1.1.2 Percentage of Programmes where syllabus revision was carried out during the last five years

The Curriculum and Syllabi of all the revised programmes are enlisted herewith:

B.S. Abdur Rahman Crescent Institute of Science & Technology
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CURRICULUM AND SYLLABI FOR UG & PG

PROGRAMMES OFFERED DURING THE LAST FIVE YEARS

TABLE OF CONTENTS

S.No.	Name of the Programme
	UG Programmes
1	B.Tech Civil Engineering
2	B.Tech Mechanical Engineering
3	B.Tech Electrical and Electronics Engineering
4	B.Tech Electronics and Communications Engineering
5	B.Tech Computer Science Engineering
6	B.Tech Electronics and Instrumentation Engineering
7	B.Tech Polymer Engineering
8	B.Tech Information Technology
9	B.Tech Aeronautical Engineering
10	B.Tech Automobile Engineering
11	B.Tech Biotechnology
12	B.A. Islamic Studies
13	B.Com General
14	B.Com Accounts and Finance
15	BBA LLB (Hons.)
16	B.Com LLB (Hons.)
17	BBA Financial Services
18	B.Sc. Biotechnology
19	B. Pharm
20	BCA
21	B. Arch
22	B.Sc. Computer Science
23	B. Des
	P.G. Programmes
1.	MBA
2.	MCA
3.	M.Tech CAD-CAM
4.	M. Tech Computer Science Engineering
5.	M.Tech Power Systems Engineering
6.	M.Tech Communication Systems

7.	M.Tech VLSI and Embedded System
8.	M. Tech Construction Engineering & Project Management
9.	M.Tech Power Electronics Drive
10.	M.Tech Manufacturing
11.	M. Tech Electronics and Instrumentation Engineering
12.	M. Tech Information Technology
13.	M.Tech Structural Engineering
14.	M.Sc. Actuarial Science
15.	M.Sc. Chemistry
16.	M.Sc. Physics
17.	M.Sc. Biotechnology
18.	M.Sc. Microbiology
19.	M.A. Islamic Studies
20.	M.Tech Network Security
21.	M.Tech Software Engineering
22.	M.Tech. Biotechnology
23.	M.Sc Biochemistry and Molecular Biology
24.	M.Arch

B.S. Abdur Rahman Crescent Institute of Science & Technology

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REGULATIONS 2017

CURRICULUM AND SYLLABI

B.TECH.

CIVIL ENGINEERING

DEPARTMENT OF CIVIL ENGINEERING

VISION AND MISSION

VISION

To be a leading school for Education, Training and Research in Civil Engineering for a better future and over-all Socio-Economic progress of the Country in a sustainable manner

MISSION

- To nurture Civil Engineers into ethically strong and responsible leaders to address Global challenges through Quality Education, Application oriented research, innovation, inspiration, motivation and sustainable growth.
- To enrich and enhance knowledge for the best practices in various disciplines of Civil Engineering through Collaborations with Global Institutions of Excellence, Industries and Research Organizations.

PROGRAMME EDUCATIONAL OBJECTIVES

- To provide fundamental knowledge in science and mathematics to understand civil engineering concepts.
- To equip with knowledge to plan, design, analyze, construct, maintain and manage civil engineering systems.
- To provide understanding of various codes and standards in the field of design and construction.
- To impart knowledge in theory and skills in practice on structural, geo-technical, geo-informatics, water resources, environmental and transportation engineering in solving civil engineering problems.
- To inculcate knowledge of sustainability in various aspects of civil engineering.
- To provide broad exposure on managerial, economic and ethical issues.

PROGRAMME OUTCOMES

On successful completion of the programme, the graduates will be able to

- Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- Identify, formulate, research literature, and analyses complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- Use research –based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.
- Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

- Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAMME SPECIFIC OUTCOMES

- Identify suitable construction materials, techniques and practices for Civil Engineering construction.
- Plan, analyze, design and estimate civil engineering structures using relevant software and appropriate codal provisions.
- Characterize water & wastewater and design sustainable water supply & sanitation schemes.

B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE AND TECHNOLOGY

B.TECH. CIVIL ENGINEERING

CURRICULUM & SYLLABUS, REGULATIONS 2017

SEMESTER I

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	BS	MAC 1181	Differential Calculus and Geometry	3	1	0	4	
2.	HS	ENC 1181/ ISC 1181/ LNC 1181/ LNC 1182 / LNC 1183	English / Arabic / Mandarin / German / Japanese	3	0	0	3	
3.	BS	PHC 1181	Physics	3	0	2	4	
4.	BS	CHC 1181	Chemistry	3	0	2	4	
5.	ESF	GEC 1101	Engineering Graphics	2	0	2	3	
6.	ESF	GEC 1102	Engineering Design	2	0	0	2	
7.	ESF	GEC 1103	Basic Engineering Practices Laboratory	0	0	2	1	
8.	ESF	GEC 1104	Computer Programming I	1	0	2	2	**23**

SEMESTER II

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	BS	MAC 1281	Advanced Calculus	3	1	0	4
2.	BS	-	Physics Elective	2	0	2	3
3.	BS	-	Chemistry Elective	2	0	2	3
4.	ESF	GEC 1211	Basic Engineering Mechanics	3	1	0	4
5.	BS	GEC 1212	Environmental Studies	2	0	0	2
6.	ESF	GEC 1213	Computer Programming II	1	0	2	2

7.	EC	CEC 1211	Engineering Geology	2	0	0	2	
8.	EC	CEC 1212	Building Construction and Practices	3	0	0	3	
9.	EC	CEC 1213	Civil Engineering Drawing	0	0	2	1	**24**

SEMESTER III

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	BS	MAC2181	Partial Differential Equations and Transforms	3	1	0	4	
2.	HS	-	Humanities Elective I	2	0	0	2	
3.	HS	ENC 2181	Oral Communication	0	0	2	1	
4.	EC	CEC2101	Mechanics of Solids	3	0	2	4	
5.	EC	CEC2102	Surveying	3	0	0	3	
6.	EC	CEC2103	Mechanics of Fluids	3	0	0	3	
7.	EC	CEC2104	Concrete Technology	3	0	2	4	
8.	EC	CEC2105	Surveying Lab	0	0	2	1	**22**

SEMESTER IV

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	BS	-	Mathematics Elective I	3	1	0	4
2.	HS	-	Humanities Elective II	2	0	0	2
3.	HS	ENC2282	Written Communication	0	0	2	1
4.	EC	CEC2211	Hydraulic and Hydraulic Machinery	3	0	2	4
5.	EC	CEC2212	Water and Wastewater Engineering	3	0	0	3
6.	EC	CEC2213	Strength of Materials	3	0	0	3
7.	EC	CEC2214	Transportation Engineering I	3	0	0	3
8.	EC	CEC2215	Environmental Engineering Lab	0	0	2	1

9.	PE	Programme Elective		3*	**24**

SEMESTER V

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	MS	MSC 3181 MSC 3182	Leadership and CEO Training/ Social Entrepreneurship	3	0	0	3	
2.	GE	-	General Elective I	3	0	0	3	
3.	HS	ENC3181	Communication and soft skill I – Career Choice	0	0	2	1	
4.	EC	CEC3101	Structural Analysis I	3	0	0	3	
5.	EC	CEC3102	Design of Reinforced Concrete Structures	3	0	0	3	
6.	EC	CEC3103	Transportation Engineering II	3	0	0	3	
7.	EC	CEC3104	Geotechnical Engineering I	3	0	2	4	
8.	PE	-	Programme Elective III				4**	**24**

SEMESTER VI

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	MS	MSC 3181 MSC 3182	Leadership and CEO Training/ Social Entrepreneurship	3	0	0	3
2.	BS	-	Mathematics Elective II	2	0	0	2
3.	HS	ENC3281	Communication and soft skill II – Confidence Building	0	0	2	1
4.	EC	CEC3211	Structural Analysis – II	3	0	0	3
5.	EC	CEC3212	Geotechnical Engineering II	3	0	0	3
6.	EC	CEC3213	Design of Steel Structures	3	0	0	3
7.	EC	CEC3214	Computer Modeling and Structural Design Laboratory	0	0	2	1

8.	EC	CEC3215	Survey and Geotechnical Investigation Camp	0	0	2	1	
9.	PE	-	Programme Elective				6#	**23**

SEMESTER VII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	GE	-	General Elective II	3	0	0	3	
2.	EC	CEC4101	Estimation and Costing	2	0	2	3	
3.	EC	CEC4102	Design of Hydraulic Structures	2	0	0	2	
4.	EC	CEC4103	Prestressed Concrete	3	0	0	3	
5.	EC	CEC4104	Construction Management	3	0	0	3	
6.	PE	-	Programme Elective	3	0	0	8##	
7.	EC	CEC4105	Internship				1***	**23**

SEMESTER VIII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	EC	CEC4211	Project Work	0	0	24	12	**12**

Total credits – 175

* Student has to take courses for a minimum of 3 credits from the list of electives for the corresponding semester.

** Student has to take courses for a minimum of 4 credits from the list of electives for the corresponding semester.

Student has to take courses for a minimum of 6 credits from the list of electives for the corresponding semester.

Student has to take courses for a minimum of 8 credits from the list of electives for the corresponding semester.

*** Industrial training will be undertaken during Third year summer vacation for 15 days. The credit will be awarded in the 7th Semester.

PROGRAMME ELECTIVES
IV SEMESTER

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	CECX01	Modern Construction Materials	2	0	0	2
2.	PE	CECX02	Construction Equipment and Techniques	2	0	0	2
3.	PE	CECX03	Principles of Architecture	2	0	0	2
4.	PE	CECX04	Safety in Construction	1	0	0	1
5.	PE	CECX05	Real Estate Laws	1	0	0	1
6.	PE	CECX06	Vaastu Satra and Architectural Design	1	0	0	1

V SEMESTER

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	CECX10	Hydrology	3	0	0	3
2.	PE	CECX11	Air Pollution and Control	3	0	0	3
3.	PE	CECX12	Traffic Engineering	3	0	0	3
4.	PE	CECX13	Solid Waste Management	3	0	0	3
5.	PE	CECX14	Rock Mechanics	2	0	0	2
6.	PE	CECX15	Form Work	2	0	0	2
7.	PE	CECX16	Industrial Waste Water Treatment	2	0	0	2
8.	PE	CECX17	Hazardous Waste Management	2	0	0	2
9.	PE	CECX18	Environmental Geotechnology	2	0	0	2
10.	PE	CECX19	Durability properties of Concrete	2	0	0	2
11.	PE	CECX20	Industrial health & Safety	2	0	0	2

12.	PE	CECX21	Urban Design	2	0	0	2
13.	PE	CECX22	Water proofing of RCC structures	1	0	0	1
14.	PE	CECX23	Construction chemicals for repair works	1	0	0	1
15.	PE	CECX24	Geo Synthetics	1	0	0	1

VI SEMESTER

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	CECX30	Dynamics of Structures	3	0	0	3
2.	PE	CECX31	Advanced Concrete Design	3	0	0	3
3.	PE	CECX32	Repair and Rehabilitation of Structures	3	0	0	3
4.	PE	CECX33	Ground Improvement Techniques	3	0	0	3
5.	PE	CECX34	Pavement Design	3	0	0	3
6.	PE	CECX35	Housing, Planning and Management	3	0	0	3
7.	PE	CECX36	Building Services	3	0	0	3
8.	PE	CECX37	Engineering Ethics	3	0	0	3
9.	PE	CECX38	Environmental Risk Assessment	3	0	0	3
10.	PE	CECX39	Remote Sensing	3	0	0	3
11.	PE	CECX40	Modern Surveying	3	0	0	3

VII SEMESTER

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	CECX45	Bridge Engineering	3	0	0	3
2.	PE	CECX46	Earthquake Engineering	3	0	0	3
3.	PE	CECX47	Industrial Structures	3	0	0	3
4.	PE	CECX48	Prefabricated Structures	3	0	0	3

5.	PE	CECX49	Tall Structures	3	0	0	3
6.	PE	CECX50	Design of Machine Foundation	3	0	0	3
7.	PE	CECX51	Ground Water Engineering	3	0	0	3
8.	PE	CECX52	Environmental Impact Assessment	3	0	0	3
9.	PE	CECX53	Coastal Engineering	3	0	0	3
10.	PE	CECX54	GIS & its Applications	3	0	0	3
11.	PE	CECX55	Geodesy	2	0	0	2
12.	PE	CECX56	Building Information Modeling	2	0	0	2
13.	PE	CECX57	Design of cold formed Steel Structures	2	0	0	2
14.	PE	CECX58	Corrosion Control of Steel in Concrete	2	0	0	2
15.	PE	CECX59	Flood Management	2	0	0	2
16.	PE	CECX60	Urban & Indoor Air Quality Management	2	0	0	2
17.	PE	CECX61	Contract laws and Regulations	2	0	0	2
18.	PE	CECX62	Smart Cities	2	0	0	2
19.	PE	CECX63	Environmental Monitoring	2	0	0	2

Physics Elective Courses

(To be offered in II Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	PHCX 01	Fundamentals of Engineering Materials	2	0	2	3
2.	PHCX 02	Heat and Thermodynamics	2	0	2	3
3.	PHCX 03	Introduction to Nanoscience and Technology	2	0	2	3
4.	PHCX 04	Lasers and their applications	2	0	2	3
5.	PHCX 05	Materials Science	2	0	2	3
6.	PHCX 06	Non-Destructive Testing	2	0	2	3
7.	PHCX 07	Properties of Matter and Acoustics	2	0	2	3
8.	PHCX 08	Properties of Matter and Nondestructive Testing	2	0	2	3
9.	PHCX 09	Semiconductor Physics and Optoelectronics	2	0	2	3

Chemistry Elective Courses

(To be offered in II Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	CHCX01	Analytical Instrumentation	2	0	2	3
2.	CHCX02	Corrosion and its Control	2	0	2	3
3.	CHCX03	Electrical Materials and Batteries	2	0	2	3
4.	CHCX04	Engineering Materials	2	0	2	3
5.	CHCX05	Fuels and Combustion	2	0	2	3
6.	CHCX06	Fundamentals of Physical Chemistry	2	0	2	3
7.	CHCX07	Green Technology	2	0	2	3
8.	CHCX08	Organic Chemistry of Biomolecules	2	0	2	3
9.	CHCX09	Polymer Science and Technology	2	0	2	3

Maths Elective Courses

(To be offered in IV Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	MACX 01	Discrete Mathematics And Graph Theory	3	1	0	4
2.	MACX 02	Probability And Statistics	3	1	0	4
3.	MACX 03	Random Processes	3	1	0	4
4.	MACX 04	Applied Numerical Methods	3	1	0	4

Maths Elective Courses

(To be offered in VI Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	MACX 05	Mathematical Programming	2	0	0	2
2.	MACX 06	Statistical Methods for Data Analysis	2	0	0	2
3.	MACX 07	Numerical Methods for Integral and Differential Equations	2	0	0	2
4.	MACX 08	Mathematical Modelling	2	0	0	2
5.	MACX 09	Graph Theory	2	0	0	2

Humanities Elective I

(To be offered in III Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	SSCX01	Fundamentals of Economics	2	0	0	2
2.	SSCX02	Principles of Sociology	2	0	0	2
3.	SSCX03	Sociology of Indian Society	2	0	0	2

Humanities Elective II

(To be offered in IV Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	SSCX04	Economics of Sustainable Development	2	0	0	2
2.	SSCX05	Industrial Sociology	2	0	0	2
3.	SSCX06	Law for Engineers	2	0	0	2

General Elective

Group I Courses

(To be offered in V semester)

Sl. No.	Course Code	Course Title	Offering Department
1.	GECX101	Disaster Management	Civil
2.	GECX102	Total Quality Management	Mechanical
3.	GECX103	Energy Studies	Mechanical
4.	GECX104	Robotics	Mechanical
5.	GECX105	Transport Management	Automobile
6.	GECX106	Control Systems	EEE
7.	GECX107	Introduction to VLSI Design	ECE
8.	GECX108	Plant Engineering	EIE
9.	GECX109	Network Security	CSE
10.	GECX110	Knowledge management	CSE
11.	GECX111	Cyber security	IT
12.	GECX112	Genetic Engineering	LS
13.	GECX113	Fundamentals of Project Management	CBS
14.	GECX114	Operations Research	Mathematics
15.	GECX115	Nano Technology	Physics / Chemistry
16.	GECX116	Vehicle Maintenance	Automobile
17.	GECX117	Fundamentals of Digital Image Processing	ECE

Group II Courses

(To be offered in VII semester)

Sl. No.	Course Code	Course Title	Offering Department
1.	GECX201	Green Design and Sustainability	Civil
2.	GECX202	Appropriate Technology	Civil / Mechanical
3.	GECX203	Engineering System Modelling and Simulation	Mechanical
4.	GECX204	Value Analysis and Engineering	Mechanical
5.	GECX205	Industrial Safety	Mechanical
6.	GECX206	Advanced Optimization Techniques	Mechanical
7.	GECX207	Mat Lab Simulation	EEE
8.	GECX208	Embedded Systems and its Applications	ECE
9.	GECX209	Usability Engineering	CSE
10.	GECX210	Supply Chain Management	CBS
11.	GECX211	System Analysis and Design	CA
12.	GECX212	Advanced Materials	Physics & Chemistry
13.	GECX213	National Service Scheme	School of Humanities
14.	GECX214	Automotive Pollution and Control	Automobile
15.	GECX215	Motor Vehicle Act, Insurance and Policy	Automobile
16.	GECX216	Principles of Communication Systems	ECE
17.	GECX217	Lean Management	Civil
18.	GECX218	Spatial Data Modeling & Analysis	Civil

SEMESTER I

MAC 1181	DIFFERENTIAL CALCULUS AND GEOMETRY	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aims of this course are to

- introduce eigen values and eigenvectors of matrix algebra.
- make the student knowledgeable in the area of Three Dimensional Analytical Geometry.
- demonstrate the application of Differential Calculus.
- familiarize the student with the functions of several variables.
- develop the use of ODE solvable techniques necessary for engineering applications.
- motivate the students with some basic engineering application problems in ODE.

MODULE I **MATRICES** **8+2**

Characteristic Equation- Eigenvalues and Eigenvectors of a real matrix –Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton Theorem (without proof) – Orthogonal matrices – orthogonal transformations of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation.

MODULE II **THREE DIMENSIONAL ANALYTICAL GEOMETRY** **7+3**

Direction cosines and ratios – angle between two lines – equations of a plane – equations of a straight line, coplanar lines - shortest distance between skew lines - sphere – tangent plane – plane section of a sphere – orthogonal spheres.

MODULE III **DIFFERENTIAL GEOMETRY** **7+3**

Curvature – Cartesian and polar coordinates – centre and radius of curvature – circle of curvature – involutes and evolutes – envelopes.

MODULE IV **DIFFERENTIAL CALCULUS OF SEVERAL VARIABLES** **8+2**

Functions of two variables – partial derivatives – total differential – Implicit Functions – Jacobian - Taylor’s series expansion – Optima of two variables – Lagrange’s multiplier method.

MODULE V **ORDINARY DIFFERENTIAL EQUATIONS** **8+2**

Linear equations of second order with constant and variable coefficients – Simultaneous first order linear equations with constant coefficients – homogeneous equations of Euler's type – method of undetermined coefficients, method of variation of parameters

MODULE VI **APPLICATIONS OF ORDINARY DIFFERENTIAL EQUATIONS** **7+3**

Solution of Ordinary Differential Equation Related to Electric Circuits – Bending of Beams- Motion of a Particle in a resisting medium – Simple harmonic motion.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Ramana, B.V, "Higher Engineering Mathematics" Tata McGraw Hill Publishing Co. New Delhi, 2006.
2. Grewal B.S., "Higher Engineering Mathematics" (43rd edition), Khanna Publishers, New Delhi, 2012.
3. John W. Cell "Engineering Problems Illustrating Mathematics" Mc Graw Hill Publishing Co., New York 1943.

REFERENCES:

1. Veerarajan.T., "Engineering Mathematics" (5th edition) Tata Mc Graw Hill Publishing Co. New Delhi, 2012
2. Kreyszig, E., "Advanced Engineering Mathematics", 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
3. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th edition, Cengage Learning, 2011.
4. Dennis G. Zill, Warren S. Wright, "Advanced Engineering Mathematics", 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
5. Alan Jeffrey, "Advanced Engineering Mathematics", Academic Press, USA, 2002.
6. Venkataraman, M.K., "Engineering Mathematics", Volume I, 2nd edition, National Publishing Co., Chennai, 2003.
7. James Stewart ".Calculus" (7th edition),Brooks/Cole cengage learning,UK

OUTCOMES:

After completing the course, student will be able to

- Understand the matrix techniques and compute eigen values and eigenvectors of a given matrix.
- Do the problems based on three dimensional analytic geometry.
- Apply differential calculus in engineering problems.
- Differentiate more than one variable and their applications.
- Solve the differential equations with constant coefficient and variable coefficient.
- Form and solve differential equations.

ENC 1181	ENGLISH	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To train students to use appropriate vocabulary in academic and technical contexts.
- To facilitate students to speak effectively while exchanging ideas and making presentations.
- To develop students' listening skill for comprehending and analyzing information.
- To develop their reading skill through sub skills like skimming , scanning and critical reading of a text.
- To sharpen their academic writing skills.
- To expose them to the correct usage of language and help them to apply that knowledge appropriately.

MODULE I **8**

L: Listening for general information

S : Self Introduction, Introducing one another.

R: Predicting the content

W: Paragraph Writing

Language Focus: Affixes, Simple Present tense , Connective & Prepositions.

MODULE II **8**

L: Listening for specific information (from dialogues)

S:Exchanging opinion.

R: Skimming technical Passages

W: Argumentative Writing (using the concept of Flipped Learning), Letter to the Editor.

Language Focus: Idioms, use of Modals, Simple Past tense & use of "Wh" and question tags.

MODULE III **7**

L: Learning the ways of describing images and presenting specific information (focusing on note making)

S: Making Presentations using visuals.

R : Scanning short texts for gist of information

W: Letter of Invitation, Expository Writing

Language Focus: Homophones, Homographs, Simple Future & Collocations.

MODULE IV **7**

L: Understanding prepared presentation techniques through videos

S: Short Presentations.

R: Reading for coherence and cohesion

W: Letter seeking permission for Industrial Visit

Language Focus: S-V agreement, Euphemism

MODULE V **8**

L : Understanding Non- Verbal Communications while listening to narration of incidents.

S: Narrating an expereince

R: Inferential Reading

W: Process Description – Transcoding a Flow chart.

Language Focus: Interchange of Active & passive voice, Impersonal Passive voice.

MODULE VI **7**

L: Learning Story telling techniques (stories & visuals) through audio files

S: Discussion in groups

R: Reading for critical appreciation

W: Developing an idea, Slogan writing, Interpreting a Bar Chart.

Language Focus: If clause and phrasal verbs.

TOTAL HOURS :45

REFERENCES:

1. Carol Rosenblun perry(2011). The Fine Art of Technical Writing. Create Space Independent Publishing Platform, New Delhi.
2. Dutt, P.K. Rajeevan. G and Prakash , C.L.N. (2007) A course in Communication Skills. Cambridge Univesity Press, India.
3. Kala, Abdul & Arun Tiwari (2004). Wings of Fire: An Autobiography (Simplified and A bridged by Mukul Chowdhri). Hyderabad Univeristy Press.
4. Sen, Leena. (2004) Communication Skills. Prentice Hall, New Delhi.

5. Matt Firth, Chris Sowton et.al. (2012). Academic English: An Integrated Skills Course for EAP. Cambridge University Press, Cambridge.

OUTCOMES:

After completion of the course, students will have the ability to

- Demonstrate their range of vocabulary in academic and technical contexts
- Exchange ideas and make presentations
- Comprehend and respond appropriately to listening tasks.
- Read a text efficiently and process information.
- Create and draft different kinds of academic documents
- Communicate effectively using grammatically correct expressions.

ISC1181	ARABIC	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To read and write in Arabic language.
- To learn vocabulary of different fields
- To develop situational communication skills.

MODULE I PREPARATORY ARABIC **7**

Introducing Arabic Alphabets.
Listening and Reading.
Audio & Video aided listening, Tajweed listening,
Writing Arabic Alphabets (connected & unconnected).
Introducing words.
Reading simple sentences.
Learning names of the things in and around the class room.
Exercises.

MODULE II FUNCTIONAL ARABIC **7**

Listening Arabic texts, stories and action verbs
Communicating Simple sentences.
Jumla' Ismiyya and Jumla' Fi'liyya
Situational Conversation:
Greetings, Introduction.
Classroom, College, Picnic.
Dining and Kitchen.
Reading skills.
Exercises

MODULE III FUNCTIONAL ARABIC **8**

Implication of effective listening.
Audio aids.
Writing Simple sentences.
Communicating ordinal and cardinal numbers.
Situational communication:

Playground, library.
Forms of plural – Sample sentences.
Introduction to tenses.
Exercises.

MODULE IV FUNCTIONAL ARABIC 8

Communication:
Family, travel
Market, Prayer hall
Writing skills:
Note making.
Sequencing of sentences.
Developing answers from the questions.
Exercises.

MODULE V TECHNICAL ARABIC 8

Importance of technical communication.
Reading and writing skills.
Audio & Video aided listening.
Introduction to Arabic terms related to administration.
Situation communication:
Air travel, Office administration, passport, visa.
Exercises

MODULE VI TECHNICAL ARABIC 7

Situation communication:
Contractual work, machineries and equipments..
Computer, internet browsing.
Banking,
Exercises.

TOTAL HOURS :45

TEXT BOOKS:

1. Arabic for professionals and employees, Kilakarai Bukhari Aalim Arabic College, Chennai, India, 2013.

REFERENCES:

1. Arabic Reader for Non Arabs (Ummul Qura University, Makkah), Kilakarai Bukhari Aalim Arabic College, 2005.

OUTCOMES:

On successful completion of the course, the student will be able to:

- Write correct sentences in Arabic.
- Communicate in Arabic at primary level in working situations in the fields of engineering and administration.

LNC1181	MANDARIN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To improve the proficiency of students in Mandarin language.
- To develop their knowledge of vocabulary.
- To train them in using appropriate grammatical forms during communications.
- To empower them for successful communication in social and academic contexts.
- To make them appreciate the language usage in real life situations.

MODULE I **8**

· General Introduction to Chinese • Pinyin and Tones • Introduction to the Writing System: basic strokes and stroke order · Numbers 1-100, song · Days of the Week · Months of the Year

MODULE II **8**

· Chinese names and related culture · Chinese family structures and values · Greetings · Introducing Yourself · Family members · Occupations

MODULE III **7**

· Languages and Nationalities · Daily Routine · Chinese breakfast · Negative Sentences and Interrogative Sentences · Asking for Personal Information · The Verb *shi* and Basic Sentence Structures

MODULE IV **7**

· Answering an Affirmative-negative Question · Food and drinks · Transportation · Likes and dislikes · Adverbs *bu*, *jiu* and *dou* · Verb-absent Sentences

MODULE V **8**

·*Jisui* and *duoda* Questions · S+V+O Construction · Routines and Daily Activities ·*Haishi* Questions · Modal Verbs · Hobbies and Habits

MODULE VI **7**

· Making Suggestions with *haoma* ·Colors · Clothing · Body parts · Talking about Likes and Dislikes · Measurement Words in Chinese

TOTAL HOURS :45

TEXT BOOKS:

1.Ma, Yanmin, and Li, Xinying. *Easy Steps to Chinese, Vol*. *1 Textbook*. Beijing: Beijing Language and Culture University Press, 2006. Print.

2. Ma, Yanmin, and Li, Xinying. *Easy Steps to Chinese, Vol. 1 Workbook*. Beijing: Beijing Language and Culture University Press, 2006. Print.

OUTCOMES:

On completion of the course, students will be able to

- Exhibit proficiency in Chinese Language.
- Use vocabulary in appropriate contexts.
- Use appropriate grammatical forms effectively.
- Use the language in social and academic contexts.
- Appreciate the use of language forms.

LNC1182	GERMAN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To improve the proficiency of students in German language.
- To create awareness of using vocabulary among students.
- To expose them to correct grammatical forms of the language.
- To empower them for successful communication in social and academic contexts.

MODULE I **8**

Introduction to German alphabets, phonetics and pronunciation- Introducing themselves and others using simple sentences and answer to some basic personal questions-: Introduction to different types of articles and verbs, Nouns

MODULE II **8**

Understanding and responding to everyday queries like instruction, questions, - number & gender, pronouns, present and past tense.

MODULE III **7**

Short telephone messages, requests etc., if spoken slowly and clearly-- Detailed overview of articles, adjectives with/without articles, Prepositions

MODULE IV **7**

Ask and giving directions using simple prepositions- Ability to fill basic information on forms while registering for courses / classes.

MODULE V **8**

Ability to extract and understand relevant information in a public announcement, broadcast, newspaper, radio etc-- dative & accusative

MODULE VI **7**

Ability to describe about people, work, immediate environment, education and other topics related to personal needs in a concise manner-- Understanding of matters that are familiar and are encountered regularly like instances at school, work, at public places, places of leisure etc.

TOTAL HOURS :45

TEXT BOOKS:

1. Course book : Tangram aktuell 1 – Lektion 1–4 (Kursbuch + Arbeitsbuch mit Audio-CD zum Arbeitsbuch), Rosa-Maria Dallapiazza, Eduard von Jan, Til Schönherr, Hueber Publisher, ISBN 978-3-19-001801-7
2. Practice book: Tangram aktuell 1 – Lektion 1–4 (Kursbuch + Arbeitsbuch mit Audio-CD zum Arbeitsbuch), Rosa-Maria Dallapiazza, Eduard von Jan, Til Schönherr, Hueber Publisher, ISBN 978-3-19-001801-7.

REFERENCES:

1. NETZWERK A1 TEXTBOOK, Deutsch als Fremdsprache,Stefanie Dengler,Paul Rusch, Helen Schmitz, Tanja Sieber, Langenscheidt and Klett, ISBN : 9788183076968
2. STUDIO D A1 (SET OF 3 BOOKS + CD), Hermann Funk. Cornelsen, ISBN: 9788183073509
3. Willkommen! Beginner's course. Paul Coggle, Heiner Schenke. 2nd edition. (chapter 1 - 6) ISBN: 9781444165159 –
4. Willkommen! Beginner's course. Paul Coggle, Heiner Schenke. ISBN: 978-1-444-16518-0
5. An Introduction to the German Language and Culture for Communication, Updated Edition Lovik, Thomas A., J. Douglas Guy & Monika Chavez. Vorsprung -. New York, Houghton Mifflin Company, 1997/2002. ISBN 0-618-14249-5.

OUTCOMES:

On completion of the course, students will be able to

- Show their proficiency in German Language.
- Use appropriate vocabulary in real life contexts.
- Use appropriate grammatical forms while communicating with people.
- Effectively use the language in social and academic contexts.

LNC1183	JAPANESE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To train students to use appropriate vocabulary in academic and technical contexts.
- To facilitate students to speak effectively while exchanging ideas and making presentations.
- To develop their reading skill through sub skills like skimming, scanning and critical reading of a text.
- To sharpen their academic writing skills.
- To expose them to the correct usage of language and help them to apply that knowledge appropriately.

MODULE I **7**

Introduction of the Japanese writing system, i.e. *Hiragana*, *Katakana* and *Kanji*, word-building, writing foreign names and loan words in Katakana.

MODULE II **8**

Oral practice of pronunciation and intonation of Japanese sounds, Japanese greetings, self introduction, identifying things, time of the day, calendar; counting using Japanese numerical classifiers; describing things;

MODULE III **7**

Making comparisons; talking of daily activities, kinship terms used for address and reference, seasons, giving and receiving, shopping; making requests, talking of one's likes and dislikes.

MODULE IV **8**

Extensive practice of basic patterns at the lower intermediate level through drills and exercises.

MODULE V **7**

Comprehension of passages in simple Japanese and writing of composition in Japanese applying lower intermediate grammatical patterns.

MODULE VI **8**

Diverse texts based on Japanese culture, customs, history, food habits, and science etc, for the development of communicative competence of students; skimming, scanning of texts with emphasis on advanced sentence patterns, grammatical structures and idiomatic phrases, reading and writing of approximately

TOTAL HOURS :45

REFERENCES:

1. Nihongo I, Kokusaigakuyukai, and other supplementary material
2. Exersice book 1of Nihongo 1, and other supplementary material
3. Nippon, the Land and its People & Encyclopedia of Contemporary Japanese
4. Japani: Japanese Conversation for Improving Spoken Proficiency, By P.A. George, Inoue Yoriko and Itsuko Nandi, Books Plus.
5. Chukyu Nihongo, Tokyo Gaikokugo Daigaku; Nihongo II, Kokusaigakuyukai, and other supplementary material.

OUTCOMES:

After completion of the course, students will have the ability to

- Demonstrate their range of vocabulary in academic and technical contexts
- Exchange ideas and make presentations
- Comprehend and respond appropriately to listening tasks.
- Read a text efficiently and process information.
- Create and draft different kinds of academic documents
- Communicate effectively using grammatically correct expressions.

PHC 1181	PHYSICS	L	T	P	C
		3	0	2	4

OBJECTIVES:

To make students conversant with the

- basic concepts of crystal physics and its structures
- production and applications of ultrasonic waves
- study of thermal conductivities of good and bad conductors
- phenomenon of wave optics and its applications
- principle of fibre optic communication and its applications to sensors
- wave mechanics principle and its applications in electron microscopy
- green energy physics and its environmental impacts to society

MODULE I CRYSTAL PHYSICS **8**

Crystalline and amorphous solids – Unit Cell – Seven Crystal Systems – Bravais Lattice – Miller Indices – Interplanar Spacing – Characteristics of Unit Cell - Calculation of Number of atoms per unit cell, Atomic Radius, Coordination Number and Packing Factor for SC, BCC, FCC and HCP and Diamond structures –Defects in crystals-Point defects –Edge and screw dislocations and their significance - Surface Defects.

MODULE II ULTRASONICS AND THERMAL PHYSICS **8**

Introduction to Ultrasonics - Properties - Production methods - Magnetostriction Oscillator method- Piezoelectric Oscillator method – Detection of Ultrasonics – Thermal method – Piezoelectric method – Kundt's tube method – Applications of Ultrasonics – Acoustic Grating – SONAR – Depth of sea – Velocity of blood flow, Ultrasonic Flaw detector (qualitative).

Transmission of heat – Conduction, Convection and Radiation – Thermal Conductivity of good Conductor – Forbe's method- Thermal Conductivity of bad Conductor – Lee's Disc method.

MODULE III APPLIED OPTICS **8**

Interference – Air Wedge – Michelson's Interferometer – Determination of wavelength of light and thickness of thin transparent sheet.

Introduction to Laser – Characteristics of Laser – Spontaneous and Stimulated Emissions – Einstein's Coefficients - Population inversion – Pumping Mechanism – Laser Action – Types of Laser: He-Ne laser, CO2 laser and Nd:YAG laser - Applications : Laser Materials

Processing .

MODULE IV FIBRE OPTICS 7

Optical fibre – Principle and propagation of light in optical fibre – Numerical aperture and acceptance angle – Types of optical fibres – Attenuation – Absorption, Scattering losses, Bending losses and Dispersion in Optical fibres – Fiber Connectors and Couplers - Applications – Fibre optic communication system (block diagram only)- Fibre optic sensors - displacement and pressure sensors (qualitative) - Medical endoscope.

MODULE V QUANTUM MECHANICS 7

Black body radiation – Planck's theory of radiation – Deduction of Wien's displacement law and Rayleigh – Jean's law from Planck's theory –Dual nature of matter – de Broglie's wavelength- Physical significance of wave function – Schrodinger wave equation – Time independent and time dependent wave equation – Particle in one dimensional box – Harmonic oscillator(qualitative).

MODULE VI RENEWABLE ENERGY SOURCES 7

Present Energy sources and sustainability - Solar energy - Solar photovoltaics - Solar cells – Bioenergy - Biomass – production of liquid fuels from biomass – Wind energy – Wind turbines – energy and power from wind turbines - Geothermal energy - Ocean energy: Wave energy – Wave energy conversion devices – Tidal energy – Tidal power basics – power generation –Tidal energy potential – Environmental benefits and impacts of renewable energy sources

PRACTICALS

1. Determination of Velocity of Ultrasonic waves in a given liquid using Ultrasonic Interferometer.
2. Determination of wavelength of ultrasonic waves using Kundt's tube method.
3. Determination of thickness of a thin wire using Air Wedge method.
4. Determination of wavelength of light using spectrometer diffraction grating.
5. Determination of angle of divergence of a laser beam using He-Ne laser.
6. Determination of particle size of lycopodium powder using semiconductor laser.
7. Determination of wavelength of laser light using semiconductor laser diffraction.
8. Determination of Acceptance angle and Numerical Aperture using fiber optic cable.
9. Determination of thermal conductivity of a good conductor by Forbe's method.
10. Determination of thermal conductivity of a bad conductor by Lee's disc method.
11. Determination of solar cell characteristics.

L – 45; P – 30; TOTAL HOURS – 75

REFERENCES :

1. Gaur R.K. and Gupta S.L., “Engineering Physics’’, 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2013.
2. Palanisamy P.K., Physics for Engineers, Vol1 & Vol2, 2nd Edition, Scitech Publications, 2003.
3. Serway R.A. and Jewett, J.W. “Physics for Scientists and Engineers with Modern Physics”. Brooks/cole Publishing Co., 2010.
4. Tipler P.A. and Mosca, G.P., “Physics for Scientists and Engineers with Modern Physics”, W.H. Freeman, 2007.
5. Markert J.T., Ohanian. H. and Ohanian, M. “Physics for Engineers and Scientists”. W.W. Norton & Co. 2007.
6. Godfrey Boyle, “Renewable Energy: Power for sustainable future”, 2nd edition, Oxford University Press, UK, 2009.

OUTCOMES:

At the end of the course, students will be able to

- understand the different types of crystal structures
- apply the concept of ultrasonic principle in engineering and medical field
- calculate thermal conductivities of good and bad conductors
- differentiate the various laser systems and its applications in engineering and medical field
- apply the principle of fibre optics for communication and sensor applications
- formulate wave mechanics principle for applications in electron microscopy
- Correlate the different renewable energy sources for societal needs.
- To complement the knowledge acquired in the theory class.
- To correlate the experimental results for application.

CHC1181	CHEMISTRY	L	T	P	C
		3	0	2	4

OBJECTIVES:

The students should be conversant with

- the basic problems like hardness, alkalinity, dissolved oxygen associated with the water used for domestic and industrial purpose and treatment process involved.
- the synthesis, properties and applications of nanomaterials.
- the importance of renewable energy sources like solar, wind, biogas, biomass, geothermal, ocean and their limitations.
- the basic analytical techniques like UV-Visible, FT-IR, NMR, AAS, AES, Circular Dichroism and XRD etc.
- photochemistry concepts related to physical processes and chemical reactions induced by photon absorption and their applications.
- basic principles of electrochemistry, cell construction and evaluation and to understand general methodologies for construction & design of electrochemical cell

MODULE I WATER TECHNOLOGY 9

Impurities present in water, hardness : types of hardness, demerits of hard water in boilers, estimation of hardness by EDTA method (problems) – alkalinity : estimation of alkalinity (problems) – dissolved oxygen: estimation of dissolved oxygen – conditioning methods : external treatment method: – lime soda and zeolite process (principle only), Ion exchange process – Internal treatment : colloidal, carbonate, phosphate and calgon methods – drinking water: standards (BIS), treatment of domestic water {screening, sedimentation, coagulation, filtration, disinfection }– desalination: electrodialysis, reverse osmosis.

MODULE II NANOCHEMISTRY 6

Introduction – distinction between molecules, bulk materials and nanoparticles – classification based on dimension with examples – synthesis (top-down and bottom-up approach} : sol-gel, thermolysis (hydrothermal and solvothermal), electrodeposition, chemical vapour deposition, laser ablation – properties and applications (electronic, magnetic and catalytic) – risk factors and future perspectives.

MODULE III ENERGY SOURCES 8

Energy: past, today, and future – a brief history of energy consumption – present energy scenario of conventional and renewable energy sources – renewable energy : needs of renewable energy, advantages and limitations of renewable energy – solar energy: basics, solar energy in the past , photovoltaic, advantages and disadvantages – bioenergy: conversion, bio degradation, biogas generation, biomass gasifier, factors affecting biogas generation, advantages and disadvantages – geothermal energy: geothermal resources (hot dry rock and magma resources, natural and artificial), advantages and disadvantages – wind energy: wind resources, wind turbines, advantages and disadvantages – ocean energy: wave energy, wave energy conversion devices, ocean thermal energy, advantages and disadvantages.

MODULE IV PHOTOCHEMISTRY 7

Introduction: absorption and emission, chromophores, auxochromes – laws of photochemistry : Grotthus-Draper law, Stark Einstein law – quantum yield (problems) –photo physical processes : fluorescence and phosphorescence - Jablonski diagram (electronic states and transitions) – quenching, annihilation – photosensitization: principle and applications – chemiluminescence, bioluminescence.

MODULE V ANALYTICAL TECHNIQUES 7

Spectroscopy: electromagnetic radiation and spectrum – types of transitions – types of spectra (atomic and molecular with their chemical usefulness) – Beer-Lamberts law (problems) – principles, instrumentation and applications of: Colourimetry – UV-Vis spectrophotometer – atomic absorption spectroscopy – atomic emission spectroscopy – principles and applications of: IR, NMR, mass and X-ray diffraction analysis.

MODULE VI ELECTROCHEMISTRY 8

Electrochemistry - types of electrodes (principle and working) : gas (SHE), metal/metal ion electrode, metal-metal insoluble salt (calomel electrode), ion-selective (glass electrode and fluoride ion selective electrode) – Electrolytic and galvanic cells, construction of cell, EMF measurement and applications (problems), standard cell (Weston-cadmium), reversible and irreversible cell, concentration cell. Determination of fluoride ion using fluoride ion selective electrode – Chemically modified electrodes (CMEs) : concept, approaches and applications.

PRACTICALS

1. Estimation of hardness in given water sample.
2. Estimation of the alkalinity of the given water sample.
3. Estimation of strong acid by conductometry.
4. Estimation of Fe^{2+} present in the given sample by potentiometry.
5. Verification of Beer-Lamberts law and estimation of Cu^{2+} present in unknown sample.
6. Estimation of sodium and potassium present in the given sample by flame photometry.
7. Determination of molecular weight and degree of polymerisation of a polymer by viscosity method.
8. Synthesis of thermosetting polymer.

L – 45; P – 30; TOTAL HOURS – 75

REFERENCES:

1. S. Vairam, P. Kalyani and Suba Ramesh, “Engineering Chemistry”, Wiley India Ltd., New Delhi, 2011.
2. G.A. Ozin and A.C. Arsenault, “Nanochemistry: A Chemical Approach to Nanomaterials”, RSC Publishing, Thomas Graham House, Cambridge, 2005.
3. P.C Jain & Monica Jain, Engineering Chemistry Dhanpatrai Publishing Company (P) Ltd., New Delhi (2013).
4. S S Umare & S S Dara, A text Book of Engineering Chemistry, S. Chand& Company Ltd, New Delhi, 2014.
5. G.D.Rai, “Non conventional energy sources,” Khanna Publishers, New Delhi, 2011.
6. John Twidell and Tony Weir, “Renewable Energy Resources, Taylor & Francis Ltd, London, United Kingdom, 2005
7. Principles of molecular photochemistry: An introduction, Nicholas J. Turro, V.Ramamurthy and Juan C. Scaiano, University Science Books, Sausalito, CA, 2009.

OUTCOMES:

The students will be able to

- solve problems related to hardness, alkalinity, dissolved oxygen associated with the water and describe the treatment processes.
- classify nanomaterials and apply the nanochemistry approach to synthesize the

nanomaterials.

- explain the principle and enumerate the advantages and disadvantages of various renewable energy sources.
- state the principle and illustrate the instrumentation of various analytical techniques.
- apply the concepts of photochemistry to elaborate various photo-physical and photochemical reactions.
- construct a electrochemical cell and describe the various types of electrodes and determine the fluoride content.

GEC 1101	ENGINEERING GRAPHICS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To introduce the students of all engineering programs, the basic concepts of engineering drawing, which is the basic communication medium for all engineers
- To provide practical exposure on important aspects like drawing analytic curves, orthographic projections, section of solids, development of surfaces, isometric projection, perspective projection and free hand drawing.
- To introduce computerized drafting.

MODULE I BASICS AND ENGINEERING CURVES 10

Drawing instruments, dimensioning, BIS conventions, types of lines, simple geometric constructions.

Conic sections: ellipse, parabola, hyperbola.

Special curves: cycloid, epicycloid, hypocycloid and involutes.

MODULE II ORTHOGRAPHIC PROJECTION 8

Orthographic projection – first angle, second angle, third angle and fourth angle projections –setup - assumptions, principle. Free hand sketching of orthographic views of simple machine parts as per first angle projection. Orthographic projection of points in all quadrants. Some commands and demonstration of drafting packages.

MODULE III PROJECTION OF STRAIGHT LINES AND PLANES 10

Projection of straight lines in first quadrant – true length and true inclinations – Rotating line and trapezoidal methods –traces of straight line.

Projection of plane lamina in first quadrant and its traces

MODULE IV PROJECTION OF SOLIDS 10

Projection of solids in first quadrant: Axis inclined to one reference plane only- prism, pyramid, cone, cylinder – change of position and auxiliary projection methods.

MODULE V SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES 12

Section of solids: prism, pyramid, cone, cylinder, and sphere – sectional view – true shape of section Solids in simple position and cutting plane inclined to one reference

plane only.

Development of surface of truncated solids: prism, pyramid, cone cylinder – frustum of cone, pyramid and simple sheet metal parts.

MODULE VI PICTORIAL PROJECTIONS 10

Isometric projection: Isometric scale – isometric axes- iso sheet - Isometric projection and view of prism, pyramid, cylinder, cone, frustums, truncated solids and simple products

Perspective projection: station point – vanishing point – Perspective projection and views of prism, pyramid, cylinder and frustums by Visual ray method.

L – 30; P – 30; TOTAL HOURS – 60

TEXT BOOKS:

1. N.D. Bhatt, 'Engineering Drawing' Charotar Publishing house, 53rd Edtion, (2014)

REFERENCES:

1. K.V. Natarajan, 'A text book of Engineering Graphics', Dhanalakshmi publishers, Chennai. (2009)
2. Venugopal. K, and V. Prabhu Raja, Engineering Graphics, New Age International (P) Ltd., Publication, Chennai. (2011)

OUTCOMES:

- Students should be able to read the specifications and standards of technical drawing and able to draw conic sections and special curves.
- Students should be able to understand the insight of orthographic projection and to draw the various views of orthographic projection of a point and various components.
- Students should be able to draw the orthographic views of straight lines and plane figures.
- Students should be able to draw the orthographic views of simple solids.
- Students should be able to draw the sections of solids and development of solid surfaces.
- Students should be able to draw the isometric and perspective projection of simple solids and components.

GEC 1102	ENGINEERING DESIGN	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To understand the role of design in Engineering
- To understand the basic design concepts
- To understand the role of innovation in design

MODULE I DESIGN AS A CENTRAL ACTIVITY IN ENGINEERING 08

Product design – products and processes – product design methodology Design of systems; Software design

MODULE II NEED ANALYSIS AND CONCEPT DEVELOPMENT 07

Voice of customers – product specification - need analysis Bench marking Product architecture – concept generation and evaluation;

MODULE III CASE STUDIES IN ENGINEERING DESIGN 08

Product design – process design; system design; software design -Ergonomics – usability

MODULE IV INNOVATION AND DESIGN 07

Role of innovation in Engineering – incremental changes and systemic changes; scientific approach to driving innovation – case studies.

TOTAL HOURS – 30

REFERENCES:

1. Clive L. Dym and David C. Brown,“Engineering Design: Representation and Reasoning”, 2nd Edition, Cambridge University Press, New Delhi, 2011.
2. Daniel G. Dorner, G. E. Gorman and Philip J. Calvert, “Information Needs Analysis: Principles and practice in information organizations”, Published by Faced Publishing, London. 2015.
3. Cliff Matthews, “Case Studies in Engineering Design”, John Wiley & Sons Pvt. Ltd, New York, 1998.
4. Bengt-Arne Vedin, “The Design-Inspired Innovation Workbook”, World Scientific, 2011.
5. Navi Radjou, Jaideep Prabhu and Simone Ahuja, “Jugaad Innovation”, Published

by Random House India, 2012.

OUTCOMES:

The students will be able to

- Apply the basic knowledge of design in engineering products / process / service.
- Analyse the problems and give innovative solutions.
- Correlate the basic knowledge of design in the real world problems.
- Apply innovative approaches to engineering design.

GEC1103	BASIC ENGINEERING PRACTICES LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To provide a practical exposure to basic engineering practices like carpentry, fitting, plumbing, welding and making of simple electrical and electronic circuits
- To have an understanding on the use of various tools, instruments and methods
- To enable the students to appreciate the practical difficulties and safety issues

CIVIL ENGINEERING PRACTICE

1. Study of plumbing in general household and industrial systems
2. Making a small window frame with Lap and Mortise & Tenon Joints
3. Introduction to power tools

MECHANICAL ENGINEERING PRACTICE

1. Fabrication of a small Table frame with Butt, Lap and Fillet Joints
2. Machining of a simple component like a table weight using lathe
3. Mold preparation for simple component

ELECTRICAL ENGINEERING PRACTICE

1. Comparison of incandescent, Fluorescent, CFL and LED lamps.
2. Study of Protection Circuits (small relay, fuse, MCB, HRC, MCCB, ECCB).
3. Familiarization of households Electrical Gadgets (Iron Box, Wet Grinder).
4. Understanding of Domestic and Industrial wiring.
5. Earthing and its significance.
6. Troubleshooting in Electrical Circuits.
7. Study of inverter fed UPS/Emergency lamp

ELECTRONICS ENGINEERING PRACTICE

1. Identifications symbolic representation of active and passive electronic components
2. Soldering and tracing of electronic circuits and checking its continuity
3. Assembling of A.C. to D.C, D.C to A.C. Circuits in bread Board and Mini project.

TOTAL HOURS – 30

OUTCOMES:

Upon the completion of the course, students should be able to

- Appreciate the practical skills needed even in making of simple objects, assemblies and circuits
- Attend minor defects especially in items used in day to day life
- Aware of the safety aspects involved in using tools and instruments

GEC 1104	COMPUTER PROGRAMMING I	L	T	P	C
		1	0	2	2

OBJECTIVES:

- To identify the hardware and software components of the computer.
- To know the basic concept of operating system and get knowledge about different operating systems.
- To learn various database concepts and operations
- To develop efficient algorithms for solving a problem.
- To implement the algorithms in C language.
- To use arrays in solving problems.

MODULE I COMPUTER FUNDAMENTALS **7**

Introduction -. Number System - Planning the computer program - Computer Software - Basic operating system concepts - Database Operations

MODULE II PROGRAMMING IN C **8**

Introduction to C Programming Language – Operators - Control statements -Iterative statements - Arrays.

LIST OF EXPERIMENTS:

1. Computer organization –Hardware in a typical computer Identification – Booting- error messages and what it means
2. Types of Operating systems – Windows and Linux
3. Structure of a basic program - Hello world program – Debugging it
4. Data types: Type conversions
5. Input / Output: Formatted functions – Unformatted functions – Library functions
6. Properties of operators – Priority of operators – Arithmetic relational logical and bitwise operators
7. If – if else- nested if else- goto- switch case – nested switch case – for loops – nested for loops – while loop – do-while loop – break and continue statement
8. Arrays – Operation with arrays
9. Sorting and searching.

L – 15; P – 30; TOTAL HOURS – 45

REFERENCES:

1. Ashok N Kamthane, “Computer Programming”, Pearson Education, 2nd Edition, ISBN 13: 9788131704370, 2012
2. Paul J. Deitel, Deitel & Associates, “C How to Program”, Pearson Education, 7th Edition, ISBN-13: 978-0132990448, 2012

OUTCOMES:

Students who complete this course will be able to

- Recognize Modular design, logic flow, data abstraction
- Analyze the working of the programming constructs, functions, and I/O.
- Write down programs for sorting and searching algorithms
- Write down programs developing cycle for different applications
- Debug the programs and solve some practical problems in programming
- Develop programs using arrays.

SEMESTER II

MAC 1281	ADVANCED CALCULUS	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aims of this course are to

- train the students in solving problems using multiple integration.
- provide knowledge in using special functions to find out the area and volume of a region.
- acquire knowledge in tangent and normal vectors.
- gain knowledge in finding the areas of a curve and surface using vector integration.
- learn about the analytic functions and their properties along with bilinear transformation.
- know complex integration using Cauchy's theorems.

MODULE I MULTIPLE INTEGRATION AND ITS APPLICATIONS 8+2

Multiple integrals– Cartesian and Polar coordinates – change of order of integration – Multiple integral to compute area and volume.

MODULE II TRANSFORMATION OF COORDINATES AND SPECIAL FUNCTIONS 7+3

Change of variables between Cartesian, polar, cylindrical and spherical coordinates - Beta and Gamma functions – Properties and applications.

MODULE III VECTOR DIFFERENTIATION 7+3

Operations on vectors – Scalar Product, Vector Product, Projection of Vectors - Angle between two vectors - Gradient, divergence and curl

MODULE IV VECTOR INTEGRATION 8+2

Line, surface and volume integrals – Green's Theorem, Gauss Divergence Theorem and Stokes Theorem (statement only) – verification and evaluation of integrals.

MODULE V

ANALYTIC FUNCTION 8+2

Analytic function - Necessary and Sufficient condition (statement only) – Cauchy-Riemann equations in polar coordinates - properties of analytic function – determination of analytic function – conformal mapping (w = z+a, az and 1/z) and bilinear transformation.

MODULE VI COMPLEX INTEGRATION **7+3**

Statement and application of Cauchy's integral theorem – Cauchy's integral formula – Taylor's series and Laurent's series expansion – singularities - classification – residues - Cauchy's residue theorem – contour integration – Unit circle and semi circular contours (excluding poles on the real axis).

L – 45; T – 15; TOTAL HOURS – 60

TEXT BOOKS:

1. Veerarajan.T., "Engineering Mathematics "(5th edition) Tata Mc Graw Hill Publishing Co. New Delhi, 2012
2. Grewal B.S., "Higher Engineering Mathematics" (43rd edition), Khanna Publishers, New Delhi, 2012.
3. John W. Cell "Engineering Problems Illustrating Mathematics" Mc Graw Hill Publishing Co., New York 1943

REFERENCES:

1. Kreyszig, E., "Advanced Engineering Mathematics", 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
2. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th edition, Cengage Learning, 2011.
3. Dennis G. Zill, Warren S. Wright, "Advanced Engineering Mathematics", 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
4. Alan Jeffrey, "Advanced Engineering Mathematics", Academic Press, USA, 2002.
5. Ramana, B.V., "Higher Engineering Mathematics" Tata Mc Graw Hill Publishing Co. New Delhi, 2006.
6. Venkataraman, M.K., "Engineering Mathematics", Volume 2, 2nd edition, National Publishing Co., Chennai, 2003.
7. James Stewart ".Calculus" (7th edition),Brooks/Cole cengage learning,UK.

OUTCOMES:

After completing the course, student will be able to

- compute the area and volume using multiple integrals.

- apply special functions to solve integration problems.
- apply differentiation in scalar and vector fields.
- find area and volume of a region using vector integration.
- verify analyticity, conformity and bilinearity of complex functions.
- evaluate complex integrals.

GEC 1211	BASIC ENGINEERING MECHANICS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To impart knowledge about the basic laws of statics and dynamics and their applications in problem solving
- To acquaint both with scalar and vector approaches for representing forces and moments acting on particles and rigid bodies and their equilibrium
- To give on exposure on inertial properties of surfaces and solids
- To provide an understanding on the concept of work energy principle, friction, kinematics of motion and their relationship

MODULE I VECTOR APPROACH TO MECHANICS **07**

Introduction - Units and Dimensions- Vectors – Vectorial representation of forces and moments –Vector Algebra and its Physical relevance in Mechanics - Laws of Mechanics – Parallelogram and triangular Law of forces -Lame's theorem, Coplanar Forces – Resolution and Composition of forces- Equilibrium of a particle.

MODULE II EQUILIBRIUM OF PARTICLE **06**

Forces in space - Equilibrium of a particle in space - Equivalent systems of forces – Principle of transmissibility – Single equivalent force

MODULE III EQUILIBRIUM OF RIGID BODY **06**

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis –Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem - Equilibrium of Rigid bodies in two dimensions -Examples

MODULE IV PROPERTIES OF SURFACES **08**

Determination of Areas – First moment of area and the Centroid of sections – Rectangle, circle, triangle from integration – T section, I section, Angle section, Hollow section by using standard formula – second and product moments of plane area – Physical relevance - Rectangle, triangle, circle from integration - T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia- Mass moment of Area

MODULE V FRICTION **08**

Introduction to friction- types of friction- Laws of Coloumb friction- Frictional force – simple contact friction – Rolling resistance –ladder friction

MODULE VI LAWS OF MOTION 10

Review of laws of motion – Newton's law – Work Energy Equation of particles– Impulse and Momentum – Impact of elastic bodies.

L – 45; T – 15; TOTAL HOURS – 60

REFERENCES:

1. Beer, F.P and Johnston Jr. E.R, "Vector Mechanics for Engineers, Dynamics & Statics", Third SI Metric Edition, Tata McGraw-Hill International Edition, 2001.
2. Hibbeller, R.C., Engineering Mechanics, Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., 2000.
3. Irving H. Shames, Engineering Mechanics – Statics and Dynamics, IV Edition Pearson Education Asia Pvt. Ltd., 2003.

OUTCOMES:

On completion of this course students should be able

- Analyse and resolve forces, moments and solve problems using various principles and laws of Mechanics
- Apply the concept of equilibrium to particles and solve problems
- Apply the concept of equilibrium to rigid bodies and solve problems
- Analyse and determine the properties of surfaces
- Analyse and evaluate the fractional forces between the bodies
- Apply the laws of motion in solving dynamics problems

GEC 1212	ENVIRONMENTAL STUDIES	L	T	P	C
		2	0	0	2

OBJECTIVES:

The student will be conversant with the

- various natural resources, availability, utilisation and its current scenario
- different ecosystems, energy transfer, values, threats and conservation of biodiversity
- levels of different pollutants and its impact and the causes and effects of natural disasters
- impacts of human population, impact assessment, human rights and environmental acts and sustainable development

MODULE I NATURAL RESOURCES 8

Land resources: land degradation, soil erosion and desertification - Forest resources: use and over-exploitation, deforestation - Water resources: use and over-utilisation of surface and ground water, conflicts over water (inter-state and international), dams (benefits and problems), water conservation (rainwater harvesting and watershed management) - Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources, mining - Food resources: world food problems, changes in land use by agriculture and overgrazing, modern agriculture and its effects, fertilizer and pesticide problems, water logging and salinity - Energy resources: increasing energy needs, renewable and non-renewable, use of alternate energy sources.

MODULE II ECOSYSTEM AND BIODIVERSITY 8

Ecosystem- energy flow in the ecosystem - food chains, food webs and ecological pyramids - characteristics, structure and function of (a) Terrestrial ecosystems (forest, grassland, desert) and (b) Aquatic fresh water ecosystems (pond, lake, river) (c) Aquatic salt water ecosystems (ocean, estuary) - ecological succession.

Biodiversity - genetic, species and ecosystem diversity – hot-spots of biodiversity – biogeographic classification of India - endangered, endemic, extinct and invasive species of India - red data book - values of biodiversity: consumptive, productive, social, ethical, aesthetic and option values - threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts - conservation of biodiversity: in-situ and ex-situ conservation of biodiversity

MODULE III ENVIRONMENTAL POLLUTION AND NATURAL DISASTER **8**

Definition, cause, effects and control measures of (a) air pollution (b) water pollution (c) soil pollution (d) marine pollution (e) noise pollution (f) thermal pollution (g) nuclear hazards - ill-effects of fireworks and upkeep of clean environment - solid waste management: types (urban, industrial, biomedical and electronic wastes), collection, processing and disposal (incineration, composting and land-fill) - natural disaster and management: flood, cyclone, drought, landslide, avalanche, volcanic eruptions, earthquake and tsunami.

MODULE IV HUMAN POPULATION, HEALTH AND SOCIAL ISSUES **6**

Population and population growth, population variation among nations, population explosion, family welfare programme.

Human health: air-borne, water borne diseases, infectious diseases, risks due to chemicals in food and environment.

Sustainable development - environmental legislation and laws: water act, air act, wildlife protection act, forest conservation act, environment protection act - environmental impact assessment, steps in EIA - human rights - women and child welfare.

Case studies related to current situation

TOTAL HOURS – 30

TEXT BOOKS:

1. Erach Bharucha, Textbook for Environmental Studies For Undergraduate Courses of all Branches of Higher Education for University Grants Commission, Orient Blackswan Pvt Ltd, Hyderabad, India, 2013.
2. Benny Joseph, Environmental Studies, Tata McGraw-Hill Education, India, 2009.
3. Ravikrishnan A, Environmental Science and Engineering, Sri Krishna Publications, Tamil Nadu, India, 2015.
4. Raman Sivakumar, Introduction to Environmental Science and Engineering, McGraw Hill Education, India, 2009.
5. Venugopala Rao P, Principles of Environmental Science and Engineering, Prentice Hall India Learning Private Limited; India, 2006.
6. Anubha Kaushik and Kaushik C.P., Environmental Science and Engineering,

New Age International Pvt Ltd., New Delhi, India, 2009.

REFERENCES:

1. Masters G.M., Introduction to Environmental Engineering and Science, Prentice Hall, New Delhi, 1997.
2. Henry J.G. and Heike G.W., Environmental Science and Engineering, Prentice Hall International Inc., New Jersy, 1996.
3. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co. Boston, USA, 2016.

OUTCOMES:

The student will be able to

- predict the scenario of various natural resources and suggest remedies to curb the exploitation of these resources.
- identify food chain and web and its role in various ecosystems, assess the impacts on biodiversity and provide solutions to conserve it.
- analyse the impacts of pollutants in the environment and propose suitable method to alleviate the pollutants and the natural disasters.
- assess on the impact of human population and the health related issues and the ethics to be followed for sustainable life.

GEC 1213	COMPUTER PROGRAMMING II	L	T	P	C
		1	0	2	2

OBJECTIVES:

- To provide knowledge about the benefits of Object Oriented Programming over Procedure oriented programming.
- To learn various File operations
- To expose fundamental concepts of object-oriented programming in classes, invoking methods and functions.
- To prepare students to get full use of code reusability using object oriented programming.
- To implement the basic concepts of object oriented programming using C++concepts.
- To focus on solving problems based on analyzing, designing and implementing programs in C and C++.

MODULE I PROGRAMMING IN C 7

Functions - Storage Classes - Structures and Unions – Pointers -Self Referential Structures and Linked Lists - File Processing.

MODULE II PROGRAMMING IN C++ 8

Programming in C++ - Overview of OOP in C – Inheritance - Polymorphism - Type Casting – Exceptions.

LIST OF EXPERIMENTS:

1. Functions
2. One dimensional arrays, Pointers
3. Recursion
4. Multi dimensional arrays, Linked lists.
5. Operating on Files.
6. Simple C++ program with Control statements.
7. Getting input from user console.
8. Classes, Object and Constructors.
9. Method overloading.
10. Inheritance

L – 15; P – 30; TOTAL HOURS – 45

REFERENCES:

1. Bjarne Stroustrup," The C++ Programming Language", Addison Wesley, 4th edition, ISBN-13: 978-0321563842, 2013.
2. Brian W. Kernighan and Dennis M. Ritchie, " The C Programming Language", Prentice Hall, ISBN 0-13-110362-8, 2015.
3. Bjarne Stroustrup, " Programming: Principles and Practice Using C++ ", Addison Wesley, 2nd edition, ISBN-13: 978-0321992789, 2014.
4. Brian W. Kernighan and Dennis M. Ritchie, " The C Programming Language (Ansi C Version)", Prentice Hall India Learning Private Limited, 2nd edition, ISBN-13: 978-8120305960, 1990.

OUTCOMES:

Students who complete this course will be able to

- Develop efficient algorithms for solving problems
- Handle files in C
- Use simple data structures like arrays and linked lists in solving problems.
- Write simple programs using concepts of object oriented programming.
- Implement algorithms in C++ Language.
- Demonstrate the Object Oriented Programming concepts applied in networking, web development and Database applications.

CEC1211	ENGINEERING GEOLOGY	L	T	P	C
		2	0	0	2

OBJECTIVES:

The objective of the course is to

- Impart knowledge of earth processes to consider them during the planning and execution of civil engineering projects
- Equip the students with the knowledge to demarcate and differentiate various rock types and minerals to be used as construction materials
- Impart knowledge on the areas of weakness in a zone and to identify the geological conditions of tunnels, dams & reservoirs.

MODULE I PHYSICAL GEOLOGY **6**

Branches of geology – Earth Internal structure – Earth processes -Weathering, volcanism, earthquake and plate tectonics

MODULE II MINERALOGY & PETROLOGY **9**

Introduction – Mineralogy, Physical properties of minerals, Rocks - Classification of rocks – igneous, sedimentary and metamorphic rocks

MODULE III STRUCTURAL GEOLOGY **9**

Types of geologic structures – Folds – Faults and Joints, classification and their effect on civil engineering projects

MODULE IV GEOLOGY FOR CIVIL ENGINEERING **6**

Geological conditions necessary for construction of tunnels, dams, reservoirs

TOTAL HOURS – 30

TEXT BOOKS:

1. Parbin Singh, “Engineering and General Geology”, Katson Publication House, 2009.
2. P.C.Varghese, “Engineering Geology for Civil Engineers”, PHI Learning Private Ltd, New Delhi, 2012.
3. P.C.Rao & D.B.Rao, “A Text Book of Geology”, Discovery Publishing House,

New Delhi, 2010.
4. N.Chenna Kesavalu, “Text book of Engineering Geology”, Macmillian Publishers India Ltd, New Delhi, 2009.
5. P.T.Sawant, “Engineering & General Geology”, New India Publishing Agency, 2011.
6. Alan.E.Kehew, “General Geology for Engineers”, Prentice Hall, 2000.

REFERENCES:

1. Todd D K., “Groundwater Hydrology”, John Wiley & Sons, New York,2006
2. Tyrrel, GW, ”The Principles of Petrology”, Asia Publishing House, Bombay, 1970

OUTCOMES:

On completion of this course students will be able to

- Identify the geological parameters required for construction, planning and design of civil engineering structures.
- Demarcate and differentiate between rock types and minerals to be used as construction materials.
- Identify the areas of weakness in a zone and consider and eradicate the weakness during the civil engineering projects.
- Identify the necessary geological conditions of tunnels, dams and reservoirs.

CEC1212	BUILDING CONSTRUCTION AND PRACTICES	L	T	P	C
		3	0	0	3

OBJECTIVES:

The main objective of this course is

- To impart the students, overview knowledge of various construction materials such as stone, brick, timber, bitumen, cement, steel etc with respect to type, mechanical properties and applications in industry.
- To impart the knowledge on various components of building and different construction activities

MODULE I LIME - CEMENT - STONES **7**

Lime – Preparation of lime mortar - Cement Ingredients – Manufacturing process – Types and Grades – Properties of cement – Hydration – Test on Cement -– Stone as building material – Criteria for selection – Tests on stones – Deterioration and Preservation of stone work - Test on Coarse Aggregates – Test on fine Aggregates – Mortar – Grades – Types

MODULE II BRICKS – BLOCKS **8**

Bricks – Classification – Manufacturing of clay bricks – Tests on bricks – Concrete – Ingredients – Manufacturing –Types - Concrete Blocks – Gypsum Blocks Applications – Properties - Tiles – Manufacturing – Properties - Industrial byproducts – Fly ash Bricks

MODULE III TIMBER AND OTHER BUILDING MATERIALS **7**

Timber – Properties – Seasoning – Defects – Preservation – Asphalt and Bituminous materials – Types – Properties – Bituminous concrete for pavement application – Types of structural steels, special steel, alloy steel, stainless steel, light gauge steel, Polymers in Civil Engineering – composites and smart materials –– Properties –- Aluminum and Other Metallic Materials – Composition – Aluminium composite panel – Uses – Market forms

MODULE IV BUILDING ELEMENTS **8**

Overview of building process - elements of a building - basic requirements of a building - planning suitable orientation - planning for energy efficiency

Types of structures – Load Bearing – Non Load Bearing – Steel – Composite- Foundation – safe bearing capacity of soil, Function and requirements of good foundation, types of foundation- Shallow – Deep Foundation - Types of walls - load

bearing, partition walls, cavity walls . Doors, Windows and Ventilators - Location of doors and windows, technical terms, Materials for doors and windows, Paneled door, Flush door, Collapsible door, Rolling shutter, PVC Door, Panelled and glazed Window, Bay Window, French window. Ventilators.

MODULE V ROOFS, FLOORS AND STAIRS 8

Floors - Requirement of good floor - Components of ground floor - Selection of flooring material - Types of floor - Roof - Requirement of good roof, Types of roof, Different roofing materials

Lintels and Arches **-**Balconies, chajjas and canopy. Arches; Elements and Stability of an Arch.

Stairs - Definitions, technical terms and types of stairs, Requirements of good stairs.

MODULE VI MASONRY AND FINISHES 7

Masonry - Definition and terms used in masonry - Mortar – Ingredients – Mixing – Grades - mortar. Brick masonry - characteristics and requirements of good brick masonry - Types of Bonds in brick work - Stone masonry, Requirements of good stone masonry – Classification - characteristics of different stone masonry - Joints in masonry.

Plastering and Pointing - purpose, materials and methods of plastering and pointing - defects in plastering- Stucco plastering - lathe plastering - Damp proofing - causes, effects and methods.Temporary structures - Scaffoldings – types –slip forms.

Painting - Purpose, types, ingredients and defects - Preparation and applications of paints to new and old plastered surfaces, wooden and steel surfaces.

TOTAL HOURS – 45

TEXT BOOKS:

1. Varghese.P.C, “Building Materials”, PHI Learning Pvt. Ltd, New Delhi, 2012.
2. Rajput. R.K., “Engineering Materials”, S. Chand and Company Ltd., 2008.
3. Shetty.M.S., “Concrete Technology (Theory and Practice)”, S. Chand and Company Ltd.,2008.
4. Gambhir.M.L., “Concrete Technology”, 3rd Edition, Tata McGraw Hill Education, 2004
5. Duggal.S.K., “Building Materials”, 4th Edition, New Age International , 2008.

REFERENCES:

1. Jagadish.K.S, “Alternative Building Materials Technology”, New Age International, 2007.

2. Gambhir. M.L., & Neha Jamwal., “Building Materials, products, properties and systems”, Tata McGraw Hill Educations Pvt. Ltd, New Delhi, 2012.
3. S.S. Bhavikatti., “ Basic Civil Engineering’, New Age International (p) Limited, New Delhi, 2010
4. IS456 – 2000: Indian Standard specification for plain and reinforced concrete.
5. IS4926–2003: Indian Standard specification for ready–mixed concrete.
6. IS383–1970: Indian Standard specification for coarse and fine aggregate from natural Sources for concrete.
7. IS1542–1992: Indian standard specification for sand for plaster.

OUTCOMES:

On completion of the course the student will be able to

- Select the type of cement, and stones to be used based on the application, properties and test results.
- Perform the tests on brick, clay and concrete products.
- Explain the properties and types of timber, bitumen, steel, aluminum, polymers and composites.
- Identify the different components in a building and its functions
- Choose the type of roofs, slabs, windows and doors used in the construction of a building.
- Suggest the type of construction practices to be followed in site for various situations.

CEC1213	CIVIL ENGINEERING DRAWING	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To enable the students to understand the fundamental and basic principles of building drawing
- To impart knowledge in basic commands of a drafting package.
- To provide training to plan and draw different views of buildings according to building rules.

MODULE I INTRODUCTION TO BUILDING COMPONENTS 6

Building components – Substructure –Superstructure – Total area of site –- plinth area- Total built up area- Arrangements of building components -Types of staircase- Drawing of conventional signs and symbols.

MODULE II BASIC PLANS 6

Drawing of simple house plans -site plan – floor plans – elevation - sectional views of a residential building.

MODULE III BUILDINGS WITH INCLINED ROOF 9

Buildings with inclined roof – Plan, Elevation & Section of an inclined roof building.

MODULE IV MULTI STOREYED STRUCTURES 9

Plan – Orientation of beams and columns - elevation - Sectional view of multi storyed buildings - drawings of the structural frame - reinforcement detail drawing of slab, beams, column, and foundation.

MODULE V INDUSTRIAL STRUCTURES 9

Plan - elevation - sectional view of Industrial structures

MODULE VI SERVICE PLANS 6

Electrical, plumbing (water and sewerage lines), gas lines for a residential building as per B.I.S

TOTAL HOURS – 45

TEXT BOOKS:

1. Venugopal, K., “Engineering Drawing And Graphics”, 5th Edition, New Age International (P) Ltd., New Delhi, 2011.
2. Gurcharan Singh, “Civil Engineering Drawing”, Standard Publishers and Distributors, 2009.
3. 3. Kumara Swamy, N. and Kameswara Rao, A., “Building Planning and Drawing”, 6th Edition, Charotar Publishing House (P) Ltd, Gujarat, India, 2012.

REFERENCES:

1. IS 962 : 1989 (R 2001), Code of Practice For Architectural and Building Drawings, Bureau of Indian Standards, New Delhi.
2. Gurcharan Singh, “Building Planning and Scheduling”,Standard Publishers and Distributors, 2012.
3. 3. Shah, M.G., Kale, C.M., Patki, S.Y., “Building Drawing: With an Integrated Approach to Built Environment”, Tata McGraw-Hill Publishing Company (P) Ltd., New Delhi, 2002.

OUTCOMES:

At the end of the course, the students will be able to

- Prepare plan, elevation of the various substructure and superstructure components of a building.
- Identify the sign and symbols as per B.I.S. and develop a simple House plan and their sectional views.
- Prepare a plan, elevation and sectional view of a masonry wall for a residential building. Develop a plan and sectional view for different types of R.C.C Buildings using cad software.
- Recognise and construct a plan and sectional view of an industrial building using drafting software.
- Locate and plan various service lines for a residential building as per codal provisions.

SEMESTER III

MAC 2181	**PARTIAL DIFFERENTIAL EQUATIONS AND TRANSFORMS**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

OBJECTIVES:

The aims of this course are to

- Familiarize in solving partial differential equation of first, second and higher orders.
- Introduce basics and engineering applications of Fourier series, Laplace Transform, Fourier Transform and Z- Transform.

MODULE I PARTIAL DIFFERENTIAL EQUATIONS 8 + 2

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solution of standard types of first order partial differential equations – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients.

MODULE II FOURIER SERIES 8+2

Fourier Series and Dirichlet's conditions - General Fourier series - Half range Fourier series - Parseval's identity - Harmonic Analysis.

MODULE III FOURIER TRANSFORMS 7+3

Fourier integral theorem (without proof) - Fourier transform pair - Fourier Inverse Transform – Properties - Convolution theorem - Parseval's identity.

MODULE IV APPLICATIONS OF FOURIER SERIES AND FOURIER TRANSFORMS 7+3

Applications of Fourier series and Fourier Transform to solution of PDEs having constant coefficients with special reference to Heat & Wave equations, Discrete & point Spectrum and Single pulse.

MODULE V LAPLACE TRANSFORM 8+2

Introduction to Laplace transform - Existence of Laplace Transform - Properties of Laplace Transforms - Initial & Final Value Theorems - Inverse Laplace Transform - Convolution Theorem – Circuits to signal square wave: Integral equations with unrepeated complex factors – Damped forced vibrations: repeated complex

factors – Resonance - Solution of differential equations

MODULE VI Z – TRANSFORM 7+3

Introduction and Definition of Z-transform - Properties of Z- Transform - Convolution Theorem of Z-Transform - Inverse Z–transform - Convolution Theorem of Inverse Z-Transform - Formation of difference equations - Solving Difference Equations using Z-Transform.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Kreyszig .E., “Advanced Engineering Mathematics“, 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
2. Grewal B.S., “Higher Engineering Mathematics”, 42nd edition, Khanna Publishers, New Delhi, 2012.
3. Ramana, B.V, “Higher Engineering Mathematics” Tata Mc Graw Hill Publishing Co. New Delhi, 2006.

REFERENCES:

1. Veerarajan.T., “Engineering Mathematics“, 5th edition, Tata Mc Graw Hill Publishing Co. New Delhi, 2012.
2. **Error! Hyperlink reference not valid.**, “Advanced Engineering Mathematics**”**, 7th edition, Cengage Learning, 2011.
3. Dennis G. Zill, Warren S. Wright, “Advanced Engineering Mathematics”, 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
4. Alan Jeffrey, “Advanced Engineering Mathematics”, Academic Press, USA, 2002.

OUTCOMES:

After completing the course, student will be able to

- solve the partial differential equations.
- derive a Fourier series of a given periodic function by evaluating Fourier coefficients.
- apply integral expressions for the forward and inverse Fourier transform to a range of non-periodic waveforms.
- solve wave equation and heat flow equation.
- solve ordinary differential equations using Laplace transform.
- solve difference equation using Z-transform.

ENC 2181 ORAL COMMUNICATION

L	T	P	C
0	0	2	1

OBJECTIVES:

- To expose students to a range of professional contexts through podcasts for learning appropriate expressions.
- To train them in making poster presentations.
- To enable them to make effective business presentations.
- To help them learn persuasive and negotiation skills.
- To train them to debate on issues of current relevance
- To train them to participate in group discussions on current affairs

MODULE I **4**

Orientation to the Importance of Oral Communication -– Verbal and non-verbal communication -Paralinguistic features.

One-minute presentations (using Audacity/Voicethread) – Just a minute (JAM) on random topics

MODULE II **4**

Negotiating and persuading through effective arguments – to arrive at a conclusion (pair-work)

Understanding Negotiation, persuasion and marketing skills through Podcasts

Listening to short conversations and monologues for understanding real life conversations

MODULE III **4**

Making Poster presentations on current issues

Understanding nuances of making effective presentations (TED Videos)

MODULE IV **6**

Deliberation on social and scientific issues – Debates (focus on rebuttal skills and deconstructing arguments)

Viewing videos on debates (NDTV Discussions)

MODULE V **6**

Discussing social issues or current affairs in groups

Viewing group discussions and listening for specific information

MODULE VI **6**

Making full length presentation (through Voicethread) with the focus on one's career plans and prospects (discipline specific)

Listening to interviews for understanding speakers' perception (on industry related issues)

P – 30; Total Hours –30

REFERENCES:

1. Hancock, Mark (2012). *English Pronunciation in Use*. Cambridge University Press, UK.
2. Anderson, Kenneth & et.al (2007). *Study Speaking: A Course in Spoken English for Academic Purposes* (Second Edition). Cambridge University Press, UK.
3. Hurlock, B.Elizabeth (2011). *Personality Development*. Tata McGraw Hill, New York.
4. Dhanavel,S.P (2015). *English and Soft Skills*. Orient Blackswan, Chennai.
5. Whitby, Norman (2014). *Business Benchmark: Pre-Intermediate to Intermediate.* Cambridge University Press, UK.

OUTCOMES:

On completion of the course, students will be able to

- Listen to business conversations and do related tasks.
- Deliver effective poster presentations.
- Make effective business presentations.
- Use persuasive and negotiating skills for justifying arguments.
- Participate effectively in debates.
- Speak English intelligibly, fluently and accurately in group discussions.

CEC 2101	MECHANICS OF SOLIDS	L	T	P	C
		3	0	2	4

OBJECTIVES:

The objective of the course is

- To impart knowledge on the basic concepts of stresses, strains and deformation due to internal forces.
- To provide knowledge on the computation of bending moment, shear force and deflection for various types of beams under transverse loading.
- To explain the theory of torsion in shafts and springs.
- To understand the principal stresses and strains
- To impart knowledge to analyze the two dimensional plane trusses.

MODULE I STRESS, STRAIN AND DEFORMATION OF SOLIDS 8

Rigid and deformable bodies - Stress and Strain – Hooke's Law – Elastic constants and their relationship – Deformation of simple and compound bars - Bar with uniform and varying section - Thermal Stresses.

MODULE II STRESSES IN BEAMS 9

Beams – Types of loading on beams– Shear force and Bending moment in cantilever beams, simply supported beams and over hanging beams – Theory of simple bending – Bending stress distribution - Shear stress distribution.

MODULE III DEFLECTION OF BEAMS 8

Double Integration method – Macaulay's method – Moment area method for computation of slopes and deflection in determinate beams.

MODULE IV TORSION 8

Theory of simple torsion – Stresses and deformation in circular and hollow shafts – Stepped shafts – Shafts fixed at both ends – Stresses and deflection of Leaf springs and helical springs.

MODULE V BIAXIAL STRESSES 6

Principal Stresses, strain and maximum shear stresses - Analytical methods - Volumetric Strain.

MODULE VI ANALYSIS OF PLANE TRUSS 6

Stability and equilibrium of trusses – Types of trusses – Analysis of forces in truss members - Method of joints - Method of sections**.**

LIST OF EXPERIMENTS:

1. Properties of steel rebar by tension test
2. Determination of hardness of metal by Rockwell and Brinell hardness test.
3. Determination of impact strength of metal by Izod and Charpy method.
4. Bending test on simply supported and cantilever beam for different types of materials.
5. Determination of Young's modulus of timber and steel.
6. Determination of Stiffness and Modulus of rigidity of steel specimen by torsion test.
7. Determination of Stiffness and Modulus of rigidity of open coil spring by compression test.
8. Determination of Stiffness and Rigidity modulus of closed coil spring by tension test.

L- 45 ; P - 30; Total Hours : 75

TEXT BOOKS:

1. Egor Popov, P., "Engineering Mechanics of Solids", 2nd Edition, PHI Learning, New Delhi, 2009.
2. William N., Nash Patter Merk, C., "Strength of Materials", 5th Edition, McGraw-Hill, India, 2010
3. Timoshenko, S. and Young, D.H., "Elements of Strength of Materials", Vol. I and Vol. II, 5th Edition, East West Press, New Delhi, 2011.Vazirani, V.N., Ratwani, M.M., "Analysis of Structures", Volume 1, 9th reprint Edition, Khanna Publishers, New Delhi, 2010.
4. Punmia, B.C., Ashok Kumar Jain, Arun Kumar Jain, "Theory of Structures", Vol. II, 12th Edition, Lakshmi publications, New Delhi, 2004.

REFERENCES:

1. Bedi, D.S., “Strength of Materials”, 5th Edition, Khanna Book Publishing, New Delhi, 2011.
2. Shames Irwing, H. and Pitarresi James, M., “Introduction to Solid Mechanics”, 3rd Edition, Prentice Hall of India, New Delhi, 2002.
3. R.K.Rajput, Strength of Materials, Lakshmi publications, New Delhi, 2004.
4. Timoshenko . S and young, D.H “Elements of strength of materials”, Vol.I and Vol. II, 5th edition, East west press, New Delhi, 2011.

OUTCOMES:

At the end of the course, the student will be able to

- describe stress, strain, elastic constants and their relationship.
- draw bending moment, shear force and axial force diagrams for statically determinate beams and sketch the deflected shapes.
- determine the stresses and deflection for various types of beams using various methods.
- determine the torsion equation and solve the problems based on torsion.
- determine the principal stresses and strains based on various methods.
- analyze the two-dimensional truss by using various methods.

CEC2102	SURVEYING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course aims to

- impart knowledge about the basic concepts of surveying and to differentiate map and plan.
- categorize the linear measurement; explore the concept of angular measurement and usage of theodolite.
- use the dumpy level with the help of leveling concept and properties of contours.
- categorize the methods of plane tabling and solve the triangulation and trilateration problems.
- use the EDM and total station for the measurement of angles and distances.
- analyze the concepts of engineering surveys and to set out works.

MODULE I INTRODUCTION TO SURVEYING 7

Basic definitions, objectives, divisions and Importance of Surveying to Engineers; Plane and geodetic surveys; Classification and principles of Surveying; Concept of Geoid and reference spheroids, coordinate systems Output of Survey – Maps, Plans, Scales.

MODULE II LINEAR AND ANGULAR MEASUREMENTS 8

Direct and indirect methods of linear measurement; Obstacles in chaining and ranging, Angular Measurements - Basic Definitions- meridians, local attraction, Theodolite – Different types and their salient parts, Temporary and Permanent Adjustments, Methods of repetition and reiteration.

MODULE III LEVELING AND CONTOURING 8

Basic Definitions, Curvature & Refraction, Level – Types and salient parts, working principle, Temporary and Permanent Adjustments, Leveling Staff, Methods of leveling - Differential leveling and field book note, Reciprocal Leveling; Profile leveling; Trigonometric leveling, Errors & Mistakes in leveling, Contouring - definition, characteristics, methods and applications.

MODULE IV TRAVERSING, TRIANGULATION AND TRILATERATION **9**

Plane Tabling - Merits and demerits, accessories; orientation and resection; methods of plane tabling; Traversing, Triangulation and Trilateration - Purpose and classification of each; Horizontal and vertical control methods, Triangulation-network, field work, selection of stations, measurements and computations. Heights and distances - Tacheometry- Introduction, Basic definitions, Methods, subtense bar, fundamental principles; Stadia system and Tangential system – methods.

MODULE V EDM AND TOTAL STATION **7**

Electronic distance Measurement (EDM) - Measuring principle, Working principle, Sources of Error, Types of EDM; Total Station – Working Principle, sources of errors in total station and types of total station instruments, Advantages of total station.

MODULE VI PROJECT AND ENGINEERING SURVEYS **6**

General requirements and specifications for engineering project surveys; Reconnaissance, preliminary, location survey and surveys for highway, railway, Setting out works for buildings and simple circular curves, Applications of GPS and GIS in surveying – case studies.

L- 45 ; Total Hours : 45

TEXT BOOKS:

1. Punmia, B.C., Ashok Kumar Jain and Arun Kumar Jain “Surveying”, Vol. I, II and III, 15th Edition, Laxmi Publications, New Delhi, 2005.
2. Kanetkar, T.P., “Surveying and Levelling”, Vol. I and II, Standard Publication, 2008.
3. Arora, K.R., “Surveying”, Vol. I & II, Standard Book House, New Delhi, 1996.

REFERENCES:

1. Clark, D., “Plane and Geodetic Surveying”, Vol. I and II, 6th Edition, C.B.S. Publishers and Distributors, New Delhi, 1983.

2. James M. Anderson and Edward M. Mikhail "Introduction to Surveying", 7th Edition, McGraw Hill, 1997.
3. Heribert Kahmen and Wolfgang Faig, “Surveying”, Walter de Gruyter, 1995.
4. Bannister, A., Raymond, S. and Raymond Baker, “Surveying”, 7th Edition, Prentice Hall, 1998.

OUTCOMES:

- Differentiate between map and plan, to classify different types of surveying and to identify map symbols.
- Obtain linear measurements and to correct the error using chain or tape.
- Correct the angular measurements with the help of theodolite & compass, use tacheometer to compute distances.
- Determine the elevation of poonits and generate the surfaces of a given
- terrain
- Map an area using plane table and to use the method of triangulation to measure area using EDM.
- Set out curves to prepare engineering projects and prepare preliminary and
- location survey for highways, railways and tunnel

CEC2103 MECHANICS OF FLUIDS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart understanding of key concepts and fundamental principles pertaining to fluid behavior, both in static and flowing conditions.
- To provide sufficient knowledge to analyze and design engineering systems and devices involving fluids and flow.
- To enhance student's interest in fluid phenomena and its applications.

MODULE I FLUID PROPERTIES AND PRESSURE MEASUREMENT **8**

Dimensions and units - Properties of Fluids - ideal and real fluid - Definition of pressure - Pressure at a point- Pascal's law- Absolute and Gauge pressure - Measurement of pressure - Simple and differential Manometer theory and problems - pressure gauges

MODULE II FLUID STATICS **8**

Hydrostatic law - Definition of total pressure, Center of pressure, Metacentric height, buoyant force - Equation for hydrostatic force and depth of center of pressure on plane surfaces (vertical and inclined) - Problems on hydrostatic force on vertical, inclined and curved submerged surfaces.

MODULE III FLUID KINEMATICS **7**

Fluid Kinematics – velocity and acceleration- Stream, streak and path lines – Classification of flows – Continuity equation (one, two and three dimensional forms) – Stream and potential functions – flow nets and its properties.

MODULE IV FLUID DYNAMICS AND FLOW THROUGH PIPES **8**

Euler and Bernoulli's equations – Application of Bernoulli's equation – Venturimeter–Orifice meter- Laminar flow through pipes– Hagen Poiseuille equation – Turbulent flow – Darcy-Weisbach formula – Major and minor losses of flow in pipes – Pipes in series and in parallel – Moody diagram.

MODULE V BOUNDARY LAYER 7

Definition of boundary layer – Thickness and classification – Displacement and momentum thickness – Separation of boundary layer – Development of laminar and turbulent flows in circular pipes.

MODULE VI SIMILITUDE AND MODEL STUDY 7

Dimensional Analysis – Rayleigh's method, Buckingham's Pi- theorem – Similitude and models-dimensionless numbers – Scale effect and distorted models

Total Hours : 45

TEXT BOOKS:

1. Bansal, R.K., "Text book of Fluid Mechanics and Hydraulic Machines", Laxmi Publications Ltd., New Delhi, 2005.
2. Modi, P.N. and Seth, S.M., "Hydraulics and Fluid Mechanics including Hydraulics Machines", Standard Book House, New Delhi, 2002.
3. Molykutty, M.V., "Fluid Mechanics and Machinery", D1 Publications, Chennai, 2008.
4. Nagaratnam, S., "Fluid Mechanics", Khanna Publishers, New Delhi, 1989.
5. Kumar, K.L., "Engineering Fluid Mechanics", 7th Edition, Eurasia Publishing House (P) Ltd., New Delhi, 1995.

REFERENCES:

1. Streeter Victor, L., Benjamin Wylie, E. and Bed Ford Keith, W., "Fluid Mechanics", 9th Edition, McGraw-Hill Ltd., 1997.
2. Jain, A.K., "Fluid Mechanics", Khanna Publishers, New Delhi, 1996.
3. Pernard Messay, "Mechanics of Fluids", 7th Edition, Nelson Thornes Ltd., U. K., 1998.
4. Jagdish, "Hydraulics Machines", Metropolitan Book Co. Pvt. Ltd, New Delhi, 1973.

OUTCOMES:

At the end of the course, the student will be able to

- Describe fluid properties, forces causing flow and will be able to solve problems involving fluid properties and fluid pressure measurements.
- Compute the magnitude and location of hydrostatic forces on vertical, inclined and curved submerged surfaces and analyze the equilibrium of floating bodies.
- Analyze the flow using principles of fluid kinematics
- Solve fluid problems using principle of fluid dynamics.
- Describe the concepts of boundary layer theory, application off the concepts in determining the separation of boundary layer and to analyze the laminar and turbulent flows in circular pipes.
- Apply the principles of dimensional analysis for fluid flow problems.

CEC2104 CONCRETE TECHNOLOGY

L	T	P	C
3	0	2	4

OBJECTIVES:

- To impart adequate knowledge on concrete constituent materials, fresh and hardened properties of concrete and durability of concrete.
- To make students understand the concepts involved in concrete mix design as per Indian Standards and ACI Method.
- To give exposure to quality control procedures, testing of concrete specimens, special concretes and concreting methods.

MODULE I CONCRETE CONSTITUENT MATERIALS 7

Cement – Grades and types as per IS and ASTM Classification – Testing of cement for quality assurance – Chemical compounds - Hydrated structure – Special cements. Coarse aggregates – Properties, classification and IS recommendations. Fine aggregate – Properties, classification and IS provisions. M Sand - Properties, classification and IS provisions. Water – Quality and IS recommendations. Mineral admixtures and chemical admixtures for concrete. –Concrete - Types – Manufacturing - , mixing, placing, compacting and curing of concrete - form work.

MODULE II PROPERTIES OF CONCRETE 8

Properties of Concrete Selection of materials for concrete - water cement ratio - Properties of fresh concrete - workability - measurement of workability - Admixtures - process of various stages of concrete - Statistical and quality control of concrete. Properties of concrete – strength, modulus of elasticity, creep, shrinkage -Testing of hardened concrete – destructive test - Compressive strength, Tensile strength, Flexural strength. – non destructive test – rebound hammer test, Windsor probe test, ultrasonic pulse velocity test, acoustic emission method, pulse-echo method, initial surface absorption test, infrared thermography, quantum test, carbonation test.

MODULE III MIX DESIGN 8

Mix design Concrete mix design - concepts of mix design - variables in

proportioning - Different methods of mix design - Indian Standard method IS 10262 - Mix design for High Strength and High performance concrete – Ready mix concrete

MODULE IV DURABILITY OF CONCRETE 8

Durability of concrete- Permeability of concrete – Shrinkage - plastic shrinkage - drying shrinkage - Chemical attack - Sulpahte attack of concrete structures - chloride attack – Alkali Aggregate Reaction – Carbonation

MODULE V SPECIAL CONCRETE 8

Special concretes - High performance concrete - high strength concrete, high density concrete - light weight concrete - Fibre reinforced concrete - self-compacting concrete - Polymer concrete – Underwater concrete – Mass concrete – Cold weather concrete – Hot weather concrete – Shotcrete – Self compacting concrete – Reactive powder concrete.

MODULE VI CONCRETE UNDER SPECIAL CIRCUMSTANCES 6

Underground construction – concrete construction in marine environment – underwater construction – piles – diaphragm walls – hot weather concreting – cold weather concreting.

LIST OF EXPERIMENTS:

1. Tests on cement, fine aggregate, coarse aggregate for concrete
2. Concrete mix design with and without admixtures as per Indian Standards for the given parameters.
3. Workability of concrete : Slump test, compaction factor test, flow table test and Vee-Bee consistometer test.
4. Compressive strength test on cubes and cylinder specimen
5. Splitting tensile strength test on concrete cylinder specimen
6. Flexural strength test on concrete prism
7. Study on the flow properties for Self-Compacting concrete
8. Tests for assessing the performance of hardened concrete to find its stress - strain relationship and Young's Modulus.

9. Non-destructive Testing on existing beams, columns & slabs.

L- 45 ; P- 30; Total Hours : 60

TEXT BOOKS:

1. Gambir M.L, ConcreteTechnology, Tata MC-Graw Hill-Education, 2013.
2. Shetty M.S., Concrete Technology, S. Chand & Company Ltd., 2010
3. Metha P.K, "Concrete: Microstructure, properties and Materials", McGraw-Hill, 2014.

REFERENCES:

1. Zongjin Li, Advanced Concrete Technolgy, John Wiley & Sons – 2011.
2. IS : 12269-1987, Specification for 53 grade ordinary Portland Cement, BIS, New Delhi.
3. IS : 383 – 1970, Specification for Coarse and fine natural sources for Concrete, BIS, New Delhi.
4. IS 10262-2009, Concrete Mix Proportioning - Guidelines.

OUTCOMES:

At the end of the course, students will be able to

- describe the manufacturing process of concrete
- determine fresh concrete and hard concrete properties as per procedures outline in Indian standards.
- perform concrete mix design as per Indian Standards and ACI Method.
- recognize various parameters influencing durability performance of RCC structure.
- apply the knowledge gained on special concrete in different civil engineering applications and appreciate various connecting method adopted in site.

CEC2105	SURVEYING LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To make the students understand the working of theodolite, and enable them to make angular measurements using a theodolite.
- To enable the students to compute the height of a building using the measure angle using trigonometrical leveling
- To enable the students to determine distances between two points and the difference in elevation between points using the tacheometric measurements.
- To enable the students to mark foundation of any structures and to set out curves.
- To enable students to use a total station to take measurements such as angles and distances and to determine area.
- To introduce GPS to students

MODULE I THEODOLITE SURVEYING 12

1. Introduction to Surveying Lab II
2. Measurement of Horizontal Angle by Direct Method
3. Measurement of Horizontal Angle by the Method of Repetition
4. Measurement of Horizontal Angle by Method of Reiteration
5. Measurement of Vertical Angles – Direct Method

MODULE II HEIGHTS AND DISTANCES 12

1. Measurement of Distances – Single Plane Method
2. Measurement of Distances – Double Plane Method
3. Determination of Constants of a Tacheometer
4. Determination of Distance using a Tacheometer – Stadia System – at an Angle of Elevation or Depression
5. Determination of Distance using a Tacheometer – Tangential System

MODULE III SETTING OUT WORKS 6

1. Foundation Marking
2. Simple Curve

MODULE IV TRIANGULATION 9

1. Determination of Area of the field
2. Trigonometric surveying

MODULE V TOTAL STATION AND GPS 6

1. Determination of Heights and Distances using a Total Station
2. Determination of RL of the given point using a Total Station
3. Demonstration of GPS

Total Hours : 45

TEXT BOOKS:

1. Bannister, A. and Raymond, S., "Surveying", 6th Edition, ELBS Publishers,1992.
2. Kanetkar, T.P., "Surveying and Levelling", Vol. I and II, United Book Corporation, Pune, 1994.
3. Punmia, B.C., "Surveying", Vol. I, II and III, Laxmi Publications, NewDelhi, 2007.

REFERENCES:

1. Clark, D.,"Plane and Geodetic Surveying", Vol. I and II, C.B.S. Publishers and Distributors, Delhi, Sixth Edition, 1971.
2. James M. Anderson and Edward M. Mikhail, "Introduction to Surveying", McGraw- Hill Book Company, 1985.
3. Heribert Kahmen and Wolfgang Faig, "Surveying", Walter de Gruyter,1995.

OUTCOMES:

At the end of the course, the students will be able to

- To measure horizontal and vertical angles using a theodolite by different methods.
- To measure the height of a building using the angles measured from a

theodolite.

- To compute distances and reduced levels between points using the tacheometric measurements.
- To prepare foundation marking and to set out curves.
- To measure the area using triangulation method and determine distances using
- trigonometric surveying
- To measure angles and distances using a total station and to determine the area of a given field using a total station. To take measurements using a GPS.

IV SEMESTER

		L	T	P	C
ENC 2282	**WRITTEN COMMUNICATION**	**0**	**0**	**2**	**1**

OBJECTIVES:

- To help students identify content specific vocabulary and learn its usage.
- To expose them to reading for specific purposes, especially in professional contexts.
- To expose them to the process of different kinds of formal writing.
- To help them learn corporate correspondence for different purposes.
- To train them in preparing effective applications with résumé
- To make them write different types of reports.

MODULE I **4**

Introduction - process of writing – Fundamentals of academic and professional writing – Understanding short, real world notices, messages, etc.

MODULE II **4**

Reading industry related texts (ex. Manufacturing, textile, hospitality sector etc.) for specific information.

Writing Instructions and recommendations

MODULE III **6**

Understanding format and conventions of writing email, memo, fax, agenda and minutes of the meeting.

Writing email, memo, fax, agenda and minutes of the meeting for various purposes (industry specific)

MODULE IV **6**

Viewing letter of application and Résumé, letter calling for an interview, letter of inquiry and Promotional letter

Writing Functional résumé and letter of application using Edmodo,

MODULE V **6**

Viewing a Video and reading a case study (industry specific) – collaborative writing using Edmodo –reading and information transfer

Writing reports- Survey, feasibility and progress – exposure to discipline

specific reports

MODULE VI **4**

Writing Statement of purpose (Higher Education)-- Justifying and writing about one's preparedness for job (Statement of Purpose highlighting strengths and weaknesses) – Peer evaluation skills through Edmodo.

P – 30; Total Hours –30

REFERENCES:

1. Riordan,D (2013). *Technical Report Writing Today*. Cengage Learning, 10th edition. USA.
2. Oliu, W. E., Brusaw, C.T., & Alred, G.J.(2012). *Writing that Works: Communicating Effectively on the Job* . Bedford/St. Martin's. Eleventh Edition.
3. Garner, B.A. (2013). *HBR Guide to Better Business Writing (HBR Guide Series)*. Harvard Business Review Press. USA.
4. Sharma, R.C. & Krishna M. (2002). *Business Correspondence and Report Writing*. Tata MacGraw – Hill Publishing Company Limited, New Delhi.
5. Macknish, C. (2010). *Academic and Professional Writing for Teachers*. McGraw-Hill Education. USA.
6. Whitby, Norman (2014). *Business Benchmark: Pre-Intermediate to Intermediate.* Cambridge University Press, UK.

OUTCOMES:

On completion of the course, the students will have the ability to

- Identify content specific vocabulary and also use them in appropriate contexts.
- Demonstrate reading skills with reference to business related texts.
- Draft professional documents by using the three stages of writing.
- Create different types of documents for various corporate correspondences.
- Write effective letter of applications, résumé and statement of purpose.
- Write business related reports efficiently.

CEC2211 HYDRAULIC AND HYDRAULIC MACHINERY

L	T	P	C
3	0	2	4

OBJECTIVES:

To familiarize the students with the flow through open channels and working of hydraulic machines such as various types of turbines and pumps.

MODULE I FLOW MEASUREMENTS 8

. Flow through Orifices, mouthpieces - classification - hydraulic coefficients - problems, Flow over notches and weirs - classification - Equation for discharge over rectangular, trapezoidal notches, V-notch-- Cippoletti notch - ventilation of weirs - discharge over Broad crested weirs, narrow crested, Submerged weirs – problems – velocity measurement using floats, currentmeter.

MODULE II FLOW IN OPEN CHANNELS 8

Definition of open channels – classification - types of flow -Geometric properties of open channels - Uniform flow- velocity measurements -Chezy's and Manning's formulae- Most economical sections - Derivation of conditions for rectangular, triangular, trapezoidal and circular sections - Specific energy - definitions- specific energy curve - conditions for minimum specific energy and maximum discharge - Critical flow and its computation.

MODULE III VARIED FLOW 8

Dynamic equations of gradually varied flow – Assumptions – Characteristics of flow profiles – Draw down and backwater curves – Profile determination – Graphical integration, direct step method - Hydraulic jump in rectangular channels – applications - derivations with Froude number concept- Problems on Hydraulic Jump, venturi flume.

MODULE IV IMPACT OF JET ON VANES 7

Impulse momentum principle and its applications- Derivation for force exerted by a jet on normal, inclined and curved surfaces for stationary and moving vanes and on a series of curved vanes- Concept of velocity triangles - Equation for work done & efficiency.

MODULE V PUMPS 7

Centrifugal pump –work done and efficiency- minimum speed to start the pump – multistage Pumps – Jet and submersible pumps - Positive displacement

pumps - reciprocating pump – work done and efficiency - negative slip - flow separation conditions - air vessels - indicator diagram and its variation - savings in work done – characteristic curves- Introduction to rotary pumps.

MODULE VI TURBINES 7

Turbines - classification - radial flow turbines - axial flow turbines – Impulse and Reaction turbines – work done and efficiency - draft tube theory - performance of turbines - similarity laws.

L – 45; P – 30;Total Hours : 75

LIST OF EXPERIMENTS:

1. FLOW MEASUREMENTS:

i) Determination of discharge for Orifice and Mouth piece fitted in a tank by constant and variable head method.

ii) Determination of co-efficient of discharge for venturimeter and orificemeter.

iii) Determination of coefficient of discharge for notches.

2.MEASUREMENT OF LOSSES IN PIPES:

i) Study on friction in pipes

ii) Study on minor losses in pipes.

3.PERFORMANCE CHARACTERISTICS OF PUMPS:

i) Performance characteristics of Jet Pump

ii) Performance characteristics of Centrifugal Pump

iii) Performance characteristics of Reciprocating Pump

iv) Performance characteristics of Submersible Pump

4.PERFORMENCE CHARACTERISTICS OF TURBINES:

i) Performance characteristics of Pelton turbine

ii) Performance characteristics of Francis turbine.

TEXT BOOKS:

1. P.N., and Seth, S.M., “Hydraulics & Fluid Mechanics including Hydraulics Machines”, 14th Edition, Standard Book House, New Delhi, 2002.
2. Bansal.R.K., “A Text Book of Fluid mechanics & Hydraulic Machines”, 9th Edition, Laxmi publications (P) Ltd., New Delhi, 2005.
3. Subramanya, K., "Flow in Open channels", 3rd Edition, Tata McGraw- Hill Publishing Company, New Delhi, 2009.

4. Jain, A.K., "Fluid Mechanics (including Hydraulic Machines)", 8th Edition, Khanna Publishers, New Delhi, 1995.
5. Molykutty, M.V., "Fluid Mechanics and Machinery", D1 Publications, Chennai, 2008.

REFERENCES:

1. Arora, K.R., "Fluid Mechanics, Hydraulics and Hydraulics Machines", 9th Edition, Standard Publishers and Distributers, New Delhi. 2005.
2. Ven Te Chow, "Open Channel Hydraulics", McGraw-H: Q Book Company, 1996.
3. Ramamrutham, S., "Fluid Mechanics, Hydraulics and Fluid Machines", Dhanpat Rai & Sons, New Delhi, 1998.
4. Kumar, K.L., "Engineering Fluid Mechanics", 7th Edition, Eurasia Publishing House (P) Ltd., New Delhi, 1995.

OUTCOMES:

At the end of the course, the student will be able to

- Describe the concepts of flow measurements and the use of flow measurement devices.
- Demonstrate various theories dealing with the flow phenomenon of fluid in an open channel.
- Analyze the various gradually varied flow profiles in an open channel flow and solve problems related to it.
- Describe the concepts behind the working of hydraulic machines and the force exerted by a jet on fixed target, moving target and curved vanes.
- List down different types of pumps, describe their working principle and compute the work done, efficiency and performance characteristics.
- Classify turbines in various categories, describe their working principle and compute the work done, efficiency and performance characteristics.

CEC2212 WATER AND WASTEWATER ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To make the student to forecast population for the design period, estimate quantity of water demand, possess knowledge on sources & intake structures
- To make the student to characterize water quality and design treatment units
- To impart knowledge on advanced treatments of water
- To impart knowledge on sewerage systems, estimation of wastewater flows & storm runoff, characterization of quality of wastewater and knowledge on primary treatment of sewage
- To make the student design secondary treatment of sewage and possess knowledge on advanced treatment of wastewater
- To impart knowledge on wastewater disposal & sludge handling.

MODULE I WATER SUPPLY SCHEME & SOURCES OF WATER 7

Water supply engineering – quantity of water, types of water demand, fluctuation in demand, factors affecting consumption, forecasting population – design period. Sources of water – surface water sources & intakes – ground water sources.

MODULE II WATER QUALITY & TREATMENT 8

Characteristics of water – treatment of water – unit operations & processes – theory & design of sedimentation, coagulation & flocculation, filtration units – theory & principle of disinfection methods.

MODULE III ADVANCED WATER TREATMENT, STORAGE & DISTRIBUTION 7

Miscellaneous & advanced treatment methods – water softening – removal of iron & manganese, fluoridation & de-fluoridation, desalination, membrane filtration. Water storage facilities – distribution networks & analysis.

MODULE IV WASTEWATER SCHEME & PRIMARY TREATMENT 7

Introduction to sanitary & sewerage systems, wastewater types & flows – estimation & variation, storm water estimation – characteristics of wastewater – treatment of wastewater – preliminary & primary – theory & principles of screens, grit chambers, sedimentation, coagulation & flocculation.

MODULE V SECONDARY & ADVANCED WASTEWATER TREATMENT 8

Theory & design of trickling filter and activated sludge process – theory & principle of aerated lagoons, stabilization ponds, oxidation ditches, constructed wetlands & root zone technology, anaerobic processes & reactors – fluidized bed, expanded bed and up-flow anaerobic sludge blanket (UASB).

MODULE VI WASTEWATER DISPOSAL & SLUDGE HANDLING 8

Disposal of treated wastewater – disposal into water bodies – self-purification of water bodies and oxygen sag curve – land disposal & sewage farming. Sludge characterization – sludge thickening & digestion – biogas recovery – sludge conditioning and dewatering – disposal.

Total Hours : 45

TEXT BOOKS:

1. Modi.P.N., “Sewage Treatment and Disposal and Wastewater Engineering”, Standard Book House, New Delhi, 2008.
2. Garg.S.K., “Environmental Engineering”, Vol. II, Khanna Publications, New Delhi, 2009.
3. Duggal.K.N., “Elements of Environmental Engineering”, S Chand and Co. Ltd., New Delhi, 2008.
4. Jain.A.K., “Fluid Mechanics (including Hydraulic Machines)", 8th Edition, Khanna Publishers, New Delhi, 1995.
5. Birdie.G.S., and Birdie, J.S., “Water Supply and Sanitary Engineering”, Dhanpat Rai and Sons, New Delhi, 2007.

REFERENCES:

1. Mark J. Hammer and Mark J. Hammer Jr., “Water and Wastewater Technology”, Prentice Hall of India Pvt. Ltd., New Delhi, 2009.
2. Metcalf and Eddy, “Wastewater Engineering Treatment, Disposal and Reuse”, Tata McGraw Hill, 2007.
3. Fair, Geyer and Okun, “Water and Wastewater Engineering”, John Wiley and sons, Inc., 2010.
4. Kiely, G., “Environmental Engineering”, McGraw Hill, 2009.

OUTCOMES:

At the end of the course, the student will be able to

- Forecast population for the design period, estimate quantity of water demand, possess knowledge on sources & intake structures
- Characterize water quality and design treatment units
- Possess knowledge on advanced treatments of water
- Possess knowledge on sewerage systems, estimate wastewater flows & storm runoff , characterize quality of wastewater and knowledge on primary treatment of sewage
- Design secondary treatment of sewage and possess knowledge on advanced treatment of wastewater
- Possess knowledge on wastewater disposal & sludge handling.

CEC2213	STRENGTH OF MATERIALS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide basic knowledge in analysis of truss and beams using energy principles.
- To calculate the bending moment and shear force for indeterminate beams.
- To understand the concepts of axially loaded member and its behaviour under eccentric loading conditions.
- To provide exposure on theories of failure and analysis of three dimensional stress.
- To introduce the students about the curved bars and unsymmetrical bending.
- To provide knowledge in the analysis of thick cylinders and spherical vessels.

MODULE I ENERGY PRINCIPLES 8

Strain energy – strain energy in axial force – flexure, shear and torsion – Castigliano's theorems –Application of energy theorems for computing deflections in beams and trusses – Maxwell's reciprocal theorem – Betti's theorem.

MODULE II INDETERMINATE BEAMS 8

Static determinacy and indeterminacy of beams - Fixing moments for a fixed beam of uniform section, slope and deflection. Continuous Beams: Analysis, Reaction at the supports, and Effect of sinking of supports.

MODULE III COLUMNS AND STRUTS 7

Classification of Columns - Euler's theory of long columns – Critical loads for prismatic columns with different end conditions - Rankine- Gordon formula - Eccentrically loaded columns.

MODULE IV THEORIES OF FAILURE 7

Theories of failure – strain energy and distortion energy theories – Application in analysis of stress, load carrying capacity and design of members.

MODULE V BENDING OF CURVED BARS AND UNSYMMETRICAL BENDING 8

Stresses on Curved beams for simple solid sections – Winkler Bach formula- Unsymmetrical bending of beams - Symmetrical and unsymmetrical sections.

MODULE VI THICK CYLINDERS AND SPHERICAL SHELLS 7

Stresses in Thick cylinders subjected to internal and external pressure and compound cylinders - Stresses and strains in thin spherical shell.

Total Hours : 45

TEXT BOOKS:

1. Bedi, D.S., "Strength of Materials", Khanna Book Publishing Co. (P) Ltd., New Delhi, 2000
2. Sadhu Singh, "Strength of materials", 7th Edition, Khanna Publishers, New Delhi, 1999.
3. Vazirani, V.N., Ratwani, M.M., and Duggal, S.K., "Analysis of Structures", Vol. I, 17th Edition, Khanna Publishers, New Delhi, 2002.
4. Vazirani, V.N., Ratwani, M.M., and Duggal, S.K., "Analysis of Structures", Vol. II, 16th Edition, Khanna Publishers, New Delhi, 2002
5. Rajput, R.K., "Strength of Materials", S.Chand & Company Ltd., New Delhi, 2006.

REFERENCES:

1. Kazimi, S.M.A., "Solid Mechanics", Tata McGraw-Hill Publishing Co., New Delhi, 2003.
2. William.A.Nash, "Theory and Problems of Strength of Materials", Schaum's Outline Series, Tata McGraw Hill Publishing Company Ltd., 2007.
3. Srinath,L.S., "Advanced Mechanics and Solids", Tata-McGraw Hill publishing company Ltd., 2005.
4. Punmia, B . C . ,"Theory of Structures (SMTS)" Vol. I & II, Laxmi Publishing Pvt. Ltd., New Delhi, 2004.

OUTCOMES:

At the end of the course, the student will be able to

- explain the various energy principles and theorems for the applications of beams and frames.
- analyse the indeterminate structures
- solve axially loaded members for buckling under different boundary conditions.
- describe the various of theories of failure for a material.
- determine the stresses in curved bars.

- demonstrate the development of stresses and strains in thick cylinders and thin spherical shells.

CEC2214 TRANSPORTATION ENGINEERING I

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge on the concepts of geometric design of highways, highway materials and hill roads.
- To understand the traffic management and airport engineering.

MODULE I INTRODUCTION TO HIGHWAY ENGINEERING 7

Role of Transportation Engineering; Modes of transportation- Their importance and limitations; Importance of Highway Transportation; Highway Planning- Principle of Highway Planning, Road developments -Jayakar Committee and Recommendations, Twenty year Road Development Plan, IRC, Institutions - HRB, NHAI, MORTH and CRRI) - Financing, Privatization of Highways, Highway Alignment Requirements, Engineering Surveys for Highway locations.

MODULE II GEOMETRIC DESIGN OF HIGHWAYS 8

Classification and Cross section of Urban and Rural Roads (IRC),Highway Cross sectional Elements – Right of way, Carriage way, Road Width, Camber, Kerbs, Shoulders and Footpaths (IRC Standards), Sight distances – Factors affecting sight distances – PIEV theory, Stopping Sight Distance (SSD), Overtaking Sight Distance (OSD), Sight Distance at Intersections, Intermediate Sight Distance and Illumination Sight Distance (Derivations and Problems in SSD and OSD), Design of Horizontal Alignments – Super elevation, Widening of pavements – Gradient – Horizontal Curves and Transition Curves (Derivation of Formulae and Problems) - Design of Vertical Alignments, Geometry design of hill roads – hairpin bends.

MODULE III HIGHWAY MATERIALS AND PAVEMENTS 7

Material Characterization and Testing of Highway Materials - Sub grade soil – California Bearing Ratio Test and Field Density Test, Aggregates – Crushing, Abrasion, Impact Test, Water absorption, Flakiness and Elongation indices and Stone Polishing value Test, Bitumen – Penetration, Ductility, Viscosity, Binder Content and Softening Point Tests- Types of Pavement, Design Practice for flexible pavements – empirical, semi-empirical method -Design Practice for Rigid pavements – stresses in concrete pavement- Design procedure as per IRC method – different joints in concrete pavement.

MODULE IV HIGHWAY CONSTRUCTION AND MAINTENANCE 7

Construction Procedure Earth work, Water bound macadam, Bituminous Road and Cement Concrete Road (as per IRC and MORTH specification) – Distress in flexible pavements – Distress in rigid pavements – Highway Maintenance - Highway Drainage- Surface drainage and Sub-soil drainage.

MODULE V AIRPORT PLANNING 8

Introduction: Advantages and limitations of air transportation - Aeroplane component parts and important technical terms - Airport planning - Aircraft characteristics, which influence judicious and scientific planning of airports - Selection of sites - survey and drawings to be prepared for airport planning - Airport layout - Characteristics of good layout - Airport configuration, Components of airport - airport obstruction - location of terminal buildings, aprons and hangers. Zoning requirements regarding permissible heights of constructions and landing within the airport boundary, wind rose diagram.

MODULE VI RUNWAY, TAXIWAYS AND APRON GEOMETRIC DESIGN STANDARDS 8

Runways and taxiways: Runway orientation, basic runway length, corrections for elevation, temperature and gradient as per ICAO and FAA recommendation - Airport classification by ICAO- geometric standards – taxiway layout – design consideration – exit taxiways, aprons , holding aprons, fillets, blast pads- air traffic control – control aids – airport markings and lighting - aircraft parking systems, planning and development of terminal building.

Total Hours : 45

TEXT BOOKS:

1. Khanna.K and Justo CEG., Highway engineering, Khanna Publishers, 2001.
2. Kadiyali.L.R., Principles and practice of highway engineering, Khanna Technical Publications, Delhi, 2000.
3. Khanna. S.K., Arora. M.G and Jain. S.S., Airport Planning and Design, Nemchand and Brothers, Roorkee, 1994.

REFERENCES:

1. Jotin Khisty, C., Kent Lall, B., “Transportation Engineering: An Introduction”,Prentice Hall, 2003.
2. Nicholas J. Garber, Lester A. Hoel, “Traffic and Highway Engineering”,

Cengage Learning, 2009
3. Fred L. Mannering and Walter P. Kilareski, “Principles of Highway Engineering and Traffic Analysis”, Wiley, 1998.
4. Norman J. Ashford, Saleh Mumayiz, Paul H. Wright, “Airport Engineering : Planning, Design and Development of 21st Century Airports”, 2011.
5. IRC-SP: 48-1998, Hill Road Manual, Indian Road Congress, 2003.

OUTCOMES:

At the end of the course, the student will be able

- To gain knowledge on highway planning
- To understand geometric design of highways
- To identify suitable materials for highway and perform mix design
- To conceptualize the layout of hill roads, their construction and maintenance activity
- To prepare the layout of airport
- To gain knowledge on airport design

CEC2215	ENVIRONMENTAL ENGINEERING LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To impart the skill & knowledge to assess the physical, chemical and biological characteristics of water & wastewater.

MODULE I WATER QUALITY STANDARDS & SAMPLING TECHNIQUES 9

General - Drinking water standards - Quality requirement for industrial use - Quality standards for boiler water - Quality standards for cooling water – Quality of water requirement for specific industries - Quality requirement for irrigation water - Quality requirement for bathing waters - Quality requirement for fishery waters - Quality standards for water in concrete usage.

MODULE II PHYSICAL ANALYSIS 9

Temperature, Color, Odor, Taste, Turbidity, pH, Conductivity, Total Solids, Total Suspended Solids, Total Dissolved Solids, Total Volatile Solids, Total fixed Solids.

MODULE III INORGANIC OR CHEMICAL ANALYSIS 9

Hardness, Calcium, Magnesium, Chloride, Sulphate, Fluoride, Alkalinity, Nitrate, Phosphate, Residual Chlorine & Available Chlorine, Jar Test for Coagulant.

MODULE IV ORGANIC ANALYSIS 9

Dissolved Oxygen, Biological Oxygen Demand, Chemical Oxygen Demand, Phenols, Oil & grease, Pesticides, Nitrate.

MODULE V TOXIC METALS 6

Copper, Chromium, Cadmium, Zinc, Lead, Mercury, Iron, Manganese (AAS)

MODULE VI BACTERIOLOGICAL ANALYSIS (DEMO) 3

Total Coliform, Feacal Coliform.

Total Hours : 45

TEXT BOOKS:

1. Garg.S.K., “Water Supply Engineering”, Khanna Publishers, Delhi, September 2001.

2. Birdie.G.S., “Water Supply and Sanitary Engineering”, Dhanpet Rai and sons, 1991.

REFERENCES:

1. APHA., “Standard methods for the examination of Water and Waste Water”, American Public Health Association, United States, 2013.
2. CPCC, “Water and Waste analysis – Manual”, Central Pollution Control Board, New Delhi, 2011.

OUTCOMES:

At the end of the course, the student will be able to

- determine the suitability and characteristics of water for various purposes
- determine the different physical characteristics of water/wastewater
- determine the different chemical or inorganic characteristics of water/wastewater
- determine the different biological or organic characteristics of water/wastewater
- determine the different toxic/ heavy metals present in the water/wastewater
- determine the bacterial count and types of microorganism present in the water/wastewater.

V SEMESTER

		L	T	P	C
MSC 3181	**LEADERSHIP & CEO TRAINING**	**3**	**0**	**0**	**3**

OBJECTIVES:

The course aims at

- Bringing about positive transformation in students' attitude.
- Building unique leadership competencies that would ensure successful transition of students across all career stages.
- Sensitizing students to identify their strengths & weakness and training them to deal with it
- Assisting students in enhancing their expressive ability and inducing a high level of self confidence to manage both business and emotions
- Training students to become more adaptable and flexible to changing business environment

MODULE I INTRODUCTION TO LEADERSHIP 12

Leadership concept - meaning, definitions, importance of leadership, leadership traits. Leadership functions- general functions, listening, observing, managing and decision making. Components of leadership - leaders, followers and situation. Leadership theories – Trait theory, Skills theory, Style theory, Situational theory, Transformational theory, Transactional theory, Path Goal Theory and LMX. Assessing emotional intelligence and exploring the capabilities and inherent traits through psychometric tests - Multi factor leadership questionnaire and personal reflections

MODULE II LEADERSHIP STYLE AND COMMUNICATION 08

Leadership styles-visionary, Coaching, Affiliative, Democratic, Pacesetting Commanding, Transformational, Transactional. Autocratic, Participative, Laissez-Faire Leader versus Managers. Leadership communication - Rationale, tactic, assertive, formal, informal, communication in crisis- leadership and negotiations, Leadership Presentations-convincing and impressive style

MODULE III LEADERSHIP ROLES 08

Facets of leadership- Leader as an individual – personality and leadership, values, attitudes and ethics of a leader. Leader as a relationship builder-empowering people to meet higher order needs, initiating organization wide

motivational programs, involvement with all stakeholders- focusing on organization growth. Leader as an inspirer- motivation and leadership, recognizing and appreciating contributions, empowering others to lead Leader as an innovator –leader's role in shaping culture and values in an organization. Leader as a Liaison- Leader as team player

MODULE IV LEADERSHIP CHALLENGES AND STRATEGIES 09

Challenges in leadership: Perception of organization culture and values, interpreting the power dynamics in the organization, establishing work life balance. Bad leadership – Reasons and impact.-Case Study of Marissa Mayer-Yahoo.Inc Organizational transformation through efficient leaders-Case study of Apple Inc. Blue Ocean Leadership-Steps to Blue ocean Leadership-Four Pillars of Blue Ocean leadership-Blue Ocean leadership grid

MODULE V LEADERSHIP AND CEO TRAINING 08

Leader as a CEO: Traits of a successful CEO, Key responsibilities of a CEO, the path to be a CEO ,Training on Board Room Discussions, Meeting the CEO –Live sessions with industry CEO's. Requirements of Leadership: - Cognitive skills, Interpersonal skills, Business skills, Strategic skills. Role of Emotional Intelligence in taking up key-positions in the organization.

Teaching Pedagogy:

Nurturing – Based on the identified strengths and weaknesses, training will be given to enhance the strengths and overcome the weakness.

Assessment - Continuous evaluation will be effected through group discussions, oratory assignments and situational enactments. Pre-and post-training assessment through peer reviews and faculty feedback.

Sustained development – Training will be imparted for self-development and monitoring of leadership skills to ensure sustained applicability of the skills learnt.

L – 45; Total Hours – 45

REFERENCES:

1. Andrew J DuBrin. "Leadership: Research Findings, Practice, and Skills", 8th Edition, South-Western College Pub, 2015.
2. Yukl G , "Leadership in Organisations", 8th Edition, Pearson Education, 2013.
3. Richard L Daft , "Leadership", 5th Edition, South Western Cengage Learning 2012.
4. Stephen P. Robbins and Timothy A. Judge. "Organizational Behaviour",

15th Edition, New Delhi: Pearson, 2013.
5. Fred Luthans, “Organizational Behavior, An Evidence Based Approach”, 12th Edition, New Delhi: McGraw Hill Education, 2013.
6. Emotional Intelligence, Why it can matter no more than IQ by Daniel Goleman (include a book) Publisher: Bloomsbury Publishing India Private Limited; Latest edition (2017)
7. Primal Leadership: Unleashing the Power of Emotional Intelligence by Prof Daniel Goleman , Richard Boyatzis and McKee ,Harvard Business Review Press

Recommended Readings:

1. Jim Collins, (2001). “Good To Great: Why Some Companies Make the Leap...And Others Don't”, Random House Publishers India Pvt.Ltd, New Delhi
2. George, B. with Sims, P. True North: Discover Your Authentic Leadership, The Times Group Books; First edition (1 October 2015)
3. Kim, W. C., & Mauborgne, R. A. (2014). Blue ocean strategy, expanded edition: How to create uncontested market space and make the competition irrelevant. Harvard business review Press.
4. Leadership Wisdom by Robin Sharma Jaico Publishing House;

OUTCOMES:

The students will be able to

- Explore through self-introspection one’s own leadership style, their strength and weakness
- Gain self confidence to lead a team in the organization
- Realize the role of leadership in making or breaking of an organization
- Acquire the practice of self introspection and development of leadership competencies thorough continuous efforts
- Manage their own emotions as well as other resulting in successful relationship building with all stakeholders

MSC 3182 SOCIAL ENTREPRENEURSHIP

L	T	P	C
3	0	0	3

OBJECTIVES:

- To be able to understand the field of social entrepreneurship and Social problems
- To be able to describe and understand the traits of social entrepreneurs
- To recognize the social business opportunities
- To synthesize the resource mobilization ways for social entrepreneurship
- To understand the social entrepreneurship models
- To recognize the impact of social entrepreneurship on societies

MODULE I INTRODUCTION TO SOCIAL ENTREPRENEURSHIP 07

Introduction - Emergence and Development of Social Entrepreneurship. Social Problems in India: An Overview. Social Development: The Indian Scenario. Emergence of Social Entrepreneurs and Sustainable Solutions to Social Problem. Characteristics and Context of Social Entrepreneurship .The Role of Social Entrepreneurship in Societies & Economies.

MODULE II SOCIAL ENTREPRENEURSHIP: DRIVERS AND CHALLENGES 07

The Drivers of Social Entrepreneurship. Elements of the Social Entrepreneurial Personality. Challenges of financial constraints. Challenge to attract and cultivate talented workers. Challenge of evaluation of social entrepreneur impact. Challenge of scaling and its impact. Cases

MODULE III SOCIAL ENTREPRENEURSHIP: OPPORTUNITY RECOGNITION 07

Opportunity Recognition and Planning Process. Opportunities for Social Entrepreneurs. The Nature of Social Entrepreneurial Opportunities. Social Problems into Opportunities. Idea development and conceptualization of social problem. Cases

MODULE IV RESOURCE MOBILIZATION FOR SOCIAL VENTURE 08

Resources at Initial Stage. Social Network as a role of Social Capital. Team

and Collective Efforts. Need and Determination of Important Resources. Resource of Knowledge, Skills and Abilities. overview of venture capital and angel investment. Cases

MODULE V BUSINESS MODELS AND BUSINESS PLAN FOR SOCIAL ENTERPRISES **08**

Design Principles of Social Entrepreneurship Business Models , Evaluation of the Root Cause of a Societal Problem. Developing business plan for social ventures. Developing an investor presentation. Feasibility study and report. How to start a business - Procedures for registration of small scale industry

MODULE VI THE IMPACT OF SOCIAL ENTREPRENEURSHIP ON SOCIETY **08**

Static Impact of Social Entrepreneurship. Impact of Charitable NGOs vs. Social Entrepreneurship, Impact of For-Profit Companies vs. Social Entrepreneurship. Social entrepreneurship report preparation by students.
Case Study of Social Entrepreneurs

L – 45; Total Hours – 45

REFERENCES:

1. “Social Entrepreneurship : New models of sustainable social change” . Alex Nicholls, Oxford University Press 2006
2. The Process of social value creation : A multiple case study on Social Entrepreneurship in India , Archana Singh Springer 2016
3. “Social Entrepreneurship and social business” Christine K Volkmann, Springer Gabler 2012
4. “Social Entrepreneurship” Manuel London ,Routlege, 2010

OUTCOMES:

The students can able to

- Conceptualize social entrepreneurship in terms of a theoretical framework between changing social values and institutions
- Think and communicate about social values
- Learn about practical models of social change to launch, lead, manage, and evaluate a social venture
- Analyze funding needs and sources for the social venture
- Experience the ideas can be critically and collaboratively examined prior to commitment

ENC 3181	COMMUNICATION AND SOFT SKILLS - I CAREER CHOICE	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To create awareness of industrial trends and market demands.
- To encourage students to explore career opportunities in an industry and evaluate themselves in relation to industry preparedness

MODULE I **6**

Knowledge about specific industry-Discussion with industry experts --Self evaluating career prospects through survey questionnaire (based on his/her eligibility for taking up a job (industry preparedness)

MODULE II **6**

. Knowing case studies of industries(pertaining to students' choice of career)- Reading and discussing about job markets-goal setting, working on creativity.

MODULE III **4**

SWOC analysis and discussing outcomes--exploring mini projects or case studies of latest industries.

MODULE IV **6**

Writing statement of purpose pertaining to career choice---- Outcomes

MODULE V **8**

Project or case study presentations (Presentation in pairs) -mini project report or case study report.

Total Hours – 30

REFERENCES:

1. Brown,D.(2002). Career Choice and Development. Wiley,J. & Sons.USA
2. Lore,N.(1998). The Pathfinder: How to Choose or Change Your Career for a Lifetime of Satisfaction and Success. Simon & Schuster.USA.
3. Shell, G.R.(2013). Springboard Launching your Personal Search for Success.Portfolio.USA

OUTCOMES:

After the completion of the course, students would be able to

- Speak about their career choice.
- Self evaluate their strengths and weaknesses and speak about it.

- Make effective presentations on case studies or relating to projects.
- Write the statement of purpose relating to their career choice.

CEC3101 STRUCTURAL ANALYSIS – I

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge on the various structural systems and general behavior of structures.
- To impart knowledge on analysis of determinate and indeterminate structures to determine structural reactions, member forces, deflections using various methods.
- To expose students to analyze the structure using influence lines.

MODULE I DEFLECTION OF DETERMINATE STRUCTURES 8

Equations of Equilibrium, Displacements, Compatibility, Boundary Conditions, Principles of Superposition, Degrees of Freedom, Determinate and indeterminate Structures, Deflections of pin-jointed plane frames and rigid plane frames- Principles of virtual work- Williot diagram - Mohr's correction.

MODULE II SLOPE DEFLECTION METHOD 8

Continuous beams and rigid frames (with and without sway) – Symmetry and anti-symmetry - Simplification for hinged end - Support displacements.

MODULE III MOMENT DISTRIBUTION METHOD 8

Stiffness and carry-over factors - Distribution and carryover of moments - Analysis of continuous Beams - Plane rigid frames with and without sway - Naylor's simplification.

MODULE IV ARCHES 8

Arches structural forms – Examples of arch structures – Types of arches – Analysis of three-hinged and two-hinged arches – fixed, parabolic and circular arches – Settlement and temperature effects.

MODULE V MOVING LOADS AND INFLUENCE LINES 8

Influence lines for reactions in statically determinate structures – Influence lines for member forces in pin jointed frames – Influence lines for shear force and bending moment in beam sections – Calculation of critical stress resultants due to concentrated and distributed moving loads.

MODULE VI INFLUENCE LINES FOR INDETERMINATE STRUCTURES 5

Muller Breslau's principle – Application of Muller Breslau's principle to determinate beams and continuous beams.

Total Hours : 45

TEXT BOOKS:

1. Bhavikatti, S. S., "Structural Analysis", Vol. I & II, Vikas Publishing House Pvt.Ltd., New Delhi, 2003.
2. Arya, A.S. and Jain, O.P., "Theory and Analysis of Structures", NemChand & Bros., Roorke, 1992.
3. Wang, C.K., "Statically Indeterminate Structures", Tata McGraw Hill, New York, 1953.
4. Punmia, B.C., Ashok Kumar Jain & Arun Kumar Jain, "Theory of structures", Laxmi Publications, New Delhi, 1999.

REFERENCES:

1. Ashok K. Jain., "Advanced Structural Analysis", Nem Chand & Sons, Roorkee, 1996.
2. Pandit, G.S. and Gupta, S.P., "Structural Analysis – A Matrix Approach", Tata McGraw Hill Publishing Company Ltd., 2006.
3. Vaidhiyanathan, R. and Perumal, P., "Structural Analysis - I", Lakshmi Publications, New Delhi, 2004.
4. Reddy, C.S., "Basic Structural Analysis", Tata McGraw Hill Publishing Company, New Delhi, 2005.

OUTCOMES:

At the end of the course, student will be able to

- analyze the concepts such as degree of freedom, boundary conditions of various structures.
- solve a statically determinate beams, trusses and frames by using principle of virtual work method.
- plot the bending moment diagram and shear force diagram of indeterminate structures by using slope deflection method.
- construct the bending moment diagram and shear force diagram of indeterminate structures by using moment distribution method.

- evaluate and construct statically determinate and indeterminate structures from the influence lines.
- generate influence line diagram for continuous beam using Muller Breslau's Principle.

CEC3102 DESIGN OF REINFORCED CONCRETE STRUCTURES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the fundamental concepts of reinforced concrete with emphasis on design of rectangular and flanged beams, slabs, columns and footings.
- To impart knowledge to students about the design of reinforced concrete structural members under bending, shear, and/or axial loads as per Indian Standards.
- To give exposure to the design of staircases.

MODULE I DESIGN CONCEPTS 5

Concept of elastic method, ultimate load method and limit state method – Advantages of Limit State method over other methods – Limit State philosophy as per IS Code recommendations.

MODULE II DESIGN OF BEAMS 8

Fundamental assumption –Linear elastic analysis of composite sections – Flexural and shear behaviour of reinforced concrete – Analysis and Design of singly and doubly reinforced rectangular and flanged sections – Behaviour and design of torsion – Mechanisms of bond resistance – Flexural bond – Anchorage bond.

MODULE III DESIGN OF SLABS 8

Behaviour of slabs spanning in one and two directions - Design of one way simply supported and continuous slabs - Design of two-way slabs for various edge conditions.

MODULE IV DESIGN OF COMPRESSION MEMBERS 8

Classification of columns – Behaviour of RC columns - Design of short columns under axial compression, combined axial compression with uniaxial and biaxial bending.

MODULE V DESIGN OF FOOTINGS 8

Types of footings – Pressure distribution under footings – Code requirements for design of footings – Design of axially and eccentrically loaded square and

rectangular footings – Design of combined rectangular footings.

MODULE VI DESIGN OF STAIRCASES 8

Dimensioning and Types of staircases – Structural behaviour of staircases – loads on staircases - Design of dog- legged, open newel, circular staircases.

Total Hours : 45

TEXT BOOKS:

1. Unnikrishna Pillai and Devadas Menon., “Reinforced Concrete Design”, Tata McGraw Hill Publishing Company Ltd., New Delhi.2003.
2. Varghese, P.C., “Limit State Design of Reinforced Concrete”, Prentice Hall of India, New Delhi, 2004.
3. Punmia, B.C., “Limit State Design of Reinforced Concrete Structures”, Laxmi Publications (P) Limited, New Delhi, 2007.
4. Krishna Raju, N., “Design of RC Structures”, CBS Publishers and Distributors, New Delhi, 2008.
5. Sinha, S.N., “Reinforced Concrete Design”, Tata-McGraw-Hill, New Delhi, 2002.

REFERENCES:

1. Syal, I.C. and Goel, A.K., “Reinforced Concrete Structures”, A.H. Wheelers & Co. Pvt. Ltd., New Delhi, 2008.
2. Purushothaman, P., “Reinforced Concrete Structural Elements – Behavior, Analysis & Design”, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1984.
3. Mallick, D.K. and Gupta, A.P., “Reinforced Concrete”, Oxford and IBH Publishing Company, New Delhi, 1987.

OUTCOMES:

Students will be able to

- identify concrete material properties relevant to design and demonstrate on various design philosophies in concrete structures.
- describe the behaviour and design the beams for flexure and shear as per Indian standards.
- apply the IS codal provisions for the design of slab.
- employ the Indian code of practice for the design of reinforced

concrete columns.

- identify suitable type of footing for structures and design as per standards.
- design and construct an appropriate staircase for RC buildings.

CEC3103 TRANSPORTATION ENGINEERING II

L	T	P	C
3	0	0	3

OBJECTIVES:

- To explain the elements of railway track and role of railways in development of nation.
- To describe the geometric design of railways tracks.
- To illustrate the construction, maintenance and operation of railway track
- To explain the layout of harbours and construction of lock gates and various break water types
- To impart knowledge on urban transportation planning
- To explain the modern techniques used in urban transportation planning.

MODULE I INTRODUCTION TO RAILWAY ENGINEERING 7

Railways: Role of Railway Transportation, Advantages and Disadvantages of Railway Transportation, Elements of permanent track way: Rails, Rail Gauges, Sleepers, Ballast, Rail Joints, Fittings, Principal of Traction: Tractive Effort, Train resistances.

MODULE II GEOMETRIC DESIGN OF RAILWAYS 7

Elements of Geometric Design: Gradients and Grade compensation on Curves, Cant, Transition Curve, Vertical curve, Sub grade and Embankments: Cutting, Level, Function, Formation of sub grade, Materials used, Slope and Stability of Embankment, Points and Crossings: Turnouts, Diamond crossings, Crossovers, Stations and Yards.

MODULE III RAILWAY SIGNALS & MAINTENANCE 7

Signals: Signaling and interlocking, Necessity, Mechanical Devices, Detectors, Stretcher bar, Point lock, Slotting of signals, Connecting Devices, Temperature compensation, Track Drainage, Safety in Railways, Modernization of Track for High Speeds, Modern Methods for Track Maintenance, Railway Expenses, Rates and Fares.

MODULE IV HARBOUR ENGINEERING 8

Role of water transportation, Basic consideration- Ocean Winds, Waves, Tides, Wharf, Pier, Harbour, Port, Layout of Harbour, Port entrance, Construction and operation of Lock gates, Dock: Wet, dry and floating docks, Break water-different types, dredging.

MODULE V URBAN TRANSPORTATION PLANNING 8

Urban Transportation Planning Process, Urban Travel and Transportation Systems Characteristics, Function and form of urban structures, services, classification of urban centres, growth patterns, Travel Demands Forecasting-trip generation, trip distribution, modal split and trip assignment, urban transport problems, Transport Behavior of Individuals and Households, Land use/ Transportation systems, land value and congestion, access and business migration.

MODULE VI MODERN URBAN TRANSPORTATION 8

Introduction to Urban Freight Transportation and Urban Mass Transportation Systems. Characteristics of buses, bicycle, para transit, rapid transit, Traffic Restraint Techniques and methods. Classification, mass and rapid transit system, Introduction to Intelligent Transportation System (ITS), Public Transport policy, intermediate. Introduction to BRT, Mono rail, sky bus, metro projects, grade separated interchanges such as flyovers, underpasses, overpasses, concept of Integrated Inter Model transit system.

Total Hours : 45

TEXT BOOKS:

1. Satish Chandra, M.M. Agarwal, Railway Engineering, Oxford University press, 2013.
2. Dr. S. P. Bindra, A course in docks and harbor Engineering, Dhonpat rai publication, 2012.
3. D. Johnson victor, S. Ponnuswamy, Urban Transportation, Planning, Operation and Management, Mcgrawhill Pvt.Ltd, 2012.

REFRENCES:

1. Vassilios Profillidis, “Railway Management and Engineering”, Ashgate Publishing Ltd., Surrey U.K. & Burlingtion U.S, 2006.
2. Srinivasan, R., "Harbour, Dock and Tunnel Engineering”, Charotar Publishing House Pvt. Limited, Anand, Gujarat, 2009.
3. Sigurd Grava, “Urban Transportation Systems”, McGraw Hill Professional, 2003.
4. Vukan R. Vuchic, “Urban Transit Systems and Technology”, John Wiley &

Sons, New Jersey, 2007.
5. Alan Black, “Urban Mass Transportation Planning”, McGrawHill, New Delhi, 1995.

OUTCOMES:

At the end of the course, student will be able to

- sort the components of permanent way and know their purpose.
- design railway tracks with proper cant and curves
- locate the railway signals according to standards and maintenance at the railway network.
- plan a layout of harbour.
- prepare a traffic survey report for planning of an urban area.
- apply a suitable modern technique to solve the given traffic problem.

CEC3104 GEOTECHNICAL ENGINEERING I

L	T	P	C
3	0	2	4

OBJECTIVE:

- To familiarize the students with geotechnical terminology and theoretical and experimental concepts commonly encountered in engineering practice.
- To impart knowledge on the behavior of soil water and its stress behavior.
- To provide knowledge on the stress distribution for the different loading condition.
- To understand concepts in compaction and consolidation of soil.
- To enable the students to analyze the shear strength of the soil.
- To provide an understanding on slope stability and slope failure in soil.

MODULE I INTRODUCTION TO SOIL 7

Nature of Soil – Problems with soil – Phase relation – sieve analysis – sedimentation analysis- Atterberg limits - classification for engineering purposes – BIS Classification System

MODULE II SOIL WATER AND WATER FLOW 7

Soil water – Various forms- Influence of clay minerals – Capillary rise – Suction - Effective stress concepts in soil – Total, neutral and effective stress distribution in soil – Permeability – Darcy's Law- Permeability measurement in the laboratory – quick sand condition.

MODULE III STRESS DISTRIBUTION IN SOIL 7

Stress distribution in soil media – Boussinesque formula- stress due to line load, circular and rectangular loaded area – approximate methods – Use of influence charts –Westergaard equation for point load.

MODULE IV COMPACTION AND CONSOLIDATION 8

Soil compaction – factors affecting compaction – field compaction methods and monitoring – Terzaghi's one dimensional consolidation theory- governing differential equation – laboratory consolidation test – Field consolidation curve. Components of settlement – Immediate and consolidation settlement.

MODULE V SHEAR STRENGTH 8

Shear strength of cohesive and cohesion less soils – Mohr – Coulomb failure theory – Saturated soil and unsaturated soil (basics only)- Strength parameters – Measurement of shear strength, direct shear, triaxial compression, UCC and Vane

shear tests-types of shear tests based on drainage and their applicability - Drained and undrained behavior of clay and sand.

MODULE VI SLOPE STABILITY 8

Slope failure mechanisms – Modes of failure- Infinite slopes – Finite slopes – Total and effective stress analysis – Stability analysis for purely cohesive and c-f soils – Method of slices – Modified Bishop's method – Friction circle method – Stability number – problems – Slope protection measures.

LIST OF EXPERIMENTS:

1. Grain size distribution by Sieve analysis and Hydrometer analysis,
2. Specific gravity of soil grains, Relative density of sands and Atterberg limits test.
3. Field density test (Core cutter and sand replacement methods).
4. Permeability determination (constant head and falling head methods)
5. Determination of moisture – density relationship using Standard Proctor Compaction test.
6. One dimensional consolidation test (Determination of co-efficient of consolidation only).
7. Determination of shear strength parameters –Direct shear test on cohesion less soil, Unconfined compression test on cohesive soil, Triaxial compression test.

L – 45; P – 30; Total Hours : 75

TEXTBOOKS:

1. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd., New Delhi, 1995.
2. Gopal Ranjan and Rao, A.S.R., "Basic and Applied Soil Mechanics", New Age International Publishers, New Delhi, 2000.
3. Venkatramaiah,C., "Geotechnical Engineering", New Age International Publishers, New Delhi, 1995.
4. Khan, I.H., "A text book of Geotechnical Engineering", Prentice Hall of India, New Delhi, 1999.

REFERENCES:

1. Coduto, D.P., "Geotechnical Engineering Principles and Practices", Prentice Hall of India Private Limited, New Delhi, 2002.

2. McCarthy, D.F., “Essentials of Soil Mechanics and Foundations - Basic Geotechniques”, 6th Edition, Prentice-Hall, New Jersey, 2002.
3. Das, B.M., “Principles of Geotechnical Engineering”, 5th Edition, Thomas Brooks/ Cole Publishing Company, 2002.
4. Muni Budhu., “Soil Mechanics and Foundations”, John Willey & Sons, Inc., New York, 2000. .
5. I.S.2720 (Part I – XIV), “Methods of test for Soils”, Bureau of Indian Standards, New Delhi.
6. Head, K.H, “Manual of Soil Laboratory Testing, (Vol.1 to 3)”, John Wiley & Sons, Chichester, 1998.
7. Vasanthi, P., “Soil Laboratory Manual”, B.S. Abdur Rahman Crescent Institute of Science & Technology, Chennai, 2012.

OUTCOMES:

At the end of this course, the student will be able to

- classify the the soil for engineering purpose based on index properties of soil.
- determine the permeability of soil by field and laboratory method and also stress distribution in soil.
- analyze the stress behavior under various loading.
- identify compaction and consolidation characteristics for different type of soils.
- determine shear strength parameters of soil based on different drainage condition.
- analyze the stability of slope by different methods.

VI SEMESTER

MSC 3181	**LEADERSHIP & CEO TRAINING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

The course aims at

- Bringing about positive transformation in students' attitude.
- Building unique leadership competencies that would ensure successful transition of students across all career stages.
- Sensitizing students to identify their strengths & weakness and training them to deal with it
- Assisting students in enhancing their expressive ability and inducing a high level of self confidence to manage both business and emotions
- Training students to become more adaptable and flexible to changing business environment

MODULE I INTRODUCTION TO LEADERSHIP 12

Leadership concept - meaning, definitions, importance of leadership, leadership traits. Leadership functions- general functions, listening, observing, managing and decision making. Components of leadership - leaders, followers and situation. Leadership theories – Trait theory, Skills theory, Style theory, Situational theory, Transformational theory, Transactional theory, Path Goal Theory and LMX. Assessing emotional intelligence and exploring the capabilities and inherent traits through psychometric tests - Multi factor leadership questionnaire and personal reflections

MODULE II LEADERSHIP STYLE AND COMMUNICATION 08

Leadership styles-visionary, Coaching, Affiliative, Democratic, Pacesetting Commanding, Transformational, Transactional. Autocratic, Participative, Laissez-Faire Leader versus Managers. Leadership communication - Rationale, tactic, assertive, formal, informal, communication in crisis- leadership and negotiations, Leadership Presentations-convincing and impressive style

MODULE III LEADERSHIP ROLES 08

Facets of leadership- Leader as an individual – personality and leadership, values, attitudes and ethics of a leader. **Leader as a relationship builder**- empowering people to meet higher order needs, initiating organization wide

motivational programs, involvement with all stakeholders- focusing on organization growth. **Leader as an inspirer**- motivation and leadership, recognizing and appreciating contributions, empowering others to lead **Leader as an innovator** –leader's role in shaping culture and values in an organization. **Leader as a Liaison- Leader as team player**

MODULE IV LEADERSHIP CHALLENGES AND STRATEGIES 09

Challenges in leadership: Perception of organization culture and values, interpreting the power dynamics in the organization, establishing work life balance. Bad leadership – Reasons and impact.-Case Study of Marissa Mayer-Yahoo.Inc Organizational transformation through efficient leaders-Case study of Apple Inc. Blue Ocean Leadership-Steps to Blue ocean Leadership-Four Pillars of Blue Ocean leadership-Blue Ocean leadership grid

MODULE V LEADERSHIP AND CEO TRAINING 08

Leader as a CEO: Traits of a successful CEO, Key responsibilities of a CEO, the path to be a CEO ,Training on Board Room Discussions, Meeting the CEO –Live sessions with industry CEO's. Requirements of Leadership: - Cognitive skills, Interpersonal skills, Business skills, Strategic skills. Role of Emotional Intelligence in taking up key-positions in the organization.

Teaching Pedagogy:

Nurturing – Based on the identified strengths and weaknesses, training will be given to enhance the strengths and overcome the weakness.

Assessment - Continuous evaluation will be effected through group discussions, oratory assignments and situational enactments. Pre-and post-training assessment through peer reviews and faculty feedback.

Sustained development – Training will be imparted for self-development and monitoring of leadership skills to ensure sustained applicability of the skills learnt.

L – 45; Total Hours – 45

REFERENCES:

1. Andrew J DuBrin. "Leadership: Research Findings, Practice, and Skills", 8th Edition, South-Western College Pub, 2015.
2. Yukl G , "Leadership in Organisations", 8th Edition, Pearson Education, 2013.
3. Richard L Daft , "Leadership", 5th Edition, South Western Cengage Learning 2012.

4. Stephen P. Robbins and Timothy A. Judge. “Organizational Behaviour”, 15th Edition, New Delhi: Pearson, 2013.
5. Fred Luthans, “Organizational Behavior, An Evidence Based Approach”, 12th Edition, New Delhi: McGraw Hill Education, 2013.
6. Emotional Intelligence, Why it can matter no more than IQ by Daniel Goleman (include a book) Publisher: Bloomsbury Publishing India Private Limited; Latest edition (2017)
7. Primal Leadership: Unleashing the Power of Emotional Intelligence by Prof Daniel Goleman , Richard Boyatzis and McKee ,Harvard Business Review Press

Recommended Readings:

1. Jim Collins, (2001). “Good To Great: Why Some Companies Make the Leap...And Others Don't”, Random House Publishers India Pvt.Ltd, New Delhi
2. George, B. with Sims, P. True North: Discover Your Authentic Leadership, The Times Group Books; First edition (1 October 2015)
3. Kim, W. C., & Mauborgne, R. A. (2014). Blue ocean strategy, expanded edition: How to create uncontested market space and make the competition irrelevant. Harvard business review Press.
4. Leadership Wisdom by Robin Sharma Jaico Publishing House;

OUTCOMES:

The students will be able to

- Explore through self-introspection one’s own leadership style, their strength and weakness
- Gain self confidence to lead a team in the organization
- Realize the role of leadership in making or breaking of an organization
- Acquire the practice of self introspection and development of leadership competencies thorough continuous efforts
- Manage their own emotions as well as other resulting in successful relationship building with all stakeholders

MSC 3182 SOCIAL ENTREPRENEURSHIP

L	T	P	C
3	0	0	3

OBJECTIVES:

- To be able to understand the field of social entrepreneurship and Social problems
- To be able to describe and understand the traits of social entrepreneurs
- To recognize the social business opportunities
- To synthesize the resource mobilization ways for social entrepreneurship
- To understand the social entrepreneurship models
- To recognize the impact of social entrepreneurship on societies

MODULE I INTRODUCTION TO SOCIAL ENTREPRENEURSHIP 07

Introduction - Emergence and Development of Social Entrepreneurship. Social Problems in India: An Overview. Social Development: The Indian Scenario. Emergence of Social Entrepreneurs and Sustainable Solutions to Social Problem. Characteristics and Context of Social Entrepreneurship .The Role of Social Entrepreneurship in Societies & Economies.

MODULE II SOCIAL ENTREPRENEURSHIP: DRIVERS AND CHALLENGES 07

The Drivers of Social Entrepreneurship. Elements of the Social Entrepreneurial Personality. Challenges of financial constraints. Challenge to attract and cultivate talented workers. Challenge of evaluation of social entrepreneur impact. Challenge of scaling and its impact. Cases

MODULE III SOCIAL ENTREPRENEURSHIP: OPPORTUNITY RECOGNITION 07

Opportunity Recognition and Planning Process. Opportunities for Social Entrepreneurs. The Nature of Social Entrepreneurial Opportunities. Social Problems into Opportunities. Idea development and conceptualization of social problem. Cases

MODULE IV RESOURCE MOBILIZATION FOR SOCIAL VENTURE 08

Resources at Initial Stage. Social Network as a role of Social Capital. Team and Collective Efforts. Need and Determination of Important Resources. Resource of Knowledge, Skills and Abilities. overview of venture capital and

angel investment. Cases

MODULE V BUSINESS MODELS AND BUSINESS PLAN FOR SOCIAL ENTERPRISES **08**

Design Principles of Social Entrepreneurship Business Models , Evaluation of the Root Cause of a Societal Problem. Developing business plan for social ventures. Developing an investor presentation. Feasibility study and report. How to start a business - Procedures for registration of small scale Industry

MODULE VI THE IMPACT OF SOCIAL ENTREPRENEURSHIP ON SOCIETY **08**

Static Impact of Social Entrepreneurship. Impact of Charitable NGOs vs. Social Entrepreneurship, Impact of For-Profit Companies vs. Social Entrepreneurship. Social entrepreneurship report preparation by students.

Case Study of Social Entrepreneurs

L – 45; Total Hours – 45

REFERENCES:

1. “Social Entrepreneurship : New models of sustainable social change” . Alex Nicholls, Oxford University Press 2006
2. The Process of social value creation : A multiple case study on Social Entrepreneurship in India , Archana Singh Springer 2016
3. “Social Entrepreneurship and social business” Christine K Volkmann, Springer Gabler 2012
4. “Social Entrepreneurship” Manuel London ,Routlege, 2010

OUTCOMES:

The students can able to

- Conceptualize social entrepreneurship in terms of a theoretical framework between changing social values and institutions
- Think and communicate about social values
- Learn about practical models of social change to launch, lead, manage, and evaluate a social venture
- Analyze funding needs and sources for the social venture
- Experience the ideas can be critically and collaboratively examined prior to commitment.

ENC 3281	COMMUNICATION AND SOFT SKILLS - II	L	T	P	C
	CONFIDENCE BUILDING	0	0	2	1

OBJECTIVES:

- To develop professional skills like work ethics, analytical skills, presentation skills etc.
- To train them in problem solving skills and leadership skills pertaining to industries.
- To train them in team building skills.
- To train in setting up career goals

MODULE I **6**

Brief about Multinational companies- Analysing work ethics of multinational companies and small industries- discussing as pairs-Knowledge about etiquette (different types)

MODULE II **6**

Visit to an Industry and prepare reports --Critically reading of industry specific journal articles and write ups-- preparing reports.

MODULE III **4**

Analysing problem solving situations in industries (relating to application of core subject to specific jobs) and discussing about them- working on a sample case

MODULE IV **6**

Developing Leadership in team projects-- debating about various aspects of leadership: for example, responsibility and reliability-time management

MODULE V **8**

Team building skills-- group discussions pertaining to industries-- presenting career goals. -- preparing for interviews- interpersonal skills

Total Hours – 30

REFERENCES:

1. Covey,S.R. (2004). The 7Habits of Highly Effective People: Powerful Lessons in Personal Change. Free Press.UK
2. Fine, P.M.& Alice Olins. (2016).Step up: Confidence, Success and Your Stellar Career in 10 Minutes a Day. Vermilion.UK
3. Pai, A. (1993).How to Develop Self-Confidence. Amazon.com
4. Wentz,F.H.(2012). Soft skills training: A Workbook to Develop Skills for Employment. Amazon.com

OUTCOMES:

After completing the course students would be able to

- Exhibit critical reading skills through review of industry specific articles.
- Provide solutions to problem based situations.
- Exhibit leadership qualities by debating over industry specific issues.
- Participate in group discussions confidently.
- Present their career goals.

CEC3211 STRUCTURAL ANALYSIS - II

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide in-depth knowledge on structural mechanics with emphasis on matrix methods for analysis of beams and framed structures.
- To enable the students to analyse the curved beams and various types of suspension bridges.
- To provide knowledge on the concepts of plastic theory to analyze beams and rigid frames
- To give exposure to finite element method.

MODULE I FLEXIBLITY MATRIX METHOD 8

Primary structure - Compatibility conditions - Analysis of indeterminate beams, pin-jointed frames, rigid jointed frames.

MODULE II MATRIX STIFFNESS METHOD 8

Element and global stiffness matrices– Co-ordinate transformations – Rotation matrix- Compatibility matrix – transformations of stiffness matrices, load vectors and displacement vectors – Analysis of Continuous Beams – Analysis of pin-jointed frames and rigid jointed frames.

MODULE III BEAMS CURVED IN PLAN 8

Introduction to curved beams- Analysis of beams curved in plan- circular arc cantilever- semicircular beams fixed at two ends and subjected to central concentrated load- circular ring beams.

MODULE IV SUSPENSION BRIDGES 8

Analysis of suspension bridges – Unstiffened cables and cables with three hinged stiffening girders – Influence lines for three hinged stiffening girders.

MODULE V PLASTIC ANALYSIS OF STRUCTURES 8

Introduction to plastic theory – assumptions in plastic analysis - Plastic moment of resistance – Plastic modulus – Shape factor – Load factor – Plastic hinge and mechanism – Basic theorems – Methods of plastic analysis – Plastic analysis of indeterminate beams and frames.

MODULE VI FINITE ELEMENT METHOD 5

Introduction - Discretisation of a structure - Displacement functions – Truss

element - Beam element - Triangular elements.

Total Hours : 45

TEXTBOOKS:

1. Vaidhiyanathan, R. and Perumal, P., “Structural Analysis II”, Lakshmi Publications, New Delhi, 2004.
2. Bhavikatti, S. S., “Structural Analysis”, Vol.1 and 2, Vikas Publishing House Pvt. Ltd., New Delhi, 2003.
3. Punmia, B.C., Ashok Kumar Jain and Arun Kumar Jain, “Theory of structures”, Laxmi Publications, New Delhi, 1999.

REFERENCES:

1. Ashok K. Jain, “Advanced Structural Analysis”, Nem Chand & Sons, New Delhi,1996.
2. Pandit, G.S. and Gupta, S.P., “Structural Analysis – A Matrix Approach”, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2006.
3. Jain, A.K. and Arya, A.S., “Structural Analysis”, Vol.II, Nem chand Publishers, Roorkee, 1996.
4. Reddy, C.S., “Basic Structural Analysis”, Tata McGraw Hill Publishing Company, New Delhi, 2005.

OUTCOMES:

Students will be able to:

- determine the statically degree of indeterminacy and analyze the beams & frames by flexibility matrix method.
- compute the degree of freedom and apply stiffness matrix method to analyze indeterminate beams & frames.
- categorize and analyze the various structural forms of arches.
- analyze the cables & suspension bridges and apply influence line analysis for three hinged stiffening girders.
- use appropriate assumptions to establish plastic hinge analysis of beams & frames.
- apply the concept of finite element analysis and generate displacement functions for various elements.

CEC3212 GEOTECHNICAL ENGINEERING II

L	T	P	C
3	0	0	3

OBJECTIVES:

- To give exposure in soil exploration and site investigation.
- To provide knowledge to determine bearing capacity of soil under shallow foundation.
- To impart knowledge in contact pressure distribution and design and proportioning of Shallow foundation.
- To introduce concepts in settlement of foundation under load.
- To enable the students to analyze the types and design of pile foundation.
- To provide an understanding on earth pressure theories in retaining structures.

MODULE I SITE INVESTIGATION AND SELECTION OF FOUNDATION **7**

Scope and objectives- Methods of exploration-auguring and boring- Water boring and rotary drilling-Depth of boring-Spacing of bore hole- Sampling-Representative and undisturbed sampling - Sampling techniques- Split spoon sampler, Thin tube sampler, Stationary piston sampler-Bore log report - Penetration tests (SPT and SCPT)- Data interpretation (Strength parameters)- Selection of foundation based on soil condition.

MODULE II SHALLOW FOUNDATION **7**

Introduction-Location and depth of foundation- Codal provisions - bearing capacity of shallow foundation on homogeneous deposits- Terzaghi's formula and BIS formula - factors affecting bearing capacity-problems - Bearing Capacity from in situ tests (SPT, SCPT and plate load) - Allowable bearing pressure.

MODULE III FOOTINGS AND RAFTS **7**

Types of foundation - Contact pressure distribution below footings & raft - Isolated and combined footings- types- proportioning - mat foundation - types - use - proportioning - floating foundation.

MODULE IV SETTLEMENT OF FOUNDATIONS **8**

Settlement - Components of settlement - Determination of settlement of foundations on granular and clay deposits - Allowable settlements - Codal provision - Methods of minimizing settlement, differential settlement.

MODULE V PILES 8

Types of piles and their function - Factors influencing the selection of pile-Load carrying capacity of single pile in granular and cohesive soil – Static formula - dynamic formulae (Engineering news and Hiley's) - Capacity from insitu tests (SPT and SCPT) - Negative skin friction- uplift capacity- Group capacity by different methods (Feld's rule, Converse Labarra formula and block failure criterion)- Settlement of pile groups - Interpretation of pile load test - Forces on pile caps - under reamed piles - Capacity under compression and uplift.

MODULE VI RETAINING WALLS 8

Plastic equilibrium in soils – active and passive states – Rankine's theory – cohesion less and cohesive soil - Coulomb's wedge theory – condition for critical failure plane - Earth pressure on retaining walls of simple configurations – Graphical methods (Rebhann and Culmann) - pressure on the wall due to line load – Stability of retaining walls.

Total Hours : 45

TEXTBOOKS:

1. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd., New Delhi, 1995.
2. Gopal Ranjan and Rao, A.S.R., "Basic and Applied Soil Mechanics", New Age International Publishers, New Delhi, 2000.
3. Venkatramaiah, C., "Geotechnical Engineering", New Age International Publishers, New Delhi, 1995.
4. Khan, I.H., "A text book of Geotechnical Engineering", Prentice Hall of India, New Delhi, 1999.

REFERENCES:

1. Coduto, D.P., "Geotechnical Engineering Principles and Practices", Prentice Hall of India Private Limited, New Delhi, 2002.
2. McCarthy, D.F., "Essentials of Soil Mechanics and Foundations - Basic Geotechniques", 6th Edition, Prentice-Hall, New Jersey, 2002.
3. Das, B.M, "Principles of Geotechnical Engineering", 5th Edition, Thomas Brooks/ Cole Publishing House, 2002.

4. Muni Budhu, “Soil Mechanics and Foundations”, John Willey & Sons, Inc., New York, 2000.

OUTCOMES:

At the end of the course, students will be able to,

- recommend an appropriate site investigation programme for any construction.
- explore the bearing capacity of the soil for different types of shallow foundation.
- propose the size and depth of shallow foundation according to the contact pressure distribution.
- analyze the settlement for various types of foundation based on soil condition.
- examine the load carrying capacity & settlement of piles.
- determine the various types of earth pressure and stability of retaining structures.

CEC3213 DESIGN OF STEEL STRUCTURES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge to students on the significance of steel structures, structural steel sections for industry applications and limit state design concept.
- To enable the students to design the bolted and welded connections.
- To provide knowledge to design the compression members, tension members, beams and roof trusses as per IS 800 – 2007 codal provisions.

MODULE I INTRODUCTION TO STEEL STRUCTURES 4

Importance of steel structures - chemical composition and properties - various form - Indian standard structural steel sections. Review of IS 800 : 2007 : General design requirements - Loads and forces - Limit state design concept - Limit state of strength - Limit state of serviceability.

MODULE II BOLTED AND WELDED CONNECTION 9

Metal joining methods - types of connections. Bolted connection - classification of bolts - advantages and disadvantages - failure modes - IS 800 codal provisions - Shear, bearing and tension capacity of bolts - Design of lap joint, butt joint -types of eccentric connection - Design of bracket connection - bolts subjected to combined shear and tension. Welded connection : Importance - advantages and disadvantages - types of welded joints - IS 800 codal provisions - strength of weld - Design of welded lap joint - bracket connection.

MODULE III DESIGN OF TENSION MEMBERS 9

Types of sections - behaviour of tension members - Design strength due to yielding, rupture of critical section and block shear - IS 800 :2007 codal provisions for design - importance of lug angle - concept of shear lag - Design tensile strength of plate, angle and roof truss member - Design of tension members - Design of tension splice.

MODULE IV DESIGN OF COMPRESSION MEMBERS 8

Types of members and forms - short column, long column and buckling phenomenon - slenderness ratio - effective length – buckling class - IS 800 : 2007 codal provisions for design - Design of simple column - Design of laced and

battened columns - Column bases - Design of slab base and gusseted base - connection details.

MODULE V DESIGN OF BEAMS 8

Importance and functions - behaviour of steel beams - IS 800 codal provisions - design of simply supported beams - web crippling and web buckling - design of laterally unsupported beams - built up beams - beams subjected to biaxial bending - Design of plate girder - bolted and welded type - intermediate and bearing stiffeners - web splices sand.

MODULE VI ROOF TRUSSES 7

Types of roof trusses - components - load combinations - IS 875 :1987 codal provisions - Design wind speed, wind pressure and wind loads - Wind pressure calculation on buildings in hilly terrain - Design of purlin for load combinations - design load on roof truss.

Total Hours : 45

TEXTBOOKS:

1. Bhavikatti, S.S., "Design of Steel Structures", I.K. International Publishing House Pvt. Ltd., New Delhi, 2010.
2. Shah, V.L. and Veena Gore, "Limit State Design of Steel Structures", Structures Publications, Pune, 2010.
3. Duggal, S.K., “Design of Steel Structures", Tata McGraw-Hill Publishers, New Delhi, 2009.

REFERENCES:

1. Subramanian, N., "Steel Structures - Design and Practice", Oxford University Press, Chennai, 2011.
2. Haji Sheik Mohammed, M.S., "Lecture Notes on Design of Steel Structures", B.S. Abdur Rahman Crescent Institute of Science & Technology, Chennai, 2011.

OUTCOMES:

Students will be able to

- recognize the composition, properties and sections used for steel structures and describe the design philosophy with an emphasis on limit state method.
- classify and design appropriate connections between structural members as IS

codal provisions.

- identify the different failure modes in tension members and select the most suitable section shape and size for the design of tension members.
- determine the lateral buckling length of compression members and design the column & column bases with suitable connection details.
- analyze and design the beams, built-up sections and plate girders in accordance to the Indian standards.
- estimate the wind pressure as per Indian standards, analyze and design the members of a steel roof truss under gravity and wind loads.

CEC3214	COMPUTER MODELING AND STRUCTURAL DESIGN LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To provide hands on experience in preparation of structural design and drawings for concrete and steel structures using latest software.

MODULE I BEAMS **9**

Analysis and Design of a continuous beam subjected to various loading systems

MODULE II PLANE FRAMES **9**

Analysis and Design of plane frames with two bay five-storey (G+4).

MODULE III SPACE FRAMES **9**

Analysis and Design of space frames with single bay two-storey (G+1).

MODULE IV FOUNDATION AND STAIRCASE **9**

Design of foundation for the space frames with single bay two storeys (G+1).Design of staircase with single bay two-storey (G+1).

MODULE V TRUSSES **9**

Analysis and Design of steel roof truss frame for industrial buildings.

Total Hours : 45

TEXT BOOKS:

1. Krishna Raju, N., “Structural Design & Drawing (Concrete & Steel)”, CBS Publishers, New Delhi, 2005.
2. Krishnamurthy, D., “Structural Design & Drawing – Vol. II”, CBS Publishers & Distributors, New Delhi,1992.
3. Krishnamurthy, D., “Structural Design & Drawing – Vol. III Steel Structures”, CBS Publishers & Distributors, New Delhi, 1992.

REFERENCES:

1. Punmia, B.C., Ashok Kumar Jain and Arun Kumar Jain, “Design of steel structures”, Lakshmi publications Pvt. Ltd., Chennai, 2008

Duggal, S.K., “Design of Steel Structures", Tata McGraw-Hill Publishers, New Delhi, 2009.

2. Unnikrishna Pillai and Devdas Menon., “Reinforced Concrete Design”, Tata McGraw Hill Publishing Company Ltd., New Delhi.2003.
3. Varghese, P.C., “Limit State Design of Reinforced Concrete”, Prentice Hall of India, New Delhi, 2004.

OUTCOMES:

At the end of the course, the students will be able to

- analyse and design the continuous beams subjected to various kinds of loadings.
- analyse and design the plane frames with two bay five-storey structures.
- analyse and design the space frames with single bay two-storey structures.
- design the foundation for the space frame structures and staircase for single bay two-storey.
- analyse and design the steel roof truss frame for industrial buildings.
- prepare relevant structural drawings as per I.S specifications using latest software.

CEC3215	SURVEY AND GEOTECHNICAL INVESTIGATION CAMP	L	T	P	C
		0	0	2	1

OBJECTIVE:

- To impart the skill & knowledge to execute real-time survey and soil investigations.

MODULE I TOPOGRAPHY & CONTOURING **7**

Preparation of Elevation Contour Map & Digital Elevation Model.

MODULE II PROFILE LEVELING **7**

Preparation of Longitudinal Profile & Cross-sectional Profiles for a new road alignment and computation of Volume of Cutting and filling required.

MODULE III CARTOGRAPHY **7**

Preparation of Map for a small area & reporting the statistics of the area.

MODULE IV TACHOMETRIC TRAVERSING **7**

Determination of shortest distance between two points and its gradient by tachometric traversing.

MODULE V SETTING OUT WORKS **7**

i) Setting out of a Curve for a new road or rail alignment

ii) Marking of foundation for a multi-storey building.

MODULE VI SOIL TESTING **10**

Conduction of SPT, Plate Load Test, Preparation of Bore log & Soil Profile.

Total Hours : 45

OUTCOMES:

At the end of the course, student: will be able to

- plan and execute a survey for topography modeling of a terrain and create an Elevation Contour Map and Digital Terrain Model
- plan and execute the survey for the formation of a new road alignment by longitudinal sectioning and cross sectioning profiles and compute the volumes of embankment and excavation.

- plan and execute a survey for preparing a map of the given area and plot a map
- plan and execute a tacheometric survey to find shortest distance between inaccessible points on terrain
- compute the characteristics of a highway curve and set out the same by appropriate method and also sketch out the excavation markings of a residential building and setout the same
- execute a soil investigation programme, sketch the soil profile and compute the safe bearing capacity of the soil.

VII SEMESTER

CEC4101	ESTIMATION AND COSTING	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To impart knowledge on various methods of estimation of buildings, roads, and irrigation structures
- To introduce the concepts of rate analysis and tendering process.
- To provide understanding on valuation engineering and report preparation.

MODULE I METHODS OF ESTIMATION 7

Types of estimates – Units of measurements – Methods of estimates – Advantages - Specifications- Sources- Detailed and general specifications.

MODULE II ESTIMATE OF BUILDINGS 8

Load bearing and framed structures - Calculation of quantities of brick work, RCC, PCC, Plastering, white washing, colour washing and painting / varnishing for shops, rooms, Various types of arches - Calculation of brick work and RCC works in arches - Estimate of joineries for panelled and glazed doors, windows, ventilators, handrails.

MODULE III ESTIMATE OF WATER SUPPLY AND SANITARY INSTALLATIONS 7

Sanitary and water supply installations- Estimating of septic tank, soak pit - Water supply pipe line - Sewer line - Tube well - Open well.

MODULE IV ESTIMATE OF OTHER STRUCTURES 7

Estimate of bituminous and cement concrete roads - Estimate of retaining walls - Culverts.

MODULE V RATE ANALYSIS AND TENDERS 8

Data- Schedule of rates- Analysis of rates- Tenders- Contracts-Types of contracts-Arbitration and legal requirements.

MODULE VI VALUATION & REPORT PREPARATION 8

Necessity - Basics of value engineering - Capitalized value – Depreciation-Escalation - Value of building - Calculation of Standard rent - Mortgage - Lease -

Principles for report preparation -Report preparation for residential buildings.

L – 30; P – 30; Total Hours : 60

TEXTBOOKS:

1. Dutta, B.N., “Estimating and Costing in Civil Engineering”, UBS Publishers & Distributors Pvt. Ltd., New Delhi, 2003.
2. Chakraborti.M., “Estimating Costing”, Specification and Valuation in Civil Engineering, 2001.

REFERENCES:

1. Kohli, D.D and Kohli, R.C., “A Text Book of Estimating and Costing (Civil)”, S.Chand & Company Ltd., New Delhi, 2004.

OUTCOMES:

At the end of the course the students will be able to

- make measurements of various quantities involved in the construction of building using central line method and long wall & short wall method
- categorize and estimate different items of work for buildings
- prepare estimate for septic tank, water supply and sanitary works
- generate estimation for road works, retaining wall and culverts
- prepare tender documents, rate analysis, schedule of rates specifications and contracts
- evaluate the value of building, fix rent and prepare report for construction of residential building.

CEC4102 DESIGN OF HYDRAULIC STRUCTURES

L	T	P	C
2	0	0	2

OBJECTIVES:

To provide appropriate knowledge for the planning and designing of various Components of an irrigation structures on various project scheme.

MODULE I TANK IRRIGATION STRUCTURES 8

Detailed design of Tank bunds – Tank surplus weirs – Tank sluices weirs on pervious foundations - Percolation ponds.

MODULE II IMPOUNDING STRUCTURES 8

Design of Gravity Dams – Design concepts of Earth dams – Arch dams – Spill ways – Energy dissipation devices.

MODULE III CROSS DRAINAGE WORKS 8

Design of Aqueducts – Syphon aqueducts – Super passage – Canal siphon

MODULE IV CANAL TRANSMISSION STRUCTURES 7

Design of Canal drops – Notch type – Syphon well drops

MODULE V CANAL REGULATION STRUCTURES 7

Design aspects of Canal head works – Canal regulator – Canal escape – Silt Exclusion structures.

MODULE VI IRRIGATION WATER MANAGEMENT STRUCTURES 7

On farm development works – Structures for proportional field distribution – Rain water harvesting structures – Design aspects.

Total Hours : 45

TEXTBOOKS:

1. Garg, S.K., “Irrigation Engineering and Design of Structures”, Khanna Publishers, New Delhi, 2009.
2. Satyanarayana Murthy, “Irrigation Design and Drawing”, L. Banumathi Publishers, Tuni, East Godavari District, A.P., 1998.

REFERENCES:

1. Sharma, R.K., “Irrigation Engineering and Hydraulic Structures”, Oxford and IBH Publishing Co., New Delhi, 2002.

OUTCOMES:

At the end of the course, students will be able to

- conceive and plan an tank irrigation structures
- design the various dams based on the hydraulic particulars.
- design the aqueducts for the locality based on the population.
- design the various canal drops or canal falls.
- plan and design the regulating structures based on the discharge released.
- analyse and plan the various irrigation water management project scheme and design its components.

CEC4103 PRESTRESSED CONCRETE

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge on the basic concepts, materials used for prestressed concreteTo provide knowledge on the analysis of stresses, losses of prestress and deflection of prestressed concrete members.
- To understand the behaviour and design the prestressed concrete flexural members.
- To give exposure to prestressed concrete in composite construction and special structures.

MODULE I BASIC CONCEPTS & ANALYSIS OF STRESSES 8

Concept of Prestressing – Advantages of prestressed concrete – Materials required – Systems and methods of prestressing – Analysis of sections – Stress concept – Strength concept – Load balancing concept –Stresses in tendons.

MODULE II LOSSES OF PRESTRESS AND DEFLECTION IN MEMBERS 7

Losses of prestress –Deflections of prestressed concrete members - Factors influencing deflections –Effect on tendon profile on deflections - Short term and long term deflections as per codal provisions.

MODULE III DESIGN OF PSC MEMBERS 8

Flexural strength – Strain compatibility method - Simplified procedures as per codes – Shear and Principal Stresses – Ultimate shear resistance of PSC members - Design of shear reinforcement – Design of PSC sections for flexure.

MODULE IV TRANSMISSION OF PRESTRESS 6

Transmission of prestress in pre-tensioned members –bond and transmission length – end zone reinforcement – Anchorage zone stresses - stress distribution - Design of anchorage zone reinforcement.

MODULE V COMPOSITE CONSTRUCTION 8

Analysis for stresses – Differential Shrinkage - Estimation of deflections – Flexural and shear strength of composite members.

MODULE VI PSC SPECIAL STRUCTURES 8

Concept of circular prestressing – Design of prestressed concrete pipes and cylindrical water tanks - Prestressed concrete poles, piles, sleepers.

Total Hours : 45

TEXTBOOKS:

1. Krishna Raju, N., “Prestressed Concrete”, Tata McGraw Hill Company, New Delhi, 1998.
2. Rajagopal, N., “Prestressed Concrete”, 2nd Edition, Narosa Publications, New Delhi, 2007.
3. Muthu K. U., Ibrahim Azmi, Janardhana Maganti, Vijayanand M., “Prestressed Concrete”, PHI Learning Pvt. Ltd., New Delhi, 2016.

REFERENCES:

1. Mallick, S.K. and Gupta, A.P., “Prestressed concrete”, Oxford and IBH publishing Co.Pvt. Ltd., New Delhi, 1997.
2. Lin, T.Y., “Design of Prestressed Concrete Structures”, Asia Publishing House, Bombay, 1995.
3. Ramaswamy, G.S., “Modern Prestressed Concrete Design”, Arnold Heinimen, New Delhi, 1990.

OUTCOMES:

At the end of the course, students will be able to

- describe the properties of constituents in prestressed concrete and apply the principles & procedures for analyzing the prestressed concrete structures.
- evaluate the short and long term losses and deflection for PSC members.
- establish appropriate approaches to calculate the design strength for flexure & shear and apply the principles for the design of PSC members.
- recognise the effects of transfer of prestress and design the anchorage reinforcement.
- analyse and design the composite structural members.
- apply the principles and techniques for the design of circular prestressing and demonstrate the various structures such as poles, piles.

CEC4104 CONSTRUCTION MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVE:

- To impart knowledge on planning of construction projects, scheduling of activities using network diagrams, estimating cost of project, controlling the cost of project by creating cash flows and budgeting.
- To give exposure to project information systems.

MODULE I CONSTRUCTION PLANNING 7

Basic concepts in the development of construction plans-Choice of technology and construction method-Defining work tasks - Defining precedence relationships among activities-Estimating activity durations-Estimating resource requirements for work activities-Coding systems. Introduction to software's used in construction management.

MODULE II SCHEDULING PROCEDURES AND TECHNIQUES 7

Introduction - plan development process- scheduling-definition -types of construction schedules-scheduling techniques-CPM - Terms and definitions - Earliest and Latest times - different types of floats - significance- calculation of critical path method-PERT - terms and definitions - network and solving problems using PERT - standard deviation and probability calculation in PERT.

MODULE III RESOURCE PLANNING 8

Materials: Quantity of materials - time of purchase- inventory control - terms and definitions - types of inventory -EOQ -reasons for maintain inventory - different tools for inventory. Equipment: Classification of major construction equipment- planning and selecting of equipment- task consideration - cost consideration.

MODULE IV COST CONTROL MONITORING AND ACCOUNTING 7

Cost – Types of Cost -Cost control problem-Project budget-Forecasting for activity cost control - Financial accounting systems and cost accounts-Control of project cash flows-Schedule and budget updates-Relating cost and schedule information.

MODULE V QUALITY CONTROL & SAFETY DURING CONSTRUCTION 8

Quality and safety concerns in construction-Organizing for quality and safety-Work and material specifications-Total quality control-Quality control by statistical methods -Statistical quality control with sampling by attributes-Statistical quality

control by sampling and variables-Safety.

MODULE VI ORGANIZATION & USE OF PROJEC INFORMATION 7

Project information- Types and use-Organizing information in databases-Centralized database management systems-Databases and application programs-Information transfer and flow.

Total Hours : 45

TEXTBOOKS:

1. Chitkara, K.K., “Construction Project Management, Planning, Scheduling and Control”, Tata McGraw-Hill Publishing Co., New Delhi, 1998.
2. Chris Hendrickson and Tung Au, “Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders”, Prentice Hall, Pitsburgh, 2000.
3. Joy, P.K., “Total Project Management - The Indian context”, Macmillan India Ltd., New Delhi, 1992.

REFERENCES:

1. Moder, J., Phillips, C. and Davis, “Project Management with CPM, PERT and Precedence Diagramming”, 3rd Edition, Van Nostrand Reinhold Co., 1983.
2. Willis, E.M., “Scheduling Construction Projects”, John Wiley and Sons, New York, 1986.
3. Halpin, D.W., “Financial and Cost Concepts for Construction Management”, John Wiley and Sons, New York, 1985.

OUTCOMES:

After completion of the course, students will be able to

- identify the WBS and precedence relationships among activities and coding systems in the project.
- describe the CPM and PERT analysis method of scheduling.
- select the resources for optimization and construct the crashing and time/cost trade off.
- solve the cost control problem and financial accounting systems on site.
- apply statistical quality control techniques and list the safety and quality control checklist on site.

CEC4105	INDUSTRIAL INTERNSHIP	L	T	P	C
		0	0	0	1

OBJECTIVES:

- To train the students in the field work so as to have knowledge of practical problems related to Civil Engineering field in carrying out engineering tasks.
- To impart hands on practice in facing and solving the problems experiencing in the field.

GENERAL GUIDELINES:

- The students individually undertake training in reputed engineering companies doing Civil works in fields like construction, environmental engineering, GIS etc., during the summer vacation for a specified duration of four weeks.
- The students should also get a evaluation form filled by concerned authority giving training during that period.
- At the end of training, a detailed report on the work done should be submitted within one month from the commencement of the semester.
- The students will be evaluated through a viva-voce examination by a team of internal staff.

Total Hours : 15

OUTCOME:

- At the end of the course, the students will be exposed to apply their knowledge in practical real-world problems and would be able to face the field works with more courage.

SEMESTER VIII

		L	T	P	C
CEC4211	**PROJECT WORK**	**0**	**0**	**24**	**12**

OBJECTIVE:

• The Project aims to provide opportunity for the students to exhibit their capacity in executing a project work as a team which deals with analysis / design /experimental works related to civil engineering

GENERAL GUIDELINES:

- The students will be given opportunity to select a project topic of his/her interest and advised to approach the faculty member with expertise in that field to appraise the project and get his/her willingness to guide the project.
- The information related to proposed topic and the faculty member willing to act as guide shall be informed to the course co-ordinator within the stipulated time. The project co-ordinator in consultation with Professor in-charge and Head of the Department shall give initial approval.
- In the project students are expected to identify a suitable topic, draw the need for present study and scope of the investigation, review at least 10 journal papers in the related field, formulate the experimental / analytical methodology and conduct preliminary studies.
- Detailed experimental investigation / in-depth analytical study / fabrication of equipment have to be performed in line with the scope of investigation.
- The students are expected to analyse the obtained results and discuss the same in an elaborate manner by preparing necessary charts / tables / curves to get an inference.
- The important conclusions need to be drawn and scope for further research also to be highlighted.
- The project co-ordinator shall arrange to conduct three reviews to ascertain the progress of the work and award the marks based on the performance.
- At the end, students should submit a report covering the various aspects of Project work. The typical components of the project report are Introduction, Need for present study, Scope of the Investigation, Literature review, Methodology / Experimental investigation / development of software packages, Results & discussion of experimental and analytical work, Conclusions, References etc.
- The project co-ordinator shall arrange for final viva-voce examination to

ascertain the overall performance in Project work.

OUTCOME:

At the end of the course, the students will be able to

- apply their knowledge base in civil engineering
- Utilize the creative ability and inference capability to solve real world problems.
- Apply the practical knowledge while solving real time problems
- Prepare an appropriate documentation.

PROFESSIONAL ELECTIVES
SEMESTER IV

CECX01	MODERN CONSTRUCTION MATERIALS	L	T	P	C
		2	0	0	2

OBJECTIVE:

• To impart knowledge regarding the properties of modern construction materials used in construction and their suitability of applications in construction industry

MODULE I STRUCTURAL MATERIALS 6

Different types of steel, aluminium and their products - other alloys – applications in civil engineering

MODULE II NON - STRUCTURAL MATERIALS 9

Non structural materials - water proofing compounds-types - non weathering materials - flooring - types - materials used for flooring – properties - facade materials - types - properties - selection - insulation materials - coatings - eco friendly materials - polymers.

MODULE III SMART AND INTELLIGENT MATERIALS 9

Smart materials – shape memory alloys - application in construction – smart windows -types - intelligent materials - nano materials - coatings & paints – nano sensors- aerogels - phase changing materials - translucent concrete – sensiTile - electrified wood – flexicomb - self-repairing cement/concrete - liquid granite - bendable concrete

MODULE IV INNOVATIVE MATERIALS 6

Self healing concrete – 3D printing sand stone – Aluminium foam – Bamboo reinforced concrete – Bio receptive concrete – Facade made from pollutants – interactive printed grapheme – stabilized soil

Total Hours : 30

TEXT BOOKS:

1. Ganapathy. C, Modern construction materials, Easwar Press, 2015
2. Viswanath.H.S, Materials of construction II, Sapna book house Pvt Ltd., 2014

REFERENCES:

1. Mamlouk, M.S. and Zaniewski J.P, Materials for Civil and Construction Engineers, Prentice Hall Inc., 2011
2. Sankar, S.K. and Saraswati, S., Construction Technology, Oxford UniversityPress, New Delhi, 2008
3. Arora S.P. and Bindra S.P., Building Construction, Planning Techniques and Method of Construction, Dhanpat Rai and Sons, 1997

OUTCOMES:

At the end of the course, the student will be able to

- Select the materials such as metal structural materials for various applications in construction.
- Select the non structural materials for various applications in construction.
- Explain the advantages of using smart and innovative material in construction
- Explain the advantages and various applications of using intelligent material in construction.

CECX02	CONSTRUCTION EQUIPMENT AND TECHNIQUES	L	T	P	C
		2	0	0	2

OBJECTIVE:

To impart knowledge about various equipments and methods used in construction Industry

MODULE I EARTH WORK EQUIPMENTS AND MATERIAL HANDLING EQUIPMENT **7**

Fundamentals of earthwork operations-earth moving operations-types of earthwork equipment – tractors, motor graders, scrapers, front end waders, earth movers, forklifts and related equipment- -cranes - hauling equipments and methods.

MODULE II OTHER CONSTRUCTION EQUIPMENTS **8**

Equipments and methods for dredging, trenching, tunneling, drilling, blasting - equipment for compaction - erection methods and equipments-types of pumps used in construction - equipment and methods for dewatering and grouting - foundation and pile driving equipment.

MODULE III AGGREGATE AND CONCRETING EQUIPMENT **7**

Crushers- feeders - screening equipment - handling equipment – batching and mixing equipment - pouring and pumping equipment - transporters and related methods- portable material bins - conveyors.

MODULE IV COMPACTION AND STABILIZATION OF EARTH MATERIALS **8**

Compaction and stabilization of geotechnical materials-Selection of equipments – machine power- planning of construction plant and equipment with emphasis on site application - site layout – safety in handling equipments.

Total Hours : 30

TEXT BOOKS:

1. Peurifoy R.L., Ledbetter W.B. and Schexnayder. C., Construction Planning, Equipment and Methods, McGraw Hill, Singapore, 2010.
2. Harris. F., Modern Construction and Ground Engineering Equipment and Methods, Prentice Hall, 1994.

3. Richard. C, Ringwalk, Heavy Construction Handbook, Caterpillar Inc., 2015.

REFERENCES:

1. Peurifoy, R.L., Ledbetter, W.B.and Schexnayder, C., Construction Planning, Equipment and Methods, 5th Edition, McGraw Hill, Singapore, 2010.
2. Sharma S.C., Construction Equipment and its Management, Khanna Publishers New Delhi, 2002.
3. Deodhar, S.V., Construction Equipment and Job Planning, Khanna Publishers, New Delhi, 2001.
4. Saxena SC, Construction Equipment and Planning, Standard Publishes-Distributors-Delhi, 2009.

OUTCOMES:

At the end of the course, students will be able to

- describe the features of construction equipments
- explain the methods for stabilization of soil
- identify suitable equipments according to the construction work
- describe the construction equipment safety measures

CECX03 PRINCIPLES OF ARCHITECTURE L T P C
2 0 0 2

OBJECTIVES:

- To make the students learn the principle aspects of design and understand how it
- To understand the ideologies from works of architects and planners.
- To learn the design communication skills to enable to put forth the design ideas in graphics and literature.

MODULE I ELEMENTS OF DESIGN IN NATURE 8

Points, lines and shapes found in nature. Role of elements to emphasize the location, as landmark, for direction and dominance, etc. Patterns in nature and building design. Chaos and Order. Study: examples of nature inspired man made design.

MODULE II PRINCIPLES OF ORGANIZATION FROM NATURE 8

Fractals – patterns, proportion, repetition, harmony- Proportion- Axis, Symmetry/Asymmetry, Massing, Form generating exercises to approach site planning in small scale and large scale projects.

MODULE III DESIGN COMMUNICATION AND GRAPHICS 7

Importance of graphics in architectural design. Study of site plans, city plans, conceptual Drawings. Interpretation of architects' conceptual sketches and the respective buildings.

MODULE IV LANDSCAPING OF FUNCTIONAL AREAS 7

Urban open spaces and principle of urban landscape; Street landscaping, landscape design for waterfront areas and functional areas in urban centers. Green infrastructure including green roofs and walls.

Total Hours : 30

TEXT BOOKS:

1. Francis D.K.Ching, Architecture-Form, Space and Order, Van Nostrand Reinhold Company, New York, 2007.
2. Simon Unwin, Analysing Architecture, Routledge, London, 2003.
3. V.S.Pramar, Design Fundamentals in Architecture, Somaiya Publications Pvt.

Ltd., New Delhi, 1973.

REFERENCES:

1. Leland M. Roth - Understanding Architecture, its experience history and meaning, Craftsman house, 1994.
2. Steen Eiler Rasmussen - Experiencing architecture, MIT Press, 1964.
3. Peter von Meiss -Elements of architecture - from form to place, Spon Press 1992.

OUTCOMES:

- A thorough understanding on the definition of architecture; elements of architectures of form.
- An exposure to the principles of architecture and applications of the same in buildings and spaces.
- An understanding the meaning of character and style of buildings with examples.
    - Understanding of the role of landscape design in the shaping of outdoor environments

CECX04 SAFETY IN CONSTRUCTIONS

L	T	P	C
1	0	0	1

OBJECTIVES:

To impart knowledge in

- Safety aspects involved in construction industry.
- Policies followed and awareness in construction industry.

MODULE I SITE SAFETY 7

Construction Safety Management – Occupational Safety and Health Ordinance (OSHO) - Role of various parties, duties and responsibilities of top management - Site managers - Supervisors, etc - Role of Safety Officers - Responsibilities of general employees - Safety Committee - Safety Monitoring - Writing Safety Manuals - Preparing Safety Checklists - Inspection Reports

MODULE II ACCIDENT, AWARENESS & POLICY IN SAFETY 8

Safety of accidents on various construction sites - Prevention of accidents - Safety measures - Recording injuries and accident indices. Method statement – SOPs - PPE - Inspections – Investigations - Site safety programs – Job Safety Analysis (JSA) - Job Hazard Analysis (JHA) - Root cause analysis – Meetings - Safety Policy – manuals - Training & Orientation

Total Hours : 15

TEXT BOOKS:

1. Tim Howarth, Paul Watson, Construction Safety Management, Wiley- Blackwell Publishing, 2008.

REFERENCES:

1. Construction safety manual – SP 70 published by National Safety Commission of India- 2007.
2. Safety Management in Construction Industry – A manual for project managers. NICMAR Mumbai, 1998.
3. Construction Safety Handbook – Davies V.S.Thomasin K, Thomas Telford, London, 1990.

OUTCOMES:

At the end of the course student will be able to

- define the roles and responsibilities of stakeholders in establishing safety in the project, the safety practices to be followed during various construction operations.
- state the awareness about safety in site and analyse the safety policies followed by organization in construction site.

CECX05 REAL ESTATE LAWS L T P C
1 0 0 1

OBJECTIVE:

- To impart knowledge on the important concepts in real estate law, including real property, the general laws of land ownership and real estate transactions, title examinations and methods of title transfer, sales contracts and the sales process, real estate financing options, and the closing/settlement process.

MODULE I INTRODUCTION 7

Scope of real estate sector and regulatory framework in India - Real Estate (Regulation and Development) Act, 2016 - Real Estate construction and development transactions - Real estate financing transactions - Sale, Lease and Licenses - Importance of real estate laws for real estate and management professionals - Legal structure of smart cities Case study - How a large real estate company is structured

MODULE II REAL ESTATE ZONING AND BYE LAWS 8

General understanding of Planning, Zoning laws - Subdivision of land, Master Plan/Town Plan Provisions - Building Bye-laws - Approvals & Sanctions - Delhi Master Plan Study.

Joint-development models - Profit sharing and price determination - Property ownership and license to construct - Rights of landowners - Rights of developer.

Total Hours : 15

TEXT BOOKS:

1. Judith, Anne Mackenzie “Text book on land law”, Oxford University Press, U.K, 2004.
2. Kevin J.Gray, “ Elements of Land Law”, Lexis Nexis Publishers, U.K., 2004
3. V.G.Ramachandran, “Law of Land Acquisition and Compensation”, 8th edition, Eastern Book Company, Lucknow, 2000

REFERENCES:

1. Gerald R Cortesi, “Mastering Real estate principles”, Dearborn Trade Publishing, New York, U.S.A, 2001.
2. Fillmore W Galaty, “Modern Real estate practice”, Dearborn Trade Publishing, New York, U.S.A, 2002.

3. Tanya Davis, “Real estate developer’s handbook”, Atlantic pub company, Ocala, USA, 2007.
4. Mike .E. Miles, “Real estate development – Principles & Process 3rd edition, Urban Land Institute, ULI – Washington DC, 2000.

OUTCOMES:

At the end of the course, the students will be able to

- identify career opportunities for students with the appropriate training in this specialty area.
- identify and explain important concepts in real estate law.

CECX06	VAASTU SATRA AND ARCHITECTURAL DESIGN	L	T	P	C
		1	0	0	1

OBJECTIVES:

- To introduce the principles of vastu and vaasthu and relationship between building and site
- To familiarize the students with the units of measurement in traditional architecture.
- To introduce the concepts of orientation and cosmogram according to the vasthu purusha mandala.

MODULE I INTRODUCTION TO VAASTU 5

Overview of mythological and scientific background of Vaastu - Understanding Life force Energy - Importance of Five Elements - Use of Magnetic Compass - Importance of Cardinal Directions & extensions – Types - shapes and selection of Land

MODULE II ORIENTATION OF HOME 10

Open Space planning and Building Design - Floor level Height factors – Verandas- Balconies -Porch Basements- Water flow - Mezzanine floors - Plants and Greenery Master Bed Room - Kids room - Living Room- Kitchen- Dining Room – Bathroom - Drawing room - Study Room - Puja Room – Doors - Windows and ventilators - Main Entrance - Staircase – Guest room

Total Hours : 15

TEXT BOOKS:

1. Dr.V.Ganapati Sthapati, “Sthapatya Veda”, Dakshina Publishing house, Chennai, India, 2001.
2. Stella Kramrish, “The Hindu Temple” Volume – I, Motital Banarsidass Publishers, 2002.
3. K.S.Subramanya Sastri, Mayamatam, Thanjavur Maharaja Sarojoji Saraswathi Mahal Library – Thanjavur, 1966.

REFERENCES:

1. . Anand Bhardwaj “Scientific approach to Vastu Shastra” Abhinav Publications; First edition, 2013.

2. . Suman Pandit " Golden rules of vastu shastra – Remedies and Solutions" UBS Publishers' Distributors (P) Ltd.,2004.

OUTCOMES:

Upon completion of the course, the student will be able to

- Summarize the Vaastu Principles.
- Explain the open space planning and building design using vaastu.
- Demonstrate the orientation of rooms based on vaastu

SEMESTER V

		L	T	P	C
CECX10	**HYDROLOGY**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To impart knowledge about the components of the hydrological cycle and their estimation.
- To provide details about the derivation of hydrographs, application of GIS in rainfall runoff process and flood routing & control.

MODULE I PRECIPITATION 7

Hydrologic cycle – Types of precipitation – Forms of precipitation – Measurement of Rainfall – Spatial measurement methods – Temporal measurement methods – Frequency analysis of point rainfall – Intensity, duration, frequency relationship – Probable maximum precipitation

MODULE II ABSTRACTION FROM PRECIPITATION 8

Losses from precipitation – Evaporation process – Reservoir evaporation – Infiltration process – Infiltration capacity – Measurement of infiltration – Infiltration indices – Effective rainfall

MODULE III HYDROGRAPHS 9

Factors affecting Hydrograph – Baseflow separation – Unit hydrograph – Derivation of unit hydrograph – S curve hydrograph – Unit hydrograph of different durations - Synthetic Unit Hydrograph

MODULE IV RUNOFF ESTIMATION 7

Runoff calculation using empirical formulae- SCS curve number method-Rational formulae – Hydrograph methods – Introduction to rainfall runoff modelling- Application of GIS in rainfall runoff analysis- case studies

MODULE V FLOODS AND FLOOD ROUTING 7

Flood frequency studies – Recurrence interval – Gumbel’s method – Flood routing – Reservoir flood routing – Muskingum’s Channel Routing – Flood control

MODULE VI GROUND WATER HYDROLOGY 7

Types of aquifers – Darcy’s law – Dupuit’s assumptions – Confined Aquifer – Unconfined Aquifer – aquifer yield- Recuperation test – Transmissibility – Specific

capacity – Pumping test – Steady flow analysis only.

Total Hours : 45

TEXT BOOKS:

1. Subramanya, K., “Engineering Hydrology”, Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 2000.
2. Raghunath, H.M., “Hydrology – Principles, Analysis and Design", New Age International (P) Ltd., New Delhi, 2006.
3. Jayarami Reddy, P., "Hydrology”, Laxmi Publications (P) Ltd., New Delhi, 2005.

REFERENCES:

1. Chow, V.T. and Maidment, “Hydrology for Engineers”, McGraw-Hill Inc. Ltd., New York, 2000.
2. Singh, V.P., “Hydrology”, McGraw-Hill Inc. Ltd., New York, 2000.

OUTCOMES:

At the end of the course, the student will be able to

- explain the hydrologic cycle, classify the types of precipitation, measure rainfall by spatial and temporal methods, relate intensity, duration and frequency of rainfall and estimate probable maximum precipitation
- estimate the losses from precipitation and compute the effective rainfall.
- discuss the factors affecting hydrograph, describe the base flow separation, derive unit hydrograph, S- curve hydrograph and unit hydrograph of different durations.
- estimate runoff using empirical formulae SCS curve number method, explain rainfall runoff modeling and apply GIS in rainfall runoff analysis
- discuss flood frequency studies, describe Gumbel’s method, identify the flood routing and reservoir flood routing methods and suggest flood control measures
- classify aquifers, derive Darcy’s law, explain Dupuit’s assumptions, compare confined and unconfined aquifer, demonstrate recurption test and pumping test procedure for steady state flow

CECX11 AIR POLLUTION AND CONTROL

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge about: The sources of air pollution and their effects on living and non-living environment.
- Analysis of various sampling methods and analysis of air pollutants
- Simulation techniques of transport and transformation of the air pollutants with the help of dispersion models.
- Use the various devices or equipments and the other techniques available for control of air pollutants.
- Categorization of air pollution control methods through legislation and regulation acts.
- To describe the sources, characteristics, effects and control of noise pollution.

MODULE I SOURCES AND EFFECTS OF AIR POLLUTANTS 8

Classification of air pollutants – Particulates and gaseous pollutants – Sources of air pollution – Source inventory – Effects of air pollution on human beings, materials, vegetation, animals – global warming-ozone layer depletion.

MODULE II SAMPLING & ANALYSIS 7

Sampling and Analysis – Basic Principles of Sampling – Source and ambient sampling – Analysis of pollutants – Principles

MODULE III DISPERSION OF POLLUTANTS 8

Elements of atmosphere – Meteorological factors – Wind roses – Lapse rate - Atmospheric stability and turbulence – Plume rise – Dispersion of pollutants – Dispersion models – Applications.

MODULE IV AIR POLLUTION CONTROL 8

Concepts of air pollution control – Principles and design of control measures – Particulates control by gravitational, centrifugal, filtration, scrubbing, electrostatic precipitation – Selection criteria for equipment - gaseous pollutant control by adsorption, absorption, condensation, combustion – Pollution control for specific major industries

MODULE V AIR QUALITY MANAGEMENT 7

Air quality standards – Air quality monitoring – Preventive measures - Air pollution

control efforts – Zoning – Town planning regulation of new industries – Legislation and enforcement – Environmental Impact Assessment and Air quality.

MODULE VI NOISE POLLUTION 7

Sources of noise pollution – Effects – Assessment - Standards – Control methods – Prevention.

Total Hours : 45

TEXT BOOKS:

1. Anjaneyulu, D., “Air Pollution and Control Technologies”, Allied Publishers, Mumbai, 2002
2. Rao, C.S., “Environmental Pollution Control Engineering”, Wiley Eastern Ltd., New Delhi, 2003
3. Rao, M.N., and Rao, H.V.N., “Air Pollution Control”, Tata-McGraw-Hill, New Delhi, 1996

REFERENCES:

1. Mahajan, S.P., “Pollution Control in Process Industries”, Tata McGraw-Hill Publishing Company, New Delhi, 1991
2. Peavy, S.W., Rowe, D.R. and Tchobanoglous, G., “Environmental Engineering”, McGraw Hill, New Delhi, 1985

OUTCOMES:

At the end of the course, students will be able to

- Classify the sources of air pollution and list its effects on living and non-living environment.
- Sample and analyse the various air pollutants
- Demonstrate the procedure for simulation of transport of air polluatnts with the help of dispersion models.
- Identify and describe features of devices or equipments available for control of air pollutants
- Suggest air pollution control methods through legislation and regulations
- Describe sources, characteristics, effects and control of noise pollution

CECX12 TRAFFIC ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVE:

- To impart knowledge on the basic concepts, design principles and management techniques of highway traffic

MODULE I INTRODUCTION **7**

Significance and scope, Characteristics of Vehicles and Road Users, Skid Resistance and Braking Efficiency (Problems), Components of Traffic Engineering-Road, Traffic and Land Use Characteristics

MODULE II TRAFFIC SURVEYS AND ANALYSIS **7**

Surveys and Analysis – Volume survey and its characteristics – Capacity-Speed and Delays- Origin and Destination studies

MODULE III TRAFFIC CONTROL **8**

Traffic Signs, Road Markings, Design of Traffic Signals and Signal Co-ordination (Problems), Traffic control Aids and Street Furniture, Computer Applications in Signal Design

MODULE IV DESIGN OF GEOMETRIC INTERSECTIONS **8**

Conflicts at Intersections, Classification of Intersections at Grade, Grade Separators (Concepts only), Principles of Intersection Design, Elements of Intersection Design, Channelization and Rotary Design (Problem)

MODULE V TRAFFIC MANAGEMENT **8**

Traffic Management- Traffic System Management (TSM) and Travel Demand Management (TDM), Restrictions on Turning Movements, One-way Streets, Traffic Segregation, Traffic Calming, Tidal Flow Operations, Exclusive Bus Lanes - Introduction to Intelligence Transport System (ITS)

MODULE VI TRAFFIC STUDIES **7**

General outline of traffic studies - Parking studies – Accidental studies – Congestion studies –Fuel conception and emission studies.

Total Hours : 45

TEXT BOOKS:

1. Khanna, K. and Justo, C.E.G., “Highway Engineering”, Khanna Publishers, Roorkee, 2001
2. Kadiyali, L.R., “Traffic Engineering and Transport Planning”, Khanna Technical Publications, New Delhi, 2000.

REFERENCES:

1. Subhasg C. Saxena, “A Course in Traffic Planning and Design”, Dhanpat Rai Publications, New Delhi, 2001.

OUTCOMES:

At the end of the course, the students will be able to

- calculate the braking efficiency and skid resistance
- prepare traffic study report
- design the traffic signals and traffic simulation models.
- identify the intersection elements and design a rotary intersection
- regulate traffic of particular area by means of modern methods.
- execute traffic studies like traffic congestion, fuel emission.

CECX13 SOLID WASTE MANAGEMENT L T P C
3 0 0 3

OBJECTIVE:

- To impart knowledge on the sources, characterization, processing and disposal of municipal solid waste.

MODULE I SOURCES AND TYPES OF MUNICIPAL SOLID WASTES 7

Sources and types of solid wastes – Quantity – factors affecting generation of solid wastes; characteristics – methods of sampling and characterization

MODULE II EFFECTS OF SOLID WASTE DISPOSAL 7

Effects of improper disposal of solid wastes – public health effects.Principle of solid waste management – social & economic aspects; Public awareness; Role of NGOs; Legislation

MODULE III ON-SITE STORAGE & HANDLING 7

On-site storage methods – materials used for containers – on-site segregation of solid wastes – public health & economic aspects of storage – options under Indian conditions – Critical Evaluation of Options.

MODULE IV COLLECTION AND TRANSFER 8

Methods of Collection – types of vehicles – Manpower requirement – collection routes; transfer stations – selection of location, operation & maintenance; options under Indian conditions.

MODULE V OFF-SITE PROCESSING 8

Processing techniques and Equipment; Resource recovery from solid wastes– composting, incineration, Pyrolysis - options under Indian conditions.

MODULE VI LANDFILLS 8

Dumping of solid waste; sanitary landfills – site selection, design and operation of sanitary landfills – Leachate collection & treatment.

Total Hours : 45

TEXT BOOKS:

1. George Tchobanoglous, “Integrated Solid Waste Management”, McGraw-Hill

Publishers, New Delhi, 1993
2. Bilitewski, B., HardHe, G., Marek, K., Weissbach, A., and Boeddicker, H., “Waste Management”, Springer, 1994

REFERENCES:

1. CPHEED, "Manual on Municipal Solid Waste Management", Central Public Health and Environmental Engineering Organisation, New Delhi, 2000
2. Landreth, R.E. and Rebers, P.A., “Municipal Solid Wastes – Problems and Solutions”, Lewis Publishers, New York, 1997

OUTCOMES:

At the end of the course, the student will be able to

- explain the sources and types of solid wastes and summarise the methods of sampling and characterization.
- describe the effects of improper disposal of solid wastes and illustrate the role of NGOs and legislation in creating public awareness.
- examine the on-site storage methods and materials used for containers, prepare critical evaluation of options fort handling of solid waste.
- analyse the methods of collection, types of vehicles, manpower requirement, collection routes and select the location, operation and maintenance of solid waste facility.
- compile processing techniques and equipment, resource recovery from wastes and describe the composting, incineration and pyrolysis methods.
- discuss the dumping of solid waste and design sanitary landfills with leachate collection and treatment facility.

CECX14 ROCK MECHANICS L T P C
2 0 0 2

OBJECTIVES:

- To familiarize the students with general terminology of rock mechanics and its applications in Civil engineering aspects.
- To impart knowledge on the properties of rocks and its classification.
- To enable the students to analyze the strength of the rocks.
- To provide an understanding on slope stability and slope failure in rocks.

MODULE I INTRODUCTION 6

Introduction on the rock mechanics - Relation with Engineering Geology and Soil Mechanics -Importance and application of the rock mechanics to Civil Engineering

MODULE II CLASSIFICATION AND PROPERTIES OF ROCKS 8

Rocks of peninsular India and the Himalayas - Index properties and classification of rock masses, competent and incompetent rock - value of RMR and ratings in field estimations

MODULE III STRENGTH CRITERIA OF ROCKS 9

Behaviour of rock under hydrostatic compression and deviatric loading - Models of rock failure - planes of weakness and joint characteristics - joint testing, Mohr - Coulomb failure criterion and tension cut-off. Hoek and Brown Strength criteria for rocks with discontinuity sets

MODULE IV SLOPE STABILITY OF ROCKS 7

Rock slopes - role of discontinuities in slope failure, slope analysis and factor of safety - remedial measures for critical slopes - case studies

Total Hours : 30

TEXT BOOKS:

1. Goodman, R.E., Introduction to rock mechanics, John Willey and Sons, 1989
2. Hudson, A. and Harrison, P., Engineering Rock mechanics – An introduction to the principles, Pergamon publications, 1997

REFERENCES:

1. Hoek, E and Bray, J., Rock slope Engineering, Institute of Mining and

Metallurgy, U.K. 1981.
2. Hoek, E and Brown, E.T., Underground Excavations in Rock, Institute of Mining and Metallurgy, U.K. 1995.
3. Obert, L. and Duvall, W., Rock Mechanics and the Design of structures in Rock, John Wiley, 1967.
4. Bazant, Z.P., Mechanics of Geomaterials Rocks, Concrete and Soil, John Wiley and Sons, Chichester, 1985.
5. Wittke, W., Rock Mechanics. Theory and Applications with case Histories, Springerverlag, Berlin, 1990.
6. Waltham, T, Foundations of Engineering Geology, Second Edition, Spon Press, Taylor & Francis Group, London and New York, 2002.

OUTCOMES:

At the end of the course, the student will be able to

- To classify the rocks for engineering purpose based on the properties and behaviour of rock masses.
- To apply the knowledge of rock mechanics in civil engineering field.
- To understand stress-strain characteristics, failure criteria, and influence of insitu stress in the stability of various structures.
- To analyze the stability of rock slope by different methods.

CECX15	FORM WORK	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To impart knowledge on
- Planning of formwork, plant and site equipments required for formwork.
- Design and erection of forms for various elements such as slabs, beams, columns and walls.

MODULE I **PLANNING, SITE EQUIPMENT & PLANT FOR FORM WORK** **8**

Introduction - forms for foundations, columns, beams and walls - general objectives of formwork building - planning for safety - development of a basic system – key areas of cost reduction - Overall planning - detailed planning - labour requirement - costing - planning crane arrangements - site layout plan -transporting plant - formwork accessories.

MODULE II **MATERIALS & ACCESSORIES** **7**

Lumber - types - finish - sheathing boards working stresses - repetitive member stress - plywood - types and grades - jointing boarding - textured surfaces and strength - reconstituted wood - steel - aluminum - hardware and fasteners – nails in plywood

MODULE III **DESIGN OF FORMS AND SHORES** **8**

Basic simplification - beam formulae - allowable stresses - deflection, bending - lateral stability - shear, bearing - design of wall, slab, beam and column forms - simple wood stresses - slenderness ratio - allowable load vs length behaviour of wood shores - form lining design tables for wall, slab and column formwork

MODULE IV **BUILDING AND ERECTING THE FORM WORK** **7**

Carpentry shop and job mill - forms for footings – wall, column, sloped, strap and stepped footing - slab form systems - sky deck and multiflex - standard table module forms - assembly sequence cycling with lifting fork - moving with table trolley and table prop - Various causes of failures.

Total Hours –30

TEXT BOOKS:

1. Robert L. Peurifoy and Garold D. Oberlender, Formwork For Concrete Structures,

McGraw - Hill, 1996.

REFERENCES:

1. Austin, C.K., Formwork for Concrete, Cleaver -Hume Press Ltd., London,1996.
2. Hurd, M.K., Formwork for Concrete, Special Publication No.4, American Concrete Institute, Detroit, 1996.
3. Michael P. Hurst, Construction Press, London and New York, 2003.

OUTCOMES:

At the end of the course, students will be able to

- plan for the formwork accessories.
- identify the required materials and their properties of the formwork.
- design and construct formwork for various structural elements.
- built and erect formwork in different conditions.

CECX16 INDUSTRIAL WASTE WATER TREATMENT

L	T	P	C
2	0	0	2

OBJECTIVE:

To impart appropriate knowledge on waste audit, waste water treatment techniques, waste water reuse and methods of industrial waste water treatment.

MODULE I INTRODUCTION **6**

Sources and types of industrial wastewater - Environmental impacts - Regulatory requirements - generation rates - characterization - Toxicity and Bioassay tests

MODULE II WASTE AUDIT **6**

Prevention Vs Control of Industrial Pollution- Source reduction techniques - Waste Audit- Evaluation of pollution prevention options.

MODULE III WASTEWATER TREATMENT TECHNIQUES **9**

Waste minimization - Equalization - Neutralization - Oil separation – Flotation - Precipitation - Heavy metal Removal - adsorption -Sequencing batch reactors - High Rate reactors - Chemical oxidation - Ozonation - Photocatalysis - Wet Air Oxidation - Evaporation - Nutrient removal – Zero effluent discharge systems.

MODULE IV TREATMENT FOR WASTEWATER FOR SPECIFIC INDUSTRIES **9**

Industrial manufacturing process description, wastewater characteristics, source reduction options and waste treatment flow sheet for textiles - Tanneries - Pulp and paper - metal finishing - Petroleum Refining - Pharmaceuticals - Sugar and Distilleries - Food Processing - fertilizers - Thermal Power Plants and Industrial Estates

Total Hours : 30

TEXT BOOKS:

1. Eckenfelder, W.W., “Industrial Water Pollution Control”, McGraw-Hill, New Delhi, 1999.
2. Arceivala, S.J., “Wastewater Treatment for Pollution Control”, McGraw-Hill, New Delhi, 1998.

REFERENCES:

1. Frank Woodard, "Industrial Waste Treatment Handbook", Butterworth

Heinemann, New Delhi, 2001.
2. Metcalf and Eddy, “Wastewater Engineering: Treatment and Reuse,” McGraw – Hill, New Delhi, 2002.

OUTCOMES:

At the end of the course, the students will able to

- Identify the various industrial wastewater sources and will be able to list the statutory requirements.
- Perform the waste audit based on the pollution generated and reduced.
- List the various wastewater treatment techniques and its applications.
- Identify the wastewater treatment method based on different industrial effluent.

CECX17 HAZARDOUS WASTE MANAGEMENT L T P C
2 0 0 2

OBJECTIVES:

- To offer sufficient knowledge on various sources and characterization of municipal solid wastes.
- To give an exposure to the on-site and off-site processing of municipal solid waste including disposal methods.

MODULE I INTRODUCTION 6

Hazardous substances and Hazardous wastes, sources of generation, Composition, physical form; quantity and quality of hazardous wastes – Legal and Administrative requirements and aspects for management, regulations for pollution control administrative liability

MODULE II WASTE COLLECTION 6

Waste Collection, segregation at source, on and off site collection, pre transport Requirements, safety in handling, transportation, storage, treatment, disposal technologies - Waste minimization physical and chemical and biological disposal treatment technologies

MODULE III LAND DISPOSAL AND THERMAL TREATMENT OF WASTE 9

Creation of treatment, storage and disposal facilities (TSDF) - Site selection for creating TSDF landfill, standards and guidelines for accepting a waste for land disposal, leachate management - Thermal treatment incinerability tests, different types of incinerators and their applicability for hazardous waste management - Biological treatment of facilities.

MODULE IV RECLAMATION AND REMEDIATION 8

Reclamation of hazardous wastes - Management of gaseous emissions/air pollutants generated during treatment and disposal operations of hazardous wastes- Remediation of hazardous wastes – Types – Stabilisation, Solidification, Myco remediation- Case studies.

Total Hours : 30

TEXT BOOKS:

1. Charles Wentz, A., “Hazardous Waste Management", 2nd Edition, McGraw Hill

International, London, 1995.
2. StanleyE. Manahan, “Hazardous Waste Chemistry, Toxicology and Treatment”, Lewis Publishers, Chelsea, 1990

REFERENCES:

1. Michael D. Lagrega, Phillip L. Buckingham and Jeffrey C. Evans., “Hazardous Waste Management” 2nd Edition, McGraw Hill International, London, 1994.
2. Rules and Regulation of Hazardous substance management”., Ministry of Environment, Forest and Climate change.

OUTCOMES:

At the end of the course, the students will able to

- Identify the various sources of hazardous waste and will be able to explain about its legal provision.
- Describe about the different steps involved in waste collection and treatment process.
- Specify the basic requirements needed for land disposal and its management techniques.
- Assess the various treatment methods of hazardous waste and air pollutants and summarize the various remediation techniques based on case studies

CECX18 ENVIRONMENTAL GEOTECHNOLOGY

L	T	P	C
2	0	0	2

OBJECTIVES:

- To impart knowledge on geotechnical engineering problems associated with soil contamination, safe disposal of wastes and remediation of contaminated soils.

MODULE I INTRODUCTION 7

Introduction to Environmental Geo techniques-Environmental cycles and their interaction-Soil water environment interaction relating to geotechnical problems-Sources, production and classification of wastes. Environmental regulations in India

MODULE II SITE SELECTION AND METHOD OF DISPOSAL 8

Criteria for selection of sites for waste disposal facilities-parameters controlling the selection of wastes disposal sites-current practices for waste disposal, subsurface disposal techniques-Passive contaminant systems- Leachate contamination-applications of geo membrane and other techniques in solid and liquid waste disposal-rigid or flexible membrane liners

MODULE III HYDROLOGY OF CONTAMINANTS 8

Transport phenomena in saturated and partially saturated porous media contaminant migration and contaminant hydrology-Hydrological design for ground water pollution control-Ground water pollution downstream for landfills - pollution of aquifers by mining and liquid wastes-protection of aquifers.

MODULE IV HAZARDOUS WASTE MANAGEMENT& REMEDIAL MEASURES 7

Hazardous waste control and storage system-Stabilization - Processes and Environmentally safe disposal of solid and liquid wastes - Ground modification techniques in waste fill, Remedial measures for contaminated grounds -Remediation technology - Bio-remediation

Total Hours : 30

TEXT BOOKS:

1. Wentz, C.A., " Hazardous Waste Management ", McGraw Hill, Singapore, 1989.

2. Daniel, B.E., " Geotechnical Practice for Waste disposal ", Chapman and Hall, London, 1997.
3. Ott, W.R., "Environmental Indices -Theory and Practice", Ann Arbor Science, 1978.
4. Row R.K, " Geotechnical and Geoenvironmental engineering Hand Book" Kluwer academic publications, London, 2000.
5. Young, R.N., "Geoenvironmental Engineering confaminated soils, pollutants fate and mitigation CRC press, New York, 2001.
6. Hillel. D., "Introduction to Environemental soil physics" Academic press, New York, 2003.

REFERENCES:

1. ASTM 874 – 1985, "Hydraulic Barrier in Soil and Rock", American Society for Testing and Materials, U.S.A
2. Westlake, K., "Landfill Waste Pollution and Control ", Albion Publishing Ltd., England, 1995.
3. Lagrega, M.D., Buckingham, P.L. and Evans, J.C., " Hazardous Waste Management ", McGraw Hill Inc., Singapore, 1994.

OUTCOMES:

At the end of the course, the student will be able to

- Identify the soil water interactions and the problems associated with the release of the wastes into soil water environment and Implement the various environmental regulations
- Select appropriate and safe sites and methods of disposal of wastes by analyzing the various parameters in the soil water environment
- Model the transport of contaminants in the soil water environment by the applying the principles of hydrology
- Apply the safe techniques of control and storage systems for hazardous waste and also Suggest remediation techniques in soil water environment

CECX19 DURABILITY PROPERTIES OF CONCRETE

L	T	P	C
2	0	0	2

OBJECTIVES:

- To impart knowledge of various deteriorating properties of reinforced concrete and assess the amount of deterioration.
- To impart knowledge on enhancing the durability of concrete

MODULE I DURABILITY PROPERTIES OF CONCRETE 9

General - Chemical attack of concrete - Corrosion of steel rebars - Carbonation - Freeze-thaw resistance - Fatigue - Abrasion resistance – Creep and Shrinkage - Transport of fluids: diffusion, absorption and permeability – Corrosion of reinforced concrete

MODULE II DURABILITY TESTS FOR CONCRETE 7

Tests related to durability properties - water absorption, permeability, sorptivity, resistance to chemical attack, freeze and thaw resistance, accelerated corrosion test, RCPT test, half-cell potential test and macro-cell corrosion test

MODULE III DETERIORATION OF CONCRETE 8

Erosion and Cracking Of Concrete - Deteriorating mechanisms: sulphate attack, alkali aggregate reaction, corrosion of steel reinforcement - mechanism, causes and consequences.

MODULE IV CONCRETES WITH PARTICULAR PROPERTIES 6

Durability of high performance concrete, fly ash concrete, concrete containing silica fume, GGBS and metakaolin, light weight concrete, high strength concrete

Total Hours : 30

TEXT BOOKS:

1. Neville.A.M., Properties of Concrete, 5th Edition, Pearson Education Limited, 2013.
2. Gambhir. M.L., Concrete Technology, McGraw Hill Education, 2006.
3. Shetty M.S., Concrete Technology, S.Chand and Company Ltd. Delhi, 2003.

REFERENCES:

1. Rendon Diaz Miron, Luis Emilio, Concrete Durability : Cementitious Materials and Reinforced Concrete Properties, Behavior and Corrosion Resistance, Springer International Publication
2. Santhakumar.A.R. ;"Concrete Technology",Oxford University Press, 2007
3. Gupta.B.L., Amit Gupta, "Concrete Technology, Jain Book Agency, 2010
4. P. Kumar Mehta and Paulo J. M. Monteiro, "Concrete, Microstructure, Properties and Materials" Indian Concrete Institute, Chennai

OUTCOMES:

At the end of the course, the student will be able to

- Identify the main factors affecting concrete durability
- Assess the durability of concrete by conducting different tests
- Identify the concrete deterioration mechanisms and causes
- Assess the durability properties of peculiar concretes

CECX 20 INDUSTRIAL HEALTH AND SAFETY

L	T	P	C
2	0	0	2

OBJECTIVE:

To make students conversant with the

- Health hazards and the safety measures to be followed in the industrial environment.
- Methods of prevention and control of Health diseases, accidents/emergencies and other hazards from the workplace.

MODULE I INTRODUCTION **7**

Need for developing Environment, Health and Safety systems in workplaces - Accident Case Studies - Status and relationship of Acts - Regulations and Codes of Practice - Role of trade union safety representatives. International initiatives - Ergonomics and workplace.

MODULE II OCCUPATIONAL HEALTH AND HYGIENE **8**

Definition of the term occupational health and hygiene - Categories of health hazards – Exposure pathways and human responses to hazardous and toxic substances - Advantages and limitations of environmental monitoring and occupational exposure limits - Hierarchy of control measures for occupational health risks - Role of personal protective equipment

MODULE III WORKPLACE SAFETY AND SAFETY SYSTEMS **7**

Features of Satisfactory and Safe design of work premises – good housekeeping - lighting and colour, Ventilation and Heat Control – Electrical Safety – Fire Safety – Safe Systems of work for manual handling operations – Machine guarding – Working at different levels – Process and System Safety.

MODULE IV ENVIRONMENTAL HEALTH AND SAFETY MANAGEMENT **8**

Concept of Environmental Health and Safety Management – Elements of Environmental Health and Safety Management Policy and methods of its effective implementation and review – Elements of Management Principles – Education and Training – Employee Participation.

Total Hours : 30

TEXT BOOKS:

1. Environmental and Health and Safety Management by Nicholas P.Cheremisinoff and Madelyn L. Graffia, William Andrew Inc. NY, 1995
2. Fundamentals of Industrial Safety and Health by Dr.K.U.Mistry, Siddharth Prakashan, 2012.
3. The Facility Manager's Guide to Environmental Health and Safety by Brian Gallant, Government Inst Publ., 2007.

REFERENCES:

1. Effective Environmental, Health, and Safety Management Using the Team Approach by Bill.
2. Taylor, Culinary and Hospitality Industry Publications Services, 2005.

OUTCOMES:

At the end of this course, the students will be able to

- Outline the common work-related diseases and accidents in occupational areas.
- Comprehend the roles that a community health practitioners play in an occupational setting to ensure the protection, promotion and maintenance of the health of the employee,
- Identify the potential risks of waste generated and analyze the threats to human and environment.
- Manage the health and safety of the employees in the working environment and incorporate various methods of health and safety.

CECX21 URBAN DESIGN

L	T	P	C
2	0	0	2

OBJECTIVES:

- To understand the scope and nature of urban design as a discipline.
- To introduce the components of a city and their interdependent roles.
- To learn to interpret the city in different ways and layers.
- To have a broad knowledge of various techniques to read a city

MODULE I INTRODUCTION TO URBAN DESIGN 7

Introduction to cities, Components of urban space such as blocks, density, neighborhood, Streets etc and their interdependencies - outline of issues/ aspects of urban space and Articulation of need for urban design - scope and objectives of urban design as a discipline.

MODULE II TRENDS IN URBAN DESIGN 7

Trend of Urbanization at International, National, State and District levels. National and regional Development Policies and Strategies – Urbanization, Housing and Transportation sustainable Urban Development- Definition and Principles.

MODULE III PLANNING PROCESS 8

Types of Urban and Regional Plans, Stages in the Planning Process – Delineation of Planning Areas, Goals and Objectives of Plans, Surveys and Analysis, Formulation of Plans, Evaluation of Alternative Plans, Plan Implementation

MODULE IV URBAN ANALYSIS 8

Understanding various tools through which an urban setting could be perceived - maps, sketches, photo documentations, reading, data collections, transects etc.. The various aspects of urban growth -. in Asian cities, city limits/boundaries, urban structure, urban architecture, typologies as well as infrastructural planning, The critical role that transportation plays in structuring the city will also be examined.

Total Hours : 30

TEXT BOOKS:

1. Rithchie. A, “Sustainable Urban Design: An Environmental Approach”, Taylor &

Francis, 2000.
2. “Time Saver Standards for Urban Design”, Donald Natson, McGraw Hill, 2003
3. A.E.J. Morris, “History of Urban Form before the Industrial Revolution”, Prentice Michelle Provoost et al., Dutchtown, NAI Publishers, Rotterdam, 1999.
4. Gallian B Arthur, Simon Eisner, The Urban Pattern, City Planning and Design, Affiliated Press Pvt. Ltd., New Delhi, 1995.
5. Margaret Roberts, An Introduction to Town Planning and Planning Techniques, Hutchinson, London, 1990.

REFERENCES:

1. Jonathan Barnett, “An Introduction to Urban Design”, Harper Row, 1982.
2. Gosling and Maitland, “Urban Design”, St. Martin’s Press, 1984.
3. Malcolm Moor, “Urban Design Futures”, Routledge, 2006.
4. Geoffrey Broadbent, “Emerging Concepts in Urban Space Design”, Taylor & Francis, 2003.

OUTCOMES:

- The students understood the role of Urban design as a discipline,
- Its role in understanding and interpreting a city.
- They also looked at addressing urban design issues in terms of awareness creation as well as with possible ways to address them.
- The student will be able to perform urban planning and design as per zoning rules and regulation

CECX22 WATER PROOFING OF R.C.C STRUCTURES

L	T	P	C
1	0	0	1

OBJECTIVE:

- To expose students to various materials and techniques for waterproofing building elements.

MODULE I INTRODUCTION **7**

Structural waterproofing industry - Background and source of a waterproofing design(BS8102:2009), water in the ground - natural and perched water tables, soil types and ground conditions, sources of water entering a structure, dampness in basements - sources and types.

MODULE II TYPES OF WATERPROOFING **8**

Effect on water movement on building components, Types of waterproofing- Barrier forms, integral forms and cavity forms – Materials used, preparation, application and aftercare of barrier, integral and drained cavity forms of waterproofing.

Total Hours : 15

TEXT BOOKS:

1. Santha Kumar, A.R., “Concrete Technology”, Oxford University Press, New Delhi, 2007.
2. Philip Perkins, H., "Repair, Protection and Waterproofing of Concrete Structures", Elsevier Applied Science Publishers, 2001.
3. Ransom, W.H., "Building Failures - Diagnosis and Avoidnce", E.& F.N. Spon Publishers, 2002.

REFERENCES:

1. Michael T. Kubal, "Waterproofing the Building Envelope", Mc-Graw Hill Inc., New Delhi, second edition, 2008.

OUTCOMES:

At the end of the course, the students will be able to

- predict the causes of dampness in structures.
- identify the suitable techniques and materials for waterproofing.

CECX23	CONSTRUCTION CHEMICALS FOR REPAIR WORKS	L	T	P	C
		1	0	0	1

OBJECTIVES:

- To impart knowledge to students on various chemicals used in construction industry.
- To give exposure to the application of chemicals for different repair works.

MODULE I CHEMICAL ADMIXTURES 8

Types of chemical admixtures - air entrainers - water reducers - set retarders - set accelerators – super plasticizers – Applications of admixtures for repair works - Grouts and grouting compounds – its applications.

MODULE II PROTECTIVE COATINGS AND MEMBRANES 7

Floor hardener and Coatings – epoxy and cement base mortars, anticorrosive protective coatings for rebar, micro concrete etc. – Applications.

Total Hours : 15

TEXT BOOKS:

1. Santha Kumar, A.R., “Concrete Technology”, Oxford University Press, New Delhi, 2007.
2. Shetty, M.S., “Concrete Technology – Theory and Practice”, S. Chand & Company Limited, New Delhi, 2008.

REFERENCES:

1. Philip Perkins, H., "Repair, Protection and Waterproofing of Concrete Structures", Elsevier Applied Science Publishers, 2001
2. Yoshihiko Ohama, “Hand Book of Polymer – Modified Concrete and Mortars”, Noyes Publications, U.K.,1995

OUTCOMES:

At the end of course , the students will be able to

- Classify the construction chemicals with their end use and its application procedures.
- Identify appropriate chemical for the intended repair works.

CECX24 GEOSYNTHETICS

L	T	P	C
1	0	0	1

OBJECTIVE:

- To provide an understanding on various types of Geosynthethic materials.
- To impart knowledge on the properties of Geosythetics and various applications of Geosynthetics materials.

MODULE I AN OVERVIEW **5**

Historical Development – Types of Geosynthetics – Geotextiles – Geogrids- Geonets – Geomembranes – Geocomposites – Functions – Reinforcement – Separation – Filtration – Drainage – Barrier Functions.

MODULE II PROPERTIES AND APPLICATIONS OF GEOSYNTHETICS 10

Physical properties : Mass per unit area – Thickness – Specific gravity; Hydraulic properties :Apparent open size – Permittivity – Transmissivity. Mechanical Properties : Uniaxial Tensile Strength – Burst and Puncture Strength – Soil Geosynthetic friction tests - Use of geosynthetics for filtration and drainage – Use of geosynthetics in roads – Improvement of bearing capacity – Geosynthetics in landfills.

Total Hours : 15

TEXT BOOKS:

1. G. Venkatappa Rao and G.V.S. Suryanarayana Raju, “Engineering with Geosynthetics”, Tata McGraw Hill, New Delhi, 1990.
2. Robert M. Koerner, “Designing with Geosynthetics “, Prentice Hall, New Jersey, USA, 2005.

REFERENCES:

1. Sivakumar Babu, G.L., An Introduction to Soil Reinforcement and Geosynthetics, University Press (India), Pvt. Ltd., Hyderabad, 2006.
2. Jewell, R.A., Soil Reinforcement with Geotextile, CIRIA, London, 1996.
3. Bazant, Z.P., Mechanics of Geomaterials Rocks, Concrete and Soil, John Wiley and Sons, Chichester, 1985.

OUTCOMES:

At the end of this course, the student will be able

- To identify different types of Geosynthetics required based on their functions.
- To analyze the properties of Geosynthetics by lab testing method and its applications for various functions in Civil engineering.

SEMESTER VI

CECX30	**DYNAMICS OF STRUCTURES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVE:

- To impart knowledge about theory of vibrations and vibration parameters to analyse the dynamic forces caused by an earthquake.
- To introduce the design of buildings for blast and impact forces as per BIS codes of practice.
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MODULE I SINGLE DEGREE OF FREEDOM SYSTEMS 8

Formulation of equations of motion by different methods, Free and forced vibrations, Effect of damping.

MODULE II MULTI DEGREE OF FREEDOM SYSTEMS 8

Formulation of structure property matrices, Eigen value problems, Mode shapes and orthonormality of modes, Approximate methods of extraction of Eigen values.

MODULE III CONTINUOUS SYSTEMS 8

Modeling - free and forced vibration of bars and beams. Rayleigh –Ritz method –Formulation using Conservation of Energy –Formulation using Virtual Work

MODULE IV DIRECT INTEGRATION METHODS FOR DYNAMIC RESPONSE 8

Damping in MDOF systems, Nonlinear MDOF systems, Wilson Theta method, Newmark beta method, step-by-step numerical integration techniques.

MODULE V DESIGN AGAINST BLAST 7

Characteristics of internal and external blast - Pressure distribution on buildings above ground due to external blast - underground explosion - Design of buildings for blast as per BIS codes of practice.

MODULE V I DESIGN AGAINST IMPACT 6

Impact and impulse loads - underground explosion - Design of buildings for impact as per BIS codes of practice.

Total Hours : 45

REFERENCES:

1. Clough R.W, and Penzien J, Dynamics of Structures, Second Edition, McGraw-Hill International Edition, 1996.
2. Mario Paz, Structural Dynamics – Theory and Computations, Third Edition, CBS Publishers, 1990.
3. Roy R Craig, Structural Dynamics – An Introduction to Computer Methods, John Wiley and Sons, 2005.
4. Humar J. L., Dynamics of Structures, Prentice Hall, 1990.
5. Smith J.W., Vibration of Structures – Application in Civil Engineering Design, Chapmat Hill 1988.
6. Dowling, C.H., Blast vibration - Monitoring and Control, Prentice Hall Inc., Englewood Cliffs, 1985.

OUTCOME:

At the end of the course, the students will be able to

- develop the equation of motion for single degree of freedom
- analyze the dynamic response of multi degree of freedom systems
- analyze the free and forced vibration of bars and beams
- find the dynamic response of structures using numerical integration procedure
- design the buildings for blast forces using BIS codes of practice.
- design the buildings for impact forces using BIS codes of practice.

CECX31 ADVANCED CONCRETE DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To acquaint with the limit state of serviceability and design of various types of retaining walls.
- To enable students to design water tanks and flat slabs.
- To give an exposure on analysis of multistory frames and yield line theory.

MODULE I SERVICEABILITY LIMIT STATES : DEFLECTION AND CRACKING **8**

Limit state of Deflection - factors affecting deflection - Short and long term deflections- control of deflection - computation of deflection as per IS code – Limit state of Cracking – reasons and effects of cracking - limiting criteria on cracking - Estimation of crack width.

MODULE II RETAINING WALLS **8**

Types of Retaining walls - Design of cantilever and counterfort retaining walls.

MODULE III WATER TANKS **8**

Underground rectangular tanks - Overhead circular and rectangular tanks – Domes for water tanks - Design of staging and foundations.

MODULE IV BUILDING FRAMES **7**

Analysis of multistores frames-method of substitute frames –Analysis for vertical loads- Analysis of frames subjected to horizontal forces-portal method & cantilever method.

MODULE V FLAT SLABS **7**

Types of flat slabs – Direct design method - Equivalent frame method – Shear in flat slab – Design of flat slab

MODULE VI YIELD LINE THEORY **7**

Introduction to yield line theory – Yield line patterns – Characteristic features of yield lines – Load on slabs – Yield line analysis by virtual work method to square, rectangular, circular and triangular slabs.

Total Hours : 45

TEXT BOOKS:

1. Krishna Raju, N., "Design of RC Structures", CBS Publishers and Distributors, New Delhi, 2008.
2. Unikrishnana Pillai, S. and Devdas menon, “Reinforced Concrete Design” Tata McGraw-Hill Book Company, New Delhi, 2003.
3. Varghese, P.C., “Advanced Reinforced Concrete Design”, PHI Learning Ltd., New Delhi, 2005.
4. Krishna Raju, N., “Advanced Reinforced Concrete Design”, CBS Publishers and Distributors, New Delhi, 2008.

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REFERENCES:

1. Dunham, C.W., “Advanced Reinforced Concrete Design”, McGraw-Hill Book Company, New Delhi, 1964.
2. Punmia, B.C., “Limit State Design of Reinforced Concrete Structures”, Laxmi Publications (P) Limited, New Delhi, 2007.
3. Ram Chandra, "Limit State Design of Concrete Structure", Standard Book House, New Delhi, 2007.

OUTCOMES:

At the end of the course, the students will be able to

- evaluate the deflection and crack width of RC members as per IS codal provisions.
- classify and design the various types of retaining walls.
- categorise the various types of water tanks and design the water tank as per standards.
- analyse the multistory frames for vertical and horizontal loading using various methods.
- employ the Indian code of practice for the design of flat slab.
- establish appropriate approaches to design the slab by yield line theory.

CECX32 REPAIR AND REHABILITATION OF STRUCTURES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge on quality assurance in construction, durability of concrete and deteriorating mechanisms and damage assessment of distressed structures.
- To expose students to various materials and techniques for repairing and rehabilitation of distressed structures with real time case studies and engineered demolition techniques

MODULE I QUALITY ASSURANCE AND DURABILITY 8

Introduction to Repair, Rehabilitation and maintenance.Importance of quality assurance - influencing parameters.Durability of concrete - strength and permeability. Deteriorating mechanisms : Corrosion of steel rebar -effects due to climate, chemical action, wear and erosion

MODULE II DAMAGE ASSESSMENT OF DISTRESSED STRUCTURES 8

Distress in structures, Damage assessment of distressed structures - Importance - Assessment procedure : preliminary inspection, planning, visual inspection, field and laboratory tests, report preparation. Non destructive testing techniques for damage assessment : Rebound hammer, Ultrasonic pulse velocity, half cell potential measurements.

MODULE III MATERIALS FOR DURABILITY AND REPAIR 8

Construction chemicals, Plasticizers, corrosion inhibitors, protective coatings for steel and concrete, rust convertors, fibre reinforced concrete, polymer concrete composites

MODULE IV REPAIR TECHNIQUES 9

Significance of repair material and repair techniques. Repair techniques : Mortar and dry pack, vacuum concrete, Ferrocement, guniting and shotcrete, epoxy injection, grouting, plate bonding, prestressing, FRP jacketing and laminates.

MODULE V REHABILITATION OF DISTRESSED STRUCTURAL ELEMENTS 9e

Procedure for repairing structural and non-structural cracks. Rehabilitation

procedure for : leaky sunken slabs, water tank and terrace slab, dampness in buildings. Case study on : Rehabilitation of distressed over head water tank due to corrosion and rehabilitation of fire damaged structure.

MODULE VI BUILDING DEMOLITION TECHNIQUES 3

Engineered demolition techniques - Water jetting, flame cutting, soundless chemical demolition etc

Total Hours : 45

TEXT BOOKS:

1. Santha Kumar, A.R., “Concrete Technology”, Oxford University Press, New Delhi, 2007
2. Shetty, M.S., “Concrete Technology – Theory and Practice”, S. Chand & Company Limited, New Delhi, 2008.
3. Yoshihiko Ohama, “Hand Book of Polymer – Modified Concrete and Mortars”, Noyes Publications, U.K.,1995.

REFERENCES:

1. Philip Perkins, H., "Repair, Protection and Waterproofing of Concrete Structures", Elsevier Applied Science Publishers, 2002.
2. Ransom, W.H., "Building Failures - Diagnosis and Avoidnce", E.& F.N. Spon Publishers, 2001.
3. Michael T. Kubal, "Waterproofing the Building Envelope", Mc-Graw Hill Inc., New Delhi, 1993.

OUTCOMES:

At the end of the course, the students will be able to

- predict the causes of distress affecting durability in structures.
- assess the damage in distressed structures
- choose the relevant materials for repair and rehabilitation
- identify the suitable techniques for repair and rehabilitation
- describe the processes used for repairing various cases such as leaky sunken slabs, water tank,fire damaged structure etc.
- suggest the suitable techniques that can be used for demolition of building.

CECX33 GROUND IMPROVEMENT TECHNIQUES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To familiraze the students with geotechnical problems in soil.
- To understand the varios drainage methods available for dewatering of soil
- To impart knowledge about selection, design, and construction aspects of ground improvement techniques in problematic soils.
- To understand the application of Geo-synthetics in soil reinforcement
- To study the different grouting materials and techniques

To provide understanding on stabilization of soil by chemicals.

MODULE I INTRODUCTION **7**

Role of ground improvement in foundation engineering - methods of ground improvement - Geotechnical problems in alluvial, laterite and black cotton soils - Selection of suitable ground improvement techniques based on soil condition.

MODULE II DRAINAGE AND DEWATERING **8**

Drainage techniques - Well points - Vaccum and electro osmotic methods - Seepage analysis for two dimensional flow-fully and partially penetrating slots in homogenous deposits (Simple cases only).

MODULE III INSITU TREATMENT OF COHESIONLESS AND COHESIVE SOILS **7**

Insitu densification of cohesion less and consolidation of cohesive soils - Dynamic compaction and consolidation - Vibrofloation - Sand pile compaction - Preloading with sand drains and fabric drains- Stone columns - Lime piles - Installation techniques only - relative merits of various methods and their limitations.

MODULE IV EARTH REINFORCEMENT **8**

Concept of reinforcement - Types of reinforcement material - Applications of reinforced earth - use of Geotextiles for filtration, drainage and separation in road and other works.

MODULE V GROUTING TECHNIQUES **8**

Types of grouts - Grouting equipment and machinery - Injection methods - Grout monitoring.

MODULE VI STABILISATION METHODS **7**

Stabilization with cement, lime and chemicals - Stabilization of expansive soil.

Total Hours : 45

TEXT BOOKS:

1. Koerner, R.M., “Construction and Geotechnical Methods in Foundation Engineering”, McGraw-Hill, New York, 1994.
2. Purushothama Raj, P., “Ground Improvement Techniques”, Tata McGraw-Hill Publishing Company, New Delhi, 1995.

REFERENCES:

1. Moseley, M.P., "Ground Improvement", Blackie Academic and Professional, Chapman and Hall, Glassgow, USA and Canada, 1993.
2. Koerner, R.M., “Design with Geosynthetics”, 3rd Edition, Prentice Hall, New Jersey, 2002.
3. Jewell, R.A., “Soil Reinforcement with Geotextiles”, CIRIA Special Publication, London, 1996.
4. Das, B.M., “Principles of Foundation Engineering”, Thomson Brooks / Cole, USA, 2003.
5. Jones, E.P., "Earth Reinforcement and Soil Structure", Butterworth's, London, 1995.

OUTCOMES:

At the end of the course, students will be able to

- explain the properties of problematic soil and necessity of different ground modification techniques.
- describe the improvement of soil by compaction, consolidation and preloading techniques suitable for specific site conditions.
- effectively utilise different earth reinforcement materials including Geo-textile for different field conditions.
- implement the grouting techniques in the field condition for soil stabilization.
- assess the suitable chemicals and admixtures for stabilisation based on soil types.

CECX34	PAVEMENT DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart sufficient knowledge on various components of highway engineering such as highway planning, design of geometric elements of highways & urban roads, and rigid & flexible pavements design.
- To give an exposure to desirable properties of highway materials and construction practices.

MODULE I PRINCIPLE OF PAVEMENT DESIGN 7

Components of a road and their function – Factors affecting pavement stability – Equivalent Single wheel load – Vehicle and traffic factors, moisture, Climate and soil factors – Stress distribution in different conditions –Modulus of elasticity of various layers.

MODULE II FLEXIBLE PAVEMENT DESIGN 8

Empirical method using soil classification tests- Estimation of CBR values-method of designing pavement-plate bearing test method-asphalt institute method –AASHTO Method-bur mister design method –principles of bituminous mix design-IRC Methods.

MODULE III RIGID PAVEMENT DESIGN 8

General design consideration – Stresses in concrete pavement- Design procedure as per IRC method – Design of different joints in concrete pavement and their maintenance.

MODULE IV PAVEMENT EVALUATION 8

Method of pavement evaluation – Distress in flexible pavements – Distress in rigid pavements – Structural evaluation of flexible and rigid pavements – Evaluation by deflection measurements.

MODULE V PAVEMENTSTRENGTHENING 7

Strengthening of pavement-Methods –Flexible overlaysand types- Rigid overlays-

Case studies

MODULE VI HIGHWAY MAINTENANCE 7

Maintenance of Bituminous surface, concrete roads and low cost roads – aintenance of shoulders and drainage system.

Total Hours : 45

TEXT BOOKS:

1. Khanna, S.K. and Justo, C.E.G., “Highway Engineering”, 8th Edition, New Chand and Brothers, Roorkee, 2001.
2. Wright, P.H., “Highway Engineers”, John Wiley and Sons Inc., New York, 1996.

REFERENCES:

1. Kadiyali, L.R., “Principles and Practice of Highway Engineering”, Khanna Tech. Publications, New Delhi, 2000.
2. Yoder, R.J. and Witchak M.W., “Principles of Pavement Design”, John Wiley, 2000.
3. IRC 37–2001, Guidelines for the Design of Flexible Pavements, The Indian roads Congress, New Delhi.
4. IRC 58-1998, Guideline for the Design of Rigid Pavements for Highways, The Indian Roads Congress, New Delhi.

OUTCOMES:

At the end of the course, the student will be able to

- explain the basic principles and factors to be considered for pavement design.
- analyze and design flexible pavement by various methods.
- analyze and design rigid pavement as per IRC method.
- describe the structural and functional evaluation for pavement performance.
- assess the overlay construction methods.
- describe the method of maintaining different roads for longer durability and serviceability.

CECX35 HOUSING, PLANNING AND MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVE:

- To impart comprehensive knowledge on planning, design, evaluation, construction and financing of housing projects.

MODULE I INTRODUCTION TO HOUSING **7**

Definition of Basic Terms – House, Home, Household, Apartments, Multi storied Buildings, Special Buildings, Objectives and Strategies of National Housing Policies, Principle of sustainable housing

MODULE II HOUSING LAWS **8**

Housing Laws at State level, Bye-laws at Urban and Rural Local Bodies – levels - Development Control Regulations, Institutions for Housing at National, State and Local levels.

MODULE III HOUSING PROGRAMMES **8**

Basic Concepts, Contents and Standards for Housing Programmes - Sites and Services, Neighbourhoods, Open Development Plots, Apartments, Rental Housing, Co-operative Housing, Slum Housing Programmes, Role of Public, Private and Non-Government Organizations

MODULE IV PLANNING AND DESIGN OF HOUSING **7**

Formulation of Housing Projects – Site Analysis, Layout Design, Design of Housing Units (Design-Problems)

MODULE V COST-EFFECTIVE MATERIALS AND TECHNIQUES **8**

New Constructions Techniques – Cost Effective Modern Construction Materials, Building Centers – Concept, Functions and Performance Evaluation.

MODULE VI HOUSING FINANCE AND PROJECT APPRISAL **7**

Appraisal of Housing Projects – Housing Finance, Cost Recovery – Cash Flow Analysis, Subsidy and Cross Subsidy, Pricing of Housing Units, Rents, Recovery Pattern (Problems).

Total Hours : 45

TEXT BOOKS:

1. Meera Mehta and Dinesh Mehta, “Metropolitan Housing Markets”, Sage Publications Pvt. Ltd., New Delhi, 1999.
2. Francis Cherunilam and Odeyar D. Heggade, “Housing in India”, Himalaya Publishing House, Bombay, 1997.

REFERENCES:

1. Development Control Rules for Chennai Metropolitan Area, CMA, Chennai, 2002.
2. UNCHS, National Experiences with Shelter Delivery for the Poorest Groups, UNCHS (Habitat), Nairobi, 1994.
3. National Housing Policy, Government of India, 1994.

OUTCOMES:

At the end of the course, the students will be able to

- explain the basic concepts about different types of housing and its Policies.
- describe the housing bye laws at different administrative levels, development and control regulations..
- analyze the various housing programmes.
- design different types of housing units.
- list and describe the new construction materials and techniques with their function and performance.
- analyze and appraise the housing projects.

CECX36 BUILDING SERVICES

L	T	P	C
3	0	0	3

OBJECTIVE:

- To impart knowledge on various elements of building services like water supply, sanitation, electrical installations, lighting, air conditioning, and fire safety including smart buildings

MODULE I WATER TREATMENT AND SUPPLY SYSTEMS 7

Water quality, Purification and treatment- water supply systems-distribution systems in small towns -types of pipes used- laying jointing, testing-testing for water tightness plumbing system for building-internal supply in buildings-municipal bye laws and regulations.

MODULE II SANITATION AND DRAINAGE 8

Rain Water Harvesting - Sanitation in buildings-arrangement of sewerage systems in housing -pipe systems- storm water drainage from buildings - septic and sewage treatment plant - collection, conveyance and disposal of town refuse systems.

MODULE III ELECTRICITY AND LIGHTING 8

Types of wires , wiring systems and their choice -planning electrical wiring for building -main and distribution boards -transformers and switch gears -modern theory of light and colour -synthesis of light -luminous flux -candela- lans of illumination-lighting design-design for modern lighting.

MODULE IV VENTILATION AND COOLING 7

Ventilation and its importance-natural and artificial systems-Window type and packaged air-conditioners-chilled water plant -fan coil systems-water piping - cooling load -air conditioning systems for different types of buildings -protection against fire to be caused by A.C. Systems.

MODULE V FIRE SAFETY AND NBC PROVISONS IN BUILDINGS 8

Causes of fire in buildings-safety regulations-NBC-planning considerations in buildings like Non-combustible materials, construction, staircases and A.C. systems, special features required for physically handicapped and elderly in building types.

MODULE VI SMART AND INTELLIGENT BUILDINGS 7

Heat and smoke detectors-dry and wet risers - Automatic sprinklers - Capacity determination of OHT and UGT for firefighting needs.. Intelligent buildings-Building automation-Smart buildings- Building services in high rise buildings.

Total Hours : 45

TEXT BOOKS:

1. Fred Hall, Roger Greeno., "Building Services Handbook" 6th edition Elsevier limited, 2016.
2. Barrie Rigby., "Design of Electrical services for Buildings" 4th edition Spon Press, London, 2005.
3. David V. Chadderton., "Building services Engineering", 5th edition Taylor & Francis, 2007.

REFERENCES:

1. Ernst and Neufert, "Architect's Data", 3rd Edition, Oxford Brookes University, England, 2001.
2. Fair, G.M., Geyer, J.C. and Okun, D., "Water and Waste Engineering", Vol.II, John Wiley & sons Inc., New York,1968.
3. Hopkinson, R.G. and Kay, J.D., "The Lighting of buildings", Faber and Faber, London, 1969.
4. NBC, "Hand Book for Building Engineers in Metric systems", National Building Code of India, New Delhi, 1968.
5. Philips, "Lighting in Architecture Designs", McGraw Hill, New York, 1964.
6. Callendar, J.H., "Time saver Standards for Architecture Design Data", McGraw Hill, New York, 1974.
7. William H. Severns and Julian R. Fellows, "Air Conditioning and Refrigeration", John Wiley and sons, London, 1988.

OUTCOMES:

At the end of the course, the students will be able to

- provide solutions regarding suitable water treatment and water supply systems based on municipal bye-laws & regulations.
- plan and design a sanitation system for buildings and collection, conveyance and disposal of drainage.
- conceptualize the basic concepts of electricity and lighting, to plan electrical wiring for a building and to design modern lighting systems.

- analyse fundamental concepts of ventilation and cooling and assess the protective measures against fire caused by A.C. systems.
- identify the causes of fire in buildings and apply the fire safety measures and NBC provisions in buildings.
- appreciate smart buildings, intelligent buildings and various building services provided for high rise buildings.

CECX37 ENGINEERING ETHICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To enable the students to identify the core values that shapes the ethical behavior of an engineer.
- To enable the students to utilize opportunities to explore one's own values in ethical issues.
- To make the students aware of ethical concerns and conflicts.

To enhance familiarity with codes of conduct and increase the ability to recognize and resolve ethical dilemmas.

MODULE I ENGINEERING ETHICS 8

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Professions and Professionalism – Professional Ideals and Virtues – Uses of Ethical Theories.

MODULE II ENGINEERING AS SOCIAL EXPERIMENTATION 8

Engineering as Experimentation – Engineers as responsible Experimenters – Research Ethics - Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – The Challenger Case Study.

MODULE III ENGINEER'S RESPONSIBILITY FOR SAFETY 8

Safety and Risk – Assessment of Safety and Risk – Risk Analysis – Reducing Risk – The Government Regulator's Approach to Risk - Case Studies Chernobyl and Bhopal disasters.

MODULE IV ETHICAL RESPONSIBILITIES 7

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime

MODULE V ETHICAL RIGHTS 6

rofessional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination

MODULE VI GLOBAL ISSUES 8

Multinational Corporations – Business Ethics - Environmental Ethics–ethics of

technology– Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct.

Total Hours : 45

TEXT BOOKS:

1. Mike Martin and Roland Schinzinger, “Ethics in Engineering”, McGraw Hill, New York, 2005.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, “Engineering Ethics Concepts and Cases”, Thompson Learning, Belmont, CA, 2000.
3. Charles D. Fleddermann, “Engineering Ethics”, Prentice Hall, New Mexico, 1999.

REFERENCES:

1 John R. Boatright, “Ethics and the Conduct of Business”, Pearson Education, 2003.
2 Edmund G. Seebauer and Robert L. Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, New York, 2001.
3 Bajaj, P.S., and Raj Agrawal, “Business Ethics – An Indian Perspective”, Biztantra, New Delhi, 2004.
4 David Ermann and Michele S. Shauf, “Computers, Ethics and Society”, Oxford University Press, New York, 2003.

OUTCOMES:

At the end of the course, the students will be:

- able to identify the core values that shape the ethical behavior of an engineer.
- aware of the ethical concerns and Standards.
- able to handle ethical dilemmas in a better way.
- able to maintain loyalty confidentiality, responsibilty and avoiding the areas where conflicts of interests arise.
- able to demonstrate the knowledge of ethical laws and intellectual rights.
- able to describe the ethical implications of emerging technologies

CECX38 ENVIRONMENTAL RISK ASSESSMENT

L	T	P	C
2	0	0	2

OBJECTIVE:

To provide knowledge related to the broad field of environmental risk assessment, important processes that control contaminant transport and tools that can be used in predicting human health risks

MODULE I INTRODUCTION TO RISK ASSESSMENT 8

Sources of Environmental hazards – Environmental and Ecological Risks – Environmental risk assessment framework – Regulatory perspectives and requirements – Risk analysis and management – Risk perception - Risk assessment in different disciplines

MODULE II ELEMENTS OF ENVIRONMENTAL RISK ASSESSMENT 7

Hazard identification – Receptor exposure to environmental contaminants - Dose Response Evaluation – Exposure Assessment – Exposure Factors, Slope factors, dose response calculations and dose conversion factors – Risk characterization – Vulnerability assessment – Uncertainty analysis

MODULE III TOOLS AND METHODS FOR RISK ASSESSMENT 8

HAZOP and FEMA methods – Cause failure analysis – Event tree and Fault tree modeling and analysis – Estimation of carcinogenic and non carcinogenic risks to human health – Methods in ecological risk assessment – Radiation risk assessment – Data sources and evaluation

MODULE IV RISK MANAGEMENT 7

Risk communication and Risk perception – Comparative Risks – Risks based decision making – Risk based environmental standard setting – Risk cost benefit optimization and tradeoffs – Emergency preparedness plans- Design of Risk management programs – Risk based remediation

Total Hours : 30

TEXT BOOKS:

1. Kasperson.J.K and Kasperson.R.E., “Global Environmental Risks”, V.N.University Press, New York,2003.
2. Joseph F Louvar and B Diane Louvar., “Health and Environmental Risk Analysis Fundamentals and applications” Prentice Hall,New Jersey, 1997.

REFERENCES:

1. Cutter, S.L., “Environmental Risk and Hazards”, Prentice – Hall of India Pvt.Ltd, New Delhi, 1993.
2. Kolluru Rao, Bartell Steven, Pitblado.R and Stricoff, “Risk Assessment and Management Handbook”, Mcgraw Hill Inc., New York, 1996.
3. Kofi Asante Duah, “Risk Assessment in Environmental Management” John Wiley and sons, Singapore, 1998.

OUTCOMES:

At the end of the course student will able

- To attain knowledge on Environmental Risk and its framework.
- To calculate the hazard exposure level and characterize the risk based on its vulnerability.
- To identify the risk by using various risk assessing tools and methods.
- To manage the risk situations and provide preparedness plans to that situation.

CECX39 REMOTE SENSING **L T P C**
3 0 0 3

OBJECTIVES:

The objective of the course is to

- To utilize the principles of remote sensing data acquisition and analysis of satellite data.
- To explore the spectral signatures of various earth features and electromagnetic interactions.
- To evaluate the satellite images for quality and apply enhancement techniques to improve the interpretability of satellite images.
- To process and interpret SAR data.
- To use the aerial photos for measurement of height determination.
- To create data models and data structures and analyse various raster and vector capabilities of GIS

MODULE I FUNDAMENTALS OF REMOTE SENSING 7

Remote sensing: definition – components of remote sensing- energy sensor, interacting body – Active and Passive remote sensing – platforms – aerial and space platforms – balloons ,helicopters, aircrafts and satellites – synoptivity and repeativity – electromagnetic radiation (EMR) – EMR spectrum – visible, infrared (IR) near IR, middle IR, thermal IR and microwave – black body radiation – Plancks Law – Stefan –Boltzman law.

MODULE II EMR INTERACTION WITH EARTH SURFACE FEATURES 8

Atmospheric characteristics – scattering of EMR – Rayliegh, Mie, Non-selective and Raman scattering – EMR interaction with water vapour and ozone – atmospheric windows – significance of atmospheric windows – EMR interaction with earth surface material, radiance, irradiance, incident, reflected, absorbed and transmitted energy – reflectance – specular and diffused reflection surfaces – spectral signature – spectral signature curves – EMR interaction with water, soil and earth surface.

MODULE III DIGITAL IMAGE PROCESSING 7

Digital processing of satellite images: Geometric rectification, spatial and radiometric enhancement, edge detection, band ratio, false color composites, Principal component analysis, Spectral domain enhancement, Supervised and unsupervised classification for thematic map generation.

MODULE IV MICROWAVE REMOTE SENSING 8

Microwave Remote Sensing: Basic principles, spatial resolution of SAR system,

geometric characteristics, and signature of earth features.

MODULE V MISCELLANEOUS REMOTE SENSING TECHNIQUES 8

Aerial photography, Stereo photo interpretation, Thermal radiation principles and thermal imaging, Radar transmission characteristics / Image interpretation, Passive microwave sensing / LIDAR.

MODULE VI REMOTE SENSING APPLICATIONS 7

Applications of remote sensing for Agriculture, forestry, land use/land cover, Soil, Geology, Water Resources, Urban and Coastal Zone Regulation.

Total Hours : 45

TEXT BOOKS:

1. Anji Reddy, “Remote sensing and Geographical Information systems”, BS Publications, 2008.
2. Srinivas, M.G., “Remote sensing applications”, Narosa Publishing House, New Delhi, 2001.
3. Lillesand, T.M. and Kuefer, R.W., “Remote sensing and image interpretation”, John Wiley and sons, 2001.

REFERENCES:

1. De Merse and Michael, N., “Fundamentals of Geographic Information System”, 2nd Edition, John Wiley and sons, New York, 2003.

OUTCOMES:

At the end of the course, the students will be able,

- To describe the basic principles of remote sensing data, types of remote sensing and laws related to remote sensing.
- To demonstrate the interactions of EMR with earth features and the features based on spectral signatures.
- To explain the evaluation techniques for interpretation of the satellite images.
- To describe the characteristic features of microwave remote sensing.
- To describe the use of aerial photos for measurement of height determination.
- To demonstrate the use of Remote Sensing for different applications

CECX40 MODERN SURVEYING L T P C

3 0 0 3

OBJECTIVSE:

- Locate the soundings and to measure the depth of water in hydrographic surveying.
- Use EDM, digital theodolite, digital level, LIDAR and total station for field measurements.
- Determine the precision of the GPS measurements and the working of GPS.
- Categorize the different measurement techniques using a GPS.
- Determine the height measurement with the help of aerial photos.
- Apply the measuring principle of GPS, Total station and EDM in civil engineering projects

MODULE I HYDROGRAPHIC SURVEYING 6

Tides – MSL – Sounding and methods – Location of Soundings and methods – Three-point problem – Strength of fix – Sextants and station pointer – River Surveys – Measurement of current and discharge.

MODULE II MODERN SYSTEMS IN SURVEYING AND MAPPING 9

General – Electronic Distance Measurement (EDM) – Digital Theodolite and its accuracy – Total Station and it's inbuilt programs like Co-go, Missing Line Measurement, Remote Elevation Measurement, 3D Coordinate Measurement, Automatic Azimuth Angle Setting, Resection, Setting out measurements and Area Calculation. Automatic total station – Laser Theodolite.Laser alignment instrument and electronic level – Digital level – Instrument for measuring tunnel profiles – Inertial positioning systems – Global Positioning System (GPS) – Digital Terrain Model (DTM) – LIDAR Measurements - Introduction to mapping software – Modern Trends.

MODULE III GLOBAL POSITIONING SYSTEM 8

History of GPS, GPS design objectives and details of segments space, control and user, blocks of GPS- Block I, II/IIA, IIR Satellites, and IIF. GPS Signal Structure - Carriers, GPS codes: C/A, P, navigational message, GPS receiver: Types and Structure of receivers, Principles of GPS position fixing: Pseudo ranging. Determination of GPS satellite coordinates, Types of ephemerides, GPS errors.

MODULE IV GPS SURVEY METHODS AND APPLICATIONS 8

Single Point or Point Vs Relative, Static Vs Kinematic, Real time Vs Post mission. Practical GPS survey field procedures: Code and Carrier-based positioning, Accuracy and recording time. GPS Applications - Geodetic control surveys, Cadastral surveys, Remote sensing, Engineering and monitoring. Military applications, Geographical Information System, Vehicle tracking and car navigation, LBS and special applications.

MODULE V PHOTOGRAMMETRY 7

Photogrammetric terms; Applications; Type of photographs; Perspective geometry of near vertical and tilted photographs, heights and tilt distortions; Flight planning; Stereoscopy, base lining, floating marks, parallax equation and stereo measurements for height determination; Developments in photogrammetry: analogue, analytical and digital methods; photogrammetric instruments.

MODULE VI TOTAL STATION 7

Electro-optical system: Measuring principle, Working principle, Sources of Error, Infrared and Laser Total Station instruments. Microwave system: Measuring principle, Working principle, Sources of Error, Microwave Total Station instruments. Comparison between Electro-optical and Microwave system applications.Care and maintenance of Total Station instruments.

Total Hours : 45

TEXT BOOKS:

1. Punmia, B.C., “Surveying”, Vol. II, III, Laxmi Publications, New Delhi, 2007.
2. Wolf, P. R., and Ghilani, C. D., “Adjustment Computations: Statistics and Least Squares in Surveying and GIS”, John Wiley & Sons, New York, 1997.
3. Kanetkar, T.P., “Surveying and Levelling”, Vol. I and II, United Book Corporation, Pune, 1994.
4. Roy, S.K., “Fundamentals of Surveying”, 2nd Edition, Prentice - Hall of India Private Ltd., New Delhi, 2004.

REFERENCES:

1. Hofmann-Wellenhof, B., Lichtenegger, H. and Collins, J., “Global Positioning System: Theory and Practice”, Springer, Berlin, 1994.
2. Xu Guochang, “GPS: Theory, Algorithms and Applications”, Springer, Berlin, 2007.

3. Schofield, W., “Engineering Surveying”, 5th Edition, Butterworth - Heinemann, London, 2001.

OUTCOMES:

At the end of the course, the students will

- Locate the soundings and to measure the depth of water in hydrographic surveying
- Map the terrain using EDM, Total Station and LIDAR.
- To determine the position of the points with GPS measurements.
- Use different GPS survey methods to improve the positional accuracy.
- Measure the heights with the help of aerial photos.
- Use the measuring principle of GPS, Total station and EDM in civil engineering projects

SEMESTER VII

		L	T	P	C
CECX45	**BRIDGE ENGINEERING**	**3**	**0**	**0**	**3**

OBJECTIVE:

- To impart knowledge on different types of bridges and culverts, investigation and planning procedures, design principles of various bridges using IRC Specifications, bearings, substructures and foundations.

MODULE I COMPONENTS, INVESTIGATIONS & SPECIFICATIONS 6

Components of a bridge structure - Inspection and site investigations for a bridge - Determination of linear waterway, design discharge and scour depth - Economical span - Types and choice of bridges - IRC loading for road bridges - General design considerations.

MODULE II SLAB BRIDGES & CULVERTS 7

Slab Bridge - Distribution of concentrated loads by IRC - Load distribution by Courbon's Method – Skew slab Bridge, RC box culvert (single vent only).

MODULE III REINFORCED CONCRETE BRIDGES 10

Design of tee beam bridge – design of main girder and cross girders, Single span rigid frame bridge (barrel or slab type only), Continuous girder bridges and Balanced cantilever RC bridges – Design of articulations.

MODULE IV STEEL BRIDGES 7

Design principles of Plate Girder bridges, IRC specifications.

MODULE V PRESTRESSED CONCRETE BRIDGES 7

Types of Prestressed Concrete Bridges - Types of prestressing – Pretensioning and Post-tensioning - Design principles of Post-tensioned concrete bridges.

MODULE VI BEARING, SUBSTRUCTURE & FOUNDATIONS 8

Bearings – types, functions – simple problems – Substructures – Pier and Abutment – Materials, Design - Stability requirements – Foundations – types, pile foundation, well foundation, Caissons – pneumatic and box types.

Total Hours : 45

TEXT BOOKS:

1. Krishnaraju, N., "Design of bridges", New Age International Publishing Ltd., New Delhi, 2005.
2. Ponnuswamy, S., "Bridge Engineering", Tata McGraw Hill Publishing Co., New Delhi, 2001.
3. Jhonson Victor, D., "Bridge Engineering", Oxford & IBH Publishing Co., New Delhi, 2003.
4. Raina, V.K., "Concrete Bridge Practice - Analysis, Design and Economics", 3rd Edition, Shroff Publishers, New Delhi, 2010.

REFERENCES:

1. Vazirani, V.N., Ratwani, M.M., and Vaswani, "Bridge Engineering", Khanna Publishers, New Delhi, 2000.
2. Chen, W.F. and Lian Duan, "Bridge Engineering Handbook", CRC Press, 2010.
3. Bindra, S.P., "Principles and Practice of Bridge Engineering", 9th Edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2012.
4. IRC 22-1986, Standard Specification and Code of Practice for Road Bridges, Section VI, Composite Construction, The Indian Road Congress, New Delhi.
5. IRC 83-1982, Standard Specification and Code of Practice for Road Bridges, Section IX, Bearings, part-I, Metallic Bearings, The Indian Road Congress, New Delhi.
6. IRC 83-1987, Standard Specification and Code of Practice for Road Bridges, Section IX, Bearings, Part-II, Elastomeric Bearings, The Indian Road Congress, New Delhi.
7. IRC 78-1983, Standard Specification and Code of Practice for Road Bridges, Section VII, Foundation and Substructures, The Indian Road Congress, New Delhi.
8. IRC 40-1970, Standard Specification and Code of Practice for Road Bridges, Section IV, Brick, Stone, Block Masonry, The Indian Road Congress, New Delhi.
9. IRC 18-2000, Design Criteria for Prestressed Concrete Road Bridges (Post-Tensioned Concrete), The Indian Road Congress, New Delhi.
10. IRC 5-1998, Standard Specifications and Code of Practice for Road Bridges, Section I – General Features of Design (Seventh Revision), The Indian Road Congress, New Delhi.
11. IRC 6-2010, Standard Specifications and Code of Practice for Road Bridges, Section II – Loads and Stresses (Fifth Revision), The Indian Road Congress, New Delhi.

12. IRC 21-2000, Standard Specifications and Code of Practice for Road Bridges, Section III – Cement Concrete (Plain and Reinforced) (Third Revision), The Indian Road Congress, New Delhi.
13. IRC: 24-2010, Standard Specifications and Code of Practice for Road Bridges, Steel Road Bridges (Limit State Method) Third Revision,The Indian Road Congress, New Delhi.
14. IRC: 22-2008, Standard Specifications and Code of Practice for Road Bridges, Section VI – Composite Construction (Limit States Design) (Second Revision), The Indian Road Congress, New Delhi.

OUTCOMES:

At the end of the course, the students will be able to

- identify a suitable site, classify different types of bridges and calculate loadings as per the standards
- describe the load distribution as per IRC standards and design the slab bridge culvert
- recognize and design the various components in different types of reinforced concrete bridges.
- explain the principles involved in the design of plate girder bridges as per IRC specifications.
- identify and apply the principles, techniques for the design of prestressed concrete bridges
- classify and describe the types of bearings, piers and abutments in bridges

CECX46 EARTHQUAKE ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide basic understanding on the theory of vibrations, earthquake phenomena and its measurements.
- To impart knowledge pertaining to design of structures in seismic areas using IS codal provisions.
- To provide insight knowledge on the seismic retrofitting techniques of structures.

MODULE I THEORY OF VIBRATIONS 9

Concepts of vibrations – Response of the system – Simple Harmonic Motion– Damped and Undamped -Free and Forced vibration- Natural frequencies and modes shapes

MODULE II ENGINEERING SEISMOLOGY 9

Earthquake characterizations – causes of Earthquake - types of Earthquake – Seismic waves – Magnitude and Intensity – Measurement of Earthquake – Seismic zones – Architectural Features – Indian Seismic Codes– Liquefaction of soil - Indian and world seismicity.

MODULE III SEISMIC BEHAVIOUR OF RC STRUCTURES 9

Seismic design philosophy – Earthquake resistant design of RC members – Beams – Columns – Beam column joints – Slabs – Staircases – Shear wall – Seismic coefficient – Load combinations - Lateral load analysis - Response spectrum method.

MODULE IV SEISMIC BEHAVIOUR OF STEEL STRUCTURES 7

Behaviour of flexural members for earthquake resistance – Steel frames – Steel panel zones – Bracing members–Connection design and joint behavior.

MODULE V DUCTILE DETAILING 6

IS 13920 codal provisions for detailing – Beams – Columns – Beam column joints – Footing – Staircases – Shear wall – Special confining reinforcements.

MODULE VI SEISMIC RETROFITTING OF STRUCTURES 5

Base isolation – Seismic dampers – Retrofitting and strengthening of structural members – Response of Buildings – Case study

Total Hours : 45

TEXT BOOKS:

1. Duggal, S.K., “Earthquake Resistant Design of Structures”. Oxford University Press, New Delhi, 2007.
2. Paulay,T. and Priestly, M.N.J., “Aseismic Design of Reinforced Concrete and Masonry Building”, John Wiley and Sons, 1991.
3. Arya, A.S., “Earthquake Engineering”, Jai Krishna 60th Birthday Anniversary Commemoration Volume, ISET, Sarita Prakashan, Meerut, 1974.

REFERENCES:

1. Anil K.Chopra, “Dynamics of Structures - Theory and Applications to Earthquake Engineering” Prentice Hall of India (P) Ltd., New Delhi, 1996.
2. Allen, R.T., Edwards, S.C., “Repair of Concrete Structures”, Blackie and Sons, U.K. 1987.
3. BMTC, “Improving Earthquake Resistance of Housing” Building Materials and Technology Promotion Council, New Delhi, 2000.
4. Damodarasamy, S.R. and Kavitha, S., "Basics of Structural Dynamics and Aseismic Design”, PHI learning Pvt. Ltd., New Delhi, 2009.

OUTCOMES:

At the end of this course students will be able to

- describe the basic concepts on theory of vibrations and apply the principles for response of structures
- recognize the characteristics of earthquake, dynamic behavior of soil and soil-structure interaction
- Critically describe the behaviour of various elements in a RCC structure under earthquake loading and evaluate the seismic forces using various analysis techniques.
- Predict the effect of building configuration and its seismic response on steel structures.
- Perform the design and detailing of various components in a structure for ductility as per codal provisions.
- Identify the seismic damage evaluation for structures and suggest suitable retrofitting techniques

CECX47 INDUSTRIAL STRUCTURES

L	T	P	C
3	0	0	3

OBJECTIVE:

- To enable the students to plan and understand the general requirements for various industrial structures.
- To impart knowledge to design the various special structures in steel and RCC.
- To give exposure on the principles involved in the design of prefabricated structures.

MODULE I PLANNING OF INDUSTRIAL STRUCTURES 5

Classification of industries and industrial structures – General requirements of various industries – Planning and layout of buildings and components.

MODULE II FUNCTIONAL REQUIREMENTS 6

Lighting – Ventilation Lighting – Illumination levels – Characteristics of Good lighting – Principles of day lighting design – Artificial lighting – Ventilation – Natural and Mechanical Ventilation – Evaporate cooling design – Measurement– Contaminant control – Installation and Operation - Acoustics – Fire safety – Guidelines from factories act.

MODULE III DESIGN OF STEEL STRUCTURES 10

Analysis and Design of Industrial buildings and bents – Industrial Roofs - Crane girders - Design of bunkers and silos.

MODULE IV POWER TRANSMISSION STRUCTURES 10

Tower configuration and bracings – Loads acting on towers – Analysis and Design of Lattice Towers – Transmission Line Towers – Tower foundations

MODULE V DESIGN OF R.C. STRUCTURES 9

Analysis and Design of bunkers and silos – Design of Chimneys – Design of Grid floor.

MODULE VI PREFABRICATED STRUCTURES 5

Principles of Prefabrication - Prestressed precast roof trusses – Functional requirements of precast concrete units.

Total Hours : 45

TEXT BOOKS:

1. Krishna Raju, N., "Advanced Concrete Structures", McGraw Hill, New Delhi, 2000.
2. Ramchandra, "Design of Steel Structures", Vol. I & II, Standard Book House, New Delhi, 1996.
3. Santhakumar, A.R. and Murthy, S.S., “Transmission Line Structures”, McGraw-Hill, New Delhi, 1990.

REFERENCES:

1. SP 32: 1986, Handbook on Functional Requirements of Industrial buildings, Bureau of Indian Standards, New Delhi.
2. Manohar, S.N., “Tall Chimneys; Design and Construction”, Tata McGraw Hill, New Delhi, 1985
3. Santhakumar, A.R. and Murthy, S.S., “Transmission Line Structures”, McGraw-Hill, New Delhi, 1990.
4. Dayaratnam, P., "Design of Steel Structures", Wheeler and Co., New Delhi, 1999.

OUTCOMES:

At the end of the course, the students will be able to

- plan the general requirements for various industries and prepare a layout for various industrial structures.
- make an appropriate lighting & ventilation and identify suitable measures to control fire as per factories act for an industrial structure.
- design an industrial building with bents and essential steel structures such as crane girder, bunkers, and silos for an industry.
- identify suitable tower configurations for power transmission and design a lattice tower with suitable foundations.
- analyse and design a RC structure such as bunkers, silos, chimneys and grid floor required for an industry.
- apply the principles and techniques to construct precast concrete units that are necessary for an industry.

CECX48 PREFABRICATED STRUCTURES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To appreciate aspects of modular construction and industrialised construction
- To design some of the prefabricated elements and also have the knowledge of the construction methods using these elements.

MODULE I DESIGN PRINCIPLES 8

General Civil Engineering requirements, specific requirements for planning and layout of prefabrication plant. IS Code specifications. Modular co-ordination, standardization, Disuniting of Prefabricates, production, transportation, erection, stages of loading and code provisions, safety factors, material properties, Deflection control, Lateral load resistance, Location and types of shear walls.

MODULE II REINFORCED CONCRETE 8

Prefabricated structures - Long wall and cross-wall large panel buildings, one way and two way prefabricated slabs, Framed buildings with partial and curtain walls - Connections – Beam to column and column to column.

MODULE III FLOORS, STAIRS AND ROOFS 8

Types of floor slabs, analysis and design example of cored and panel types and two-way systems, staircase slab design, types of roof slabs and insulation requirements, Description of joints, their behaviour and reinforcement requirements, Deflection control for short term and long term loads, Ultimate strength calculations in shear and flexure.

MODULE IV WALLS 8

Types of wall panels, Blocks and large panels, Curtain, Partition and load bearing walls, load transfer from floor to wall panels, vertical loads, Eccentricity and stability of wall panels, Design Curves, types of wall joints, their behaviour and design, Leak prevention, joint sealants, sandwich wall panels, approximate design of shear walls.

MODULE V INDUSTRIAL BUILDINGS AND SHELL ROOFS 7

Components of single-storey industrial sheds with crane gantry systems, R.C. Roof Trusses, Roof Panels, corbels and columns, wind bracing design. Cylindrical, Folded plate and hyper-prefabricated shells, Erection and jointing, joint design, hand book based design.

MODULE VI JOINT IN STRUCTURAL MEMBERS 6

Joints for different structural connections – Dimensions and detailing – Design of expansion joints

Total Hours : 45

REFERENCES:

1. Koncz.T., Manual of Precast Concrete Construction, Vol.I II and III & IV Bauverlag, GMBH, 1971.
2. Laszlo Mokk, Prefabricated Concrete for Industrial and Public Structures, Akademiai Kiado, Budapest, 2007.
3. Lewicki.B, Building with Large Prefabricates, Elsevier Publishing Company, Amsterdam/ London/New York, 1998.
4. Structural Design Manual, Precast Concrete Connection Details, Society for the Studies in the use of Precase Concrete, Netherland Betor Verlag, 2009.
5. Warszawski, A., Industrialization and Robotics in Building - A managerial approach, Harper and Row, 1990.

OUTCOME:

Upon successful completion of this course, students will be able to

- describe the design principles used to construct prefabricated structures.
- Illustrate to create a panel and framed buildings with their connections of prefabricated RC structures.
- Classify the types of floors, stairs and roofs and describe their behaviour of structures.
- Critically describe the various of types wall panels of prefabricated structures.
- Construct a prefabricated structural components for industrial buildings.
- Detailing of various joints in structural memnbers

CECX49 TALL STRUCTURES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the various problems associated with tall structures with respect to different kind of loads.
- To impart knowledge on the behaviour, analysis, design of various structural systems and stability of tall buildings including dynamic analysis

MODULE I DESIGN CRITERIA & LOADING 7

General - Factors affecting growth, height and structural form - Design philosophy - Loading - Gravity loading - Wind loading - Earthquake loading - Combinations of loading - Strength and Stability - Stiffness and Drift limitations - Human comfort criteria- Creep effects - Shrinkage effects - Temperature effects - Fire - Foundation settlement - Soil-structure interaction.

MODULE II STRUCTURAL FORMS 6

Structural forms – braced frame, rigid frame, infilled frame, shear wall structures, wall- frame structures, framed tube structures, outrigger braced structures, space structures, hybrid structures, R.C.floor systems - One-way slab on beams and girders - Two-way flat slab - Two-way flat plate - Waffle flat slabs - Two-way slab and beam - Steel framing floor systems - One-way beam system - Two-way beam system - Three-way beam system - Composite steel - Concrete floor systems.

MODULE III MODELING FOR ANALYSIS 8

Modeling for analysis - Assumptions - Modeling for approximate analyses - Modeling for accurate analysis - Reduction techniques.

MODULE IV BEHAVIOUR & ANALYSIS OF STRUCTURAL SYSTEMS 8

Types, Behaviour and analysis methods of braced frames - Behaviour and analysis of Rigid frame structures - Behaviour, analysis & design of Infilled frame structures - Behaviour and analysis of Shear wall, Coupled shear wall and Wall-frame structures - Behaviour of Tubular structures, Core structures and Outrigger-braced structures.

MODULE V STABILITY OF TALL BUILDINGS 8

Overall buckling analysis of frames (approximate methods) - Overall buckling analysis of wall frames - Second order effects of gravity loading - Translational -

Torsional instability - Out-of-plumb effects - Effects of foundation rotation - Creep and Shrinkage effects - Temperature effects.

MODULE VI DYNAMIC ANALYSIS 8

Response to wind loading - Along-wind response - Across-wind response - Estimation of natural frequencies & damping - Types of excitation - Design to minimise dynamic response - Response to earthquake motions - Response to ground accelerations - Response spectrum analysis - Estimation of natural frequencies and damping - Human response to building motions.

Total Hours : 45

TEXT BOOKS:

1. Bryan Stafford Smith and Alex Coull, "Tall building Structures Analysis Design", John Wiley and Sons, Inc., New York, 1991.
2. Taranath, B.S., "Structural Analysis and Design of Tall Buildings", McGraw Hill Book Co., New York, 1998.

REFERENCES:

1. Lin, Y. and Burry, D., Stotes, "Structural Concepts and Systems for Architects and Engineers", John Wiley, New York, 1994.
2. Lynn S. Beedle., “Advances in Tall Buildings”, CBS Publishers and Distributors, New Delhi, 1996.
3. Angus J. MacDonald., “Wind Loading on Buildings”, Wiley, New York, 1975.
4. Lawson, T. V., “Wind Effects on Buildings”, Applied Science Publishers, London, 2001.

OUTCOMES:

At the end of the course, the students will be able to

- compute the different types of loading acting on tall structures and identify the different factors affecting the tall structures.
- classify and use appropriate types of structural systems in tall structures.
- construct modeling using various analysis techniques and describe its behaviour for various structural systems.
- interpret the behaviour of different structural systems and predict a suitable system for tall structures.
- manipulate the second order effects of gravity loading, translational and torsional

instability in the analysis of tall structures

- analyze the response of wind and seismic motions on tall structures

CECX50 DESIGN OF MACHINE FOUNDATION

L	T	P	C
3	0	0	3

OBJECTIVE:

- To provide sound understanding of the concepts, principles, and techniques of designing foundations for different types of machines.

MODULE I INTRODUCTION TO VIBRATION OF SYSTEMS 7

Vibration of elementary systems-vibratory motion-single degree freedom system-free and forced vibration with and without damping.

MODULE II WAVES AND WAVE PROPAGATION 8

Wave propagation in an elastic homogeneous isotropic medium- Raleigh, shear and compression waves-waves in elastic half space.

MODULE III DYNAMIC PROPERTIES OF SOILS 7

Elastic properties of soils-coefficient of elastic, uniform and non-uniform compression - shear-effect of vibration dissipative properties of soils-determination of dynamic properties of soil- codal provisions.

MODULE IV DESIGN OF RECIPROCATING MACHINES 8

Dynamic loads - simple design procedures for foundations under reciprocating machines.

MODULE V DESIGN OF IMPACT AND ROTARY MACHINES 8

Design procedures for machines producing impact loads - rotary type machines.

MODULE VI VIBRATION ISOLATION 7

Vibration isolation techniques-mechanical isolation- foundation isolation-isolation by location-isolation by barriers- active and passive isolation tests.

Total Hours :45

TEXT BOOKS:

1. Swamisaran, “Soil Dynamics and Machine Foundations”, Galgotia Publications Pvt. Ltd., New Delhi, 1999.
2. Prakesh, S. and Puri, V.K., “Foundation for Machines”, McGraw-Hill, New York, 1993.
3. Srinivasulu, P. and Vaidyanathan, “Hand book of Machine Foundations”,

McGraw-Hill, New York, 1996.
4. Kramar, S.L., “Geotechnical Earthquake Engineering”, Prentice Hall International Series, Pearson Education (Singapore) Pvt. Ltd., U.S.A., 1986.
5. Kameswara Rao, “Dynamics Soil Tests and Applications”, Wheeler Publishing, New Delhi, 2003.

REFERENCES:

1. Kameswara Rao, “Vibration Analysis and Foundation Dynamics”, Wheeler Publishing, New Delhi, 1998.
2. IS 2974 (Part V) - 1987, Code of Practice for Design and Construction of Machine Foundations, Bureau of Indian Standards, New Delhi.
3. Moore, P.J., “Analysis and Design of Foundation for Vibration”, Oxford and IBH, New Delhi, 1995.

OUTCOMES:

At the end of the course, students will be able to

- describe the fundamentals of free and forced vibration with regard to single degree of freedom
- examine the propagation of waves in a soil medium subjected to dynamic loading
- explain the dynamic properties of soil and its method of determination based on codal provisions.
- design the foundation for reciprocating machines
- design the foundation for impact and rotary machines
- analyze the different vibration isolation systems.

CECX51 GROUND WATER ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the principles of Groundwater governing Equations and characteristics of different aquifers,
- To understand the techniques of development and management of groundwater

MODULE I HYDROGEOLOGICAL PARAMETERS 8

Introduction – Water bearing Properties of Rock – Type of aquifers – Aquifer properties – permeability, specific yield, transmissivity and storage coefficient – Methods of Estimation– Ground water table fluctuation and its interpretations – Groundwater development and Potential in India – GEC norms.

MODULE II WELL HYDRAULICS 8

Objectives of Groundwater hydraulics – Darcy's Law – Groundwater equation – steady state flow – Dupuit Forchheimer assumption – Unsteady state flow – Theis method – Jacob method -Slug tests – Image well theory – Partial penetrations of wells.

MODULE III GROUNDWATER MANAGEMENT 7

Need for Management Model – Database for groundwater management – groundwater balance study – Introduction to Mathematical model – Conjunctive use – Collector well and Infiltration gallery

MODULE IV GROUNDWATER QUALITY 8

Ground water chemistry – Origin, movement and quality – Water quality standards – Health and aesthetic aspects of water quality – Saline intrusion – Environmental concern and Regulatory requirements.

MODULE V GROUNDWATER CONSERVATION 7

Artificial recharge techniques – Remediation of Saline intrusion– Ground water management studies – Protection zone delineation, Contamination source inventory, remediation schemes – Ground water Pollution and legislation.

MODULE VI GROUNDWATER IMPROVEMENT METHODS 8

Tube wells- Types and Parts, optimum capacity, silting of tube well,design of tube wells in different aquifers.Bore hole, strains - types, well pipe, casing pipe, blind

pipe. Construction and working of tube wells, siteselection, drilling operation, alignment of tubewells, gravel packing. Methods -cable tool method, hydraulic method, rivers Rotary Method and drilling fluids.Pumping equipment and hydraulic testing of pumps.

Total Hours : 45

TEXT BOOKS:

1. Raghunath H.M., “Ground Water Hydrology”, New Age International (P) Limited, New Delhi, 2010.
2. Todd D.K., “Ground Water Hydrology”, John Wiley and Sons, New York, 2000.

REFERENCES:

1. Fitts R Charles, “Groundwater Science”. Elsevier, Academic Press, 2002.
2. Ramakrishnan, S, Ground Water, K.J. Graph arts, Chennai, 1998.

OUTCOMES:

At the end of the course, the students will be able to

- Understand aquifer properties and its dynamics after the completion of the course.
- Give an exposure towards well design and practical problems of groundwater aquifers.
- Impacts the Knowledge about the groundwater management
- Manage the quality of groundwater, exploration and saline instrusion
- Understand the importance of artificial recharge and groundwater quality concepts
- Understand the application of various groundwater improvement methods

CECX52 ENVIRONMENTAL IMPACT ASSESSMENT

L	T	P	C
3	0	0	3

OBJECTIVE:

- To familiarize the students about impact of infrastructure projects on the components of environment, impact assessment methods and mitigation measures

MODULE I INTRODUCTION **7**

Evolution of EIA - Concepts - Methodologies - Screening - Scoping – Mitigation-Matrices – Checklist- Impact of development projects – Sustainable development-Need for Environmental Impact Assessment (EIA) – Environmental Impact Statement (EIS)

MODULE II EIA PROCESS **8**

EIA capability and limitations-Stages of EIA, Types of EIA Rapid and Comprehensive EIA - Legislative and Environmental Clearance procedure in India - Prediction tools for EIA.

MODULE III EIA FOR SPECIFIC PROJECTS **7**

Assessment of Impact - Air - Water - Soil - Noise – Biological - EIA for infrastructure projects – Bridges – Stadium – Highways – Dams – Multi-storey Buildings-– Water Supply and Drainage Projects

MODULE IV PUBLIC PARTICIPATION IN EIA **8**

Socio-cultural environment - Public participation - Addressing the issues related to the Project Affected People - Resettlement and rehabilitation.

MODULE V MONITORING IN EIA **8**

Documentation of EIA - Environmental management plan - Plan for mitigation of adverse impact on environment options for mitigation of impact on water, air and land, flora and fauna; Post project monitoring

MODULE VI ENVIRONMENTAL AUDIT **7**

Environmental Audit- Life cycle assessment case studies - EMS - case studies in EIA- Industrial ecology – carbon trading

Total Hours :45

TEXT BOOKS:

1. Canter, R. L., “Environmental Impact Assessment”, McGraw Hill, New Delhi, 1996.
2. Shukla, S. K., and Srivastava.P.R., “ Concept in Environmental Impact Analysis”, common wealth publishers, New Delhi, 1992.

REFERENCES:

1. John G. Rau and David C. Wooten (Ed.), “Environmental Impact Analysis Hand Book”, McGraw Hill Book Company, 1990.
2. Judith Petts, “ Handbook of Environmental Impact, assessment Volume I & II “ Blackwell Science, 1999.

OUTCOMES:

At the end of the course, the student will be able to

- describe the concepts and methodologies of Environmental impact assessment
- explain the legislative and environmental clearance procedure and apply the prediction tools for EIA.
- assess the impacts of Infrastructure projects on air, water, soil and environment.
- Describe the public participation, procedure, resettlement and rehabilitation processes in EIA.
- prepare documentation of EIA and to develop environmental management plan for the same.
- Conduct environmental audit and life cycle assessment of products

CECX53 COASTAL ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

- To impart sufficient knowledge on the coastal processes, coastal dynamics and management perspectives.

MODULE I COASTAL ZONE 7

Introduction to basic concepts -Coastal zone – Coastal zone regulations – Beach profile – Surf zone – Off shore – Coastal waters – Estuaries – Wet lands and Lagoons – Living resources and their conservation – Non living resources and their exploration and exploitation.

MODULE II WAVE DYNAMICS 7

Wave classification – Airy's Linear Wave theory – Deep water waves – Shallow water waves – Wave pressure – Wave energy – Wave Decay – Reflection, Refraction and Diffraction of waves – Breaking of waves – Wave force on structures – Vertical – Sloping and stepped barriers – Force on piles.

MODULE III WAVE FORECASTING AND TIDES 8

Need for forecasting - SMB and PNJ methods of wave forecasting – Classification of tides – Darwin's equilibrium theory of tides –Renewable tidal energy- Effects on structures – seiches, Surges and Tsunamis.

MODULE IV COASTAL PROCESSES 8

Erosion and depositional shore features – Change levels of shoreline-sediment movement -Methods of protection – Littoral currents – Shifting river mouths and delta formation - Coastal aquifers – Sea water intrusion –Desalination - Impact of sewage disposal in seas.

MODULE V COASTAL STRUCTURES 8

Types and selection of break waters – Design and Application of break water-Need and mode of dredging – Selection of dredgers- Types and design of Coastal Protection Works- Design of shore defense structures- Wave-tidal engineering structures and other infrastructure in coastal zone – Dykes and Levees

MODULE VI COASTAL MANAGEMENT 7

Land use in coastal zone – Coastal zone management – Concepts and

development – Data base for coastal zone management – Design and operation of closure works – Sand closure --Generation, propagation and effect of tsunami – Environment impact of ports-Introduction and basic concepts of GIS – Aquaculture remote sensing – Basic concepts – Application of remote sensing in coastal zone management.

Total Hours : 45

TEXT BOOKS:

1. Richard Sylvester, “Coastal Engineering, Vol. I and II”, Elsevier Scientific Publishing Co., New York, 1999.
2. Quinn, A.D., “Design & Construction of Ports and Marine Structures”, McGraw-Hill Book Co., 1999.

REFERENCES:

1. Ed. A.T. Ippen, “Coastline Hydrodynamics”, McGraw-Hill Inc., New York, 1993.
2. Dwivedi, S.N., Natarajan, R. and Ramachandran, S., “Coastal Zone Management in Tamilnadu State, India", Ocean Data Centre, 1991.
3. ACER, "Coastal Engineering Manual, Vol. I-VI", U.S. Army Coastal Engineering Research, USA.

OUTCOMES:

At the end of the course, students will be able to

- explain the coastal zone regulations and describe the estuaries, lagoons, exploration and exploitation of living and non living resources
- classify waves and describe Airy’s linear theory, breaking of waves and wave force on structures
- forecast waves using SMB and PNJ methods of wave forecasting and to describe Darwin’s equilibrium theory of tides
- explain the coastal processes, erosion and depositional shore features and to describe desalination process
- identify the type of break waters and to design shore defense structures, wave –tidal engineering structures and other infrastructure in coastal zone
- explain the concepts and development of coastal zone management, to design closure works and to describe the concepts and applications of remote sensing in coastal zone management

CECX54	GIS AND ITS APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide fundamental concepts of GIS, its definitions, components and map making process.
- To provide information to segregate real world data, different storage procedures and database structures to store the GIS data in a database management system.
- To impart knowledge on classification of real world data into raster and vector representation, to understand data quality and handling of errors.
- To expose the students to raster and vector data analysis methods, to create raster and vector data models, create queries and solve surface to network problems.
- To provide different application scenarios available in different domains such as natural resources management, land information, water resources management, environmental engineering and monitoring and ways to solve the problems in these domains.
- To provide different application scenarios in problems related to urban, utilities, business development, web and mobile GIS and ways to solve the problems in these domains.

MODULE I FUNDAMENTALS OF GIS 7

Introduction – definitions of GIS – components of GIS – Geographic data Presentation: maps – mapping process – coordinate systems – transformations – map projection – geo referencing - data acquisition

MODULE II GIS DATA MODELS & STRUCTURES 8

Geographic data representation, storage, quality and standards: storage: digital representation of data –data-base structures and database management systems.

MODULE III SPATIAL DATA STRUCTURES 7

Raster data representation – vector data representation – concepts and definitions of data quality – components of data quality – assessment of data quality – managing

data errors – geographic data standards.

MODULE IV GIS DATA PROCESSING AND ANALYSIS 8

GIS data processing, analysis and modeling : Raster based GIS data processing – vector based GIS data processing – queries – spatial analysis – descriptive statistics – spatial autocorrelation – quadrant counts and nearest neighbour analysis – network analysis – surface modeling – DTM.

MODULE V APPLICATIONS OF GIS FOR NATURAL RESOURCES 8

Applications of GIS: Natural Resources Management, Natural hazard management, Land information, Water Resources Management, Environmental Engineering & Monitoring.

MODULE VI APPLICATIONS OF GIS IN CIVIL ENGINEERING 7

Applications of GIS: Urban planning, Transportation Engineering, Utility management, Business development, Cartography, Web GIS and Mobile GIS.

Total Hours : 45

TEXT BOOKS:

1. Anji Reddy, “Remote sensing and Geographical systems”, B.S Publications, Hyderabad, 2008.
2. Clarke, K., “Getting Started with Geographic Information Systems”, Prentice Hall, New Jersy, 2001.

REFERENCES:

1. Burrough, P.A., “Principles of Geographical Information Systems”, Oxford Publication, 2001.
2. De Mers and Michael, N., “Fundamentals of geographic information system”, 2nd Edition, John Wiley and sons, 2003.

OUTCOMES:

At the end of the course, the students will be able to

- describe GIS, list its different components, to identify different elements of a map.
- design a GIS database scheme, data structure for storage of data and segregate the different layers that needs to be stored for an application.
- create raster, vector layers and to generate and create error free spatial data with its attributes.
- categorize raster and vector data processing methods and to solve network and surface related problems and to generate spatial queries and to identify the outputs achieved.
- solve real world problems on environmental, water resources, natural resources and natural hazards through spatial analysis.
- solve real world problems on urban, utilities, business development, web and mobile GIS through spatial analysis.

CECX55 GEODESY

L	T	P	C
2	0	0	2

OBJECTIVE:

- To provide students comprehensive understanding of the various concepts of geodetic surveying and to solve geodetic problems

MODULE I FUNDAMENTALS **7**

Definitions, Classifications, and Problem of Geodesy. Historical development and Organization of Geodesy. Reference Surfaces and their relationship. Applications.Engineering, Lunar and Planetary Geodesy.

MODULE II GEOMETRIC GEODESY **9**

Geodetic, Geocentric and Reduced latitudes and their relationship.Coordinates in terms of Reduced, Geodetic and geocentric latitude.Radius of curvature in the meridian & prime vertical and their relationship.Radius of curvature in any azimuth, Length of the meridian arcs and arcs of parallel and Area of trapezium on the ellipsoid.Curves on the ellipsoid, properties of Geodesic and Everest ellipsoid.

MODULE III PHYSICAL GEODESY **8**

Gravity field of earth, Concept of equipotential, Geopotential and Spheropotential Surface - Normal gravity, The Significance of gravity measurements, Measurements of Absolute and Relative gravity, Reduction of gravity measurements, Isostasy. Gravity networks.Gravity anomaly and Gravity disturbance - Fundamental equation of Physical Geodesy. Determination of Geoid and Deflection of Vertical, Orthometric height, Normal height, Dynamic height and their corrections, Ellipsoidal height and geoidal height.

MODULE IV GEODETIC COMPUTATION **6**

Rectangular and Polar Co – ordinates - First and Second geodetic problem - Similarity and Helmert's transformation, Point determination by Intersection - Resection and Arc Section.

Total Hours : 30

TEXT BOOKS:

1. James R. Smith, "Introduction to Geodesy", John wiley & Sons Inc., New York, 2001.

REFERENCES:

1. Wolfgang Torge, “Geodesy”, Walter De Gruyter Inc., Berlin, 2001.
2. Bomford, G., “Geodesy”, Clarendon press, Oxford, 2004
3. Petr Vanicek and Edward J. Krakiwsky, “Geodesy : The Concepts”, North-Holland Publications Co., Amsterdam, 1991
4. Heribert kahmen and Wolfgang Faig, “Surveying”, Walter De Gruyter, Berlin, 2003.
5. Schwarze, V.S., “Geodesy: The challenge of the 3rd Millennium”, Springer verlag, 2002
6. Howard gore, J., “Elements of Geodesy”, Kessinger Publishing, 2007.
7. George l. Hosmer, “Geodesy”, Kessinger Publishing, 2007.

OUTCOMES:

At the end of the course, the students will be able,

- To categorize the classification of geodesy, to describe the problem of geodesy and to list the reference surfaces with their relationship.
- To sort the various types of the latitude with their relationship and to explore the radius of curvature in the the meridian, prime vertical, azimuth and ellipsoid.
- To justify the significance of gravity and to sort the various types of gravity, to solve the fundamental equation of physical geodesy and to categorize the different height involved in physical geodesy.
- To solve the rectangular and polar coordinates, to conclude first and second geodetic problem, to determine the coordinates of point by Intersection, Resection and Arc Section.

CECX56 BUILDING INFORMATION MODELLING

L	T	P	C
2	0	0	2

OBJECTIVES:

To provide knowledge on

- the basics of Building Information modelling
- how BIM principles are applied to the Construction industry to improve the ease of project delivery.

MODULE I AN OVERVIEW OF BIM 6

Introduction to BIM Software – Back ground and History of BIM – Purpose and objectives of BIM – BIM benefits

MODULE II INCORPORATING AND MANAGING BIM 8

To build a building virtually prior to building it physically - work out problems, simulate and analyze potential impacts - anticipation and ease of project delivery, the overall safety of the project – Introduction to Navis work

MODULE III BIM THROUGHOUT PROJECT LIFE CYCLE 9

Programming – Conceptual design – Detailed design – Analysis – Documentation – Fabrication – Construction 4D/5D – Construction Logistics – Operation and Maintenance – Demolition – Renovation

MODULE IV APPLICATIONS OF BIM 7

Application to enhance efficiency during and post construction phases, and facility management - Applications like determination of quantities of items and material inventory – Application like Building energy performance analysis

Total Hours –30

TEXT BOOKS:

1. Peter Thomas Barnes and Nigel Davies “BIM and Construction Management: Proven Tools, Methods and Workflows” ICE Publishing; First edition 2013.

2. Brad Hardin and Dave Mccool “BIM and Construction Management: Proven tools, methods and work force” Wiley; Second edition, 2015.

REFERENCES:

1. BIM Handbook: A Guide to Building Information Modeling for Owners, Managers, Designers, Engineers and Contractors, John Wiley & Sons; 2nd Revised edition, 2011.
2. BIM and Construction Management: Proven Tools, Methods, and Workflows / Hardin / Sybex — A BIM reference with a focus on construction management

OUTCOMES:

At the end of the course, students will be able to

- Summarize the BIM Principles.
- Understand the analyzing potential impacts using navis works.
- Explain the BIM Application.
- Demonstrate the construction project delivery using BIM.

CECX57	DESIGN OF COLD FORMED STEEL STRUCTURES	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To impart sufficient knowledge to students on techniques , properties and types of cold formed steel sections
- To give exposure to students on buckling of members; codal provisions; and connection methods.
- To offer knowledge to analyse and design different structural elements i.e., columns, beams, purlins using cold formed sections.

MODULE I INTRODUCTION 5

Manufacturing Techniques and properties of cold formed sections - Types of cross sections - Merits and demerits of cold formed sections.

MODULE II COLD FORMED STEEL SECTIONS 7

Concepts of local buckling - effective width - Stiffened and unstiffened elements – Codal Provisions - IS 801 & IS 811 – concept of lateral buckling - Methods of connections.

MODULE III DESIGN OF COMPRESSION MEMBERS 9

Design of axially compressed column – Analysis and design of effective section under bending and compression - Combined stresses.

MODULE IV DESIGN OF FLEXURAL MEMBERS 9

Concept of shear lag and flange curling - Design of beams and beam webs – deflection of beams - Empirical design of Z-purlins with lips and wall studs.

Total Hours : 30

TEXT BOOKS:

1. Dayaratnam, P., Design of Steel Structures, Wheeler Publishing, 1990.
2. Rhodes, J, Design of Cold-Formed Steel Members, Elsevier Science Publishers, 1991.
3. Ramchandra, S., Design of Steel Structures, Vol.-II, Standard Publications, New Delhi, 2010.
4. Subramanian N, Steel Structures - Design and practice, Oxford University

Press, 2011.

REFERENCES:

1. Teaching Resource for Structural Steel Design, INSDAG, Kolkatta, 2010.
2. BIS: 800-2007, Indian standard code of practice for general construction in steel, Bureau of Indian Standards.
3. BIS 801: 1975 - Indian standard code of practice for use of cold-formed light gauge steel structural members in general building construction, Bureau of Indian Standards.
4. SP 6 (5) -1980 – Hand book for structural Engineers, 5. Cold formed, Lightgauge steel structures, Bureau of Indian Standards.

OUTCOMES:

At the end of course work, students will be able to

- describe the manufacturing techniques, merits and demerits of cold formed steel structures
- illustrate the concepts of buckling , warping mechanisms and shear lag.
- analyse and design the cold formed compression members
- analyse and design the cold formed flexural members

CECX58	CORROSION CONTROL OF STEEL IN CONCRETE	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To impart sound knowledge on mechanism of corrosion of steel in concrete, its causes, consequences and control measures.
- To offer in depth knowledge on codal provisions for enhancing durability and corrosion rate measurement in distressed structures including rehabilitation techniques

MODULE I CORROSION MECHANISM 7

Corrosion mechanism – black rust - pits - stray current - bacterial corrosion causes of corrosion – carbonation - chloride attack - influence of concrete cover corrosion damage – damage in conventionally reinforced concrete - corrosion cracking - hydrogen embrittlement - Types of corrosion.

MODULE II CORROSION CONTROL IN CONCRETE 8

Control of carbonation - control of chlorides - high performance concrete- corrosion inhibitors – anodic, cathodic and mixed Inhibitors

MODULE III CORROSION CONTROL IN STEEL REBARS 7

Protective coatings to steel rebars – fusion bonded epoxy coating, galvanization, cement polymer composite coating, inhibited cement slurry coating and anticorrosive polymer cementious coatings - stainless steel reinforcement - sealers and membranes – cathodic protection.

MODULE IV CORROSION RATE MEASUREMENT 8

half cell potential measurements - carbonation depth measurement – chloride determination and resistivity measurement - corrosion rate measurement – linear polarization resistance techniques.

Total Hours : 30

TEXT BOOKS:

1. Arnon Bentur, Sidney Diamond and Neal S. Berke, Steel Corrosion in Concrete – Fundamentals and Civil Engineering Practice, E & FN SPON Publications, Madras,1997

2. John P.Broomfield, Corrosion of steel in concrete - Understanding, investigation and repair, E & FN SPON Publications, Madras,1997.

REFERENCES:

1. Mars G. Fontana, Corrosion Engineering Mc-Graw Hill Publishers, New Delhi, 2001.
2. Philip H. Perkins, Repair, Protection and Waterproofing of Concrete Structures, Elsevier Applied Science Publishers, London, 1986.

OUTCOMES:

At the end of course work, students will be able to

- Identify the causes and mechanism of corrosion in reinforced concrete
- Suggest passive measures to control the corrosion in reinforced concrete
- Suggest active measures to control the corrosion in steel reinforcement
- Assess the rate at which the reinforced concrete is being corroded

CECX59 FLOOD MANAGEMENT

L	T	P	C
2	0	0	2

OBJECTIVE:

To impart knowledge about:

- Water shed management, rainfall- runoff process, causes & effects of floods, flood risk assessment , modeling & mapping
- Flood prevention, preparedness and mitigation measures.
- Flood damage assessment, recovery and rehabilitation measures,
- National disaster management guide lines on flood management

MODULE I RAINFALL RUNOFF PROCESS 7

Water shed- and water shed management-rain fall runoff process - Criteria for sustainable water management -causes of floods-Impacts-Flood routing.

MODULE II FLOOD MODELLING AND RISK ASSESSMENT 9

Basic principles and aspects of flood risk assessment - Flood Hazard Modelling – Flood Plain delineation & mapping –Software tools- Application of GIS-Community-based flood risk assessment- Case studies.

MODULE III FLOOD RISK MANAGEMENT 7

flood plain management – Tools for flood plain management –Flood prevention, preparedness and mitigation – frame work - Structural and non structural flood mitigation measures– Integrated watershed management- Urban and Rural development planning – Public awareness and capacity building

MODULE IV FLOOD DISASTER PLANNING 7

Flood forecasting and warning–Indian context - Emergency response planning and management – Evacuation process, rescue process– Environmental health - Concepts of recovery and rehabilitation – Flood damage assessment – Management of recovery and rehabilitation activities- National disaster management guide lines on flood management.

Total Hours : 30

TEXT BOOKS:

1. Rangapathy.V. karmegam. M and Sakthivadivel.R., “ Monograph in flood routin

g methods as applied to Indian Rivers" Anna University Publication.
2. Andreas H. Schumann., "Flood Risk Assessment and Management", Springer Science & Business Media B.V.2011

REFERENCES:

1. Ashley R., Garvin S., Pasche E. and Vassilopoulos A., Advances in Urban Flood Management, Balkema, 2007
2. Saul A, Floods and Flood Management, Springer, 1992.
3. Engineering hydrology by K. Subramanya, Tata McGraw-Hill Education.

OUTCOMES:

Upon completion of the course students will be able to:

- Apply the various wasteshed concepts and flood and flood routing.
- Discuss the methods of flood risk assessment and mapping using geospatial techniques
- Demonstrate their knowledge on flood mitigation measures and public awareness.
- Analyse the flood forecasting and flood disaster.

CECX60	URBAN AND INDOOR AIR QUALITY MANAGEMENT	L	T	P	C
		2	0	0	2

OBJECTIVES:

- scientific principles that make up the broad field of air quality
- its pollution and management

MODULE I **MONITORING AND MANAGEMENT** **7**

Monitoring and measuring - air quality indicators - Air quality assessment methods - Monitoring objectives - Functions - Air quality assurance and air quality control

MODULE II **MONITORING SYSTEMS** **8**

Types of monitoring systems - Monitoring levels - Critical analysis of the existing monitoring systems - Software for air quality monitoring - Quality modeling and decision-making: Air quality and pollution sources - from assessment to management

MODULE III **INDOOR AIR QUALITY** **7**

Indoor activities of inhabitants - Levels of pollutants in indoor and outdoor air- Design and operation of buildings for improvements of public health- IAQ policy issues- sustainability. Air pollutants in indoor environments- private residences- offices- schools-public buildings- ventilation.

MODULE IV **POLLUTION & CONTROL** **9**

Indoor air pollution from outdoor sources- particulate matter and ozone- Combustion byproducts-Radon and its decay products- Volatile organic compounds- odours and sick-building syndrome- Humidity- Bio aerosols- infectious disease transmission- Special indoor environments- A/C units in indoor- Measurement methods- Control technologies- Control strategies.

Total Hours –30

TEXT BOOKS:

1. Griffin, R. D.: Principles of Air Quality Management, CRC Press, ISBN 0-8493-7099-X, 2006.

2. T.K. Gosh, S.K. Loyalka and R.C.Warder, Jr., "Indoor Air Quality & Control" PTR Prentice Hall,1993.

REFERENCES:

1. Richard A. Wadden, and Peter A. Scheff, "Indoor Air Pollution - Characterization, Prediction, and Control", John Wiley & Sons,1983.
2. Zanneti, P. "Air Pollution Modeling Theories", Computational Methods and Available Software. Van Nostrand Reinhold, New York. 1990
3. Boubel R.W., Fox D.L., Turner D.B & Stern A.C., "Fundamentals of Air Pollution" Academic Press, New York, 1994
4. Thaddes Godish, Indoor air and Environmental Quality, CRC press, 2000.
5. Nazaroff W.W. and L. Alvarez-Cohen, Environmental Engineering Science, Wiley sons, Newyork, 2001.

OUTCOMES:

At the end of the course, students will be able to

- Recognize hazardous atmospheric conditions
- Evaluate atmospheres relative to health and environmental standards
- Model air emissions to predict atmospheric concentrations and recommend appropriate controls and management strategies to reduce or eliminate pollutants and their effects
- Understand the measurement methods and control strategies

CECX61 CONTRACT LAWS AND REGULATIONS

L	T	P	C
2	0	0	2

OBJECTIVES:

To improve the knowledge of the students in various elements of contract, tendering procedures, arbitration, labor regulations and other laws related to it.

MODULE I CONSTRUCTION CONTRACTS **8**

Indian contracts act – elements of contracts – types of contracts – public private partnership in contract - design of contract documents – international contract document - standard contract document.

MODULE II TENDERS **7**

Prequalification – bidding – accepting – evaluation of tender from technical, contractual and commercial points of view – contract formation and interpretation-potential contractual problems.

MODULE III LEGAL REQUIREMENTS **8**

Insurance and bonding – laws governing sale, purchase and use of urban and rural land – tax laws – income tax, sales tax, excise and custom duties and their influence on construction costs – legal requirements for planning – property law local government laws for approval – statutory regulations.

MODULE IV LABOUR REGULATIONS **7**

laws relating to wages, bonus and industrial disputes, labour administration – insurance and safety regulations Workmen's Compensation Act – Indian Factory Act – Tamilnadu Factory Act – Child Labour Act - Other Labour Laws

Total Hours –30

TEXT BOOKS:

1. Gajaria G.T., Laws Relating to Building and Engineering Contracts in India, M.M.Tripathi Private Ltd., Bombay, 2000.

2. Patil. B.S, Civil Engineering Contracts and Estimates, Universities Press Private Limited, India, 2006.

REFERENCES:

1. Jimmie Hinze,Construction Contracts, McGraw Hill, 2001.
2. Joseph T. Bockrath, Contracts and the Legal Environment for Engineers and Architects, McGraw Hill, 2000.
3. The Indian Contracts Act, 1872,
4. Arbitration and Conciliation Act, 1996.
5. The Tamilnadu Transparency in Tenders act, 1998.

OUTCOMES:

At the end of the course, students will be able to

- define the various elements, types and laws related to contract.
- list the various processes involved in tendering.
- describe the various legal requirements related to construction activities.
- list the available labor regulations and its benefits to the labour.

CECX62 SMART CITIES

L	T	P	C
2	0	0	2

OBJECTIVES:

- To examine the core challenges relating to the foundation of sustainable smart cities
- To develop knowledge, understanding, and critical thinking related to smart, sustainable urban development.
- To explore issues relating to the development and deployment of new and emerging technologies, that will create a thorough understanding of smart processes and systems of the present and future.

MODULE I UNDERSTANDING SMART CITIES 7

Introduction to Smart City - How did the idea evolve - History and Evolution of Smart Cities, worldwide - barriers and benefits of smart cities - Development Perspectives - Definitions and Core Concepts - characteristics and factors of Smart cities

MODULE II SMART CITY RESPONSIBILITIES 7

Built environment – Energy – Telecommunications – Transportation - Health and human services - Water and wastewater - Public safety and Payments.

MODULE III SMART CITY ENABLERS 7

Instrumentation and control – connectivity- interoperability- security and privacy - data management - computing resources and analytics - Process of building a smart cities roadmap

MODULE IV TOWARDS SMART CITIES IN INDIA 9

ICT initiatives in Indian Cities - Are we ready for smart cities - economic development - smart city technologies: inventory and standardization- potential of commercialization and emerging trends - e-democracy and e-governance - Case studies in India : Palava - Dombivalli, Mumbai, Lavasa- Pune.

Total Hours : 30

TEXT BOOKS:

1. Chan.D (2016) Defining smart cities seminar : A Guiding Frame work.
2. Goldsmith.S & Crawford.S “ the responsive city: engaging communities through data – smart governance”John Wiley & sons, 2014.

3. Mele.N The end of big: How the internet makes david the new Goliath, Macmillan 2013
4 Townsend, A.M., " Smart Cities: Big data, Civic Hackers, and the quest for new ww norton & company, 2013.

REFERENCES:

1. Jesse Berst, Liz Enbysk and Christopher Williams Smart Cities Readiness Guide - The planning manual for building tomorrow's cities today, Smart Cities Council, 2014.
2. Aniket Bhagwat, Suparna Bhalla, Sanjay Prakash Ashish Bhalla Destination 100 The Making of Smart Cities in India**,** Future Institute publishers, 2014,
3. Vinod kumar T. M., Geographic Information Systems for Smart Cities, Copal Publishing, New Delhi, 2014,

OUTCOMES:

Upon completion of the course, the student will be able to

- To understand the technological, environmental and socio-economic aspects of sustainable smart cities.
- To understand how and to what extent cities are changing, following or contrasting the path of the so-called "smart cities revolution"
- To develop strategies and techniques in design which enable innovative solution for the improvement of quality of life.
- To learn how to develop successfully in a team a complete and feasible project which will contribute to the improvement of Indian city.

CECX63	ENVIRONMENTAL MONITORING	L	T	P	C
		2	0	0	2

OBJECTIVES:

- The fundamental objective of environmental monitoring is to collect data that can be used to make informed decisions to best manage and improve the environment.

MODULE I ANALYTICAL METHODS 7

Classification of instrumental methods- Performance characteristics of instruments (static and dynamic)-errors and uncertainties in performance parameters- noise reduction- Sensitivity and detection limit Errors-types-expression of errors- Precision and accuracy- Calibration of instrumental methods.

MODULE II AIR QUALITY MONITORING METHOD 7

Spectophotometry - Electromagnetic radiation -Atomic absorption and emission spectrometry -Ultraviolet-visible spectrophotometry principle and instrumentation- Atomic adsorption spectroscopy principle and instrumentation.

MODULE III WATER QUALITY MONITORING METHODS 8

Electro chemical methods- electrochemical cell- Fluorimetry- nephelometry and turbidimety- principles- Electrodes- Conductomety- electrolytic conductivity specific equivalent and molar conductance- working principles of pH, EC, TDS meters.

MODULE IV MATERIAL CHARACTERIZATION METHODS 8

Material characterization techniques- SEM, TEM, XRD, FTIR, thermal analysis- working principles and applications.

Total Hours : 30

TEXT BOOKS:

1. H.H, Willard, L.L. Merit, J.A. Dean and F.A. Settle, Instrumental Methods of Analysis, 7th Ed. CBP Publishers and Distributors, New Delhi, 1986.

2. D.A. Skoog, D.M. West and T.A. Nieman, Principles of Instrumental Analysis, 5th Ed. Thomson Asion(P) Ltd. Singapore, 2004.

REFERENCES:

1. Paul. R. Locontio, Trace Environmental Quantitaive Analysis: Princeiples, Techniques and Applications, 2nd Edition, 2005.

2. Ewing, Instrumental methods of chemical analysis,5th Edition, McGraw Hill, Newyork,1985.

3. Reeve R.N., Introduction to Environmental Analysis, Analytical techniques in sciences, John and Sons, Chichester, UK, 2002.

OUTCOMES:

At the end of the course, the students will be able to

- It elaborate about the problems and errors in instruments.
- Understand the principle, working & components of air quality, monitoring techniques.
- Understand the principle, working & components of water quality monitoring technique.
- Select a method for solid waste characterization.

Physics Elective Courses
(To be offered in II Semester)

PHCX 01	FUNDAMENTALS OF ENGINEERING MATERIALS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To help students to acquire the properties and applications of conducting and semiconducting materials.
- To familiarize students with basic ideas about the properties of dielectric and magnetic materials and their applications.
- To familiarize students with basic knowledge of nanomaterials and its electrical, electronic, mechanical and magnetic properties.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I CONDUCTING AND SEMICONDUCTING MATERIALS 7

Conductors: properties, Fermi distribution function, Fermi energy in metals- density of states- conducting polymers-properties-applications, semiconductors: intrinsic and extrinsic semiconductors-carrier concentration, conductivity and energy band gap, semiconducting polymers- properties- applications.

MODULE II DIELECTRIC MATERIALS 8

Polarization- dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – Internal field - Clausius Mosotti relation - dielectric loss – dielectric breakdown – applications of dielectric materials (capacitors and transformers) – Pyroelectricity, Piezoelectricity, ferroelectricity and applications in Ferroelectric Random Access Memory (FeRAM) - multiferroic materials and its applications.

MODULE III MAGNETIC MATERIALS 7

Origin of magnetism-magnetic moment, susceptibility, permeability – Bohr magneton – Dia, Para and Ferro magnetism –Spontaneous magnetization- Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites and its application - Giant Magneto-resistance effect (GMR) - Magnetic resonance imaging(MRI).

MODULE IV NANOMATERIALS 8

Properties of nanomaterials – size effect on thermal, electrical, electronic, mechanical,

optical and magnetic properties – quantum confinement – classification of nanomaterials – quantum well, quantum wire, quantum dot - nanoporous materials - carbon nanotubes, graphene - nanocomposites – applications of nano materials.

PRACTICALS

1. Determination of energy band gap of a semiconductor.
2. Determination of resistivity of metals by four point probe method.
3. Determination of dielectric constant of dielectric material.
4. Determination of time constant of a capacitor using RC circuit.
5. Determination of paramagnetic susceptibility of given liquid.
6. Determination of hysteresis loss in a transformer using BH curve.
7. Analysis of size effect on the absorption spectrum of nanomaterials.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. William D. Callister, “Material Science and Engineering”, Wiley Publications, 2006.
2. Raghavan, V., “Materials Science and Engineering”, 5th edition, Printice Hall of India Pvt Ltd. New Delhi, 2004.
3. Wahab. M.A, “Solid State Physics: Structure and Properties of Materials”, Narosa Publishing House Pvt. Ltd., New Delhi , 2nd Edition, 2010.
4. Pillai, S.O., “Solid State Physics”, New Age International, New Delhi, 2005.
5. Charles P. Poole and Frank J. Owens, ”Introduction to nanotechnology”, Wiley (India), 2009.
6. Pradeep. T., “Textbook of Nanoscience and Nanotechnology”, McGraw Hill Education (India) Private Limited, New York, 2012.

OUTCOMES:

On completion of this course, the student will be able to

- apply the concepts of conducting and semiconducting materials for solid state devices.
- comprehend the significance of properties of dielectric magnetic materials and derive these properties from synthesized materials.
- differentiate between the properties of the nanomaterials compared to bulk materials.
- complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 02	HEAT AND THERMODYNAMICS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To familiarize students with basic concepts of heat.
- To help students acquire the fundamentals of heat conduction and radiation.
- To enable students acquaint with the basics of thermodynamic concepts.
- To make students understand the fundamentals of heat based experiments.

MODULE I CONCEPTS OF HEAT **10**

Definition of temperature, thermal and thermodynamic equilibrium - relationship between temperature and kinetic energy - definition of solid, liquid, gas - Introduction to phase transitions, critical and triple points- definition of heat capacity, mechanical equivalent of heat -Joule's calorimeter- latent heat- microscopic model of ideal gas - equation of state, internal energy, equipartition theorem- equation of state for non-ideal gases.

MODULE II CONDUCTION AND RADIATION **10**

Thermal conductivity – rectilinear flow of heat – thermal conductivity of a good conductor – Forbe’s method – thermal conductivity of a bad conductor – Lee’s disc method – conduction of heat through compound media - radiation – Planck’s law of blackbody radiation – Wien’s law – Stefan’s law – Newton’s law of cooling from Stefan’s law – Solar constant – Pyrometry.

MODULE III FUNDAMENTALS OF THERMODYNAMICS **10**

Thermodynamic equilibrium – zeroth law of thermodynamics – first law of thermodynamics – Reversible and irreversible processes – second law of thermodynamics - Heat engine – Carnot’s engine – Carnot’s theorem – Internal combustion engines – petrol and diesel engines (qualitative) – Entropy and available energy – temperature – entropy diagram for Carnot’s cycle - Third Law of thermodynamics (qualitative).

PRACTICALS

1. Determination of mechanical equivalent of heat by Joule’s calorimeter.
2. Relation between temperature of a body and time by plotting a cooling curve-Newton’s law of cooling.

3. Determination of specific heat capacity of liquid by cooling.
4. Determination of thermal conductivity of a good conductor-Forbe's method
5. Determination of thermal conductivity of a bad conductor-Lee's disc method

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Mathur. D.S, “Heat & Thermodynamics”, S.Chand & Co., 2009.
2. Brijlal & Subramaniam, “Heat and Thermodynamics”, S.Chand & Co, Delhi, 2010.
3. Gupta. A.B and Roy. H, “Thermal Physics”, Books and Allied Ltd., 2002.
4. Sharma. J.K and Sarkar. K.K, “Thermodynamics and statistical Physics”, Himalaya Publishing House, 1988.

OUTCOMES:

On completion of this course, the student will be able to

- understand the concepts of heat and its properties.
- comprehend the ideas governing the conduction and radiation processes.
- apply the knowledge of laws of thermodynamics in thermodynamic systems.
- perform heat based experiments and determine its various properties.

PHCX 03	INTRODUCTION TO NANOSCIENCE AND TECHNOLOGY	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To acquire basic knowledge about the nanomaterials and applications.
- To learn about the synthesis and imaging techniques of nanomaterials.
- To gain the basic concepts of fabrication techniques.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I NANOMATERIALS AND APPLICATIONS **10**

Properties of nanomaterials – size effect on thermal, electrical, electronic, mechanical, optical and magnetic properties – quantum confinement – classification of nanomaterials – quantum well, quantum wire, quantum dot - nanoporous materials - zeolite, mesoporous materials, carbon nanotubes, grapheme - nanocomposites - applications (qualitative): Molecular electronics-nanoelectronics – nanophotonics - single electron transistor-drug delivery.

MODULE II SYNTHESIS AND IMAGING TECHNIQUES **12**

Top-down and bottom up approaches – mechanical alloying and mechanical ball milling - sol-gel approach - hydrothermal method - precipitation method - spray pyrolysis - spin coating-self assembled monolayer (SAM) - Chemical vapour deposition method – Physical vapour deposition method: laser ablation method, sputtering method.

Optical microscopy – Phase contrast and interference microscopy – confocal microscopy - high resolution Scanning electron microscope (HRSEM) - high resolution Transmission electron microscope (HRTEM) - Atomic force microscope - Scanning Tunnelling microscope (STM).

MODULE III NANOFABRICATION **8**

Photolithgraphy - electron beam lithography - X-ray and Ion beam lithography - nanoimprint lithography - soft lithograpy - nanoelectromechnical systems (NEMS) - nanoindentation principles.

PRACTICALS

1. Synthesis of nanomaterials by sol-gel method.

2. Synthesis of nanomaterials by hydrothermal method.
3. Synthesis of nanomaterials by solid state reaction method.
4. Synthesis of nanomaterials by chemical bath deposition method.
5. Synthesis of nanomaterials by co-precipitation method.
6. Synthesis of nano thin films by spray pyrolysis method.
7. Synthesis of nano thin films by pulsed laser deposition (PLD) method.
8. Analysis of size effect on the absorption spectrum of nanomaterials.
9. SEM characterization of nanomaterials.
10. AFM characterization of nano thin films.
11. Phase confirmation by XRD.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Charles P.Poole and Frank J. Owens, ”Introduction to nanotechnology”, Wiley (India), 2009.
2. Cao. G., “Nanostructures & Nanomaterials: Synthesis, Properties & Applications”, Imperial College Press, 2004.
3. Gaddand. W., Brenner. D., Lysherski. S. and Infrate. G.J., “Handbook of NanoScience Engineering and Technology”, CRC Press, 2002.
4. Pradeep. T., “Textbook of Nanoscience and Nanotechnology”, McGraw Hill Education (India) Private Limited, New York, 2012.
5. Chris Mack, “Fundamental Principles of Optical Lithography: The Science of Microfabrication”, John Wiley & Sons, 2008.
6. Bandyopadhyay A.K., “Nano Materials”, New Age International Publishers, New Delhi, 2008.

OUTCOMES:

At the end of the course, the students will be able to

- understand the importance and basic concepts of the nanomaterials.
- comprehend the imaging techniques for nanomaterials.
- illustrate the various nanofabrication techniques.
- complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 04 LASERS AND THEIR APPLICATIONS

L	T	P	C
2	0	2	3

OBJECTIVES:

- To recognize the fundamentals of laser and its characteristics.
- To comprehend and compare the different laser systems.
- To apply lasers in metrology and material processing.
- To understand the working of laser instrumentation.
- To correlate the experimental results for applications.

MODULE I LASER THEORY **8**

Spontaneous and stimulated emission - Population inversion – Einstein's A & B coefficients - Threshold condition – super-radiance Laser – Three level and four level laser systems -conditions for CW and pulsed laser action. Q-Switching - experimental methods - cavity dumping - Mode locking - experimental methods - Spatial and Temporal coherence.

MODULE II DIFFERENT LASER SYSTEMS **8**

Laser systems – General description - Laser structure - excitation mechanism - Different laser systems- He-Ne laser, Carbon-dioxide laser - Excimer laser – Free electron laser- Alexandrite laser - Ti-Sapphire laser – Semiconductor diode laser - Diode pumped solid state laser - Pulsed-CW dye laser- Fibre laser.

MODULE III METROLOGICAL AND MATERIAL PROCESSING APPLICATIONS **8**

CW and Pulsed laser beam characteristics and its measurements - Beam focusing effects - spot size - Power and Energy density Measurements - Distance measurement - Interferometric techniques - LIDARS - different experimental arrangements - Pollution monitoring by remote sensing - Laser gyroscope - Laser welding, drilling, machining and cutting - Laser surface treatment - Laser vapour deposition – Biophotonic applications.

MODULE IV LASER INSTRUMENTATION **7**

Laser for measurement of length, current and voltage – Laser Doppler Velocimetry - Holography and speckle in displacement and deformation measurements - Laser for communication with fiber optics as channel.

PRACTICALS

1. Tuning of Dye Laser using DFDL Arrangement
2. Determination of Brewster Angle using He-Ne laser
3. Study of transversely Pumped Dye Lasers
4. Study of longitudinally Pumped Dye Lasers
5. Determination of power and wavelength using Distributed Feedback Dye Laser (DFDL)
6. Determination of fibre optic losses using semiconductor laser.
7. Bandgap determination of a semiconductor diode.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. William T. Silfvast, “Laser Fundamentals”, Cambridge University Press, 2009.
2. Ghatak. A. & Thyagarajan. K. “Optical Electronics”, Cambridge University, 1994.
3. Laud.B.B., “Laser and Non-Linear Optics”, Second Edition, New Age International (p) Limited Publishers, 2011.
4. Nambiar. K.R., “Lasers Principle, Types and Applications”, New Age International (p) Ltd, 2004.
5. Wilson. J. & Hawkes. J.F.B., “Opto Electronics - An Introduction”, Prentice Hall, 1992.
6. William M.Steen, ”Laser Material Processing”, Springer-Verlag, Berlin, Third Edn., 2005.

OUTCOMES:

At the end of the course, the students will be able

- To complement the knowledge acquired in the theory class.
- To work with dye lasers for tunability of laser wavelength.
- To measure the loss of information involved in fibre optic communication.
- To correlate the results for application.

PHCX 05	MATERIALS SCIENCE	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To gain basic knowledge in conducting and semiconducting materials and their properties.
- To provide basic understanding of properties and applications of dielectric materials.
- To impart knowledge on magnetic and optical materials and their properties & applications.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I CONDUCTING AND SEMICONDUCTING MATERIALS 10

Quantum free electron theory of metals and its importance - Energy distribution of electrons in metals - Fermi distribution function - Density of energy states and carrier concentration in metals - Fermi energy – Classification of solids into conductors, semiconductors and insulators on the basis of Band theory – Introduction to Elemental and Compound semiconductors - Carrier concentration derivation for Intrinsic semiconductors - Density of electrons in conduction band & Density of holes in valence band- intrinsic carrier concentration - Fermi energy & Variation of Fermi energy level with temperature - Mobility and electrical conductivity - Band gap determination.

MODULE II DIELECTRIC MATERIALS 7

Introduction to dielectric materials & basic definitions – Electronic, Ionic, Orientation & Space charge polarizations - Total polarization – Frequency and temperature dependence of polarization - Internal field in a dielectric material - Deduction of Clausius - Mosotti's relation - dielectric loss & loss tangent – Different types of dielectric breakdown – Applications of dielectric materials : Capacitors and Transformers.

MODULE III MAGNETIC MATERIALS 6

Introduction to magnetic materials & origin of magnetic moment - Different types of

magnetic materials and their properties - Ferromagnetism & Domain theory of ferromagnetism - Hysteresis, Soft and Hard magnetic materials - Antiferromagnetic materials - Ferrites and its applications – Applications of magnetic materials : Data storage.

MODULE IV OPTICAL MATERIALS 7

Optical properties of semiconductors - Direct and Indirect bandgap semiconductors – Traps, recombination centre, color center and exciton – Luminescence : Fluorescence and Phosphorescence - Liquid crystal display : twisted nematic crystal display – Applications of Optical materials - Optical Sources : light emitting diode and laser diode - Photo detectors : PIN photodiode and Avalanche Photodiode - Pyroelectric devices - Electro optic effect : Kerr effect and Faraday effect.

PRACTICALS

1. Resistivity measurement of a semiconductor using four point probe method.
2. Determination of band gap of a semiconductor diode.
3. Determination of Hall coefficient of a given semiconductor material.
4. Determination of dielectric constant of a given non-polar liquid.
5. Determination of magnetic susceptibility of a given paramagnetic liquid using Quincke's method.
6. Determination of energy loss of a given transformer core using hysteresis method.
7. To study the I-V characteristics of a photodiode.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Palanisamy P.K., ''Physics II'', Material Science for ECE, Scitech Publications (India) Pvt. Ltd., 2006.
2. Kasap. S.O., ''Principles of Electronic materials and devices'', McGraw Hill Publishers, 3rd Edition, 2007.
3. Arumugam. M, "Physics II'', Material Science for ECE, Anuradha Publishers, 5th Edition, 2005.
4. Sze. S.M., ''Semiconductor Devices – Physics and Technology'', John Wiley, 2nd Edition. 2002.
5. Raghavan. V, ''Materials Science and Engineering'', Prentice Hall of India, 5th Edition, 2004.

OUTCOMES:

On the completion of this course, the students will be able to

- Gain knowledge about fundamentals of conducting and semiconducting materials.
- Understand concepts and applications of Dielectric and Magnetic materials.
- Familiarize Optical materials and their applications in Engineering and Medical fields.
- Complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 06	NON-DESTRUCTIVE TESTING	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To study the process and applications of ultrasonic inspection method.
- To understand the basic concepts of radiographic inspection method.
- To acquire the knowledge about the various surface Non-Destructive Testing (NDT) techniques.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I ULTRASONIC INSPECTION METHOD **10**

Ultrasonic Testing - Principle of operations - types of sound waves - types of Transducers - transmission and pulse-echo method - straight beam and angle beam, instrumentation - calibration methods - ultrasonic testing technique- data representation, A Scan, B-scan, C-scan. Phased Array Ultrasound, Time of Flight. Diffraction - thickness determination - advantages, disadvantages and applications.

MODULE II RADIOGRAPHIC INSPECTION METHOD **10**

Radiographic testing – Principle - Interaction of X-ray with matter - X-ray radiography - method of generation-industrial radiography inspection techniques – Equipment - Exposure charts - Types of films – Fluoroscopy - Xero-Radiography – Limitations - Gamma radiography - Equipment, radiation sources - method of generation - film processing - interpretations of radiography - safety in industrial radiography.

MODULE III SURFACE NDT TECHNIQUES **10**

Liquid Penetrant Testing – Principles, Characteristics and types of liquid penetrants – developers - advantages and disadvantages of various methods - Inspection Procedure and Interpretation of results. Applications of Liquid Penetrant testing.

Magnetic Particle Testing - Principle-magnetizing technique - procedure –equipment - Interpretation and evaluation of test indications - applications and limitations - demagnetization.

PRACTICALS

1. Inspection of welds using solvent removable visible dye penetrant.
2. Inspection of welds using solvent removable fluorescent dye penetrant.

3. Inspection on non magnetic materials by eddy current method.
4. Inspection on magnetic materials by eddy current method.
5. Inspection of welds by Eddy current Testing.
6. Inspection of welds by Magnetic Particle Testing - Dry method.
7. Inspection of welds by Magnetic Particle Testing - Wet method.
8. Ultrasonic flaw detector - Inspection of defects.
9. Demonstration of Radiographic inspection.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Baldev Raj., Jayakumar T.,Thavasimuthu., “Practical Non-Destructive Testing”, Narosa Publishing House, 2009.
2. Ravi Prakash., “Non-Destructive Testing Techniques”, 1st revised edition, New Age International Publishers, 2010.
3. ASM Metals Handbook of Non-Destructive Evaluation and Quality Control, American Society of Metals, Metals Park, Ohio, USA, Volume-17, 2000.
4. Paul E Mix,”Introduction to Non-destructive testing: a training guide”, Wiley, 2nd Edition New Jersey, 2005.
5. Charles J., Hellier, “Handbook of Nondestructive evaluation”, McGraw Hill, New York, 2001.

OUTCOMES:

Upon completion of this course, the students will be able to

- illustrate the ultrasonic inspection methods of NDT.
- understand the basic concept of radiographic inspection method.
- test the surfaces by the various surface NDT techniques.
- complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 07	PROPERTIES OF MATTER AND ACOUSTICS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To understand principles and properties of elasticity.
- To understand the basic concepts and application of viscosity.
- To analysis acoustic of building.
- To know about photoelasticity and its applications.

MODULE I ELASTICITY **8**

Stress and strain - Hooke's Law of elasticity - Elastic moduli - Stress-Strain Diagram - Poisson's Ratio - Relation between elastic constants - Work done in stretching and twisting a wire - Twisting couple on a cylinder- Expression for bending moment - Cantilever–Expression for depression - Uniform bending and Non-uniform bending of beams (theory & experiment) - I form Girders (qualitative treatment) and applications.

MODULE II VISCOSITY **8**

Viscosity- Newton’s formula for viscous flow - Streamline and turbulent motion - Reynolds number - Poiseuille's formula - Determination of coefficient of viscosity- factors affecting viscosity - capillary flow method - Stoke's formula- viscosity of highly viscous liquids – Stoke’s method - Lubricants and its applications –viscosity measurements - Viscometer - Variation of Viscosity with Temperature.

MODULE III ACOUSTICS OF BUILDING **7**

Basic requirement for the acoustically good halls - Reverberation and time of reverberation – Sabine’s formula for reverberation time - Absorption coefficient and its measurement -Transmission of sound and transmission loss - Factors affecting the architectural acoustics and their remedy-sound absorbing materials - vibration and noise control systems for buildings.

MODULE IV PHOTOELASTICITY **7**

Polarization - double refraction - Theory of Plane, Circularly and Elliptically polarized light - Quarter wave plate and half wave plate - photo elasticity - Theory of photo-elasticity - Stress optic relations - model materials - analysis techniques - Photo elastic bench - Three dimensional photo elasticity - Digital photo elasticity - Photo elastic

coatings.

PRACTICALS

1. Determination of viscosity of liquid by Poiseuille's method.
2. Determination of viscosity of liquid by Stoke's method.
3. Analysis of stress by photo elastic method.
4. Verification of Hooke's law by spring method.
5. Determination of Young's modulus of the cantilever beam.
6. Determination of rigidity modulus by static torsion method.
7. Visit to acoustically good auditorium and identifying the sound absorbing materials in the auditorium.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Mathur D.S., "Elements of Properties of Matter", S.Chand & Co, Delhi, 2009.
2. Gaur R.K., Gupta S.L.,"Engineering Physics", Dhanpat Rai Publishers, 2010.
3. Brijlal and Subramaniam.," Properties of Matter", Eurasia Publishing Co, New Delhi, 2002.
4. Smith C.J.," General Properties of Matter", Orient & Longman,1960.
5. Kenneth G. Budinski and Michel K., Budinski, "Engineering Materials Properties and Selection", Pearson, Singapore, 2002.

OUTCOMES:

Upon completion of this course, the students will be able to

- understand the basic concepts of the elasticity of materials.
- comprehend the concepts of viscosity of liquid and measurement.
- demonstrate the acoustical aspects of building and its importance in construction.
- apply the fundamental concept of photo elasticity for the stress analysis of the object.

PHCX 08	PROPERTIES OF MATTER AND NONDESTRUCTIVE TESTING	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To impart knowledge about the principles and properties of elasticity.
- To learn the laws governing the dynamic of rigid bodies.
- To acquire the knowledge of the various techniques of Non-Destructive Testing (NDT) of materials.
- To understand the principle and basic concept of low temperature applications.

MODULE I ELASTICITY **8**

Stress and strain - Hooke's Law of elasticity - Elastic moduli - Stress-Strain Diagram - Poisson's Ratio - Relation between elastic constants - Work done in stretching and twisting a wire - Twisting couple on a cylinder- Expression for bending moment- Cantilever–Expression for depression - Uniform Bending and Non-uniform bending of beams (theory & experiment) - I form Girders (qualitative treatment) and applications.

MODULE II DYNAMICS OF RIGID BODIES **8**

Rigid bodies - angular acceleration - Torque on a particle - angular momentum - law of conservation of angular momentum - moment of inertia and its significance - Theorem of parallel and perpendicular axis - moment of inertia of a thin uniform bar - moment of inertia of a rectangular lamina - moment of inertia of uniform circular disc - Moment of inertia of hollow and solid cylinders – flywheel
(qualitative) - kinetic energy of rotating body – Routh rule.

MODULE III NDT TECHNIQUES **6**

Ultrasonic Testing- types of Transducers-transmission and pulse-echo method-Radiographic testing- Principle-Interaction of X-ray with matter-X-ray radiography-method of generation-industrial radiography inspection techniques- Liquid Penetrant Testing**-** Inspection Procedure and Interpretation of results.

MODULE IV LOW TEMPERATURE PHYSICS **8**

Definition of Refrigeration and Air-Conditioning - Types of Refrigeration Systems-

Applications- Comfort Air Conditioning, Industrial Refrigeration, Food processing and food chain - Cryogenic treatment - Low temperature properties of engineering materials: Mechanical properties, Thermal properties, Electrical properties.

PRACTICALS

1. Verification of Hooke's law by spring method.
2. Determination of Young's modulus of the beam by bending method.
3. Inspection of welds using solvent removable visible dye penetrant.
   Inspection of welds using solvent removable fluorescence dye penetrant.
5. Inspection of welds by Magnetic Particle Testing.
6. Determination of moment of inertia of the disc by torsion pendulum method.
7. Determination of moment of inertia of the disc by static torsion method.
8. Demonstration of working of flywheel.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Mathur D.S.,"Elements of Properties of Matter", S.Chand & Co, Delhi, 2009.
2. Brijlal & Subramaniam," Properties of Matter", Eurasia Publishing Co, Delhi, 2002.
3. Gaur R.K., Gupta S.L., "Engineering Physics" Dhanpat Rai Publishers, 2010.
4. Baldev Raj.,Jayakumar T., Thavasimuthu M.,"Practical Non-Destructive testing", Narosa Publishing House, 2009.
5. Brijlal & Subrahmanyam., "Heat and Thermodynamics" S.Chand & Company Ltd, 2002.
6. Paul E Mix.," Introduction to Non-destructive testing: a training guide", Wiley, 2nd Edition, New Jersey, 2005.
7. Charles J., Hellier.," Handbook of Nondestructive evaluation", McGraw Hill, New York, 2001.

OUTCOMES:

Upon completion of this course, the students will be able to

- understand the basic of concept of elasticity of materials.
- comprehend the basic concepts of motion of rigid bodies and its applications.
- demonstrate the various NDT techniques and its importance.
- know the low temperature systems and its applications.

PHCX 09	SEMICONDUCTOR PHYSICS AND OPTOELECTRONICS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To understand the Physics of Semiconductor devices.
- To make the students learn the fundamentals of Photoluminous - semiconductors, Optoelectronic devices, Optical modulators/detectors.
- To make them understand the technology behind latest Display devices like LCD, Plasma and LED Panels.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I PHYSICS OF SEMICONDUCTORS **8**

Elemental and compound semiconductors – Drift and diffusion current - Intrinsic semiconductors – Carrier concentration (derivation) – Fermi energy – Variation of Fermi energy level with temperature – Mobility and electrical conductivity – Band gap determination – Extrinsic semiconductors – Carrier concentration in n-type and p-type semiconductor (derivation) – Variation of Fermi level with temperature and impurity concentration – Variation of Electrical conductivity with temperature – Hall effect – Experiment and applications of Hall effect.

MODULE II OPTOELECTRONIC DEVICES **7**

Light Emitting Diodes (LED) – power and efficiency - double hetero LED - LED structure - LED characteristics - White LED – Applications. Liquid crystal displays – Dynamic scattering and Twisted nematic display, Semiconductor Lasers, Homojunction and Heterojunction laser diodes - Optical processes in semiconductor lasers.

MODULE III OPTICAL MODULATORS **7**

Modulation of light – birefringence –Modulation Techniques - Electro optic effect – Electro optic materials –Types of Electro optic Modulators : Kerr and Pockel modulators –- Magneto optic effect - Magneto optic Modulators – Acousto Optic modulators.

MODULE IV OPTICAL DETECTORS **8**

Photo detectors - photodiodes - phototransistors - noise characteristics - PIN diode – Avalanche Photodiode (APD) characteristics - APD design of detector arrays – Charged Couple Device - Solar cells - Materials and design considerations, Thin film

solar cells, amorphous silicon solar cells.

PRACTICALS

1. Resistivity measurement of a semiconductor using four point probe method.
2. Determination of band gap of a semiconductor diode.
3. Determination of Hall coefficient of a given semiconductor material.
4. Determination of the wavelength of a given laser source using diffraction grating.
5. Determination of Planck's constant using LED.
6. To study the I-V characteristics of photodiode and phototransistor.
7. To study the characteristics of a solar cell.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Arumugam. M, "Physics II", Anuradha Publishers, 5th Edition, 2005.
2. Sze. S.M., "Semiconductor Devices – Physics and Technology", 2nd edn. John Wiley, 2002.
3. Wilson & J.F.B. Hawkes, "Optoelectronics – An Introduction", Prentice Hall, India, 1996.
4. Bhattacharya, "Semiconductor optoelectronic devices", Second Edn, Pearson Education, 2002.
5. Safa O. Kasap, "Optoelectronics & Photonics:Principles & Practices", Second Edn, Pearson Education,2013.
6. Palanisamy P.K., "Semiconductor physics and optoelectronics" Scitech Publications, 2003.

OUTCOMES:

On completion of this course, the student will be able to

- understand the principles of Physics behind semiconductor devices.
- choose the correct semiconductors for electronic devices and display.
- differentiate the working principle of LED and Diode Laser.
- apply the knowledge of modulation of light for different types of optical modulators.
- select suitable photodetectors for different types of applications.
- complement the knowledge acquired in the theory class and correlate the results for applications.

Chemistry Elective Courses
(To be offered II Semester)

CHCX01	ANALYTICAL INSTRUMENTATION	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make the student conversant with

- principles, instrumentation and applications of different electroanalytical techniques
- different chromatographic techniques
- principles, instrumentation and applications of various types of absorption and emission spectroscopy
- different thermal analytical methods and their applications

MODULE I ELECTROANALYTICAL TECHNIQUES **7**

Principle and applications: conductometric titrations – potentiometrIc titrations, ion-selective electrodes and pH-metry – coulometry – voltammetry - polarography, amperometric titrations.

MODULE II CHROMATOGRAPHY **8**

Basic concepts of chromatography – paper chromatography – column chromatography – thin layer chromatography – gas chromatography – high performance liquid chromatography – gel permeation chromatography.

MODULE III SPECTROSCOPY **8**

Absorption spectroscopy (principle, instrumentation and applications): Colorimetric analysis – UV-Visible spectroscopy – FTIR spectroscopy - Emission Spectroscopy (principle, instrumentation and applications): fluorescence, phosphorescence and chemiluminescence – Atomic absorption spectroscopy – flame emission spectroscopy.

MODULE IV THERMAL ANALYSIS **7**

Principle, instrumentation and applications: Thermo gravimetric analysis – Differential thermal analysis – Differential scanning calorimetry

PRACTICALS

1. Conductometric titrations: acid-base and precipitation titrations

2. Potentiometric titrations
3. Determination of pH of the unknown solution
4. Estimation of alkali metals using flame emission spectroscopy
5. Estimation of metal ions of coloured solutions using colorimetric analysis
6. Separation of compounds using gas chromatography
7. Separation of compounds using high performance liquid chromatography
8. Analysis of the given sample and interpretation of the data using IR, UV-Visible spectroscopy
9. Demonstration of TGA/DTA and DSC and interpretation of data.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Skoog D.A., West D.M., Holler F.J. and Crouch S.R., Fundamentals of Analytical Chemistry, 8th Edition, Thomson Brooks/Cole Publication., Singapore, 2004.
2. Willard H.H., Merritt L.L., Dean J.A. and Settle F.A., Instrumental Methods of Analysis, 7th Edition, CBS Publication, New Delhi Reprint, 2004.
3. A.I. Vogel, Vogel's Textbook of Practical Organic Chemistry, 5th Edition, Prentice Hall, London, 2008.
4. Christian G.D., Analytical Chemistry, 6th Edition, John Wiley, Singapore, 2003.
5. Fifield F.W. and Kealey D., Principles and Practice of Analytical Chemistry, 5th Edition, Blackwell Publication, London, 2000.
6. Settle F. (Editor), Handbook of Instrumental Techniques for Analytical Chemistry, Pearson Education, Singapore, 2004.

OUTCOMES:

The student will be able to

- state the principle and applications of various electro-analytical techniques
- identify the right separation method for a given sample using different chromatographic techniques
- explain the principle, instrumentation & applications of various spectroscopic methods and also to interpret the data
- elaborate the principle, instrumentation and applications of various thermal analytical techniques and interpret the data.

CHCX02	CORROSION AND ITS CONTROL	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students should be conversant with the

- Basic concepts, principles and factors affecting corrosion
- Types and mechanism of corrosion
- Control measures of corrosion by material selection, proper design and by applying organic coatings
- Control of corrosion by applying inorganic coating

MODULE I BASIC CONCEPTS OF CORROSION 8

Corrosion – causes and impacts of corrosion – mechanism of corrosion: Dry corrosion- oxidation corrosion - corrosion by other gases – Pilling-Bedworth rule- Corrosion by hydrogen: hydrogen blistering, hydrogen embritttlement, decarburization and hydrogen attack – corrosion of silver and copper by sulphur compounds – liquid metal corrosion (embritttlement or cracking) – Wet corrosion : hydrogen evolution – presence and absence of oxygen and absorption of oxygen – difference between dry and wet corrosion-factors influencing corrosion-polarization-passivity-emf series and galvanic series- corrosion current -rate of corrosion.

MODULE II FORMS OF CORROSION 7

Forms of corrosion-conditions for electrochemical corrosion –galvanic corrosion – differential aeration corrosion: pitting, water line, wire fencing, crevice and filiform corrosion – stress corrosion – Intergranular corrosion- erosion corrosion – soil corrosion – microbiological corrosion- fretting corrosion- corrosion in composites.

MODULE III CORROSION CONTROL AND ORGANIC COATINGS 8

Corrosion control – selection of materials and designing- cathodic protection – sacrificial anode and impressed current cathodic protection – corrosion inhibitors: anodic, cathodic and vapour phase inhibitors.

Organic protective coatings – paints: constituents – functions – varnishes : types-constituents – functions – lacquers : constituents – functions –enamels-constituents – functions – special paints : fire retardant, water repellant, heat resistant, temperature indicating and luminous paints.

MODULE IV INORGANIC COATINGS 7

Treatment of metal surface-inorganic coatings- classification- metallic coatings : anodic and cathodic coatings-hot dipping : galvanizing and tinning- electroplating—electroless plating – cementation (diffusion) : sherardizing, calorizing and chromizing – metal cladding-metal spraying – non metallic coatings (chemical conversion coatings) : phosphate, chromate, oxide coatings and anodizing – comparison of anodic and cathodic protection.

PRACTICALS

1. Determination and comparison of rate of corrosion of metals in the presence of acid, base and neutral medium by weight loss method.
2. Determination of rate of corrosion of iron in the presence of various acids by weight loss method.
3. Determination of rate of corrosion of iron in the presence and absence of anodic Inhibitor by weight loss method.
4. Determination of rate of corrosion of iron in the presence and absence of cathodic Inhibitor by weight loss method.
5. Electroplating of base metal with copper.
6. Electrolessplating of base metal with copper
7. Chemical conversion coatings such as chromate and phosphate coatings.
8. Demonstration on the study of rate of corrosion by using cyclic voltametry.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. P.C Jain & Monica Jain, Engineering Chemistry Dhanpatrai Publishing Company (P) Ltd., New Delhi (2013).
2. S S Umare & S S Dara, A text Book of Engineering Chemistry, S. Chand& Company Ltd, New Delhi, 2014.
3. M.G. Fontana and N.G. Green, Corrosion Engineering, McGraw Hill Book Company, NewYork, 1984.
4. S. Banerjee, A.K. Tyagi, Functional Materials- Preparation, Processing and Applications, ELSEVIER Publications, London ; Waltham, MA : 2011

OUTCOMES:

Students will be able to

- explain the mechanism, compare and enumerate the factors affecting

corrosion

- describe and identify the place and types for a given situation.
- choose and elaborate the suitable organic coating method for a given real time situation.
- apply a suitable metallic coating for a given situation

CHCX03	ELECTRICAL MATERIALS AND BATTERIES	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students should be conversant with

- preparation, properties and applications of plastics used in electrical and electronic applications
- properties and uses of electrical engineering materials
- classification and description of different types of batteries.
- classification and types of fuel cells

MODULE I POLYMERS FOR ELECTRICAL AND ELECTRONIC APPLICATIONS **8**

Preparation, properties and applications **:** polyethylene, polypropylene, EPDM, Nylon-6,6, PVC, PTFE, polycarbonates, ABS, phenol formaldehyde, urea formaldehyde, epoxy resins – polymer blends and alloys.

MODULE II ELECTRICAL ENGINEERING MATERIALS **7**

Conductors: Silver, Copper, Gold, Aluminum – Semiconductors: Germanium, Silicon, Gallium Arsenic – Insulating Materials: Rubbers, Mica, Plastics, Ceramics, Insulating papers – Magnetic Materials: ferromagnetic materials, paramagnetic materials, diamagnetic materials, antiferromagnetic materials, ferrites

MODULE III BATTERIES **7**

Electrochemical and electrolytic cell – batteries: types (primary, secondary and flow cell) – primary batteries: dry cells, alkaline batteries – secondary batteries: nickel-cadmium cell – lead acid storage cell, lithium battery: primary and secondary type – solar cell – dye sensitized solar cell.

MODULE IV FUEL CELLS **8**

Difference between batteries and fuel cells - chemistry of fuel cells - types of fuel cell (based on temperature and electrolyte) – principle, characteristic features, advantages, disadvantages and applications of polymer electrolyte membrane or proton exchange membrane fuel cell (PEMFC), direct methanol fuel cell (DMFC), alkaline fuel cell (AFC), phosphoric acid fuel cell (PAFC), molten carbonate fuel cell (MCFC) and solid oxide

fuel cells (SOFC).

PRACTICALS

1. Free radical polymerization of styrene.
2. Free radical polymerization of PMMA.
3. Preparation of phenol-formaldehyde.
4. Preparation of urea-formaldehyde.
5. Synthesis of epoxy resin.
6. Demonstration of mechanical properties of insulating materials using UTM
7. Demonstration of electrical properties of insulating materials
8. Construction of batteries using natural resources
9. Measurement of EMF for different batteries.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Jain P.C. and Renuka Jain, Engineering Chemistry, Dhanpat Rai Publication Co. (P) Ltd., New Delhi, 2013.
2. Michael L. Berins, Plastics Engineering Hand Book, 5th Edition, Chapman and Hall, New York, 1991.
3. H.F. Mark and N. Gaylord, Encyclopedia of Polymer Science and Technology, Vol. 1 to XIV Interscience, 2nd Ed. 1988.
4. Gowarikar V.R., Viswanathan N.V and Jayadev Sreedhar, Polymer Science, Wiley Eastern Limited, Madras, 1981.
5. R.K. Rajput,A Textbook of Electrical Engineering Materials, Firewall Media, 2004
6. Vladimir S. Bagotsky, Fuel Cells: Problems and Solutions, 2nd Edition, John Wiley and Sons, 2012.
7. B. Viswanathan and M. Aulice Scibioh, Fuel Cells: Principles and Applications, Taylor and Francis Group, 2007.

OUTCOMES:

The student will be able to

- summarise the preparation, properties and applications of plastics used in electrical and electronic applications
- enumerate the properties and uses of electrical engineering materials
- illustrate various types of batteries with the aid of a diagram
- classify the fuel cells and elaborate the different types of fuel cells.

CHCX04	ENGINEERING MATERIALS	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students should be conversant with

- properties and uses of different types of refractories and abrasives
- adhesives, cements and lime, setting of cements and their chemical behaviors.
- types, properties and uses of lubricants.
- various types of composite materials.

MODULE I REFRACTORIES AND ABRASIVES **8**

Introduction refractory: -classification - based on chemical nature- characteristic and selection of good refractory - general manufacture of refractory- preparation properties and uses of: silica refractory - magnesite refractory - zirconia refractory, properties of refractories: refractoriness - refractoriness under load - thermal spalling - porosity and dimensional stability, Cermets - super refractory.

Abrasives : introduction - Moh's scale - natural abrasives: diamond – corundum – emery - garnet and quartz, synthetic abrasives: preparation properties and uses: carborundum (silicon carbide)– alundum - boron (norbide) carbide

MODULE II ADHESIVES AND BINDING MATERIALS **7**

Introduction - classification of adhesives –advantage –limitation of adhesive bonding – development of adhesive- factors influencing adhesive action: chemical and physical, application techniques of adhesive – Lime: classification – manufacture - setting and hardening, Gypsum: -Manufacture and properties and uses - Cement : chemical composition- Manufacture – setting and hardening – concrete – weathering of cement and concrete and its prevention- special cements: high alumina cement - sorel cement - white portland cement – water proof cement.

MODULE III LUBRICANTS **7**

Introduction –functions of lubricant- mechanism of lubrication - classification of lubricant – liquid lubricant: vegetable and animal oils – mineral oils, semisolid: grease(calcium, lithium, aluminium) – petroleum jelly, solid lubricant: graphite - molybdenum disulphide, Properties of lubricant: viscosity - viscosity index - flash point and fire point - cloud point and pour point – oiliness - aniline point - carbon residue.

MODULE IV COMPOSITE MATERIALS 7

Introduction – advantageous characteristics of composites, applications of composites, main constituent of composites, types and applications of composites: RCC fibre-reinforced plastics (glass , carbon and aramid) - particulate composite - metal matrix composite - layered composites - failures in fibre-reinforced composites, ceramic matrix composites (CMC) – properties and applications.

PRACTICALS

1. Preparation of refractory bricks
2. Preparation of abrasive papers/cloth
3. Preparation of simple adhesives
4. Estimation of alkalinity in cements
5. Determination of cloud point and pour point
6. Determination of flash point and fire point
7. Preparation of fibre-reinforced composite

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. P.C Jain & Monica Jain, Engineering Chemistry Dhanpatrai Publishing Company (P) Ltd., New Delhi (2013).
2. B.Sivasnakar, “Engineering Chemistry”, Tata McGrow-Hill Publication Limited, New Delhi, second reprint 2008.
3. Engineering Chemistry, Wiley India Editorial Team, Willey India Publisher, New Delhi, 2011.
4. S S Umare & S S Dara, A text Book of Engineering Chemistry, S. Chand& Company Ltd, New Delhi, 2014.

OUTCOMES:

The student will be able to

- classify and describe the manufacture the refractories and enumerate the properties and uses of abrasive materials.
- elaborate the manufacture, properties and uses of various adhesives and binding materials.
- classify lubricants and describe the properties and uses of them
- enumerate the properties and uses of various composite materials.

CHCX05	FUELS AND COMBUSTION	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make the students conversant with the

- three types of fuels available and the different processes involved in it.
- analysis of fuel characteristics and manufacture of fuels
- calculations involved in calorific values and minimum air requirement for complete combustion.
- classification, functions, mechanism and properties of lubricants.

MODULE I SOLID FUELS **7**

Characteristics of good fuel. Solid fuel – Wood, Coal – Ranking of coal – selection of coal. Analysis of coal – Proximate analysis. Pulverized coal – Metallurgical coke – Carbonization of coal – types. Manufacture of metallurgical coke – Beehive oven and Otto Hoffman's by-product oven methods.

MODULE II LIQUID AND GASEOUS FUELS **8**

Liquid fuel: Petroleum: Refining of petroleum, Liquid fuels derived from petroleum – Cracking: Thermal (Liquid and Vapour phase) – Catalytic (fixed bed and moving bed cracking – Synthetic petrol: Fischer-Tropsch method– Knocking in petrol and diesel engine: octane number and antiknocking – cetane number and improvement of cetane number – biodiesel (trans-esterification) – Gaseous fuels: Compressed natural gas (CNG) – LPG – oil gas – producer gas – water (blue) gas – biogas.

MODULE III COMBUSTION **8**

Calorific value: Gross and net caloric value – Bomb Calorimeter, Gas calorimeter - Definition of combustion – calculation of minimum requirement of air (problems) – theoretical calculation of calorific values (Dulong's formula), Gross and net calorific values ((problems) – Analysis of flue gas: Orsat's gas analysis method, explosive range, Ignition temperature. Introduction to air pollution from IC (Internal combustion) engines, photochemical smog, primary and secondary pollutants.

MODULE IV LUBRICANTS **7**

Friction and wear – lubricants: definition, functions and mechanism of lubrication

(thick film and thin film) –classification: liquid lubricants: animal and vegetable origin, mineral oil, blended oils, lubricating emulsions and silicones – properties of lubricating oils: viscosity and viscosity index; Flash and fire-point, Cloud and pour point, oiliness, emulsification number, volatility, carbon residue, aniline point – semisolid lubricant: greases and waxes – solid lubricant: graphite and molybdenum disulphide –nanolubricants.

PRACTICALS

1. Testing of fuels - proximate analysis (moisture, volatile matter, ash content and fixed carbon present in coal, coke, charcoal etc)
2. Ash content and carbon residue test
3. Biodiesel synthesis by trans-esterification method (from coconut, groundnut, mustard oil, palm oil)
4. Determination of calorific value of a solid fuel using Bomb calorimeter (coal, charcoal, coke etc)
5. Determination of calorific value of a liquid fuel using Bomb calorimeter (petrol, diesel, biodiesel etc)
6. Determination of cloud point and pour point of a lubricant
7. Determination of flash and fire point of diesel.
8. Aniline Point of diesel
9. Viscosity Index of lubricants and Fuels by Viscometer
10. Flue gas analysis by Orsat's gas analysis method – Demonstration
11. Working of internal combustion engine – Demonstration

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai and Sons, New Delhi, 2001.
2. Engineering Chemistry, Wiley India Editorial Team, Willey India Publisher, New Delhi, 2011.
3. John Griswold, Fuels Combustion and Furnaces, Mc-Graw Hill Book Company Inc. University of Michigan, 1946.
4. J.B. Heywood, Internal Combustion Engine Fundamentals, McGraw Hill International Editions, 1989.
5. Bahl B.S., Tuli and Arun Bahl, Essentials of Physical Chemistry, S. Chand and Company Ltd., New Delhi, 2004.

OUTCOMES:

The students will be able to

- compare and contrast the solid, liquid and gaseous fuels and also describe the processes involved in liquid and gaseous fuels.
- analyse the fuel properties such as moisture, votalite matter, ash content, calorific value etc
- calculate minimum air required for complete combustion and calorific values of fuels.
- categorize different lubricants into three types, explain the preparation and determine their properties.

CHCX06	FUNDAMENTALS OF PHYSICAL CHEMISTRY	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students will be conversant with the

- various thermodynamic terms and relate the laws of thermodynamics in chemical processes
- molecularity and order of reaction and derive the rate constant for different order of reactions
- basics of adsorption of different materials and propose mechanisms and surface area measurement
- conditions for equilibrium and learn different components at equilibrium

MODULE I BASIC THERMODYNAMICS **8**

Introduction - Thermodynamic terms - Thermodynamic equilibrium and processes - 1st law of thermodynamics: internal energy, enthalpy, heat capacity, isothermal and adiabatic expansion, Joule-Thomson effect - Zeroth law of thermodynamics: absolute temperature - 2nd law of thermodynamics: - spontaneous and cyclic process, Entropy in isothermal, isobaric and isochoric processes, work and free energy function, Maxwell's relation - 3rd law of thermodynamics

MODULE II CHEMICAL KINETICS **8**

Rate of chemical reaction - order and molecularity of a reaction - Rate constant - kinetics of opposing, parallel and consecutive and chain reactions - isotope effects - effect of temperature on reaction rate - collision theory - absolute reaction rate theory - kinetics in enzyme catalysis

MODULE III SURFACE SCIENCE AND CATALYSIS **8**

Adsorption - adsorption isotherms - uni and bimolecular adsorption reactions - parahydrogen conversion - factors affecting adsorption – Langmuir adsorption isotherm - Hinshelwood mechanism and *Eley-Rideal* mechanism with example - adsorption of gases on solids and surface area measurement by BET method - Terms in catalysis - homogeneous and heterogeneous and enzyme catalysis with example

MODULE IV PHASE RULE **6**

Terms involved - Conditions for equilibrium - application of phase rule to water, lead-silver system, freezing mixtures, thermal analysis: cooling curves.

PRACTICALS

1. Determination of the heat capacity of benzoic acid, internal energy of combustion of camphor using Bomb calorimeter. Calculation of enthalpy of combustion and formation for camphor.
2. Determination of adsorption isotherm of (i) acetic acid on charcoal (ii) oxalic acid on charcoal.
3. *Kineticsoffirst and second order reactions.*
4. Phase rule experiments with organic compounds: (i) naphthalene and p-dichloro benzene (ii) naphthalene and diphenyl (iii) m-dinitrobenzenzene and p-nitro toluene.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Rajaram J. and Kuriacose J.C., Chemical Thermodynamics: Classical, Statistical and Irreversible, Pearson Education, India, 2013.
2. Samuel Glasstone, Thermodynamics for Chemists, Read Books, United Kingdom, 2007.
3. James E. House, Principles of Chemical Kinetics, 2nd Edition, Academic Press, United States of America, 2007.
4. Keith J. Laidler, Chemical Kinetics, Pearson Education, India, 1987.
5. Douglas M. Ruthven, Principles of Adsorption and Adsorption Processes, John Wiley & Sons, 1984.
6. Puri B.R., Sharma L.R. and Pathania M.S., Principles of Physical Chemistry, 47th Edition, Vishal Publishing Co. India, 2016.

OUTCOMES:

The student will be able to

- calculate entropy, enthalpy and free energy change for different chemical processes
- calculate the rate constant for any chemical and biochemical processes
- differentiate the adsorption processes and calculate the surface area and predict the suitability of catalysts for different chemical processes
- predict the equilibrium conditions for water, alloys, freezing mixtures and draw the thermal curves for phase transition

CHCX07	GREEN TECHNOLOGY	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make students conversant with the

- basic principles of green chemistry and green technology.
- wastes that causes hazards to human health
- chemicals that harms our environment
- need for green processes in various industries

MODULE I GREEN CHEMISTRY PROTOCOL **7**

Need – Significance – 12 Principles with examples – R4 model – Life cycle analysis – sustainable and cleaner production - Green Technology: definition, examples: CFC free refrigerants, green building, energy, 3D printers, nanotechnology – Awards for Green chemistry – organization promoting green chemistry.

MODULE II WASTE & WASTE MINIMISATION **8**

Source of wastes: domestic, industrial, medical, nuclear, e-waste; problems; prevention – economy of waste disposal – Waste minimization techniques: general waste treatment and recycling – alternate waste water treatment technologies: hybrid process – Green computing: goals, green cloud, green ICT - Pollution statistics from various industries (Industrial case studies).

MODULE III GREEN SYNTHESIS **7**

Introduction - Solvent free reactions - green reagents, green solvents in synthesis - microwave and ultrasound assisted reactions – supercritical fluid extraction – green oxidation and photochemical reactions – catalyst and biocatalysts.

MODULE IV GREEN INDUSTRIAL PROCESSES **8**

Polymer industry: biodegradable polymer - textile industry: greener approaches of dyeing, waste disposal – ecofriendly agrochemicals: biofertilizers, biopesticides – Pharmaceutical industry: atom economy, reduction of toxicity, use of biocatalyst, zero waste disposal – Leather industry: greener process in tanning, crusting, surface coating – ecofriendly batteries & fuel cells.

PRACTICALS

1. Synthesis of an ionic liquids (Ex: imidazolium) and testing the solubility of organic

chemicals.

2. Green bromination of stilbene (using pyridine hydrobromide).
3. Green synthesis: Photocatalytic reactions, solvent-free organic reaction – Aldol; green oxidation, green reduction.
4. Microwave assisted chemical reaction. (synthesis of aspirin, pinacol-pinacolone reaction, etc).
5. Comparison of conventional reaction with microwave assisted reactions (atom economy, solvent, etc) [Ex: aldehyde and ketones with hydrazines to give hydrazones].
6. Diels-Alder reaction in eucalyptus oil (green process).

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai and Sons, New Delhi. 2001.
2. V. K. Ahluwalia, Green Chemistry: Environmentally Benign Reactions, Ane Books India, New Delhi, 2006.
3. Paul Anastas, John C.Warner, John Warner Joint; Green Chemistry: Theory & Practice New Ed Edition; Oxford University press, USA, 2000.
4. Rashmi Sanghi, M. M. Srivastava, Green chemistry, Narosa publishers, New Delhi, 2003.

OUTCOMES:

The students will be able to

- outline the principles and implications of green chemistry.
- comprehend the potential risks of waste generated and analyse the threats to human and environment.
- integrate information into design of molecules to avoid/eliminate toxic solvents & reagents or reduce toxic products.
- identify various alternate greener technologies for various industries.

CHCX08	ORGANIC CHEMISTRY OF BIOMOLECULES	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make students conversant with the

- basic concepts in organic chemistry
- types and structure of carbohydrates and lipids
- formation of different structures of proteins from amino acid
- structure of nucleic acids

MODULE I BASIC CONCEPTS IN ORGANIC CHEMISTRY **8**

Classification and IUPAC nomenclature of organic compounds – stereochemistry – optical, stereo and geometrical isomerism – types of reagents: electrophiles and nucleophiles – types of reactions: addition, substitution, elimination and rearrangement reactions.

MODULE II CARBOHYDRATES, LIPIDS AND VITAMINS **7**

Structure and functions of carbohydrates: mono, di, oligo and polysaccharides – lipids: phospholipids, glycolipids, sphingolipids – cholesterol – steroids – Structure, functions and deficiency disorders of fat soluble vitamins: A, D, E & K - Water soluble vitamins B & C: Thiamine, riboflavin, pantothenic acid, niacin, pyridoxine, biotin, cobalamine, folic acid and ascorbic acid.

MODULE III AMINO ACIDS, PEPTIDES AND PROTEINS **7**

Aminoacids: classification, properties - peptides – polypeptides – proteins: primary, secondary, tertiary and quaternary structure – glycoproteins – lipoproteins – Enzymes: classification and functions

MODULE IV NUCLEIC ACIDS **8**

Nucleic acids – importance - structure of purines and pyrimidines – nucleotides – polynucleotides - RNA – types & structure - DNA – phosphodiester bonds – chemical, helical structure and functions – DNA replication – gene modification.

PRACTICALS

1. Qualitative tests to identify carbohydrates.

2. Quantitative estimation of carbohydrates.
3. Separation of sugars – TLC and/or paper chromatography.
4. Quantitative estimation of lipids.
5. Separation of amino acids – TLC and/or paper chromatography.
6. Quantitative estimation of proteins by Lowry's method.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. V. K. Ahluwalia, Organic Reaction Mechanism, Narosa Publishers, New Delhi, 2002.
2. Johnson Arthur T., Biology for Engineers, CRC Press, Finland, 2011.
3. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai and Sons, New Delhi. 2001.
4. David L. Nelson, Michael M. Cox, Lehninger Principles of biochemistry, Macmillan press, London, 2010

OUTCOMES:

The students will be able to

- classify organic compounds and explain the mechanism of various organic reactions.
- draw the structures and enumerate the functions of carbohydrate, lipids and vitamins.
- correlate the relationship among amino acids, peptides and proteins.
- recognize the role of nucleic acid in the formation of RNA & DNA and differentiate DNA & RNA using their structure and function.

CHCX09	POLYMER SCIENCE AND TECHNOLOGY	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make the student conversant with the

- basic concepts of polymers, classification, types of polymerization and molecular weight & its distribution
- preparation, properties and applications of thermoplastics and introduction to biodegradable polymers
- properties and applications of thermosets, elastomers and FRP
- different types of moulding techniques

MODULE I BASIC CONCEPTS OF POLYMERS **8**

Definitions: monomer, polymer, functionality, degree of polymerization – classification of polymers: source, structure, application, thermal processing behavior (thermoplastics and thermosets), composition and structure (addition and condensation), mechanism (chain growth and step-wise growth) – copolymer: types – Definition –nomenclature of polymers – tacticity – types of polymerization : free radical, cationic and anionic polymerization (concepts only) – average molecular weight of polymer: number, weight – molecular weight distribution (problems)

MODULE II THERMOPLASTICS AND BIODEGRADABLE POLYMERS **8**

Preparation, properties and applications : LDPE, HDPE, polypropylene, PVC, PTFE, PET, polyamides (Nylon-6 and Nylon 6,6) and polycarbonates – polymer blends and alloys – basics of biodegradable polymers.

MODULE III THERMOSET RESINS, ELASTOMERS AND FRP **7**

Thermoset resins : phenolic resins, amino resins (urea and melamine formaldehyde), epoxy resins, unsaturated polyesters – polyurethanes – elastomers : vulcanization of natural rubber, diene based elastomers –fibre reinforced plastics: glass, aramid and carbon.

MODULE IV MOULDING TECHNIQUES 7

Moulding constituents**:** functions – moulding techniques**:** compression, injection, extrusion (single screw), blow moulding, thermoforming, (mechanical and vacuum forming), lamination.

PRACTICALS

1. Determination of molecular weight and degree of polymerization using Oswald's viscometer.
2. Free radical polymerization of styrene.
3. Free radical polymerization of PMMA.
4. Preparation of phenol-formaldehyde.
5. Preparation of urea-formaldehyde.
6. Synthesis of epoxy resin.
7. Synthesis of unsaturated polyester.
8. Preparation of FRP laminates.
9. Demonstration of injection moulding, compression moulding and blow moulding.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Billmeyer F.N., Text Book of Polymer Science, 3rd Edition, John Wiley and Sons, New York, 1994.
2. George Odian, Principles of Polymerisation, 3rd Edition, McGraw Hill Book Company, New York, 1991.
3. Michael L. Berins, Plastics Engineering Hand Book, 5th Edition, Chapman and Hall, New York, 1991.
4. Jacqueline I., Kroschwitz, Concise Encyclopedia of Polymer Science and Engineering, John Wiley and Sons, New York, 1998.
5. Encyclopedia of Polymer Science and Technology, Vol. 1 to XIV, H.F. Mark and N. Gaylord, Interscience, 2nd Ed. 1988.
6. Gowarikar V.R., Viswanathan N.V and Jayadev Sreedhar, Polymer Science, Wiley Eastern Limited, Madras, 1981.

OUTCOMES:

The student will be able to

- classify various polymers, name the polymers and types of polymerization

reactions, calculate molecular weight of polymers,

- summarise preparation, properties and applications of thermoplastics and give examples of biodegradable polymers
- elaborate the properties and applications of thermosets, elastomers and FRP
- select the appropriate moulding technique for a given polymer, based on the application

Maths Elective Courses

(to be offered in IV

Semester)

MACX 01	**DISCRETE MATHEMATICS AND GRAPH THEORY**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

OBJECTIVES:

The aims of this course are to

- introduce Logical and Mathematical ability to deal with abstraction.
- familiarize the basic mathematical ideas and terminologies used in computer science.
- translate real life situations into diagrammatic representations.

MODULE I PROPOSITIONAL CALCULUS 8

Propositions – Logical connectives – Compound propositions – Conditional and biconditional propositions – Truth tables – Tautologies and contradictions – Contrapositive – Logical equivalences and implications – DeMorgan's Laws – Normal forms – Principal conjunctive and disjunctive normal forms – Rules of inference – Arguments – Validity of arguments.

MODULE II PREDICATE CALCULUS 7+3

Predicates – Statement function – Variables – Free and bound variables – Quantifiers – Universe of discourse – Logical equivalences and implications for quantified statements – Theory of inference – The rules of universal specification and generalization – Validity of arguments.

MODULE III FUNCTIONS 7+3

Functions – Classification of functions –– Composition of functions – Inverse functions – Binary and n–ary operations – Characteristic function of a set – Hashing functions – Recursive functions – Permutation functions.

MODULE IV ALGEBRAIC SYSTEMS 8+2

Groups, Cyclic Groups, Subgroups, Cosets, Lagrange's theorem, Normal subgroups – Codes and group codes – Basic notions of error correlation – Error recovery in group codes.

MODULE V GRAPH THEORY 7+3

Graphs – incidence and degree – subgraphs – isomorphism – complement of a graph – operations on graphs

MODULE VI PATH AND CIRCUIT 8+2

Walks, trails and paths – Eulerian graphs – Konigsburg bridge problem - Hamiltonian graphs

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1 Trembly J.P and Manohar R, “Discrete Mathematical Structures with Applications to Computer Science”, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, 30th Reprint 2011.

2 Kenneth H.Rosen, “Discrete Mathematics and its Applications:, 7th Edition, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, Special Indian Edition, 2011.

REFERENCES:

1 Ralph.P.Grimaldi, “Discrete and Combinatorial Mathematics: An Introduction”, 4th Edition, Pearson Education Asia, Delhi, 2007.

2 Thomas Koshy, “Discrete Mathematics with Applications”, Elsevier Publications, 2006.

3 C.L.Liu, D.P.Mohapatra, “Elements of Discrete Mathematics”, 4th Edition, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, 2012.

OUTCOMES:

At the end of the course, student will be able to

- use the concepts of propositional calculus.
- use the concepts of predicate calculus.
- identify types of functions and their importance.
- decode and encode the messages using group theory concepts.
- apply the basic concepts of graph theory.
- represent some real life situations into diagrammatic representation.

MACX 02 PROBABLITY AND STATISTICS L T P C
3 1 0 4

OBJECTIVES:

The aims of this course are to impart the

- knowledge of the theory of probability and random variables
- techniques to carry out probability calculations and identifying probability distributions
- application of statistical inference in practical data analysis

MODULE I BASICS OF PROBABILITY AND STATISTICS 8+2

Sample space, events- axioms of probability and interpretation – Addition, multiplication rules – conditional probability, Independent events - Total probability – Baye's theorem - Descriptive Statistics.

MODULE II ONE DIMENSIONAL RANDOM VARIABLE AND PROBABILITY DISTRIBUTION FUNCTIONS 7+3

Discrete random variable –continuous random variable – Expectation - probability distribution - Moment generating function – Binomial, Poisson, Geometric, Uniform (continuous), Exponential and Normal distributions.

MODULE III TWO DIMENSIONAL RANDOM VARIABLES 8+2

Joint, marginal, conditional probability distributions –covariance, correlation - transformation of random variables.

MODULE IV SAMPLING AND ESTIMATION 7+3

Sampling distributions – basic knowledge on Random , simple random , stratified and cluster samplings – Test of Hypotheses - concepts- Point estimation and Interval estimation.

MODULE V THEORY OF INFERENCE 8+2

Large sample tests – test for single and difference on proportions, single mean, difference of means, difference of variances – confidence intervals. Small sample tests – Student's t test, F test and Chi square test on theory of goodness of fit and analyses of independence of attributes.

MODULE VI DESIGN OF EXPERIMENTS 7+3

Analysis of variance – one way classification – two way classification – Completely

Randomised Block Designs – Randomised Block Design – Latin square designs - Interpretations - case studies.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. T.Veerarajan, “Probability and Statistics”, Tata McGraw-Hill Education, 2008.
2. Miller, I., Miller, M.,Freund, J. E., “Mathematical statistics”, 7th Edition, Prentice Hall International, 1999.
3. S.P.Gupta, “Applied Statistics”, Sultan Chand & Sons

REFERENCES:

1. S.M.Ross, “Introduction to Probability and Statistics for Engineers and Scientists” Fifth Edition, Elesvier.
2. S.C.Gupta and V.K.Kapoor, “Fundamentals of Mathematical Statistics” First edition, Sultan Chand and Sons.
3. Arora and Arora, “Comphrensive Statistical Methods”, S. Chand, 2007

OUTCOMES:

On completion of the course, students will be able to

- do basic problems on probability and descriptive statistics.
- derive the probability mass / density function of a random variable.
- calculate probabilities and derive the marginal and conditional distributions of bivariate random variables.
- calculate point and interval estimates.
- apply some large sample tests and small sample tests.
- carry out the data collection representation analysis and implications and the importance of inferences.

MACX 03	RANDOM PROCESSES	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aims of the course are to

- acquire the knowledge of the theory of probability and random variables
- study discrete and continuous probability distributions.
- demonstrate the techniques of two dimensional random variables and its distributions.
- introduce the random process, stationarity, Markov process and the study of correlation function and spectral analysis.

MODULE I Basics of Probability 7+3

Sample space, events- axioms of probability and interpretation – Addition, multiplication rules – conditional probability, Independent events - Total probability – Baye's theorem - Tchebychev's inequality.

MODULE II One dimensional Random variable and Probability Distribution functions 7+3

Discrete random variable –continuous random variable – Expectation - probability distribution - Moment generating function – Binomial, Poisson, Geometric, Uniform (continuous), Exponential and Normal distributions.

MODULE III Two dimensional random variables 7+3

Joint, marginal, conditional probability distributions - covariance, correlation and regression lines - transformation of random variables.

MODULE IV RANDOM PROCESSES 8+2

Classification of Random process - Stationary process - WSS and SSS processes - Poisson process – Markov Chain and transition probabilities.

MODULE V CORRELATION FUNCTIONS 8+2

Autocorrelation function and its properties - Cross Correlation function and its properties - Linear system with random inputs – Ergodicity.

MODULE VI SPECTRAL DENSITY 8+2

Power spectral Density Function - Properties - System in the form of convolution - Unit Impulse Response of the System – Weiner-Khinchine Theorem - Cross Power

Density Spectrum.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Veerarajan T., “Probability, Statistics and Random Processes”, Tata McGraw Hill,3rd edition, 2008.
2. Papoulis, “Probability, Random Variables and Stochastic Processes”, 4th Edition, Tata McGraw Hill Company, 2002.
3. S.M.Ross, “Introduction to Probability and Statistics for Engineers and Scientists” Fifth Edition, Elesvier

REFERENCES:

1. Scott L. Miller,Donald G. Childers, Probability and Random Processes, Academic Press,2009.
2. Trivedi K S, “ Probability and Statistics with reliability, Queueing and Computer Science Applications”,Prentice Hall of India,New Delhi,2nd revised edition, 2002

OUTCOMES:

On completion of the course, students will be able to

- do basic problems on probability.
- derive the probability mass / density function of a random variable.
- calculate probabilities and derive the marginal and conditional distributions of bivariate random variables.
- identify and study the different random processes.
- compute correlation functions and related identities.
- compute power spectral density functions and apply Weiner-Khinchine formula.

MACX 04 APPLIED NUMERICAL METHODS L T P C
3 1 0 4

OBJECTIVES:

The aims of the course are to

- introduce basic computational methods for analyzing problems that arise in engineering and physical sciences.
- acquire knowledge about approximation theory and convergence analysis associated with numerical computation.

MODULE I NUMERICAL SOLUTIONS OF EQUATIONS 7+3

Bisection method - Regula Falsi method – Secant method - Fixed point iteration method - Newton's Raphson method –Gauss Elimination method - Gauss-Jordon method – Gauss Jacobi method - Gauss-Seidel method.

MODULE II INTERPOLATION 8+2

Finite difference operators – Gregory Newton's forward and backward interpolations – Cubic spline interpolation - Lagrange interpolation - Newton's divided difference formula.

MODULE III NUMERICAL DIFFERENTIATION AND INTEGRATION 8+2

Numerical differentiation using Newton's forward and backward formulae – Numerical integration : Trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Gaussian Two Point and Three Point Quadrature formulae – Double integrals using Trapezoidal and Simpson's 1/3 rule.

MODULE IV INITIAL VALUE PROBLEMS FOR FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS 7+3

Numerical solutions by Taylor's Series method, Euler's method, Modified Euler's Method - Runge – Kutta Method of fourth order – Milne's and Adam's Bashforth Predictor and Corrector methods

MODULE V INITIAL AND BOUNDARY VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 8+2

Numerical solutions by Taylor's Series method - Runge – Kutta Method of fourth order of second order ODE. Finite difference methods.

MODULE VI BOUNDARY VALUE PROBLEMS FOR PARTIAL DIFFERENTIAL EQUATIONS **7+3**

Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace equation.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Grewal, B.S., “Numerical methods in Engineering and Science”, 7th edition, Khanna Publishers, 2007.
2. C.F.Gerald, P.O.Wheatley, “Applied Numerical Analysis” ,Pearson Education, New Delhi, 2002.

REFERENCES:

1. Chapra S.C, Canale R.P. “Numerical Methods for Engineers”, 5th Ed., McGraw Hill, 2006.
2. M.K.Jain, S.R.K.Iyengar, R.K.Jain, “Numerical methods for Scientific and Engineering Computation”, New Age International Publishers, New Delhi, 2003

OUTCOMES:

At the end of this course, students will be able to

- solve algebraic, transcendental and system of equations.
- apply interpolation techniques.
- carry out numerical differentiation and integration using different methods.
- solve first order ODE using single and multi step methods.
- solve second order ODE, initial and boundary value problems.
- solve the boundary value problems in PDE.

Maths Elective Courses
(To be offered in VI Semester)

MACX 05	MATHEMATICAL PROGRAMMING	L	T	P	C
		2	0	0	2

OBJECTIVES:

The aims of the course are to

- acquire knowledge and training in optimization techniques.
- obtain knowledge about optimization in utilization of resources.
- understand and apply operations research techniques to industrial operations.

MODULE I LINEAR PROGRAMMING PROBLEM 10

Linear programming – formulation of the problem - graphical interpretation of optimality - Simplex method – to obtain basic feasible solution – types of linear programming solution – complications and their resolution.

MODULE II ADVANCED LINEAR PROGRAMMING PROBLEMS 8

Artificial variable - Big M method – Two phase method – alternative optimal solution – unbounded solution - Duality – primal dual relationships.

MODULE III TRANSPORTATION PROBLEM 7

Transportation problems – Initial basic feasible solutions, MODI method, Unbalanced transportation problem, Degeneracy in transportation models,.

MODULE IV ASSIGNMENT PROBLEM 5

Assignment problem – Minimization and Maximization type of problems by Hungarian method.

Total Hours –30

TEXT BOOKS:

1. Hamdy A Taha, “Operations Research - An introduction”, 8th edition, Phil Pearson, 2007.
2. Winston.W.L., “Operations Research”, 4th edition, Thompson-Brooks/Cole, 2003.

REFERENCES:

1. Wayne.L. Winston, “Operations Research Applications and Algorithms”,

4th edition, Thomson learning, 2007.

2. Frederick. S. Hiller and Gerald J Lieberman, “Operations Research Concepts and Cases”, 8th edition (SIE), Tata McGraw – Hill Pub. Co. Ltd., New Delhi, 2006.
3. A. Ravindran, D. T. Phillips and J. J. Solberg, "Operations Research: Principles and Practice", 2nd edition, John Wiley & Sons, New York, 1992.
4. Robertazzi. T.G., “Computer networks and systems-Queuing theory and performance evaluation”, 3rd edition, Springer, 2002.

OUTCOMES:

At the end of the course, students will be able to

- formulate industrial problems as mathematical programming problems.
- solve linear programming problems by different methods.
- solve transportation problems by different methods.
- solve assignment problems by Hungarian method.

MACX 06	STATISTICAL METHODS FOR DATA ANALYSIS	L	T	P	C
		2	0	0	2

OBJECTIVES:

The aim of the course is to

- introduce statistical quality control tools.

MODULE I TESTS OF HYPOTHESES AND STATISTICAL INFERENCES 8

Small sample tests – Student's ' t ' test for single mean , difference of means, paired t test – F test for difference of variances – Chi square test on theory of goodness of fit and analyses of independence of attributes.

MODULE II DESIGN OF EXPERIMENTS 7

Analysis of variance – one way classification – two way classification – Completely Randomised Block Designs – Randomised Block Design – Latin square designs - Statistical analysis -Interpretations - case studies.

MODULE III STATISTICAL QUALITY CONTROL-I 8

Quality improvement and statistics –Statistical quality control- statistical process control – control charts – design of control charts –analysis of patterns on control charts - X bar chart, R chart and S chart.

MODULE IV STATISTICAL QUALITY CONTROL-II 7

Process and product control – attribute charts – P, np and C charts – control charts performance.

Total Hours –30

TEXT BOOKS:

1. Douglas C.Montgomery, George C. Runger "Applied Statistics and probability for Engineers" V Edition – John Wiley & Sons Inc.
2. Miller, I., Miller, M., Freund, J. E. "Mathematical statistics" 7th Edition. Prentice Hall International, 1999.

REFERENCES:

1. Dekking, F.M., Kraaikamp, C., Lopuhaä, H.P., Meester, L.E. "A Modern Introduction to Probability and Statistics" Springer, 2nd Edition.
2. Chin Long chiang "Statistical Methods of Analysis "World Scientific Books,

2003.
3. S.C.Gupta and V.K. Kapoor, “Mathematical Statistics” , Sultan Chand publications.
4. Veerarajan “Fundamentals of Mathematical Statistics” I Edition, Yes Dee Publishing Pvt. Ltd., 2017.

OUTCOMES:

On completion of the course, students will be able to

- develop and test hypothesis for different statistical tests
- design an experiment and case study the experiment with different data.
- analyze the industrial data using quality control design tools statistically.
- analyze the industrial data using process and product control tools statistically.

MACX 07 NUMERICAL METHODS FOR INTEGRATION AND DIFFERENTIAL EQUATIONS

L	T	P	C
2	0	0	2

OBJECTIVES:

- This course aims to solve numerically integral and differential equations.

MODULE I NUMERICAL INTEGRATION **8**

Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Two Point and Three point Gaussian quadrature formulae.

MODULE II NUMERICAL DOUBLE INTEGRATION **6**

Double integrals using trapezoidal and Simpson's 1/3 rules

MODULE III NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS **8**

Milne's Predictor and Corrector Method – Adam's Predictor-Corrector Method - Finite difference methods for two – point Boundary Value problems for Ordinary Differential Equations.

MODULE IV BOUNDARY VALUE PROBLEMS FOR PARTIAL DIFFERENTIAL EQUATIONS **8**

Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace and Poisson equations

Total Hours –30

TEXT BOOKS:

1. M.K.Jain, S.R.K.Iyengar, R.K.Jain, "Numerical methods for Scientific and Engineering Computation", New Age International Publishers, New Delhi, 2003.
2. Grewal, B.S., "Numerical methods in Engineering and Science" 7th edition, Khanna Publishers, 2007

REFERENCES:

1. C.F.Gerald, P.O.Wheatley, "Applied Numerical Analysis" Pearson Education, New Delhi 2002.
2. P.Dechaumphai, N. Wansophark, "Numerical Methods in Engineering", Narosa Publications, 2012.

OUTCOMES:

At the end of the course students will be able to

- solve the integration by numerical methods.
- solve the double integration by numerical methods
- find numerical solution of ordinary differential equations in engineering problems.
- find numerical solution of partial differential equations in engineering problems.

MACX 08 MATHEMATICAL MODELLING

L	T	P	C
3	0	0	3

OBJECTIVES:

The aims of the course are to

- provide basic idea of formation and use of Mathematical models for different purposes.
- determine the extent to which models are able to replicate real-world phenomena under different conditions

MODULE I PRINCIPLES OF MATHEMATICAL MODELING 7

Mathematics as a modelling language - Classification of models - Building, studying, testing and using models - Black and white box models – Difference equations

MODULE II PHENOMENOLOGICAL MODELS 7

Linear, Multiple linear and nonlinear regression - Neural networks - Fuzzy model - Stability and higher dimensional systems

MODULE III MECHANISTIC MODELS –I 8

Setting up ODE models – Initial and Boundary value problems - Numerical solutions - Fitting ODE to data - Applications

L	T	P	C
2	0	0	2

MODULE IV MECHANISTIC MODELS –II 8

Linear and nonlinear equations - Elliptic, parabolic and hyperbolic equations - Closed form solutions - Finite difference and finite element methods

Total Hours –30

TEXT BOOKS:

1. G . Ledder , “Calculus, modelling , probability and dynamic systems”, Springer 2013
2. Kei Velten, “Mathematical modelling and simulation”, J. Wiley and sons,2009

REFERENCES:

1. Michael D Alder, “An introduction to Mathematical modelling”, Heaven for Books.com
2. Alfio Quarteroni, “Mathematical models in science and engineering”, Notices of AMS
3. J.N. Kapur, “Mathematical models in Biology and Medicine”, Affiliated East-

West Press Private Limited, New Delhi, 1992.

OUTCOMES:

On completion of the course, the students will be able to

- identify the relationship between real world and mathematical models
- Classify the data and choose the appropriate model
- Distinguish between linear and nonlinear models
- identify the relationship between empirical and mechanistic models

MACX 09 **GRAPH THEORY** **L T P C**

3 0 0 3

OBJECTIVES:

The aims of this course are to

- represent the real life situations diagrammatically.
- appraise different methods to find solutions to graph theory problems.

MODULE I INTRODUCTION TO GRAPH THEORY **8**

Graphs - finite and infinite graphs - Incident and degree-isolated vertex, pendent vertex and null vertex.

MODULE II PATH AND CIRCUIT **8**

Isomorphism – sub graphs-walks, paths and circuits – connected and disconnected graphs- Euler graphs – operation on a graph.

MODULE III TREES AND FUNDAMENTAL CIRCUITS **7**

Trees- some properties of trees- pendent vertices in a tree – rooted binary tree-spanning trees-fundamental circuits.

MODULE IV CUT SETS AND CUT VERTICES

Cut sets – some properties of cut sets- fundamental circuits and cut sets-network flows.

Total Hours –30

TEXT BOOKS:

1. NARSINGH DEO, Graph theory with applications to Engineering and Computer Science, Prentice Hall INC, New Delhi,
2. J.A. Pondy and U.S.R. Murthy, North Holland, Oxford, New York Graph theory with applications

REFERENCES:

1. Trembly J.P and Manohar R, “Discrete Mathematical Structures with Applications to Computer Science”, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, 30th Reprint 2011
2. Kenneth H.Rosen, “Discrete Mathematics and its Applications”, 7th Edition, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, Special Indian Edition, 2011

3. Md. Saidur Rahman, “Basic graph theory”, Springer, 2017

OUTCOMES:

At the end of the course, students will be able to

- demonstrate the basic concepts of Graph theory.
- explore connected and disconnected graphs.
- identify the real life problems with trees and circuits.
- bring out the cut set properties and network flows properties.

Humanities Elective I

(To be offered in III Semester)

		L	T	P	C
SSCXO1	**FUNDAMENTALS OF ECONOMICS**	**2**	**0**	**0**	**2**

OBJECTIVES:

- To identify and present the basic concepts of demand, supply and equilibrium.
- To explain and discuss the types and concepts of national income and inflation.
- To illustrate the fundamental concepts of money, banking and public finance.
- To apprise the students about Indian economy and the role of engineers in economic development.

MODULE I DEMAND AND SUPPLY ANALYSIS 8

Classification of economy – open and closed economy, Demand - Types of demand - Determinants of demand – Law of Demand - Demand elasticity - Supply - Determinants of Supply – Law of Supply - Supply elasticity - Pricing strategies.

MODULE II NATIONAL INCOME AND INFLATION 7

Concepts of National income and measurement – Importance and difficulties of estimating National Income in India - Aggregate demand and aggregate supply, Macroeconomic equilibrium – meaning of inflation- types - causes and preventive measures

MODULE III MONEY, BANKING AND PUBLIC FINANCE 9

Money – Meaning, types, functions, importance - Commercial Banks - Central Bank - Monetary policy – meaning, objectives, Methods of Credit Control By RBI, Government Budget – Government revenue and Expenditures – Fiscal policy - Its objectives, instruments and limitations - Deficit Financing - The Fiscal Responsibility and Budget Management Act, 2003 (FRBMA) .

MODULE IV INDIAN ECONOMY AND THE ROLE OF ENGINEERS 6

Economic reforms – Liberalization, Privatization and Globalization - challenges and opportunities, Engineers – Engineers' contributions to the economic growth.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Dutt and Sundharam (2013), *Indian Economy*, S. Chand & Company Pvt. Ltd, New Delhi.
2. Hussain, Moon Moon (2015), *Economics for Engineers*, Himalaya Publishing House, New Delhi.

REFERENCES:

1. Cleaver Tony (2004), "*Economics: The Basics*", Routledge, London.
2. Mell Andrew and Walker Oliver (2014), "*The Rough Guide to Economics*", Rough Guide Ltd.

OUTCOMES:

On successful completion of this course,

- Students will have had exposure to the basic concepts of demand, supply and various pricing strategies.
- Students will have understood the macroeconomic concepts of national income and inflation.
- Students will be able to apply the knowledge of money, banking and public finance in their real life situations.
- Students will have an overview of the economic reforms introduced in Indian economy.

SSCXO2 PRINCIPLES OF SOCIOLOGY.

L	T	P	C
2	0	0	2

OBJECTIVES:

- To acquaint the students with Concepts and perspectives of Sociology
- To explain the reflection of society in Individuals and vice versa
- To describe the hierarchical arrangement of individuals and groups in society
- To explicate the dimensions, forms and factors of Social change.
- To examine the context, impact and agencies of Globalization

MODULE I THE FOUNDATIONAL CANON 8

Sociology-Definition, scope and importance; Major theoretical perspectives- Functionalism, Conflict Theorising and Interactionism; Elements of social formation- Society, Community, Groups and Association; Associative Social Process- Co-operation, Accommodation and Assimilation; Dissociative Social Process- Competition and Conflict.

MODULE II INDIVIDUAL AND SOCIETY 7

Culture-definition, characteristics, functions, types, cultural lag and civilization, Socialization – definition, process, stages, agencies and anticipatory socialization; Social Control- definition, characteristics, importance, types & agencies.

MODULE III SOCIAL INEQUALITY AND STRATIFICATION 7

Concepts- inequality, hierarchy, differentiation, Social Exclusion, and Social Stratification. Forms of Social Stratification- Caste, Class and Estate. Gender and Social Stratification- sex and gender, patriarchy, factors perpetuating gender stratification; Globalization and gender inequality

MODULE IV SOCIAL CHANGE AND GLOBALIZATION 8

Social Change-definition, nature, direction; Forms- evolution, development, progress and transformation; Factors of social change- demography, economy, technology, polity and culture. Globalization- definition, characteristics, historical and social context and Impact, agencies of globalization- IGOs, INGOs, Nation-State, MNEs and Media

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Giddens A. 1989. “Sociology” Cambridge: Polity Press.

2. Heald Haralambos, R.M(2014) . ‘‘Sociology Themes and Perspectives”, Oxford, New Delhi-92
3. Bhushan Vidya and D.R. Sachdeva (2012). ‘‘Fundamental of Sociology”, Pearson, Delhi.

REFERENCES:

1. Das Gupta, Samir and Paulomi Saha (2012), ‘‘An Introduction to Sociology”, Pearson, Delhi
2. Bottomore, T.B. 1972. *Sociology- A Guide to Literature and Problems*, New Delhi,

OUTCOMES:

On successful completion of this course,

- Students will have exposure to the fundamentals tenets of Sociology.
- Students will be trained to understand social reality with sociological perspective.
- Students will be oriented to constructively analyze human interactions, social relationship and social issues
- Students will gain exposure to the dynamics of human society with special reference to the contemporary trends of globalization.

SSCXO3 SOCIOLOGY OF INDIAN SOCIETY.

L	T	P	C
2	0	0	2

OBJECTIVES:

- To present a portrayal of the components of the Indian Social structure
- To describe the nature and contemporary structure of Indian social Institutions.
- To examine the causality and magnitude of social problem facing the contemporary India.
- To elucidate the processes forms and impact of change and development in Indian society

MODULE I INDIAN SOCIAL STRUCTURE 7

Unity and Diversity; Concepts of unity and diversity- racial, religious, ethnic and linguistic composition of India. Types of communities-rural, urban and tribal; Social backwardness- OBC, SC and ST; Indian minorities- religious, ethnic, linguistic and LGBT

MODULE II INDIAN SOCIAL INSTITUTIONS 7

Family- definition, types, characteristics, functions of family; Joint Family- definition features, utility, changes; Marriage- definition, characteristics, marriage as sacrament or contract. Caste- definition, principles, contemporary changes, dominant caste, caste -class interface.

MODULE III SOCIAL PROBLEMS IN INDIA 8

Social Problem-definition, nature, social disorganization; Population explosion-causes, effects, relationship with development; Child Labour- causes, magnitude and consequences; Unemployment-nature , types, causes and effects; Gender issues-social status of women, violence against women and women in work place; Contemporary issues- communalism, terrorism and corruption.

MODULE IV SOCIAL CHANGE AND DEVELOPMENT IN INDIA 8

Socio-cultural Change- Sanskritization, Westernization, Secularization, Modernization; Processes of Social change- Industrialization, Urbanization, Globalization; Development- definition, elements, role of government, industry and corporate sector. Technology and change- invention and innovation, impact of technology on social institutions, technology and development.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Sharma,K.L.2008. *Indian Social Structure and Change*. Jaipur: Rawat Publications,.
2. Shah, A.M. 1998. *The Family in India: Critical Essays*. New Delhi: Orient Longman,
3. Ahuja Ram. 1999. *Social problems in India*, Rawat Publication: New Delhi.
4. Ahuja Ram. 2014. *Society in India,*, Rawat Publication: New Delhi.

REFERENCES:

1. Jayapalan, N.(2001), **"**Indian Society and Social Institutions" Atlantic Publishers & Distri,
2. Atal, yogesh (2006), "Changing Indian Society" Rawat Publications, Jaipur

OUTCOMES:

On successful completion of this course,

- Students will gain an in-depth understanding of the social structure and social institutions that constitute society in India.
- Students will be sensitized to the various categories ,Inequalities and their challenges
- Students will be exposed to the social problems encountered in contemporary India.
- Students will gain knowledge about the various forms and trends of the social change.
- Students will become aware about the challenges in the path of progress of Indian society and realize relevance of their role in bringing about development

Humanities Elective II

(To be offered in IV Semester)

SSCXO4	**ECONOMICS OF SUSTAINABLE DEVELOPMENT**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**2**

OBJECTIVES:

- To have an increased awareness on the concept and components of sustainable development.
- To develop the ability to demonstrate the need of sustainable development and international responses to environmental challenges.
- To have an insight into global environmental issues and sustainable globalization.
- To establish a clear understanding of the policy instruments of sustainable development.

MODULE I CONCEPT OF SUSTAINABLE DEVELOPMENT 7

Evolution of the Concept – Rio Summit and sustainable development - various definitions of sustainable development - Components of sustainable development: Social, environmental and economic components.

MODULE II NEED FOR SUSTAINABLE DEVELOPMENT 8

Need for sustainability – Global environmental challenges: population growth, resource depletion, pollution, energy use, climate change, pollution, growing water scarcity, other urban problems, loss of biodiversity, hazardous wastes disposal.International responses to environmental challenges - Global policy such as Kyoto Protocol, Montreal Protocol, Basel Convention.

MODULE III GLOBALIZATION AND ENVIRONMENT SUSTAINABILITY 8

Impact of Globalization on sustainable development, Co - existence of globalization and Environment sustainability, Globalization and Global Governance.Green economy - Renewable energy, sustainable transport, sustainable construction, land and water management, waste management.

MODULE IV POLICIES FOR ACHIEVING SUSTAINABLE DEVELOPMENT 7

Principles of environmental policy for achieving sustainable development: precautionary principle and polluter pays principle – Business Charter for Sustainable Development.Policy instruments for sustainable development: direct regulation – market based pollution control instruments such as pollution tax, subsidy, pollution permits.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Anderson, David A (2010), "*Environmental Economics and Natural Resource Management*", Routledge, 3rd edition.
2. Karpagam M (1999), "*Environmental Economics: A Textbook*", Sterling Publishers Pvt. Ltd, New Delhi.

REFERENCES:

1. Karpagam M and Jaikumar Geetha (2010), "*Green Management Theory and Applications*", Ane Books Pvt. Ltd, New Delhi.
2. Sengupta Ramprasad (2004), "*Ecology and Economics: An Approach to Sustainable Development*", Oxford University Press, New Delhi.

OUTCOMES:

On successful completion of this course,

- The students will have understood the concepts and components of sustainable development.
- The students will have a holistic overview on the challenges of sustainable development and International responses to environmental challenges.
- The students will have gained knowledge on the global environment issues and demonstrate responsible globalization through global governance.
- The students will have developed awareness of the ethical, economic, social and political dimensions that influence sustainable development.

SSCXO5 INDUSTRIAL SOCIOLOGY

L	T	P	C
2	0	0	2

OBJECTIVES:

- To introduce sociological approaches and perspectives to understand the social relationship in manufacturing industries and corporate sector.
- To explain the structure and functions of industrial organizations.
- To elucidate the dynamics of organizational behavior, leadership and communication.
- To inculcate professional ethics and values to equip students to work in organizational settings.

MODULE I INTRODUCTION 8

Industrial Sociology- definition, scope and importance; Theoretical approaches- scientific management, human relations approach, theory of bureaucracy, Fordism and post-fordism; Production system- concept and characteristics of factory system, automation and rationalization; Industrial conflict- strike , lockout and trade unions.

MODULE II INDUSTRIAL ORGANIZATION 7

Formal organization- definition, features, utility; Informal organization- definition, characteristics, types and relevance; Structure of industrial organization- features and functions of line organization, characteristics and roles of staff organization, distinction;

Industrial hierarchy-white collar, blue collar, supervisors and managers.

MODULE III DYNAMICS OF INDUSTRIAL RELATIONS 8

Group dynamics- Definition, Group behaviour model, Group decision making process, group cohesiveness; Leadership- definitions, style and effective supervision; Communication- concepts, types, model barriers; Job satisfaction- nature, employee compensation and job satisfaction.

MODULE IV PROFESSIONAL ETHICS AND VALUES 7

Concepts- values- morals, and ethics, Integrity, work ethics , service learning - Civic Virtue - caring - Sharing - Honesty - Courage - Valuing Time - Co-operation - commitment - empathy - Self-Confidence - Environmental Ethics, Cyber issues - computer ethics, cyber crimes, plagiarism Ethical living-concept of harmony in life.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Narender Singh, Industrial Sociology, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2012.
2. Gisbert Pascal, Fundamentals of Industrial Sociology, Tata Mc. Graw Hill Publishing Co., New Delhi, 1972
3. Schneider Engeno. V, Industrial Sociology 2nd Edition, Mc. Graw Hill Publishing Co., New Delhi, 1979.

REFERENCES:

1. Robbins, Stephen, Organizational Behaviour , Prentice Hall of India PVT ltd new Delhi, 1985
2. Devis Keith , Human Behaviour at work place, Mc. Graw Hill Publishing Co., New Delhi,1984

OUTCOMES:

On successful completion of this course,

- Students will have acclimatized with sociological perspectives for dealing with social relationships in production and service organizations.
- Students will be familiar with structure of authority, roles and responsibility in organizational settings.
- Students will imbibe leadership, communication and behavioral acumen to govern organization
- Students will be sensitized to standards of desirable behavior to engage in industrial and corporate sector.

SSCXO6 **LAW FOR ENGINEERS** **L T P C**
2 0 0 2

OBJECTIVES:

- To understand the Constitution and Governance of our country.
- To apprise the students of human rights - local and international and redressal mechanism.
- To have an insight into the industrial, corporate and labour laws of our country.
- To establish a clear understanding about the importance of intellectual property related laws.

MODULE I INDIAN CONSTITUTION AND GOVERNANCE 8

Constitution – salient features, Preamble, Citizenship, Fundamental rights, Fundamental duties, Directive principles, Union executive, Legislature – Union – State and union territories – Election Commission – Election for parliament and state legislature, Judiciary- basic functioning of the Supreme Court and High Courts, Right to information Act 2005 – evolution – concept – practice.

MODULE II HUMAN RIGHTS 7

Human rights – meaning and significance, Covenant on civil and political rights, Covenant on Economic, Social and Cultural rights, UN mechanism and agencies, The Protection of Human Rights Act, 1993 – watch on human rights and enforcement.

MODULE III INDUSTRIAL, CORPORATE AND LABOUR LAWS 8

Corporate laws – meaning and scope, Companies Act 1956 – Indian Contract Act 1872 - Principles of Arbitration - Industrial Employment (Standing Orders) Act 1946 - Industrial Disputes Act 1947 - Workmen's Compensation Act 1923 - The Factories Act, 1948.

MODULE IV LAWS RELATED TO IPR 7

IPR – meaning and scope, International organization – WIPO – TRIPS, Major Indian IPR Acts – Copyright laws, Patent and Design Act, Trademarks Act, Trade Secret Act, Geographical Indicator.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. M.P. Jain (2005) *Indian Constitutional Law*, Wadhwa & Co.

2. H. D, Agarwal (2008), *International Law and Human Rights,* Central Law Publications,
3. Rao, Meena (2006), *Fundamental Concepts in Law of Contract*, 3rd edn., Professional offset.
4. Ramappa (2010), *Intellectual Property Rights Law in India*, Asia Law House.
5. Singh, Avtar (2007), *Company Law*, Eastern Book Co.
6. R.F, Rustamji (1967)*, Introduction to the Law of Industrial Disputes*, Asia Publishing House.

REFERENCES:

1. Acts: Right to Information Act, Industrial Employees (standing order) Act, Factories Act, Workmen Compensate Act.

OUTCOMES:

On successful completion of this course,

- Students will `be able to apply the basic concepts of Indian Constitution, Governance and power in their real life situation.
- Students will have gained knowledge in human rights, cultural, social and political rights.
- Students will have synthesized knowledge about industrial, corporate and labour laws of our country.
- Students will have an overview of IPRs and laws related to Intellectual Property Rights.

General Elective Courses

Group I courses

(To be offered in V Semester)

		L	T	P	C
GECX101	**DISASTER MANAGEMENT**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To give an exposure to various environmental hazards and disasters: and various concepts and principles to manage disaster.
- To give exposure to various environmental policies & programs in India for disaster management

MODULE I ENVIRONMENTAL HAZARDS 7

Environmental hazards, Environmental Disasters and Environmental stress-Meaning and concepts. Vulnerability and disaster preparedness.

MODULE II NATURAL DISASTERS 7

Natural hazards and Disasters - Volcanic Eruption, Earthquakes, Tsunamis, Landslides, Cyclones, Lightning, Hailstorms, Floods, Droughts, Cold waves, Heat waves and Fire.

MODULE III MAN-MADE DISASTERS 7

Man induced hazards & Disasters - Soil Erosion, Chemical hazards, Population Explosion

MODULE IV DISASTER MANAGEMENT 8

Emerging approaches in Disaster Management- Preparing hazard zonation maps, Predictability / forecasting & warning, Preparing disaster preparedness plan, Land use zoning, Communication. Disaster resistant house construction, Population reduction in vulnerable areas, Awareness - Rescue training for search & operation at national & regional level - Immediate relief, Assessment surveys, Political, Administrative, Social, Economic, Environmental Aspects.

MODULE V NATURAL DISASTER REDUCTION & MANAGEMENT 8

Provision of Immediate relief measures to disaster affected people, Prediction of Hazards & Disasters, Measures of adjustment to natural hazards

MODULE VI ENVIRONMENTAL POLICIES & PROGRAMMES IN INDIA **8**

Regional survey of Land Subsidence, Coastal Disaster, Cyclonic Disaster & Disaster in Hills with particular reference to India. Ecological planning for sustainability & sustainable development in India, Sustainable rural development: A Remedy to Disasters, Role of Panchayats in Disaster mitigations, Environmental policies & programmes in India- Institutions & National Centers for Natural Disaster reduction, Environmental Legislations in India, Awareness, Conservation Movement, Education & training.

L – 45; Total Hours –45

REFERENCES:

1. Satender, “Disaster Management in Hills”, Concept Publishing Co., New Delhi, 2003.
2. Singh, R.B. (Ed.), “Environmental Geography”, Heritage Publishers, New Delhi,1990.
3. Savinder Singh, “Environmental Geography”, Prayag Pustak Bhawan,1997.
4. Kates, B.I. and White, G.F., “The Environment as Hazards”, Oxford University Press, New York, 1978.
5. Gupta, H.K., (Ed), “Disaster Management”, University Press, India, 2003.
6. Singh, R.B.,“Space Technology for Disaster Mitigation in India (INCED)”, University of Tokyo, 1994.
7. Bhandani, R.K., “An overview on Natural & Manmade Disaster & their Reduction”, IIPA Publication, CSIR, New Delhi, 1994.
8. Gupta, M.C., “Manuals on Natural Disaster management in India”, National Centre for Disaster Management, IIPA Publication, New Delhi, 2001.

OUTCOMES:

At the end of the course, the students will

- achieve sufficient knowledge on the disaster prevention strategy, early warning system, disaster preparedness, response and human resource development.
- be familiar with the National Policy on Disaster Management.

GECX102	TOTAL QUALITY MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the various principles, practices of TQM to achieve quality.
- To get acquainted with the various statistical tools and approaches for quality control and continuous improvement.
- To get aware of the importance of ISO and Quality Systems.

MODULE I INTRODUCTION 8

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

MODULE II TQM PRINCIPLES 7

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits.

MODULE III TQM IMPROVEMENT PROCESS 8

Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

MODULE IV STATISTICAL PROCESS CONTROL (SPC) 8

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

MODULE V TQM TOOLS 7

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

MODULE VI QUALITY SYSTEMS 7

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System– Elements, Implementation of Quality System, Documentation, Quality Auditing, TS 16949, ISO 14000 – Concept, Requirements and Benefits

L – 45; Total Hours –45

TEXT BOOKS:

1. Dale H.Besterfiled, et al., “Total Quality Management”, Pearson Education, Inc. 2003.

REFERENCES:

1. James R.Evans & William M.Lidsay, “The Management and Control of Quality”, 5th Edition, South-Western (Thomson Learning), 2002.
2. Feigenbaum.A.V., “Total Quality Management”, McGraw-Hill, 1991.
3. Oakland.J.S., “Total Quality Management”, Butterworth Hcinemann Ltd., Oxford, 1989.
4. Narayana V. and Sreenivasan. N.S., “Quality Management – Concepts and Tasks”, New Age International, 1996.
5. Zeiri, “Total Quality Management for Engineers”, Wood Head Publishers, 1991.

OUTCOMES:

The student should be able to

- apply the various statistical tools and approaches for Quality control.
- achieve continuous process improvement through TQM.

GECX103 ENERGY STUDIES L T P C
3 0 0 3

OBJECTIVES:

- To learn the growing demand, supply of energy on global and national levels and the need for renewable energy promotion.
- To understand the basic need for energy conservation and waste heat recovery.
- To learn the important aspects of energy audit and management.
- To get acquainted with the global environmental issues and carbon credits.

MODULE I GLOBAL AND NATIONAL ENERGY SCENARIO 7

Role of energy in economic development, various energy resources - overall energy demand and availability- Energy consumption in various sectors and its changing pattern - Exponential increase in energy consumption and projected future demands. Need for renewable energy.

MODULE II SOLAR ENERGY 8

Solar Radiation – Measurements of Solar Radiation - Flat Plate and Concentrating Collectors – Solar direct Thermal Applications – Solar thermal Power Generation - Fundamentals of Solar Photo Voltaic Conversion – Solar Cells – Solar PV Power Generation – Solar PV Applications.

MODULE III OTHER RENEWABLE ENERGY SOURCES 8

Power from wind – wind turbine working and types, solar thermal power plants – low medium and high power generation, power from wave , tidal, geothermal sources, OTEC system. MHD power plants – working, types, merits and demerits. Energy from biomass.

MODULE IV COGENERATION, WASTE HEAT RECOVERY AND COMBINED CYCLE PLANTS 8

Cogeneration principles- topping and bottoming cycles, role in process industries. Energy from wastes- waste heat recovery- heat recovery from industrial processes. Heat exchange systems – recuperative and regenerative heat exchangers – commercially available waste heat recovery devices. Combined cycle plants – concept, need and

advantages, different combinations and practical scope.

MODULE V ENERGY CONSERVATION AND MANAGEMENT 7

Need for energy conservation – use of energy efficient equipment. Energy conservation opportunities - in educational institutions, residential, transport, municipal, industrial and commercial sectors – concept of green building. Energy audit in industries – need, principle and advantages. Case studies.

MODULE VI GLOBAL ENERGY ISSUES AND CARBON CREDITS 7

Energy crisis, fossil consumption and its impact on environmental climate change. Energy treaties – Montreal and Kyoto protocols - Transition from carbon rich and nuclear to carbon free technologies, carbon foot print – credits – clean development mechanism.

L – 45; Total Hours –45

TEXT BOOKS:

1. S.S. Rao and B.B. Parulekar, “Energy Technology”, 3rd Edition, Khanna Publishers, New Delhi, 2011.
2. O. Callaghn. P.W., “Design and Management for Energy Conservation”, Pergamon Press, Oxford, 1981.

REFERENCES:

1. G.D. Rai, “Non Conventional Energy Sources”, Khanna Publishers, New Delhi, 2011.
2. Archie, W Culp. “Principles of Energy Conservation”, McGraw Hill, 1991.
3. D Patrick and S W Fardo, “Energy Management and Conservation”, PHI,1990
4. P. O’Callaghan: “Energy Management”, McGraw - Hill Book Company, 1993.
5. Kenney, W. F., “Energy Conservation in Process Industries”, Academic Press, 1983.

OUTCOMES:

The student should be able to

- Realize the global and national energy status and need to switch over to renewable energy technology.
- Energy audit and suggest methodologies for energy savings.
- Utilize the available resources in an optimal way.
- Concern about the global environmental issues & promote carbon credits.

GECX104 **ROBOTICS** **L T P C**
3 0 0 3

OBJECTIVES:

To learn about the robots, various components, of Robots, programming and their applications.

MODULE I **8**

Definition- Need - Application, Types of robots – Classifications – Configuration, work volume, control loops, controls and intelligence- basic parts - functions – specifications. of robot, degrees of freedoms, end effectors – types, selection

MODULE II ROBOT DRIVES AND CONTROL **8**

Controlling the Robot motion – Position and velocity sensing devices – Design of drive systems – Hydraulic and Pneumatic drives – Linear and rotary actuators and control valves – Electro hydraulic servo valves, electric drives – Motors – Designing of end effectors – Vacuum, magnetic and air operated grippers.

MODULE III ROBOT SENSORS **8**

Transducers and Sensors – Tactile sensor – Proximity and range sensors – Sensing joint forces – Robotic vision system – Image Representation - Image Grabbing –Image processing and analysis – Edge Enhancement – Contrast Stretching – Band Rationing - Image segmentation – Pattern recognition – Training of vision system.

MODULE IV ROBOT PROGRAMMING & AI TECHNIQUES **7**

Types of Programming – Teach pendant programming – Basic concepts in AI techniques – Concept of knowledge representations – Expert system and its components.

MODULE V ROBOTIC WORK CELLS AND APPLICATIONS OF ROBOTS **7**

Robotic cell layouts – Inter locks – Humanoid robots – Micro robots – Application of robots in surgery, Manufacturing industries, space and underwater.

MODULE VI ROBOT KINEMATICS AND DYNAMICS 7

Forward and inverse Kinematic equations, Denvit – Hartenbers representations Fundamental problems with D-H representation, differential motion and velocity
of frames - Dynamic equations for sing, double and multiple DOF robots – static force analysis of robots.

L – 45; Total Hours –45

REFERENCES:

1. Yoram Koren," Robotics for Engineers", Mc Graw-Hill, 1987.
2. Kozyrey, Yu, "Industrial Robots", MIR Publishers Moscow, 1985.
3. Richard. D, Klafter, Thomas, A, Chmielewski, Michael Negin, "Robotics Engineering – An Integrated Approach", Prentice-Hall of India Pvt. Ltd., 1984.
4. Deb, S.R. "Robotics Technology and Flexible Automation", Tata Mc Graw-Hill, 1994.
5. Mikell, P. Groover, Mitchell Weis, Roger, N. Nagel, Nicholas G. Odrey, "Industrial Robotics Technology, Programming and Applications", Mc Graw- Hill, Int. 1986.
6. Timothy Jordanides et al,"Expert Systems and Robotics", Springer – Verlag, New York, May 1991.

OUTCOMES:

Students would be able to

- Understand about the robots, its various components.
- Design Robots for industrial applications.
- Do programming for robots and apply them in real time applications.

GECX105 TRANSPORT MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the transport fleet and their related activities for minimizing operational cost.
- To understand the need of maintenance and its importance.
- To understand the functions and applications of various types of transport system.

MODULE I INTRODUCTION 7

Personnel management; objectives and functions of personnel management, psychology, sociology and their relevance to organization, personality problems. Selection process: job description, employment tests, interviewing, introduction to training objectives, advantages, methods of training, training procedure, psychological tests.

MODULE II ORGANISATION AND MANAGEMENT 7

Forms of Ownership – principle of Transport Management – Staff administration – Recruitment and Training – welfare – health and safety. Basic principles of supervising. Organizing time and people. Driver and mechanic hiring - Driver checklist - Lists for driver and mechanic - Trip leasing - Vehicle operation and types of operations.

MODULE III TRANSPORT SYSTEMS 9

Introduction to various transport systems. Advantages of motor transport. Principal function of administrative, traffic, secretarial and engineering divisions. chain of responsibility, forms of ownership by state, municipality, public body and private undertakings.

MODULE IV SCHEDULING AND FARE STRUCTURE 8

Principal features of operating costs for transport vehicles with examples of estimating the costs. Fare structure and method of drawing up of a fare table. Various types of fare collecting methods. Basic factors of bus scheduling. Problems on bus scheduling.

MODULE V MOTOR VEHICLE ACT 7

Traffic signs, fitness certificate, registration requirements, permit insurance, constructional regulations, description of vehicle-tankers, tippers, delivery vans, recovery vans, Power wagons and fire fighting vehicles. Spread over, running time, test for competence to drive.

MODULE VI MAINTENANCE 7

Preventive maintenance system in transport industry, tyre maintenance procedures. Causes for uneven tyre wear; remedies, maintenance procedure for better fuel economy, Design of bus depot layout.

L – 45; Total Hours –45

TEXT BOOKS:

1. John Duke, "Fleet Management", McGraw-Hill Co, USA, 1984.
2. Kitchin.L.D., "Bus Operation", III edition, Illiffee and Sons Co., London, 1992

REFERENCES:

1. Government Motor Vehicle Act, Publication on latest act to be used as on date.

OUTCOMES:

Upon completion of the course, students will

- Know about different aspects related to transport system and management.
- Features of scheduling, fixing the fares
- Know about the motor vehicle act and maintenance aspects of transport.

GECX106 CONTROL SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the system modeling and to derive their transfer function.
- To provide adequate knowledge of time response of systems and steady state error analysis.
- To accord basic knowledge in obtaining the open loop and closed–loop frequency responses of Control systems.

MODULE I BASIC CONCEPTS AND SYSTEM REPRESENTATION **8**

Control System - Basic elements in control systems – Open and closed loop systems – Electrical analogy of mechanical and thermal systems – Transfer function – Block diagram reduction techniques – Signal flow graphs.

MODULE II TIME RESPONSE ANALYSIS AND DESIGN **8**

Time response – Time domain specifications – Types of test input – First and Second order system - Type I and Type II System – Response - Error coefficients – Generalized error series – Steady state error – P, PI, PID modes of feedback control.

MODULE III FREQUENCY RESPONSE ANALYSIS AND DESIGN **7**

Performance specifications - correlation to time domain specifications - bode plots and polar plots – gain and phase margin – constant M and N circles and Nichols chart – all pass and non-minimum phase systems.

MODULE IV STABILITY **8**

Characteristics equation – Location of roots in s plane for stability – Routh Hurwitz criterion – Root locus construction – Effect of pole, zero addition – Gain margin and phase margin – Nyquist stability criterion.

MODULE V COMPENSATOR DESIGN **8**

Performance criteria – Lag, lead and lag-lead networks – Compensator design using bode plots and root locus technique.

MODULE VI CONTROL SYSTEM COMPONENTS AND APPLICATION OF CONTROL SYSTEMS **6**

Synchros – AC servomotors - DC Servo motors - Stepper motors - AC

Tacho generator - DC Tacho generator - Typical applications of control system in industry.

L – 45; Total Hours –45

REFERENCES:

1. K. Ogata, “Modern Control Engineering”, 4th Edition, Pearson Education, New Delhi, 2003.
2. I.J. Nagrath & M. Gopal, “Control Systems Engineering”, New Age International Publishers, 2003.
3. C.J.Chesmond, “Basic Control System Technology”, Viva student edition, 1998.
4. I.J.Nagarath and M.Gopal, “Control System Engineering”, Wiley Eastern Ltd., Reprint, 1995.
5. R.C.Dorf and R.H.Bishop, “Modern Control Systems”, Addison-Wesley (MATLAB Reference), 1995.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Proper understanding of basics of Control Systems.
- Ability and skill to carry-out time domain and frequency domain analysis.
- Capable of determining stability of the system using Routh Hurwitz criterion, Root locus and Nyquist criterion.
- Ability to design lag, lead and lag lead compensator networks.

GECX107 INTRODUCTION TO VLSI DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- Basic concepts of HDL.
- Verilog language and its syntax constructs.
- Programmable Logic Devices and FPGAs
- MOS devices theory
- CMOS based combinational and sequential circuits

PREREQUISITES:

Fundamentals of Electronics

Basics knowledge in Digital Electronics.

MODULE I REVIEW OF BASIC DIGITAL SYSTEMS 7

Boolean algebra, Building blocks of combinational logic design-Adders, multiplexer, encoder, decoder, comparator, Latches & flip-flops, counters, shift registers.

MODULE II LOGIC DESIGN USING VERILOG HDL 8

Overview of Digital Design with Verilog HDL, Levels of Design Description, Concurrency, Hierarchical Modeling Concepts, Modules and Ports, Component instantiation Data flow and RTL, structural, gate level, switch level modeling and Behavioral Modeling.

MODULE III LANGUAGE CONSTRUCTS OF VERILOG HDL 7

Identifiers- gate primitives, gate delays, operators, timing controls, procedural assignments, conditional statements Variable types, arrays and tables, Tasks and functions, Test bench.

MODULE IV BUILDING BLOCKS OF DIGITAL VLSI SYSTEMS 8

HDL Design -Data Path Operations-Addition/Subtraction, Parity Generators, Comparators, Zero/One Detectors, Binary Counters, ALUs, Multiplication, Shifters, Memory Elements. Programmable logic elements and AND-OR arrays, FPGAs programming methods.

MODULE V TRANSISTOR THEORY 7

Introduction to MOS Transistors-NMOS & PMOS Characteristics, Current Equations, Complementary CMOS Inverter-DC Characteristics, Static Load MOS Inverters.

MODULE VI BASICS OF DIGITAL CMOS DESIGN 8

NMOS & PMOS Logic Gate, CMOS Logic Gate, Basic layout design of simple gate-stick diagram, CMOS Logic Structures-full adder, multiplexers.

Total Hours –45

TEXT BOOKS:

1. M.Morris Mano "Digital Design", 3rd Edition, Prentice Hall of India Pvt. Ltd New Delhi, 2003

REFERENCES:

1. Michael D. Ciletti“Advanced Digital Design with the Verilog HDL" (2nd Edition) Hardcover – January 31, 2010
2. J.Bhasker: Verilog HDL primer, BS publication, 2001.
3. J. P. Uyemura, "Introduction to VLSI Circuits and System", Wiley, 2002
4. Neil Weste and K. Eshragian, “Principles of CMOS VLSI Design: A System Perspective,” 2nd edition, Pearson Education (Asia) Pvt.Ltd., 2000
5. Douglas A Pucknell& Kamran Eshragian , “Basic VLSI Design” PHI 3rd Edition (original edition – 1994)

OUTCOMES:

At the end of the course the students will be able to

- Create basic Register Transfer Level (RTL) models for combinational circuits & Sequential circuits using Verilog HDL.
- Create basic behavioral models for combinational circuits & Sequential circuits using Verilog HDL.
- Describe the usage of Programmable Logic Devices and FPGAs.
- Describe MOS devices theory and inverter circuit DC characteristics
- Design the basic digital building blocks using MOS circuit.
- Apply VLSI design concepts based on the requirements to conduct experiments or projects

GECX108 PLANT ENGINEERING

L	T	P	C
3	0	0	4

OBJECTIVES:

- To provide in depth knowledge on Plant Engineering
- To introduce detail engineering and P&ID
- To learn about the support to Instrumentation from other disciplines
- To study about the Installation and commissioning

MODULE I INTRODUCTION OF PLANTS 7

General Project Cycle – Feed – Sales - Plant Description, Component / Areas of Plant, Plant Layout, Plant Interfaces, Plant Location

MODULE II ELEMENTS OF PLANT 8

Main Elements of a Plant, Process Flow Scheme (PFD – Process Flow Diagram) P&ID's, Plant Legend Finalization.

MODULE III DETAIL ENGINEERING 10

P& ID Development with PFD's, Major Discipline Involvement & Inter discipline Interaction, Major Instrumentation & Control Systems - Development Phase – Instrument List , I/O Count, Specification Sheets, Instrument Installation (Hook ups) , Control Philosophy – Detail Engineering.

MODULE IV SUPPORT FROM OTHER DISCIPLINE 8

Other Discipline Supports to Instrumentation – Plot Plan, Piping / Equipment Plan, Electrical Area Classification, Fire Hazardous Classification Telecommunication Systems - Control Network architecture.

MODULE V INSTALLATION AND COMMISSIONING 7

Plant Construction - Key Drawings for Construction Support Construction Activities, System Testing, Startup / Commissioning, Production.

MODULE VI CASE STUDIES 5

Case studies of Water Treatment Plant - Paper Industry – Power Plant etc

L – 45; Total Hours –45

REFERENCES:

1. Duncan C Richardson, Plant Equipment and Maintenance Engineering Handbook, McGraw-Hill Education: New York, Chicago, San Francisco, Athens, London, Madrid, Mexico City, Milan, New Delhi, Singapore, Sydney, Toronto, 2014 McGraw-Hill Education
2. Gabriel Salvendy, Handbook of Industrial Engineering – Technology and operations Management, John Wiley & Sons, 2001.
3. Robert C Rosaler , Standard Handbook of Plant Engineering, Mc Graw Hill third Edition, 2004
4. R. Keith Mobley, Plant Engineer's Handbook, Technology and Engineering, 2001.

OUTCOMES:

At the end of the course, the student will be able to

- Review and correct P&IDs
- Do installation and commissioning of new plants
- Apply plant engineering in design and maintenance of water treatment plant / power plant etc

GECX109	NETWORK SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

The students should be able to

- Discuss the basic concepts of computer security, model and attacks
- Examine the major types of threats and the associated attacks
- Identify the encryption techniques in real time applications
- Understand the special requirements for wireless security and how authentication is implemented in wireless systems
- Understand the functions of Network Security Device Firewall and its types
- Interpret the various network intrusion such as computer viruses, network worms etc

MODULE I INTRODUCTION 6

Computer Security Concepts - The OSI Security Architecture - Security Attacks - Security Services - Security Mechanisms - A Model for Network Security - Standards – classical encryption techniques.

MODULE II SYMMETRIC ENCRYPTION AND MESSAGE CONFIDENTIALITY 7

Symmetric Encryption Principles - Symmetric Block Encryption Algorithms - Random and Pseudorandom Numbers - Stream Ciphers and RC4 - Cipher Block Modes of Operation

MODULE III PUBLIC KEY CRYPTOGRAPHY AND MESSAGE AUTHENTICATION 8

Approaches to Message Authentication - Secure Hash Functions - Message Authentication Codes - Public-Key Cryptography Principles - Public-Key Cryptography Algorithms - Digital Signatures

MODULE IV KEY DISTRIBUTION ,USER AUTHENTICATION AND TRANSPORT-LEVEL SECURITY 8

Symmetric Key Distribution Using Symmetric Encryption - Kerberos - Key Distribution Using Asymmetric Encryption - X.509 Certificates - Public-Key Infrastructure -Federated Identity Management - Web Security Considerations -

Secure Socket Layer and Transport Layer Security - Transport Layer Security

MODULE V WIRELESS NETWORK SECURITY, ELECTRONIC MAIL SECURITY AND IP SECURITY **8**

IEEE 802.11 Wireless LAN Overview -IEEE 802.11i Wireless LAN Security - Wireless Application Protocol Overview - Wireless Transport Layer Security - WAP End-to-End Security - Pretty Good Privacy - S/MIME – Domain Keys Identified Mail- IP Security Overview -IP Security Policy - Encapsulating Security Payload - Combining Security Associations - Internet Key Exchange - Cryptographic Suites

MODULE VI SYSTEM SECURITY **8**

Intruders -Intrusion Detection -Password Management - Types of Malicious Software - Viruses Virus Countermeasures – Worms - Distributed Denial of Service Attacks- The Need for Firewalls - Firewall Characteristics - Types of Firewalls - Firewall Basing - Firewall Location and Configurations

L – 45; Total Hours –45

REFERENCES:

1. William Stallings,"Network security Essentials:Applications and standards", Prentice Hall, Fifth Edition , ISBN-13: 978-0134527338, 2013
2. William Stallings, "Cryptography and Network Security: Principles and Practice", Pearson, ISBN-13:978-0-273-79335-9,2013
3. Behrouz Forouzan, Debdeep Mukhopadhyay,Cryptography and network security (sie) 2nd edition, ISBN-13: 978-0070702080, 2016
4. Wikipedia, "Network Security and Management" , https://en.wikipedia.org/wiki/Book:Network Security and Management, 2014.
5. Nitesh Dhanjani, Justin Clarke, "Network Security Tools", O'Reilly Media, ISBN-13: 9780596007942, 2005.

OUTCOMES:

Students who complete this course will be able to

- Recognize the computer security concepts, architecture attacks and model
- Distinguish the symmetric and asymmetric encryption techniques
- Apply the cryptographic algorithms in different applications
- Express the network security designs using available secure solutions

such as PGP,SSL, IPSec, etc.

- Describe the firewalls principles and different types of firewalls applied in organization
- Identify abnormalities within the network caused by worms, viruses and Network related security treats**.**

GECX110	KNOWLEDGE MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course

- Focuses on positioning knowledge as a valuable commodity, embedded in products and in the tacit knowledge of highly mobile individual employees.
- Presents KM as a deliberate and systematic approach to cultivating and sharing an organization's knowledge base.
- Brings out the paradigm in terms of information technology and intellectual capital.

MODULE I KNOWLEDGE MANAGEMENT 6

KM Myths – KM Life Cycle – Understanding Knowledge – Knowledge, intelligence – Experience – Common Sense – Cognition and KM – Types of Knowledge – History of Knowledge Management - From Physical assets to Knowledge Assets – Expert knowledge – Human Thinking and Learning.

MODULE II KNOWLEDGE MANAGEMENT SYSTEMS AND MODELS 9

Challenges in Building KM Systems – Conventional Vs KM System Life Cycle (KMSLS) – Knowledge Creation and Knowledge Architecture – KM cycle - Different variants of KM cycle - KM models - Implications and practical implementations.

MODULE III CAPTURING KNOWLEDGE AND SHARING 9

Tacit knowledge capture - Explicit knowledge codification – Knowledge taxonomies - Knowledge sharing - Communities - Obstacles to knowledge capture and sharing.

MODULE IV KNOWLEDGE MANAGEMENT TOOLS 9

KM System tools – Neural Network – Association Rules – Classification Trees – Data Mining and Business Intelligence – Knowledge capture and creation tools - Content creation tools - Data mining and knowledge discovery – Content management tools - Knowledge sharing and dissemination tools – Group ware

and Collaboration tools - Intelligent filtering tools.

MODULE V KNOWLEDGE APPLICATION 6

KM at individual level - Knowledge workers - Task analysis and modeling - Knowledge application at group and organizational levels – Knowledge repositories - Knowledge reuse -Case study: e-learning.

MODULE VI VALUE OF KNOWLEDGE MANAGEMENT 6

KM return on investment and metrics - Benchmarking method – Balanced scorecard method - House of quality method - Results based assessment method - Measuring success - Future challenges for KM.

L – 45; Total Hours –45

TEXT BOOKS:

1. Elias M. Awad, Hassan M. Ghaziri, “Knowledge Management”, Prentice Hall, 2nd Edition, 2010.
2. Jay Liebowitz, “Handbooks on Knowledge Management”, 2nd Edition, 2012.
3. Irma Becerra-Fernandez, Rajiv Sabherwal, ”Knowledge Management: Systems and Processes”, 2010.

OUTCOMES:

Students who complete this course will be able to

- Describe the fundamental concepts in the study of knowledge and its creation, acquisition, representation, dissemination, use and re-use, and management.
- Explains the core concepts, methods, techniques, and tools for computer support of knowledge management.
- Critically evaluate current trends in knowledge management and apply it for e-learning

GECX111 CYBER SECURITY L T P C

3 0 0 3

OBJECTIVES:

- To understand the basics of Cyber Security Standards and Policies.
- To know the legal, ethical and professional issues in Cyber security.
- To understand Cyber Frauds and Abuse and its Security Measures.
- To know the technological aspects of Cyber Security.

MODULE I FUNDAMENTALS OF CYBER SECURITY 7

Security problem in computing – Cryptography Basics – History of Encryption – Modern Methods – Legitimate versus Fraudulent Encryption methods – Encryption used in Internet.

MODULE II CYBERCRIME AND CYBEROFFENSES 8

Cybercrime and Information Security – Cybercriminals – Classifications of Cybercrimes – Email Spoofing – Spamming – Cyber defamation – Internet Time Theft – Forgery – Web jacking – Hacking – Online Frauds – Software Piracy – Mail Bombs – Password Sniffing – Cyberoffenses – Categories – Planning the attacks – Cyberstalking – Cybercafe and Cybercrimes – Botnets.

MODULE III CYBERCRIME: MOBILE AND WIRELESS DEVICES 8

Proliferation of Mobile and Wireless Devices – Trends in Mobility – Credit card frauds in Mobile and Wireless Computing – Security Challenges – Authentication Service Security – Attacks on Mobile Phones.

MODULE IV TOOLS AND METHODS USED IN CYBERCRIME 8

Proxy Servers and Anonymizers – Phishing – Password Cracking – Keyloggers and Spywares – Virus and Worms – Trojan Horses and Backdoors – Steganography – DoS and DDoS Attacks.

MODULE V SECURITY POLICIES 7

Introduction - Defining User Policies – Passwords – Internet Use – Email Usage – Installing/ Uninstalling Software – Instant Messaging – Defining System Administrative Policies – Defining Access Control Developmental Policies Standards, Guidelines and Procedures – Basics of assessing a system

MODULE VI COMPUTER FORENSICS 7

General Guidelines – Finding Evidence on the PC - Finding Evidence in System Logs – Windows Logs – Linux Logs – Getting Back Deleted Files – Operating System Utilities – The Windows Registry.

L – 45; Total Hours –45

TEXT BOOKS:

1. Nina Godbole, Sunit Belapure, “Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Wiley, 2011.

2. Chuck Easttom, “Computer Security Fundamentals”, 2nd Edition, Pearson Education, 2012.

REFERENCES:

1. Charles B. Pfleeger, Shari Lawrence Pfleeger, “Security in Computing”, 3rd Edition, Pearson Education, 2003.
2. William Stallings, “Cryptography and Network Security – Principles and Practices”, 3rd Edition, Pearson Education, 2003.
3. Atul Kahate, “Cryptography and Network Security”, Tata McGraw Hill, 2000.

OUTCOMES:

Upon completion of this course, students will be able to

- Explain the general security issues.
- Discuss various cybercrimes and offenses.
- Outline the occurrence of Cybercrime in mobile and wireless environment.
- Use relevant tools and methods in cybercrime
- Apply security policies in cyber forensics.
- Outline the strategies adopted in computer forensics.

GECX112 GENETIC ENGINEERING L T P C
4 0 0 4

OBJECTIVES:

The course aims to provide an advanced understanding of the core principles and topics of Cell and Organism reproduction and the Principles of heredity and their experimental basis, and to enable students to be able to apply these principles in assessment of pedigrees to identify genotypes and predict the mating outcomes.

MODULE I GENETICS AND ORGANISM 10

Genetics and human affairs, Genetics and Biology, Genes and Environment, Techniques of genetic analysis, The chromosome theory of heredity, Sex chromosomes, Sex linkage, The parallel behaviour of autosomal genes and chromosomes.

MODULE II MENDELISM AND LINKAGE 12

Mendel's laws of inheritance, Interaction of genes, Variations on dominance, Multiple alleles, Lethal alleles, Several genes affecting the same character, Penetrance and expressivity, Linkage- Basic eukaryotic chromosome mapping, The discovery of linkage, Recombination linkage symbolism, Linkage of genes on X chromosomes, Linkage maps, Examples of linkage maps.

MODULE III FINE STRUCTURE OF GENES 10

The concept of promoter, Coding sequence, Terminator, Induction of gene for expression. The concept of extranuclear genome in higher plants and animals, Overview of mitochondrial genome, Chloroplast genome.

MODULE IV RECOMBINATION IN BACTERIA AND VIRUSES 10

Conjugation recombination and mapping the E.coli chromosomes, Transformation, Transduction, Chromosome mapping. Population genetics: Darwin's revolution, Variation and its modulation, The effect of sexual reproduction on variation, The sources of variation, Selection quantitative genetics

MODULE V PRINCIPLES OF PLANT BREEDING 9

Objectives, Selfing and crossing techniques, Male sterility,Incompatability, Hybrid vigour.

MODULE VI HUMAN GENOME PROJECT 9

Genetic diseases in humans, Genetics and society

L – 45; T – 15; Total Hours –60

REFERENCES:

1. In Introduction to genetic analysis, Griffiths, Miller, Suzuki, Lewontin and Gelbart, Freeman and Company.
2. Genetics, A.V.S.S. Sambamurty, Narosa Publishing House.
3. Concepts of Genetics, Klug & Cummings, Prientice Hall.
4. Molecular Cloning, Moniatisetal, Cold Spring Harbor Laboratory.

OUTCOMES:

At the end of the course students will be able to

- Describe the structure, function and replication of DNA as the genetic material
- Describe gene structure, expression and regulation
- Describe the chromosomal basis of inheritance and how alterations in chromosome number or structure may arise during mitosis and meiosis

GECX113	FUNDAMENTALS OF PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The students would gain knowledge on

- Technicalities attached to Project Management and Significance of Quality Consideration
- Project management methodologies – tools and techniques, supplemented with examples from case studies
- The importance of Efficient HR team and role of Communication in executing Projects.
- Managing Risks in Project Management

MODULE I INTRODUCTION TO PROJECT MANAGEMENT 9

Introduction to Project and Project Management-Project Management as a Career-Project Management Skill Sets-Project Scope Management: Project Charter, Scope Creep, Scope Validation, Scope Change Control-Type of Organization: Organization Structure-Influence of Organization Structure on Project, Project Stakeholders and Organizational Productivity.

MODULE II PROJECT MANAGEMENT PROCESS, TOOLS AND TECHNIQUES 8

Project life cycle-Initiation, Planning, Execution, Monitoring and Closing Phase; - Link between project management process, process groups and knowledge areas; Project management tools and techniques- Project Stakeholders description and mapping - Stakeholder Management Process

MODULE III PROJECT QUALITY, COST AND SCHEDULE MANAGEMENT 10

Triple constraints of project-quality, cost and schedule-Quality Planning, Quality Assurance and Quality Control, Process Control, Cost of Quality, Seven Tools of Quality Control- Cost Management: Cost Estimating Methods, Estimating Completion Cost, Earned Value Management, Budgeting, Life-Cycle Cost analysis- Project Time Management: Duration Estimation Method, FS/FF/SS/ SF Relations, Lead/Lag, Arrow Diagram Method and Precedence Diagram Method for Scheduling-Resource Allocation

MODULE IV PROJECT HR MANAGEMENT 5

Organizational Goals- (MBO/MBE/MBP)-Responsibility Assignment Matrix (RAM)-Types of Powers- Manage or Lead-Conflict management Techniques-Performance Evaluation Process-Motivation Theories and its Application for execution of Projects-Leadership Styles-Project Team Building-Project Staffing Constraints/Policies

MODULE V COMMUNICATION MANAGEMENT 5

Communication Management: Understanding Body languages of Project Personnel-Effective Communications- Interpersonal Skills for project Managers-PMIS-Communicating with the Customer-Communicating with Management- Formal vs. Informal Communications-Written, Verbal and Non-Verbal Communications.

MODULE VI PROJECT PROCUREMENT & RISK MANAGEMENT 8

Introduction to Project Procure Management: Soliciting RFQ/RFP-Contract Proposals-Contract Negotiation-Contract Closure-Risk Management: Defining risks-Risk management process-Risk identification-Qualitative and Quantitative Risk-Probability and Decision trees-Risk Response strategies / methods-Expected monetary value-Risk vs. life cycle phases

L – 45; Total Hours –45

REFERENCES:

1. Jack. R. Meredith, Samuel. J. Mantel & Scott. M. Shafer, Project Management in Practice, Fifth Edition, Bangalore: Wiley, 2015
2. Bob Hughes, Mike Cotterrel “Software Project Management”, Tata McGraw-Hill, 2009

OUTCOMES:

- Learners will be able to identify the Key Knowledge Areas and apply PM process in hypothetical project assignments given as continuous assessment.
- They would be able to suitably recognize tools and techniques required for various phases included in a project.
- They would also be able to manage scope, time, cost and other major components that would help them to execute the project efficiently.

GECX114 OPERATIONS RESEARCH

L	T	P	C
3	0	0	3

OBJECTIVES:

- To acquire knowledge and training in optimization techniques.
- To get knowledge about optimization in utilization of resources.
- To understand and apply operations research techniques to industrial operations

MODULE I LINEAR PROGRAMMING PROBLEM 8

Linear programming – formulation of the problem - graphical interpretation of optimality - Simplex method – to obtain basic feasible solution – types of linear programming solution – complications and their resolution.

MODULE II ARTIFICIAL VARIABLE AND TWO PHASE METHOD, DUALITY 6

Artificial variable - Big M method – Two phase method – alternative optimal solution – unbounded solution - Duality – primal dual relationships - rules of constructing the dual from primal.

MODULE III TRANSPORTATION PROBLEM & ASSIGNMENT PROBLE 8

Transportation problems – Initial basic feasible solutions, MODI method, Unbalance in transportation, Degeneracy in transportation models, Assignment problem – Minimization and Maximization type of problems by Hungarian method.

MODULE IV NETWORK AND SEQUENCING PROBLEMS 8

PERT and CPM – Network diagram – Fulkerson's rule - CPM Probability of achieving completion date – Crash time – Cost analysis. Sequencing N jobs through 2 machines and 3 machines.

MODULE V QUEUING THEORY & SIMULATION 7

Poisson arrivals and exponential service times – characteristics of Queuing models – single channel – Introduction to multi channel models – Random number generation – Monte Carlo Simulation.

MODULE VI INVENTORY CONTROL, REPLACEMENT MODELS AND GAME THEORY 8

Types of inventory- Inventory cost - EOQ - Deterministic inventory problems – Introduction to probabilistic models & system level inventory control - Replacement models – Replacement of items that deteriorate with time – value of money changing with time – not changing with time – Individual and group replacement policy - Game theory – simple games.

L – 45; Total Hours –45

TEXT BOOKS:

3. Hamdy ATaha, “Operations Research an introduction”, 8th edition, Phil Pearson, 2007.
4. Winston.W.L., “Operations Research”, 4th edition, Thompson-Brooks/Cole, 2003.

REFERENCES:

1. Wayne.L. Winston, “Operations Research applications and algorithms”, 4th edition, Thomson learning, 2007.
2. Frederick. S. Hiller and Gerald.J.Lieberman, “Operations Research concepts and cases”, 8th edition (SIE), Tata McGraw – Hill Pub. Co. Ltd., New Delhi, 2006.
3. A. Ravindran, D. T. Phillips and J. J. Solberg, "Operations Research:Principles and Practice", 2nd edition, John Wiley & Sons, New York, 1992.
4. Robertazzi. T.G., “Computer networks and systems-Queuing theory and performance evaluation”, 3rd edition, Springer, 2002.

OUTCOMES:

At the end of the course students will be able to

- solve linear programming problems
- solve transportation and assignment problems.
- solve network and sequencing problems.
- apply the operations research techniques to solve industrial problems.

GECX115 NANO TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the basic concepts of Nanoscience relevant to the field of engineering.
- To provide an exposure about the importance of various synthesis method.
- To enrich the knowledge of students in various characterisation techniques.

MODULE I INTRODUCTION & CLASSIFICATION OF NANOMATERIALS 9

Definition - Origin of nanotechnology - Difference between bulk and nanomaterials- Top-down and bottom-up processes - Size dependent properties (magnetic, electronic,transport and optical), Classification based on dimensional property - 0D, 1D, 2D and 3D nanostructures – Kubo gap.

MODULE II TYPES OF NANOMATERIALS 9

Metal oxides and metal nano particles - Ceramic nano particles - Semi conducting quantum dots - Core-shell quantum dots - Nanocomposites - Micellar nanoparticles.

MODULE III PRODUCTION OF NANOPARTICLES 7

Sol-gel, hydrothermal, solvothermal, Plasma Arcing, Electro deposition, RF sputtering, Pulsed laser deposition, Chemical vapour, deposition.

MODULE IV CARBON BASED NANOMATERIALS 6

Carbon nanotubes: Single wall nanotubes (SWNT), Multiwall nanotubes (MWNT) - structures-carbon nanofibre, Fullerenes-Application of carbon nanotubes and Fullerenes.

MODULE V NANOPHOTONICS 7

Light and nanotechnology, Interaction of light and nanotechnology, Nanoholes and photons, nanoparticles and nanostructures; Nanostructured polymers, Photonic Crystals, Solar cells.

MODULE VI CHARACTERISATION TECHNIQUES 7

Basic principles of scanning Electron Microscopy (SEM), Atomic force microscopy (AFM), Scanning tunneling microscopy (STM), Scanning probe

microscopy (SPM) and Transmission electron microscopy (TEM), Particle size analyzer, Luminescence techniques.

L – 45; Total Hours –45

TEXT BOOKS:

1. Hari Singh Nalwa, “Handbook of Nanostructured Materials and Nanotechnology”, Academic Press, 2000.
2. Guozhong Cao, “Nanostructures and Nano materials-Synthesis, Properties and Applications”, Imperial College Press (2011).
3. Zhong Lin Wang, “Handbook of Nanophase and Nanomaterials (Vol 1 and II)”, Springer, 2002.
4. Mick Wilson, Kamali Kannangara, Geoff smith, “Nanotechnology: Basic Science and Emerging Technologies”, Overseas press, 2005.

REFERENCES:

1. A. Nabok, “Organic and Inorganic Nanostructures”, Artech House, 2005.
2. C.Dupas, P.Houdy, M.Lahmani, Nanoscience: “Nanotechnologies and Nanophysics”, Springer-Verlag Berlin Heidelberg, 2007.
3. Mick Wilson, Kamali Kannangara, Michells Simmons and Burkhard Raguse, “Nano Technology – Basic Science and Emerging Technologies”, 1st Edition, Overseas Press, New Delhi,2005.
4. M.S. Ramachandra Rao, Shubra SinghH, “Nanoscience and Nanotechnology: Fundamentals to Frontiers”, Wiley, 2013.

OUTCOMES:

At the end of this course, the students will be able to:

- Apply the knowledge of different types of nanomaterials for various engineering applications.
- Acquire the knowledge of various methods of production of nanomaterials.
- Familiarize with various characterization techniques.

GECX116	VEHICLE MAINTENANCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To know about the various methods of maintaining procedure, vehicle insurance and basic problems in a vehicle.
- The student able to impart knowledge in maintaining of engine components and subsystems.
- The student able to impart knowledge in maintaining of transmission, driveline, steering, suspension, braking and wheels.
- The student able to impart **carefully maintaining their vehicle and can increase driving safety.**

MODULE I MAINTENANCE, WORKSHOP PRACTICES, SAFETY AND TOOLS **7**

Maintenance – Need, importance, primary and secondary functions, policies - classification of maintenance work - vehicle insurance - basic problem diagnosis. Automotive service procedures – workshop operations – workshop manual - vehicle identification. Safety – Personnel, machines and equipment, vehicles, fire safety - First aid. Basic tools – special service tools – measuring instruments – condition checking of seals, gaskets and sealants. Scheduled maintenance services – service intervals - Towing and recovering.

MODULE II ENGINE AND ENGINE SUBSYSTEM MAINTENANCE **8**

General Engine service- Dismantling of Engine components- Engine repair- working on the underside, front, top, ancillaries- Service of basic engine parts, cooling and lubricating system, fuel system, Intake and Exhaust system, electrical system - Electronic fuel injection and engine management service - fault diagnosis- servicing emission controls.

MODULE III TRANSMISSION AND DRIVELINE MAINTENANCE **8**

Clutch- general checks, adjustment and service- Dismantling, identifying, checking and reassembling transmission, transaxle- road testing- Removing and replacing propeller shaft, servicing of cross and yoke joint and constant velocity joints- Rear axle service points- removing axle shaft and bearings- servicing differential assemblies- fault diagnosis.

MODULE IV STEERING AND SUSPENSION MAINTENANCE 7

Maintenance and Service of Mc person strut, coil spring, leaf spring, shock absorbers. Dismantling and assembly procedures. Inspection, Maintenance and Service of steering linkage, steering column, Rack and pinion steering, Recirculating ball steering service- Worm type steering, and power steering system.

MODULE V BRAKE AND WHEEL MAINTENANCE 7

Inspection, Maintenance and Service of Hydraulic brake, Drum brake, Disc brake, parking brake. Bleeding of brakes. Wheel alignment and balance, removing and fitting of tyres, tyre wear and tyre rotation.

MODULE VI AUTO ELECTRICAL AND AIR CONDITIOING MAINTENANCE 8

Maintenance of batteries, starting system, charging system and body electrical -Fault diagnosis using Scan tools. Maintenance of air conditioning parts like compressor, condenser, expansion valve, evaporator - Replacement of hoses- Leak detection- AC Charging- Fault diagnosis Vehicle body repair like panel beating, tinkering, soldering, polishing, painting.

L – 45; Total Hours –45

TEXT BOOKS:

1. Ed May, "Automotive Mechanics Volume One" , Mc Graw Hill Publications, 2003
2. Ed May, "Automotive Mechanics Volume Two" , Mc Graw Hill Publications, 2003
3. Vehicle Service Manuals of reputed manufacturers
4. Vehicle maintenance and garage practice by Jigar A.Doshi Dhru U.Panchal,Jayesh P.Maniar. 2014
5. A Practical Approach to Motor Vehicle Engineering and Maintenance 3rd Edition by Allan Bonnick.

REFERENCES:

1. Bosch Automotive Handbook, Sixth Edition, 2004.
2. Advanced Automotive Fault Diagnosis by Tom Denton 2011.
3. Nissan Patrol Automotive Repair Manual: 1998-2014 by Haynes Manuals Inc.
4. Automobile electrical manual a comprehensive guide by Haynes manual car repair.

OUTCOMES:

On completion of the course student should be able to

- Prepare maintenance schedules and procedures with appropriate tools.
- Demonstrate the procedure and methods to repair and calibrate the engine.
- **Analyze the causes and remedies for fault in transmission and drive line systems.**
- **Analyze the causes and remedies of steering and suspension systems.**
- **Analyze the causes and remedies of brake system.**
- **Demonstrate the procedure for wheel alignment and wheel balanced.**

GECX117	FUNDAMENTALS OF DIGITAL IMAGE PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Describe and explain basic principles of digital image processing
- Design and implement algorithms that perform basic image processing
- Design and implement algorithms for advanced image analysis
- Assess the performance of image processing algorithms and systems

PRE-REQUISITES:

- Basic knowledge of transforms in Mathematics

MODULE I DIGITAL IMAGE FUNDAMENTALS 8

Elements of Image Processing System, Fundamentals steps in Digital Image Processing, Image Sampling & Quantization, Spatial and Gray Level Resolution.

MODULE II COLOR IMAGE PROCESSING 8

Fundamental of color image processing, color models- RGB, CMY, HIS, Pseudo color image processing

MODULE III IMAGE ENHANCEMENT 7

Basic gray level Transformations, Histogram Processing, Spatial Filtering

MODULE IV IMAGE TRANSFORMS 7

2D-DFT, DCT, Haar Transform, Fundamentals of 2D-wavelet transform, sub-band coding

MODULE V IMAGE SEGMENTATION AND RESTORATION 8

Point, line and edge detection methods ,Image Segmentation and its types, Restoration: Noise model, Inverse filter and Wiener filter.

MODULE VI IMAGE COMPRESSION 7

Fundamentals of redundancies, Basic Compression Methods: Huffman coding, Arithmetic coding, JPEG and MPEG Compression standards.

TOTAL HOURS 45

TEXT BOOKS

1. Gonzalez and Woods, "Digital Image Processing", 3rd Edition, Pearson Education, 2016.
2. Anil. K. Jain, "Fundamentals of Digital Image Processing"; 4th Edition, PHI, 2007

REFERENCES

1. Pratt William, "Digital Image Processing", John Wiley & Sons, 2007.
2. Arthur Weeks Jr., "Fundamentals of Digital Image Processing", PHI, 2006.

OUTCOMES:

On completion of the course, students will be able to

- Explain the fundamental concepts of digital image processing.
- Discuss about color image processing
- Recognize & apply various image enhancement techniques.
- Apply various transforms for image processing.
- Apply various techniques for image segmentation and restoration.
- Identify and use appropriate image compression techniques

Group II courses

(To be offered in VII Semester)

		L	T	P	C
GECX201	**GREEN DESIGN AND SUSTAINABILITY**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To impart knowledge to face challenges, the technology poses for water, energy, and climate change by implementing sustainable design.

MODULE I CONCEPTS OF SUSTAINABLE DEVELOPMENT 7

Objectives of Sustainable Development - Need for sustainable development-Environment and development linkages - Globalisation and environment-Population, poverty and pollution- global, regional and local environment issues-Green house gases and climate change.

MODULE II SUSTAINABLE DEVELOPMENT OF SOCIO ECONOMIC SYSTEMS 8

Demographic dynamics of sustainability- Policies for socio economic development- Sustainable Development through trade- Economic growth- Action Plan for implementing sustainable development- Sustainable Energy and Agriculture.

MODULE III FRAME WORK FOR ACHIEVING SUSTAINBAILITY 7

Sustainability indicators- Hurdles to sustainability- Business and Industry – Science and Technology for Sustainable Development- Performance indicators of sustainability and assessment mechanism- Constraints and barriers of Sustainable Development.

MODULE IV GREEN BUILDINGS 8

Introduction to Green Building- Energy- Water- Materials and Resources - Sustainable Sites and Land Use - Indoor Environmental Quality- Life Cycle Assessment- Energy, water and materials efficiency.

MODULE V ENERGY CONSERVATION AND EFFICIENCY 7

Energy savings- Energy Audit- Requirements- Benefits of Energy conservation-Energy conservation measures for buildings- Energy wastage- impact to the environment.

MODULE VI GREEN BUILDINGS DESIGN 8

Elements of Green Buildings Design- Foundation, Electrical, Plumbing, flooring, Decking, roofing, insulation, wall coverings, windows, siding, doors and finishing, LEED certification for Green Buildings, Green Buildings for sustainability.

L – 45; Total Hours –45

TEXT BOOKS:

1. Kirby, J., Okeefe, P., and Timber lake, “Sustainable Development”, Earthscan Publication, London, 1995.

REFERENCES:

1. Charles Kibert, J., “Sustainable Construction: Green Building Design and Delivery”, 2nd Edition, John Wiley and sons, 2007.

OUTCOMES:

At the end of the course, the students will be able to

- Explain the relationship between sustainability and emergence of green building practices.
- Address the economic, environmental, and social concerns.

GECX202 APPROPRIATE TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES:

- To impart students knowledge about the basics and applications of various appropriate technologies in the field of civil engineering.

MODULE I BASICS CONCEPTS 7

Back ground, Tools, Choices and Implications, Appropriate Technology Movement (an overview) - Basic design process, basic financial analysis-discounted cash flow, and energy fundamentals.

MODULE II APPROPRIATE TECHNOLOGY WITH REFERENCE TO BUILDING DESIGN 7

Appropriate Building Materials, Appropriate Energy Saving Techniques, Water Conservation (Indoor), Rain Water Harvesting.

MODULE III WATER, HEALTH AND SANITATION MANAGEMENT 7

Water Storage: Designing Dams and Pipelines, Appropriate Selection for Sanitation Technique, Sewerage, Communal Health and Waste Water Recycling.

MODULE IV WASTE MANAGEMENT 8

Types of Waste - Sources - Collections and On-Site Processing -Transferring Stations - Disposal Systems - Recycling.

MODULE V ENERGY EFFICIENT TECHNIQUES 8

Green building concepts-renewable energy sources- Solar – Steam and wind-Biofuels - Biogas – Electricity.

MODULE VI TECHNOLOGY POLICY 8

Government Policies- Energy Policy-Appropriate technology Development Centre-its function and responsibilities-Building policies-Case Studies.

L – 45; Total Hours –45

TEXT BOOKS:

1. Barrett Hazeltine and Christopher Bull, “Appropriate Technology: Tools Choices and Implications”, Academic Press, Orlando, USA, 1998.
2. Ken Darrow and Mike Saxenian, “Appropriate Technology Source Book : A Guide to Practical Books for Village and Small Community Technology”, Stanford, 1986.

REFERENCES:

1. Richard Heeks, “Technology and Developing Countries: Practical Applications Theoretical Issues”, 1995.
2. John Pickford, “The Worth of Water : Technical Briefs on Health, Water and Sanitation”, Intermediate Technology Publications, 1998.

OUTCOMES:

- At the end of the course, the students will be able to use suitable technologies for various conditions for sustainable development.

GECX203 ENGINEERING SYSTEM MODELLING AND SIMULATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn the concepts, techniques, tools for modeling and simulation systems and environments through the use of computers.
- To study the various aspects of discrete dynamic, stochastic systems modeling and conducting experiments with those models on a computer.

MODULE I INTRODUCTION 6

Systems – Modelling – types – systems components – Steps in model building- Simulation Algorithms and Heuristics; Simulation Languages.

MODULE II RANDOM NUMBERS / VARIATES 7

Random numbers – methods of generation – random variates for standard distributions like uniform, exponential, Poisson, binomial, normal etc. – Testing of Random variates – Monte Carlo Simulation.

MODULE III MODELLING PROCESS 7

Primitive Models : Establishing relationships via physical laws; Establishing relationships via curve fitting; Parameters estimation problems; Elementary state transition models.

MODULE IV DESIGN OF SIMULATION EXPERIMENTS 9

Steps on Design of Simulation Experiments – Development of models using of Highlevel language for systems like Queuing, Inventory, Replacement, Production etc., – Model validation and verification, Output analysis.

MODULE V SIMULATION LANGUAGES 10

Need for simulation Languages – Comparisons & Selection of Languages – GPSSARENA- EXTEND – Study of any one of the languages.

MODULE VI CASE STUDIES USING SIMULATION LANGUAGES 6

Case Study using simulation languages

L – 45; Total Hours –45

REFERENCES:

1. Law, A.M., & W.D. Kelton, “Simulation Modelling and Analysis”, McGraw

Hill, Singapore, 2000.
2. Harrel, C.R., et. al., “System Improvement Using Simulation”, 3rd Edition, JMI Consulting Group and ProModel Corporation, 1995.
3. Harrel, C.R. & T. Kerim, “Simulation Made Easy, A Manager’s Guide”, IIE Press, 1995.
4. Geoffrey Gordon, “Systems Simulation”, Prentice Hall, 2002.
5. David Kelton, Rondall P Sadowski, David T Sturrock, “Simulation with Arena”, Mc Graw Hill, 2004.

OUTCOMES:

The student should be able to

- Model and simulate systems and environments through the use of computers.
- Conduct experiments with discrete dynamic, stochastic system models on a computer.

GECX204 VALUE ANALYSIS AND ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To get acquainted with value analysis and engineering tool for productivity improvement.
- To understand and analyze the theory and methodology of Value Engineering.

MODULE I VALUE ENGINEERING BASICS 8

Origin of Value Engineering, Meaning of value, Definition of Value Engineering and Value analysis, Difference between Value analysis and Value Engineering, Types of Value, function - Basic and Secondary functions, concept of cost and worth, creativity In Value Engineering.

MODULE II VALUE ENGINEERING JOB PLAN AND PROCESS 6

Seven phases of job plan, FAST Diagram as Value Engineering Tool, Behavioural and organizational aspects of Value Engineering, Ten principles of Value analysis, Benefits of Value Engineering.

MODULE III ORIENTATION AND INFORMATION PHASES 8

Launching Value Engineering project work - Objectives and Targets - VE Project work: a time-bound programme - Projects and Teams - Time Schedule - Co-ordination - Consultant. Technical data - Marketing related information - Competition profile - Cost data - Materials Management related information - Quality related information - Manufacturing data.

MODULE IV FUNCTION ANALYSIS AND CREATIVE PHASES 9

Objectives - Function definition - Classification of functions - Higher level functions – Function – Cost – Function – Worth - Value Gap - Value index - How to carry out Function Analysis? – Fast Diagraming - Cost Modelling.

Creativity - How to improve creativity of an individual? – How to promote creativity in the organisation? - Obstacles to Creativity - Mental road blocks - Creativity killer phrases. Positive thinking - Ideas stimulators - Creativity techniques - Brainstorming.

MODULE V EVALUATION, INVESTIGATION AND RECOMMENDATION 6

Paired comparison and Evaluation Matrix techniques - Criteria for selection of

VE solutions. Design – Materials – Quality – Marketing – Manufacturing - Preview session. The report - presentation.

MODULE VI IMPLEMENTATION PHASE AND CASE STUDIES 8

Design department - Materials department - Production Planning & Control - Quality Control – Manufacturing – Marketing - Need for co-ordinated teams - The Action Plan. Value Engineering case studies.

L – 45; Total Hours –45

TEXT BOOKS:

1. Mudge, Arthur E. “Value Engineering- A systematic approach”, McGraw Hill, New York, 2000.
2. Kumar S, Singh R K and Jha J K (Ed), “Value Engineering”, Narosa Publishing House, 2005.

REFERENCES:

1. Park RJ, “Value Engineering: A Plan for Invention”, St.Lucie Press, New York, 1999.
2. Lawrence, D.M., “Techniques of Value Analysis and Engineering”, McGraw Hill 1988.
3. George, E.D., “Engineering Design: a Material and Processing Approach”, McGraw Hill, 1991.
4. Heller, D.E., “Value Management, Value Engineering and Cost Reduction”, Addison Wesley, 1988.

OUTCOMES:

- The student will be able to realize the value of products, processes and implement value analysis to achieve productivity improvement.

GECX205 INDUSTRIAL SAFETY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the various safety measures to be taken in different industrial environments.

MODULE I SAFETY MANAGEMENT **7**

Evolution of modern safety concept- Safety policy - Safety Organization - line and staff functions for safety- Safety Committee- budgeting for safety. safety education and training.

MODULE II SAFETY IN MANUFACTURING **7**

Safety in metal working-Machine guarding -Safety in welding and gas cutting - Safety in cold forming and hot working of metals -Safety in finishing, inspection and testing -Regulation.

MODULE III SAFETY IN CONSTRUCTION **8**

General safety consideration in Excavation, foundation and utilities – Cordoning – Demolition – Dismantling –Clearing debris – Types of foundations – Open footings.

Safety in Erection and closing operation - Safety in typical civil structures – Dams-bridges-water Tanks-Retaining walls-Critical factors for failure-Regular Inspection and monitoring.

MODULE IV ELECTRICAL SAFETY **8**

Electrical Hazards – Energy leakage – Clearance and insulation – Excess energy – Current surges – Electrical causes of fire and explosion – National electrical Safety code.

Selection of Environment, Protection and Interlock – Discharge rods and earthing device – Safety in the use of portable tools - Preventive maintenance.

MODULE V SAFETY IN MATERIAL HANDLING **8**

General safety consideration in material handling devices - Ropes, Chains, Sling, Hoops, Clamps, Arresting gears – Prime movers.

Ergonomic consideration in material handling, design, installation, operation and

maintenance of Conveying equipments, hoisting, traveling and slewing mechanisms.

Storage and Retrieval of common goods of shapes and sizes in a general store of a big industry.

MODULE VI SAFETY EDUCATION AND TRAINING 7

Importance of training-identification of training needs-training methods – programme, seminars, conferences, competitions – method of promoting safe practice - motivation – communication - role of government agencies and private consulting agencies in safety training – creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign – Domestic Safety and Training.

L – 45; Total Hours –45

REFERENCES:

1. Krishnan N.V, “Safety Management in Industry”, Jaico Publishing House, Bombay, 1997.
2. Blake R.B., “Industrial Safety”, Prentice Hall, Inc., New Jersey, 1973.
3. Fulman J.B., “Construction Safety, Security, and Loss Prevention”, John Wiley and Sons, 1979.
4. Fordham Cooper W., “Electrical Safety Engineering”, Butterworths, London, 1986.
5. Alexandrov M.P., “Material Handling Equipment”, Mir Publishers, Moscow, 1981.

OUTCOMES:

Students would be able to

- Acquire knowledge on various safety Hazards.
- Carry out safety measures for different industrial environments.

GECX206 ADVANCED OPTIMIZATION TECHNIQUES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the various advanced optimization tools.
- To provide an understanding to deal with ill identified and fuzzy problems.

MODULE I INTRODUCTION **7**

Review of conventional optimization techniques - limitations - limitation of exhaustive search - need for artificial intelligence - bio mimicking methods

MODULE II HEURISTICS METHODS **8**

Introduction – Advanced methods of algorithm design: Greedy method, Backtracking method, Divide and Conquer method – Dynamic programming – Heuristics exploration algorithms – Greedy search - Local search – Hill climbing – Tabu search – Gradient search – Beam search – Simulated Annealing.

MODULE III GENETIC ALGORITHM **7**

Introduction - Basics of GA – Population – Reproduction – Cross over – Mutation -genetic algorithms in search, optimization and machine learning-practical genetic algorithms.

MODULE IV ANT COLONY OPTIMIZATION **8**

Introduction: Ant Colony Optimization – Meta-heuristic Optimization – History – The ACO Meta-heuristic – ACO Algorithms: Main ACO – Ant system – Ant colony system – Max-Min Ant system – Applications: Routing in telecommunication networks – Travelling salesmen – Graph Coloring – Advantages & Disadvantages

MODULE V FUZZY LOGIC AND ANN **8**

Fuzzy logic, knowledge representation and inference mechanism – Fuzzy and expert control – standard Takagi-Sugeno mathematical characterizations – Design example – Biological foundations to intelligent systems: Artificial neural networks, Back-propagation networks, Radial basis function networks, and recurrent networks.

MODULE VI IMPLEMENTATIONS & APPLICATIONS 7

Reduction of size of an optimization problem – multilevel optimization – parallel processing – multi objective optimization – Job shop scheduling – Vehicle scheduling – Line balancing – Sensor integration.

L – 45; Total Hours –45

REFERENCES:

1. Singiresu S. Rao, “Engineering optimization – Theory and practices”, John Wiley and Sons, 1996.
2. Ravindran – Phillips –Solberg, “Operations Research – Principles and Practice, John Wiley and Sons, 1987.
3. Fredrick S.Hillier and G.J.Liberman, “Introduction to Operations Research”, McGraw Hill Inc. 1995.
4. Kalymanoy Deb, “Optimization for Engineering Design”, PHI, 2003
5. Christos H. Papadimitriou, Kenneth Steiglitz, Combinatorial Optimization, PHI 2006

OUTCOMES:

At the end of the course student will be able to

1. Formulate a real life situation as an optimization the problem.
2. Identify the appropriate solution methodology and provide a solution

GECX207 MATLAB SIMULINK

L	T	P	C
3	0	0	3

OBJECTIVES:

- Teach students how to mathematically model engineering systems
- Teach students how to use computer tools to solve the resulting mathematical models. The computer tool used is MATLAB and the focus will be on developing and solving models of problems encountered in engineering fields

MODULE I INTRODUCTION MATLAB DATA PRESENTATION 7

Vectors, Matrices -Vector/Matrix Operations & Manipulation- Functions vs scripts- Making clear and compelling plots-Solving systems of linear equations numerically and symbolically- Least squares regression -Curve fitting.

MODULE II MATLAB PLOT FUNCTION 7

Introduction- Plot Function – Animation- 3D Plots-Customizing Plots – Plot Applications- Saving &Painting Plots.

MODULE III ROOT FINDING AND COMPUTER REPRESENTATION OF NUMBERS 7

Linearization and solving non-linear systems of equations- The Newton-Rapson method- Integers and rational numbers in different bases- Floating point numbers- Round off and errors in basic arithmetic-Significant digits when reporting results

MODULE IV ORDINARY DIFFERENTIAL EQUATIONS 8

Numerical integration and solving 1^{st} order, ordinary differential equations (Euler's method and Runge-Kutta)- Use of ODE function in MATLAB

MODULE V NON-LINEAR DIFFERENTIAL EQUATIONS 8

Converting 2^{nd} order and higher ODEs to systems of 1^{st} order ODEs- Solving systems of ODEs via Euler's method and Runge-Kutta)- Solving single and systems of non-linear differential equations by linearization-Use of the function ODE in MATLAB to solve differential equations

MODULE VI INTRODUCTION OF SIMULINK 8

Simulink & its relations to MATLAB – Modeling a Electrical Circuit- Modeling a fourth order differential equations- Modeling the solution of three equations with three unknowns- Representing a model as a subsystem-Simulink demos.

L – 45; Total Hours –45

REFERENCES:

1. Griffiths D V and Smith I M, Numerical Methods for Engineers, Blackwell, 1991.
2. Laurene Fausett, Applied Numerical Analysis Using MATLAB, Pearson 2008.
3. Moin P, Fundamentals of Engineering Numerical Analysis, Cambridge University Press, 2001.
4. Wilson HB, Turcotte LH, Advanced mathematics and mechanics applications using MATLAB. CRC Press, 1997
5. Ke Chen, Peter Giblin and Alan Irving , Mathematical Exploration with MATLAB, Cambridge University Press, 1999.

OUTCOMES:

At the end of this unit students will be able to:

1. Use Matlab as a convenient tool for solving a broad range of practical problems in engineering from simple models to real examples.
2. Write programs using first principles without automatic use of built-in ones.
3. Write programs for solving linear and nonlinear systems, including those arising from boundary value problems and integral equations, and for root-finding and interpolation, including piecewise approximations.
4. Be fluent in exploring Matlab's capabilities, such as using matrices as the fundamental data-storage unit, array manipulation, control flow, script and function m-files, function handles, graphical output.
5. Make use of Maltab visual capabilities for all engineering applications.
6. An ability to identify, formulate, and solve engineering problems. This will be accomplished by using MATLAB to simulate the solution to various problems in engineering fields

GECX208	EMBEDDED SYSTEMS AND ITS APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide a detailed overview of embedded system.
- To equip students with the software development skills necessary for practitioners in the embedded systems field.
- To understand entire software development lifecycle and examine the various issues involved in developing software for embedded systems.

MODULE I EMBEDDED SYSTEMS OVERVIEW 8

Introduction –Embedded Systems vs. General computing systems- Fundamental Components of embedded systems- Characteristics- Challenges-Examples- Embedded System design process.

MODULE II EMBEDDED COMPUTING PLATFORM 8

Overview of Processors and hardware units in an embedded system-CPU buses – Memory devices –Memory types- I/O devices – Designing with computing platforms- Consumer electronics architecture-Design example: Alarm clock.

MODULE III REAL TIME EMBEDDED SYSTEMS 8

Programming embedded systems in assembly and C – Real time systems – Hard and Soft real time systems- Need for RTOS in Embedded Systems- Multiple tasks and processes –Context switching-Scheduling policies- Interprocess communication and synchronization.

MODULE IV EMBEDDED SOFTWARE DEVELOPMENT PROCESS and TOOLS 8

Development process of an embedded system-software modules and tools for implementation of an embedded system- Integrated development environment- Host and target machines-cross compiler-cross assembler-Choosing right platform.

MODULE V PROGRAM MODELING IN EMBEDDED SYSTEMS 8

Program Models – Data Flow Graph model-control DFG model-Synchronous DFG model- Finite state machines- UML modeling – UML Diagrams.

MODULE VI EMBEDDED SYSTEMS APPLICATION 5

Application specific embedded system – case study: digital camera hardware and software architecture, embedded systems in automobile, embedded system for a smart card.

Total Hours –45

TEXT BOOKS:

1. Marilyn Wolf , "Computers as components", Elsevier 2012.
2. Shibu. K.V, “Introduction to Embedded Systems”, Tata Mcgraw Hill,2009.
3. Rajkamal, "Embedded Systems Architecture, Programming and Design",1st Reprint,Tata McGraw-Hill, 2003
4. Frank Vahid and Tony Gwargie, "Embedded System Design", John Wiley & sons, 2002.

REFERENCES:

1. Sriram V Iyer and PankajGupta ,”Embedded Realtime Systems Programming ”Tata McGraw-Hill,2008
2. Qing Li and Carolyn Yao," Real-Time Concepts for Embedded Systems", CMPBooks, 2003
3. David E.Simon, "An Embedded Software Primer", Pearson Education, 2003

OUTCOMES:

On completion of this course, the students will be able to

- Identify the suitable processor and peripherals in embedded applications
- Develop embedded programs in assembly and c
- Choose the right platform for designing an embedded system
- Explore different scheduling mechanism in rtos
- Design the program model for embedded applications.
- Analyze different domain specific applications in embedded systems.

GECX209 USABILITY ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

The objective of this course is

- To understand the emerging concept of usability, requirements gathering and analysis.
- To learn about human computer interaction with the help of interfaces that has high usability.

MODULE I INTRODUCTION 6

Cost Savings – Usability Now – Usability Slogans – Discount Usability Engineering – Usability – Definition – Example – Trade-offs – Categories – Interaction Design – Understanding & Conceptualizing Interaction – Cognitive Aspects.

MODULE II USER INTERFACES 8

Generation of User Interfaces – Batch Systems, Line Oriented Interfaces, Full Screen Interfaces, Graphical User Interfaces, Next Generation Interfaces, Long Term Trends – Usability Engineering Life Cycle – Interfaces – Data Gathering – Data Analysis Interpretation and Presentation.

MODULE III INTERACTION DESIGN 8

Process of Interaction Design - Establishing Requirements – Design,Prototyping and Construction - Evaluation and Framework.

MODULE IV USABILITY TESTING 8

Usability Heuristics – Simple and Natural Dialogue, Users' Language, Memory Load, Consistency, Feedback, Clearly Marked Exits, Shortcuts, Error Messages, Prevent Errors, Documentation, Heuristic Evaluation – Usability Testing - Test Goals and Test Plans, Getting Test Users, Choosing Experimenters, Ethical Aspects, Test Tasks, Stages of a Test, Performance Measurement, Thinking Aloud, Usability Laboratories.

MODULE V USABILITY ASSESSMENT METHODS 8

Observation, Questionnaires and Interviews, Focus Groups, Logging Actual Use, User Feedback, Usability Methods – Interface Standards - National, International and Vendor Standards, Producing Usable In-House Standards.

MODULE VI USER INTERFACES 7

International Graphical Interfaces, International Usability Engineering, Guidelines for Internationalization, Resource Separation, Multilocale Interfaces – Future Developments – Case Study.

L – 45; Total Hours –45

TEXT BOOKS:

1. Yvonne Rogers, Helen Sharp, Jenny Preece, “Interaction Design: Beyond Human - Computer Interaction”, John Wiley & Sons, 3rd Edition, 2011 (Module I, II, III).
2. Jakob Nielsen, “Usability Engineering”, Morgan Kaufmann Academic Press, 1994. (Module I – VI).

REFERENCES:

1. Ben Shneiderman, Plaisant, Cohen, Jacobs, “Designing the User Interface: Strategies for Effective Human Interaction”, Pearson Education, 5th Edition, 2010.
2. Laura M. Leventhal, Julie A. Barnes, “Usability Engineering: Process, Products, and Examples”, Pearson/Prentice Hall, 2008

OUTCOMES:

Students who complete this course will be able to

- build effective, flexible and robust user interfaces.
- translate system requirements into appropriate human/computer interaction sequences.
- choose mode, media and device for the application requirements.

GECX210 SUPPLY CHAIN MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the various decision phases in a supply chain
- To be aware of the Supply Chain and its drivers
- To design Supply Chain Network
- To build a aggregate plan in supply chain
- To understand Sourcing Decisions in Supply Chain
- To comprehend the influence of Information technology in Supply Chain

MODULE I INTRODUCTION TO SUPPLY CHAIN 7

Understanding Supply Chain - Decision phases - Supply chain performance - Competitive and supply chain strategies - Achieving strategic fit - Expanding strategic scope

MODULE II SUPPLY CHAIN DRIVERS AND DESIGN 7

Drivers of supply chain performance – Designing distribution network - Network Design in the Supply Chain - Network design in Uncertain Environment

MODULE III AGGREGATE PLANNING AND MANAGING SUPPLY, DEMAND AND INVENTORY 8

Aggregate Planning in a Supply chain: role - Managing Supply - Managing Demand in Supply Chain – Cycle and Safety inventory in supply chain – Level of product availability.

MODULE IV MANAGING INVENTORY IN SUPPLY CHAIN 8

Managing Economies of Scale in a Supply Chain : Cycle Inventory- Managing uncertainty in a Supply Chain Safety Inventory- Determining optimal level of Product Availability

MODULE V SOURCING AND TRANSPORTATION 8

Sourcing decision in supply chain - Third and Fourth – Party Logistics providers - Supplier scoring and assessment - Transportation in a Supply Chain – Risk and Trade-offs in transportation design.

MODULE VI INFORMATION TECHNOLOGY IN A SUPPLY CHAIN 7

Information technology in a supply chain – CRM, ISCM, SRM in supply chain -

Over view of recent trends in Supply Chain: e-SRM, e-LRM, e-SCM.

L – 45; Total Hours –45

REFERENCES:

1. Sunil Chopra and Peter Meindl, “Supply Chain Management-Strategy Planning and Operation”, Pearson Education, 5th Indian Reprint, 2013.
2. Jananth Shah “Supply Chain Management – Text and Cases“ Pearson Education, 2008.
3. Altekar Rahul V, “Supply Chain Management-Concept and Cases”, Prentice Hall India, 2005.
4. Monczka et al., “Purchasing and Supply Chain Management”, Thomson Learning, 2nd Edition, 2nd Reprint, 2002.

OUTCOMES:

- After taking up the course the student will be able to brighten his prospects of taking up a career on supply chain management.
- The student decision making capability specific to supply chain issues in an industry is improved.
- The student can plan a well defined execution of supply chain strategy in companies.
- The student will be able to design a optimal distribution network as per the demands of the industry.
- The student can also determine the most favorable transportation plan for a company.
- The student will also be able to bring in company from paper environment to paperless environment.

GECX211 SYSTEMS ANALYSIS AND DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To describe the phases of the systems development life cycle
- To teach the automated tools for system development
- To develop and evaluate system requirements.
- To explain the organizational issues in system implementation
- To teach the usability testing and electronic data interchange
- To elucidate the importance of System analysis and design in electronic commerce.

MODULE I FUNDAMENTALS OF SYSTEM DEVELOPMENT 8

System Concept – Characteristics – Elements of System – Types of System – Modern Approach to System Analysis and Design – System Development Life Cycle – Approaches to Improving Development – Tools for System Development – Succeeding as a System Analyst – Skills – Managing the Project.

MODULE II AUTOMATED TOOLS FOR SYSTEMS DEVELOPMENT 7

What is requirements determination? Fact finding techniques, Tools for documenting procedure and decision-CASE Tools-Need for CASE tools-Reverse engineering and reengineering- phases of the software life cycle-Ranking projects-Value Chain Analysis- Corporate Strategic Planning vs. Information Systems Planning.

MODULE III SYSTEM ANALYSIS 8

Determining System Requirements – Traditional Methods - Modern Methods – Radical Methods – Structuring System Requirements – Process Modeling – Data Flow Diagramming – Logic Modeling – Conceptual Data Modeling – E-R Modeling.

MODULE IV SYSTEM DESIGN 8

System Implementation – Software Application Testing – Installation – Documentation – Training and Support – Organizational Issues in Systems Implementation – Maintaining Information System – Conducting System Maintenance.

MODULE V USABILITY AND MEASURING USER SATISFACTION 7

Usability Testing-User satisfaction test- A tool for analyzing user satisfaction – Unified Modeling Language(UML)- Case study: System Design: Application in Human Resource-Financial Applications

MODULE VI SAD IN E-COMMERCE 7

Systems analysis and design in the era of electronic commerce: B2B, B2C and C2C e-commerce -advantages and disadvantages of e-commerce. E-commerce system architecture – physical networks, logical network, World Wide Web, web-services - HTML, XML - case studies-El electronic data interchange: EDI standards - virtual private networks - XML and EDI

L – 45; Total Hours –45

REFERENCES:

1. Jeffrey A. Hoffer, Joey F. George, Joseph S. Valacich, “Modern Systems Analysis and Design”,Fifth Edition, Prentice Hall,March 2007.

2.Ned Kock, “Systems Analysis & Design Fundamentals” Sage South Asia, May 2008.

3. Joseph S. Valacich, Jeffrey A. Hoffer, Joey F. George, “Essentials Of System Analysis And Design” Prentice Hall , August 2005.

4. Rumbaugh et al, “Succeeding with Booch and Rambaugh Methods”, Addisson Wesley, second Edition, 1998.

5.Larman, C.,” Applying UML and Patterns. An introduction to Object-Oriented Analysis and Design”. Prentice-Hall PTR, 2002.

OUTCOMES:

- List the characteristics of the system and specify the approaches in the development of the system.
- Summarize the phases of the software life cycle
- Differentiate Corporate Strategic Planning and Information Systems Planning.
- Illustrate the system requirements through various modeling diagrams.
- Use tools and techniques for process and data modeling.
- Solve realistic systems analysis problems and perform user satisfaction test.

GECX212 **ADVANCED MATERIALS** **L T P C**

3 0 0 3

OBJECTIVES:

To make the student conversant with

- Dielectric materials
- Magnetic materials
- Energy materials
- Nano materials
- Semi conductors
- Smart materials

MODULE I **8**

Dielectric Materials- Polarization and Mechanism-Internal or local field-Clausius-Mossotti relation- Dielectric loss- Temperature and Frequency effect-Measurement of Dielectric constant and loss using Scherring bridge- electric break down- ferro, piezo, pyroelectric materials and its application.

MODULE II **8**

Magnetic Materials- Terminology and classification of magnetic materials (Dia, Para, Ferro & Ferri) – Magnetic moments due to electrospin – Domain theory of Hysteresis – Heisenberg theory of Exchange Interaction (without derivation)- Structure and properties of Ferrites- Properties of Soft and Hard Magnetic Materials- Application: floppy disk, CD ROM, Magneto optical recording.

MODULE III **8**

Energy Materials (Nuclear) - Introduction to nuclear materials- Materials for nuclear fuel in fission and fusion reactors, Fissile and fertile materials- Control & Construction Materials for Nuclear reactors, Moderators, Heat Exchangers- Radiation proof materials- Brief discussion of safety and radioactive waste disposal.

MODULE IV **7**

Nano Materials- The nanosize range- classification of nanomaterials- processing of nanomaterials-properties of nanomaterials- mechanical, electrical, magnetic properties- other properties- carbon based nanomaterials- other nanomaterials and its application.

MODULE V **7**

Semiconductors- The energy gap in solids-Extrinsic Semiconductors- Intrinsic Semiconductors- Hall Effect in semiconductors- Application of Hall Effect- Basic ideas of compound semiconductors -Semiconductor materials- Fabrication of Integrated Circuits- Some semiconductor Devices

MODULE VI **7**

Smart materials- aerospace materials Ni and Co based super alloys, Special steels, Titanium alloys, Intermetallics, ceramics and their composites, New High strength material, Properties of Materials, Materials in Medical Applications, Stainless steel alloys,Cobalt based alloys, titanium based alloys, polymers

L – 45; Total Hours –45

REFERENCES:

1. Materials science and Engineering: A first course by V. RAGHAVAN, 6th ed., Eastern Economy edition,Prentice Hall of India,2015
2. Materials science and Engineering: An Introduction by William D. Callister Jr., 7th ed. John Wiley & Sons Inc. 2007
3. Material science by Dr.M.Arumugam, Anurasha agencies ,third revised edition ,2002

OUTCOMES:

Students will be able to know

- significance of dielectric materials
- types and applications of magnetic materials
- applications of nuclear materials for energy harvesting
- applications of nano materials
- significance of semi conductor devices
- applications of smart materials

GECX213	NATIONAL SERVICE SCHEME	L	T	P	C
		2	0	0	2

OBJECTIVES:

Primary Objective: Personality development through community service.
To achieve the above objective, the following should be adhered:

1. To provide an understanding about the aims, structure and programmes and activities of National Service scheme in terms of Nation Building
2. To develop certain basic skills for personality development through community development.
3. Understand the community in which they work and their relation
4. Identify the needs and problems of the community and involve them in problem-solving and
5. Practice national integration and social harmony.

MODULE I INTRODUCTION TO NSS 8

Orientation and structure of NSS,-Aims and Objectives of National Service Scheme- The history of NSS- Symbol and meaning- NSS hierarchy from national to college level – Role and responsibilities of various NSS functionaries

MODULE II PERSONALITY AND COMMUNITY DEVELOPMENT SKILLS 8

Importance of youth Leadership, Traits of Good Leadership and Personality Development. Role of youth in creating awareness through NSS Programmes on Health & Hygiene; Environmental Conservation and Enrichment for Sustainable Development; Sanitation and Swachh Bharat.

MODULE III UNDERSTANDING YOUTH 7

Definition and Profiles of youth categories, Youth Issues, Challenges and Opportunities for Youth, Youth as agent of social change & Community Mobilization .Role of Youth in Nation Building. National Youth Policy.

MODULE IV SOCIAL HARMONY AND NATIONAL INTEGRATION 7

National Integration, Various obstacles in the way of National Integration; such as caste, religion, language and provisional problems etc. Role of youth in Peace building and conflict resolution- Globalization and its Economic Social Political and

Cultural impacts.

L – 30; Total Hours –30

TEXT BOOKS:

1. National Service Scheme – A Youth Volunteers Programme for Under Graduate students as per UGC guidelines J.D.S.Panwar et al. Astral International. New Delhi.
2. National Service Scheme Revised Manual, 2006.Govt. of India. Ministry of Youth Affairs & Sports. New Delhi.
3. Social Problems in India, *Ram Ahuja.*

REFERENCES:

1. National Youth Policy-2014. Ministry of Youth Affairs & Sports. .Govt. of India

OUTCOMES:

On successful completion of this course-

- Students will have exposure to the the aims, structure and programmes and activities of National Service scheme in terms of Nation Building
- Students will be trained to skills for personality development through community development.
- Students will gain knowledge about national integration and social harmony.
- Students will be exposed to the role of youths in Nation building Students will gain

GECX214	AUTOMOTIVE POLLUTION AND CONTROL	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To have a fair knowledge in automotive pollution control.
- To understand the concept of formation and control techniques of pollutants like UBHC, CO, NOx, particulate matter and smoke for both SI and CI engine will be taught to the students.
- To know about the instruments for measurement of pollutants
- To get introduced about emission standards

MODULE I EMISSION FROM AUTOMOBILES 8

Sources of Air Pollution. Various emissions from Automobiles — Formation — Effects of ollutants on environment and human beings. Emission control techniques – Modification of fuel, after treatment devices. Emission standards. Automotive waste management, old vehicle disposal, recycling, tyre recycling

MODULE II SI ENGINE EMISSIONS AND CONTROL 9

Emission formation in SI Engines- Carbon monoxide & Carbon di oxide - Unburned hydrocarbon, NOx, Smoke —Effects of design and operating variables on emission formation – controlling of pollutants - Catalytic converters, Charcoal Canister, Positive Crank case ventilation system, Secondary air injection, thermal reactor

MODULE III CI ENGINE EMISSION AND CONTROL 8

Formation of White, Blue, and Black Smokes, NOx, soot, Effect of Operating variables on Emission formation — Fumigation, Split injection, Catalytic Coating, EGR, Particulate Traps, SCR, Fuel additives — Cetane number Effect.

MODULE IV NOISE POLLUTION FROM AUTOMOBILES 8

Sources of Noise — Engine Noise, Transmission Noise, vehicle structural Noise, aerodynamics noise, Exhaust Noise. Noise reduction in Automobiles — Encapsulation technique for noise reduction —Silencer Design.

MODULE V TEST PROCEDURES 6

Constant Volume Sampling I and 3 (CVSI &CVS3) Systems- Sampling Procedures — Chassis dynamometers - Seven mode and thirteen mode cycles for Emission Sampling.

MODULE VI EMISSION MEASUREMENTS 6

Emission analysers —NDIR, FID, Chemiluminesecent, Smoke meters, Dilution Tunnel, SHED Test, Sound level meters.

L – 45; Total Hours –45

TEXT BOOKS:

1. V.Ganesan, 'Internal combustion Engines', Tata McGraw Hill Book Co, Eighth Reprint, 2005.
2. Crouse and Anglin, 'Automotive Emission Control', McGraw Hill company., Newyork 1993.

REFERENCES:

1. G.P.Springer ad D.J.Patterson, Engine Emissions, Pollutant formation, Plenum Press, New York. 1986.
2. D.J.Patterson and N.A.Henin, 'Emission from Combustion Engine and their control', Anna Arbor Science Publication,1985.
3. L.Lberanek, 'Noise Reduction', Mcgrawhill Company., Newyork1993.
4. C.Duerson, 'Noise Abatment', Butterworths ltd., London1990.
5. A.Alexander, J.P.Barde, C.lomure and F.J. Langdan, 'Road traffic noise', Applied science publisher ltd., London,1987.

OUTCOMES:

On completion of the course student should be able to

- Identify the sources of emission from vehicles.
- Analyse the causes and effects of emissions.
- Analyse causes and effects of noise pollution
- Bring out solutions for control of emissions.
- Demonstrate the test procedures and emission norms.
- Select suitable instruments for measurement of emissions.

GECX215	MOTOR VEHICLE ACT, INSURANCE & POLICY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn about basic act and regulation followed for road vehicle
- To learn about systematic steps involved to get licence and registration of motor vehicle
- To learn arbour various types of motor vehicle polices and insurances

MODULE I BASIC RULES FOR ROAD VEHICLE 8

Display and Use of Number Plates- Attachment of number plates- Number plates in horizontal position- Removal of number plates on transfer- Hours prescribed for lighted lamps- Mounting of lamps and reflectors- Multiple beam headlamps- Daytime running lamps- Auxiliary driving lamps- Parking lamps- Brakes- Stopping distances- Emergency or parking brakes- Horn- Muffler- Mirrors- Inspection of motor vehicles- Standards of safety and repair

MODULE II LICENSING OF DRIVERS OF MOTOR VEHICLES 8

Necessity of driving licence- Age limit in connection with driving of motor vehicle-Responsibility of owners of motor vehicles-Restriction on the holding of driving licence-Grant of learner's licence-Grant of driving licence-Addition to driving licence- Renewal of driving licence-Revocation of driving licence on grounds of disease or disability-Driving licence to drive motor vehicle belonging to the central government- power of court to disqualify- suspension of driving licence in certain cases- suspension or cancellation of driving licence on convection- Endorsement.

MODULE III REGISTRATION OF MOTOR VEHICLE 7

Necessity for registration – Registration Where and how to be made- Special provision for registration of motor vehicle of diplomatic officers-Temporary registration- Production of vehicle at the time of registration- Refusal of registration- renewal of certificate of registration- effectiveness in India of registration- Change of residence or place of business-transfer of ownership-Suspension of registration – cancellation of registration suspended under section 53- certificate of fitness of transport vehicle-cancellation of registration.

MODULE IV INSURANCE OF MOTOR VEHICLE 8

Necessity for insurance against third party – Requirements of policies and limits of liability- - Duty of insurers to satisfy judgements and awards against person insured in respect of third party risks-Duty to give information as to insurance-Settlement between insurers and insured persons- transfer of certificate of insurance-production of certain certificates, licences and permit in certain cases-Special provisions as to compensation in case of hit and run motor accident – Types of motor polices

MODULE V CONTROL OF TRANSPORT VEHICLES 7

Power to State Government to control road transport- Transport authorities-General provision as to applications for permits- Application for stage carriage permit- Procedure of Regional Transport Authority in considering application for stage carriage permit- Scheme for renting of motor cabs- Application for private service vehicle permit- Procedure in applying for and granting permits- Duration and renewal of permits- Transfer of permit- Replacement of vehicles-Temporary permits

MODULE VI OFFENCES AND PUNISHMENT 7

Driving without holding an effective driving licence- Driving by an under-aged person (Minor driving vehicle)- Holding of a driving licence permitting it to be used by other person.- Driving a vehicle at an excessive speed- Driving or permitting to drive a vehicle carrying excess load- Driving dangerously / its Abetment Driving an uninsured vehicle

Rider and pillion rider failing to wear protective head gear (Helmet) -Violation of Mandatory Signs -.e-challan and spot challan

L – 45; Total Hours –45

TEXT BOOKS:

1. The motor vehicle act 1988, Universal law publishing co.cpvt ltd. Newdelhi 2011
2. A Commentary On The Motor Vehicles Act, 1988 by SUKHDEV AGGARWAL The Bright Law House, New Delhi

REFERENCES:

1. The Motor Vehicles Act, 1988 Along with Latest Case Law, Notifications

& Table of Offences and Punishments Asia Law House; 15th edition (2014)

2. Assessment of Compensation in Accidents under Motor Vehicles Act by Karkara Delhi Law House (2013)

OUTCOMES:

On completion of the course students should be able to

- Explain the analysis of rules and regulations for road vehicles
- Analyze the procedure for getting driving license for vehicles at national and international level
- Analyze the procedure for registration of vehicles.
- Analyze the procedure for Insurance of vehicles and claims.
- Analyze the procedure for obtaining Government Permits and renewal
- Analyze the consequences of not following the rules and regulations

GECX216	PRINCIPLES OF COMMUNICATION SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

To introduce the analog and digital modulation techniques.
To elaborate the working of communication receivers in the presence of noise.
To give an overview of various communication systems.

MODULE I LINEAR MODULATION 8

Baseband signals, Amplitude Modulation – Modulation Index, Power Transmitted, Double Side Band and Single Side Band AM, AM Modulators and AM Receivers, AM Radio systems, Frequency Division Multiplexing.

MODULE II ANGLE MODULATION 8

Frequency Modulation and Phase Modulation, Frequency deviation and modulation index, Bandwidth of FM, FM Modulators and FM receivers, FM Radio and FM Stereo Systems

MODULE III SAMPLING AND PULSE MODULATION 7

Sampling, Nyquist's Sampling Theorem, Pulse Modulations - PAM, PPM and PWM, Time Division Multiplexing, Bandwidth of TDM systems.

MODULE IV DIGITAL COMMUNICATION 7

Digital baseband data, Digital Modulations – ASK, FSK, PSK and QPSK. Digital Communication Transmitters and Receivers.

MODULE V NOISE 8

Sources of Noise, Thermal Noise, shot noise, White noise, Narrow band Noise, Effect of noise in communication, SNR, Receiver Noise Temperature and Noise Equivalent Bandwidth.

MODULE VI COMMUNICATION SYSTEMS & NETWORK 7

FM Radio Systems, Cellular Mobile network, Satellite Communications, Optical Fiber Communication.

L – 45; T – 0; Total Hours – 45

TEXT BOOKS:

1. A. Bruce Carlson, Paul B. Crilly, "Communication Systems", 5th Edition,

McGraw Hill Int., 2011.
2. B.P. Lathi, Zhi Ding, Hari M. Gupta, “Modern Digital and Analog Communication Systems”, 4th Edition, Oxford University Press, 2017.

REFERENCES:

1. Herbert Taub, Donald L. Schilling, Goutam Saha, “Principles of Communication Systems” 4th Edition, McGraw Hill Int. 2013.
2. Simon Haykin, “An Introduction To Analog And Digital Communications”, 1st Edition, Wiley India, 2010.
3. Simon Haykin , “Communications Systems” 4th Edition, Wiley India, 2006.
4. Hwei P. Hsu, “Analog and Digital Communications” 3rd Edition,

OUTCOMES:

On completion of the course students will be able to

1. Identify various communication systems and the corresponding modulation schemes.
2. Predict the characteristics of various analog and digital modulation schemes.
3. Interpret the effect of noise and bandwidth in a communication systems
4. Apply the Nyquist criteria for a given baseband signals.
5. Evaluate the performance of communication receivers.
6. Demonstrate the applications of common communication systems.

GECX217 **LEAN MANAGEMENT** **L T P C**

3 1 0 4

OBJECTIVES:

The objective of the Course to make the student know about

- the basics of lean production management,
- how Lean principles are applied to the Construction industry to improve the operation management and product development.

MODULE I **8**

lean production? – Introduction, background, and lean thinking. Importance of philosophy, strategy, culture, alignment, focus and systems view. Discussion of Toyota Production System.

MODULE II **8**

Manufacturing systems – an overview of manufacturing strategies. Job shops, batch flow, and flexible manufacturing systems Flow production and lean production systems

MODULE III **7**

Value stream mapping in process design and product development Waste reduction - lead time reduction

Process cycle time and value-added vs. non-value added activities Optimum lot sizing

MODULE IV **8**

Lean production processes, approaches and techniques.—Importance of focusing upon flow. Tools -. Workplace organization – 5S. - Stability. - Just-In-Time – One piece flow – Pull. - . Cellular systems. - . Quick change and set-up reduction methods. f. Total productive maintenance. -. Poka-Yoke – mistake proofing, quality improvement. Standards. - . Leveling. - . Visual management. Just-in-time techniques – SMED and Takt Times - Standard work processes and line balancing Poka-yoke and pull systems material handling reduction and facilities planning

MODULE V **8**

Managing change in the lean organization Human resource management and the lean enterprise Employee involvement – Teams – Training – Supporting and encouraging involvement – Involving people in the change process -- communication -- Importance of culture. Startup of lean processes and examples of applications.

Sustaining improvement and change, auditing, follow-up actions.

7

MODULE VI

The lean enterprise and supply chain management Costs and risks of lean initiatives - Measuring lean initiatives

L – 45; Total Hours –45

TEXT BOOKS:

1. The Toyota Way Fieldbook, Jeffrey Liker and David Meier, McGraw-Hill, 2006. Lean Production Simplified, Pascal Dennis, Productivity Press, 2007.
2. Womack, James P., and Daniel T. Jones. Lean Thinking. New York, NY: Simon and Schuster, 2003. ISBN: 0743249275.
3. Murman, Earll. Lean Enterprise Value. New York, NY: Palgrave Macmillan, 2002. ISBN: 0333976975.

REFERENCES:

1. Readings at http://www.leanconstruction.org/readings.htm
2. Hopp, W. J., and Spearman, M. L. (2011). Factory Physics, Third Edition, Waveland Press, Long Grove, Il. 720 pp.

OUTCOMES:

The student will be able to

- Describe the manufacturing approaches employed and the background and philosophy of lean production.
- Illustrate the concept of waste reduction
- Apply evaluation techniques that can be used in preparation for and use in learn production activities.
- Select the tools that can be used implementing lean production in production operations.
- Discuss the importance of workplace organization, pull production, cellular arrangement and employee involvement, need for employee creativity
- Describe about the Methods for promoting success in implementing lean transformations

GECX218 GEOSPATIAL MODELING & ANALYSIS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To equip the students with fundamental representation and analysis of geospatial phenomena and provides foundations in methods and algorithms used in GIS analysis.
- To focus is on terrain modeling, geomorphometry, watershed analysis and introductory GIS-based modeling of landscape processes (water, sediment). The course includes analysis from lidar data, coastal change assessment and 3D visualization.

MODULE I INTRODUCTION TO GEOSPATIAL DATA 7

Mapping natural phenomena –Concept of continuous fields and discrete sampling – Units, projections, coordinate transformation – Georeferencing, geospatial formats, conversions, geospatial data abstraction library – Raster and vector representation, raster and vector conversions and resampling.

MODULE II DATA DISPLAY AND VISUALIZATION 7

Display of continuous and discrete data, use of color, shading, symbols, to extract the spatial pattern and relationships – 3D visualization: multiple surfaces and volumes, 3D vector objects – visualization for data analysis (lighting, scaling, transparency, cutting planes, animations) – view/create maps/post your data on-line (Google Earth/Maps, GPS visualizer)

MODULE III GEOSPATIAL ANALYSIS 7

Foundations for analysis of continuous and discrete phenomena – neighborhood operations and buffers – analysis and modeling with map algebra – cost surfaces and least cost path – spatial interpolation and approximation (gridding)

MODULE IV TERRAIN MODELING AND ANALYSIS 9

terrain and bathymetry mapping – mathematical and digital representations (point clouds, contour, raster, TIN) – DEM and DSM, working with multiple return lidar data – spatial interpolation of elevation data and topographic analysis, line of sight, view shed analysis – solar irradiation, photovoltaic energy potential, time series of elevation data, analysis of coastal change.

MODULE V FLOW TRACING, WATERSHED ANALYSIS AND LANDFORMS **8**

Methods for flow routing and flow accumulation – Extraction of stream networks – Extraction of watershed boundaries and building watershed hierarchies – feature extraction, types of landforms.

MODULE VI MODELING OF GEOSPATIAL PROCESSES **7**

Model formulation, input data processing – introduction to GIS-based hydrologic, erosion and environmental modeling – Geocomputational methods, including agent-based modeling, artificial neural networks and evolutionary computing.

L – 45; T – 0; Total Hours –45

TEXT BOOKS:

1. Hassan A, Karimi (2017), *Geospatial Data Science Techniques and Applications*, CRS Press & Co.
2. Sudipto Banerjee, Bradley P, Carlin, Alan E. Gelfand (2014), *Hierarchical Modeling and Analysis for Spatial Data*, CRS Press & Co.

REFERENCES:

1. Maguire, D., M. Batty, and M. Goodchild. 2015. GIS, Spatial analysis, and modeling. ESRI Press (G70.212 .G584 2005)
2. Zeiler, M. 2010. Modeling Our World: The ESRI Guide to Geodatabase Design. Second Ed. ESRI Press, Redlands, California

OUTCOMES:

On successful completion of this course,

- Students will be able to apply the basic concepts of Conceptualize models as representations of real life systems with inputs, outputs, and processes.
- Students will have gained knowledge in spatial tools to make simulations and predictions of real life phenomena.
- Students will have synthesized knowledge about Apply, integrate, and develop models with geospatial data through a GIS.
- Students will have an overview of Evaluate models in terms of accuracy, sensitivity, and uncertainty.
- Students will have Use of a system-based approach for problem solving, with an emphasis on sustainability.

B.S. Abdur Rahman Crescent Institute of Science & Technology

Deemed to be University u/s 3 of the UGC Act, 1956

REGULATIONS 2017

CURRICULUM AND SYLLABI

B.TECH.

MECHANICAL ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

VISION AND MISSION

VISION

To excel in providing quality education and training through Undergraduate and Postgraduate programs and carryout quality research in the field of Mechanical Engineering.

MISSION

- To provide a good learning experience through appropriate design of curriculum and syllabi that facilitate students to gain thorough understanding of the fundamental concepts and applications in Mechanical Engineering
- To equip students to solve challenging problems in Mechanical Engineering and related areas taking in to account their impact on the society
- To facilitate students to develop good communication, leadership and managerial skills through team approach in conducting experiments and projects
- To pursue academic and collaborative research activities with industry and other research institutions ensuring high quality in publications and other research outputs

PROGRAMME EDUCATIONAL OBJECTIVES

- To induce a sense of excitement in learning by adapting a holistic approach through well designed curriculum, pedagogy and evaluation for a successful professional career
- To provide a strong foundation in physical sciences and analytics to enable comprehensive understanding of the basic principles of Mechanical Engineering
- To develop knowledge and skill in applying engineering principles to conceive, design, analyze, manufacture, maintain and recycle engineering systems and components
- To equip the students with essential fundamental knowledge not only in the facets of Mechanical Engineering but also from other relevant disciplines to infuse a multi-disciplinary approach
- To enhance the spirit of inquiry through projects, internships leading to development of creativity, self confidence and team spirit
- To provide necessary ambience with scope for developing communication and life skills so as to meet the needs of the society in the globalized environment.

PROGRAMME OUTCOMES

On successful completion of the programme, the graduates will

- Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- Identify, formulate, research literature, and analyses complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- Use research –based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.
- Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

- Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change
- Apply the principles of engineering to model, analyse, design and realize the physical components, processes and systems
- Work professionally in Mechanical systems

B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE AND TECHNOLOGY

B.TECH. MECHANICAL ENGINEERING

CURRICULUM& SYLLABUS, REGULATIONS 2017

SEMESTER I

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	-
1.	BS	MAC 1181	Differential Calculus and Geometry	3	1	0	4	
2.	HS	ENC 1181/ ISC 1181/ LNC 1181/ LNC 1182 / LNC 1183	English / Arabic / Mandarin / German / Japanese	3	0	0	3	
3.	BS	PHC 1181	Physics	3	0	2	4	
4.	BS	CHC 1181	Chemistry	3	0	2	4	
5.	ESF	GEC 1101	Engineering Graphics	2	0	2	3	
6.	ESF	GEC 1102	Engineering Design	2	0	0	2	
7.	ESF	GEC 1103	Basic Engineering Practices Laboratory	0	0	2	1	
8.	ESF	GEC 1104	Computer Programming I	1	0	2	2	**23**

SEMESTER II

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	BS	MAC 1281	Advanced Calculus	3	1	0	4
2.	BS	-	Physics Elective	2	0	2	3
3.	BS	-	Chemistry Elective	2	0	2	3
4.	ESF	GEC1211	Basic Engineering Mechanics	3	1	0	4
5.	BS	GEC 1212	Environmental Studies	2	0	0	2
6.	ESF	GEC 1213	Computer Programming II	1	0	2	2

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
7.	EC	MEC1211	Material Science	3	0	0	3	
8.	EC	MEC1212	Design Appreciation Lab	0	0	3	1	
9.	ESF	EEC 1283	Basic Electrical Engineering	2	0	0	2	
10.	ESF	EEC 1284	Electrical Engineering Laboratory	0	0	2	1	**25**

SEMESTER III

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	BS	MAC2181	Partial Differential Equations and Transforms	3	1	0	4	
2.	HS	-	Humanities Elective I	2	0	0	2	
3.	HS	ENC 2181	Oral Communication	0	0	2	1	
4.	EC	MEC2101	Manufacturing Processes	3	0	0	3	
5.	EC	MEC2102	Engineering Metallurgy	3	0	0	3	
6.	EC	MEC2103	Engineering Thermodynamics	3	1	0	4	
7.	EC	MEC2104	Solid Mechanics	3	1	0	4	
8.	EC	MEC2105	Manufacturing Processes Lab	0	0	3	1	
9.	EC	MEC2106	Material Testing and Metallurgy Lab	0	0	3	1	
10.	EC	MEC2107	Part Modeling Lab	0	0	3	1	**24**

SEMESTER IV

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	BS	-	Mathematics Elective I	3	1	0	4
2.	HS	-	Humanities Elective II	2	0	0	2
3.	HS	ENC2282	Written Communication	0	0	2	1

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
4.	EC	MEC2211	Kinematics of Machinery	3	0	0	3	
5.	EC	MEC2212	Fluid Mechanics and Machinery	3	1	0	4	
6.	EC	MEC2213	Metal Cutting and Machine Tools	3	0	0	3	
7.	EC	MEC2214	Machining Lab	0	0	3	1	
8.	EC	MEC2215	Product Modelling Lab	0	0	3	1	
9.	EC	MEC2216	Fluid Mechanics and Machinery Lab	0	0	3	1	**20**

SEMESTER V

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	MS	MSC 3181 MSC 3182	Leadership and CEO Training/ Social Entrepreneurship	3	0	0	3	
2.	GE	-	General Elective I	3	0	0	3	
3.	HS	ENC3181	Communication and soft skill I Career Choice	0	0	2	1	
4.	EC	MEC3101	Dynamics of Machinery	3	1	0	4	
5.	EC	ECC3181	Electronics for Mechanical Systems	2	0	0	2	
6.	EC	MEC3102	Thermal Engineering (Integrated Lab)	3	0	3	4	
7.	EC	MEC3103	Mechanics Lab	0	0	3	1	
8.	EC	ECC31812	Electronics Lab	0	0	3	1	
9.	PE		Programme Elective ##				6**	**25**

SEMESTER VI

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	MS	MSC 3181 MSC 3182	Leadership and CEO Training/ Social Entrepreneurship	3	0	0	3	
2.	BS	-	Mathematics Elective II	2	0	0	2	
3.	HS	ENC3281	Communication and soft skill II – Confidence Building	0	0	2	1	
4.	EC	MEC3211	Machine Design	3	1	0	4	
5.	EC	MEC3212	Metrology and Mechanical Measurements (Integrated Lab)	3	0	3	4	
6.	EC	MEC3213	Heat and Mass Transfer	3	0	0	3	
7.	EC	MEC3214	Heat and Mass Transfer Lab	0	0	3	1	
8.	EC	MEC3215	CNC Lab	0	0	3	1	
9.	PE		Programme Elective ##				6**	**25**

SEMESTER VII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	GE	-	General Elective II	3	0	0	3
2.	EC	MEC4101	Finite Element Analysis (Integrated Lab)	3	0	3	4
3.	EC	MEC4102	Mechatronics (Integrated Lab)	3	0	3	4
4.	EC	MEC4103	Design of Transmission Systems	3	0	0	3
5.	EC	MEC4104	Simulation Lab	0	0	3	1
6.	EC	MEC4105	Automobile Lab	0	0	3	1

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
7.	PE		Programme Elective ##				6**	
8.	EC	MEC4106	Internship				1	**23**

SEMESTER VIII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	EC	MEC4211	Project Work	0	0	24	12	12

Total credits – 177

* Industrial training will be undertaken during Third year summer vacation. The credit will be awarded in the 7th Semester.

PROGRAMME ELECTIVES

DESIGN ELECTIVES

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	MECX01	Advanced Strength of Materials	3	0	0	3
2.	PE	MECX02	Composite Materials for Manufacture	3	0	0	3
3.	PE	MECX03	Design of Hydraulics and Pneumatics	3	0	0	3
4.	PE	MECX04	Noise, Vibration and Harshness	3	0	0	3
5.	PE	MECX05	Design of Jigs, Fixtures and Press Tools	3	0	0	3
6.	PE	MECX06	Industrial Problem Solving Techniques	3	0	0	3
7.	PE	MECX07	Geometric Modelling	2	0	0	2
8.	PE	MECX08	Reverse Engineering	2	0	0	2
9.	PE	MECX09	Reliability Engineering	2	0	0	2
10	PE	MECX10	Micro Electro Mechanical Systems (MEMS)	2	0	0	2
11	PE	MECX11	Geometric Dimensioning and Tolerancing	1	0	0	1
12	PE	MECX12	Tool and Die Design	1	0	0	1

THERMAL ELECTIVES

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	MECX21	Refrigeration and Air Conditioning	3	0	0	3
2.	PE	MECX22	Advanced I.C. Engines	3	0	0	3
3.	PE	MECX23	Nuclear Engineering	3	0	0	3
4.	PE	MECX24	Gas Dynamics and Jet Propulsion	3	0	0	3
5.	PE	MECX25	Energy Conversion	3	0	0	3
6.	PE	MECX26	Turbomachinery	3	0	0	3
7.	PE	MECX27	Energy Conservation and Management	3	0	0	3
8.	PE	MECX28	Computational Flow and Heat Transfer	3	0	0	3
9.	PE	MECX29	Renewable Sources of Energy	3	0	0	3
10	PE	MECX30	Solar Engineering	3	0	0	3
11	PE	MECX31	Design of Thermal Systems	3	0	0	3
12	PE	MECX32	Automobile Engineering	3	0	0	3
13	PE	MECX33	Automotive Pollution and Control	2	0	0	2
14	PE	MECX34	Fuels and Combustion	2	0	0	2
15	PE	MECX35	Alternate Fuels	1	0	0	1

MANUFACTURING AND MATERIALS ELECTIVES

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	MECX41	Modern Manufacturing Systems	3	0	0	3
2.	PE	MECX42	Process Planning and Cost Estimation	3	0	0	3
3.	PE	MECX43	Production Planning and Control	3	0	0	3
4.	PE	MECX44	Statistics and Quality Control	3	0	0	3
5.	PE	MECX45	Modern Production Management	3	0	0	3
6.	PE	MECX46	Advanced Optimisation Techniques	3	0	0	3
7.	PE	MECX47	Mechanical Maintenance	2	0	0	2
8.	PE	MECX48	Robotics and Automation	2	0	0	2
9.	PE	MECX49	Advanced Production Process for Automotive Components	2	0	0	2
10	PE	MECX50	Plant Layout and Material Handling	2	0	0	2
11	PE	MECX51	Industrial Safety Engineering	2	0	0	1
12	PE	MECX52	Operations Research & System Analysis	2	0	0	1
13	PE	MECX53	Nano Materials & Fabrications	2	0	0	2
14	PE	MECX54	Advanced materials	2	0	0	2
15	PE	MECX55	Prototyping Techniques	2	0	0	2
16	PE	MECX57	Industrial Marketing	1	0	0	1
17	PE	MECX58	Entrepreneurial Development	1	0	0	1

18	PE	MECX59	Digital Manufacturing	1	0	0	1
19	PE	MECX60	Additive Manufacturing	1	0	0	1
20	PE	MECX61	Failure Analysis and techniques	1	0	0	1
21	PE	MECX62	Advanced System Simulation (1 D Modeling)	1	0	0	1

Physics Elective Courses

(To be offered in II Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	PHCX 01	Fundamentals of Engineering Materials	2	0	2	3
2.	PHCX 02	Heat and Thermodynamics	2	0	2	3
3.	PHCX 03	Introduction to Nanoscience and Technology	2	0	2	3
4.	PHCX 04	Lasers and their applications	2	0	2	3
5.	PHCX 05	Materials Science	2	0	2	3
6.	PHCX 06	Non-Destructive Testing	2	0	2	3
7.	PHCX 07	Properties of Matter and Acoustics	2	0	2	3
8.	PHCX 08	Properties of Matter and Nondestructive Testing	2	0	2	3
9.	PHCX 09	Semiconductor Physics and Optoelectronics	2	0	2	3

Chemistry Elective Courses

(To be offered in II Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	CHCX01	Analytical Instrumentation	2	0	2	3
2.	CHCX02	Corrosion and its Control	2	0	2	3
3.	CHCX03	Electrical Materials and Batteries	2	0	2	3
4.	CHCX04	Engineering Materials	2	0	2	3
5.	CHCX05	Fuels and Combustion	2	0	2	3
6.	CHCX06	Fundamentals of Physical Chemistry	2	0	2	3
7.	CHCX07	Green Technology	2	0	2	3
8.	CHCX08	Organic Chemistry of Biomolecules	2	0	2	3
9.	CHCX09	Polymer Science and Technology	2	0	2	3

Maths Elective Courses

(To be offered in IV Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	MACX 01	Discrete Mathematics And Graph Theory	3	1	0	4
2.	MACX 02	Probability And Statistics	3	1	0	4
3.	MACX 03	Random Processes	3	1	0	4
4.	MACX 04	Applied Numerical Methods	3	1	0	4

Maths Elective Courses

(To be offered in VI Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	MACX 05	Mathematical Programming	2	0	0	2
2.	MACX 06	Statistical Methods for Data Analysis	2	0	0	2
3.	MACX 07	Numerical Methods for Integral and Differential Equations	2	0	0	2
4.	MACX 08	Mathematical Modelling	2	0	0	2
5.	MACX 09	Graph Theory	2	0	0	2

Humanities Elective I

(To be offered in III Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	SSCX01	Fundamentals of Economics	2	0	0	2
2.	SSCX02	Principles of Sociology	2	0	0	2
3.	SSCX03	Sociology of Indian Society	2	0	0	2

Humanities Elective II

(To be offered in IV Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	SSCX04	Economics of Sustainable Development	2	0	0	2
2.	SSCX05	Industrial Sociology	2	0	0	2
3.	SSCX06	Law for Engineers	2	0	0	2

General Elective

Group I Courses

(To be offered in V semester)

Sl. No.	Course Code	Course Title	Offering Department
1.	GECX101	Disaster Management	Civil
2.	GECX102	Total Quality Management	Mechanical
3.	GECX103	Energy Studies	Mechanical
4.	GECX104	Robotics	Mechanical
5.	GECX105	Transport Management	Automobile
6.	GECX106	Control Systems	EEE
7.	GECX107	Introduction to VLSI Design	ECE
8.	GECX108	Plant Engineering	EIE
9.	GECX109	Network Security	CSE
10.	GECX110	Knowledge management	CSE
11.	GECX111	Cyber security	IT
12.	GECX112	Genetic Engineering	LS
13.	GECX113	Fundamentals of Project Management	CBS
14.	GECX114	Operations Research	Mathematics
15.	GECX115	Nano Technology	Physics / Chemistry
16.	GECX116	Vehicle Maintenance	Automobile
17.	GECX117	Fundamentals of Digital Image Processing	ECE

Group II Courses

(To be offered in VII semester)

Sl. No.	Course Code	Course Title	Offering Department
1.	GECX201	Green Design and Sustainability	Civil
2.	GECX202	Appropriate Technology	Civil / Mechanical
3.	GECX203	Engineering System Modelling and Simulation	Mechanical
4.	GECX204	Value Analysis and Engineering	Mechanical
5.	GECX205	Industrial Safety	Mechanical
6.	GECX206	Advanced Optimization Techniques	Mechanical
7.	GECX207	Mat Lab Simulation	EEE
8.	GECX208	Embedded Systemsand its Applications	ECE
9.	GECX209	Usability Engineering	CSE
10.	GECX210	Supply Chain Management	CBS
11.	GECX211	System Analysis and Design	CA
12.	GECX212	Advanced Materials	Physics & Chemistry
13.	GECX213	National Service Scheme	School of Humanities
14.	GECX214	Automotive Pollution and Control	Automobile
15.	GECX215	Motor Vehicle Act, Insurance and Policy	Automobile
16.	GECX216	Principles of Communication Systems	ECE
17.	GECX217	Lean Management	Civil
18.	GECX218	Spatial Data Modeling & Analysis	Civil

SEMESTER I

MAC 1181	DIFFERENTIAL CALCULUS AND GEOMETRY	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aims of this course are to

- introduce eigen values and eigenvectors of matrix algebra.
- make the student knowledgeable in the area of Three Dimensional Analytical Geometry.
- demonstrate the application of Differential Calculus.
- familiarize the student with the functions of several variables.
- develop the use of ODE solvable techniques necessary for engineering applications.
- motivate the students with some basic engineering application problems in ODE.

MODULE I MATRICES 8+2

Characteristic Equation- Eigenvalues and Eigenvectors of a real matrix – Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton Theorem (without proof) – Orthogonal matrices – orthogonal transformations of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation.

MODULE II THREE DIMENSIONAL ANALYTICAL GEOMETRY 7+3

Direction cosines and ratios – angle between two lines – equations of a plane – equations of a straight line, coplanar lines - shortest distance between skew lines - sphere – tangent plane – plane section of a sphere – orthogonal spheres.

MODULE III DIFFERENTIAL GEOMETRY 7+3

Curvature – Cartesian and polar coordinates – centre and radius of curvature – circle of curvature – involutes and evolutes – envelopes.

MODULE IV DIFFERENTIAL CALCULUS OF SEVERAL VARIABLES 8+2

Functions of two variables – partial derivatives – total differential – Implicit Functions – Jacobian - Taylor's series expansion – Optima of two variables – Lagrange's multiplier method.

MODULE V ORDINARY DIFFERENTIAL EQUATIONS 8+2

Linear equations of second order with constant and variable coefficients – Simultaneous first order linear equations with constant coefficients – homogeneous equations of Euler's type – method of undetermined coefficients, method of variation of parameters

MODULE VI APPLICATIONS OF ORDINARY DIFFERENTIAL EQUATIONS 7+3

Solution of Ordinary Differential Equation Related to Electric Circuits – Bending of Beams- Motion of a Particle in a resisting medium – Simple harmonic motion.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Ramana, B.V, "Higher Engineering Mathematics" Tata McGraw Hill Publishing Co. New Delhi, 2006.
2. Grewal B.S., "Higher Engineering Mathematics" (43rd edition), Khanna Publishers, New Delhi, 2012.
3. John W. Cell "Engineering Problems Illustrating Mathematics" Mc Graw Hill Publishing Co., New York 1943.

REFERENCES:

1. Veerarajan.T., "Engineering Mathematics" (5th edition) Tata Mc Graw Hill Publishing Co. New Delhi, 2012
2. Kreyszig, E., "Advanced Engineering Mathematics", 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
3. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th edition, Cengage Learning, 2011.
4. Dennis G. Zill, Warren S. Wright, "Advanced Engineering Mathematics", 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
5. Alan Jeffrey, "Advanced Engineering Mathematics", Academic Press, USA, 2002.
6. Venkataraman, M.K., "Engineering Mathematics", Volume I, 2nd edition, National Publishing Co., Chennai, 2003.

7. James Stewart ".Calculus" (7th edition),Brooks/Cole cengage learning,UK

OUTCOMES:

After completing the course, student will be able to

- Understand the matrix techniques and compute eigen values and eigenvectors of a given matrix.
- Do the problems based on three dimensional analytic geometry.
- Apply differential calculus in engineering problems.
- Differentiate more than one variable and their applications.
- Solve the differential equations with constant coefficient and variable coefficient.
- Form and solve differential equations.

ENC 1181	ENGLISH	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To train students to use appropriate vocabulary in academic and technical contexts.
- To facilitate students to speak effectively while exchanging ideas and making presentations.
- To develop students' listening skill for comprehending and analyzing information.
- To develop their reading skill through sub skills like skimming , scanning and critical reading of a text.
- To sharpen their academic writing skills.
- To expose them to the correct usage of language and help them to apply that knowledge appropriately.

MODULE I **8**

L: Listening for general information

S : Self Introduction, Introducing one another.

R: Predicting the content

W: Paragraph Writing

Language Focus: Affixes, Simple Present tense , Connective & Prepositions.

MODULE II **8**

L: Listening for specific information (from dialogues)

S:Exchanging opinion.

R: Skimming technical Passages

W: Argumentative Writing (using the concept of Flipped Learning), Letter to the Editor.

Language Focus: Idioms, use of Modals, Simple Past tense & use of "Wh" and question tags.

MODULE III **7**

L: Learning the ways of describing images and presenting specific information (focusing on note making)

S: Making Presentations using visuals.

R : Scanning short texts for gist of information

W: Letter of Invitation, Expository Writing

Language Focus: Homophones, Homographs, Simple Future & Collocations.

MODULE IV **7**

L: Understanding prepared presentation techniques through videos

S: Short Presentations.

R: Reading for coherence and cohesion

W: Letter seeking permission for Industrial Visit

Language Focus: S-V agreement, Euphemism

MODULE V **8**

L : Understanding Non- Verbal Communications while listening to narration of incidents.

S: Narrating an expereince

R: Inferential Reading

W: Process Description – Transcoding a Flow chart.

Language Focus: Interchange of Active & passive voice, Impersonal Passive voice.

MODULE VI **7**

L: Learning Story telling techniques (stories & visuals) through audio files

S: Discussion in groups

R: Reading for critical appreciation

W: Developing an idea, Slogan writing, Interpreting a Bar Chart.

Language Focus: If clause and phrasal verbs.

TOTAL HOURS :45

REFERENCES:

1. Carol Rosenblun perry(2011). The Fine Art of Technical Writing. Create Space Independent Publishing Platform, New Delhi.
2. Dutt, P.K. Rajeevan. G and Prakash , C.L.N. (2007) A course in Communication Skills. Cambridge Univesity Press, India.
3. Kala, Abdul & Arun Tiwari (2004). Wings of Fire: An Autobiography (Simplified and A bridged by Mukul Chowdhri). Hyderabad Univeristy Press.
4. Sen, Leena. (2004) Communication Skills. Prentice Hall, New Delhi.
5. Matt Firth, Chris Sowton et.al. (2012). Academic English: An Integrated Skills Course for EAP. Cambridge University Press, Cambridge.

OUTCOMES:

After completion of the course, students will have the ability to

- Demonstrate their range of vocabulary in academic and technical contexts
- Exchange ideas and make presentations
- Comprehend and respond appropriately to listening tasks.
- Read a text efficiently and process information.
- Create and draft different kinds of academic documents
- Communicate effectively using grammatically correct expressions.

ISC1181	ARABIC	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To read and write in Arabic language.
- To learn vocabulary of different fields
- To develop situational communication skills.

MODULE I PREPARATORY ARABIC **7**

Introducing Arabic Alphabets.

Listening and Reading.

Audio & Video aided listening, Tajweed listening,

Writing Arabic Alphabets (connected & unconnected).

Introducing words.

Reading simple sentences.

Learning names of the things in and around the class room.

Exercises.

MODULE II FUNCTIONAL ARABIC **7**

Listening Arabic texts, stories and action verbs

Communicating Simple sentences.

Jumla' Ismiyya and Jumla' Fi'liyya

Situational Conversation:

Greetings, Introduction.

Classroom, College, Picnic.

Dining and Kitchen.

Reading skills.

Exercises

MODULE III FUNCTIONAL ARABIC **8**

Implication of effective listening.

Audio aids.

Writing Simple sentences.

Communicating ordinal and cardinal numbers.

Situational communication:

Playground, library.

Forms of plural – Sample sentences.

Introduction to tenses.

Exercises.

MODULE IV FUNCTIONAL ARABIC **8**

Communication:
Family, travel
Market, Prayer hall
Writing skills:
Note making.
Sequencing of sentences.
Developing answers from the questions.
Exercises.

MODULE V TECHNICAL ARABIC 8

Importance of technical communication.
Reading and writing skills.
Audio & Video aided listening.
Introduction to Arabic terms related to administration.
Situation communication:
Air travel, Office administration, passport, visa.
Exercises

MODULE VI TECHNICAL ARABIC 7

Situation communication:
Contractual work, machineries and equipments..
Computer, internet browsing.
Banking,
Exercises.

TOTAL HOURS :45

TEXT BOOKS:

1. Arabic for professionals and employees, Kilakarai Bukhari Aalim Arabic College, Chennai, India, 2013.

REFERENCES:

1. Arabic Reader for Non Arabs (Ummul Qura University, Makkah), Kilakarai Bukhari Aalim Arabic College, 2005.

OUTCOMES:

On successful completion of the course, the student will be able to:

- Write correct sentences in Arabic.
- Communicate in Arabic at primary level in working situations in the fields of engineering and administration.

LNC1181	MANDARIN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To improve the proficiency of students in Mandarin language.
- To develop their knowledge of vocabulary.
- To train them in using appropriate grammatical forms during communications.
- To empower them for successful communication in social and academic contexts.
- To make them appreciate the language usage in real life situations.

MODULE I **8**

General Introduction to Chinese • Pinyin and Tones • Introduction to the Writing System: basic strokes and stroke order · Numbers 1-100, song · Days of the Week · Months of the Year

MODULE II **8**

Chinese names and related culture · Chinese family structures and values · Greetings · Introducing Yourself · Family members · Occupations

MODULE III **7**

Languages and Nationalities · Daily Routine · Chinese breakfast · Negative Sentences and Interrogative Sentences · Asking for Personal Information · The Verb *shi* and Basic Sentence Structures

MODULE IV **7**

Answering an Affirmative-negative Question · Food and drinks Transportation · Likes and dislikes · Adverbs *bu*, *jiu* and *dou* · Verb-absent Sentences

MODULE V **8**

Jisui and *duoda* Questions · S+V+O Construction · Routines and Daily Activities ·*Haishi* Questions · Modal Verbs · Hobbies and Habits

MODULE VI **7**

Making Suggestions with *haoma* ·Colors · Clothing · Body parts · Talking about Likes and Dislikes · Measurement Words in Chinese

TOTAL HOURS :45

TEXT BOOKS:

1. Ma, Yanmin, and Li, Xinying. *Easy Steps to Chinese, Vol*. *1 Textbook*. Beijing: Beijing Language and Culture University Press, 2006. Print.
2. Ma, Yanmin, and Li, Xinying. *Easy Steps to Chinese, Vol. 1 Workbook*. Beijing: Beijing Language and Culture University Press, 2006. Print.

OUTCOMES:

On completion of the course, students will be able to

- Exhibit proficiency in Chinese Language.
- Use vocabulary in appropriate contexts.
- Use appropriate grammatical forms effectively.
- Use the language in social and academic contexts.
- Appreciate the use of language forms.

LNC1182	GERMAN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To improve the proficiency of students in German language.
- To create awareness of using vocabulary among students.
- To expose them to correct grammatical forms of the language.
- To empower them for successful communication in social and academic contexts.

MODULE I **8**

Introduction to German alphabets, phonetics and pronunciation- Introducing themselves and others using simple sentences and answer to some basic personal questions-: Introduction to different types of articles and verbs, Nouns

MODULE II **8**

Understanding and responding to everyday queries like instruction, questions, - number & gender, pronouns, present and past tense.

MODULE III **7**

Short telephone messages, requests etc., if spoken slowly and clearly-- Detailed overview of articles, adjectives with/without articles, Prepositions

MODULE IV **7**

Ask and giving directions using simple prepositions- Ability to fill basic information on forms while registering for courses / classes.

MODULE V **8**

Ability to extract and understand relevant information in a public announcement, broadcast, newspaper, radio etc-- dative & accusative

MODULE VI **7**

Ability to describe about people, work, immediate environment, education and other topics related to personal needs in a concise manner-- Understanding of matters that are familiar and are encountered regularly like instances at school, work, at public places, places of leisure etc.

TOTAL HOURS :45

TEXT BOOKS:

1. Course book : Tangram aktuell 1 – Lektion 1–4 (Kursbuch + Arbeitsbuch mit Audio-CD zum Arbeitsbuch), Rosa-Maria Dallapiazza, Eduard von Jan, Til Schönherr, Hueber Publisher, ISBN 978-3-19-001801-7
2. Practice book: Tangram aktuell 1 – Lektion 1–4 (Kursbuch + Arbeitsbuch mit Audio-CD zum Arbeitsbuch), Rosa-Maria Dallapiazza, Eduard von Jan, Til Schönherr, Hueber Publisher, ISBN 978-3-19-001801-7.

REFERENCES:

1. NETZWERK A1 TEXTBOOK, Deutsch als Fremdsprache,Stefanie Dengler,Paul Rusch, Helen Schmitz, Tanja Sieber, Langenscheidt and Klett, ISBN : 9788183076968
2. STUDIO D A1 (SET OF 3 BOOKS + CD), Hermann Funk. Cornelsen, ISBN: 9788183073509
3. Willkommen! Beginner's course. Paul Coggle, Heiner Schenke. 2nd edition. (chapter 1 - 6) ISBN: 9781444165159 –
4. Willkommen! Beginner's course. Paul Coggle, Heiner Schenke. ISBN: 978-1-444-16518-0
5. An Introduction to the German Language and Culture for Communication, Updated Edition Lovik, Thomas A., J. Douglas Guy & Monika Chavez. Vorsprung -. New York, Houghton Mifflin Company, 1997/2002. ISBN 0-618-14249-5.

OUTCOMES:

On completion of the course, students will be able to

- Show their proficiency in German Language.
- Use appropriate vocabulary in real life contexts.
- Use appropriate grammatical forms while communicating with people.
- Effectively use the language in social and academic contexts.

LNC1183	JAPANESE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To train students to use appropriate vocabulary in academic and technical contexts.
- To facilitate students to speak effectively while exchanging ideas and making presentations.
- To develop their reading skill through sub skills like skimming, scanning and critical reading of a text.
- To sharpen their academic writing skills.
- To expose them to the correct usage of language and help them to apply that knowledge appropriately.

MODULE I **7**

Introduction of the Japanese writing system, i.e. *Hiragana*, *Katakana* and *Kanji*, word-building, writing foreign names and loan words in Katakana.

MODULE II **8**

Oral practice of pronunciation and intonation of Japanese sounds, Japanese greetings, self introduction, identifying things, time of the day, calendar; counting using Japanese numerical classifiers; describing things;

MODULE III **7**

Making comparisons; talking of daily activities, kinship terms used for address and reference, seasons, giving and receiving, shopping; making requests, talking of one's likes and dislikes.

MODULE IV **8**

Extensive practice of basic patterns at the lower intermediate level through drills and exercises.

MODULE V **7**

Comprehension of passages in simple Japanese and writing of composition in Japanese applying lower intermediate grammatical patterns.

MODULE VI **8**

Diverse texts based on Japanese culture, customs, history, food habits, and science etc, for the development of communicative competence of students; skimming, scanning of texts with emphasis on advanced

sentence patterns, grammatical structures and idiomatic phrases, reading and writing of approximately

TOTAL HOURS :45

REFERENCES:

1. Nihongo I, Kokusaigakuyukai, and other supplementary material
2. Exersice book 1of Nihongo 1, and other supplementary material
3. Nippon, the Land and its People & Encyclopedia of Contemporary Japanese
4. Japani: Japanese Conversation for Improving Spoken Proficiency, By P.A. George, Inoue Yoriko and Itsuko Nandi, Books Plus.
5. Chukyu Nihongo, Tokyo Gaikokugo Daigaku; Nihongo II, Kokusaigakuyukai, and other supplementary material.

OUTCOMES:

After completion of the course, students will have the ability to

- Demonstrate their range of vocabulary in academic and technical contexts
- Exchange ideas and make presentations
- Comprehend and respond appropriately to listening tasks.
- Read a text efficiently and process information.
- Create and draft different kinds of academic documents
- Communicate effectively using grammatically correct expressions.

PHC 1181	PHYSICS	L	T	P	C
		3	0	2	4

OBJECTIVES:

To make students conversant with the

- basic concepts of crystal physics and its structures
- production and applications of ultrasonic waves
- study of thermal conductivities of good and bad conductors
- phenomenon of wave optics and its applications
- principle of fibre optic communication and its applications to sensors
- wave mechanics principle and its applications in electron microscopy
- green energy physics and its environmental impacts to society

MODULE I CRYSTAL PHYSICS 8

Crystalline and amorphous solids – Unit Cell – Seven Crystal Systems – Bravais Lattice – Miller Indices – Interplanar Spacing – Characteristics of Unit Cell - Calculation of Number of atoms per unit cell, Atomic Radius, Coordination Number and Packing Factor for SC, BCC, FCC and HCP and Diamond structures –Defects in crystals-Point defects –Edge and screw dislocations and their significance - Surface Defects.

MODULE II ULTRASONICS AND THERMAL PHYSICS 8

Introduction to Ultrasonics - Properties - Production methods - Magnetostriction Oscillator method- Piezoelectric Oscillator method – Detection of Ultrasonics – Thermal method – Piezoelectric method – Kundt's tube method – Applications of Ultrasonics – Acoustic Grating – SONAR – Depth of sea – Velocity of blood flow, Ultrasonic Flaw detector (qualitative).

Transmission of heat – Conduction, Convection and Radiation – Thermal Conductivity of good Conductor – Forbe's method- Thermal Conductivity of bad Conductor – Lee's Disc method.

MODULE III APPLIED OPTICS 8

Interference – Air Wedge – Michelson's Interferometer – Determination of wavelength of light and thickness of thin transparent sheet.

Introduction to Laser – Characteristics of Laser – Spontaneous and Stimulated Emissions – Einstein's Coefficients - Population inversion –

Pumping Mechanism – Laser Action – Types of Laser: He-Ne laser, CO2 laser and Nd:YAG laser - Applications : Laser Materials Processing .

MODULE IV FIBRE OPTICS 7

Optical fibre – Principle and propagation of light in optical fibre – Numerical aperture and acceptance angle – Types of optical fibres – Attenuation – Absorption, Scattering losses, Bending losses and Dispersion in Optical fibres – Fiber Connectors and Couplers - Applications – Fibre optic communication system (block diagram only)- Fibre optic sensors - displacement and pressure sensors (qualitative) - Medical endoscope.

MODULE V QUANTUM MECHANICS 7

Black body radiation – Planck's theory of radiation – Deduction of Wien's displacement law and Rayleigh – Jean's law from Planck's theory –Dual nature of matter – de Broglie's wavelength- Physical significance of wave function – Schrodinger wave equation – Time independent and time dependent wave equation – Particle in one dimensional box – Harmonic oscillator(qualitative).

MODULE VI RENEWABLE ENERGY SOURCES 7

Present Energy sources and sustainability - Solar energy - Solar photovoltaics - Solar cells – Bioenergy - Biomass – production of liquid fuels from biomass – Wind energy – Wind turbines – energy and power from wind turbines - Geothermal energy - Ocean energy: Wave energy – Wave energy conversion devices – Tidal energy – Tidal power basics – power generation –Tidal energy potential – Environmental benefits and impacts of renewable energy sources

PRACTICALS

1. Determination of Velocity of Ultrasonic waves in a given liquid using Ultrasonic Interferometer.
2. Determination of wavelength of ultrasonic waves using Kundt's tube method.
3. Determination of thickness of a thin wire using Air Wedge method.
4. Determination of wavelength of light using spectrometer diffraction grating.

5. Determination of angle of divergence of a laser beam using He-Ne laser.
6. Determination of particle size of lycopodium powder using semiconductor laser.
7. Determination of wavelength of laser light using semiconductor laser diffraction.
8. Determination of Acceptance angle and Numerical Aperture using fiber optic cable.
9. Determination of thermal conductivity of a good conductor by Forbe's method.
10. Determination of thermal conductivity of a bad conductor by Lee's disc method.
11. Determination of solar cell characteristics.

L – 45; P – 30; TOTAL HOURS – 75

REFERENCES :

1. Gaur R.K. and Gupta S.L., "Engineering Physics'', 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2013.
2. Palanisamy P.K., Physics for Engineers, Vol1 & Vol2, 2nd Edition, Scitech Publications, 2003.
3. Serway R.A. and Jewett, J.W. "Physics for Scientists and Engineers with Modern Physics". Brooks/cole Publishing Co., 2010.
4. Tipler P.A. and Mosca, G.P., "Physics for Scientists and Engineers with Modern Physics", W.H. Freeman, 2007.
5. Markert J.T., Ohanian. H. and Ohanian, M. "Physics for Engineers and Scientists". W.W. Norton & Co. 2007.
6. Godfrey Boyle, "Renewable Energy: Power for sustainable future", 2nd edition, Oxford University Press, UK, 2009.

OUTCOMES:

At the end of the course, students will be able to

- understand the different types of crystal structures
- apply the concept of ultrasonic principle in engineering and medical field
- calculate thermal conductivities of good and bad conductors

- differentiate the various laser systems and its applications in engineering and medical field
- apply the principle of fibre optics for communication and sensor applications
- formulate wave mechanics principle for applications in electron microscopy
- Correlate the different renewable energy sources for societal needs.
- To complement the knowledge acquired in the theory class.
- To correlate the experimental results for application.

CHC1181	CHEMISTRY	L	T	P	C
		3	0	2	4

OBJECTIVES:

The students should be conversant with

- the basic problems like hardness, alkalinity, dissolved oxygen associated with the water used for domestic and industrial purpose and treatment process involved.
- the synthesis, properties and applications of nanomaterials.
- the importance of renewable energy sources like solar, wind, biogas, biomass, geothermal, ocean and their limitations.
- the basic analytical techniques like UV-Visible, FT-IR, NMR, AAS, AES, Circular Dichroism and XRD etc.
- photochemistry concepts related to physical processes and chemical reactions induced by photon absorption and their applications.
- basic principles of electrochemistry, cell construction and evaluation and to understand general methodologies for construction & design of electrochemical cell

MODULE I WATER TECHNOLOGY 9

Impurities present in water, hardness : types of hardness, demerits of hard water in boilers, estimation of hardness by EDTA method (problems) – alkalinity : estimation of alkalinity (problems) – dissolved oxygen: estimation of dissolved oxygen – conditioning methods : external treatment method: – lime soda and zeolite process (principle only), Ion exchange process – Internal treatment : colloidal, carbonate, phosphate and calgon methods – drinking water: standards (BIS), treatment of domestic water {screening, sedimentation, coagulation, filtration, disinfection }– desalination: electrodialysis, reverse osmosis.

MODULE II NANOCHEMISTRY 6

Introduction – distinction between molecules, bulk materials and nanoparticles – classification based on dimension with examples – synthesis (top-down and bottom-up approach} : sol-gel, thermolysis (hydrothermal and solvothermal), electrodeposition, chemical vapour deposition, laser ablation – properties and applications (electronic, magnetic and catalytic) – risk factors and future perspectives.

MODULE III ENERGY SOURCES 8

Energy: past, today, and future – a brief history of energy consumption – present energy scenario of conventional and renewable energy sources – renewable energy : needs of renewable energy, advantages and limitations of renewable energy – solar energy: basics, solar energy in the past , photovoltaic, advantages and disadvantages – bioenergy: conversion, bio degradation, biogas generation, biomass gasifier, factors affecting biogas generation, advantages and disadvantages – geothermal energy: geothermal resources (hot dry rock and magma resources, natural and artificial), advantages and disadvantages – wind energy: wind resources, wind turbines, advantages and disadvantages – ocean energy: wave energy, wave energy conversion devices, ocean thermal energy, advantages and disadvantages.

MODULE IV PHOTOCHEMISTRY 7

Introduction: absorption and emission, chromophores, auxochromes – laws of photochemistry : Grotthus-Draper law, Stark Einstein law – quantum yield (problems) –photo physical processes : fluorescence and phosphorescence - Jablonski diagram (electronic states and transitions) – quenching, annihilation – photosensitization: principle and applications – chemiluminescence, bioluminescence.

MODULE V ANALYTICAL TECHNIQUES 7

Spectroscopy: electromagnetic radiation and spectrum – types of transitions – types of spectra (atomic and molecular with their chemical usefulness) – Beer-Lamberts law (problems) – principles, instrumentation and applications of: Colourimetry – UV-Vis spectrophotometer – atomic absorption spectroscopy – atomic emission spectroscopy – principles and applications of: IR, NMR, mass and X-ray diffraction analysis.

MODULE VI ELECTROCHEMISTRY 8

Electrochemistry - types of electrodes (principle and working) : gas (SHE), metal/metal ion electrode, metal-metal insoluble salt (calomel electrode), ion-selective (glass electrode and fluoride ion selective electrode) – Electrolytic and galvanic cells, construction of cell, EMF measurement and applications (problems), standard cell (Weston-cadmium), reversible and irreversible cell, concentration cell. Determination of fluoride ion using fluoride ion selective electrode – Chemically modified electrodes (CMEs) :

concept, approaches and applications.

PRACTICALS

1. Estimation of hardness in given water sample.
2. Estimation of the alkalinity of the given water sample.
3. Estimation of strong acid by conductometry.
4. Estimation of Fe^{2+} present in the given sample by potentiometry.
5. Verification of Beer-Lamberts law and estimation of Cu^{2+} present in unknown sample.
6. Estimation of sodium and potassium present in the given sample by flame photometry.
7. Determination of molecular weight and degree of polymerisation of a polymer by viscosity method.
8. Synthesis of thermosetting polymer.

L – 45; P – 30; TOTAL HOURS – 75

REFERENCES:

1. S. Vairam, P. Kalyani and Suba Ramesh, “Engineering Chemistry”, Wiley India Ltd., New Delhi, 2011.
2. G.A. Ozin and A.C. Arsenault, “Nanochemistry: A Chemical Approach to Nanomaterials”, RSC Publishing, Thomas Graham House, Cambridge, 2005.
3. P.C Jain & Monica Jain, Engineering Chemistry Dhanpatrai Publishing Company (P) Ltd., New Delhi (2013).
4. S S Umare & S S Dara, A text Book of Engineering Chemistry, S. Chand& Company Ltd, New Delhi, 2014.
5. G.D.Rai, “Non conventional energy sources,” Khanna Publishers, New Delhi, 2011.
6. John Twidell and Tony Weir, “Renewable Energy Resources, Taylor & Francis Ltd, London, United Kingdom, 2005
7. Principles of molecular photochemistry: An introduction, Nicholas J. Turro, V.Ramamurthy and Juan C. Scaiano, University Science Books, Sausalito, CA, 2009.

OUTCOMES:

The students will be able to

- solve problems related to hardness, alkalinity, dissolved oxygen associated with the water and describe the treatment processes.
- classify nanomaterials and apply the nanochemistry approach to synthesize the nanomaterials.
- explain the principle and enumerate the advantages and disadvantages of various renewable energy sources.
- state the principle and illustrate the instrumentation of various analytical techniques.
- apply the concepts of photochemistry to elaborate various photo-physical and photochemical reactions.
- construct a electrochemical cell and describe the various types of electrodes and determine the fluoride content.

GEC 1101	ENGINEERING GRAPHICS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To introduce the students of all engineering programs, the basic concepts of engineering drawing, which is the basic communication medium for all engineers
- To provide practical exposure on important aspects like drawing analytic curves, orthographic projections, section of solids, development of surfaces, isometric projection, perspective projection and free hand drawing.
- To introduce computerized drafting.

MODULE I BASICS AND ENGINEERING CURVES 10

Drawing instruments, dimensioning, BIS conventions, types of lines, simple geometric constructions.

Conic sections: ellipse, parabola, hyperbola.

Special curves: cycloid, epicycloid, hypocycloid and involutes.

MODULE II ORTHOGRAPHIC PROJECTION 8

Orthographic projection – first angle, second angle, third angle and fourth angle projections –setup - assumptions, principle. Free hand sketching of orthographic views of simple machine parts as per first angle projection. Orthographic projection of points in all quadrants. Some commands and demonstration of drafting packages.

MODULE III PROJECTION OF STRAIGHT LINES AND PLANES 10

Projection of straight lines in first quadrant – true length and true inclinations – Rotating line and trapezoidal methods –traces of straight line.

Projection of plane lamina in first quadrant and its traces

MODULE IV PROJECTION OF SOLIDS 10

Projection of solids in first quadrant: Axis inclined to one reference plane only- prism, pyramid, cone, cylinder – change of position and auxiliary projection methods.

MODULE V SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES 12

Section of solids: prism, pyramid, cone, cylinder, and sphere – sectional view – true shape of section Solids in simple position and cutting plane

inclined to one reference plane only.

Development of surface of truncated solids: prism, pyramid, cone cylinder – frustum of cone, pyramid and simple sheet metal parts.

MODULE VI PICTORIAL PROJECTIONS 10

Isometric projection: Isometric scale – isometric axes- iso sheet - Isometric projection and view of prism, pyramid, cylinder, cone, frustums, truncated solids and simple products

Perspective projection: station point – vanishing point – Perspective projection and views of prism, pyramid, cylinder and frustums by Visual ray method.

L – 30; P – 30; TOTAL HOURS – 60

TEXT BOOKS:

1. N.D. Bhatt, 'Engineering Drawing' Charotar Publishing house, 53rd Edtion, (2014)

REFERENCES:

1. K.V. Natarajan, 'A text book of Engineering Graphics', Dhanalakshmi publishers, Chennai. (2009)
2. Venugopal. K, and V. Prabhu Raja, Engineering Graphics, New Age International (P) Ltd., Publication, Chennai. (2011)

OUTCOMES:

- Students should be able to read the specifications and standards of technical drawing and able to draw conic sections and special curves.
- Students should be able to understand the insight of orthographic projection and to draw the various views of orthographic projection of a point and various components.
- Students should be able to draw the orthographic views of straight lines and plane figures.
- Students should be able to draw the orthographic views of simple solids.
- Students should be able to draw the sections of solids and development of solid surfaces.
- Students should be able to draw the isometric and perspective projection of simple solids and components.

GEC 1102	ENGINEERING DESIGN	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To understand the role of design in Engineering
- To understand the basic design concepts
- To understand the role of innovation in design

MODULE I DESIGN AS A CENTRAL ACTIVITY IN ENGINEERING 08

Product design – products and processes – product design methodology Design of systems; Software design

MODULE II NEED ANALYSIS AND CONCEPT DEVELOPMENT 07

Voice of customers – product specification - need analysis Bench marking Product architecture – concept generation and evaluation;

MODULE III CASE STUDIES IN ENGINEERING DESIGN 08

Product design – process design; system design; software design - Ergonomics – usability

MODULE IV INNOVATION AND DESIGN 07

Role of innovation in Engineering – incremental changes and systemic changes; scientific approach to driving innovation – case studies.

TOTAL HOURS – 30

REFERENCES:

1. Clive L. Dym and David C. Brown,"Engineering Design: Representation and Reasoning", 2nd Edition, Cambridge University Press, New Delhi, 2011.
2. Daniel G. Dorner, G. E. Gorman and Philip J. Calvert, "Information Needs Analysis: Principles and practice in information organizations", Published by Faced Publishing, London. 2015.
3. Cliff Matthews, "Case Studies in Engineering Design", John Wiley & Sons Pvt. Ltd, New York, 1998.
4. Bengt-Arne Vedin, "The Design-Inspired Innovation Workbook", World Scientific, 2011.

5. Navi Radjou, Jaideep Prabhu and Simone Ahuja, “Jugaad Innovation”, Published by Random House India, 2012.

OUTCOMES:

The students will be able to

- Apply the basic knowledge of design in engineering products / process / service.
- Analyse the problems and give innovative solutions.
- Correlate the basic knowledge of design in the real world problems.
- Apply innovative approaches to engineering design.

GEC1103	BASIC ENGINEERING PRACTICES LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To provide a practical exposure to basic engineering practices like carpentry, fitting, plumbing, welding and making of simple electrical and electronic circuits
- To have an understanding on the use of various tools, instruments and methods
- To enable the students to appreciate the practical difficulties and safety issues

CIVIL ENGINEERING PRACTICE

1. Study of plumbing in general household and industrial systems
2. Making a small window frame with Lap and Mortise & Tenon Joints
3. Introduction to power tools

MECHANICAL ENGINEERING PRACTICE

1. Fabrication of a small Table frame with Butt, Lap and Fillet Joints
2. Machining of a simple component like a table weight using lathe
3. Mold preparation for simple component

ELECTRICAL ENGINEERING PRACTICE

1. Comparison of incandescent, Fluorescent, CFL and LED lamps.
2. Study of Protection Circuits (small relay, fuse, MCB, HRC, MCCB, ECCB).
3. Familiarization of households Electrical Gadgets (Iron Box, Wet Grinder).
4. Understanding of Domestic and Industrial wiring.
5. Earthing and its significance.
6. Troubleshooting in Electrical Circuits.
7. Study of inverter fed UPS/Emergency lamp

[[

ELECTRONICS ENGINEERING PRACTICE

1. Identifications symbolic representation of active and passive

electronic components

2. Soldering and tracing of electronic circuits and checking its continuity
3. Assembling of A.C. to D.C, D.C to A.C. Circuits in bread Board and Mini project.

TOTAL HOURS – 30

OUTCOMES:

Upon the completion of the course, students should be able to

- Appreciate the practical skills needed even in making of simple objects, assemblies and circuits
- Attend minor defects especially in items used in day to day life
- Aware of the safety aspects involved in using tools and instruments

GEC 1104 COMPUTER PROGRAMMING I L T P C
1 0 2 2

OBJECTIVES:

- To identify the hardware and software components of the computer.
- To know the basic concept of operating system and get knowledge about different operating systems.
- To learn various database concepts and operations
- To develop efficient algorithms for solving a problem.
- To implement the algorithms in C language.
- To use arrays in solving problems.

MODULE I COMPUTER FUNDAMENTALS 7

Introduction -. Number System - Planning the computer program - Computer Software - Basic operating system concepts - Database Operations

MODULE II PROGRAMMING IN C 8

Introduction to C Programming Language – Operators - Control statements -Iterative statements - Arrays.

LIST OF EXPERIMENTS:

1. Computer organization –Hardware in a typical computer Identification – Booting- error messages and what it means
2. Types of Operating systems – Windows and Linux
3. Structure of a basic program - Hello world program – Debugging it
4. Data types: Type conversions
5. Input / Output: Formatted functions – Unformatted functions – Library functions
6. Properties of operators – Priority of operators – Arithmetic relational logical and bitwise operators
7. If – if else- nested if else- goto- switch case – nested switch case – for loops – nested for loops – while loop – do-while loop – break and continue statement
8. Arrays – Operation with arrays
9. Sorting and searching.

L – 15; P – 30; TOTAL HOURS – 45

REFERENCES:

1. Ashok N Kamthane, “Computer Programming”, Pearson Education, 2nd Edition, ISBN 13: 9788131704370, 2012
2. Paul J. Deitel, Deitel & Associates, “C How to Program”, Pearson Education, 7th Edition, ISBN-13: 978-0132990448, 2012

OUTCOMES:

Students who complete this course will be able to

- Recognize Modular design, logic flow, data abstraction
- Analyze the working of the programming constructs, functions, and I/O.
- Write down programs for sorting and searching algorithms
- Write down programs developing cycle for different applications
- Debug the programs and solve some practical problems in programming
- Develop programs using arrays.

SEMESTER II

MAC 1281	ADVANCED CALCULUS	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aims of this course are to

- train the students in solving problems using multiple integration.
- provide knowledge in using special functions to find out the area and volume of a region.
- acquire knowledge in tangent and normal vectors.
- gain knowledge in finding the areas of a curve and surface using vector integration.
- learn about the analytic functions and their properties along with bilinear transformation.
- know complex integration using Cauchy's theorems.

MODULE I MULTIPLE INTEGRATION AND ITS APPLICATIONS 8+2

Multiple integrals– Cartesian and Polar coordinates – change of order of integration – Multiple integral to compute area and volume.

MODULE II TRANSFORMATION OF COORDINATES AND SPECIAL FUNCTIONS 7+3

Change of variables between Cartesian, polar, cylindrical and spherical coordinates - Beta and Gamma functions – Properties and applications.

MODULE III VECTOR DIFFERENTIATION 7+3

Operations on vectors – Scalar Product, Vector Product, Projection of Vectors - Angle between two vectors - Gradient, divergence and curl

MODULE IV VECTOR INTEGRATION 8+2

Line, surface and volume integrals – Green's Theorem, Gauss Divergence Theorem and Stokes Theorem (statement only) – verification and evaluation of integrals.

MODULE V ANALYTIC FUNCTION 8+2

Analytic function - Necessary and Sufficient condition (statement only) – Cauchy-Riemann equations in polar coordinates - properties of analytic function – determination of analytic function – conformal mapping (w = z+a,

az and 1/z) and bilinear transformation.

MODULE VI COMPLEX INTEGRATION 7+3

Statement and application of Cauchy's integral theorem – Cauchy's integral formula – Taylor's series and Laurent's series expansion – singularities - classification – residues - Cauchy's residue theorem – contour integration – Unit circle and semi circular contours (excluding poles on the real axis).

L – 45; T – 15; TOTAL HOURS – 60

TEXT BOOKS:

1. Veerarajan.T., "Engineering Mathematics "(5th edition) Tata Mc Graw Hill Publishing Co. New Delhi, 2012
2. Grewal B.S., "Higher Engineering Mathematics" (43rd edition), Khanna Publishers, New Delhi, 2012.
3. John W. Cell "Engineering Problems Illustrating Mathematics" Mc Graw Hill Publishing Co., New York 1943

REFERENCES:

1. Kreyszig, E., "Advanced Engineering Mathematics", 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
2. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th edition, Cengage Learning, 2011.
3. Dennis G. Zill, Warren S. Wright, "Advanced Engineering Mathematics", 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
4. Alan Jeffrey, "Advanced Engineering Mathematics", Academic Press, USA, 2002.
5. Ramana, B.V., "Higher Engineering Mathematics" Tata Mc Graw Hill Publishing Co. New Delhi, 2006.
6. Venkataraman, M.K., "Engineering Mathematics", Volume 2, 2nd edition, National Publishing Co., Chennai, 2003.
7. James Stewart ".Calculus" (7th edition),Brooks/Cole cengage learning,UK.

OUTCOMES:

After completing the course, student will be able to

- compute the area and volume using multiple integrals.
- apply special functions to solve integration problems.
- apply differentiation in scalar and vector fields.
- find area and volume of a region using vector integration.
- verify analyticity, conformity and bilinearity of complex functions.
- evaluate complex integrals.

GEC 1211 BASIC ENGINEERING MECHANICS L T P C
3 1 0 4

OBJECTIVES:

- To impart knowledge about the basic laws of statics and dynamics and their applications in problem solving
- To acquaint both with scalar and vector approaches for representing forces and moments acting on particles and rigid bodies and their equilibrium
- To give on exposure on inertial properties of surfaces and solids
- To provide an understanding on the concept of work energy principle, friction, kinematics of motion and their relationship

MODULE I VECTOR APPROACH TO MECHANICS 07

Introduction - Units and Dimensions- Vectors – Vectorial representation of forces and moments –Vector Algebra and its Physical relevance in Mechanics - Laws of Mechanics – Parallelogram and triangular Law of forces -Lame's theorem, Coplanar Forces – Resolution and Composition of forces- Equilibrium of a particle.

MODULE II EQUILIBRIUM OF PARTICLE 06

Forces in space - Equilibrium of a particle in space - Equivalent systems of forces – Principle of transmissibility – Single equivalent force

MODULE III EQUILIBRIUM OF RIGID BODY 06

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis –Vectorial representation of moments and couples – Scalar components of a moment –Varignon's theorem - Equilibrium of Rigid bodies in two dimensions -Examples

MODULE IV PROPERTIES OF SURFACES 08

Determination of Areas – First moment of area and the Centroid of sections – Rectangle, circle, triangle from integration – T section, I section, Angle section, Hollow section by using standard formula – second and product moments of plane area – Physical relevance - Rectangle, triangle, circle from integration - T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis

theorem – Polar moment of inertia- Mass moment of Area

MODULE V FRICTION 08

Introduction to friction- types of friction- Laws of Coloumb friction- Frictional force – simple contact friction – Rolling resistance –ladder friction

MODULE VI LAWS OF MOTION 10

Review of laws of motion – Newton's law – Work Energy Equation of particles– Impulse and Momentum – Impact of elastic bodies.

L – 45; T – 15; TOTAL HOURS – 60

REFERENCES:

1. Beer, F.P and Johnston Jr. E.R, "Vector Mechanics for Engineers, Dynamics & Statics", Third SI Metric Edition, Tata McGraw-Hill International Edition, 2001.
2. Hibbeller, R.C., Engineering Mechanics, Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., 2000.
3. Irving H. Shames, Engineering Mechanics – Statics and Dynamics, IV Edition Pearson Education Asia Pvt. Ltd., 2003.

OUTCOMES:

On completion of this course students should be able

- Analyse and resolve forces, moments and solve problems using various principles and laws of Mechanics
- Apply the concept of equilibrium to particles and solve problems
- Apply the concept of equilibrium to rigid bodies and solve problems
- Analyse and determine the properties of surfaces
- Analyse and evaluate the fractional forces between the bodies
- Apply the laws of motion in solving dynamics problems

GEC 1212	ENVIRONMENTAL STUDIES	L	T	P	C
		2	0	0	2

OBJECTIVES:

The student will be conversant with the

- various natural resources, availability, utilisation and its current scenario
- different ecosystems, energy transfer, values, threats and conservation of biodiversity
- levels of different pollutants and its impact and the causes and effects of natural disasters
- impacts of human population, impact assessment, human rights and environmental acts and sustainable development

MODULE I NATURAL RESOURCES 8

Land resources: land degradation, soil erosion and desertification - Forest resources: use and over-exploitation, deforestation - Water resources: use and over-utilisation of surface and ground water, conflicts over water (inter-state and international), dams (benefits and problems), water conservation (rainwater harvesting and watershed management) - Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources, mining - Food resources: world food problems, changes in land use by agriculture and overgrazing, modern agriculture and its effects, fertilizer and pesticide problems, water logging and salinity - Energy resources: increasing energy needs, renewable and non-renewable, use of alternate energy sources.

MODULE II ECOSYSTEM AND BIODIVERSITY 8

Ecosystem- energy flow in the ecosystem - food chains, food webs and ecological pyramids - characteristics, structure and function of (a) Terrestrial ecosystems (forest, grassland, desert) and (b) Aquatic fresh water ecosystems (pond, lake, river) (c) Aquatic salt water ecosystems (ocean, estuary) - ecological succession.

Biodiversity - genetic, species and ecosystem diversity – hot-spots of biodiversity –biogeographic classification of India - endangered, endemic, extinct and invasive species of India - red data book - values of biodiversity: consumptive, productive, social, ethical, aesthetic and option values - threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts - conservation of biodiversity: in-situ and ex-situ conservation of

biodiversity

MODULE III ENVIRONMENTAL POLLUTION AND NATURAL DISASTER **8**

Definition, cause, effects and control measures of (a) air pollution (b) water pollution (c) soil pollution (d) marine pollution (e) noise pollution (f) thermal pollution (g) nuclear hazards - ill-effects of fireworks and upkeep of clean environment - solid waste management: types (urban, industrial, biomedical and electronic wastes), collection, processing and disposal (incineration, composting and land-fill) - natural disaster and management: flood, cyclone, drought, landslide, avalanche, volcanic eruptions, earthquake and tsunami.

MODULE IV HUMAN POPULATION, HEALTH AND SOCIAL ISSUES **6**

Population and population growth, population variation among nations, population explosion, family welfare programme.

Human health: air-borne, water borne diseases, infectious diseases, risks due to chemicals in food and environment.

Sustainable development - environmental legislation and laws: water act, air act, wildlife protection act, forest conservation act, environment protection act - environmental impact assessment, steps in EIA - human rights - women and child welfare.

Case studies related to current situation

TOTAL HOURS – 30

TEXT BOOKS:

1. Erach Bharucha, Textbook for Environmental Studies For Undergraduate Courses of all Branches of Higher Education for University Grants Commission, Orient Blackswan Pvt Ltd, Hyderabad, India, 2013.
2. Benny Joseph, Environmental Studies, Tata McGraw-Hill Education, India, 2009.
3. Ravikrishnan A, Environmental Science and Engineering, Sri Krishna Publications, Tamil Nadu, India, 2015.
4. Raman Sivakumar, Introduction to Environmental Science

and Engineering, McGraw Hill Education, India, 2009.

5. Venugopala Rao P, Principles of Environmental Science and Engineering, Prentice Hall India Learning Private Limited; India, 2006.
6. Anubha Kaushik and Kaushik C.P., Environmental Science and Engineering, New Age International Pvt Ltd., New Delhi, India, 2009.

REFERENCES:

1. Masters G.M., Introduction to Environmental Engineering and Science, Prentice Hall, New Delhi, 1997.
2. Henry J.G. and Heike G.W., Environmental Science and Engineering, Prentice Hall International Inc., New Jersy, 1996.
3. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co. Boston, USA, 2016.

OUTCOMES:

The student will be able to

- predict the scenario of various natural resources and suggest remedies to curb the exploitation of these resources.
- identify food chain and web and its role in various ecosystems, assess the impacts on biodiversity and provide solutions to conserve it.
- analyse the impacts of pollutants in the environment and propose suitable method to alleviate the pollutants and the natural disasters.
- assess on the impact of human population and the health related issues and the ethics to be followed for sustainable life.

GEC 1213	COMPUTER PROGRAMMING II	L	T	P	C
		1	0	2	2

OBJECTIVES:

- To provide knowledge about the benefits of Object Oriented Programming over Procedure oriented programming.
- To learn various File operations
- To expose fundamental concepts of object-oriented programming in classes, invoking methods and functions.
- To prepare students to get full use of code reusability using object oriented programming.
- To implement the basic concepts of object oriented programming using C++concepts.
- To focus on solving problems based on analyzing, designing and implementing programs in C and C++.

MODULE I PROGRAMMING IN C 7

Functions - Storage Classes - Structures and Unions – Pointers -Self Referential Structures and Linked Lists - File Processing.

MODULE II PROGRAMMING IN C++ 8

Programming in C++ - Overview of OOP in C – Inheritance - Polymorphism - Type Casting – Exceptions.

LIST OF EXPERIMENTS:

1. Functions
2. One dimensional arrays, Pointers
3. Recursion
4. Multi dimensional arrays, Linked lists.
5. Operating on Files.
6. Simple C++ program with Control statements.
7. Getting input from user console.
8. Classes, Object and Constructors.
9. Method overloading.
10. Inheritance

L – 15; P – 30; TOTAL HOURS – 45

REFERENCES:

1. Bjarne Stroustrup," The C++ Programming Language", Addison Wesley, 4th edition, ISBN-13: 978-0321563842, 2013.
2. Brian W. Kernighan and Dennis M. Ritchie, " The C Programming Language", Prentice Hall, ISBN 0-13-110362-8, 2015.
3. Bjarne Stroustrup, " Programming: Principles and Practice Using C++ ", Addison Wesley, 2nd edition, ISBN-13: 978-0321992789, 2014.
4. Brian W. Kernighan and Dennis M. Ritchie, " The C Programming Language (Ansi C Version)", Prentice Hall India Learning Private Limited, 2nd edition, ISBN-13: 978-8120305960, 1990.

OUTCOMES:

Students who complete this course will be able to

- Develop efficient algorithms for solving problems
- Handle files in C
- Use simple data structures like arrays and linked lists in solving problems.
- Write simple programs using concepts of object oriented programming.
- Implement algorithms in C++ Language.
- Demonstrate the Object Oriented Programming concepts applied in networking, web development and Database applications.

MEC1211	MATERIAL SCIENCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To integrate the materials science, manufacturing, and mechanics knowledge that students have from previous courses and apply it to engineering design.
- To impart knowledge on properties, testing and applications of materials so as to identify and select suitable materials for various engineering applications.
- To Impart knowledge on the various modes of failures and newer materials for engineering uses.

MODULE I CLASSIFICATION OF MATERIALS 10

Historical perspective, Material properties and qualities, Classification of materials: Ferrous (steel) and Non-ferrous (Aluminium, copper)metals, Polymers (PC, PP, PE, PVC, PTFE, Acrylic), Engineering Ceramics (Aliumina, SiC), Composites–Types, Properties and Applications.

MODULE II NEWER/ADVANCED MATERIALS 5

Smart materials, Nano crystalline Materials, Superalloys ,Intermetallics, Biomaterials – Properties and applications

MODULE III TESTING OFMATERIALS 9

Testing of materials under tension, compression and shear loads. Hardness tests(Brinnell, Vickers and Rockwell).Impact test-Izod and Charpy.Tests for Creep and Fatigue.

MODULE IV FAILUREANALYSIS 6

Wear and Corrosion Failures– Factors influencing failures, Failure analysis techniques, Analysis of failures, Simple case studies.

MODULE V FRACTURE AND ITS PREVENTION 9

Fundamentals, Mechanism of plastic deformation, Slip and Twinning, Types of fracture, Ductile fracture: mechanism and prevention. Brittle fracture: principles of fracture mechanics, Griffith's theory on fracture, stress intensity factor and fracture toughness. Creep and Fatigue fracture: Mechanism, Factors affecting fracture, Prevention.

MODULE VI MATERIALSELECTION 6

Steps in materials selection process, Factors influencing materials selection, Case studies

TOTAL HOURS – 45

TEXT BOOKS:

1. Williams D Callister, "Material Science and Engineering"WileyIndiaPvt Ltd, Revised, Indianedition2007.
2. KennethG.Budinski,MichaelK.Budinski,"EngineeringMaterials,PropertiesandSelection", Pearson Education, 8th Edition,2005

REFERENCES:

1. Elements ofMaterial Science and Engineering: VanVlack, Wesley Pub.Comp.
2. Materials Selection in Mechanical Design Fourth Edition MichaelF. Ashby Butterworth – Heinemann 2011.
3. EngineeringMaterials1 An Introduction to their Properties and Applications Second Edition by MichaelF. Ashby and DavidR.H.Jones Butterworth- Heinemann Reprint 2002.
4. Introduction to Physical Metallurgy by Sydney Avner, McGraw Hill Ltd

OUTCOMES:

Students will be able to

- Classify commonly used engineering materials and to describe the key properties and applications.
- Identify newer materials for engineering applications.
- Evaluate the mechanical properties of materials under different loading conditions using standard testing practices.
- Evaluate failures arising from wear and corrosion.
- Analyze and provide solution for fracture in engineering components.
- Know how to use information sources to select materials for engineering uses.

MEC 1212	DESIGN APPRECIATION LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To disassemble products and understand the interactions between its subsystems and their functionality.
- To appreciate the use of various mechanisms involved in engineering products.
- To gain knowledge through experience in handling of engineering products.
- To kindle own creativity, ideation and realize the importance of team working.

STUDY EXERCISE:

1. Study of Standard Components (Threaded fasteners, Gears, Bearings, Belt / chain drives, etc)
2. Mechanical components in electronic devices (CDD, HDD and Printer)
3. Front axle with Steering and Rear axle with Differential

TEAR DOWN EXERCISE:

Dismantle and assemble the following engineering products to identify the components and its functions

1. Reciprocating pump, axial piston pump and radial piston pump
2. Gear pump and vane pump
3. Centrifugal pump and submersible pump
4. Reciprocating compressor / Blower / Rotary compressor
5. Different type of valves
6. Work holding devices
7. Fixed reduction gear box
8. Internal combustion engine (2 Stroke and 4 Stroke)
9. Fuel feed pump and carburetor
10. Transmission system for diesel engine
11. Braking systems
12. Motors and generators

PROJECT:

Student groups will identify a product and perform a complete tear down and present it to the class.

TOTAL HOURS - 45

REFERENCES:

1. Things Come Apart: A Teardown Manual for Modern Living by Todd McLellan, Thames & Hudson Ltd, London, United Kingdom, 2013.
2. Reverse Engineering: Mechanisms, Structures, Systems & Materials by Robert W. Messler, McGraw Hill Professional, 2013.
3. Kevin Otto, Kristin wood, Product Design, Pearson Publishers,2013.

OUTCOMES:

On completion of the course, the students would be able to

- Understand of engineering systems and their mechanisms
- Understand the importance of design features in various engineering components.
- Develop awareness about single product meets multiple functions.
- Gain interest and ability to dismantle products by preparing tear down plan.
- Enhance team working and technical report writing skills.

EEC1283	BASIC ELECTRICAL ENGINEERING	L	T	P	C
		2	0	0	2

OBJECTIVES:

To impart knowledge on

- Basic concepts of electrical circuits and their solutions
- Principle of operation and applications of various D.C. and A.C. Machines
- Usage of the machines as drives
- Concepts of Basic Electronics and Devices.

MODULE I DC AND AC CIRCUITS 9

Ohm's law and its limitations. Kirchhoff's laws and its applications. Analysis of series, parallel and series-parallel resistive circuits. Power and Energy in such circuits. Generation of sinusoidal AC voltage-Phase and phase difference of sinusoidal varying voltage and current. Definition of real power, reactive power, apparent power and power factor -. The relationship between line and phase voltage & currents in balanced 3phase Star and Delta connections - Illustrative Examples

MODULE II DC MOTORS AND SPECIAL ELECTRICAL MOTORS 6

Working principle of motor.-Types and constructional feature - DC motor - Characteristics and applications. Principle of operation and constructional features of BLDC motor, Stepper and servo motors.

MODULE III TRANSFORMER AND INDUCTION MOTORS 8

Principle of operation and construction and types of single phase transformers. E.M.F equation, - voltage regulation. Three Phase Induction Motor: Principle of operation, constructional features, types, slip and its significance. Applications of squirrel- cage and slip-ring motors, Star Delta starter. Single phase Induction Motor: Principle of operation and applications.

MODULE IV ELECTRONICS 7

Semiconductor Diode: Operation, characteristics and its applications – Rectifiers and Filters, Zener diode Operation, characteristics and its applications - Regulated power supply using 78XX regulator ICs - Transistor, characteristics, operation and Applications- Transistor based

Relay Driver Circuits – opto - isolators and its applications - Basics of Thyristors and applications.

TOTAL HOURS – 30

REFERENCES:

1. Edward Hughes, “Electrical and Electronics Technology”, Pearson India, 9th Edition, 2007.
2. D P Kothari and I J Nagrath, “Basic Electrical Engineering”, McGraw Hill Publishing Co. Ltd., 2nd Edition, 2002.
3. Cotton H, Electrical Technology, Pitman, 2004.
4. B L Theraja and A K Theraja, “A textbook of Electrical Technology”, S.Chand, 2005.
5. Tom Denton “Automobile Electrical and Electronic Systems” Elsevier Butterworth- Heinemann,Third edition, 2004

OUTCOMES:

On completion of this course, the student will be familiar with

- Demonstrate the basics of Electrical circuits and their solution methods.
- Understand the working of Thyristors.
- Explain the structure of DC Motors systems.
- Understand the working of Special machines system.
- Demonstrate working of AC DC conversion.
- Explain the operation of Transformers and Induction motors

EEC1284	ELECTRICAL ENGINEERING LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To understand, simulate and verify Ohm's Law and Kirchhoff's Laws theorem.
- To understand and verify the characteristics of various Electrical Machines
- To fabricate the interfacing and power supply circuits.
- To understand the battery chargers.

LIST OF EXPERIMENTS:

1. Verification of Ohm's Law and Kirchhoff's Laws using MATLAB.
2. Power and power factor measurement using two wattmeter method.
3. Load Test on DC Shunt Motor.
4. Load Test on DC Series Motor
5. Load Test on Single Phase Transformer
6. Load Test on Three Phase Induction Motor.
7. Three phase transformer connections.
8. Fabrication of IC78XX based Regulated power supply.
9. Fabrication of opto - Isolator based transistor - relay driver circuit.
10. Fabrication of Transistor based Amplifier.
11. Study of battery chargers.

TOTAL HOURS – 30

REFERENCES:

1. Mr. M. Ramkumar, Mr. S. Suresh Electrical Workshop Manual, , Department of EEE, BSACU

OUTCOMES:

At the end of the course, the student should be able to

- Construct and simulate any given simple electric circuits and verify theorems using MATLAB.
- Study and understand the performance of Electrical Machines.
- Fabricate the power supplies.

- Design the relay driver stage.
- Implement the amplifier circuits.
- Analyse the battery charging system.

SEMESTER III

MAC 2181	PARTIAL DIFFERENTIAL EQUATIONS AND TRANSFORMS	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aims of this course are to

- Familiarize in solving partial differential equation of first, second and higher orders.
- Introduce basics and engineering applications of Fourier series, Laplace Transform, Fourier Transform and Z- Transform.

MODULE I PARTIAL DIFFERENTIAL EQUATIONS 8 + 2

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solution of standard types of first order partial differential equations – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients.

MODULE II FOURIER SERIES 8+2

Fourier Series and Dirichlet's conditions - General Fourier series - Half range Fourier series - Parseval's identity - Harmonic Analysis.

MODULE III FOURIER TRANSFORMS 7+3

Fourier integral theorem (without proof) - Fourier transform pair - Fourier Inverse Transform – Properties - Convolution theorem - Parseval's identity.

MODULE IV APPLICATIONS OF FOURIER SERIES AND FOURIER TRANSFORMS 7+3

Applications of Fourier series and Fourier Transform to solution of PDEs having constant coefficients with special reference to Heat & Wave equations, Discrete & point Spectrum and Single pulse.

MODULE V LAPLACE TRANSFORM 8+2

Introduction to Laplace transform - Existence of Laplace Transform - Properties of Laplace Transforms - Initial & Final Value Theorems - Inverse Laplace Transform - Convolution Theorem – Circuits to signal square wave: Integral equations with unrepeated complex factors – Damped forced vibrations: repeated complex

factors – Resonance - Solution of differential equations

MODULE VI Z – TRANSFORM 7+3

Introduction and Definition of Z-transform - Properties of Z- Transform - Convolution Theorem of Z-Transform - Inverse Z–transform - Convolution Theorem of Inverse Z-Transform - Formation of difference equations - Solving Difference Equations using Z-Transform.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Kreyszig .E., "Advanced Engineering Mathematics", 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
2. Grewal B.S., "Higher Engineering Mathematics", 42nd edition, Khanna Publishers, New Delhi, 2012.
3. Ramana, B.V, "Higher Engineering Mathematics" Tata Mc Graw Hill Publishing Co. New Delhi, 2006.

REFERENCES:

1. Veerarajan.T., "Engineering Mathematics", 5th edition, Tata Mc Graw Hill Publishing Co. New Delhi, 2012.
2. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th edition, Cengage Learning, 2011.
3. Dennis G. Zill, Warren S. Wright, "Advanced Engineering Mathematics", 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
4. Alan Jeffrey, "Advanced Engineering Mathematics", Academic Press, USA, 2002.

OUTCOMES:

After completing the course, student will be able to

- solve the partial differential equations.
- derive a Fourier series of a given periodic function by evaluating Fourier coefficients.
- apply integral expressions for the forward and inverse Fourier transform to a range of non-periodic waveforms.
- solve wave equation and heat flow equation.
- solve ordinary differential equations using Laplace transform.
- solve difference equation using Z-transform.

ENC 2181 **ORAL COMMUNICATION** **L T P C**
0 0 2 1

OBJECTIVES:

- To expose students to a range of professional contexts through podcasts for learning appropriate expressions.
- To train them in making poster presentations.
- To enable them to make effective business presentations.
- To help them learn persuasive and negotiation skills.
- To train them to debate on issues of current relevance
- To train them to participate in group discussions on current affairs

MODULE I **4**

Orientation to the Importance of Oral Communication -– Verbal and non-verbal communication -Paralinguistic features.

One-minute presentations (using Audacity/Voicethread) – Just a minute (JAM) on random topics

MODULE II **4**

Negotiating and persuading through effective arguments – to arrive at a conclusion (pair-work)

Understanding Negotiation, persuasion and marketing skills through Podcasts

Listening to short conversations and monologues for understanding real life conversations

MODULE III **4**

Making Poster presentations on current issues

Understanding nuances of making effective presentations (TED Videos)

MODULE IV **6**

Deliberation on social and scientific issues – Debates (focus on rebuttal skills and deconstructing arguments)

Viewing videos on debates (NDTV Discussions)

MODULE V **6**

Discussing social issues or current affairs in groups

Viewing group discussions and listening for specific information

MODULE VI **6**

Making full length presentation (through Voicethread) with the focus on one's career plans and prospects (discipline specific)

Listening to interviews for understanding speakers' perception (on industry related issues)

P – 30; Total Hours –30

REFERENCES:

1. Hancock, Mark (2012). *English Pronunciation in Use*. Cambridge University Press, UK.
2. Anderson, Kenneth & et.al (2007). *Study Speaking: A Course in Spoken English for Academic Purposes* (Second Edition). Cambridge University Press, UK.
3. Hurlock, B.Elizabeth (2011). *Personality Development*. Tata McGraw Hill, New York.
4. Dhanavel,S.P (2015). *English and Soft Skills*. Orient Blackswan, Chennai.
5. Whitby, Norman (2014). *Business Benchmark: Pre-Intermediate to Intermediate.* Cambridge University Press, UK.

OUTCOMES:

On completion of the course, students will be able to

- Listen to business conversations and do related tasks.
- Deliver effective poster presentations.
- Make effective business presentations.
- Use persuasive and negotiating skills for justifying arguments.
- Participate effectively in debates.
- Speak English intelligibly, fluently and accurately in group discussions.

MEC2101 MANUFACTURING PROCESSES L T P C
3 0 0 3

OBJECTIVES:

- To study the principles of various casting processes and their applications
- To learn the features of various types of welding processes
- To study the applications of various metal forming processes
- To describe various types of sheet metal forming process and its application
- To know the various steps required in powder metallurgy for making different components
- To understand the methods used for making plastic components

MODULE I CASTING PROCESSES 8

Sand casting process: Principle, Types of patterns- Pattern materials- Pattern allowance - Moulding sand – moulding sand properties and testing – Core making- Moulding machine types: Jolt and Squeeze- Cupola and Crucible furnace -Steps involved in sand casting-- Sand casting defects –Sand casting inspection methods- Moulding sand –Principle of special casting processes: Shell, Lost wax process, Centrifugal casting, Pressure die casting and Stir casting

MODULE II METAL JOINING PROCESSES 8

Gas welding: Principle, Equipment and types of flames- Arc Welding process: Principle, Equipment- Resistance welding: Principle, Spot, Seam, Percussion- MIG and TIG welding process- Submerged arc welding- Electro slag – Electron beam welding – Brazing and Soldering- Welding defects

MODULE III METAL FORMING PROCESSES 7

Hot and cold working of metals- Forging processes: Principle, Open and closed die forging, Forging operations, Forging machine types- Rolling : Principle, Types of rolling mills, Shape rolling operations, Flat strip rolling- Extrusion: Principle and types- Drawing process: Principle and rod , wire and tube drawing

MODULE IV SHEET METAL FORMING PROCESSES 7

Sheet metal forming operations: Shearing, bending, drawing and Stretching operations- Evaluation of formability of sheet metal: Forming limit diagram and Erichsen cupping tester-Hydro forming – Rubber pad forming- Metal spinning- Explosive forming- Magnetic pulse forming- Peen forming- Super Plastic forming

MODULE V POWDER METALLURGY 7

Principle- Methods of production of metal powders- Mixing of powders – Compaction

of metal powders- Sintering- Secondary operations- Selective laser sintering- Applications, Advantages and limitations

MODULE VI MANUFACTURE OF PLASTIC COMPONENTS 8

Types of Plastics: Thermosetting plastics and Thermo plastic – Injection Moulding: Plunger and Screw machines- Blow moulding- Rotational moulding- Film blowing- Extrusion moulding- Compression moulding- Thermoforming- Transfer moulding- Bonding of thermoplsatics

Total Hours –45

REFERENCES:

4. Hajra Choudhury , Elements of Workshop Technology, Vol I and Vol II, Media Promoters Pvt. Ltd, Mumbai 2007
5. Serope kalpakjian, Steven R. Schmid, Manufacturing Engineering and Technology, Pearson Education, Inc.2006.
6. Elements of Manufacturing Processes, B.S. Magendran Parashar & R.K. Mittal, Prentice Hall of India, 2003
7. Manufacturing Technology, P.N. Rao, Tata McGraw- Hill Publishing Limited, II Edition, 2009
8. A text book of production technology, P.C. Sharma, S.Chand and Company, X Edition, 2008
9. Manufacturing Process- Begman, John Wilely & Sons, VIII Edition, 1999.
10. Manufacturing Science, G.S. Sawhney, Vol I & II, I.K. International Publishing House Pvt. Ltd, New Delhi

OUTCOMES:

Students will be able to

- Identify a suitable casting process for making a component
- Select an appropriate welding process for joining of metals
- Choose proper equipment for making components by metal forming processes
- Pick appropriate sheet metal forming process to make a desired shape of component
- Apply the various steps involved in powder metallurgy for making various components
- Elite the process required to fabricate plastic products

MEC2102	ENGINEERING METALLURGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the fundamentals of crystallographic structures
- To learn the different phases of an alloy through phase diagrams
- To educate on different types of ferrous materials, properties and their applications
- To discuss different heat treatment processes and phase transformations
- To instruct the various processing of materials
- To describe the various strengthening mechanisms of materials

MODULE I CRYSTALLOGRAPHY 5

Crystal structures fundamentals, Crystallographic points, directions and planes, Structure of crystalline solids, Imperfection in metal crystals: Crystal imperfections and their classifications, point defects, line defects, edge & screw dislocations, surface defects, volume defects. Effects of imperfections on metal properties.

MODULE II PHASE DIAGRAM 10

Alloys constitution, Solid solutions: Substitutional and Interstitial, Solubility limit, phase, Importance and interpretation of phase diagram, Cooling curves, Unary & binary phase diagrams, Gibbs's phase rule, eutectic, eutectoid, peritectic and peritectoid systems, iron-Iron carbide phase diagram. Grain size determination. Diffusion Mechanisms, Steady-State and Non-steady-State Diffusion, Factors That Influence Diffusion.

MODULE III FERROUS MATERIALS 8

Ferrous materials, Classification, Specification of steel, Effect of alloying elements in steel (Mn, Si, Cr, Mo, V Ti & W), Stainless steel, Tool steel, Dual phase steels, High strength low alloy (HSLA) Steel, Transformation included plasticity (TRIP) steel, Maraging steel – properties and applications. Cast Irons - Gray, White malleable, Spheroidal graphite – properties and applications.

MODULE IV HEATTREATMENT PROCESSES AND PHASE TRANSFORMATIONS 9

Principles, purpose, Classification of heat treatment processes: Annealing, Normalizing, Hardening, Tempering. Case hardening: Carburizing, Nitriding, Cyaniding, Flame and induction hardening. Phase transformations: basic concepts, Isothermal and Continuous cooling transformation diagrams. Austempering, Martempering, Hardenability: Jominy end quench test.

MODULE V PROCESSING OF MATERIALS 5

Processing of engineering materials – Primary and Secondary processes – Castability, Weldability, Forgeability and Malleability Criteria – Process induced defects – Monitoring and control.

MODULE VI STRENGTHENING MECHANISM 8

Basic concepts: Dislocations and plastic deformations - Solid solution strengthening, strengthening by grain size reduction, Precipitation hardening, Particle and fiber dispersion strengthening, Strain hardening, Recovery, Recrystallisation and grain growth.

Total Hours –45

TEXT BOOKS:

1. Williams D Callister, “Material Science and Engineering” Wiley India Pvt Ltd, Revised, Indian edition 2007.
2. Kenneth G. Budinski, Michael K. Budinski, “Engineering Materials, Properties and Selection”, Pearson Education, 8thEdition,2005

REFERENCES:

1. Raghavan. V. “Materials Science and Engineering”, Prentice Hall of India Pvt. Ltd, 5th edition, 2007.
2. George. E. Dieter, “Mechanical Metallurgy”, McGraw Hill, 2007.
3. SyndneyHAvner,“IntroductiontoPhysicalMetallurgy”,2 / ETata McGraw Hill Book Company, 2007.

OUTCOMES:

Students will be able to

- Express the different crystallographic structures
- Interpret the different phases in the phase diagram
- Identify suitable ferrous material for a specific application
- Use a relevant heat treatment process and recognize its transformation
- Categorize the different processing of materials
- Select a suitable strengthening mechanism for various applications

MEC2103	ENGINEERING THERMODYNAMICS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To study the fundamental concept of thermodynamic systems and energy transfer
- To study and understand zeroth and first laws of thermodynamics
- To analyze second law of thermodynamics
- To learn the principle of steam power cycle and its improvement
- To understand thermodynamic relations and their significance
- To gain knowledge on the properties of moist air and psychrometric processes

MODULE I BASIC CONCEPTS AND PROPERTIES 12

Thermodynamic systems and control volume, Property- pressure, temperature (Zeroth law of thermodynamics),volume, internal energy, specific heat capacities, enthalpy. Concept of Energy- modes of work and heat- P- dV work, Path function - work and its illustrations for simple processes- Quasi-static process -thermal equilibrium, thermodynamic cycle.

Properties of pure substances -vapour, liquid and dryness fraction – Use of Steam Tables Phase rule, P-V, P-T, T-V, PVT surfaces

MODULE II FIRST LAW OF THERMODYNAMICS 10

Cyclic & Non-cyclic processes - Calculations of work done and heat transfer for an ideal gases and pure substances for various processes.

Derivation of Steady Flow Energy Equation (SFEE) for control volume - Steady flow processes including throttling- Examples of steady flow devices- Problems in SFEE for ideal gases and pure substances.

MODULE III SECOND LAW, ENTROPY AND AVAILABILITY 12

Second law of thermodynamics – Kelvin’s and Clausius’s statements of second law- Reversibility and irreversibility- Carnot cycle, reversed Carnot cycle, efficiency, COP- Thermodynamic temperature scale.

Clausius inequality, concept of entropy, entropy of ideal gases and pure substances- principle of increase in entropy – Carnot theorem, absolute entropy, availability, Concept of Exergy analysis.

MODULE IV STEAM POWER CYCLES 8

Illustration of processes in T-S and H-S diagrams for pure substances - Standard

Rankine's cycle, Modified Rankine's cycle, cycle improvements - reheat cycle and regenerative cycle - Simple problems.

MODULE V GAS MIXTURES AND THERMODYNAMIC RELATIONS 8

Gas mixtures – properties of ideal and real gases, equation of state, Vander Waal's equation of state, compressibility factor, compressibility chart – Dalton's law of partial pressure, Amagut's law, T-ds equations, Maxwell's relations, Clausius Clapeyron equation, Joule – Thomson experiment.

MODULE VI PSYCHROMETRY 10

Psychrometry and psychrometric charts, property calculation of air vapour mixtures- Psychrometric process – Sensible heat exchange processes - Latent heat exchange processes - Adiabatic mixing, evaporative cooling - simple problems.

L-45;T-15; Total Hours –60

REFERENCES:

1. Nag. P.K., "Engineering Thermodynamics", 4th Edition, Tata McGraw-Hill, New Delhi, 2008.
2. Rajput. R.K., "Thermal Engineering", Laxmi publications.
3. Cengel, "Thermodynamics" An Engineering Approach, Third Edition – 2003, Tata Mc Graw Hill, New Delhi.
4. Venwylen and Sontag, "Classical Thermodynamics", Wiley Eastern, 5th edition 2000
5. Arora C.P, "Thermodynamics", Tata McGraw-Hill, New Delhi, 2003.
6. Holman. J.P., "Thermodynamics", 3rd Ed. McGraw-Hill, 1995.
7. D.B. Spalding and E.H. Cole, "Engineering Thermodynamics", 3rd edition, ELBS 1973.

OUTCOMES:

Students will be able to

- Apply the concept of thermodynamic properties to quantify energy transfer
- Apply and analyse zeroth and first laws of thermodynamics
- Evaluate the second law of thermodynamics applied to heat engines and refrigerators
- Analyse and evaluate vapour power cycles
- Evaluate properties of gas mixtures
- Demonstrate various Psychrometric processes and their relations

MEC2104	SOLID MECHANICS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To study about stress, strain and deformation of solids
- To learn various loads and stresses in different types of beams
- To educate about torsional effects in different types of shafts
- To study about application of torsion in springs and columns
- To describe the different mathematical models for beam deflection
- To discuss analysis of stresses in two dimensions

MODULE I STRESS, STRAIN AND DEFORMATION OF SOLIDS 10

Rigid and Deformable bodies – Strength, Stiffness and Stability – Stresses - Tensile, Compressive and Shear – Deformation of simple and compound bars under axial load – Thermal stress – Elastic constants – Strain energy and unit strain energy – Strain energy in uniaxial loads.

MODULE II BEAMS - LOADS AND STRESSES 12

Types of beams: Supports and Loads – Shear force and Bending Moment in beams : Cantilever, Simply supported and Overhanging beams – Stresses in beams – Theory of simple bending – Stress variation along the length and in the beam section – Effect of beam section on stress induced – Shear stresses in beams – Shear flow.

MODULE III TORSION 10

Analysis of torsion in circular bars – Shear stress distribution – Bars of Solid and hollow circular section – Stepped shaft – Twist and torsion stiffness – Compound shafts – Fixed and simply supported shafts.

MODULE IV SPRINGS AND COLUMNS 10

Application to close-coiled helical springs – Maximum shear stress in spring section including Wahl Factor – Deflection of helical coil springs under axial loads – Design of helical coil springs – stresses in helical coil springs under torsion loads. Columns – End conditions – Equivalent length of a column – Euler equation – Slenderness ratio – Rankine formula for columns.

MODULE V BEAM DEFLECTION 8

Elastic curve of Neutral axis of the beam under normal loads – Evaluation of beam deflection and slope: Double integration method and Macaulay Method.

MODULE VI ANALYSIS OF STRESSES IN TWO DIMENSIONS 10

Biaxial state of stresses – Thin cylindrical and spherical shells – Deformation in thin cylindrical and spherical shells – Biaxial stresses at a point – Stresses on inclined plane – Principal planes and stresses – Mohr's circle for biaxial stresses – Maximum shear stress - Strain energy in bending and torsion.

L-45; T-15; Total Hours –60

TEXT BOOKS:

1. Bansal, R.K, "A text book of strenth of material", Laxmi Pulication (P) Ltd., 2010.
2. Ramamrutham, S, strenth of materials, 14th Edition, Dhanth Rai Publication, 2011.

REFERENCES:

1. Popov E.P, "Engineering Mechanics of Solids", Prentice-Hall of India, New Delhi, 1997.
2. Beer F. P. and Johnston R, "Mechanics of Materials", 3rd Edition, McGraw-Hill Book Co, 2002.
3. Nash W.A, "Theory and problems in Strength of Materials", Schaum Outline Series, McGraw-Hill Book Co, New York, 1995.
4. Timoshenko S.P, "Elements of Strength of Materials", Tata McGraw-Hill, New Delhi 1997.
5. Singh D.K "Mechanics of Solids" Pearson Education, 2002.
6. Kazimi S.M.A, "Solid Mechanics", Tata McGraw-Hill Publishing Co, New Delhi, 1981.

OUTCOMES:

The students will be able to

- Demonstrate stress, strain and deformation of solids
- Recognise the various loads and analyse stresses in different types of beams
- Evaluate the torsional effects in different types shafts
- Calculate the various design parameters for springs and columns
- Estimate the beam deflection using various mathematical models
- Express the stresses in two dimensions

MEC2105	MANUFACTURING PROCESSES LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To provide the basic knowledge on different manufacturing techniques
- To experience the various operational activities of basic manufacturing processes including metal casting, metal joining, metal forming and machining
- To enable the students to fabricate simple components through the acquired skills

LIST OF EXPERIMENTS:

- CASTING PROCESS
  - Preparation of green sand mould for dumble and flange
- JOINING PROCESS
  - Preparation of weldments by arc welding and TIG welding
- FORMING PROCESS
  - Forming of hexagonal rod from the round rod
- SHEET METAL OPERATIONS
  - Making of tray and funnel from sheet metal
- OPERATIONS ON PLASTICS
  - Injection moulding by plastics
  - Extrusion / Blow moulding
- BASIC MACHINING
  - Facing, Plain turning, step turning and taper turning on lathe
  - Grooving, external chamfering, single start ‘V’ thread cutting and knurling on lathe
  - Drilling, boring, internal thread cutting, internal chamfering on lathe
  - Square cut shaping and key way cut by shaper
  - Internal slot / key way cut by slotter
  - Five holes at a given pitch circle on a plate (Boring center hole, drilling and tapping in five holes)
- PROJECT WORK
  - Combined Skill (Each team has to make an engineering component)

Total Hours –30

REFERENCES:

1. A course manual for the laboratory (prepared by SMS, BSACU) http://home.iitk.ac.in/~vkjain/manual.pdf

2. Hajra Choudhury, Elements of Workshop Technology, Vol. I and II, Media Promotors Pvt. Ltd., Mumbai, 2007.

OUTCOMES:

Students should be able to

- Describe various basic manufacturing processes
- Make the components using moulding, welding, forging and basic machine tools
- Produce a simple component using different manufacturing process

MEC2106	MATERIAL TESTING AND METALLURGY LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To observe the microstructure of various materials
- To study and record the various destructive test methods
- To understand the importance of various metallurgical and mechanical tests

EXPERIMENT

- MATERIAL TESTING LAB EXPERIMENTS
  - Tension test. 1
  - Compression test. 1
  - Torsion test. 1
  - Deflection test. 1
  - Impact test. 1
  - Double Shear test 1
  - Fatigue test 1
- METALLURGYLABEXPERIMENTS
  - Metallographic Examination-Demonstration and Practice 2
  - Study of metallurgical microscope.
  - Specimen preparation for microstructural examination-cutting, grinding, polishing, etching.
  - Selections of etchants for various metals and alloys.
  - Identification of microstructures of Ferrous and Non-ferrous materials. 2
  - Heat treatment: Annealing, normalizing, hardening and tempering of
  - steel- Hardness and its microstructure. 2
  - Study of microstructure of welded (HAZ)and cast component. 1
  - Hardenability test -Jominy End quench test. 1

Total Hours –30

REFERENCES:

1. ASTME3-01(2007) e1 Standard Guide for Preparation of Metallographic Specimens.
2. ASTM E407- 07Standard Practice for Microetching Metals and Alloys.
3. ASTM E7 – 03(2009) Standard Terminology Relating to Metallography.

OUTCOMES:

Students should be able to

- Interpret and analyse the microstructure of various materials
- Test the various mechanical properties of materials
- Correlate the results for applications

MEC2107	PART MODELING LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To familiarize with the codes and specifications of BIS, limits, fits and tolerances
- To learn and draw assembly drawing of various machine components using drafting packages
- To generate part and assembly drawings of actual mechanical products

DRAWING STANDARDS & FITS AND TOLERANCES

Introduction – Need of Graphical Language – Importance of Machine Drawing – Tools – Projections – Designation – Relative position of views – Classification of Machine Drawings – Scales as per ISO standards – Importance of Title Block and Part list – Lines types – Sectioning – Principle of Dimensioning – Limits, Fits and Tolerance – Definitions – Classifications of Fits – Method of Indicating Fits on Drawings – Tolerance Grade – Shaft and Hole Terminology – Conventional Representations – Surface finishing & Machining Symbols – Abbreviations and Symbols – Screwed Fastenings – Designation of Bolted Joints – Special Types of Bolts and Nuts – Key Joints – Types of Key joints – Introduction to Rivets and Riveting – Welded Joints – Pipes and Pipe Joints – Pulleys – Couplings.

INTRODUCTION TO 2D DRAFTING

Assembly Drawings – Introduction – Types of Assembly – Importance of BOM – Assembly procedures – Assembly Drawings (Examples) – Assembly of Engine Parts: Assembly of Machine Tools Parts – Production Drawings – Difference with Normal Drawings – Method of amendment of Corrections.

INTRODUCTION TO 3D MODELLING AND ASSEMBLY

Introduction of Solid 3D Modelling – Sketcher – Datum planes – Protrusion – Holes – Part modelling – Extrusion – Revolve – Sweep – Loft – Blend – Fillet – Pattern – Chamfer – Round – Mirror – Section – Assembly

Couplings – Flange, Universal, Oldham’s, Muff, Gear couplings

Joints – Knuckle, Gib & cotter, strap, sleeve & cotter joints

Engine parts – Piston, connecting rod, cross-head (vertical and horizontal), stuffing box, multi-plate clutch

Miscellaneous machine components – Screw jack, machine vice, tail stock, chuck,

vane and gear pumps

Total Hours –30

TEXT BOOKS:

1. N. D. Bhatt and V.M. Panchal, “Machine Drawing”, 48th Edition, Charotar Publishers,2013
2. Gopalakrishna K.R., “Machine Drawing”, 22 Edition, Subhas Stores Books Corner, Bangalore, 2013.

REFERENCES:

1. Bertoline, Wiebe, Miller, Nasma., Technical Graphics Communication, IRWIN Graphic Series
2. William P. Spence, Engineering Graphics, Printice - Hall Inc, Engle Wood Cliff
3. S. Bogolyubov. A. Voinov., Engineering Drawing, Van Nostr and Reinhold Company
4. Brain Griffiths., Engineering Drawing for Manufacture, Kogan Page Science, USA
5. Hart. K R, Engineering Drawing with Problems and Solutions, Hodder and Stoughton, London Sydney Auckland
6. David L., Goetsch Williams Chaulk John A., Nelson, Technical Drawing (Drafting and Design) Savee Informatics.
7. D.E. Hewitt., Engineering Drawing and Design for Mechanical Technicians, The Macmillan Press Ltd, London

OUTCOMES:

Students should be able to

- State the codes, standards of BIS, limits, fits and tolerances
- Interpret complex drawings of machine parts and assembly
- Generate components and assembly drawings of actual products

SEMESTER IV

ENC 2282	WRITTEN COMMUNICATION	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To help students identify content specific vocabulary and learn its usage.
- To expose them to reading for specific purposes, especially in professional contexts.
- To expose them to the process of different kinds of formal writing.
- To help them learn corporate correspondence for different purposes.
- To train them in preparing effective applications with résumé
- To make them write different types of reports.

MODULE I **4**

Introduction - process of writing – Fundamentals of academic and professional writing – Understanding short, real world notices, messages, etc.

MODULE II **4**

Reading industry related texts (ex. Manufacturing, textile, hospitality sector etc.) for specific information.

Writing Instructions and recommendations

MODULE III **6**

Understanding format and conventions of writing email, memo, fax, agenda and minutes of the meeting.

Writing email, memo, fax, agenda and minutes of the meeting for various purposes (industry specific)

MODULE IV **6**

Viewing letter of application and Résumé, letter calling for an interview, letter of inquiry and Promotional letter

Writing Functional résumé and letter of application using Edmodo,

MODULE V **6**

Viewing a Video and reading a case study (industry specific) – collaborative writing using Edmodo –reading and information transfer

Writing reports- Survey, feasibility and progress – exposure to discipline specific reports

MODULE VI **4**

Writing Statement of purpose (Higher Education)-- Justifying and writing about one's preparedness for job (Statement of Purpose highlighting strengths and weaknesses) – Peer evaluation skills through Edmodo.

P – 30; Total Hours –30

REFERENCES:

1. Riordan,D (2013). *Technical Report Writing Today*. Cengage Learning, 10th edition. USA.
2. Oliu, W. E., Brusaw, C.T., & Alred, G.J.(2012). *Writing that Works: Communicating Effectively on the Job* . Bedford/St. Martin's. Eleventh Edition.
3. Garner, B.A. (2013). *HBR Guide to Better Business Writing (HBR Guide Series)*. Harvard Business Review Press. USA.
4. Sharma, R.C. & Krishna M. (2002). *Business Correspondence and Report Writing*. Tata MacGraw – Hill Publishing Company Limited, New Delhi.
5. Macknish, C. (2010). *Academic and Professional Writing for Teachers*. McGraw-Hill Education. USA.
6. Whitby, Norman (2014). *Business Benchmark: Pre-Intermediate to Intermediate.* Cambridge University Press, UK.

OUTCOMES:

On completion of the course, the students will have the ability to

- Identify content specific vocabulary and also use them in appropriate contexts.
- Demonstrate reading skills with reference to business related texts.
- Draft professional documents by using the three stages of writing.
- Create different types of documents for various corporate correspondences.
- Write effective letter of applications, résumé and statement of purpose.
- Write business related reports efficiently.

MEC2211	KINEMATICS OF MACHINERY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the various simple mechanisms
- To analyse the velocity of different mechanisms
- To acquire knowledge on acceleration analysis of different mechanisms
- To educate the kinematics of cams
- To study the different types of gears and gear trains
- To understand the various friction drives

MODULE I BASICS OF MECHANISMS 7

Terminology and Definitions- Description of common Mechanisms-Four Bar Mechanism-Single and double slider crank mechanisms - Kinematic Inversions of 4-bar and slider crank chains-– Indexing Mechanisms - Rocking Mechanisms - Straight line generators- Ratchets and escapements - Design of Mechanisms – Mobility - Grubler's criterion - Grashoff's law- Mechanical Advantage-Transmission angle.

MODULE II VELOCITY ANALYSIS OF MECHANISMS 7

Displacement and velocity analysis in mechanisms - Graphical Method – Velocity polygons – Kinematic analysis by Complex Algebra methods - Vector Approach - Instantaneous Centre method - Kennedys Theorem.

MODULE III ACCELERATION ANALYSIS OF MECHANISMS 7

Acceleration analysis in simple mechanisms - Graphical Method- acceleration polygons - Kinematic analysis by Complex Algebra methods - Vector Approach, Computer applications in the kinematic analysis of simple mechanisms- Coriolis component of acceleration.

MODULE IV KINEMATICS OF CAM 7

Classifications - Displacement diagrams - Simple harmonic, parabolic, and cycloidal motions - Layout of plate cam profiles - Derivatives of Follower motion - High speed cams - Circular arc and tangent cams - Standard cam motion - Pressure angle and undercutting.

MODULE V KINEMATICS OF GEARS 10

Spur gear Terminology and definitions - Fundamental Law of toothed gearing and involute gearing - Inter changeable gears - gear tooth action – Terminology - Interference and undercutting – Non standard gear teeth- Helical, Bevel, Worm, Rack

and Pinion gears (Basics only) - Gear trains - Parallel axis gear trains - Epicyclic gear trains – Differential mechanism.

MODULE VI FRICTION IN MACHINERY 7

Friction drives - Belt and rope drives, Friction in clutches - Friction aspects in Brakes – Friction in vehicle propulsion and braking.

Total Hours –45

REFERENCES:

1. Rattan S.S, “Theory of Machines”, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 1998.
2. Shigley J.E and Uicker J.J, “Theory of Machines and Mechanisms”, McGraw- Hill, Inc. 1995.
3. Thomas Bevan, “Theory of Machines”, CBS Publishers and Distributors, 1984.
4. Ghosh A and A.K. Mallick, “Theory of Mechanisms and Machines”, Affiliated East-West Pvt. Ltd., New Delhi, 1988.
5. Rao J.S and Dukkipati R.V, “Mechanism and Machine Theory”, Wiley-Eastern Ltd., New Delhi, 1992.
6. John Hannah and Stephens R.C, “Mechanics of Machines”, Viva Low-Prices Student Edition, 1999.

OUTCOMES:

The students will be able to

- Describe various simple mechanisms
- Construct the velocity diagram and predict the velocities of mechanisms
- Draw the acceleration diagram and predict the acceleration of mechanisms
- Create various types of cam profiles with different follower motions
- Analyse the kinematics of gears and gear trains
- Solve simple application problems on frictional drives

MEC2212	FLUID MECHANICS AND MACHINERY	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To learn the fundamental concepts and properties of fluids
- To study the governing equations for fluid flow
- To educate different types of flow and its losses
- To understand boundary layer concepts and dimensional analysis
- To impart knowledge on hydraulic turbines
- To acquire knowledge on hydraulic pumps

MODULE I FUNDAMENTALS OF FLUID MECHANICS 10

Fluid Properties- Definition, distinction between solid and fluid – Units and Dimensions- Properties of fluid - Density, specific weight, specific volume, specific gravity, temperature, viscosity, compressibility, vapour pressure, capillary and surface tension. Fluid statics: concept of fluid static pressure, absolute and gauge pressure-pressure measurements by manometers pressure gauges

MODULE II FLUID KINEMATICS AND FLUID DYNAMICS 12

Fluid Kinematics – Flow visualization – Lines of flow – types of flow – velocity field and acceleration–continuity equation (one and three dimensional forms) Equation of stream line-stream function-velocity potential function–circulation–flow net – fluid dynamics – equation of motion – Euler's equation along streamline – Bernoulli's equation – applications - Venturimeter, Orificemeter, Pitot tube

MODULE III INCOMPRESSIBLE FLUID FLOW 10

Viscous flow - Navier's Stoke equation (statement only)–Shear stress ,pressure gradient relationship- Laminar flow between parallel plates- Laminar flow through circular tubes (Hagen poiseulle's law)–Hydraulic and energy gradient – Flow through pipes–Darcy's Weisback's equation–Pipe roughness–friction factor – Moody's diagram minor losses- Flow through pipes in series and in parallel power transmission.

MODULE IV BOUNDARY LAYER & DIMENSIONAL ANALYSIS 10

Boundary Layer theory, Boundary layer separation – drags and lifts coefficients. Buckingham's pi-Theorem – applications - similarity laws and models

MODULE V HYDRAULIC TURBINES 8

Hydraulic machines: Definition and classification- exchange of energy- Euler's equation for turbo machines–Construction of velocity vector diagrams head and specific work–components of energy transfer–degree of reaction. Hydro turbines: Pelton turbine – Francis turbines – working principles – velocity triangle – work done– specific speed–efficiencies–performance curve for turbines

MODULE VI HYDRAULIC PUMPS 10

Pumps, definition and classifications: - Centrifugal pump: classifications and velocity triangles, specific speed, efficiency and performance curves. Reciprocating pumps: Classification, working principle, indicator diagram, work saved by air vessels and performance curves.

L-45; T-15; Total Hours –60

REFERENCES:

1. Bansal.R.K "Fluid Mechanics and hydraulics Machines",(5thedition), Laxmi Publications (P) Ltd, New Delhi, 1995.
2. Kumar.K.L., "Engineering Fluid Mechanics ", Eurasia Publishing House(P) Ltd, New delhi, (7thedition), 1995.
3. Vasandani. V.P "Hydraulic Machines–Theory and design", Khanna Publishers
4. Kumar DS, "Fluid Mechanics and Fluid Power Engineering", Kataria SKand Sons, NewDelhi, 1997.
5. Streeter V. Land Wylie, E.B "Fluid Mechanics", Mc. Grath-Hill,1983.
6. White, F.M., Fluid Mechanics", Tata McGrawhill, 5th Edition, NewDelhi.-2003.
7. John.D.Anderson, "Computational Fluid Dynamics–The Basics with Applications", Mc Graw Hill, New Delhi, 1995.
8. Robert W Fox, "Introduction to Fluid Mechanics", Fourth Edition, John Wiley and sons, Singapore, 1994.

OUTCOMES:

Students will be able to

- Apply the fundamental concepts in the design of flow measuring devices
- Apply the governing equation in flow through conduits
- Analyze incompressible fluid flow through pipes
- Measure Boundary layer friction and establish expression for any measurable parameter from the dependent variables

- Demonstrate and analyze the performance of hydraulic turbines
- Describe and analyze the performance of hydraulic pumps

MEC2213	METAL CUTTING AND MACHINE TOOLS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the various material removal process
- To learn the functions of centre lathe and special purpose lathes
- To acquire knowledge about reciprocating machines and milling machines
- To understand the principle of drilling, broaching and gear cutting
- To gain knowledge about finishing and super finishing processes
- To educate the working principle of CNC machine tools and non-traditional machining processes

MODULE I THEORY OF METAL CUTTING 7

Introduction: material removal processes, types of machine tools – theory of metal cutting, geometry of single point cutting tool, mechanism of chip formation, types of chips, orthogonal metal cutting, machining forces and Merchant's Circle Diagram - cutting tool materials, tool wear, tool life, cutting fluids.

MODULE II CENTRE LATHE AND SPECIAL PURPOSE LATHES 7

Centre lathe, constructional features, cutting tools, various operations, special attachments, machining time and power estimation - Capstan and turret lathes – automatic lathes: semiautomatic, automats – kinematics – single spindle : cutting off, swiss type, automatic screw type – multi spindle; cutting off, bar type

MODULE III RECIPROCATING MACHINES AND MILLING MACHINES 7

Reciprocating machine tools: shaper, planer, slotter - milling: types, milling cutters, plain milling cutter- nomenclature - operations.

MODULE IV DRILLING, BROACHING AND GEAR CUTTING 7

Hole making: drilling, reaming, boring, tapping – Deep hole Drilling – Broaching machines: broach construction – push, pull, surface and continuous broaching machines - Gear cutting: forming, generation, shaping, hobbing – Mechanics of processes.

MODULE V FINISHING AND SUPER FINISHING PROCESSES 10

Abrasive processes – Mechanics: grinding wheel – specifications and selection, types of grinding process – centreless grinding, cylindrical grinding, surface grinding– honing, lapping, super finishing, polishing and buffing

MODULE VI CNC MACHINE TOOLS AND MODERN MACHINING 7

METHODS

Numerical control (NC) machine tools – CNC: types, construction details, special features - Advantages and limitations : Abrasive Jet Machining- Ultrasonic Machining - Electron Beam and Laser Beam Machining

Total Hours –45

REFERENCES:

1. Rao, P.N. “Manufacturing Technology”, Metal Cutting and Machine Tools, Tata McGraw–Hill, New Delhi, 2008
2. Richerd R. Kibbe, John E. Neely, Roland O. Merges and Warren J. White, “Machine Tool Practices”, Prentice Hall of India, 2003
3. HMT – “Production Technology”, Tata McGraw-Hill, 2001
4. P.C. Sharma, “A Text Book of Production Engineering”, S. Chand and Co. Ltd, X edition, 2008
5. Hajra Choudry, “Elements of Work Shop Technology – Vol. II”, Media Promoters. 2007
6. Geofrey Boothroyd, “Fundamentals of Metal Machining and Machine Tools”, McGraw Hill, 2006

OUTCOMES:

Students will be able to

- Describe the various material removal process
- Discuss the various types of lathe and its operations
- Illustrate the operations in reciprocating machines and milling machines
- Explain drilling, broaching and gear cutting operations
- Exhibit the various finishing and super finishing processes
- Deliberate the functions of CNC machine tools and non-traditional machining processes

MEC2214	MACHINING LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To gain knowledge in various mechanisms of special machine tools
- To learn the functions of various machines such as milling, shaping and grinding
- To acquire knowledge on producing various assembly components such as bushes, shafts, bolts and nuts

LIST OF EXPERIMENTS:

- SPECIAL MACHINES
  - Milling machines
  - Spur gear milling
  - Milling polygon surfaces
  - Reciprocating machines
  - Making of 'V' Block for work holding device
  - Super finishing machine
  - Surface grinding
  - Cylindrical grinding
- MACHINING IN LATHE
  - Bush and shaft
  - Bolt and nut
  - Double start 'V' thread
  - Eccentric turning and coupling
- MACHINING IN SEMI-AUTOMATIC LATHE
  - Machining in capstan and turret lathes
- PROJECT WORK
  - Combined Skill (Each team has to make a working model)

Total Hours –30

REFERENCES:

1. A course manual for the laboratory (prepared by SMS,BSACU)
2. http://home.iitk.ac.in/~vkjain/manual.pdf
3. HMT – "Production Technology", Tata McGraw-Hill, 2001.

OUTCOMES:

Students will be able to

- Demonstrate the different mechanisms involved in special machine tools
- Perform operations in various machines such as in milling, shaping and grinding
- Produce various assembly components such as bushes, shafts, bolts and nuts

MEC2215	PRODUCT MODELLING LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To understand the fundamentals of CAD systems
- To create a 3D model of the component given
- To familiarize students with the assembly of various machine components

OVERVIEW OF CAD SOFTWARE

Create 3D models of standard machine components by reading orthographic views of Brackets, V Blocks, Stop Block.

ASSEMBLY DRAWING

Create part model, assembly, exploded view, sectional views and detail drawings of

Joints: Cotter joints, knuckle joints, Hook's joint.

Shaft Couplings: rigid, flexible.

Bearings: Journal, footstep, thrust or collar bearing, Plummer block.

Engine parts: Stuffing box, connecting rod.

Machine tool components: Drill jig, tool post, machine vice, screw jack.

Valves: Safety valve, relief valve, non-return valve.

PARAMETRIC MODELLING

Modelling of screw threads, threaded fasteners, gears & pulleys.

PROJECT

Create CAD models of real time components.

Total Hours –30

TEXT BOOKS:

1. N. D. Bhatt and V.M. Panchal, "Machine Drawing", 48th Edition, Charotar Publishers,2013
2. Gopalakrishna K.R., "Machine Drawing", 22 Edition, Subhas Stores Books Corner,Bangalore, 2013.

REFERENCES:

1. Bertoline, Wiebe, Miller, Nasma., Technical Graphics Communication, IRWIN Graphic Series

2. William P. Spence, Engineering Graphics, Printice - Hall Inc, Engle Wood Cliff
3. S. Bogolyubov. A. Voinov., Engineering Drawing, Van Nostr and Reinhold Company
4. Brain Griffiths., Engineering Drawing for Manufacture, Kogan Page Science, USA
5. Hart. K R, Engineering Drawing with Problems and Solutions, Hodder and Stoughton, London Sydney Auckland
6. David L., Goetsch Williams Chaulk John A., Nelson, Technical Drawing (Drafting and Design) Savee Informatics.
7. D.E. Hewitt., Engineering Drawing and Design for Mechanical Technicians, The Macmillan Press Ltd, London

OUTCOMES:

Students should be able to

- Describe the fundamentals of CAD systems
- Create a 3D model of the given component
- Perform virtual assembly of various machine components

MEC2216	FLUID MECHANICS AND MACHINERY LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To learn about the flow measuring instruments.
- To verify the laws of fluid mechanics.
- To study the performance of various pumps and turbines.

LIST OF EXPERIMENTS:

1. Comparison of coefficient of discharge of given orifice meter and Venturi meter.
2. Calibration of Rotameter.
3. Determination of various losses for the given set of pipes.
4. Performance study of centrifugal pumps / Submersible pumps.
5. Determination of maximum efficiency for the given reciprocating pump.
6. Characteristic curves for Gear pump / Vane pump.
7. Determination of maximum power at constant speed / constant load for an impulse turbine.
8. Performance characteristic of reaction turbine.
9. Impact of jet on flat and curved vanes.
10. Verification of Bernoulli's theorem.
11. Performance test on a jet pump.
12. Flow visualization: Laminar and Turbulent flows.

Total Hours –30

REFERENCES:

1. Bansal.R.K "Fluid Mechanics and hydraulics Machines",(5thedition), Laxmi Publications (P) Ltd, New Delhi, 1995.
2. Kumar.K.L., "Engineering Fluid Mechanics ", Eurasia Publishing House(P) Ltd, New delhi, (7thedition), 1995.
3. Vasandani. V.P "Hydraulic Machines–Theory and design", Khanna Publishers
4. Kumar DS, "Fluid Mechanics and Fluid Power Engineering", Kataria SKand Sons, NewDelhi, 1997.
5. Streeter V. Land Wylie, E.B "Fluid Mechanics",Mc. Grath-Hill,1983.
6. White, F.M., Fluid Mechanics", Tata McGrawhill, 5th Edition, NewDelhi.-2003.
7. John.D.Anderson, "Computational Fluid Dynamics–The Basics

with Applications", Mc Graw Hill, New Delhi, 1995.

8. Robert W Fox, "Introduction to Fluid Mechanics", Fourth Edition, John Wiley and sons, Singapore, 1994.

OUTCOMES:

Students should be able to

- Apply the laws of fluid mechanics and measure parameters of fluid flow
- Analyse the performance of Hydraulic turbines and pumps
- Evaluate performance of Impinging jet on vanes

SEMESTER V

MSC 3181	LEADERSHIP AND CEO TRAINING	L	T	P	C
		3	0	0	3

OBJECTIVES:
The course aims at

- Bringing about positive transformation in students' attitude.
- Building unique leadership competencies that would ensure successful transition of students across all career stages.
- Sensitizing students to identify their strengths & weakness and training them to deal with it
- Assisting students in enhancing their expressive ability and inducing a high level of self confidence to manage both business and emotions
- Training students to become more adaptable and flexible to changing business environment

MODULE I INTRODUCTION TO LEADERSHIP 12

Leadership concept - meaning, definitions, importance of leadership, leadership traits. Leadership functions- general functions, listening, observing, managing and decision making. Components of leadership - leaders, followers and situation. Leadership theories – Trait theory, Skills theory, Style theory, Situational theory, Transformational theory, Transactional theory, Path Goal Theory and LMX. Assessing emotional intelligence and exploring the capabilities and inherent traits.through psychometric tests - Multi factor leadership questionnaire and personal reflections

MODULE II LEADERSHIP STYLE AND COMMUNICATION 8

Leadership styles-visionary, Coaching, Affiliative, Democratic, Pacesetting Commanding, Transformational, Transactional. Autocratic, Participative, Laissez-Faire Leader versus Managers. Leadership communication - Rationale, tactic, assertive, formal, informal, communication in crisis- leadership and negotiations, Leadership Presentations-convincing and impressive style

MODULE III LEADERSHIP ROLES 8

Facets of leadership- Leader as an individual – personality and leadership, values, attitudes and ethics of a leader. **Leader as a relationship builder**- empowering people to meet higher order needs, initiating organization wide motivational programs, involvement with all stakeholders- focusing on organization growth. **Leader as an inspirer**- motivation and leadership, recognizing and appreciating contributions, empowering others to lead **Leader as an innovator** –leader's role in shaping culture

and values in an organization. **Leader as a Liaison- Leader as team player**

MODULE IV LEADERSHIP CHALLENGES AND STRATEGIES 9

Challenges in leadership: Perception of organization culture and values, interpreting the power dynamics in the organization, establishing work life balance. Bad leadership – Reasons and impact.-Case Study of Marissa Mayer-Yahoo.Inc Organizational transformation through efficient leaders-Case study of Apple Inc. Blue Ocean Leadership-Steps to Blue ocean Leadership-Four Pillars of Blue Ocean leadership-Blue Ocean leadership grid

MODULE V LEADERSHIP AND CEO TRAINING 8

Leader as a CEO: Traits of a successful CEO, Key responsibilities of a CEO, the path to be a CEO ,Training on Board Room Discussions, Meeting the CEO –Live sessions with industry CEO's. Requirements of Leadership: - Cognitive skills, Interpersonal skills, Business skills, Strategic skills. Role of Emotional Intelligence in taking up key-positions in the organization.

Teaching Pedagogy:

Nurturing – Based on the identified strengths and weaknesses, training will be given to enhance the strengths and overcome the weakness.

Assessment - Continuous evaluation will be effected through group discussions, oratory assignments and situational enactments. Pre-and post-training assessment through peer reviews and faculty feedback.

Sustained development – Training will be imparted for self-development and monitoring of leadership skills to ensure sustained applicability of the skills learnt.

L – 45; T – 0; Total Hours –45

REFERENCES:

1. Andrew J DuBrin. "Leadership: Research Findings, Practice, and Skills", 8th Edition, South-Western College Pub, 2015.
2. Yukl G , "Leadership in Organisations", 8th Edition, Pearson Education, 2013.
3. Richard L Daft , "Leadership", 5th Edition, South Western Cengage Learning 2012.
4. Stephen P. Robbins and Timothy A. Judge. "Organizational Behaviour", 15th Edition, New Delhi: Pearson, 2013.

5. Fred Luthans, “Organizational Behavior, An Evidence Based Approach”, 12th Edition, New Delhi: McGraw Hill Education, 2013.
6. Emotional Intelligence, Why it can matter no more than IQ by Daniel Goleman (include a book) **Publisher:** Bloomsbury Publishing India Private Limited; Latest edition (2017)
7. Primal Leadership: Unleashing the Power of Emotional Intelligence by Prof Daniel Goleman , Richard Boyatzis and McKee ,Harvard Business Review Press

RECOMMENDED READINGS:

1. Jim Collins, (2001). “Good To Great: Why Some Companies Make the Leap...And Others Don't”, Random House Publishers India Pvt.Ltd, New Delhi
2. George, B. with Sims, P. True North: Discover Your Authentic Leadership, The Times Group Books; First edition (1 October 2015)
3. Kim, W. C., & Mauborgne, R. A. (2014). Blue ocean strategy, expanded edition: How to create uncontested market space and make the competition irrelevant. Harvard business review Press
4. Leadership Wisdom by Robin Sharma Jaico Publishing House;

OUTCOMES:
The students will be able to

- Explore through self-introspection one’s own leadership style, their strength and weakness
- Gain self confidence to lead a team in the organization
- Realize the role of leadership in making or breaking of an organization
- Acquire the practice of self introspection and development of leadership competencies thorough continuous efforts
- Manage their own emotions as well as other resulting in successful relationship building with all stakeholders

MSC 3182	SOCIAL ENTREPRENEURSHIP	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To be able to understand the field of social entrepreneurship and Social problems
- To be able to describe and understand the traits of social entrepreneurs
- To recognize the social business opportunities
- To synthesize the resource mobilization ways for social entrepreneurship
- To understand the social entrepreneurship models
- To recognize the impact of social entrepreneurship on societies

MODULE I INTRODUCTION TO SOCIAL ENTREPRENEURSHIP 7

Introduction - Emergence and Development of Social Entrepreneurship. Social Problems in India: An Overview. Social Development: The Indian Scenario. Emergence of Social Entrepreneurs and Sustainable Solutions to Social Problem. Characteristics and Context of Social Entrepreneurship .The Role of Social Entrepreneurship in Societies & Economies.

MODULE II SOCIAL ENTREPRENEURSHIP: DRIVERS AND CHALLENGES 7

The Drivers of Social Entrepreneurship. Elements of the Social Entrepreneurial Personality. Challenges of financial constraints. Challenge to attract and cultivate talented workers. Challenge of evaluation of social entrepreneur impact. Challenge of scaling and its impact. Cases

MODULE III SOCIAL ENTREPRENEURSHIP: OPPORTUNITY RECOGNITION 7

Opportunity Recognition and Planning Process. Opportunities for Social Entrepreneurs. The Nature of Social Entrepreneurial Opportunities. Social Problems into Opportunities. Idea development and conceptualization of social problem. Cases

MODULE IV RESOURCE MOBILIZATION FOR SOCIAL VENTURE 8

Resources at Initial Stage. Social Network as a role of Social Capital. Team and Collective Efforts. Need and Determination of Important Resources. Resource of Knowledge, Skills and Abilities. overview of venture capital and angel investment. Cases

MODULE V BUSINESS MODELS AND BUSINESS PLAN FOR SOCIAL ENTERPRISES 8

Design Principles of Social Entrepreneurship Business Models, Evaluation of the Root Cause of a Societal Problem. Developing business plan for social ventures. Developing an investor presentation. Feasibility study and report. How to start a business - Procedures for registration of small scale industry

MODULE VI THE IMPACT OF SOCIAL ENTREPRENEURSHIP ON SOCIETIES AND CASES 8

Static Impact of Social Entrepreneurship. Impact of Charitable NGOs vs. Social Entrepreneurship, Impact of For-Profit Companies vs. Social Entrepreneurship. Social entrepreneurship report preparation by students. Case Study of Social Entrepreneurs

L – 45; T – 0; Total Hours –60

REFERENCES:

1. "Social Entrepreneurship : New models of sustainable social change" . Alex Nicholls, Oxford University Press 2006
2. The Process of social value creation : A multiple case study on Social Entrepreneurship in India , Archana Singh Springer 2016
3. "Social Entrepreneurship and social business" Christine K Volkmann, Springer Gabler 2012
4. "Social Entrepreneurship" Manuel London ,Routlege, 2010

OUTCOMES:

The students can able to

- Conceptualize social entrepreneurship in terms of a theoretical framework between changing social values and institutions
- Think and communicate about social values
- Learn about practical models of social change to launch, lead, manage, and evaluate a social venture
- Analyze funding needs and sources for the social venture
- Experience the ideas can be critically and collaboratively examined prior to commitment.

ENC 3181	COMMUNICATION AND SOFT SKILLS - I CAREER CHOICE	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To create awareness of industrial trends and market demands.
- To encourage students to explore career opportunities in an industry and evaluate themselves in relation to industry preparedness

MODULE I **6**

Knowledge about specific industry-Discussion with industry experts --Self evaluating career prospects through survey questionnaire (based on his/her eligibility for taking up a job (industry preparedness)

MODULE II **6**

. Knowing case studies of industries(pertaining to students' choice of career)- Reading and discussing about job markets-goal setting, working on creativity.

MODULE III **4**

SWOC analysis and discussing outcomes--exploring mini projects or case studies of latest industries.

MODULE IV **6**

Writing statement of purpose pertaining to career choice---- Outcomes

MODULE V **8**

Project or case study presentations (Presentation in pairs) -mini project report or case study report.

Total Hours – 30

REFERENCES:

1. Brown,D.(2002). Career Choice and Development. Wiley,J. & Sons.USA
2. Lore,N.(1998). The Pathfinder: How to Choose or Change Your Career for a Lifetime of Satisfaction and Success. Simon & Schuster.USA.
3. Shell, G.R.(2013). *Springboard Launching your Personal Search for Success.Portfolio.USA.*

OUTCOMES:

After the completion of the course, students would be able to

- Speak about their career choice.
- Self evaluate their strengths and weaknesses and speak about it.
- Make effective presentations on case studies or relating to projects.
- Write the statement of purpose relating to their career choice.

MEC3101	DYNAMICS OF MACHINERY	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To understand the basics of Dynamics of mechanisms and machinery.
- To understand the basics of balancing of moving parts.
- To understand the basics of free and forced vibrations.
- To understand the basics of control mechanisms.

MODULE I FUNDAMENTALS OF DYNAMICS 9

Introduction on static force analysis, Static Equilibrium, Equilibrium of Two force and three-force members, Member with Two force and a torque, Force convention, free body diagrams, Principle of Superposition. D-Alembert's Principle- Inertia Force Analysis of Mechanisms.

MODULE II ENGINE DYNAMICS 9

Velocity and acceleration of piston-Torque exerted on the crank shaft when friction and inertia of moving parts are neglected- Forces on the reciprocating parts of an engine considering friction and inertia of moving parts, Dynamically equivalent system, Turning moment diagrams-Fly wheels Engine shaking Forces.

MODULE III BALANCING OF MASSES 10

Introduction to balancing, Static balancing, dynamic balancing, balancing of several masses in same planes, balancing of several masses in different planes, Balancing of Reciprocating masses, balancing of locomotives, balancing of inline engines, balancing of V-engines.

MODULE IV UN-DAMPED FREE VIBRATIONS 10

Natural frequencies of free longitudinal vibrations of systems having single degree of freedom- Equilibrium method-Energy method and Rayleigh's method- Natural of free transverse vibrations due to point load and UDL acting over a simply supported shaft, dunkerley's method, critical speed of a shaft- Natural frequency of free torsional vibrations of a single rotor system, two rotor and three rotor system.

MODULE V DAMPED FREE AND FORCED VIBRATIONS 10

Damping factor and Logarithmic Decrement in free vibration- Forced Vibration- Steady state amplitude –Vibration due to Imbalance- Vibration isolation and transmissibility ratio for the systems subjected to forced vibrations.

MODULE VI CONTROL MECHANISMS 12

Introduction to Governors, types of Governor, Watt Governor, Porter governor, Proell Governor, Hartnell Governor, Sensitivity, Stability, Isochronism, Hunting, Governor Effort and Power, controlling force. Introduction, Precessional angular motion, gyroscopic couple, effect of gyroscopic couple on an aero plane, effect of gyroscopic couple on a naval ship -stability of a four wheel drive moving in a curved path- stability of a two wheel vehicle taking a turn.

L – 45; T – 15; Total Hours –60

REFERENCES:

1. S.S.Rattan, 'Theory of Machines', Tata McGraw Hill Publishing Company Ltd., New Delhi, 1994.
2. Design of Machinery by R.L.Norton, Mc Graw Hill Publications.
3. J.E.Shigley and J.J.Uicker, Theory of machines and Mechanisms, McGraw Hill, Inc., 1995.
4. Theory of Machines by Thomas Bevan, Pearson education publications.
5. A.Ghosh and A.K.Mallick, 'Theory of Mechanisms and Machines', Affiliated East-West Press Pvt. Ltd., New Delhi, 1988.
6. Theory of Machines by P.L.Ballaney, Khanna Publications.
7. Theory of Machines by R.S. Khurmi & J.K.Gupta, S. Chand Publications.

OUTCOMES:

Student will be able to

- Analyze conceptual fundamentals of mechanisms for static and dynamic conditions.
- Analyze and solve balancing and vibration problems.
- Understand and apply control mechanisms.

ECC3181 ELECTRONICS FOR MECHANICAL SYSTEMS

L	T	P	C
2	0	0	2

OBJECTIVES:

- To study the characteristics of semiconductor devices such as diodes, transistors and their applications.
- To study fundamentals of digital logic circuits.
- To study 8085 microprocessors and its interfacing with other peripheral devices.

MODULE I SEMICONDUCTORS AND RECTIFIERS 8

Classification of solids based on energy band theory-Intrinsic semiconductors-Extrinsic semiconductors-P type and N type-PN junction and its application – Zener diode. Bipolar junction transistor- CB, CE, CC configuration and characteristics- Field effect transistor: Configuration and characteristic-SCR, DIAC, TRIAC, UJT Characteristics and simple applications.

MODULE II DIGITAL ELECTRONICS 7

Number systems- Binary Arithmetic Operations-Boolean Algebra-Logic gates-Karnaugh map: SOP, POS.

MODULE III COMBINATIONAL AND SEQUENTIAL CIRCUITS 8

Combinational Circuits: Half and full adders- Magnitude Comparator- Multiplexer/ Demultiplexer- encoder / decoder Sequential circuits: Flip Flops: SR, JK, D and T FF-Truth tables and circuits-Shift Registers-Ripple Counters.

MODULE IV 8085 MICROPROCESSOR AND APPLICATIONS OF MICROPROCESSOR 7

Architecture of 8085-Pin configuration - Instruction set-Addressing modes- Simple programs using arithmetic and logical operations. Applications.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Milman and Halkias, "Integrated Electronics", Tata McGraw-Hill publishers,1995.
2. Ramesh Goankar, "Microprocessor Architecture", Programming and Applications with 8085, Wiley Eastern, 1998.

REFERENCES:

1. Malvino and Leach, "Digital Principles and Applications", Tata McGraw-

Hill,1996

2. Mehta V.K, "Principles of Electronics", S. Chand and Company Ltd, 1994
3. Dougles V.Hall, "Microprocessor and Interfacing", Programming and Hardware, Tata McGraw-Hill, 1999.
4. Salivahanan S, Suresh Kumar N, Vallavaraj A, "Electronic Devices and Circuits" First Edition, Tata McGraw-Hill, 1999.

OUTCOMES:

The student should be able to understand

- Working principles and characteristics of various semiconductor devices.
- Different digital logic circuits: Combinational and sequential circuits.
- Architecture of 8085, its features and programming for specific application.

MEC3102	THERMAL ENGINEERING (INTEGRATED LAB)	L	T	P	C
		3	0	3	4

(Use of Steam Tables, Mollier Diagram, Psychrometric chart and Refrigeration property Tables are permitted in the University examination)

OBJECTIVES:

- To impart knowledge on working and performance of IC engines, steam nozzles, steam turbines and air compressors.
- To understand the cycles and systems of refrigeration and air conditioning.
- To know the working Principles of IC engines.
- To understand the performance of various engines under different loadings.
- To learn and measure the various heat transactions within and outside the engines.
- To study the properties of fuels and exhaust gases.

MODULE I I.C. ENGINES 10

Classification of IC engine - components and functions. Two stroke and Four stroke engines - working principle, actual and theoretical valve timing diagrams, port timing diagrams and PV diagrams. Comparison - two stroke and four stroke engines- petrol and diesel engines. Fuel supply systems and ignition systems, Lubrication system and cooling system

MODULE II AIR STANDARD CYCLES AND IC ENGINE PERFROMANCE 10

Otto, Diesel, Dual, Brayton cycles - Calculation of mean effective pressure and air standard efficiency, Actual and theoretical PV diagram of two stroke and four stroke engines. Performance test on IC engine and Heat balance calculation. Knocking and Detonation. Exhaust gas analysis, pollution control norms.

MODULE III STEAM NOZZLES AND TURBINES 10

Flow of steam through nozzles, shapes of nozzles, effect of friction, critical pressure ratio, super saturated flow. Impulse and reaction principles, compounding, velocity diagrams for simple and multistage turbines, speed regulations - governors and nozzle governors.

MODULE IV AIR COMPRESSORS 10

Classification and working principle, work of compression with and without clearance. Volumetric efficiency, Isothermal efficiency and isentropic efficiency of reciprocating air compressors. Multistage air compressor and inter cooling – working of multistage

air compressor, Problems in single and two stage air compressors. Various types of compressors (Descriptive treatment only)

MODULE V REFRIGERATION 10

vapour compression refrigeration cycle - super heating, sub coolingperformance calculations. working principle of vapour absorption system. Ammonia - water, Lithium bromide - water systems, comparison between vapour compression and absorption systems.

MODULE VI AIR-CONDITIONING 10

Psychrometry, Psychometric chart, cooling load calculation, Concept of RSHF, GSHF, ESHF. Air conditioning Systems - summer and winter air conditioning systems Requirements for comfort and industrial air-conditioning.

List of Experiments:

1. (a) Experimental study on valve timing diagram in 4-stroke engine cut model.
   (b) Experimental study on port timing diagram in 2-stroke engine cut model.
2. Experiment on Fuel properties
   a. Redwood Viscometer
   b. Fire and Flash point
   c. Calorific Value.
3. Performance test on constant speed 4-stroke diesel engine.
4. Heat balance test on 4-stroke twin cylinder diesel engine.
5. IC engine performance and heat balance evaluation using PC interface.
6. Motoring test on 4-stroke diesel engine with electrical loading.
7. Retardation test on 4-stroke diesel engine with mechanical loading.
8. Study on the composition of Exhaust gas of an IC engine using Orsat Apparatus under various loads.
9. Performance test on high pressure two stage reciprocating air compressor.
10. Experiment on air conditioning unit.
11. Experiment on Refrigeration tutor.
12. Experiment on Vapour absorption refrigeration unit.

L – 30; P – 30; Total Hours –60

TEXT BOOKS:

1. Rajput, R.K, " Thermal Engineering", 8th Edition, Laxmi Publications Pvt Ltd., 2010

REFERENCES:

1. Rudramoorthy R, "Thermal Engineering", Tata McGraw Hill Publishers

Co. Ltd., New Delhi, 2006.

2. Sarkar .B.K, "Thermal Engineering", Tata McGraw Hill Publishers Co. Ltd., New Delhi, 2005.
3. Ganesan V, "Internal Combustion Engine", 3rd edition,Tata McGraw Hill Publishers Co. Ltd., New Delhi, 2008.
4. Rajput, R.K, “Thermal Engineering”, 8th edition, Laxmi publications pvt ltd., 2010
5. Arora. C.P. “Refrigeration and Air conditioning” 3rd edition, Tata McGraw Hill Publishers Co. Ltd., 2008.
6. Frank Kreith, “Hand Book of thermal Engineering”, CRC press, 2000.
7. Manohar Prasad, “Refrigeration and Air-conditioning” 2nd edition, new age international, 2003.

OUTCOMES:

The students should be able to

- analyses air standard cycles and performance of I.C engines
- possess the knowledge of compressor, steam nozzle and turbines
- Analyze refrigeration and air conditioning cycles and systems.
- Run and analyze the performance and emission of IC engines.
- Understand and analyze the working of air compressors and refrigeration and air conditioning systems.

MEC3103	MECHANICS LAB	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To study the various principles of mechanics using simple mechanisms.
- To study the various controlling mechanisms such as governors and gyroscope.
- To determine the vibration parameters under various modes of vibration.

LIST OF EXPERIMENTS:

1. Governors - Determination of sensitivity, effort, etc. for watt, porter, proell, Hartnell governors.
2. Cam - Study of jump phenomenon and drawing profile of the cam.
3. Motorised Gyroscope-Verification of law's -Determination of gyroscopic couple.
4. Whirling of shaft-Determination of critical speed of shaft with concentrated loads.
5. Balancing of reciprocating masses.
6. Balancing of rotating masses.
7. Determination of Moment of inertia by oscillation method for connecting rod and flywheel.
8. Vibrating system Spring mass-system-Determination of damping co-efficient of single degree of freedom system.
9. Determination of influence co-efficients for multi degree freedom suspension system.
10. Determination of transmissibility ratio - vibrating table.
11. Determination of torsional frequencies for compound pendulum and flywheel –system with lumped Moment of inertia
12. Transverse vibration –free- Beam. Determination of natural frequency and deflection of beam.

L – 0; P – 30; Total Hours –30

OUTCOMES:

The students should be able to

- Apply the principles of mechanics in real time mechanisms.
- Be familiar with various controlling mechanisms.
- Analyze the vibration parameters under various modes of vibration.

ECC31812	ELECTRONICS LAB	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To study the characteristics of various electronic devices.
- To learn the usage of microprocessor and controllers for various operations.

LIST OF EXPERIMENTS:

1. VI characteristics of PN Junction Diode
2. VI characteristics of Zener Diode
3. Characteristic of CE Transistor
4. Characteristics of JFET
5. Characteristics of Uni Junction Transistor
6. Study of Logic Gates (Basic Gates)
7. Half Adder and Full Adder
8. Shift Register
9. Ripple counter
10. bit addition, subtraction
11. Multiplication and division
12. Maximum and Minimum of block of data
13. Sorting and block transfer
14. Stepper Motor Interfacing
15. Traffic light controller

L – 0; P – 30; Total Hours –30

OUTCOMES:

Students will be able to

- Analyze the characteristics of various electronic devices.
- Apply microprocessors and controllers for various operations.

SEMESTER VI

ENC 3281	COMMUNICATION AND SOFT SKILLS - II CONFIDENCE BUILDING	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To develop professional skills like work ethics, analytical skills, presentation skills etc.
- To train them in problem solving skills and leadership skills pertaining to industries.
- To train them in team building skills.
- To train in setting up career goals

MODULE I **6**

Brief about Multinational companies- Analysing work ethics of multinational companies and small industries- discussing as pairs-Knowledge about etiquette (different types)

MODULE II **6**

Visit to an Industry and prepare reports --Critically reading of industry specific journal articles and write ups-- preparing reports.

MODULE III **4**

Analysing problem solving situations in industries (relating to application of core subject to specific jobs) and discussing about them- working on a sample case

MODULE IV **6**

Developing Leadership in team projects-- debating about various aspects of leadership: for example, responsibility and reliability-time management

MODULE V **8**

Team building skills-- group discussions pertaining to industries-- presenting career goals. -- preparing for interviews- interpersonal skills

Total Hours – 30

REFERENCES:

1. Covey,S.R. (2004). The 7Habits of Highly Effective People: Powerful Lessons in Personal Change. Free Press.UK
2. Fine, P.M.& Alice Olins. (2016).Step up: Confidence, Success and Your Stellar Career in 10 Minutes a Day. Vermilion.UK
3. Pai, A. (1993).How to Develop Self-Confidence. Amazon.com
4. Wentz,F.H.(2012). Soft skills training: A Workbook to Develop Skills for Employment. Amazon.com

OUTCOMES:

After completing the course students would be able to

- Exhibit critical reading skills through review of industry specific articles.
- Provide solutions to problem based situations.
- Exhibit leadership qualities by debating over industry specific issues.
- Participate in group discussions confidently.
- Present their career goals.

MEC3211	MACHINE DESIGN	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To familiarize the various steps involved in the Design Process.
- To understand the principles involved in evaluating the design procedure
- Optimal utilization of Data book
- Able to satisfy a design under maximum loading conditions

MODULE I STEADY STRESSES AND VARIABLE STRESSES 12

Introduction to the design process - factors influencing machine design, selection of materials based on mechanical properties - Direct, Bending and torsional stress equations –calculation of principle stresses for various load combinations, eccentric loading – design of curved beams – crane hook and 'C' frame - factor of safety - theories of failure – stress concentration – design for variable loading– Soderberg, Goodman and Gerber relations.

MODULE II DESIGN OF SHAFTS AND COUPLINGS 10

Design of solid and hollow shafts based on strength, rigidity and critical speed - Design of Keys, key ways and splines - Design of rigid, flange and muff couplings.

MODULE III DESIGN OF TEMPORARY AND PERMANENT JOINTS 10

Threaded fasteners - Design of bolted joints including eccentric loading, Knuckle joints – Design of welded joints, riveted joints for structures - theory of bonded joints.

MODULE IV IV DESIGN OF ENERGY STORING ELEMENTS 8

Design of helical and leaf springs - Design of flywheels considering stresses in rims and arms for engines and punching machines.

MODULE V DESIGN OF BEARINGS 12

Sliding contact and rolling contact bearings -Design of hydrodynamic journal bearings, McKee's Eqn., Sommerfield Number, Raimondi & Boyd graphs – Derivation of McKee's Eqn - Selection of Rolling Contact bearings.

MODULE VI DESIGN OF MISCELLANEOUS ELEMENTS 8

Design of Seals and Gaskets -Design of crankshafts- Design of Connecting Rod.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Shigley J.E, Mischke C. R., “Mechanical Engineering Design”, 6th Edition, Tata McGraw-Hill, 2003.
2. Bhandari V.B, “Design of Machine Elements”, 6th Edition, Tata McGraw-Hill Book Co, 2007.

REFERENCES:

1. Sundararajamoorthy T.V, Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2003.
2. Orthwein W, “Machine Component Design”, Jaico Publishing Co, 2003.
3. Ugural A.C, “Mechanical Design – An Integral Approach”, McGraw-Hill Book Co, 5. 2004.
4. Spotts M.F., Shoup T.E, “Design and Machine Elements” Pearson Education, 2004.

OUTCOMES:

Students should be able to

- Familiar with design procedures for various components
- Will be able to understand and follow standards in designing a component
- They will be explored to practical difficulties that are faced in a design calculations

MEC3212	METROLOGY AND MECHANICAL MEASUREMENT	L	T	P	C
		3	0	3	4

OBJECTIVES:

- To teach the concepts, calibration and analysis of errors in measurements.
- To measure experimentally various specifications of engineering components.
- To train on modern measuring equipment such as CMM, Machine vision system and surface roughness tester.
- To use modern techniques for acquiring data in the measurement parameters such as temperature, vibration, displacement, force, torque etc.

MODULE I CONCEPT OF MEASUREMENT 10

Definition of metrology, General Concepts of measurement system-Units and standards-measuring instruments- sensitivity, readability, range of accuracy, precision-static and dynamic response-repeatability-Measurement system behavior: General model for dynamic measurement system and special cases: zero order, first order and second order system, determination of time constant and settling time, phase linearity- systematic and random errors-correction, calibration, interchangeability, traceability. Statistical concepts: Mean, Range, Variance and Standard deviation in error analysis.

MODULE II LINEAR AND ANGULAR MEASUREMEN 11

Linear measuring instruments: Slip gauges, Tool Maker's microscope, limit gauges. Comparators: Mechanical, pneumatic and electrical types, applications. Angular measurements: -Sine bar, bevel protractor-Taper angle measurements.

MODULE III FORM AND FINISH MEASUREMENT 10

Form measurement- Measurement of screw threads- floating carriage micrometer-measurement of gears-tooth thickness-constant chord and base tangent method-straightness, flatness and roundness measurements- surface finish-surface roughness tester.

MODULE IV LASER AND ADVANCES IN METROLOGY 9

Precision instruments based on laser-Principles- laser interferometer-application in measurements and machine tool metrology- Coordinate measuring machine (CMM): need, construction, types, applications.- computer aided inspection. Machine Vision systems - principle and functions.

MODULE V MEASUREMENT OF POWER FLOW AND TEMPERATURE RELATED PROPERTIES **10**

Response of Measuring System: Amplitude, Frequency and Phase - Force, torque measurement- mechanical, pneumatic, hydraulic and electrical type-Flow measurement-Temperature measurement- bimetallic strip, pressure thermometers, thermocouples, electrical resistance thermistor.

MODULE VI SENSORS AND SENSING SYSTEMS FOR PROCESS, SYSTEM AND CONDITION MONITORING **10**

Vibration measurement – Vibrometers and accelerometers, test methods and calibration- Acoustic Measurement- AE Parameters, principles of acoustic emission techniques ,– Advantages, limitations and applications –Acoustic sensors- piezo electric sensors -Microphones and its types.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. 1. Jain R.K., “Engineering Metrology”, Khanna Publishers, 2009
2. 2. Alan S. Morris, “The Essence of Measurement”, Prentice Hall of India, 1997

REFERENCES:

1. Gupta S.C, “Engineering Metrology”, Dhanpat rai Publications, 2005.
2. Beckwith T.G, and R.D. Marangoni, “Mechanical Measurements”, Addison Wesley, 2007
3. Donald D Eckman, “Industrial Instrumentation”, Wiley Eastern, 1985.
4. ASTME, “hand book of industrial metrology” Prentice Hall of India, 1988
5. ASNT, “Nondestructive testing handbook Emission” Volme.5- Acoustic emission testing,1994

OUTCOMES:

- Students should able to know the basic concepts of measurement and measuring systems
- Students should able to measure various engineering specifications with linear and angular instruments.
- Students should able to perform the form measurement on different components like screw thread and gears.
- Students should able to execute dimensional measurement and angularity using Coordinate Measuring Machine and Machine Vision

System and to evaluate roughness of measuring surfaces.

- Students should able to measure the force , torque ,flow and temperature
- Students should able to carry out vibration and acoustic measurement using vibrometers and accelerometers.

MEC3213	HEAT AND MASS TRANSFER	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the different modes of heat transfer and their application in engineering.
- To study and design various types of heat exchangers.
- To learn the basic concepts of mass transfer.

MODULE I BASIC OF HEAT TRANSFER & GOVERNING EQUATIONS 10

Basic Concepts- Modes of heat transfer- conduction, convection, and radiation, Fourier law of heat conduction, three-dimensional heat conduction equations in various co-ordinate systems, steady state heat conduction equation for plane, cylindrical and spherical shapes- overall heat transfer co-efficient, Composite systems, Critical radius of insulation.

MODULE II CONDUCTIVE HEAT TRANSFER 7

Variable thermal conductivity, heat transfer with heat generation in different shapes. Extended surfaces (fins)-numerical methods for varying sections of fins with different end conditions. Transient heat conduction Lumped parameter systems, infinite solids, semi-infinite solids, numerical and graphical methods.

MODULE III CONVECTIVE HEAT TRANSFER 7

Concepts of Boundary Layer: Differential and integral equations for hydrodynamics and thermal boundary layer. Convection Heat Transfer: Forced Heat transfer from flat plate, laminar and turbulent flow, cylinders and spheres, flow through tubes. Free convection, heat transfer from vertical and horizontal surfaces.

MODULE IV RADIATION HEAT TRANSFER 6

Radiation Heat Transfer: Emissive power, grey body. Radiation heat transfer between surfaces, shape factor.-Electrical analogy, Gas radiation.

MODULE V HEAT EXCHANGERS 9

Types-tube arrangements, single and multi-tube types, parallel, counter and cross flow, Overall heat transfer coefficient, Analysis – LMTD method, - NTU method. Fouling factor. Boiling and Condensation: Boiling heat transfer - bubble growth, freezing and melting. Condensation, film condensation and drop wise condensation.

MODULE VI MASS TRANSFER 6

Mass Transfer: Basic Concepts- Diffusion mass transfer- Fick's law of diffusion steady state molecular diffusion- convective mass transfer- momentum, Heat and mass transfer analogies- convective mass transfer correlations.

L – 45; T – 0; Total Hours –45

REFERENCES:

1. Holman J P, "Heat Transfer", 9th edition, Tata McGraw Hill Inc., New York, 2008.
2. S. P. Sukhatme, "Text book of Heat transfer" 4th edition, University Press (India) Pvt. Ltd. 2006.
3. Yunus A Cengel, "Heat Transfer: A Practical Approach", 2nd Edition, Tata McGraw Hill Inc., New York, 2005.
4. Sachdeva R C, "Fundamentals of Engineering Heat and Mass Transfer", 4th edition, New Age International Publishers, New Delhi, 2010.
5. Nag P K., "Heat and Mass Transfer", Tata McGraw Hill Publishing Company, New Delhi, 2004.
6. Suhas V Patankar, "Numerical Heat transfer and fluid flow", ane books, 1st edition series in computational methods in mechanics and thermal sciences.
7. Frank P Incropera and David P Dewitt, "Heat and Mass Transfer", 5th edition 2001, Wiley.
8. Donald Q Kern, "Process Heat Transfer", TMH.

OUTCOMES:

The student should be able to

- Conceptualize and apply the different modes of heat transfer to real applications.
- Solve the real time problems with the help of HMT data book.
- Design heat exchangers to suit specific requirements.

MEC3214	HEAT AND MASS TRANSFER LAB	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To experimentally study the different modes of heat transfer.
- To determine the parameters such as thermal conductivity, heat transfer coefficient and Stefan Boltzmann constant.

LIST OF EXPERIMENTS:

1. Thermal conductivity measurement of pipe insulation using lagged pipe apparatus.
2. Thermal conductivity of metal rod.
3. Thermal Conductivity of liquids.
4. Heat transfer through composite wall.
5. Thermal conductivity measurement using guarded plate apparatus.
6. Determination of heat transfer coefficient under natural convection from a vertical cylinder.
7. Determination of heat transfer coefficient under forced convection from a tube.
8. Heat transfer from pin-fin (natural & forced convection modes)
9. Determination of Stefan – Boltzmann constant.
10. Determination of emissivity of a grey surface.
11. Heat transfer studies on pool boiling.
12. Effectiveness of Parallel / counter flow heat exchanger.
13. Drop and Film-wise condensation study
14. Transient heat conduction study

L – 0; P – 30; Total Hours –30

OUTCOMES:

Students should be able to

- apply heat laws and equations to measure heat transfer.

MEC3215	CNC LAB	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To learn part programming for CNC machines.
- To practice tool path simulation in CAD/CAM software.
- To generate NC code for CNC controllers from 3D models.
- To familiarize interfacing between software and machines.

LIST OF EXPERIMENTS:

CNC Lathe:

1. Part programming for Linear and Circular interpolation.
2. Part programming using standard canned cycles for Turning.

CNC Mill:

1. Part programming for Linear, Circular interpolation and Contour motions.
2. Part programming involving canned cycles for Drilling, Peck drilling and Boring.

Modelling and Simulation in CAD/CAM software:

1. Tool path generation and Mould design from 3D models using CAD/ CAM software.
2. Post processing for standard CNC Controllers like FANUC, Sinumerik etc.

Designing and realizing a product:

1. Design a simple product and its required tooling and simulate its 3D model.
2. Generate NC codes and interface with CNC machine to realize the product.

L – 0; P – 30; Total Hours –30

TEXT BOOKS:

1. Lab Manual.

REFERENCES:

1. P.N. Rao, “CAD / CAM Principles and Applications”, 2nd Edition, Tata Mc Graw Hill, 2004.
2. Ibrahim Zeid, “CAD/CAM - Theory and Practice”, McGraw Hill, International Edition, 1998.

OUTCOMES:

Students should be able to

- Write part programs and operate CNC lathe.
- Write part programs and operate CNC milling machine.
- Choose proper manufacturing processes and tooling for machining.
- Create 3D models and simulate tool path using CAM software.
- Perform post processing for various CNC controllers and interface with machines.
- Develop their ideas into CAD models and realize it in a CNC machine.

SEMESTER VII

MEC4101	FINITE ELEMENT ANALYSIS (INTEGRATED LAB)	L	T	P	C
		3	0	3	4

OBJECTIVES:

- To introduce the concept of mathematical modeling of engineering problems.
- To understand the principles of discretization and finite element formulation.
- To reveal the types of elements and its selection.
- To form and assemble stiffness matrices and force vectors for simple elements.
- To appreciate the use of FEM to a structural and thermal applications.
- To discover Isoparametric formulation and its importance.

MODULE I INTRODUCTION 12

Basic Concept, comparison with FDM and FVM, advantages and disadvantages, history of development, application. – Application to the continuum – Discretization – Governing equations for continuum – Variational methods - Weighted residual method.

MODULE II BASICS OF FINIETE ELEMENT FORMULATION 8

Finite Element Analysis of 1D Problems - Element type - Spring element, two noded line element - lower order and higher order element types - discretization, displacement function, shape function, formulation, element equations, assembly, boundary conditions, solution of equations- post processing, convergence criteria, examples from solid mechanics.

MODULE III BEAM ELEMENT AND ITS APPLICATIONS

Element Shape Functions - C0, C1 continuity- completeness and compatibility condition, formulation, element equations, assembly, boundary conditions, solution of equations and examples - types of beam and different loading conditions.

MODULE IV TWO DIMENSIONAL STRUCTURAL ANALYSIS

Theory of Elasticity – Plane Stress – Plain Strain and Axisymmeteric Concept – CST - LST - shape function - strain - displacement matrix - constitutive matrix - stiffness matrix - assembly - solutions - examples - finite element formulation of plate, dam, pipe, pressure vessels problems.

MODULE V ISOPARAMETRIC FORMULATION AND NUMERICAL INTEGRATION

Natural co-ordinate systems –Lagrangian Interpolation Polynomials-Serendipity Formulation- Isoparamatric Elements Formulation - Rectangular elements - Numerical integration – simple Problems using Gauss quadrature Technique.

MODULE VI FEA IN THERMAL ANALYSIS

Governing equation - 1D heat flow and finite element formulation – 2D thermal element and its formulation - Conduction and Convection - Simple problems - heat transfer in composite wall, fins

L – 45; T – 15; Total Hours –60

REFERENCES:

1. Reddy J.N. – “A Introduction to Finite Element Method”, McGraw Hill,International Edition, 1993.
2. Seshu. P – “Textbook of Finite Element Analysis”, Prentice-Hall India Pvt. Ltd, 2006.
3. Cook,Robert Devis etal, - “Concepts and Application of finite Element Analysis”, Wiley John & Sons,1999.
4. David V Hutton “Fundamentals of Finite Element Analysis” 2004. McGraw-Hill Int. Ed.
5. O.C.Zienkiewicz and R.L.Taylor, “The Finite Element Methods”, Vol.1, “The basic formulation and linear problems”, Vol.1, Butterworth Heineman, 5th Edition, 2000.
6. Rao.S.S, - Finite Element Method in Engineering, Pergamon Press, 1989
7. Chandrupatla T.R., and Belegundu A.D., “Introduction to Finite Elements in Engineering”, Pearson Education 2002, 3rd Edition.
8. Krishnamoorthy C.S – “Finite Element Analysis: Theory and Programming”, Tata McGraw Hill Publishing Company .Ltd 1998.

OUTCOMES:

Students should be able to

- develop corresponding mathematical model for the engineering problems.
- write governing equations and solves them for boundary and initial value problems.
- assemble stiffness matrices and force vectors for simple elements.

- apply concepts of FEM to structural and thermal applications
- model any complex problem into a simple two dimensional problems.
- form and solve the stiffness matrices in natural coordinates.

MEC4102	MECHATRONICS (INTEGRATED LAB)	L	T	P	C
		3	0	3	4

OBJECTIVES:

- To study the interdisciplinary applications of electronics, electrical, mechanical and computer systems for the control of mechanical and electronic systems.
- To impart knowledge on the role of sensors, actuators, control, and machine intelligence in mechanical engineering.
- To gain knowledge on the concepts and techniques involved in mechatronic systems which are widely used in various industries.

MODULE I INTRODUCTION 12

Introduction to Mechatronics- Systems- Concepts of Mechatronics app roach – Need for Mechatronics- Emerging area of Mechatronics- Sequential controllers. Introduction to Sensors & Transducers – Performance Terminology- Sensors for motion and position measurement, force, torque, tactile, temperature sensors, ultrasonic sensors, hall-effect sensors. Selection of sensors for different applications, Signal Conditioning.

Hands on Practices in Following Sensors - Potentiometer, Strain gauge, Torque, LVDT, Hall effect, speed, Vibration, Pressure - Practices on Transducer – Temperature, optical - operational amplifier circuits.

MODULE II ACTUATORS 12

Review of Pneumatic and Hydraulic Systems - Control Valves, Actuators. Review of Mechanical Actuation Systems – Electrical Actuation Systems – Mechanical Switches, Solid State Switches, Solenoids, Construction and working principle of DC and AC Motors –speed control of AC and DC drives, Stepper Motors-switching circuitries for stepper motor.

Hands on Practices in Electro Pneumatic trainer kit and simulation software.

MODULE III PROGRAMMABLE LOGIC CONTROLLER 8

Programmable Logic Controllers –Basic Structure, Input / Output Processing, Programming, Mnemonics, Timers, Internal relays and counters, Shift Registers, Master and Jump Controls, Data Handling, Analogs Input / Output, Selection of a PLC.

Hands on Practices in Simulation of real life automation viz., bottling plant and punching operation using PLC Ladder Diagram

MODULE IV SYSTEM MODELS 9

System Models - Building blocks of Mechanical, Electrical, Fluid and Thermal Systems, Modeling spring, mass & damper systems, Rotational –Translational Systems, Electromechanical Systems, and Hydraulic –Mechanical Systems.

Hands on Practices in the development of an obstacle avoidance robot using servo motors, ultrasonic and touch sensors, Measurement of damping ratio of a machine tool base from free vibration studies using an impact hammer and an accelerometer pick up with data acquisition system.

MODULE V SYSTEM CONTROLLERS 9

Closed-Loop Controllers - Continuous and discrete process Controllers, Control Modes –Two –Step mode, Proportional Mode, Derivative Mode, Integral Mode, PID Controllers –Digital Controllers –Velocity Control –Adaptive Control –Digital Logic Control.

Hands on Practices in control of speed, direction and number of revolutions of a stepper motor using PC interface, control valve characteristics, Level Process Stations.

MODULE VI DESIGN OF A MECHATRONICS SYSTEM 10

Mechatronics Design process-stages -Traditional and Mechatronics design concepts- Case studies of Mechatronics systems- Pick and place Robot, Autonomous mobile robot - Engine Management system- Automatic car park barrier- Robot walking machine. Introduction to data acquisition and control systems, virtual instrumentation, interfacing of various sensors and actuators with PC.

Hands on Practices in interfacing of a thermal sensor to monitor and control the temperature in a thermal chamber within a specified tolerance limits - Virtual process controls systems and Heating and Ventilation control using Data Acquisition techniques

L – 45; T – 15; Total Hours –60

REFERENCES:

1. Bolton,W, “Mechatronics”, Pearson education, second edition, fifth Indian Reprint, 2003.
2. Smaili.A and Mrad.F, "Mechatronics integrated technologies for intelligent machines", Oxford university press, 2008.

3. Michael B. Histand and David G. Alciatore, “Introduction to Mechatronics and Measurement Systems”, McGraw-Hill International Editions, 2000.
4. Sanjay Gupta and Joseph John, "Virtual Instrumentation and LabVIEW", Tata McGraw Hill Publications, Co., 2005.
5. Bradley D. A., Dawson D., Buru N.C. and. Loader A.J, “Mechatronics”, Chapman and Hall, 1993.
6. Dan Necsulesu, “Mechatronics”, Pearson Education Asia, 2002 (Indian Reprint).
7. Lawrence J. Kamm, “Understanding Electro –Mechanical Engineering”, An Introduction to Mechatronics, Prentice –Hall of India Pvt., Ltd., 2000.

OUTCOMES:

Students will be able to

- Identify the elements of a mechatronic system.
- Select suitable sensors and actuators to meet specific requirement.
- Design basic system model.
- Utilize suitable controller for a given system
- Able to build a mechatronics system using PLC
- Design mechatronic system for engineering application

MEC4103	DESIGN OF TRANSMISSION SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To gain knowledge on the principles and procedure for the design of power transmission components.
- To understand the standard procedure available for Design of Transmission systems.
- To learn to use standard data and catalogues.

MODULE I DESIGN OF BELT AND CHAIN DRIVES 8

Introduction : Selection of Flat belts and pulleys – Selection of V belts and pulleys – Wire ropes and pulleys-Selection of Transmission chains and Sprockets. Design of pulleys and sprockets.

MODULE II SPUR GEARS AND PARALLEL AXIS HELICAL GEARS 9

Gear Terminology-Speed ratios and number of teeth-Force analysis – Tooth stresses – Dynamic effects – Fatigue strength – Factor of safety – Gear materials – Module and Face width-power rating calculations based on strength and wear considerations – Parallel axis. Helical Gears – Pressure angle in the normal and transverse plane – Equivalent number of Teeth-forces and stresses. Estimating the size of the helical gear.

MODULE III BEVEL, WORM GEARS AND CROSSED HELICAL GEARS 9

Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number of teeth estimating the dimensions of pair of straight bevel gears. Worm Gear: Merits and demerits –Terminology. Thermal Capacity, Materialsforces and stresses, efficiency, estimating the size of the worm gear pair. Crossed -helical Terminology-helix angles – Estimating the size of the pair of Crossed-helical gears.

MODULE IV DESIGN OF GEAR BOXES 9

progression – Standard step ratio – Ray diagram, kinematic layout – Design of Sliding mesh gear box- Constant mesh gearbox – Design of multi speed gear box.

MODULE V DESIGN OF CAMS 5

Cam Design: Types-pressure angle and under cutting base circle determination-forces and Surface stresses.

MODULE VI DESIGN OF CLUTCHES AND BRAKES 5

Design of plate clutches – axial clutches-cone clutches-internal expanding rim clutches-internal and external shoe brakes. Case Studies and Mini Projects

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Shigley J.E and Mischke C. R., “Mechanical Engineering Design”, Sixth Edition,Tata McGraw-Hill , 2003.
2. Sundararajamoorthy T. V and Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2003.

REFERENCES:

1. Maitra G.M. and Prasad L.V., “Hand book of Mechanical Design”, II Edition, Tata McGraw-Hill, 1985.
2. Bhandari, V.B., “Design of Machine Elements”, Tata McGraw-Hill Publishing Company Ltd., 1994.
3. Prabhu. T.J., “Design of Transmission Elements”, Mani Offset, Chennai, 2000,
4. Hamrock B.J., Jacobson B. and Schmid S.R., “Fundamentals of Machine Elements”, Tata McGraw-Hill Book Co., 1999.
5. Ugural A,C, "Mechanical Design, An Integrated Approach", Tata McGraw-Hill,2003.

STANDARDS:

1. 1.IS 4460 : Parts 1 to 3 : 1995, Gears – Spur and Helical Gears – Calculation of Load Capacity.
2. IS 7443 : 2002, Methods of Load Rating of Worm Gears
3. IS 15151: 2002, Belt Drives – Pulleys and V-Ribbed belts for Industrial applications – PH, PJ, PK, Pl and PM Profiles : Dimensions
4. IS 2122 : Part 1: 1973, Code of practice for selection, storage, installation and maintenance of belting for power transmission : Part 1 Flat Belt Drives.
5. 5. IS 2122: Part 2: 1991, Code of practice for selection, storage, installation and maintenance of belting for power transmission : Part 2: V-Belt Drives.

OUTCOMES:

The students should be able to

- use standard design data and catalogues.
- design different types of power transfer devices.
- design gear box assembly, Cams, brakes etc..

MEC4104	SIMULATION LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To realize the importance of Computational efficiency in simulation of Real time Mechanical systems.
- To Implement Dynamics and control problems in Vibratory systems.
- To learn vibration pattern in vibratory systems with damping and without damping.
- To implement automation systems by virtual simulation and analysis of Real Time systems.

LIST OF EXPERIMENTS

1. Simulation of simple pendulum.
2. Simulation of Double pendulum.
3. Single degree of freedom spring-mass system with free and forced vibration.
4. Single degree of freedom spring-mass-damper system with free and forced vibration.
5. Two degree of freedom spring-mass system with free and forced vibration.
6. Two degree of freedom spring-mass-damper system with free and forced vibration.
7. Implementation of PID controller in Tuning and control of above dynamic systems.
8. Simulation of Four bar mechanism.
9. Simulation of Simple pendulum.
10. Simulations of Slider crank mechanism.
11. Simulation of Single link Robot Arm.
12. Simulation of Hydraulic system with Single-Acting Cylinder.
13. Simulation of Elevator system.
14. Simulation of Hydraulic system with Double-Acting Cylinder.

OUTCOMES:

The students should be able to

- simulate and study different systems and mechanisms.
- acquire knowledge on automation through virtual simulation of real time systems

MEC4105	AUTOMOBILE LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To study the various components of vehicle by dismantling and assembling
- To study the functions and performance of various automobile systems

LIST OF EXPERIMENTS

1. Dismantling & Assembling of petrol engine.
2. Dismantling & Assembling of diesel engine.
3. Study of oil filter, fuel filter, fuel injection system, carburetor, MPFI
4. Study of ignition system components – coil, magneto and electronic ignition systems.
5. Study of engine cooling system components
6. Study of engine lubrication system components
7. Dismantling & Assembling of Differential
8. Dismantling & Assembling of gear box
9. Dismantling & Assembling of Clutch assembly

L – 45; T – 15; Total Hours –60

OUTCOMES:

Student should be able to

- understand the function of various automobile components.
- dismantle and assemble various components of a vehicle.

MEC4106	INTERNSHIP	L	T	P	C
		0	0	0	1

Students must undergo two weeks industrial training to gain practical experience.

SEMESTER VIII

MEC4211	PROJECT WORK	L	T	P	C
		0	0	24	12

OBJECTIVES:

- To practice the knowledge gained from all the courses
- To develop individual responsibility and team work

Students should do a project which involves themselves with innovative ideas of design, fabrication, analysis, Industrial problem solving, new development.

Frequently, progress in the project work is evaluated by conducting reviews.

At end semester students should appear for their project viva-voce and submit the reports.

OUTCOMES:

Student can able to

- Examine a part or product feasibility
- Develop a real time working model
- Planning of activities and time management skills.
- Fault diagnosis of industrial parts.

PROGRAMME ELECTIVES
DESIGN ELECTIVES

		L	T	P	C
MECX01	**ADVANCED STRENGTH OF MATERIALS**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To understand the stress strain relations and location of shear centers.
- To study and analyze stress and deflections in curved beams.
- To understand the stresses in flat plates.
- To study and analyze torsional stresses in thin walled tubes and non-circular sections.
- To understand the stresses in rotary sections and contacts.

MODULE I STRESS AND STRAIN RELATIONS 8

Elastic and Inelastic response of a solid, Transformation of stress, strain, principal stresses and strains, general equations of elasticity in Cartesian, Polar and spherical coordinates, differential equations of equilibrium-compatibility- boundary conditions. Representation of three dimensional stress of a tension, generalized hook's law – St. Venant's principle-plane stress-Airy's stress function.

MODULE II SHEAR CENTRE 7

Shear Centre – Location of shear centre for various sections: thin wall beam cross section, channel section, box beams, beams formed from stringers and thin webs-shear flows.

MODULE III UNSYMMETRICAL BENDING 8

Flexible Members – Circumference and radial stresses-deflections-curved beam with restrained ends-closed ring subjected to concentrated load and uniform load-chain links and crane hooks.

MODULE IV FLAT PLATES 7

Stresses in circular and rectangular plates due to various types of loading and end conditions, buckling of plates.

MODULE V TORSION OF NON-CIRCULAR SECTIONS 8

Torsion of rectangular cross section – S.Venants theory – elastic membrane analogy, Prandtl's stress function. Torsional stress in hollow thin walled tubes.

MODULE VI STRESSES DUE TO ROTARY SECTIONS & CONTACTS 7

Radial and tangential stresses in solid disc and ring of uniform thickness and varying

thickness allowable speeds. Contact Stresses – Methods of computing contact stress - deflection of bodies in point and line contact applications.

Total Hours –45

REFERENCES:

1. Boresi A.P., Schmidt R.J., “Advanced Mechanics of Materials”, John Wiley and Sons, Sixth edition, 2003.
2. Seely and Smith, "Advanced Mechanics of Materials", John Wiley International Edn, 1952.
3. Timoshenko and Goodier, "Theory of Elasticity", McGraw Hill.
4. Wang, "Applied Elasticity", McGraw Hill.
5. Robert D. Cook, Warren C. Young, "Advanced Mechanics of Materials", Mcmillan pub. Co., 1985.

OUTCOMES:

Students will be able to

- Analyze two and three dimensional complex stress problems.
- Identify the shear centers for different sections.
- Compute stresses and deflections in curved beams subjected to unsymmetrical loading.
- Critique stresses in flat plates.
- Analyze and solve torsion of non-circular sections.
- Evaluate problems arising from stresses in rotary sections and contact applications.

MECX02	COMPOSITE MATERIALS FOR MANUFACTURE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the fundamentals of mechanics and manufacturing methods of composites.
- To study and analyze the behavior of composite materials.

MODULE I INTRODUCTION 9

Fundamentals of composites - Need for composites - Matrix materials - Properties- Reinforcement - Fibres - Glass fibre, Aramid fibre, Carbon fibre, boron fibre - Fabrication - Properties - Applications - Comparison of fibres - Particulate and whisker reinforcements. Matrix Reinforcement Interface - Wettability - Effect of surface roughness - Interfacial bonding - Methods for measuring bond strength.

MODULE II POLYMER MATRIX COMPOSITES 8

Polymer matrix resins - Thermosetting resins -Thermoplastic resins – PMC Processes - Hand layup and spray processes - Compression moulding - Reinforced reaction injection moulding - Resin transfer moulding - Pultrusion- Filament winding - Injection moulding - Fibre Reinforced Plastics (FRP) – Glass fibre Reinforced Plastics(GRP).

MODULE III METAL MATRIX COMPOSITES 8

Characteristics - Types - Alloy vs. MMCs - Advantages - Limitations – Metallic materials - Reinforcement - Particles - Fibres - Effect of reinforcement – Volume fraction - Rule of mixtures - Processing of MMCs - Solid state, liquid state, deposition and insitu - Applications.

MODULE IV CERAMIC MATRIX COMPOSITES 8

Engineering ceramic materials - Properties - Advantages - Limitations – Need for CMCs - Processing - Hot pressing, liquid infiltration technique, Lanxide process, insitu chemical reaction techniques - CVD, CVI, Solgel process - Interface in CMCs - Applications.

MODULE V MICROMECHANICS 6

Micromechanics models for stiffness - Micromechanics models for strength - Thermal and moisture effects.

MODULE VI FATIGUE AND CREEP IN COMPOSITE MATERIALS 6

Fatigue - S-N curves - Fatigue behavior of CMCs - Fatigue of particle and whisker

reinforced composites -Hybrid composites - Thermal fatigue - Creep.

Total Hours –45

REFERENCES:

1. Mathews F.L. and Rawlings R.D., “Composite materials: Engineering and Science”, Chapman and Hall, London, England, 1st edition, 1994.
2. Chawla K.K., “Composite materials”, Springer - Verlag, 1987.
3. Clyne T.W. and Withers P.J. “Introduction to Metal Matrix Composites”, Cambridge University Press, 1993.
4. Strong A.B., “Fundamentals of composite Manufacturing”, SME, 1989.
5. Sharma S.C., “Composite Materials”, Narosa Publications, 2000.
6. Mathews F. L. and Rawlings R. D., “Composite Materials: Engineering and Science”, CRC Press and Woodhead Publishing Limited, 2002.
7. Derek Hull, “Introduction to Composite Materials”, Cambridge University Press, 1988.
8. Handbook of Composites - American Society of Metals, 1990.

OUTCOMES:

Students will be able to

- Familiar with the mechanics and manufacturing methods of different types of composites.
- Analyze the behavior of composite materials.

MECX03 DESIGN OF HYDRAULICS AND PNEUMATICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn the advantages and applications of fluid power engineering and power transmission system.
- To learn the applications of fluid power system in automation of machine tools and others equipment.

MODULE I FLUID POWER PRINCIPLES & REVIEW OF FUNDEMENTALS **7**

Introduction to Fluid power- Advantages and Applications- Fluid power systems – Types of fluids- Properties of fluids Basics of Hydraulics – Pascal's Law- Principles of flow – Work, Power and Torque. Properties of air– Perfect Gas Laws. General types of fluids – fluid power symbols.

MODULE II HYDRAULIC SYSTEM AND COMPONENTS **8**

Sources of Hydraulic power: Pumping Theory – Pump Classification-Gear , vane and piston pumps - Construction, Working, Advantages, Disadvantages, Performance-Variable displacement pumps.Fluid power actuators: Linear hydraulic actuators – Types of hydraulic cylinders – single & double acting – special cylinders like tandem, rodless, Telescopic, cushioning Mechanism, construction of double acting cylinder, Rotary Actuator – Fluid motors, Gear, Vane and piston motors. Construction of control components – DCV – 3/2 , 4/ 2 valves – shuttle valve – check valve – pressure control valve – pressure reducing valve, sequence valve, flow control valve- Fixed and adjustable, electrical control solenoid valves, relays, ladder diagrams.

MODULE III DESIGN OF HYDRAULIC CIRCUITS **7**

Reciprocating, quick return, sequencing, synchronizing circuits, simple industrial circuits – Press circuits, earth movers, grinding machines. Safety and emergency emergency modules. Accumulators and intensifiers: Types, sizing and applications.

MODULE IV PNEUMATIC SYSTEM **8**

Compressors- Filter, Regulator, Lubricator, Muffler, Air control Valves, Quick Exhaust valves, Pneumatic actuators, Servo systems. Fluid power design, speed control circuits, synchronizing circuit, Pneumo hydraulic circuit, and sequential circuit design for simple industrial applications using cascade methods.

MODULE V DESIGN OF HYDRALIC AND PNEUMATIC CIRCUITS 8

Servo systems – hydro mechanical servo systems, electro hydraulic servo systems and proportional valves. Introduction to electro hydraulic pneumatic logic circuits, ladder diagrams, PLC applications in fluid power control. Fluid power circuits.

MODULE VI TROUBLESHOOTING AND MAINTENANCE 7

Common faults in hydraulic system, Procedure for repair, contamination, Component fittings and failure due to contaminants, Filter and filter maintenance, Pump maintenance, hydraulic system maintenance, performance monotoring General safety measures for fluid power system.

Total Hours –45

REFERENCES:

1. Anthony Esposito," Fluid Power with Applications", PHI / Pearson Education, 2005.
2. Shanmugasundaram.K, "Hydraulic and Pneumatic controls", Chand & Co, 2006.
3. Majumdar, S.R., "Oil Hydraulics Systems- Principles and Maintenance", Tata McGraw Hill, Fourth Reprint 2003.
4. Majumdar, S.R., "Pneumatic Systems – Principles and Maintenance", Tata McGraw Hill, 2007.
5. Dudelyt, A Pease and John J Pippenger, "Basic Fluid Power", Prentice Hall, 1987.

OUTCOMES:

Students will be able to

- Design pneumatic and hydraulic circuits for industrial automation.

MECX04	NOISE, VIBRATION AND HARSHNESS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart fundamental knowledge in the area of mechanical vibration and noise.
- To understand the fundamental knowledge on vibrating systems.
- To understand how to model the physical vibrating systems mathematically and the basic behavior of vibration measuring instruments and their industrial applications.
- To understand the fundamental of noise and its control.

MODULE I INTRODUCTION 7

Introduction to Noise, Vibration and Harshness (NVH) and its role in automotive and industrial applications. Sources of vibration and noise. Physiological effects of noise and vibration. Vibration and noise standards and limit.

MODULE II BASICS OF NOISE 8

Basic concept about sound. Sound intensity measurements. Sound propagation characteristics. Acoustic parameters. Sound pressure level and sound intensity; frequency and time weightings. Assessment of combustion noise, assessment of mechanical noise, engine radiated noise, intake and exhaust noise, engine accessory contributed noise, transmission noise, aerodynamic noise, tyre noise, brake noise.

MODULE III MODELING OF VIBRATING SYSTEMS 7

Relevance and need for vibration analysis – Mathematical modeling of Vibrating Systems – Discrete and Continuous systems - Single degree of freedom Systems – Free and Forced Vibrations- Various Damping Models.

MODULE IV VIBRATION MEASUREMENTS 8

Vibration Monitoring. Data Acquisition. Vibration Parameter Selection. Vibration Sensors. Accelerometers. Performance Characteristics. Sensor Location Signal. Preamplifications. Types of Preamplifiers. Real Time Analysis. Digital Fourier Transforms. FFT Analysis. Vibration Meters. Vibration Signatures. Standards. Vibration Testing Equipment. Modal analysis.

MODULE V NOISE CONTROLLING METHODS 7

Methods for control of engine noise, combustion noise, mechanical noise, predictive analysis, palliative treatments and enclosures, automotive noise control principles, sound in enclosures, sound energy absorption, sound transmission through barriers.

MODULE VI VIBRATION CONTROLLING TECHNIQUES 8

Methods of vibration control. Excitation reduction at source, Balancing of rigid, flexible and variable mass rotors. Dynamic properties and selection of structural materials. Vibration absorbers. Tuned absorber. Tuned and damped absorber. Untuned viscous damper. Vibration isolation. Harshness. Sources and its Effects, Measurement and control.

Total Hours –45

REFERENCES:

1. W.T. Thomson. (1997) “Mechanical Vibration”, 5th edition, Prentice-Hall.
2. S.S. Rao. (1995) “Mechanical Vibrations”, 3rd edition, Addison Wesley.
3. M.P. Norton. (1994) “Fundamentals of Noise and Vibrations Analysis for Engineers”, Cambridge University Press.
4. S.P. Parker. (1987) Acoustics Source Book, McGraw-Hill.
5. Gatti P. and Ferrari V. “Applied Structural and Mechanical Vibrations: Theory, Methods and Measuring Instrumentation”, E & FN Spon, London, 1999.
6. D.J. Ewins. (2000) Modal Testing: Theory, Practice and Applications, Research Studies.
7. Clarence W. de Silva. (2007) Vibration Monitoring, Testing, and Instrumentation, CRC Press.
8. M. Harrison. (2004) Vehicle Refinement: Controlling Noise and Vibration in Road Vehicles, Elsevier Butterworth-Heinemann.

OUTCOMES:

Student should be able to

- Understand the basic physics of sound and acoustic parameters.
- Model and analyze the vibration systems.
- Measure and control Noise and vibrations.

MECX05	DESIGN OF JIGS, FIXTURES AND PRESS TOOLS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the functions and design principles of Jigs, fixtures and press tools.
- To gain proficiency in the development of the final design.

MODULE I PURPOSE TYPES, FUNCTIONS OF JIGS AND FIXTURES 5

Tool design objectives - Production devices - Inspection devices – Materials used in Jigs and Fixtures – Types of Jigs - Types of Fixtures.

MODULE II CLAMPS AND TOLERANCE 3

Types of clamps - Mechanical actuation-pneumatic and hydraulic actuation Analysis of clamping force-Tolerance and error analysis.

MODULE III JIGS 9

Drill bushes –different types of jigs-plate latch, channel, box, post, angle plate, angular post, turnover, pot jigs-Automatic drill jigs-Rack and pinion operated. Air operated Jigs components. Design and development of Jigs for given components.

MODULE IV FIXTURES 9

General principles of boring, lathe, milling and broaching fixtures- Grinding, planning and shaping fixtures, assembly, Inspection and welding fixtures, Modular fixtures. Design and development of fixtures for given component.

MODULE V PRESS WORKING TERMINOLOGIES AND ELEMENTS OF DIES AND STRIP LAYOUT 6

Press working terminology-Presses and press accessories-Computation of capacities and tonnage requirements. Elements of progressive combination and compound dies:Die block-die shoe. Bolster plate-punch plate-punch holder-guide pins and bushes – strippers – knockouts-stops –pilots-Selection of standard die sets strip lay out-strip lay out calculations.

MODULE VI DESIGN AND DEVELOPMENT OF DIES 6

Design and development of progressive and compound dies for Blanking and piercing operations. Bending dies – development of bending dies-forming and drawing dies-Development of drawing dies. Design considerations in forging, extrusion, casting and plastic dies.

Total Hours –45

TEXT BOOKS:

1. Edward G Hoffman, “Jigs & Fixture Design”, Thomson – Delmar Learning, Singapore 2004.
2. Donaldson. C, “Tool Design”, Tata McGraw-Hill, 1986.

REFERENCES:

1. Kempster, “Jigs & Fixtures Design”, The English Language Book Society”, 1978.
2. Joshi, P.H., “Jigs & Fixtures”, Second Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi 2004.
3. Hiram E Grant, “ Jigs and Fixture” Tata McGraw-Hill, New Delhi, 2003.
4. “Fundamentals of Tool Design”, CEEE Edition, ASTME, 1983.
5. Design Data Handbook PSG College of Technology, Coimbatore.

OUTCOMES:
Students will be able to

- Apply the functions and design principles of Jigs, fixtures and press tools.

MECX07	GEOMETRIC MODELLING	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To understand the basics of mathematical representation of geometry
- To understand the modeling techniques and tools
- To understand the basics of modeling algorithms
- To understand the graphics standards and applications

MODULE I INTRODUCTION AND PRINCIPLES OF COMPUTER GRAPHICS 10

The design process and the role of CAD/CAM - Defining the modeling schemes: wire frame geometry, surface representation, Solid modeling – Elements of interactive computer graphics: Introduction, input and output devices, raster graphics, 2D (Translations, Rotation, Scaling and Shear) and 3D transformation (Translations, Rotation, Scaling, Shear, Orthographic and Perspective Projections), Windows to View port transformation, Clipping, Hidden line removal, Hidden Surface removal.

MODULE II LINES AND CURVES 10

Introduction to Equations - Implicit, explicit, parametric - Line Drawing Algorithm – Circles - Introduction to curves, parametric continuity condition, geometric continuity condition, Conics, Spline representation, Hermite Curves (Algebraic and Geometric Forms, Basis Functions, Matrix Form, Tangent Vectors, Truncating and Sub-dividing, 3-point and 4-point interpolation), Bézier Curves (Bézier basis functions, control points, truncating and subdividing, composite Bézier curve, characteristics of Bézier curve), B-Spline Curves (Uniform and Nonuniform B-Spline basis function, Quadratic and Cubic B-Spline basis function, Closed B-Spline Curve, Continuity, NURBS, Representation of conics with NURBS).

MODULE III SURFACES AND SOLDS 10

Surfaces: Introduction, Implicit and explicit function of surfaces, types of surfaces, Surface Representation, Surface Analysis (Tangent, Normal, Twist, Distance Calculation, Curvature, Tangent Plane), Plane Surface, Ruled Surface, Surfaces of Revolution, Tabulated Surfaces, Hermite Bi-cubic surface, Bézier Surface, Coons Surface, Introduction, Solid Representation, Properties of Solid model, Regularized Boolean set operations, Primitive instancing, Sweep representations, Boundary representations (B-rep), Constructive Solid Geometry (CSG), Comparison of representations.

Total Hours –30

REFERENCES:

1. Mastering CAD / CAM Ibrahim Zeid McGraw-Hill
2. Geometric Modelling M Mortenson Industrial Press.
3. CAD / CAM: Theory and Practice Ibrahim Zeid McGraw-Hill
4. Mathematical Elements of Computer Graphics David F Roger McGraw Hill
5. Computer Graphics: C Version Hearn and Baker Pretice Hall of India
6. Curves and Surfaces for CAGD: A Practical Guide 5/e, Gerald Farin Morgan Kaufmann
7. Computer Graphics and Geometric Modelling David Salomon Springer.
8. Computer Aided Engineering Design Anupam Saxena and Birendra Sahay Springer
9. Mechanical Assemblies: Their Design, Manufacture, and Role in Product Development D E Whitney Oxford Press

OUTCOMES:

The students should be able to

- Apply the mathematical representation of various geometries used in CAD/CAM.
- Perform the background activities/algorithms used in of modeling techniques.
- Compile the basic geometry commands used in different software to create the basic geometry.
- Predict the mathematical representations used to for different curves

MECX08	REVERSE ENGINEERING	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To explain reverse engineering and its scope
- To learn the tools for reverse engineering
- To study the concepts of reverse engineering
- To enlighten the students on data management
- To study different integration methods of reverse engineering

MODULE I INTRODUCTION & TOOLS FOR REVERSE ENGINEERING 10

Scope and tasks of reverse engineering - Domain analysis- Process of duplicating - Functionality- Dimensional- Developing technical data - Digitizing techniques - Construction of surface model - Solid-part material- Characteristics evaluation - Software and application- Prototyping – Verification - History of reverse engineering – Preserving and preparation for the four stage process – Evaluation and verification- Technical data generation, Data verification, Project implementation.

MODULE II DATA MANAGEMENT 10

Data reverse engineering – Three data reverse engineering strategies – Definition – Organization data issues - Software application – Finding reusable software components – Recycling real-time embedded software – Design of experiments to evaluate a reverse engineering tool – Rule based detection for reverse engineering user interfaces – Reverse engineering of assembly programs: A model based approach and its logical basics.

MODULE III INTEGRATION 10

Cognitive approach to program understated – Integrating formal and structured methods in reverse engineering – Integrating reverse engineering, reuse and specification tool environments to reverse engineering - Coordinate measurement – Feature capturing – Surface and solid members.

Total Hours –30

REFERENCES:

1. Bigger staff T J, Design Recovery for Maintenance and Reuse, IEEE Corpn. July 1991.
2. Rugaban S, White paper on RE, Technical Report, Georgia Instt. Of Technology, 1994.

3. Katheryn A. Ingle, Reverse Engineering, McGraw-Hill, 1994
4. Aiken Peter, Data Reverse Engineering, McGraw-Hill, 1996
5. Linda Wills, Reverse Engineering, Kluiver Academic Publishers, 1996
6. Donald R. Honsa, Co-ordinate Measurement and reverse engineering, American Gear Manufacturers Association.

OUTCOMES:
Students should be able to

- Describe about reverse engineering and its scope
- Use relevant tools for reverse engineering
- Apply the concepts of reverse engineering
- Practice data management
- Synthesize various integration methods of reverse engineering

MECX09	RELIABILITY ENGINEERING	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To familiarize probability theory and determine system reliability for series, parallel and mixed configurations.
- To understand the features of redundancy and fault tree analysis
- To understand the various aspects of Maintainability, Availability and Repairable systems.

MODULE I RELIABILITY CONCEPTS 10

Probability concept-Definition of reliability-Failure data analysis: Mean time to failure and Mean time between failure- Bathtub curve and Hazard Model: Constant Hazard and linearly Increasing Hazard- System reliability: Series configuration, parallel configuration and mixed configurations. System Relaiblity Problems.

MODULE II RELIABILITY IMPROVEMENT AND FAULT TREE ANALYSIS 10

Improvements of components – Redundancy: Element redundancy, unit redundancy- Standby redundancy- Reliability cost Trade off- Redundancy problems- Fault Tree Construction- Calculation of Reliability from Fault tree.

MODULE III MAINTAINABILITY/ AVAILABILITY AND REPAIRABLE SYSTEMS 10

Maintainability approach, Availability aspect, System down time, Availability types: Inherent Availability, Achieved availability and operational availability- Reliability and Maintainability trade off- Instantaneous repair rate- Mean time to repair.

Total Hours –30

REFERENCES:

1. L.S.Srinath," Reliability Engineering" , Affiliated East West (PVT) Ltd, New Delhi
2. Patrick D To' corner " Practical Reliability Engineering" , John Wiley and sons Inc, 2002.
3. Modarres, "Reliability and Risk analysis", Maral Dekker Inc. 1993
4. Charles E Ebeling, "An Introduction to Reliability and Maintainability Engineering", Tata McGraw Hill, New Delhi, 2009.
5. Dhillon , Engineering Maintainability – How to design for reliability and easy maintenance, PHI, 2008

6. David J Smith, Reliability, maintainability and Risk: Practical Methods for Engineers, Butterworth 2002.

OUTCOMES:
Students will be able to

- Able to apply the concept of Probability to engineering problems and able to estimate system reliability of simple and complex systems.
- Able to determine redundancy for various combinations of reliability system
- Aware about Maintainability, Availability and repair systems for reliability of components.

MECX10	MICRO ELECTRO MECHANICAL SYSTEMS (MEMS)	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To understand the design, fabrication and application of Micro Electro Mechanical Systems (MEMS).

MODULE I INTRODUCTION 8

MEMS and Microsystems, Miniaturization, Typical products, Micro sensors, Micro accelerometers, Micro actuators, Micro fluidics, Bio chemical micro system - Static bending of thin plates, Configurations of accelerometers, Thermo mechanics, Fracture mechanics, Thin film mechanics.

MODULE II MICRO SENSORS AND MICRO ACTUATORS 7

Pressure sensors, Thermal sensors, Electrostatics: basic theory, Gap and finger pull up, Electro static actuators, Comb generators, Inchworms, Electromagnetic actuators, Bistable actuators, Micro motors.

MODULE III CIRCUIT AND SYSTEM DESIGN ISSUES 7

System types, Basic modeling elements in system, Feedback systems, Noise, Modeling of MEMS systems, CAD for MEMS, Capacitive accelerometers.

MODULE IV MEMS MATERIALS AND FABRICATION TECHNOLOGIES 8

MEMS materials, Substrates and wafers, Micro system fabrication: Photolithography, Etching techniques, CVD process, Oxidation, Diffusion, Micro machining process: Bulk micro machining, Surface micro machining, and LIGA process.

Total Hours –30

TEXT BOOKS:

1. Stephen Santeria," Microsystems Design", Kluwer publishers, 2000.

REFERENCES:

1. Nadim Maluf," An introduction to Micro electro mechanical system design", Artech House, 2000.
2. Mohamed Gad-el-Hak, editor," The MEMS Handbook", CRC press Baco Raton,2000.
3. Tai Ran Hsu," MEMS & Micro systems Design and Manufacture" Tata McGraw Hill, New Delhi, 2002.

4. Nitaigour Premchand Mahalik “MEMS” McGraw hill education (India) private limited, 2007.

OUTCOMES:
Students will be able to

- Identify various products in MEMS and their application in Industries.
- Analyze and evaluate their performance of the MEMS components.
- Explain the working functions of various MEMS components.
- Design the new model and application of CAD in MEMS.
- Explain the development of advanced MEMS components and their applications.
- Identify suitable materials and fabrication methods for manufacturing MEMS components.

MECX11	GEOMETRIC DIMENSIONING AND TOLERANCING	L	T	P	C
		1	0	0	1

OBJECTIVES:

- To teach the principles of geometric product definition
- To educate the students on types of tolerances.

MODULE I INTRODUCTION 5

Introduction to limits fits and tolerances – GDNT definitions and importance –Datum reference frame – Feature control frame - MMC & LMC – General Rules – Datum System.

MODULE II PRINCIPLES OF MEASUREMENT FOR GEOMETRIC CHARACTERISTICS 10

Geometric characteristic symbols and meanings – Form tolerances – Profile tolerances – Location tolerances – Runout tolerances – Orientation tolerances – True position theory – Dimensional and tolerance schemes.

Total Hours –15

REFERENCES:

1. ASME Y – 14.5
2. Rao Ming, Harry Peck, “Designing for Manufacture”, Pitman Publications, London, 1983.
3. Krulikowski. A, “Fundamentals of Geomtric Dimensioning and Tolerancing”, Delmar Publishers – New York, 1997
4. Spotts.M.F, “Dimensioning and Tolerance for Quality Production”, Prentice Hall Inc., New Jersey, 1983.
5. Oliver R Wade, “Tolerance Control in Design and Manufacturing”, Industrial Press Inc., New York, 2008.

OUTCOMES:

Students should be able to

- Analyze situations and proceed to the logical end to solve product’s geometric definitions in order to function and be cost effective
- Totally consider function, manufacturing process and inspection methods in order to guarantee function with reduction in manufacturing and inspection cost

MECX12	TOOL AND DIE DESIGN	L	T	P	C
		1	0	0	1

OBJECTIVES:

- To teach the principles of geometric product definition
- To educate the students on types of tolerances.

MODULE I DESIGN OF CUTTING TOOLS 8

Single Point Cutting Tools: Classification, Nomenclature, geometry, design of single point tools for lathes, shapers, planers etc. Chip breakers and their design. Multipoint Cutting Tools: Classification and specification, nomenclature, Design of drills, milling cutters, broaches, taps etc. Design of Form Tools: Flat and circular form tools, their design and applications.

MODULE II DESIGN OF DIES 7

Classification of dies, Design of Dies for Bulk metal Deformation-Wire Drawing, Extrusion, Forging and Rolling; Design of Dies for Sheet metal: Blanking and Piercing, Bending and Deep-drawing; Design of Dies used for Casting and Moulding, Powder Metallurgy die design.

Total Hours –15

REFERENCES:

1. Donaldson, C., “Tool Design”, Tata Mc-Graw Hill, 2006
2. Pollack, H.W., “Tool Design” Reston Publishing Company, Inc. 1976.
3. Joshi, P.H., “Jigs and Fixtures, Tata Mc-Graw Hill, 2003
4. Grant, H,E., “Jigs and Fixtures, Tata Mc-Graw Hill, 2006
5. Kempster, M.H.A., “Principles of Jig and Tool Design”, English University Press Ltd.,1968.

OUTCOMES:

Students should be able to

- Increase their employability skills
- Develop innovative ideas work holding methods

THERMAL ELECTIVES

MECX21	REFRIGERATION AND AIR CONDITIONING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the principles of refrigeration and air conditioning.
- To learn the principles of psychrometry, cooling and heating load calculations.
- To acquire knowledge of system components of refrigeration and air conditioning.

MODULE I REFRIGERATION SYSTEMS 7

Review of thermodynamic principles of refrigeration – Concept of air craft refrigeration system- Vapour compression refrigeration system – use of PH charts- Multi stage and multi evaporator systems- Cascade system- COP comparison- Vapour Absorption system- Ammonia water and lithium Bromide water systems-Steam jet refrigeration system.

MODULE II REFRIGERANTS AND COMPONENT SELECTION 8

Compressors- reciprocating and rotary (elementary treatment)-condensersevaporators- ooling towers-Refrigerants-Properties- selection of refrigerants, alternate refrigerants, refrigeration plant controls- testing and charging of refrigeration units. Balancing of system components. Application to refrigeration systems-ice plant-food storage plants-milk chilling plants-refrigerated cargo ships.

MODULE III PSYCHROMETRY 7

Psychrometric Processes-use of psychrometric charts- Grand and Room Sensible Heat Factors-by bass factor-requirements of comfort air conditioningcomfort charts-factors governing optimum effective temperature, recommended design condition and ventilation standards.

MODULE IV COOLING LOAD CALCULATION 8

Types of load – design of space cooling load- heat transmission through building. Solar radiation–infiltration – internal heat sources (sensible and latent heat)-outside air and fresh air load-estimation of total load-domestic, industrial systems- central air conditioning systems.

MODULE V AIR CONDITIONING SYSTEMS 7

Air conditioning equipment – air cleaning and filters-humidifiers-dehumidifiers air

washers-condensers-cooling tower and spray ponds.

MODULE VI AIR CONDITIONING SYSTEM DESIGN & CONTROLS 8

Design of summer and winter air conditioning systems-Elementary treatment of duct design- Air distribution system- Temperature, Pressure and Humidity sensors, Actuators- Thermal insulation of air conditioning system – Applications: Car, industry, Stores and public buildings.

L – 45; T – 0; Total Hours –45

REFERENCES:

1. Manohar Prasad, “Refrigeration and Air conditioning”, Wiley Eastern Ltd, 1983.
2. Arora C.P. “Refrigeration and Air conditioning”,Tata Mcgraw-Hill New Delhi,1988.
3. Roy.J.Dosaat, “Principles of Refrigeration”,PearsonEducation 1997.
4. Jordan and Prister, “Refrigeration and Air conditioning”,Prentice Hall of India Pvt Ltd. New Delhi,1985.
5. Stoecker N.F. and Jones, “Refrigeration and Air conditioning”,Tata McGraw Hill, New Delhi,1981.
6. Arora & Domkundwar, A course in Refrigeration & Air Conditioning –, Dhanpat Rai & Sons.
7. R.C. Jordan and G.B. Priester, “Refrigeration & Air conditioning” – Prentice Hall of India. Manohar Prasad, “Refrigeration and Air conditioning”, Wiley Eastern Ltd, 1983.

OUTCOMES:

- Student will be able to design refrigeration and air conditioning systems and solve the related issues.

MECX22	ADVANCED I.C. ENGINES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To acquire an overview about various systems in I C engines.
- To study the combustion process in I C engines.
- To learn about automobile emissions, use of alternate fuels and the recent developments.

MODULE I FUEL SUPPLY SYSTEM FOR IC ENGINE 7

Carburetion- Theory of carburetion, Mixture requirements for components in S.I Engines, Simple carburetor, Requirements of ignition system; types of ignition system- Direct and indirect- Monopoint, Multipoint injection – MPFI Types of Nozzles.

MODULE II COMBUSTION IN I.C. ENGINES 8

combustion phenomena S.I Engine– Normal and abnormal combustion – Factor affecting combustion in S.I. Engines, Combustion chamber for S.I engines, octane rating of fuels; knocking in S.I and C.I Engine- combustion phenomena C.I Engine– Normal and abnormal combustion - Factor affecting combustion in C.I. Engines, Combustion chamber for C.I engines, Cetane rating.

MODULE III ENGINE SYSTEM AND COMPONENTS 7

Ignition system, Lubrication system, Engine starting system, Engine cooling system, Governing system.

MODULE IV AIR POLLUTION FROM IC ENGINE AND ITS REMEDIES 8

Pollutants - sources - formation of carbon monoxide , unburnt hydrocarbon, NOx , Smoke and particulate matter – Method of controlling Emissions - Catalytic converters and particulate Traps - EGR – SER, Method of measurement – Emissions norms.

MODULE V ALTERNATIVE FUELS 8

Alcohol, Hydrogen, Compressed Natural Gas, LPG, Bio Diesel – properties, Suitability, Merits and Demerits – Engine Modifications.

MODULE VI RECENT TRENDS 7

HCCI - Variables Geometry turbochargers - CRDI- Free piston Engines, Plasma Jet Ignition, Stratified charge engine- six stroke engine, fuel cells.

L – 45; T – 0; Total Hours –45

REFERENCES:

1. Heywood, J.B., Internal Combustion Engine Fundamentals, Tata Mc-Graw- Hill, 1988.
2. V.Ganesan, Internal Combustion Engines, 4th Edition, Tata Mc-graw Hill Publishing Co.ltd. 2012.
3. K.K. Ramalingam, Internal Combustion Engines Fundamentals, Scitech Publications (India) Pvt Ltd,2009.
4. Dr. V.M. Domkundar, A Course In Internal Combustion Engines, Dhanapat Rai &Co, Delhi.
5. R.Yadav, I.C.Engines, Central book Depot, Allahabad.
6. Willard w.Pulkrabek, Internal Combustion Engines, Pearson Education.

OUTCOMES:

Student will be able to

- Understand the various systems of IC engines.
- Realize the ill effects of automobile emissions and the use of alternate fuels.

MECX23	NUCLEAR ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basics of nuclear physics.
- To learn about nuclear reactions and reaction materials and their reprocessing and disposal.
- To study about various reactors.

MODULE I NUCLEAR PHYSICS 7

Nuclear model of an atom-Equivalence of mass and energy-binding- radio activity-half life-neutron interactions-cross sections.

MODULE II NUCLEAR REACTIONS AND REACTION MATERIALS 8

Mechanism of nuclear fission and fusion- radio activity- chain reactions-critical mass and composition-nuclear fuel cycles and its characteristics-uranium production and purification-Zirconium, thorium, beryllium.

MODULE III REPROCESSING 7

Reprocessing: nuclear fuel cycles-spent fuel characteristics-role of solvent extraction in reprocessing-solvent extraction equipment.

MODULE IV NUCLEAR REACTOR 8

Nuclear reactors: types of fast breeding reactors-design and construction of fast breeding reactors-heat transfer techniques in nuclear reactors- reactor shielding. Fusion reactors.

MODULE V SEPARATION OF REACTOR PRODUCTS 8

Processes to be considered - 'Fuel Element' dissolution - precipitation process – ion exchange - redox - purex - TTA - chelation -U235 - Hexone - TBP and thorax Processes - oxidative slaging and electro - refinng - Isotopes – principles of Isotope separation.

MODULE VI SAFETY AND DISPOSAL 7

Safety and disposal: Nuclear plant safety-safety systems-changes and consequences of accident-criteria for safety-nuclear waste-types of waste and its disposal-radiation hazards and their prevention-weapons proliferation.

L – 45; T – 0; Total Hours –45

TEXT BOOKS:

1. Thomas J.Cannoly, “Fundamentals of nuclear Engineering” John Wiley 1978.

REFERENCES:

1. Collier J.G., and Hewitt G.F, “Introduction to Nuclear power”, Hemisphere publishing, New York. 1987.
2. Wakil M.M.El., “Power Plant Technology” – McGraw-Hill International, 1984.
3. S. Glasstone and A. Sesonske, “Nuclear Reactor Engineering: Reactor Design Basics”, Vol. 1, Ed. 4, Chapman and Hall, London, 1994.
4. S. Glasstone and A. Sesonske, “Nuclear Reactor Engineering: Reactor Systems Engineering”, Vol. 2, Ed. 4, Chapman and Hall, New York, 1994.

OUTCOMES:

Students will be able to

- Understand the basic concepts of nuclear physics.
- Be familiar with different types of nuclear reactions and reactors.
- Be aware of fuel reprocessing and disposal of nuclear wastes.

MECX24 GAS DYNAMICS AND JET PROPULSION L T P C
3 0 0 3

OBJECTIVES:

- To provide an insight into the applications of compressible flows and the fundamentals of jet and space propulsion system.
- To enable the student formulate and solve problems in steady compressible flow in constant and variable area ducts.
- To understand the phenomenon of shock waves and its effect.

MODULE I COMPRESSIBLE FLOW – FUNDAMENTALS 7

Energy and momentum equations for compressible fluid flows, reference velocities, stagnation state, velocity of sound, critical states, Mach number, critical Mach number, types of waves, Mach cone, Mach angle-Effect of Mach number on compressibility.

MODULE II FLOW THROUGH VARIABLE AREA DUCT 8

Isentropic flow through variable area ducts, comparison of isentropic and adiabatic process, T-s and H-s diagrams for nozzle and diffuser flows- Mach number Variation-Impulse function Area ratio as a function of Mach number mass flow rate through nozzles and diffusers.

MODULE III FLOW THROUGH CONSTANT AREA DUCT 8

Flow in constant area ducts with friction (Fanno flow)- Fanno curves, variation of flow properties, variation of Mach number with duct length, Isothermal flow with friction-Flow in constant area ducts with heat transfer(Rayleigh flow),Rayleigh line, variation of flow properties, maximum heat transfer.

MODULE IV NORMAL SHOCK 8

Governing equations, variation of flow parameters like static pressure, static temperature, density, stagnation pressure and entropy across the normal shock, Prandtl-Meyer equation, Impossibility of shock in subsonic flows, flow in convergent and divergent nozzle with shock, normal shock in Fanno and Rayleigh flows, flow with oblique shock (elementary treatment only).

MODULE V JET PROPULSION 7

Aircraft propulsion- types of jet engines- energy flow through jet engines, study of turbo jet engine components- diffuser, compressor, combustion chamber, turbine and exhaust sytems, performance of turbo jet engines- thrust, thrust power, propulsive and overall efficiencies, thrust augmentation in turbo jet engines, Ram jet and pulse

jet engines.

MODULE VI SPACE VEHICLES 7

Rocket propulsion- Types of rocket engines- Constructional details and working principle – Thrust equation- effective jet velocity, specific impulse- Rocket engine performance, solid and liquid propellants, and comparison of different propulsion systems. Space vehicle applications.

L – 45; T – 0; Total Hours –45

REFERENCES:

1. Yahya. S.M., “Fundamentals of compressible flow with Aircraft and Rocket Propulsion”, New Age Internal Pvt ltd., New Delhi, 2003.
2. Patrich.H. Oosthvizen, William E.Carscallen, “Compressible Fluid Flow”, Tata McGraw –Hill, 1997.
3. Cohen.H., Rogers R.E.C and Saravanmutoo, “ Gas Turbine theory”, Addision Wesley Ltd., 1987.
4. Ganesan. V., “Gas Turbines”, Tata McGraw –Hill, New Delhi, 1999.
5. RadhaKrishnan. E, “Gas Dynamics”, Prentice Hall of India, New Delhi, 2001.

OUTCOMES:

Student should be able to

- Apply the concepts of gas dynamics for applications related to compressible flows and jet propulsion.
- Possess the knowledge of jet engines and space propulsion theories.

MECX25	ENERGY CONVERSION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart knowledge on power generation from fossil, renewable and nuclear energy sources.
- To impart knowledge on energy conservation opportunities in various sectors of energy usage, concepts of cogeneration and combined cycle plants.

MODULE I COAL BASED THERMAL POWER PLANT 9

High Pressure and Super Critical Boilers – Fluidized Bed Boilers, coal and ash handling, burning-stoker firing, burners, FBC, dust collection-scrubbers, ESP, boiler calculations. Layout of thermal plant – components.

MODULE II DIESEL ENGINE AND HYDROELECTRIC PLANTS 7

Diesel engine power plant layout – components, various operating systems, merits, demerits, applications. Hydel plant – layout and system components, hydraulic turbines, types of hydel plants, safety.

MODULE III NUCLEAR AND GAS TURBINE PLANTS 7

Development of nuclear plant in India, nuclear energy – fission chain reaction, reactor components, types of reactors and plants, waste disposal and safety. Gas turbines – working, types, methods to improve power output and efficiency, layout with inter-cooling, reheating and regeneration.

MODULE IV RENEWABLE ENERGY BASED PLANTS AND MHD PLANTS 9

Power from wind – wind turbine working and types, solar thermal power plants – low medium and high power generation, power from wave, tidal, geothermal sources, OTEC system, Energy from biomass. MHD power plants – working, types, merits and demerits.

MODULE V ENERGY CONSERVATION AND WASTE HEAT RECOVERY 6

Energy conservation – need and importance, energy efficient equipment, energy conservation opportunities (ECOs) in residential, transport, commercial and industrial sectors. Energy from wastes , Waste heat recovery – need and importance, cogeneration, combined cycle plants.

MODULE VI ENERGY ECONOMICS AND ENVIRONMENTAL POLLUTION **7**

Cost of Energy generation – load curves– Economics of load sharing, comparison of economics of various power plants. Environmental degradation - emissions from fossil based power plants and their implications –remedial measures.

L – 45; T – 0; Total Hours –45

TEXT BOOKS:

1. EI- Wakil M.M, “Power Plant Technology”, McGraw-Hill 1984.
2. G.R. Nagpal, “Power Plant Engineering”, Hanna Publishers, 1998.
3. G.D.Rai, “Introduction to Power Plant Technology”, Khanna Publishers, 1995

REFERENCES:

1. Arora S.C and Domkundwar S, “A course in Power Plant Engineering”, Dhanpatrai, 2001.
2. Nag P.K, “Power plant Engineering”, Tata McGraw-Hill, 1998.
3. R.K.Rajput, “Power Plant Engineering”, Laxmi Publications, 1995.

OUTCOMES:

Students should be able to

- Recognize the construction and working of various power plants.
- Implement the concepts of cogeneration and combined cycle plants wherever applicable.
- Recognize the need and implement the concepts of energy conservation and waste heat recovery wherever applicable.

MECX28	COMPUTATIONAL FLOW AND HEAT TRANSFER	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the Governing Equations of viscous fluid flows.
- To study numerical modeling and its role in the field of fluid flow and heat transfer.
- To understand the various discretization methods, solution procedures and turbulence modeling.

MODULE I GOVERNING EQUATIONS AND BOUNDARY CONDITIONS 8

Basics of computational fluid dynamics – Governing equations of fluid dynamics – Continuity, Momemtum and Energy equations – Chemical species transport – Physical boundary conditions – Mathematical behaviour of PDEs on CFD - Elliptic, Parabolic and Hyperbolic equations.

MODULE II FINITE DIFFERENCE METHOD 8

Derivation of finite difference equations – Simple Methods – General Methods for first and second order accuracy – solution methods for finite difference equations – Elliptic equations – Iterative solution Methods – Parabolic equations – Explicit and Implicit schemes – Example problems on elliptic and parabolic equations.

MODULE III FINITE VOLUME METHOD (FVM) FOR DIFFUSION 8

Finite volume formulation for steady state One, Two and Three –dimensional diffusion problems. One dimensional unsteady heat conduction through Explicit, Crank – Nicolson and fully implicit schemes.

MODULE IV FINITE VOLUME METHOD FOR CONVECTION DIFFUSION 7

Steady one-dimensional convection and diffusion – Central, upwind differencing schemes properties of discretization schemes – Conservativeness, Boundedness, Trasnportiveness, Hybrid, Power-law, QUICK Schemes.

MODULE V CALCULATION FLOW FIELD 7

Representation of the pressure gradient term and continuity equation – Staggered grid – Momentum equations – Pressure and Velocity corrections – Pressure Correction equation, SIMPLE algorithm and its variants.

MODULE VI TURBULENCE 7

Introduction-Time-averaged equations for Turbulent Flow – Turbulent–Kinetic Energy Equations Turbulence models, mixing length model, two equation (k- ?) models – High and low Reynolds number models.

L – 45; T – 0; Total Hours –45

REFERENCES:

1. T.J. Chung, “Computational Fluid Dynamics”, Cambridge University, Press, 2002.
2. Versteeg, H.K., and Malalasekera, W., “An Introduction to Computational Fluid Dynamics:,the finite volume Method”, Longman, 1998.
3. Ghoshdastidar , P.S., “Computer Simulation of flow and heat transfer”, Tata McGraw Hill, Publishing Company Ltd., 1998.
4. Patankar, S.V. “Numerical Heat Transfer and Fluid Flow”, Hemisphere Publishing Corporation, 2004.
5. Muralidhar, K., and Sundararajan, T., “Computationsl Fluid Flow and Heat Transfer”, Narosa Publishing House, NewDelhi, 1995.
6. Ghoshdastidar P.S., “Heat Transfer”, Oxford Unversity Press, 2005.
7. Prodip Niyogi, Chakrabarty .S.K., Laha .M.K. “Introduction to Computational Fluid Dynamics”, Pearson Education, 2005
8. Anil W. Date “Introduction to Computational Fluid Dynamics” Cambridge University Press, 2005.

OUTCOMES:

Students should be able to

- Derive the governing equations to solve real time problems.
- Solve complex problems in the field of fluid flow and heat transfer.

MECX29	RENEWABLE SOURCES OF ENERGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To know the Global and National energy scenario of renewable energy resources.
- To study harnessing of energy from various renewable sources.

MODULE I INTRODUCTION 7

Primary energy sources - World energy resources-Indian energy scenario, energy cycle of the earth-environmental aspects of energy utilisation-CO2 emmisions and Global warming, Global dimming - renewable energy resources and their importance. Potential impacts of harnessing the different renewable energy sources.

MODULE II SOLAR ENERGY 8

Principles of solar energy collection – solar radiation- measurements – instruments – data and estimation – types of collectors- characteristics and design principles of different types of collectors – performance of collectors – testing of collectors. Solar thermal applications – water heaters and air heaters,- performance and applications – simple calculations – solar cooling – solar drying, solar ponds- solar tower concept. Solar furnace.

MODULE III WIND AND GEOTHERMAL ENERGY 8

Wind potential in India, Energy from the wind – general theory of wind mills, types of windmills design aspects of horizontal axis wind mills – applications, Potential Sites, Estimations of Geothermal Power, Nature of Geothermal Sites, Hot-Dry Rocks, Resources, Magma Resources, Systems for Energy Generation, Applications of Geothermal, Energy, Environmental Issues.

MODULE IV OCEAN ENERGY, TIDAL ENERGY AND SMALL SCALE HYDRO ELECTRIC POWER PLANTS 7

Basic theory of OTEC, potential and application of technologies Energy from tides and waves – working principles of tidal plants, Classification of Small Hydro Power Stations, Mini and Micro Hydel Projects, Turbines and Generators for Small Scale Hydro Electric, Protection, Advantages and Limitations

MODULE V BIO ENERGY 8

Energy from bio mass and bio gas plants – various types – design principles of biogas plants – applications. Energy from wastes – waste collection, Reduction and transfer. Waste burning power plants – utilization of industrial and municipal wastes – energy

from the agricultural wastes.

MODULE VI OTHER RENEWABLE ENERGY SOURCES 7

Direct energy conversion (Description, principle of working and basic design aspects only) – Magneto hydrodynamic systems (MHD) – thermoelectric generators – thermionic generators, fuel cells – solar cells – types – Emf generated, power output losses and efficiency and applications. Hydrogen conversion and storage systems.

L – 45; T – 0; Total Hours –45

REFERENCES:

1. Sukhatme. S.P., Solar Energy, 2nd Edition, TMH, 2003.
2. Sulton, “Direct Energy Conversion”, Mc-Graw-Hill, 1966.
3. Duffie and Beckmann, “ Solar Energy Thermal Processes ”, John Wiley, 1974.
4. Garg. H.P and Prakash. J.,” Solar Energy – Fundamentals and Applications”, TMH, New Dwlhi, 1997.

OUTCOMES:

- Students should be able recognize the significance of renewable energy and its harnessing.

MECX30	SOLAR ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the working and performance of various solar collectors.
- To learn about solar photovoltaic principle and usage.
- To learn about the applications and economic use of solar energy.

MODULE I SOLAR RADIATION AND MEASUREMENT 9

The Solar energy option- an overview of thermal applications. Solar Radiation analysis – Solar constant, electromagnetic energy spectrum, determination of earth-sun angles, Solar time, solar angles, sunset, sunrise, and day length. Solar Radiation -Measurements and data estimation.

MODULE II FLAT PLATE COLLECTOR 9

Physical principle and general characteristics of a Liquid flat plate collectors- Performance and thermal analysis of liquid flat plate collector, Coatings and selection of materials ,effect of dust and shade. High temperature non concentrating collectors.

Solar Air heaters collectors – materials, types, Performance analysis and applications.

MODULE III CONCENTRATING COLLECTORS 7

Line focusing and point focusing collectors- cylindrical parabolic collector, compound parabolic concentrators(CPC), Paraboloid dish collector, Thermal performance of focusing collectors. Solar energy storage – types, Solar Ponds

MODULE IV SOLAR CELLS 7

Photovoltaic principle- materials for solar cells. Design and fabrication of Photovoltaic cells. Performance analysis of P-V cells- thermoelectric generator solar cells.

MODULE V APPLICATIONS OF SOLAR ENERGY 6

Solar heating, solar cooling, heat pump, solar pumping, Solar distillation, solar cooking. Solar Thermal Power generation.

MODULE VI ECONOMIC ANALYSIS 7

Cost analysis and pay back calculations for different types of solar panels and collectors, installation and operating costs; Environmental and safety issues, protection systems, performance monitor.

L – 45; T – 0; Total Hours –45

REFERENCES:

1. G.D.Rai, “Solar energy utilisation, Khanna Publishers”, New Delhi.
2. S.P. Sukhatme, “Solar Energy”, Tata McGrew Hill Company Ltd., New Delhi.
3. H.P. Garg, “Advanced in Solar Energy Technology”, D. Reidel Publishing Co., Drdricht.
4. Mathur and Methaf – “Solar Energy”.
5. Duffle and Beckman, “Solar Thermal Engineering Process’, John Wiley & Sons, New York.
6. J.S. Hsieh, “Solar Energy”, Prentice Hall Inc. New Jerssey.
7. A.B. Meinel and M.B. Meinel, “Applied Solar Energy”, Addison – Wiley Pub. Co., Reading.
8. G.N. Tiwari and S. Suneja, “Solar Thermal Engineering Systems”, Narosa Publishing House.

OUTCOMES:

Students will be able to

- Select suitable solar device for a particular application.
- Use solar energy effectively and economically.

MECX31	DESIGN OF THERMAL SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the working and performance of heat transfer equipment.
- To learn design of thermal systems for effective and efficient heat transfer.

MODULE I DOUBLE PIPE HEAT EXCHANGER AND HEAT PIPES 8

Thermal and hydraulic design-Inner pipe- Annulus, Hairpin heat exchangers- Base inner tube-finned inner multi tubes-parallel and series arrangements, pressure drop and constructional features. Heat pipes-structures-Applications- Basic relations-Performance characteristics-Effects of working fluid and operating temperature, Wick-selection of material-pore size

MODULE II SHELL AND TUBE HEAT EXCHANGERS 7

Basic components-shell-tube bundles-Baffles –Types and geometry, Design procedure-Preliminary estimation of size, pressure drop and heat transfer calculations- shell and tube sides-Kenn method –bell-Delaware method.

MODULE III COMPACT AND GASKETTED PLATE HEAT EXCHANEGRS 8

Compact heat exchangers- types-constructional features, heat transfer and pressure drop calculation- Finned plate and tube. Gasketted plate heat exchangers-Constructional features-Plate pack and frame-operational characteristics- flow arrangement, heat transfer and pressure drop calculation, performance analysis, comparison with other type of heat exchangers.

MODULE IV CONDENSERS 7

Shell and tube condenser- horizontal and vertical types- temperature distribution and heat flow in a condenser-pressure drop in a condenser - extended surfaces- design and operational consideration, plate heat condenser, air cooled and direct contact types, condensers for refrigeration, evaporative condenser.

MODULE V EVAPORATORS 7

Temperature distribution and heat flow in an evaporator-Evaporator for refrigeration and air conditioning- chillers- air coolers- thermal analysis- Shah, Kandhar and Ghngor and Wintertom correlations, standard types.

MODULE VI COOLING TOWERS 8

Cooling tower-types-Basic relation- heat balance and heat transfer- Characteristics, effects of: Packings- Geometry, spray Design- Selection of: Pumps, Fans, Testing, Maintenance, Environmental effects, Wind loads, Typical Installations.

L – 45; T – 0; Total Hours –45

REFERENCES:

1. Sadic Kakac and Hongtan Lin, Heat Exchangers – CRC Press, London, 1998.
2. Arthur P.Fraas, Heat Exchnger design – John Wiley & Sons, 1997.
3. Kenn.D.Process Heat Transfer –Tata McGraw Hill,1980.
4. Walker, Industrial Heat Exchangers-Tata Mcgraw Hill, 1997.
5. Holger Martin, Heat Exchangers- Hemisphere Publishing Corporation, London, 1992.
6. Arora, Domkundwar, A course in Heat and mass Transfer – Dhanpat Rai & co. (P) ltd -2003.

OUTCOMES:

Student will be able to

- Be familiar with functions, characteristics and performance of various thermal systems.
- Design a heat exchanger for any specific application.

MECX32	AUTOMOBILE ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide a comprehensive view of automobile engineering.
- To provide an overview about different systems in an automobile.
- To impart knowledge on recent developments.

MODULE I VEHICLE STRUCTURE AND ENGINES 7

Types of Automobiles- Vehicle construction- Chassis – Frame and Body – aerodynamics. Components of Engine – Their forms, Functions and Materials- Basic layout of Automotive vehicles.

MODULE II ENGINE SYSTEMS 8

Cooling and Lubrication systems in Engine - fuel injection systems- Electrical systems- Battery generator- Starting Motor and drives – Lighting and Ignition (Battery ,Magneto Coil and Electronic Types)- Regulators – Cut outs.

MODULE III TRANSMISSION SYSTEM 7

Types of Clutch- gear box (manual and automatic)-differential and types of rear axle- Transfer Box Fluid flywheel – Torque convertors- Propeller shaft.

MODULE IV STEERING AND BRAKING SYSTEM 8

Wheels and Tyres- Wheel Alignments Parameters – Steering Geometry and Types of Steering gear box- Power Steering- Breaking Systems – Types and Constructions – Diagonal Braking Systems

MODULE V SUSPENSION SYSTEMS 7

Shock absorbers – Independent Suspension -Torsions bars – Air suspension systems.

MODULE VI AUTOMOTIVE SAFETY AND RECENT TRENDS 8

Safety systems- Active safety- Passive safety – Electric Vehicle- Hybrid vehicles , Fuel cells – Antilock Braking Systems- Adaptive lighting- Active cruise Control- Traction control-Drive by wire.

L – 45; T – 0; Total Hours –45

REFERENCES:

1. Automotive Mechanics, William H Crouse and Donald L. Anglin, Tata McGraw Hill Publishing Company Ltd., 2004, Tenth Edition.

2. Automotive Handbook, Bosch, Robert Bosch GmbH, Germany 2004, Eighth edition.
3. Automotive Technology – A Systems Approach, Jack Erjavek, Thomson Learning, 3rd Edition, 1999.
4. The Motor Vehicle K. Newton, W. Steeds, T. K. Garrett,SAE International,13th edition
5. Advanced Vehicle Technology, Heinz Heisler, Elsevier Ltd, (Second Edition)

OUTCOMES:

Student should be able to

- Be familiar with different systems of an automobile.
- Be aware of the recent developments in automobile engineering.

MECX34	FUELS AND COMBUSTION	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To learn the characteristics, types and utility of solid, liquid and gaseous fuels.
- To understand the combustion phenomenon of different fuels and equipment for their combustion.

MODULE I FUEL CHARACTERIZATION 6

Fuels - Types and Characteristics of Fuels - Determination of Properties of Fuels – Fuels Analysis - Proximate and Ultimate Analysis – Moisture Determination - Calorific Value – Gross & Net Calorific Values - Calorimetry - DuLong's Formula for CV Estimation – Flue gas Analysis - Orsat Apparatus - Fuel & Ash Storage & Handling - Spontaneous Ignition Temperatures.

MODULE II SOLID, LIQUID and GASEOUS FUELS 11

Solid fuel types - Coal Family - Properties - Calorific Value - ROM, DMMF, DAF and Bone Dry Basis - Ranking - Bulk & Apparent Density - Storage - Washability - Coking & Caking Coals - Renewable Solid Fuels - Biomass - Wood Waste - Agro Fuels – Manufactured Solid Fuels.

Liquid fuel types - Sources - Petroleum Fractions - Classification - Refining – Properties of Liquid Fuels - Calorific Value, Specific Gravity, Flash & Fire Point, Octane Number, Cetane Number etc, - Alcohols - Tar Sand Oil - Liquefaction of Solid Fuels.

Classification - Composition & Properties - Estimation of Calorific Value – Gas Calorimeter. Rich & Lean Gas - Wobbe Index - Natural Gas - Dry & Wet Natural Gas - Stripped NG - Foul & Sweet NG - LPG - LNG - CNG – Methane - Producer Gas - Gasifiers - Water Gas - Town Gas - Coal Gasification - Gasification Efficiency - Non - Thermal Route - Biogas - Digesters – Reactions - Viability - Economics.

MODULE III COMBUSTION STOICHIOMETRY & KINETICS 7

Stoichiometry - Mass Basis & Volume Basis - Excess Air Calculation - Fuel & Flue Gas. Compositions - Calculations - Rapid Methods – Combustion Processes – Stationary. Flame - Surface or Flameless Combustion - Submerged Combustion - Pulsating & Slow. Combustion Explosive Combustion. Mechanism of Combustion - Ignition & Ignition Energy - Spontaneous Combustion - Flame Propagation - Solid, Liquid & Gaseous Fuels Combustion - Flame Temperature - Theoretical, Adiabatic &

Actual - Ignition Limits - Limits of Inflammability

MODULE IV COMBUSTION EQUIPMENT 6

Coal Burning Equipment - Types - Pulverized Coal Firing - Fluidized Bed Firing – Fixed Bed & Recycled Bed - Cyclone Firing - Spreader Stokers - Vibrating Grate Stokers - Sprinkler Stokers, Traveling Grate Stokers. Oil Burners - Vaporizing Burners, Atomizing Burners - Design of Burners. Gas Burners - Atmospheric Gas Burners - Air Aspiration Gas Burners – Burners Classification according to Flame Structures - Factors Affecting Burners & Combustion.

L – 30; T – 0; Total Hours –30

REFERENCES:

1. Bhatt, Vora Stoichiometry, 2nd Edition, Tata Mcgraw Hill, 1984.
2. Fuels And Combustion (3rd Edition), Samir Sarkar,Orient BlackSwan.
3. Sharma SP, Mohan Chander, Fuels & Combustion, Tata Mcgraw Hill, 1984
4. Civil Davies, Calculations in Furnace Technology, Pergamon Press, Oxford, 1966

OUTCOMES:

Student will be able to

- Recognize the nature, characteristics and suitability of fuels.
- Calculate the air – fuel ratio for different fuels under different types of combustion.
- Select suitable combustion equipment for different fuels based on nature of combustion.

MECX33 AUTOMOTIVE POLLUTION AND CONTROL L T P C
2 0 0 2

OBJECTIVES:

- To have a fair knowledge in automotive pollution control.
- To understand the concept of formation and control techniques of pollutants like UBHC, CO, NOx, particulate matter and smoke for both SI and CI engine will be taught to the students.
- To know about the instruments for measurement of pollutants
- To get introduced about emission standards

MODULE I EMISSION FROM AUTOMOBILES 6

Sources of Air Pollution. Various emissions from Automobiles — Formation — Effects of pollutants on environment and human beings. Emission control techniques – Modification of fuel, after treatment devices. Emission standards. Automotive waste management, old vehicle disposal, recycling, tyre recycling

MODULE II SI ENGINE AND CI ENGINE EMISSIONS AND CONTROL 10

Emission formation in SI Engines- Carbon monoxide & Carbon di oxide – Unburned hydrocarbon, NOx, Smoke —Effects of design and operating variables on emission formation – controlling of pollutants - Catalytic converters, Charcoal Canister, Positive Crank case ventilation system, Secondary air injection, thermal reactor.

Formation of White, Blue, and Black Smokes, NOx, soot, Effect of Operating variables on Emission formation — Fumigation, Split injection, Catalytic Coating, EGR, Particulate Traps, SCR, Fuel additives — Cetane number Effect.

MODULE III NOISE POLLUTION FROM AUTOMOBILES 6

Sources of Noise — Engine Noise, Transmission Noise, vehicle structural Noise, aerodynamics noise, Exhaust Noise. Noise reduction in Automobiles — Encapsulation technique for noise reduction —Silencer Design.

MODULE IV TEST PROCEDURES AND EMISSION MEASUREMENTS 8

Constant Volume Sampling I and 3 (CVSI &CVS3) Systems- Sampling Procedures —

Chassis dynamometers - Seven mode and thirteen mode cycles for Emission Sampling.

Emission analysers —NDIR, FID, Chemiluminesecent, Smoke meters, Dilution Tunnel, SHED Test, Sound level meters.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. V.Ganesan, 'Internal combustion Engines', Tata McGraw Hill Book Co, Eighth Reprint, 2005.
2. Crouse and Anglin, 'Automotive Emission Control', McGraw Hill company., Newyork 1993.

REFERENCES:

1. G.P.Springer ad D.J.Patterson, Engine Emissions, Pollutant formation, Plenum Press, New York. 1986.
2. D.J.Patterson and N.A.Henin, 'Emission from Combustion Engine and their control', Anna Arbor Science Publication,1985.
3. L.Lberanek, 'Noise Reduction', Mcgrawhill Company., Newyork1993.
4. C.Duerson, 'Noise Abatment', Butterworths ltd., London1990.
5. A.Alexander, J.P.Barde, C.lomure and F.J. Langdan, 'Road traffic noise', Applied science publisher ltd., London,1987.

OUTCOMES:

The student should be able to

- Identify the sources of emission form vehicles.
- Analyze the causes of emissions. Bring out solutions for control of emissions.
- Be familiar with test procedures and emission norms
- Select suitable instrument and procedure for measurement of emissions

MANUFACTURING AND MATERIALS ELECTIVES

MECX41	MODERN MANUFACTURING SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the concepts and applications of flexible manufacturing systems.

MODULE I INTRODUCTION TO FLEXIBLE MANUFACTURING SYSTEMS 7

Introduction to FMS– benefits - the challenge – major elements – types of flexibility – FMS application – single product, single batch, n – batch scheduling problem Production Flow Analysis - Rank Order Clustering – knowledge based scheduling system.

MODULE II COMPUTER CONTROL FOR FLEXIBLE MANUFACTURING SYSTEMS 8

Introduction – composition of FMS– hierarchy of computer control –computer control of work center and assembly lines – FMS supervisory computer control – types of software specification and selection – trends.

MODULE III SIMULATION AND DATABASE 7

Application of simulation–model of FMS–simulation software – advantages and limitation – manufacturing data systems–data flow–FMS database systems–planning for FMS database.

MODULE IV MODULE IV GROUP TECHNOLOGY 8

Introduction – matrix formulation – graph formulation – knowledge based system for group technology – Part Family sequencing - Dispatching rules - economic justification of FMS- application of possibility distributions in FMS systems justification.

MODULE V APPLICATIONS OF FMS AND TOOLS 8

FMS application in machining, sheet metal fabrication, prismatic component production – aerospace application. Tools – Cellular Manufacturing, Automation, Material Handling - Just In Time Manufacturing – Kanban - CONWIP and Kanbanetc,.

MODULE VI SYNCHRONOUS MANUFACTURING AND FMS FUTURE FACTORIES 7

The Goal - Principles of SM - TOC and LP - Scheduling FMS development towards

factories of the future – artificial intelligence and expert systems in FMS.

L – 45; T – 0 ; Total Hours –45

REFERENCES:

1. Montgomery, Douglas C., “Introduction to Statistical Quality Control”, 6th Edition,John Wiley and Sons, Inc., 2009.
2. Raouf, A. and Ben-Daya, M., “Flexible manufacturing systems: recentdevelopment”, Elsevier Science, 1995.
3. Groover M.P., “Automation, production systems and computer integratedmanufacturing”, Prentice Hall of India Pvt., New Delhi, 1996.
4. Kalpakjian, “Manufacturing engineering and technology”, Addison-WesleyPublishing Co., 1995.
5. TaiichiOhno, “Toyota production system: beyond large-scale production”,Productivity Press (India) Pvt. Ltd. 1992.
6. Askin R G and Strandridge C R (1993), Modelling and Analysis of Manufacturing

OUTCOMES:

Students will be able to

- Implement FMS in the modernization of manufacturing systems

MECX42	PROCESS PLANNING AND COST ESTIMATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To appreciate the need for process planning
- To understand the concept of work study and ergonomics
- To apprehend the importance of estimation and costing
- To know about the elements of cost
- To apply basic calculation in manufacturing processes
- To study and analyze the cost estimation in different manufacturing units

MODULE I INTRODUCTION 9

Types of production- Standardization, Simplification- Production design and selection- Process planning, selection and analysis- steps involved in manual experience based planning and computer aided process planning- Retrieval, generative-Selection of processes analysis-Breakeven analysis

MODULE II WORK STUDY AND ERGONOMICS 8

Method study, Definition- Objectives-Motion economy- Principles-Tools and Techniques – Applications- Work measurements- Purpose, Use, Procedure, tools and techniques, standard time- Ergonomics- Principles and applications.

MODULE III ESTIMATION AND COSTING 8

Importance and aims of cost estimation –Functions of estimation –costing – Importance and aims of costing- Difference between costing and estimation - importance of realistic estimates- Estimation procedure.

MODULE IV ELEMENTS OF COST 7

Introduction-Material cost- Determination of material cost, Labor cost - Determination of Direct Labor cost-Expenses- Cost of Product(Ladder of cost)-Illustrative examples, Analysis of overhead expenses-Factory expenses - Depreciation-Causes of depreciation- Methods of depreciation- Administrative expenses- selling and distributing expenses- allocation of overhead expenses.

MODULE V ESTIMATION OF MACHINE TIME AND COST 6

Estimation of machining time for machining operations involved in lathe, drilling, and milling and grinding – Estimation of machining cost

MODULE VI COST ESTIMATION IN FORMING, CASTING AND 7

WELDING SHOP

Product cost Estimation: Estimation in forging shop-Losses in forging-Forging cost-Illustrative examples.Estimation in foundry shop-Estimation of pattern cost and casting cost- Illustrative examples.Estimation in welding shop-Gas cutting- Electric welding- illustrative examples

L – 45; T – 0 ; Total Hours –45

REFERENCES:

1. Sinha.B.P., "Mechanical Estimation and costing", Tata McGraw hill publishing co., 1995
2. Nanusa Singh, "System approach to Computer Integrated Design and Manufacturing" John Wiley & Sons, Inc., 1996
3. Joseph G. Monks, "Operations Management, Theory & Problems", McGraw Hill Book Company, 1982
4. G.B.S. Narang and V. Kumar, "Production and costing ", Khanna Publishers, 1995

OUTCOMES:

Upon the completion of the course, students will be able to

- know about the need and various types of process planning
- effectively implement the process planning concepts
- implement the concepts of work study and ergonomics in manufacturing units
- distinguish various cost components
- estimate the machining time for metal cutting operations
- estimate the cost for other different manufacturing units

MECX43	PRODUCTION PLANNING AND CONTROL	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the various functions of production planning and control.
- To study the steps involved in the work study and principles of ergonomics.
- To provide knowledge on product and process planning.
- To know the production scheduling procedures, inventory control and recent trends in manufacturing requirement Planning (MRP) and EnterpriseResource Planning (ERP).

MODULE I INTRODUCTION 7

Objectives and benefits of planning and control-Functions of production control-Types of production-job- batch and continuous-Product development and design-Marketing aspect - Functional aspects-Operational aspect-Durability and dependability aspect aesthetic aspect. Profit consideration- Standardization, Simplification & specialization- Break even analysis- Economics of a new design.

MODULE II WORK STUDY 8

Method study, basic procedure-Selection-Recording of process - Critical analysis, Development - Implementation - Micro motion and memo motion study – work measurement - Techniques of work measurement - Time study- Production study - Work sampling - Synthesis from standard data - Predetermined motion time standards.

MODULE III PRODUCT AND PROCESS PLANNING 7

Product planning-Extending the original product information-Value analysis- Problems in lack of product planning-Process planning and routing-Pre requisite information needed for process planning-Steps in process planning- Quantity determination in batch production-Machine capacity, balancing- Analysis of process capabilities in a multi-product system.

MODULE IV PRODUCTION SCHEDULING 8

Introduction to Scheduling and Shop Floor Planning and Control; Production Control Systems-Loading and scheduling; Master Scheduling-Scheduling rules-Gantt charts-Perpetual loading, Basic scheduling problems – Flow production scheduling-Batch production scheduling;Order Sequencing Rules and Their Performance Based on Different Evaluation Criteria; Changeover Costs and Job Sequence; Sequencing Jobs Through Two Work centers - Johnson's Rule.

MODULE V LINE BALANCING 8

Introduction to Line Balancing – Steps involved in line balancing - Techniques for Analyzing Line Balancing Problems; Application of Incremental Utilization and Longest-Task-Times Heuristics.

MODULE VI INVENTORY CONTROL AND RECENT TRENDS IN PPC 7

Inventory control-Purpose of holding stock-Effect of demand on inventories- Ordering procedures. Two bin system -Ordering cycle system-Determination of Economic order quantity and economic lot size-ABC analysis-Recorder procedure-Introduction to computer integrated production planning systems- elements of JUST IN TIME SYSTEMS-Fundamentals of MRP II and ERP.

L – 45; T – 0 ; Total Hours –45

TEXT BOOKS:

1. MartandTelsang, “Industrial Engineering and Production Management”, First edition, S.Chand and Company, 2000.

REFERENCES:

OUTCOMES:

- Understand the overall aspects of production planning and control activities.
- Conduct method study and time study to improve process and resource utilization.
- Plan the product and processes effectively.
- Implement the concepts of scheduling in manufacturing.
- Analyze and provide solution for line balancing problems.
- Analyze and control inventory effectually.

MECX44	STATISTICS AND QUALITY CONTROL	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the various statistical approaches for Quality control.
- To understand the various principles, practices of quality management.
- To understand the various tools for continuous process control and improvement.

MODULE I STATISTICS 7

Introduction to Statistics - Meaning and significance of statistical process control (SPC) Process capability – meaning, significance and measurement – Six sigma concepts of process capability.

MODULE II STATISTICAL PROCESS CONTROL 8

Reliability concepts – definitions, reliability in series and parallel, product life characteristics curve.Total productive maintenance (TMP) – relevance to TQM, Terotechnology. Business process re-engineering (BPR) – principles, applications, reengineering process, benefits and limitations.

MODULE III INTRODUCTION TO QUALITY MANAGEMENT 7

Definitions – TQM framework, benefits, awareness and obstacles. Quality – vision, mission and policy statements. Customer Focus – customer perception of quality, Translating needs into requirements, customer retention. Dimensions of product and service quality. Cost of quality.

MODULE IV TOOLS AND TECHNIQUES FOR QUALITY MANAGEMENT 8

Overview of the contributions of Deming, Taguchi techniques – introduction, loss function, parameter and tolerance design, signal to noise ratio. Concepts of Quality circle, Japanese 5S principles and 8D methodology. Quality functions development (QFD) – Benefits, Voice of customer, information organization, House of quality (HOQ), building a HOQ, QFD process.

MODULE V CONTROL CHARTS 8

Control Charts for X and R (statistical basis, development and use, estimating process capability; interpretation, the effect of non normality on the chart, the OC function, average run length); Control Charts for X and S; Control Chart for Individual Measurements. Control Chart for Fraction Nonconforming (OC curve of the control

chart, variable sample size, nonmanufacturing application, the OC function and ARL calculation); Control Charts for Nonconformities or Defects; Choices Between Attribute and Variable Control Charts.

MODULE VI SAMPLING 7

Introduction to sampling distributions, sampling distribution of mean and proportion, application of central limit theorem, sampling techniques. Estimation: Point and Interval estimates for population parameters of large sample and small samples, determining the sample size.

L – 45; T – 0 ; Total Hours –45

REFERENCES:

1. Montgomery, Douglas C. (2009). Introduction to Statistical Quality Control, Sixth Edition. John Wiley and Sons, Inc. (ISBN: 978 -0-470-16992-6).

OUTCOMES:
Students should be able to

- apply statistical tools and techniques for quality improvement.
- achieve process control and improvement.

MECX45	MODERN PRODUCTION MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Enable students to understand manufacturing and production system
- Able to design a layout for optimal usage of plant
- To understand the critics at management level
- They will be able to control the processes in an optimized way
- Have knowledge in maintaining the inventory level
- Students will have a broad scope in maintenance part of firm

MODULE I INTRODUCTION 5

Manufacturing systems – types and concepts, manufacturing automation - Performance measures – types and uses of manufacturing models.

MODULE II FACILITY, CAPACITY & LAYOUT PLANNING 8

Facility planning – Factors affecting selection of plant location, Factor rating analysis: Break – event, Load distance model, closeness ratings.

Types of plant layout, criteria for good layout, Process layout, Assembly line balancing. Computer based solutions to layout problems such as CRAFT, ALDEP, CORELAP and PREP.

Capacity planning – Analysis of designed capacity, installed capacity, commissioned capacity, utilized capacity, factors affecting productivity and capacity expansion strategies.

MODULE III DEMAND FORECASTING & PROJECT MANAGEMENT 8

Demand forecasting – Quantitative and qualitative techniques, measurement of forecasting errors, numerical problems, Long term forecast methodologies.

Project management – its role in functional areas of management, network representation of a project, CPM and PERT techniques, Analyzing cost-time trade-offs – Case study.

MODULE IV PRODUCTION PLANNING & CONTROL 8

Steps in PPC process mapping, preparation of process mapping and feedback control for effective monitoring. Aggregate production planning, production planning strategies, Disaggregating the aggregate plan, Materials Requirement Planning (MRP), MRP-II, Supply chain management, Operation scheduling, prioritization.

MODULE V INVENTORY PLANNING & CONTROL 8

EOQ models- with and without shortages, price breaks, effect of quantity discount – selective inventory control techniques – ABC, FSN, VED etc. Types of inventory control – Perpetual, two-bin and periodic inventory system – JIT, SMED, kanban, Zero inventory – Case study.

MODULE VI MAINTENANCE SYSTEM 8

Maintenance strategies and planning, Maintenance economics: quantitative analysis, optimal number of machines, Replacement strategies and policies – economic service life, opportunity cost, replacement analysis using specific time period, spares management, Maintenance records.

L – 45; T – 0 ; Total Hours –45

REFERENCES:

1. S. N. Chary, "**Production and Operations Management**", 4th Edition, SIE, TMH, 2009.
2. R. Pannererselvam, "**Production and Operations Management**", 3rd Edition, PHI, 2012.
3. James. B. Dilworth, "Operations Management – Design, Planning and Control for Manufacturing and Services", McGraw Hill Inc. Management Series, 1992.
4. MelnykDenzler, "Operations Management – A Value Driven Approach", Irwin McGraw Hill 1996.
5. Lee. J. Krajewski, L. P. Ritzman, & M. K. Malhothra, "**Operations Management – Process and Value Chains**", 8th Edition, PHI/Pearson Education, 2007.
6. R. B. Chase, N. J. Aquilano, & F. R. Jacobs, "**Operations Management – For Competitive Advantage**", 11th Edition, SIE, TMH, 2007.
7. KanishkaBedi, "**Production and Operations Management**", 2nd Edition, Oxford Higher Education, 2007.

OUTCOMES:

Students must able to:

- Identify the type of automation process in a manufacturing industry.
- To make an optimized plant layout.
- Apply forecasting techniques
- Prepare process plan for various production activities
- Control the inventory level
- Gain knowledge in maintenance strategies

MECX46 ADVANCED OPTIMISATION TECHNIQUES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the various advanced optimization tools.
- To provide an understanding to deal with ill identified and fuzzy problems.

MODULE I INTRODUCTION 7

Review of conventional optimization techniques - limitations - limitation of exhaustive search - need for artificial intelligence - bio mimicking methods

MODULE II HEURISTICS METHODS 8

Introduction – Advanced methods of algorithm design: Greedy method, Backtracking method, Divide and Conquer method – Dynamic programming– Heuristics exploration algorithms – Greedy search - Local search – Hill climbing – Tabu search – Gradient search – Beam search – Simulated Annealing

MODULE III GENETIC ALGORITHM 7

Introduction - Basics of GA – Population – Reproduction – Cross over – Mutation – genetic algorithms in search, optimization and machine learning practical genetic algorithms

MODULE IV ANT COLONY OPTIMIZATION 8

Introduction: Ant Colony Optimization – Meta-heuristic Optimization – History – The ACO Meta-heuristic – ACO Algorithms: Main ACO – Ant system – Ant colony system – Max-Min Ant system – Applications: Routing in telecommunication networks – Travelling salesmen – Graph Coloring –Advantages & Disadvantages

MODULE V FUZZY LOGIC AND ANN 8

Fuzzy logic, knowledge representation and inference mechanism – Fuzzy and expert control – standard Takagi-Sugeno mathematical characterizations – Design example – Biological foundations to intelligent systems: Artificial neural networks, Back-propagation networks, Radial basis function networks, and recurrent networks.

MODULE VI IMPLEMENTATIONS & APPLICATIONS 7

Reduction of size of an optimization problem – multilevel optimization – parallel processing – multi objective optimization – Job shop scheduling – Vehicle scheduling – Line balancing – Sensor integration.

L – 45; T – 0 ; Total Hours –45

REFERENCES:

1. Singiresu S. Rao, “Engineering optimization – Theory and practices”, John Wiley and Sons, 1996.
2. Ravindran – Phillips –Solberg, “Operations Research – Principles and Practice”, John Wiley and Sons, 1987.
3. Fredrick S.Hillier and G.J.Liberman, “Introduction to Operations Research”, McGraw Hill Inc. 1995.
4. Kalymanoy Deb, “Optimization for Engineering Design”,PHI,2003
5. Christos H. Papadimitriou, Kenneth Steiglitz, Combinatorial Optimization, PHI 2006

OUTCOMES:

At the end of the course student will be able to

- Formulate a real life situation as an optimization the problem.
- Identify the appropriate solution methodology and provide a solution

MECX47	MECHANICAL MAINTENANCE	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To stress the importance of reliability in engineering and products.
- To understand the concept of maintability, failure modes and testing methods.
- To study the maintenance strategies in different types of industries.

MODULE I CONCEPTS OF RELIABILITY, SYSTEM AND MODELS 8

Definition of reliability – reliability Vs quality – reliability function – derivation of the reliability function -MTTF – hazard rate function – constant failure rate model – time dependent failure models – Weibull distribution – Types of system – series, parallel, series parallel, stand by and complex – methods of reliability evaluation¬ – matrix methods, event trees and fault trees methods – reliability evaluation using probability distributions – Markov method – frequency and duration method.

MODULE II DESIGN FOR RELIABILITY AND MAINTAINABILITY 8

Reliability improvement – techniques – Pareto analysis – Design for reliability – Redundancy – standby redundancy – failsafe systems classifications – failure characteristics – failure data analysis – mean time to failure maintainability and availability – system reliability in terms of probability of failure – MTBF – Acceptance sampling based on reliability test – OC curves.

MODULE III MAINTENANCE CONCEPT 7

Need for maintenance – Maintenance definition – Maintenance objectives – Challenges of Maintenance management – Tero technology – Scope of maintenance department – Maintenance costs.

MODULE IV MAINTENANCE MODELS 7

Proactive/Reactive maintenance – Imperfect maintenance – Maintenance policies – PM versus b/d maintenance – Optimal PM schedule and product characteristics – Optimal Inspection frequency: Maximizing profit – Minimizing downtime – Replacement models.

MODULE V MAINTENANCE QUALITY 7

Maintenance excellence –Five Zero concept –FMECA –Root cause analysis – System effectiveness – Design for maintainability – Maintainability allocation – CMMS – Reliability Centered Maintenance

MODULE VI TOTAL PRODUCTIVE MAINTENANCE 8

TPM features – Chronic and sporadic losses – Equipment defects – Six major losses – Overall Equipment Effectiveness – TPM pillars –TPM implementation – Autonomous maintenance.

L – 45; T – 0 ; Total Hours –45

REFERENCES:

1. Patrick D T o'connor, "Practical Reliability Engineering", John-Wiley and Sons inc, 2002.
2. David J Smith, "Reliability, Maintainability and Risk: Practical Methods for Engineers", Butterworth, 2002
3. Way kuo, Rajendra Prasad V, Frank A and Tillman, ching- lai Hwang "Optimal Reliability Design and Applciations", Cambridge University Press P ltd., 2001.
4. Srinath I.S, Engineering Design and Reliability, ISTE, 1999.
5. Oleg Vinogradov, "Introduction to Mechanical Reliability: A Designers Approach, Hemisphere Publications, 1991.
6. An introduction to Reliability and Maintainability Engineering –Charles E.Ebeling, Tata McGraw-Hill, New Delhi, 2003.
7. Maintenance, Replacement and Reliability –Andrew K.S.Jardine and Albert H.C.Tsang, Taylor & Francis, New York, 2006.
8. Autonomous maintenance in seven steps – Masaji Tajiri and Fumio Gotoh, Productivity Inc., Oregon, 1999.

OUTCOMES:

- Students should be able to effectively implement reliability concepts and maintenance strategies in different types of industries.

MECX48	ROBOTICS AND AUTOMATION	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To introduce the basic concepts, parts and types of robots
- To gain knowledge on working principles of different sensors machine vision
- To study various drives and controls of robot
- To impart knowledge about kinematics, dynamics and control of robots

MODULE 1 INTRODUCTION 7

Robot – Definition – Robot Anatomy – Co ordinate Systems, Work EnvelopeTypes and classification – Specifications – pitch, Yaw, Roll, Joint Notations,Speed of Motion, Pay Load – Robot Parts and their Functions – Need for Robots

MODULE II SENSING AND MACHINE VISION 8

Range sensing – Proximity sensing –Touch sensing – Force and Torque sensing. Introduction to Machine vision – Sensing and Digitizing – Image processing and analysis

MODULE III ROBOT DRIVES AND CONTROL 7

Controlling the Robot motion – Design of drive systems – Hydraulic and Pneumatic drives – Linear and rotary actuators and control valves – Electro hydraulic servo valves, electric drives – Motors.

End Effectors – Grippers – Mechanical Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Selection and Design Considerations.

MODULE IV ROBOT MOTION ANALYSIS AND CONTROL 7

Manipulator kinematics, homogenous transformations and robot kinematics, manipulator path control, robot dynamics, configuration of robot controller.

L – 45; T – 0 ; Total Hours –45

TEXT BOOKS:

1. K.S.Fu, R.C. Gonzalez and C.S.G. Lee, “Robotics Control, Sensing,

Vision and Intelligence", Mc Graw Hill, 1987

REFERENCES:

1. YoramKoren," Robotics for Engineers' Mc Graw-Hill, 1987.
2. Kozyrey, Yu. "Industrial Robots", MIR Publishers Moscow, 1985.
3. Richard. D, Klafter, Thomas, A, Chmielewski, Michael Negin, "Robotics Engineering – An Integrated Approach", Prentice-Hall of India Pvt. Ltd., 1984.
4. Deb, S.R." Robotics Technology and Flexible Automation", Tata Mc Graw- Hill, 1994.
5. Mikell, P. Groover, Mitchell Weis, Roger, N. Nagel, Nicholas G. Odrey," Industrial Robotics Technology, Programming and Applications", Mc Graw- Hill, Int. 1986.

OUTCOMES:

Students should be able to

- Understand the basic components of robots and Differentiate types of robots
- Choose appropriate sensors and machine vision system
- Apply suitable drives and controls for robot design
- Model forward and inverse kinematics of robot manipulators

MECX49	ADVANCED PRODUCTION PROCESS FOR AUTOMOTIVE COMPONENTS	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To understand the various manufacturing processes of automobile components.

MODULE I POWDER METALLURGY 7

Powder Metallurgy -Process flow chart - Production of metal powders and their raw materials - Manufacture of friction lining materials for clutches and brakes - Testing and inspection of PM parts.

MODULE II METAL FORMING 8

Forging - process flow chart, forging of valves, connecting rod, crank shaft, cam shaft, propeller shaft, transmission gear blanks, foot brake linkage, steering knuckles, Extrusions: Basic process steps, extrusion of transmission shaft, steering worm blanks, brake anchor pins, rear axle drive shaft, axle housing spindles, piston pin and valve tappets. Thermoforming, hydro forming & press forming, welding of body panels.

MODULE III METAL CASTING AND MACHINING 8

Sand casting of cylinder block and liners - Centrifugal casting of flywheel, piston rings, bearing bushes, and liners, permanent mould casting of piston, pressure die casting of carburettor other small auto parts. Machining of connecting rods - crank shafts - cam shafts - pistons - piston pins – piston rings - valves - front and rear axle housings - fly wheel - Honing of cylinder bores - Copy turning and profile grinding machines.

MODULE IV METAL COATING 7

Chemical Vapour Deposition and Physical Vapour Deposition in ball bearings. Spraying, plating and painting in paint booth for automobile body.

MODULE V GEAR MANUFACTURING 7

Gear milling, Hobbing and shaping - Gear finishing of automobile gears and inspection.

MODULE VI SPECIAL MANUFACTURING PROCESSES 8

Powder injection moulding - Shotpeen hardening of gears - Production of aluminium MMC liners for engine blocks - Plasma spray coated engine blocks and valves – Recent developments in auto body panel forming – Squeeze casting of pistons -

aluminimum composite brake rotors.

L – 45; T – 0 ; Total Hours –45

REFERENCES:

1. Heldt.P.M., " High Speed Combustion Engines ", Oxford Publishing Co., New York, 1990
2. Haslehurst.S.E., " Manufacturing Technology ", ELBS, London, 1990.
3. Rusinoff, “Forging and Forming of metals ", D.B. Taraporevala Son & Co. Pvt Ltd., Mumbai, 1995.
4. Sabroff.A.M. & Others, “Forging Materials & Processes ", Reinhold Book Corporation, New York, 1988.
5. Upton, "Pressure Die Casting ", pergamon Press, 1985.
6. High Velocity " Forming of Metals ", ASTME, prentice Hall of India (P) Ltd., New Delhi, 1990
7. HMT handbook.

OUTCOMES:

- Student should be able to identify and apply the appropriate process to manufacture the automobile components.

MECX50 PLANT LAYOUT AND MATERIAL HANDLING

L	T	P	C
2	0	0	2

OBJECTIVES:

- To learn the different types of plant layout, essential requirements and safety aspects.
- To study the need and use of appropriate equipment for effective material handling.

MODULE I PRODUCT LAYOUT 7

Selection of plant locations, territorial parameters, considerations of land, water, electricity, location for waste treatment and disposal, further expansions Safe location of chemical storages, LPG, LNG, CNG, acetylene, ammonia, chlorine, explosives and propellants

MODULE II PROCESS LAYOUT 8

Safe layout for process industries, engineering industry, construction sites, pharmaceuticals, pesticides, fertilizers, refineries, food processing, nuclear power stations, thermal power stations, metal powders manufacturing, fireworks and match works. Safe layout, equipment layout, safety system, fire hydrant locations, fire service rooms, facilities for safe effluent disposal and treatment tanks, site considerations, approach roads, plant railway lines,security towers.

MODULE III LAYOUT REQUIREMENTS 7

Principles of good ventilation, purpose, physiological and comfort level types, local and exhaust ventilation, hood and duct design, air conditioning, ventilation standards, application. Purpose of lighting, types, advantages of good illumination, glare and its effect, lighting requirements for various work, standards- Housekeeping, principles of 5S.

MODULE IV LAYOUT SAFETY 8

Preventing common injuries, lifting by hand, team lifting and carrying, handling specific shape machines and other heavy objects – accessories for manual handling, hand tools, jacks, hand trucks, dollies and wheel barrows – storage of specific materials - problems with hazardous materials, liquids, solids – storage and handling of cryogenic liquids - shipping and receiving, stock picking, dock boards, machine and tools, steel strapping and sacking, glass and nails, pitch and glue, boxes and cartons and car loading – personalprotection – ergonomic considerations.

MODULE V MATERIAL HANDLING 8

Fiber rope, types, strength and working load inspection, rope in use, rope in storage - wire rope, construction, design factors, deterioration causes, sheaves and drums, lubrication, overloading, rope fitting, inspection and replacement – slings, types, method of attachment, rated capacities, alloy chain slings, hooks and attachment, inspection. Hoisting apparatus, types - cranes, types, design and construction, guards and limit devices, signals, operating rules, maintenance safety rules, inspection and inspection checklist – conveyors, precautions, types, applications.

MODULE VI MATERIAL HANDLING EQUIPMENT 7

Powered industrial trucks, requirements, operating principles, operators selection and training and performance test, inspection and maintenance, electric trucks, gasoline operated trucks, LPG trucks – power elevators, types of drives, hoist way and machine room emergency procedure, requirements for the handicapped, types- Escalator, safety devices and brakes, moving walks – man lifts, construction, brakes, inspection.

L – 45; T – 0 ; Total Hours –45

REFERENCES:

1. Spivakosky, “Conveyors and related Equipment”, Vol.I and II Peace Pub. Moscow, 1982.
2. APPLE M. JAMES “Plant layout and material handling”, 3rd edition, John Wiley and sons.
3. Accident prevention manual for industrial operations” N.S.C., Chicago, 1982.
4. Safety and good house keeping”, N.P.C. New Delhi, 1985.
5. Reymond, A.Kulwice, “Material Handling Hand Book - II”, John Wiley and Sons, New York, 1985.
6. Rudenko, N., “Material handling Equipment”, Mir Publishers, 1981.
7. “Industrial ventilation (A manual for recommended practice), American conference of Governmental Industrial Hygiene, USA, 1984.

OUTCOMES:

Students will be able to

- Design appropriate layout for manufacturing considering safety.
- Select and use appropriate material handling equipment.

MECX51	INDUSTRIAL SAFETY ENGINEERING	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To understand the basics of industrial hazards, safety measures, safety analysis and safety management activities
- To bring the awareness on safety in various manufacturing processes, inspection and testing, health and safety regulation of people at work.
- To impart basic knowledge on different material handling devices and its mechanisms with proper safety and ergonomic considerations.

MODULE I INDUSTRIAL SAFETY SYSTEM 12

Evolution of modern safety concept - industrial hazard - significant of safety - causes of industrial accidents - accident preventions - personal protective equipment - safety signs and colour at work - safety analysis - JSA – FMEA

Organizational safety culture - safety organization - safety committee - safety policy - Budgeting for safety - Safety education and training

MODULE II SAFETY IN MANUFACTURING 8

Machine guarding - safety in metal working - safety in welding and gas cutting - safety in cold forming and hot working of metals - safety in finishing - safety in inspection and testing - health and safety regulations - OSHA

MODULE III SAFETY IN MATERIAL HANDLING 10

Material handling basics - principles - classifications of material handling equipment - general safety considerations in material handling devices - ropes, chains, slinks, hoops, clamps, arresting gears and prime movers

Ergonomic and anatomy - ergonomic consideration in material handling, design, installation, operation and maintenance of conveying equipment, hoisting, traveling and slewing mechanisms - storage and retrieval of common goods of shapes and sizes in a general store of big industry

L – 30; T – 0 ; Total Hours –30

REFERENCES:

1. Mahajan.M, “Industrial engineering and production management”, Dhanpat ray & co (p) ltd., 2001.
2. Krishnan N.V, “Safety management in industry”, Jaico publication house, Bombay, 1997.

3. Blake R.B, “Industrial safety”, Prentice Hall, Inc., New jersey, 1973.
4. Edel Engineering consultancy (p) ltd., “Safety Manual”, Novena publications, 2000.
5. IAPA , “Safety Signs and Colour at Work”, Industrial Accident Prevention Association, 2007
6. Alexandrov M.P, “Material Handling Equipment”, Mir Publishers, Moscow, 1981.
7. Siddhartha ray, “Introduction to Materials Handling”, New age international publications, 2008

OUTCOMES:

Upon satisfactory completion of the course, the student will be able to:

- Identify safety hazards and implement appropriate safety measures in industries. Also can perform various safety management activities.
- Identify the hazards in various manufacturing processes and provide suitable safety prevention through appropriate safety regulations
- Apply the knowledge of safety and ergonomic concepts to handle the different material handling devices in industry

MECX52	OPERATIONS RESEARCH & SYSTEM ANALYSIS	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To acquire knowledge in optimization techniques and know about utilization of resources. To determine optimum transportation cost
- To determine project duration and slack time in network problem and to determine elapsed time and idle time of machines
- To determine the replacement period, features of inventory approach and simulation analysis

MODULE I LINEAR PROGRAMMING PROBLEMS AND TRANSPORTATION PROBLEM 10

Linear programming problem: Formulation of problem- Determination of unknown values by Simplex method – Graphical method- Big M method.

Transportation Problem: Initial Basic feasible cost- MODI method- Non degeneracy type

MODULE II ASSIGNMENT, NETWORK ANALYSIS AND SEQUENCING PROBLEMS 10

Assignment Problems: Hungarian method for Minimization and Maximization type

Network Analysis: Determination of Project duration and slack time for PERT and CPM type of problem

Sequencing problem: Determination of Elapsed time and idle time for N Jobs 2 & 3 Machines

MODULE III REPLACEMENT MODELS, INVENTORY MODELS AND SIMULATION ANALYSIS 10

Replacement of items that deteriorate with time- Value of money changing with time- not changing with time

Inventory Model; Deterministic inventory model

Simulation Analysis: Random number generation- Monte carlo simulation

L – 30; T – 0 ; Total Hours –30

TEXT BOOKS:

1. Taha H.A. Operations Research, pearson Education, 6th Edition, 2003

REFERENCES:

1. Hira and Gupta, Problems in Operations research, S.Chand and Co. 2002
2. Panneerselvam, Operations Research, Prentice Hall of india, 2003.

OUTCOMES:

- Able to apply techniques for Optimum utilization of resources
- Able to determine project duration for large projects and determine idle time of machines
- Students will determine optimum replacement period, unnecessary stock and features of simulation analysis.

MECX53	NANO MATERIALS & FABRICATIONS	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To study the basics of Nano technology and Nano science.
- To Understand Nano fabrication and inspection.
- To study the applications of Nano materials.

MODULE I NANOMATERIAL CLASSES AND FUNDAMENTALS 7

Classification of Nanomaterials– size effects-surface to volume ratio- surface curvature-strain confinement –quantum effects.

MODULE II PROPERTIES OF NANOMATERIALS 8

Mechanical properties-Thermal-electrical-mechanical-optical-acoustic properties-study of carbon Nanotubes and Nano Composites.

MODULE III SYNTHESIS AND CHARACTERIZATION 7

Methods for making 0D,1D,2D and 3D Nanomaterial -Top down process-Intermediate process-Bottom up process-Nano profiling-Characterization of Nanomaterial.

MODULE IV PRODUCTION OF NANOMATERIAL 8

Methods of production-Mechanical alloying-Sol-gel, Electro deposition,Inert gas condensation.

MODULE V INSPECTION OF NANOMATERIAL 8

Electron Microscopy, X- ray Diffraction-Scanning Probe Microscopy-contact mode-tapping mode- Atomic Force Microscopy-Scanning Tunnel Microscopy- Nano Indentation.

MODULE VI APPLICATION OF NANOMATERIAL 7

Nano coatings-Nano films-self cleaning and easy cleaning materials-self healing materials-smart materials-Nano drugs and its delivery-Nano Tribology -Molecular Nanomachines

L – 45; T – 0 ; Total Hours –45

REFERENCES:

1. Michel F.Ashby, Paulo J Ferreira and Daniel L Schodek “Nanomaterials, Nanotechnologies and design”Elsiever, 2009.
2. T.Pradeep “Nano: The essentials”, Tata Mcgraw Hill Education pvt. Ltd, New Delhi, 2007.
3. Mark Ratner and Daniel Ratner, “Nanotechnology”, Pearson Education, New Delhi, 2003.
4. Guozong Cao “Nano structures and Nanomaterials” Imperial college press, London, 2006.

OUTCOMES:

Students will be able to

- fabricate and inspect nonmaterial.
- use nonmaterial for industrial and other applications.

MECX54	ADVANCED MATERIALS	L	T	P	C
		2	0	0	1

OBJECTIVES:

- To learn the Physical Properties of various Smart Materials
- To acquire knowledge on synthesis of newer materials.
- To learn the techniques of characterization of newer materials.
- To acquire knowledge on applications of smart sensor, actuator and transducer technologies.

MODULE I SMART BEHAVIOURS AND MATERIALS 12

Piezoelectric, electrostrictive, magnetostrictive, pyroelectric, electrooptic, Piezomagnetism, Pyromagnetism, Piezoresitivity, Thermoelectricity, photon striction, Thermally and Magnetically activated Shape memory alloy, Superelastic, Viscoelastic, Thermochromic materials. Magneto rheological fluid: constitutive behaviour and its applications as damper, Behaviour of Electro active polymer and its use as artificial muscles.

MODULE II MATERIAL SYNTHESIS 6

Solid state reaction, sol-gel process

MODULE III APPLICCATIONS 12

Impact Design and fabrication of devices and structures and their integration with system, Biomorphs / Moonies, Chip capacitor, Memory devices (FRAM), Sensor, actuator and transducers, Accelerometer, Gyroscopes, Ultrasonic Motor, Liquid Crystal display, Photonics, Structural Health Monitoring

L – 30; T – 0 ; Total Hours –30

REFERENCES:

1. Volti Rudi, “Society and Technology Change”, 6th Edition, Worth publishers Inc, USA, 2009.
2. Ferroelectric devices- Kenji Uchino, Marcell Decker Inc., 2000.
3. Smart Materials and Structures- M.V. Gandhi, B.S. Thompson, Chapman and Hall, London1992.
4. Electromechanical Sensors and Actuators, Ilene J. Busch-Vishniac, Springer-Verlag NY,1999.
5. Fundamentals of Piezoelectricity- Takuro Ikeda, Oxford University Press, 1990.
6. Actuators: Basics and Applications H.armut Janocha (Ed), Springer-Verlag Berlin Heidelberg, 2004.

7. Smart Material Systems: Model Developments, Ralph C. Smith, Cambridge University Press, Series: Frontiers in Applied Mathematics (No. 32), 2005.
8. T. Yoneyama & S. Mayazaki, Shape memory alloys for biomedical applications, CRC Press, 2009
9. Kwang J. Kim & S. Tadokoro, Electroactive polymers for robotics applications, artificial muscles and sensors, Springer, 2007.

OUTCOMES:

At the end of this course, the students will be able to

- Summarize the properties of newer materials, their synthesis and characterization.
- Explain the development of actuators and sensors and their integration into a smart structure
- Demonstrate about application areas of smart materials

MECX55	PROTOTYPING TECHNIQUES	L	T	P	C
		2	0	0	1

OBJECTIVES:

- To learn the fundamentals of rapid prototyping and automated fabrication.
- To acquire knowledge on the generation of suitable CAD models.
- To study the current rapid prototyping fabrication technologies, the use of secondary processing and the impact of these technologies.
- To understand the various rapid prototyping fabrication technologies, their underlying material science and the application of this technology on society.

MODULE I INTRODUCTION 5

Introduction to RP –Technology- Description -Definition to RP -Overview of RP - Benefits and Application

MODULE II RPT FILE GENERATION 8

RP Processes: Process overviews, STL file Generation, File Verification & Repair, Build File Creation, Part Construction, Part Cleaning and finishing, Process Strength & limitations.

MODULE III LIQUID BASED AND SOLID BASED RAPID PROTOTYPING SYSTEMS 10

Classes of RP systems: 3D Printers, Enterprise Prototyping centers, Direct digital tooling, Direct digital manufacturing, system classification, Stereo lithography, SL with photo polymerization, Selective Laser Sintering, Fused deposition modeling, Laminated object manufacturing, Laser powder forming. Prototype properties: Material, color, dimensional accuracy, stability, surface finish, machine-ability, environmental resistance, operational properties

MODULE IV RAPID PROTOTYPING APPLICATIONS 9

RP Applications: Design, Concept Models, Form & fit checking, Ergonomic Studies, Functional testing, Requesting Price quotes, CAD data verification, Rapid Tooling, rapid manufacturing, Science & Medicine, Archeology, Paleontology & forensic Science, miniaturization

L – 30; T – 0 ; Total Hours –30

REFERENCES:

1. Chua C.K., Leong K.F., and Lim C.S., Rapid prototyping: Principles and applications, second edition, World Scientific Publishers, 2003.
2. Andreas Gebhardt, Hanser Gardener, Rapid prototyping, Publications, 2003.
3. Liou W. Liou, Frank W. Liou, Rapid Prototyping and Engineering applications: A tool box for prototype development, CRC Press, 2007.
4. Ali K. Kamrani, Emad Abouel Nasr, Rapid Prototyping: Theory and practice, Springer, 2006.
5. Peter D. Hilton, Hilton / Jacobs, Paul F. Jacobs, Rapid Tooling: Technologies and Industrial Applications, CRC press, 2000.

OUTCOMES:

The students will

- Identify the currently available rapid prototyping systems, their fundamental operating principles and their characteristics
- Demonstrate complementary, secondary fabrication processes commonly used with the above rapid prototyping systems
- Select the appropriate fabrication technology or technologies for a given prototyping task

MECX57	INDUSTRIAL MARKETING	L	T	P	C
		1	0	0	1

OBJECTIVES:

- To share the concepts and frameworks which may be more relevant in industrial marketing situations
- To develop skills in identifying an interesting industrial marketing problem to study, as well as finding relevant facts.

MODULE I OVERVIEW AND PREPARATION 7

The Industrial Marketing system and the Industrial Marketing concept, Industrial goods demand and product characteristics market levels and product types, the industrial customer, buyer motives business and institutional buyers.

MODULE II INDUSTRIAL BUYER BEHAVIOUR AND INPUTS TO MARKETING 8

Analysis of micro and macro environment of industrial markets, BUYGRID MODEL, phases in purchasing decision process & their marketing implications, buying center - Webster and Wind model - Sheth model. Purchasing Agents in Industrial Buying; Negotiation in Industrial Marketing

L – 15; T – 0 ; Total Hours –15

REFERENCES:

1. Krishna K. Havaldar, “Industrial Marketing,” Tata McGraw Hill Pub Co. Ltd, New Delhi, 2002.
2. Richard M. Hill, Ralph S. Alexander, James S.Cross, “Industrial Marketing”, AITBS, 2000
3. Robert R. Reeder, Edward G. Brittle and Pretty H. Reedier, “Industrial Marketing – Analysis Planning and Control,” Prentice Hall of India Limited, New Delhi,2000.

OUTCOMES:

Students should be able to

- Take strategic decisions to promote marketing.
- Analyse the industrial market potential

MECX58	ENTREPRENEURIAL DEVELOPMENT	L	T	P	C
		1	0	0	1

OBJECTIVES:

- To make the students aware of the importance of entrepreneurship opportunities available in the society for the entrepreneur.
- Acquaint them with the challenges faced by the entrepreneur

MODULE I INTRODUCTION 8

Objectives, scope & philosophy, Characteristics and skills of a Successful Entrepreneur, Design Thinking for Customer Delight,creativity & entrepreneurship, harnessing locally available resources, Role of small Enterprise in Economic development, Problems of Small scale industrial units,

MODULE II BUSINESS REQUIREMENTS 7

Market Survey and Research - Feasibility Study –Preparation and Evaluation of report – Central and State Government Industrial Policies and Regulations –Taxes - Global Business, Sources of finance mobilization – External factors

L – 15; T – 0 ; Total Hours –15

REFERENCES:

1. Hisrich, “Entrepreneurship”, Tata McGraw Hill, New Delhi, 2006.
2. P.C. Jain (ed.), “Handbook for New Entrepreneurs”, EDII, Oxford UniversityPress, New Delhi, 1999.
3. Rabindra N. Kanungo, “Entrepreneurship and Innovation”, Sage Publications,New Delhi, 1998.

OUTCOMES:

Students should be able to

- Develop leadership qualities, business ethics and positive value system.
- Acquire the requirements of entrepreneurship to lead a business.

MECX60	ADDITIVE MANUFACTURING	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To gain the knowledge of importance of Additive manufacturing techniques in manufacturing
- To learn the various additive processes and their principles and applications
- To learn how to create physical objects using additive manufacturing devices and processes

MODULE I INTRODUCTION 8

Introduction and basic fundamentals of AM technology- Traditional manufacturing Vs Additive manufacturing- Reverse Engineering: Introduction, From Scanner to Model validation - Development of Additive Manufacturing Technology-Classifications- Materials for Additive Manufacturing Technology – Additive manufacturing in medical applications- Bio-manufacturing.

MODULE II ADDITIVE MANUFACTURING PROCESS 12

Extrusion Based Additive Manufacturing Process- Fused Deposition Modeling (FDM), Shape Deposition Manufacturing (SDM), Laminated Object Manufacturing (LOM)- Photo-polymer vat Additive Manufacturing Process-Streolithography (SLA), Solid Ground Curing (SGC), Selective Laser Sintering (SLS)-Powder bed fusion and material jetting Additive Manufacturing Process- Electron Beam Melting (EBM), Laser Engineered Net Shaping (LENS), Three Dimensional Printing (3DP) - Hybrid Additive Manufacturing Process- Issues with additive manufacturing

MODULE III BASIC ADDITIVE MANUFACTURING MACHINE 10

Preprocessing – Post processing – Tooling - Construction of basic AM machines: Axes, Linear motion guide ways, Ball screws, Motors, Bearings, Encoders/ Glass scales, Process Chamber, Sensors - Laser scanning system, Powder feeding and Wire feeding systems

L – 30; T – 0 ; Total Hours –30

REFERENCES:

1. Gibson, I., Rosen, D.W. and Stucker, B., “Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing”, Springer, 2010.
2. Chua, C.K., Leong K.F. and Lim C.S., “Rapid prototyping: Principles and applications”, second edition, World Scientific Publishers, 2010.

3. Gebhardt, A., “Rapid prototyping”, Hanser Gardener Publications, 2003.
4. Liou, L.W. and Liou, F.W., “Rapid Prototyping and Engineering application : A tool box for prototype development”, CRC Press, 2011.
5. Hilton, P.D. and Jacobs, P.F., Rapid Tooling: Technologies and Industrial Applications, CRC press, 2005.
6. Chee Kai Chua, Kah Fai Leong, 3D Printing and Additive Manufacturing: Principles and Applications: Fourth Edition of Rapid Prototyping
7. Andreas Gebhardt, Understanding Additive Manufacturing: Rapid Prototyping, Rapid Tooling, Rapid Manufacturing
8. Jacobs, Paul F, Rapid Tooling: Technologies And Industrial Applications
9. D.T. Pham, S.S. Dimov, Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling

OUTCOMES:

Upon satisfactory completion of the course, the student will be able to:

- Learn the importance of additive process parameters and their applications
- Demonstrate comprehensive knowledge of the broad range of additive manufacturing processes, devices, capabilities and materials that are available.
- Understand to create the physical objects through additive manufacturing process

MECX61	FAILURE ANALYSIS AND TECHNIQUES	L	T	P	C
		1	0	0	1

OBJECTIVES:

- Introduce students to the concept of material failure analysis and Techniques, and
- Equip them with knowledge on how to design against catastrophic failures required in carrying out failure analysis.
- To identify different types of fracture and to various methods of identifying them.

MODULE I FAILURE ANALYSIS INTRODUCTION 8

Historical background, origin, detection and prevention of failure, types of mechanical failure: Ductile and brittle fracture, fatigue fracture, buckling, creep rupture, stress concentration, statistical aspect of failure analysis, loading spectrum, metallurgical aspect of component failure.

MODULE II FAILURE ANALYSIS TECHNIQUES 7

Processing-structure-property relationship, metallurgical imperfection, processing defects, NDT methods, surface defects and corrosion, propagation of defects, tools for metallurgical failure analysis, Case study reports

L – 15; T – 0 ; Total Hours –15

REFERENCES:

11. George E. Dieter, Mechanical metallurgy, McGraw-Hill Book Company, SI Metric Edition Printed in Singapore.

OUTCOMES:

Physics Elective Courses
(To be offered in II Semester)

PHCX 01	FUNDAMENTALS OF ENGINEERING MATERIALS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To help students to acquire the properties and applications of conducting and semiconducting materials.
- To familiarize students with basic ideas about the properties of dielectric and magnetic materials and their applications.
- To familiarize students with basic knowledge of nanomaterials and its electrical, electronic, mechanical and magnetic properties.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I CONDUCTING AND SEMICONDUCTING MATERIALS 7

Conductors: properties, Fermi distribution function, Fermi energy in metals- density of states- conducting polymers-properties-applications, semiconductors: intrinsic and extrinsic semiconductors-carrier concentration, conductivity and energy band gap, semiconducting polymers- properties- applications.

MODULE II DIELECTRIC MATERIALS 8

Polarization- dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – Internal field - Clausius Mosotti relation - dielectric loss – dielectric breakdown – applications of dielectric materials (capacitors and transformers) – Pyroelectricity, Piezoelectricity, ferroelectricity and applications in Ferroelectric Random Access Memory (FeRAM) - multiferroic materials and its applications.

MODULE III MAGNETIC MATERIALS 7

Origin of magnetism-magnetic moment, susceptibility, permeability – Bohr magneton – Dia, Para and Ferro magnetism –Spontaneous magnetization- Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites and its application - Giant Magneto-resistance effect (GMR) - Magnetic resonance imaging(MRI).

MODULE IV NANOMATERIALS 8

Properties of nanomaterials – size effect on thermal, electrical, electronic, mechanical,

optical and magnetic properties – quantum confinement – classification of nanomaterials – quantum well, quantum wire, quantum dot - nanoporous materials - carbon nanotubes, graphene - nanocomposites – applications of nano materials.

PRACTICALS

1. Determination of energy band gap of a semiconductor.
2. Determination of resistivity of metals by four point probe method.
3. Determination of dielectric constant of dielectric material.
4. Determination of time constant of a capacitor using RC circuit.
5. Determination of paramagnetic susceptibility of given liquid.
6. Determination of hysteresis loss in a transformer using BH curve.
7. Analysis of size effect on the absorption spectrum of nanomaterials.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. William D. Callister, “Material Science and Engineering”, Wiley Publications, 2006.
2. Raghavan, V., “Materials Science and Engineering”, 5th edition, Printice Hall of India Pvt Ltd. New Delhi, 2004.
3. Wahab. M.A, “Solid State Physics: Structure and Properties of Materials”, Narosa Publishing House Pvt. Ltd., New Delhi , 2nd Edition, 2010.
4. Pillai, S.O., “Solid State Physics”, New Age International, New Delhi, 2005.
5. Charles P. Poole and Frank J. Owens, ”Introduction to nanotechnology”, Wiley (India), 2009.
6. Pradeep. T., “Textbook of Nanoscience and Nanotechnology”, McGraw Hill Education (India) Private Limited, New York, 2012.

OUTCOMES:

On completion of this course, the student will be able to

- apply the concepts of conducting and semiconducting materials for solid state devices.
- comprehend the significance of properties of dielectric magnetic materials and derive these properties from synthesized materials.
- differentiate between the properties of the nanomaterials compared to bulk materials.
- complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 02	HEAT AND THERMODYNAMICS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To familiarize students with basic concepts of heat.
- To help students acquire the fundamentals of heat conduction and radiation.
- To enable students acquaint with the basics of thermodynamic concepts.
- To make students understand the fundamentals of heat based experiments.

MODULE I CONCEPTS OF HEAT **10**

Definition of temperature, thermal and thermodynamic equilibrium - relationship between temperature and kinetic energy - definition of solid, liquid, gas - Introduction to phase transitions, critical and triple points- definition of heat capacity, mechanical equivalent of heat -Joule's calorimeter- latent heat- microscopic model of ideal gas - equation of state, internal energy, equipartition theorem- equation of state for non-ideal gases.

MODULE II CONDUCTION AND RADIATION **10**

Thermal conductivity – rectilinear flow of heat – thermal conductivity of a good conductor – Forbe’s method – thermal conductivity of a bad conductor – Lee’s disc method – conduction of heat through compound media - radiation – Planck’s law of blackbody radiation – Wien’s law – Stefan’s law – Newton’s law of cooling from Stefan’s law – Solar constant – Pyrometry.

MODULE III FUNDAMENTALS OF THERMODYNAMICS **10**

Thermodynamic equilibrium – zeroth law of thermodynamics – first law of thermodynamics – Reversible and irreversible processes – second law of thermodynamics - Heat engine – Carnot’s engine – Carnot’s theorem – Internal combustion engines – petrol and diesel engines (qualitative) – Entropy and available energy – temperature – entropy diagram for Carnot’s cycle - Third Law of thermodynamics (qualitative).

PRACTICALS

1. Determination of mechanical equivalent of heat by Joule’s calorimeter.
2. Relation between temperature of a body and time by plotting a cooling curve-Newton’s law of cooling.

3. Determination of specific heat capacity of liquid by cooling.
4. Determination of thermal conductivity of a good conductor-Forbe's method
5. Determination of thermal conductivity of a bad conductor-Lee's disc method

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Mathur. D.S, “Heat & Thermodynamics”, S.Chand & Co., 2009.
2. Brijlal & Subramaniam, “Heat and Thermodynamics”, S.Chand & Co, Delhi, 2010.
3. Gupta. A.B and Roy. H, “Thermal Physics”, Books and Allied Ltd., 2002.
4. Sharma. J.K and Sarkar. K.K, “Thermodynamics and statistical Physics”, Himalaya Publishing House, 1988.

OUTCOMES:

On completion of this course, the student will be able to

- understand the concepts of heat and its properties.
- comprehend the ideas governing the conduction and radiation processes.
- apply the knowledge of laws of thermodynamics in thermodynamic systems.
- perform heat based experiments and determine its various properties.

PHCX 03 INTRODUCTION TO NANOSCIENCE AND TECHNOLOGY

L	T	P	C
2	0	2	3

OBJECTIVES:

- To acquire basic knowledge about the nanomaterials and applications.
- To learn about the synthesis and imaging techniques of nanomaterials.
- To gain the basic concepts of fabrication techniques.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I NANOMATERIALS AND APPLICATIONS **10**

Properties of nanomaterials – size effect on thermal, electrical, electronic, mechanical, optical and magnetic properties – quantum confinement – classification of nanomaterials – quantum well, quantum wire, quantum dot - nanoporous materials - zeolite, mesoporous materials, carbon nanotubes, grapheme - nanocomposites - applications (qualitative): Molecular electronics-nanoelectronics – nanophotonics - single electron transistor-drug delivery.

MODULE II SYNTHESIS AND IMAGING TECHNIQUES **12**

Top-down and bottom up approaches – mechanical alloying and mechanical ball milling - sol-gel approach - hydrothermal method - precipitation method - spray pyrolysis - spin coating-self assembled monolayer (SAM) - Chemical vapour deposition method – Physical vapour deposition method: laser ablation method, sputtering method.

Optical microscopy – Phase contrast and interference microscopy – confocal microscopy - high resolution Scanning electron microscope (HRSEM) - high resolution Transmission electron microscope (HRTEM) - Atomic force microscope - Scanning Tunnelling microscope (STM).

MODULE III NANOFABRICATION **8**

Photolithgraphy - electron beam lithography - X-ray and Ion beam lithography - nanoimprint lithography - soft lithograpy - nanoelectromechnical systems (NEMS) - nanoindentation principles.

PRACTICALS

1. Synthesis of nanomaterials by sol-gel method.

2. Synthesis of nanomaterials by hydrothermal method.
3. Synthesis of nanomaterials by solid state reaction method.
4. Synthesis of nanomaterials by chemical bath deposition method.
5. Synthesis of nanomaterials by co-precipitation method.
6. Synthesis of nano thin films by spray pyrolysis method.
7. Synthesis of nano thin films by pulsed laser deposition (PLD) method.
8. Analysis of size effect on the absorption spectrum of nanomaterials.
9. SEM characterization of nanomaterials.
10. AFM characterization of nano thin films.
11. Phase confirmation by XRD.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Charles P.Poole and Frank J. Owens, ”Introduction to nanotechnology”, Wiley (India), 2009.
2. Cao. G., “Nanostructures & Nanomaterials: Synthesis, Properties & Applications”, Imperial College Press, 2004.
3. Gaddand. W., Brenner. D., Lysherski. S. and Infrate. G.J., “Handbook of NanoScience Engineering and Technology”, CRC Press, 2002.
4. Pradeep. T., “Textbook of Nanoscience and Nanotechnology”, McGraw Hill Education (India) Private Limited, New York, 2012.
5. Chris Mack, “Fundamental Principles of Optical Lithography: The Science of Microfabrication”, John Wiley & Sons, 2008.
6. Bandyopadhyay A.K., “Nano Materials”, New Age International Publishers, New Delhi, 2008.

OUTCOMES:

At the end of the course, the students will be able to

- understand the importance and basic concepts of the nanomaterials.
- comprehend the imaging techniques for nanomaterials.
- illustrate the various nanofabrication techniques.
- complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 04	LASERS AND THEIR APPLICATIONS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To recognize the fundamentals of laser and its characteristics.
- To comprehend and compare the different laser systems.
- To apply lasers in metrology and material processing.
- To understand the working of laser instrumentation.
- To correlate the experimental results for applications.

MODULE I LASER THEORY **8**

Spontaneous and stimulated emission - Population inversion – Einstein's A & B coefficients - Threshold condition – super-radiance Laser – Three level and four level laser systems -conditions for CW and pulsed laser action. Q-Switching - experimental methods - cavity dumping - Mode locking - experimental methods - Spatial and Temporal coherence.

MODULE II DIFFERENT LASER SYSTEMS **8**

Laser systems – General description - Laser structure - excitation mechanism - Different laser systems- He-Ne laser, Carbon-dioxide laser - Excimer laser – Free electron laser- Alexandrite laser - Ti-Sapphire laser – Semiconductor diode laser - Diode pumped solid state laser - Pulsed-CW dye laser- Fibre laser.

MODULE III METROLOGICAL AND MATERIAL PROCESSING APPLICATIONS **8**

CW and Pulsed laser beam characteristics and its measurements - Beam focusing effects - spot size - Power and Energy density Measurements - Distance measurement - Interferometric techniques - LIDARS - different experimental arrangements - Pollution monitoring by remote sensing - Laser gyroscope - Laser welding, drilling, machining and cutting - Laser surface treatment - Laser vapour deposition – Biophotonic applications.

MODULE IV LASER INSTRUMENTATION **7**

Laser for measurement of length, current and voltage – Laser Doppler Velocimetry - Holography and speckle in displacement and deformation measurements - Laser for communication with fiber optics as channel.

PRACTICALS

1. Tuning of Dye Laser using DFDL Arrangement
2. Determination of Brewster Angle using He-Ne laser
3. Study of transversely Pumped Dye Lasers
4. Study of longitudinally Pumped Dye Lasers
5. Determination of power and wavelength using Distributed Feedback Dye Laser (DFDL)
6. Determination of fibre optic losses using semiconductor laser.
7. Bandgap determination of a semiconductor diode.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. William T. Silfvast, “Laser Fundamentals”, Cambridge University Press, 2009.
2. Ghatak. A. & Thyagarajan. K. “Optical Electronics”, Cambridge University, 1994.
3. Laud.B.B., “Laser and Non-Linear Optics”, Second Edition, New Age International (p) Limited Publishers, 2011.
4. Nambiar. K.R., “Lasers Principle, Types and Applications”, New Age International (p) Ltd, 2004.
5. Wilson. J. & Hawkes. J.F.B., “Opto Electronics - An Introduction”, Prentice Hall, 1992.
6. William M.Steen, ”Laser Material Processing”, Springer-Verlag, Berlin, Third Edn., 2005.

OUTCOMES:

At the end of the course, the students will be able

- To complement the knowledge acquired in the theory class.
- To work with dye lasers for tunability of laser wavelength.
- To measure the loss of information involved in fibre optic communication.
- To correlate the results for application.

PHCX 05	MATERIALS SCIENCE	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To gain basic knowledge in conducting and semiconducting materials and their properties.
- To provide basic understanding of properties and applications of dielectric materials.
- To impart knowledge on magnetic and optical materials and their properties & applications.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I CONDUCTING AND SEMICONDUCTING MATERIALS **10**

Quantum free electron theory of metals and its importance - Energy distribution of electrons in metals - Fermi distribution function - Density of energy states and carrier concentration in metals - Fermi energy – Classification of solids into conductors, semiconductors and insulators on the basis of Band theory – Introduction to Elemental and Compound semiconductors - Carrier concentration derivation for Intrinsic semiconductors - Density of electrons in conduction band & Density of holes in valence band- intrinsic carrier concentration - Fermi energy & Variation of Fermi energy level with temperature - Mobility and electrical conductivity - Band gap determination.

MODULE II DIELECTRIC MATERIALS **7**

Introduction to dielectric materials & basic definitions – Electronic, Ionic, Orientation & Space charge polarizations - Total polarization – Frequency and temperature dependence of polarization - Internal field in a dielectric material - Deduction of Clausius - Mosotti's relation - dielectric loss & loss tangent – Different types of dielectric breakdown – Applications of dielectric materials : Capacitors and Transformers.

MODULE III MAGNETIC MATERIALS **6**

Introduction to magnetic materials & origin of magnetic moment - Different types of magnetic materials and their properties - Ferromagnetism & Domain theory of ferromagnetism - Hysteresis, Soft and Hard magnetic materials - Antiferromagnetic materials - Ferrites and its applications – Applications of magnetic materials : Data storage.

MODULE IV OPTICAL MATERIALS 7

Optical properties of semiconductors - Direct and Indirect bandgap semiconductors – Traps, recombination centre, color center and exciton – Luminescence : Fluorescence and Phosphorescence - Liquid crystal display : twisted nematic crystal display – Applications of Optical materials - Optical Sources : light emitting diode and laser diode - Photo detectors : PIN photodiode and Avalanche Photodiode - Pyroelectric devices - Electro optic effect : Kerr effect and Faraday effect.

PRACTICALS

1. Resistivity measurement of a semiconductor using four point probe method.
2. Determination of band gap of a semiconductor diode.
3. Determination of Hall coefficient of a given semiconductor material.
4. Determination of dielectric constant of a given non-polar liquid.
5. Determination of magnetic susceptibility of a given paramagnetic liquid using Quincke's method.
6. Determination of energy loss of a given transformer core using hysteresis method.
7. To study the I-V characteristics of a photodiode.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Palanisamy P.K., ''Physics II'', Material Science for ECE, Scitech Publications (India) Pvt. Ltd., 2006.
2. Kasap. S.O., ''Principles of Electronic materials and devices'', McGraw Hill Publishers, 3rd Edition, 2007.
3. Arumugam. M, "Physics II'', Material Science for ECE, Anuradha Publishers, 5th Edition, 2005.
4. Sze. S.M., ''Semiconductor Devices – Physics and Technology'', John Wiley, 2nd Edition. 2002.
5. Raghavan. V, ''Materials Science and Engineering'', Prentice Hall of India, 5th

Edition, 2004.

OUTCOMES:

On the completion of this course, the students will be able to

- Gain knowledge about fundamentals of conducting and semiconducting materials.
- Understand concepts and applications of Dielectric and Magnetic materials.
- Familiarize Optical materials and their applications in Engineering and Medical fields.
- Complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 06	NON-DESTRUCTIVE TESTING	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To study the process and applications of ultrasonic inspection method.
- To understand the basic concepts of radiographic inspection method.
- To acquire the knowledge about the various surface Non-Destructive Testing (NDT) techniques.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I ULTRASONIC INSPECTION METHOD **10**

Ultrasonic Testing - Principle of operations - types of sound waves - types of Transducers - transmission and pulse-echo method - straight beam and angle beam, instrumentation - calibration methods - ultrasonic testing technique- data representation, A Scan, B-scan, C-scan. Phased Array Ultrasound, Time of Flight. Diffraction - thickness determination - advantages, disadvantages and applications.

MODULE II RADIOGRAPHIC INSPECTION METHOD **10**

Radiographic testing – Principle - Interaction of X-ray with matter - X-ray radiography - method of generation-industrial radiography inspection techniques – Equipment - Exposure charts - Types of films – Fluoroscopy - Xero-Radiography – Limitations - Gamma radiography - Equipment, radiation sources - method of generation - film processing - interpretations of radiography - safety in industrial radiography.

MODULE III SURFACE NDT TECHNIQUES **10**

Liquid Penetrant Testing – Principles, Characteristics and types of liquid penetrants – developers - advantages and disadvantages of various methods - Inspection Procedure and Interpretation of results. Applications of Liquid Penetrant testing.

Magnetic Particle Testing - Principle-magnetizing technique - procedure –equipment - Interpretation and evaluation of test indications - applications and limitations - demagnetization.

PRACTICALS

1. Inspection of welds using solvent removable visible dye penetrant.
2. Inspection of welds using solvent removable fluorescent dye penetrant.

3. Inspection on non magnetic materials by eddy current method.
4. Inspection on magnetic materials by eddy current method.
5. Inspection of welds by Eddy current Testing.
6. Inspection of welds by Magnetic Particle Testing - Dry method.
7. Inspection of welds by Magnetic Particle Testing - Wet method.
8. Ultrasonic flaw detector - Inspection of defects.
9. Demonstration of Radiographic inspection.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Baldev Raj., Jayakumar T.,Thavasimuthu., “Practical Non-Destructive Testing”, Narosa Publishing House, 2009.
2. Ravi Prakash., “Non-Destructive Testing Techniques”, 1st revised edition, New Age International Publishers, 2010.
3. ASM Metals Handbook of Non-Destructive Evaluation and Quality Control, American Society of Metals, Metals Park, Ohio, USA, Volume-17, 2000.
4. Paul E Mix,”Introduction to Non-destructive testing: a training guide”, Wiley, 2nd Edition New Jersey, 2005.
5. Charles J., Hellier, “Handbook of Nondestructive evaluation”, McGraw Hill, New York, 2001.

OUTCOMES:

Upon completion of this course, the students will be able to

- illustrate the ultrasonic inspection methods of NDT.
- understand the basic concept of radiographic inspection method.
- test the surfaces by the various surface NDT techniques.
- complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 07	PROPERTIES OF MATTER AND ACOUSTICS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To understand principles and properties of elasticity.
- To understand the basic concepts and application of viscosity.
- To analysis acoustic of building.
- To know about photoelasticity and its applications.

MODULE I ELASTICITY **8**

Stress and strain - Hooke's Law of elasticity - Elastic moduli - Stress-Strain Diagram - Poisson's Ratio - Relation between elastic constants - Work done in stretching and twisting a wire - Twisting couple on a cylinder- Expression for bending moment - Cantilever–Expression for depression - Uniform bending and Non-uniform bending of beams (theory & experiment) - I form Girders (qualitative treatment) and applications.

MODULE II VISCOSITY **8**

Viscosity- Newton’s formula for viscous flow - Streamline and turbulent motion - Reynolds number - Poiseuille's formula - Determination of coefficient of viscosity- factors affecting viscosity - capillary flow method - Stoke's formula- viscosity of highly viscous liquids – Stoke’s method - Lubricants and its applications –viscosity measurements - Viscometer - Variation of Viscosity with Temperature.

MODULE III ACOUSTICS OF BUILDING **7**

Basic requirement for the acoustically good halls - Reverberation and time of reverberation – Sabine’s formula for reverberation time - Absorption coefficient and its measurement -Transmission of sound and transmission loss - Factors affecting the architectural acoustics and their remedy-sound absorbing materials - vibration and noise control systems for buildings.

MODULE IV PHOTOELASTICITY **7**

Polarization - double refraction - Theory of Plane, Circularly and Elliptically polarized light - Quarter wave plate and half wave plate - photo elasticity - Theory of photo-elasticity - Stress optic relations - model materials - analysis techniques - Photo elastic bench - Three dimensional photo elasticity - Digital photo elasticity - Photo elastic

coatings.

PRACTICALS

1. Determination of viscosity of liquid by Poiseuille's method.
2. Determination of viscosity of liquid by Stoke's method.
3. Analysis of stress by photo elastic method.
4. Verification of Hooke's law by spring method.
5. Determination of Young's modulus of the cantilever beam.
6. Determination of rigidity modulus by static torsion method.
7. Visit to acoustically good auditorium and identifying the sound absorbing materials in the auditorium.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Mathur D.S., "Elements of Properties of Matter", S.Chand & Co, Delhi, 2009.
2. Gaur R.K., Gupta S.L.,"Engineering Physics", Dhanpat Rai Publishers, 2010.
3. Brijlal and Subramaniam.," Properties of Matter", Eurasia Publishing Co, New Delhi, 2002.
4. Smith C.J.," General Properties of Matter", Orient & Longman,1960.
5. Kenneth G. Budinski and Michel K., Budinski, "Engineering Materials Properties and Selection", Pearson, Singapore, 2002.

OUTCOMES:

Upon completion of this course, the students will be able to

- understand the basic concepts of the elasticity of materials.
- comprehend the concepts of viscosity of liquid and measurement.
- demonstrate the acoustical aspects of building and its importance in construction.
- apply the fundamental concept of photo elasticity for the stress analysis of the object.

PHCX 08	PROPERTIES OF MATTER AND NONDESTRUCTIVE TESTING	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To impart knowledge about the principles and properties of elasticity.
- To learn the laws governing the dynamic of rigid bodies.
- To acquire the knowledge of the various techniques of Non-Destructive Testing (NDT) of materials.
- To understand the principle and basic concept of low temperature applications.

MODULE I ELASTICITY **8**

Stress and strain - Hooke's Law of elasticity - Elastic moduli - Stress-Strain Diagram - Poisson's Ratio - Relation between elastic constants - Work done in stretching and twisting a wire - Twisting couple on a cylinder- Expression for bending moment-Cantilever–Expression for depression - Uniform Bending and Non-uniform bending of beams (theory & experiment) - I form Girders (qualitative treatment) and applications.

MODULE II DYNAMICS OF RIGID BODIES **8**

Rigid bodies - angular acceleration - Torque on a particle - angular momentum - law of conservation of angular momentum - moment of inertia and its significance -Theorem of parallel and perpendicular axis - moment of inertia of a thin uniform bar - moment of inertia of a rectangular lamina - moment of inertia of uniform circular disc - Moment of inertia of hollow and solid cylinders – flywheel (qualitative) - kinetic energy of rotating body – Routh rule.

MODULE III NDT TECHNIQUES **6**

Ultrasonic Testing- types of Transducers-transmission and pulse-echo method-Radiographic testing- Principle-Interaction of X-ray with matter-X-ray radiography-method of generation-industrial radiography inspection techniques- Liquid Penetrant Testing**-** Inspection Procedure and Interpretation of results.

MODULE IV LOW TEMPERATURE PHYSICS **8**

Definition of Refrigeration and Air-Conditioning - Types of **Refrigeration Systems-**Applications- Comfort Air Conditioning, Industrial Refrigeration, Food

processing and food chain - **Cryogenic treatment - Low temperature properties of engineering materials: Mechanical properties, Thermal properties, Electrical properties.**

PRACTICALS

1. Verification of Hooke's law by spring method.
2. Determination of Young's modulus of the beam by bending method.
3. Inspection of welds using solvent removable visible dye penetrant.
   Inspection of welds using solvent removable fluorescence dye penetrant.
5. Inspection of welds by Magnetic Particle Testing.
6. Determination of moment of inertia of the disc by torsion pendulum method.
7. Determination of moment of inertia of the disc by static torsion method.
8. Demonstration of working of flywheel.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Mathur D.S.,"Elements of Properties of Matter", S.Chand & Co, Delhi, 2009.
2. Brijlal & Subramaniam," Properties of Matter", Eurasia Publishing Co, Delhi, 2002.
3. Gaur R.K., Gupta S.L., "Engineering Physics" Dhanpat Rai Publishers, 2010.
4. Baldev Raj.,Jayakumar T., Thavasimuthu M.,"Practical Non-Destructive testing", Narosa Publishing House, 2009.
5. Brijlal & Subrahmanyam., "Heat and Thermodynamics" S.Chand & Company Ltd, 2002.
6. Paul E Mix.," Introduction to Non-destructive testing: a training guide", Wiley, 2nd Edition, New Jersey, 2005.
7. Charles J., Hellier.," Handbook of Nondestructive evaluation", McGraw Hill, New York, 2001.

OUTCOMES:

Upon completion of this course, the students will be able to

- understand the basic of concept of elasticity of materials.
- comprehend the basic concepts of motion of rigid bodies and its applications.
- demonstrate the various NDT techniques and its importance.
- know the low temperature systems and its applications.

PHCX 09	SEMICONDUCTOR PHYSICS AND OPTOELECTRONICS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To understand the Physics of Semiconductor devices.
- To make the students learn the fundamentals of Photoluminous - semiconductors, Optoelectronic devices, Optical modulators/detectors.
- To make them understand the technology behind latest Display devices like LCD, Plasma and LED Panels.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I PHYSICS OF SEMICONDUCTORS **8**

Elemental and compound semiconductors – Drift and diffusion current - Intrinsic semiconductors – Carrier concentration (derivation) – Fermi energy – Variation of Fermi energy level with temperature – Mobility and electrical conductivity – Band gap determination – Extrinsic semiconductors – Carrier concentration in n-type and p-type semiconductor (derivation) – Variation of Fermi level with temperature and impurity concentration – Variation of Electrical conductivity with temperature – Hall effect – Experiment and applications of Hall effect.

MODULE II OPTOELECTRONIC DEVICES **7**

Light Emitting Diodes (LED) – power and efficiency - double hetero LED - LED structure - LED characteristics - White LED – Applications. Liquid crystal displays – Dynamic scattering and Twisted nematic display, Semiconductor Lasers, Homojunction and Heterojunction laser diodes - Optical processes in semiconductor lasers.

MODULE III OPTICAL MODULATORS **7**

Modulation of light – birefringence –Modulation Techniques - Electro optic effect – Electro optic materials –Types of Electro optic Modulators : Kerr and Pockel modulators –- Magneto optic effect - Magneto optic Modulators – Acousto Optic modulators.

MODULE IV OPTICAL DETECTORS **8**

Photo detectors - photodiodes - phototransistors - noise characteristics - PIN diode – Avalanche Photodiode (APD) characteristics - APD design of detector arrays – Charged Couple Device - Solar cells - Materials and design considerations, Thin film

solar cells, amorphous silicon solar cells.

PRACTICALS

1. Resistivity measurement of a semiconductor using four point probe method.
2. Determination of band gap of a semiconductor diode.
3. Determination of Hall coefficient of a given semiconductor material.
4. Determination of the wavelength of a given laser source using diffraction grating.
5. Determination of Planck's constant using LED.
6. To study the I-V characteristics of photodiode and phototransistor.
7. To study the characteristics of a solar cell.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Arumugam. M, "Physics II", Anuradha Publishers, 5th Edition, 2005.
2. Sze. S.M., "Semiconductor Devices – Physics and Technology", 2nd edn. John Wiley, 2002.
3. Wilson & J.F.B. Hawkes, "Optoelectronics – An Introduction", Prentice Hall, India, 1996.
4. Bhattacharya, "Semiconductor optoelectronic devices", Second Edn, Pearson Education, 2002.
5. Safa O. Kasap, "Optoelectronics & Photonics:Principles & Practices", Second Edn, Pearson Education,2013.
6. Palanisamy P.K., "Semiconductor physics and optoelectronics" Scitech Publications, 2003.

OUTCOMES:

On completion of this course, the student will be able to

- understand the principles of Physics behind semiconductor devices.
- choose the correct semiconductors for electronic devices and display.
- differentiate the working principle of LED and Diode Laser.
- apply the knowledge of modulation of light for different types of optical modulators.
- select suitable photodetectors for different types of applications.
- complement the knowledge acquired in the theory class and correlate the results for applications.

Chemistry Elective Courses
(To be offered II Semester)

CHCX01	ANALYTICAL INSTRUMENTATION	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make the student conversant with

- principles, instrumentation and applications of different electroanalytical techniques
- different chromatographic techniques
- principles, instrumentation and applications of various types of absorption and emission spectroscopy
- different thermal analytical methods and their applications

MODULE I ELECTROANALYTICAL TECHNIQUES **7**

Principle and applications: conductometric titrations – potentiometrIc titrations, ion-selective electrodes and pH-metry – coulometry – voltammetry - polarography, amperometric titrations.

MODULE II CHROMATOGRAPHY **8**

Basic concepts of chromatography – paper chromatography – column chromatography – thin layer chromatography – gas chromatography – high performance liquid chromatography – gel permeation chromatography.

MODULE III SPECTROSCOPY **8**

Absorption spectroscopy (principle, instrumentation and applications): Colorimetric analysis – UV-Visible spectroscopy – FTIR spectroscopy - Emission Spectroscopy (principle, instrumentation and applications): fluorescence, phosphorescence and chemiluminescence – Atomic absorption spectroscopy – flame emission spectroscopy.

MODULE IV THERMAL ANALYSIS **7**

Principle, instrumentation and applications: Thermo gravimetric analysis – Differential thermal analysis – Differential scanning calorimetry

PRACTICALS

1. Conductometric titrations: acid-base and precipitation titrations

2. Potentiometric titrations
3. Determination of pH of the unknown solution
4. Estimation of alkali metals using flame emission spectroscopy
5. Estimation of metal ions of coloured solutions using colorimetric analysis
6. Separation of compounds using gas chromatography
7. Separation of compounds using high performance liquid chromatography
8. Analysis of the given sample and interpretation of the data using IR, UV-Visible spectroscopy
9. Demonstration of TGA/DTA and DSC and interpretation of data.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Skoog D.A., West D.M., Holler F.J. and Crouch S.R., Fundamentals of Analytical Chemistry, 8th Edition, Thomson Brooks/Cole Publication., Singapore, 2004.
2. Willard H.H., Merritt L.L., Dean J.A. and Settle F.A., Instrumental Methods of Analysis, 7th Edition, CBS Publication, New Delhi Reprint, 2004.
3. A.I. Vogel, Vogel's Textbook of Practical Organic Chemistry, 5th Edition, Prentice Hall, London, 2008.
4. Christian G.D., Analytical Chemistry, 6th Edition, John Wiley, Singapore, 2003.
5. Fifield F.W. and Kealey D., Principles and Practice of Analytical Chemistry, 5th Edition, Blackwell Publication, London, 2000.
6. Settle F. (Editor), Handbook of Instrumental Techniques for Analytical Chemistry, Pearson Education, Singapore, 2004.

OUTCOMES:

The student will be able to

- state the principle and applications of various electro-analytical techniques
- identify the right separation method for a given sample using different chromatographic techniques
- explain the principle, instrumentation & applications of various spectroscopic methods and also to interpret the data
- elaborate the principle, instrumentation and applications of various thermal analytical techniques and interpret the data.

CHCX02	CORROSION AND ITS CONTROL	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students should be conversant with the

- Basic concepts, principles and factors affecting corrosion
- Types and mechanism of corrosion
- Control measures of corrosion by material selection, proper design and by applying organic coatings
- Control of corrosion by applying inorganic coating

MODULE I BASIC CONCEPTS OF CORROSION **8**

Corrosion – causes and impacts of corrosion – mechanism of corrosion: Dry corrosion- oxidation corrosion - corrosion by other gases – Pilling-Bedworth rule-Corrosion by hydrogen: hydrogen blistering, hydrogen embritttlement, decarburization and hydrogen attack – corrosion of silver and copper by sulphur compounds – liquid metal corrosion (embritttlement or cracking) – Wet corrosion : hydrogen evolution – presence and absence of oxygen and absorption of oxygen –difference between dry and wet corrosion-factors influencing corrosion-polarization-passivity-emf series and galvanic series- corrosion current -rate of corrosion.

MODULE II FORMS OF CORROSION **7**

Forms of corrosion-conditions for electrochemical corrosion –galvanic corrosion – differential aeration corrosion: pitting, water line, wire fencing, crevice and filiform corrosion – stress corrosion – Intergranular corrosion- erosion corrosion – soil corrosion – microbiological corrosion- fretting corrosion- corrosion in composites.

MODULE III CORROSION CONTROL AND ORGANIC COATINGS **8**

Corrosion control – selection of materials and designing- cathodic protection – sacrificial anode and impressed current cathodic protection – corrosion inhibitors: anodic, cathodic and vapour phase inhibitors.

Organic protective coatings – paints: constituents – functions – varnishes : types-constituents – functions – lacquers : constituents – functions –enamels-

constituents – functions – special paints : fire retardant, water repellant, heat resistant, temperature indicating and luminous paints.

MODULE IV INORGANIC COATINGS 7

Treatment of metal surface-inorganic coatings- classification- metallic coatings : anodic and cathodic coatings-hot dipping : galvanizing and tinning-electroplating—electroless plating – cementation (diffusion) : sherardizing, calorizing and chromizing – metal cladding-metal spraying – non metallic coatings (chemical conversion coatings) : phosphate, chromate, oxide coatings and anodizing – comparison of anodic and cathodic protection.

PRACTICALS

1. Determination and comparison of rate of corrosion of metals in the presence of acid, base and neutral medium by weight loss method.
2. Determination of rate of corrosion of iron in the presence of various acids by weight loss method.
3. Determination of rate of corrosion of iron in the presence and absence of anodic Inhibitor by weight loss method.
4. Determination of rate of corrosion of iron in the presence and absence of cathodic Inhibitor by weight loss method.
5. Electroplating of base metal with copper.
6. Electrolessplating of base metal with copper
7. Chemical conversion coatings such as chromate and phosphate coatings.
8. Demonstration on the study of rate of corrosion by using cyclic voltametry.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. P.C Jain & Monica Jain, Engineering Chemistry Dhanpatrai Publishing Company (P) Ltd., New Delhi (2013).
2. S S Umare & S S Dara, A text Book of Engineering Chemistry, S. Chand& Company Ltd, New Delhi, 2014.
3. M.G. Fontana and N.G. Green, Corrosion Engineering, McGraw Hill Book Company, NewYork, 1984.
4. S. Banerjee, A.K. Tyagi, Functional Materials- Preparation, Processing and Applications, ELSEVIER Publications, London ; Waltham, MA : 2011

OUTCOMES:

Students will be able to

- explain the mechanism, compare and enumerate the factors affecting corrosion
- describe and identify the place and types for a given situation.
- choose and elaborate the suitable organic coating method for a given real time situation.
- apply a suitable metallic coating for a given situation

CHCX03	ELECTRICAL MATERIALS AND BATTERIES	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students should be conversant with

- preparation, properties and applications of plastics used in electrical and electronic applications
- properties and uses of electrical engineering materials
- classification and description of different types of batteries.
- classification and types of fuel cells

MODULE I POLYMERS FOR ELECTRICAL AND ELECTRONIC APPLICATIONS **8**

Preparation, properties and applications **:** polyethylene, polypropylene, EPDM, Nylon-6,6, PVC, PTFE, polycarbonates, ABS, phenol formaldehyde, urea formaldehyde, epoxy resins – polymer blends and alloys.

MODULE II ELECTRICAL ENGINEERING MATERIALS **7**

Conductors: Silver, Copper, Gold, Aluminum – Semiconductors: Germanium, Silicon, Gallium Arsenic – Insulating Materials: Rubbers, Mica, Plastics, Ceramics, Insulating papers – Magnetic Materials: ferromagnetic materials, paramagnetic materials, diamagnetic materials, antiferromagnetic materials, ferrites

MODULE III BATTERIES **7**

Electrochemical and electrolytic cell – batteries: types (primary, secondary and flow cell) – primary batteries: dry cells, alkaline batteries – secondary batteries: nickel-cadmium cell – lead acid storage cell, lithium battery: primary and secondary type – solar cell – dye sensitized solar cell.

MODULE IV FUEL CELLS **8**

Difference between batteries and fuel cells - chemistry of fuel cells - types of fuel cell (based on temperature and electrolyte) – principle, characteristic features, advantages, disadvantages and applications of polymer electrolyte membrane or proton exchange membrane fuel cell (PEMFC), direct methanol fuel cell (DMFC), alkaline fuel cell (AFC), phosphoric acid fuel cell (PAFC), molten carbonate fuel cell (MCFC) and solid oxide

fuel cells (SOFC).

PRACTICALS

1. Free radical polymerization of styrene.
2. Free radical polymerization of PMMA.
3. Preparation of phenol-formaldehyde.
4. Preparation of urea-formaldehyde.
5. Synthesis of epoxy resin.
6. Demonstration of mechanical properties of insulating materials using UTM
7. Demonstration of electrical properties of insulating materials
8. Construction of batteries using natural resources
9. Measurement of EMF for different batteries.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Jain P.C. and Renuka Jain, Engineering Chemistry, Dhanpat Rai Publication Co. (P) Ltd., New Delhi, 2013.
2. Michael L. Berins, Plastics Engineering Hand Book, 5th Edition, Chapman and Hall, New York, 1991.
3. H.F. Mark and N. Gaylord, Encyclopedia of Polymer Science and Technology, Vol. 1 to XIV Interscience, 2nd Ed. 1988.
4. Gowarikar V.R., Viswanathan N.V and Jayadev Sreedhar, Polymer Science, Wiley Eastern Limited, Madras, 1981.
5. R.K. Rajput,A Textbook of Electrical Engineering Materials, Firewall Media, 2004
6. Vladimir S. Bagotsky, Fuel Cells: Problems and Solutions, 2nd Edition, John Wiley and Sons, 2012.
7. B. Viswanathan and M. Aulice Scibioh, Fuel Cells: Principles and Applications, Taylor and Francis Group, 2007.

OUTCOMES:

The student will be able to

- summarise the preparation, properties and applications of plastics used in electrical and electronic applications
- enumerate the properties and uses of electrical engineering materials
- illustrate various types of batteries with the aid of a diagram
- classify the fuel cells and elaborate the different types of fuel cells.

CHCX04	ENGINEERING MATERIALS	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students should be conversant with

- properties and uses of different types of refractories and abrasives
- adhesives, cements and lime, setting of cements and their chemical behaviors.
- types, properties and uses of lubricants.
- various types of composite materials.

MODULE I REFRACTORIES AND ABRASIVES **8**

Introduction refractory: -classification - based on chemical nature- characteristic and selection of good refractory - general manufacture of refractory- preparation properties and uses of: silica refractory - magnesite refractory - zirconia refractory, properties of refractories: refractoriness - refractoriness under load - thermal spalling - porosity and dimensional stability, Cermets - super refractory.

Abrasives : introduction - Moh's scale - natural abrasives: diamond – corundum – emery - garnet and quartz, synthetic abrasives: preparation properties and uses: carborundum (silicon carbide)– alundum - boron (norbide) carbide

MODULE II ADHESIVES AND BINDING MATERIALS **7**

Introduction - classification of adhesives –advantage –limitation of adhesive bonding – development of adhesive- factors influencing adhesive action: chemical and physical, application techniques of adhesive – Lime: classification – manufacture - setting and hardening, Gypsum: -Manufacture and properties and uses - Cement : chemical composition- Manufacture – setting and hardening – concrete – weathering of cement and concrete and its prevention- special cements: high alumina cement - sorel cement - white portland cement – water proof cement.

MODULE III LUBRICANTS **7**

Introduction –functions of lubricant- mechanism of lubrication - classification of lubricant – liquid lubricant: vegetable and animal oils – mineral oils, semisolid: grease(calcium, lithium, aluminium) – petroleum jelly, solid lubricant: graphite - molybdenum disulphide, Properties of lubricant: viscosity - viscosity index - flash point and fire point - cloud point and pour point – oiliness - aniline point - carbon residue.

MODULE IV COMPOSITE MATERIALS 7

Introduction – advantageous characteristics of composites, applications of composites, main constituent of composites, types and applications of composites: RCC fibre-reinforced plastics (glass , carbon and aramid) - particulate composite - metal matrix composite - layered composites - failures in fibre-reinforced composites, ceramic matrix composites (CMC) – properties and applications.

PRACTICALS

1. Preparation of refractory bricks
2. Preparation of abrasive papers/cloth
3. Preparation of simple adhesives
4. Estimation of alkalinity in cements
5. Determination of cloud point and pour point
6. Determination of flash point and fire point
7. Preparation of fibre-reinforced composite

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. P.C Jain & Monica Jain, Engineering Chemistry Dhanpatrai Publishing Company (P) Ltd., New Delhi (2013).
2. B.Sivasnakar, “Engineering Chemistry”, Tata McGrow-Hill Publication Limited, New Delhi, second reprint 2008.
3. Engineering Chemistry, Wiley India Editorial Team, Willey India Publisher, New Delhi, 2011.
4. S S Umare & S S Dara, A text Book of Engineering Chemistry, S. Chand& Company Ltd, New Delhi, 2014.

OUTCOMES:

The student will be able to

- classify and describe the manufacture the refractories and enumerate the properties and uses of abrasive materials.
- elaborate the manufacture, properties and uses of various adhesives and binding materials.
- classify lubricants and describe the properties and uses of them
- enumerate the properties and uses of various composite materials.

CHCX05	FUELS AND COMBUSTION	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make the students conversant with the

- three types of fuels available and the different processes involved in it.
- analysis of fuel characteristics and manufacture of fuels
- calculations involved in calorific values and minimum air requirement for complete combustion.
- classification, functions, mechanism and properties of lubricants.

MODULE I SOLID FUELS **7**

Characteristics of good fuel. Solid fuel – Wood, Coal – Ranking of coal – selection of coal. Analysis of coal – Proximate analysis. Pulverized coal – Metallurgical coke – Carbonization of coal – types. Manufacture of metallurgical coke – Beehive oven and Otto Hoffman's by-product oven methods.

MODULE II LIQUID AND GASEOUS FUELS **8**

Liquid fuel: Petroleum: Refining of petroleum, Liquid fuels derived from petroleum – Cracking: Thermal (Liquid and Vapour phase) – Catalytic (fixed bed and moving bed cracking – Synthetic petrol: Fischer-Tropsch method– Knocking in petrol and diesel engine: octane number and antiknocking – cetane number and improvement of cetane number – biodiesel (trans-esterification) – Gaseous fuels: Compressed natural gas (CNG) – LPG – oil gas – producer gas – water (blue) gas – biogas.

MODULE III COMBUSTION **8**

Calorific value: Gross and net caloric value – Bomb Calorimeter, Gas calorimeter - Definition of combustion – calculation of minimum requirement of air (problems) – theoretical calculation of calorific values (Dulong's formula), Gross and net calorific values ((problems) – Analysis of flue gas: Orsat's gas analysis method, explosive range, Ignition temperature. Introduction to air pollution from IC (Internal combustion) engines, photochemical smog, primary and secondary pollutants.

MODULE IV LUBRICANTS **7**

Friction and wear – lubricants: definition, functions and mechanism of lubrication

(thick film and thin film) –classification: liquid lubricants: animal and vegetable origin, mineral oil, blended oils, lubricating emulsions and silicones – properties of lubricating oils: viscosity and viscosity index; Flash and fire-point, Cloud and pour point, oiliness, emulsification number, volatility, carbon residue, aniline point – semisolid lubricant: greases and waxes – solid lubricant: graphite and molybdenum disulphide –nanolubricants.

PRACTICALS

1. Testing of fuels - proximate analysis (moisture, volatile matter, ash content and fixed carbon present in coal, coke, charcoal etc)
2. Ash content and carbon residue test
3. Biodiesel synthesis by trans-esterification method (from coconut, groundnut, mustard oil, palm oil)
4. Determination of calorific value of a solid fuel using Bomb calorimeter (coal, charcoal, coke etc)
5. Determination of calorific value of a liquid fuel using Bomb calorimeter (petrol, diesel, biodiesel etc)
6. Determination of cloud point and pour point of a lubricant
7. Determination of flash and fire point of diesel.
8. Aniline Point of diesel
9. Viscosity Index of lubricants and Fuels by Viscometer
10. Flue gas analysis by Orsat's gas analysis method – Demonstration
11. Working of internal combustion engine – Demonstration

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai and Sons, New Delhi, 2001.
2. Engineering Chemistry, Wiley India Editorial Team, Willey India Publisher, New Delhi, 2011.
3. John Griswold, Fuels Combustion and Furnaces, Mc-Graw Hill Book Company Inc. University of Michigan, 1946.
4. J.B. Heywood, Internal Combustion Engine Fundamentals, McGraw Hill International Editions, 1989.
5. Bahl B.S., Tuli and Arun Bahl, Essentials of Physical Chemistry, S. Chand and Company Ltd., New Delhi, 2004.

OUTCOMES:

The students will be able to

- compare and contrast the solid, liquid and gaseous fuels and also describe the processes involved in liquid and gaseous fuels.
- analyse the fuel properties such as moisture, votalite matter, ash content, calorific value etc
- calculate minimum air required for complete combustion and calorific values of fuels.
- categorize different lubricants into three types, explain the preparation and determine their properties.

CHCX06	FUNDAMENTALS OF PHYSICAL CHEMISTRY	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students will be conversant with the

- various thermodynamic terms and relate the laws of thermodynamics in chemical processes
- molecularity and order of reaction and derive the rate constant for different order of reactions
- basics of adsorption of different materials and propose mechanisms and surface area measurement
- conditions for equilibrium and learn different components at equilibrium

MODULE I BASIC THERMODYNAMICS **8**

Introduction - Thermodynamic terms - Thermodynamic equilibrium and processes - 1st law of thermodynamics: internal energy, enthalpy, heat capacity, isothermal and adiabatic expansion, Joule-Thomson effect - Zeroth law of thermodynamics: absolute temperature - 2nd law of thermodynamics: - spontaneous and cyclic process, Entropy in isothermal, isobaric and isochoric processes, work and free energy function, Maxwell's relation - 3rd law of thermodynamics

MODULE II CHEMICAL KINETICS **8**

Rate of chemical reaction - order and molecularity of a reaction - Rate constant - kinetics of opposing, parallel and consecutive and chain reactions - isotope effects - effect of temperature on reaction rate - collision theory - absolute reaction rate theory - kinetics in enzyme catalysis

MODULE III SURFACE SCIENCE AND CATALYSIS **8**

Adsorption - adsorption isotherms - uni and bimolecular adsorption reactions - parahydrogen conversion - factors affecting adsorption – Langmuir adsorption isotherm - Hinshelwood mechanism and *Eley-Rideal* mechanism with example - adsorption of gases on solids and surface area measurement by BET method - Terms in catalysis - homogeneous and heterogeneous and enzyme catalysis with example

MODULE IV PHASE RULE 6

Terms involved - Conditions for equilibrium - application of phase rule to water, lead-silver system, freezing mixtures, thermal analysis: cooling curves.

PRACTICALS

1. Determination of the heat capacity of benzoic acid, internal energy of combustion of camphor using Bomb calorimeter. Calculation of enthalpy of combustion and formation for camphor.
2. Determination of adsorption isotherm of (i) acetic acid on charcoal (ii) oxalic acid on charcoal.
3. *Kineticsoffirst and second order reactions.*
4. Phase rule experiments with organic compounds: (i) naphthalene and p-dichloro benzene (ii) naphthalene and diphenyl (iii) m-dinitrobenzenzene and p-nitro toluene.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Rajaram J. and Kuriacose J.C., Chemical Thermodynamics: Classical, Statistical and Irreversible, Pearson Education, India, 2013.
2. Samuel Glasstone, Thermodynamics for Chemists, Read Books, United Kingdom, 2007.
3. James E. House, Principles of Chemical Kinetics, 2nd Edition, Academic Press, United States of America, 2007.
4. Keith J. Laidler, Chemical Kinetics, Pearson Education, India, 1987.
5. Douglas M. Ruthven, Principles of Adsorption and Adsorption Processes, John Wiley & Sons, 1984.
6. Puri B.R., Sharma L.R. and Pathania M.S., Principles of Physical Chemistry, 47th Edition, Vishal Publishing Co. India, 2016.

OUTCOMES:

The student will be able to

- calculate entropy, enthalpy and free energy change for different chemical processes
- calculate the rate constant for any chemical and biochemical processes
- differentiate the adsorption processes and calculate the surface area and predict the suitability of catalysts for different chemical processes

- predict the equilibrium conditions for water, alloys, freezing mixtures and draw the thermal curves for phase transition

CHCX07	GREEN TECHNOLOGY	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make students conversant with the

- basic principles of green chemistry and green technology.
- wastes that causes hazards to human health
- chemicals that harms our environment
- need for green processes in various industries

MODULE I GREEN CHEMISTRY PROTOCOL **7**

Need – Significance – 12 Principles with examples – R4 model – Life cycle analysis – sustainable and cleaner production - Green Technology: definition, examples: CFC free refrigerants, green building, energy, 3D printers, nanotechnology – Awards for Green chemistry – organization promoting green chemistry.

MODULE II WASTE & WASTE MINIMISATION **8**

Source of wastes: domestic, industrial, medical, nuclear, e-waste; problems; prevention – economy of waste disposal – Waste minimization techniques: general waste treatment and recycling – alternate waste water treatment technologies: hybrid process – Green computing: goals, green cloud, green ICT - Pollution statistics from various industries (Industrial case studies).

MODULE III GREEN SYNTHESIS **7**

Introduction - Solvent free reactions - green reagents, green solvents in synthesis - microwave and ultrasound assisted reactions – supercritical fluid extraction – green oxidation and photochemical reactions – catalyst and biocatalysts.

MODULE IV GREEN INDUSTRIAL PROCESSES **8**

Polymer industry: biodegradable polymer - textile industry: greener approaches of dyeing, waste disposal – ecofriendly agrochemicals: biofertilizers, biopesticides – Pharmaceutical industry: atom economy, reduction of toxicity, use of biocatalyst, zero waste disposal – Leather industry: greener process in tanning, crusting, surface coating – ecofriendly batteries & fuel cells.

PRACTICALS

1. Synthesis of an ionic liquids (Ex: imidazolium) and testing the solubility of organic

chemicals.

2. Green bromination of stilbene (using pyridine hydrobromide).
3. Green synthesis: Photocatalytic reactions, solvent-free organic reaction – Aldol; green oxidation, green reduction.
4. Microwave assisted chemical reaction. (synthesis of aspirin, pinacol-pinacolone reaction, etc).
5. Comparison of conventional reaction with microwave assisted reactions (atom economy, solvent, etc) [Ex: aldehyde and ketones with hydrazines to give hydrazones].
6. Diels-Alder reaction in eucalyptus oil (green process).

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai and Sons, New Delhi. 2001.
2. V. K. Ahluwalia, Green Chemistry: Environmentally Benign Reactions, Ane Books India, New Delhi, 2006.
3. Paul Anastas, John C.Warner, John Warner Joint; Green Chemistry: Theory & Practice New Ed Edition; Oxford University press, USA, 2000.
4. Rashmi Sanghi, M. M. Srivastava, Green chemistry, Narosa publishers, New Delhi, 2003.

OUTCOMES:

The students will be able to

- outline the principles and implications of green chemistry.
- comprehend the potential risks of waste generated and analyse the threats to human and environment.
- integrate information into design of molecules to avoid/eliminate toxic solvents & reagents or reduce toxic products.
- identify various alternate greener technologies for various industries.

CHCX08	ORGANIC CHEMISTRY OF BIOMOLECULES	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make students conversant with the

- basic concepts in organic chemistry
- types and structure of carbohydrates and lipids
- formation of different structures of proteins from amino acid
- structure of nucleic acids

MODULE I BASIC CONCEPTS IN ORGANIC CHEMISTRY **8**

Classification and IUPAC nomenclature of organic compounds – stereochemistry – optical, stereo and geometrical isomerism – types of reagents: electrophiles and nucleophiles – types of reactions: addition, substitution, elimination and rearrangement reactions.

MODULE II CARBOHYDRATES, LIPIDS AND VITAMINS **7**

Structure and functions of carbohydrates: mono, di, oligo and polysaccharides – lipids: phospholipids, glycolipids, sphingolipids – cholesterol – steroids – Structure, functions and deficiency disorders of fat soluble vitamins: A, D, E & K - Water soluble vitamins B & C: Thiamine, riboflavin, pantothenic acid, niacin, pyridoxine, biotin, cobalamine, folic acid and ascorbic acid.

MODULE III AMINO ACIDS, PEPTIDES AND PROTEINS **7**

Aminoacids: classification, properties - peptides – polypeptides – proteins: primary, secondary, tertiary and quaternary structure – glycoproteins – lipoproteins – Enzymes: classification and functions

MODULE IV NUCLEIC ACIDS **8**

Nucleic acids – importance - structure of purines and pyrimidines – nucleotides – polynucleotides - RNA – types & structure - DNA – phosphodiester bonds – chemical, helical structure and functions – DNA replication – gene modification.

PRACTICALS

1. Qualitative tests to identify carbohydrates.

2. Quantitative estimation of carbohydrates.
3. Separation of sugars – TLC and/or paper chromatography.
4. Quantitative estimation of lipids.
5. Separation of amino acids – TLC and/or paper chromatography.
6. Quantitative estimation of proteins by Lowry's method.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. V. K. Ahluwalia, Organic Reaction Mechanism, Narosa Publishers, New Delhi, 2002.
2. Johnson Arthur T., Biology for Engineers, CRC Press, Finland, 2011.
3. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai and Sons, New Delhi. 2001.
4. David L. Nelson, Michael M. Cox, Lehninger Principles of biochemistry, Macmillan press, London, 2010

OUTCOMES:

The students will be able to

- classify organic compounds and explain the mechanism of various organic reactions.
- draw the structures and enumerate the functions of carbohydrate, lipids and vitamins.
- correlate the relationship among amino acids, peptides and proteins.
- recognize the role of nucleic acid in the formation of RNA & DNA and differentiate DNA & RNA using their structure and function.

CHCX09	POLYMER SCIENCE AND TECHNOLOGY	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make the student conversant with the

- basic concepts of polymers, classification, types of polymerization and molecular weight & its distribution
- preparation, properties and applications of thermoplastics and introduction to biodegradable polymers
- properties and applications of thermosets, elastomers and FRP
- different types of moulding techniques

MODULE I BASIC CONCEPTS OF POLYMERS **8**

Definitions: monomer, polymer, functionality, degree of polymerization – classification of polymers: source, structure, application, thermal processing behavior (thermoplastics and thermosets), composition and structure (addition and condensation), mechanism (chain growth and step-wise growth) – copolymer: types – Definition –nomenclature of polymers – tacticity – types of polymerization : free radical, cationic and anionic polymerization (concepts only) – average molecular weight of polymer: number, weight – molecular weight distribution (problems)

MODULE II THERMOPLASTICS AND BIODEGRADABLE POLYMERS **8**

Preparation, properties and applications : LDPE, HDPE, polypropylene, PVC, PTFE, PET, polyamides (Nylon-6 and Nylon 6,6) and polycarbonates – polymer blends and alloys – basics of biodegradable polymers.

MODULE III THERMOSET RESINS, ELASTOMERS AND FRP **7**

Thermoset resins : phenolic resins, amino resins (urea and melamine formaldehyde), epoxy resins, unsaturated polyesters – polyurethanes – elastomers : vulcanization of natural rubber, diene based elastomers –fibre reinforced plastics: glass, aramid and carbon.

MODULE IV MOULDING TECHNIQUES 7

Moulding constituents**:** functions – moulding techniques**:** compression, injection, extrusion (single screw), blow moulding, thermoforming, (mechanical and vacuum forming), lamination.

PRACTICALS

1. Determination of molecular weight and degree of polymerization using Oswald's viscometer.
2. Free radical polymerization of styrene.
3. Free radical polymerization of PMMA.
4. Preparation of phenol-formaldehyde.
5. Preparation of urea-formaldehyde.
6. Synthesis of epoxy resin.
7. Synthesis of unsaturated polyester.
8. Preparation of FRP laminates.
9. Demonstration of injection moulding, compression moulding and blow moulding.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Billmeyer F.N., Text Book of Polymer Science, 3rd Edition, John Wiley and Sons, New York, 1994.
2. George Odian, Principles of Polymerisation, 3rd Edition, McGraw Hill Book Company, New York, 1991.
3. Michael L. Berins, Plastics Engineering Hand Book, 5th Edition, Chapman and Hall, New York, 1991.
4. Jacqueline I., Kroschwitz, Concise Encyclopedia of Polymer Science and Engineering, John Wiley and Sons, New York, 1998.
5. Encyclopedia of Polymer Science and Technology, Vol. 1 to XIV, H.F. Mark and N. Gaylord, Interscience, 2nd Ed. 1988.
6. Gowarikar V.R., Viswanathan N.V and Jayadev Sreedhar, Polymer Science, Wiley Eastern Limited, Madras, 1981.

OUTCOMES:

The student will be able to

- classify various polymers, name the polymers and types of polymerization

reactions, calculate molecular weight of polymers,

- summarise preparation, properties and applications of thermoplastics and give examples of biodegradable polymers
- elaborate the properties and applications of thermosets, elastomers and FRP
- select the appropriate moulding technique for a given polymer, based on the application

Maths Elective Courses

(to be offered in IV Semester)

		L	T	P	C
MACX 01	**DISCRETE MATHEMATICS AND GRAPH THEORY**	**3**	**1**	**0**	**4**

OBJECTIVES:

The aims of this course are to

- introduce Logical and Mathematical ability to deal with abstraction.
- familiarize the basic mathematical ideas and terminologies used in computer science.
- translate real life situations into diagrammatic representations.

MODULE I PROPOSITIONAL CALCULUS 8

Propositions – Logical connectives – Compound propositions – Conditional and biconditional propositions – Truth tables – Tautologies and contradictions – Contrapositive – Logical equivalences and implications – DeMorgan's Laws – Normal forms – Principal conjunctive and disjunctive normal forms – Rules of inference – Arguments – Validity of arguments.

MODULE II PREDICATE CALCULUS 7+3

Predicates – Statement function – Variables – Free and bound variables – Quantifiers – Universe of discourse – Logical equivalences and implications for quantified statements – Theory of inference – The rules of universal specification and generalization – Validity of arguments.

MODULE III FUNCTIONS 7+3

Functions – Classification of functions –– Composition of functions – Inverse functions – Binary and n–ary operations – Characteristic function of a set – Hashing functions – Recursive functions – Permutation functions.

MODULE IV ALGEBRAIC SYSTEMS 8+2

Groups, Cyclic Groups, Subgroups, Cosets, Lagrange's theorem, Normal subgroups – Codes and group codes – Basic notions of error correlation – Error recovery in group codes.

MODULE V GRAPH THEORY 7+3

Graphs – incidence and degree – subgraphs – isomorphism – complement of a graph – operations on graphs

MODULE VI PATH AND CIRCUIT 8+2

Walks, trails and paths – Eulerian graphs – Konigsburg bridge problem - Hamiltonian graphs

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1 Trembly J.P and Manohar R, “Discrete Mathematical Structures with Applications to Computer Science”, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, 30th Reprint 2011.

2 Kenneth H.Rosen, “Discrete Mathematics and its Applications:, 7th Edition, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, Special Indian Edition, 2011.

REFERENCES:

1 Ralph.P.Grimaldi, “Discrete and Combinatorial Mathematics: An Introduction”, 4th Edition, Pearson Education Asia, Delhi, 2007.

2 Thomas Koshy, “Discrete Mathematics with Applications”, Elsevier Publications, 2006.

3 C.L.Liu, D.P.Mohapatra, “Elements of Discrete Mathematics”, 4th Edition, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, 2012.

OUTCOMES:

At the end of the course, student will be able to

- use the concepts of propositional calculus.
- use the concepts of predicate calculus.
- identify types of functions and their importance.
- decode and encode the messages using group theory concepts.
- apply the basic concepts of graph theory.
- represent some real life situations into diagrammatic representation.

MACX 02 PROBABLITY AND STATISTICS L T P C
3 1 0 4

OBJECTIVES:

The aims of this course are to impart the

- knowledge of the theory of probability and random variables
- techniques to carry out probability calculations and identifying probability distributions
- application of statistical inference in practical data analysis

MODULE I BASICS OF PROBABILITY AND STATISTICS 8+2

Sample space, events- axioms of probability and interpretation – Addition, multiplication rules – conditional probability, Independent events - Total probability – Baye's theorem - Descriptive Statistics.

MODULE II ONE DIMENSIONAL RANDOM VARIABLE AND PROBABILITY DISTRIBUTION FUNCTIONS 7+3

Discrete random variable –continuous random variable – Expectation - probability distribution - Moment generating function – Binomial, Poisson, Geometric, Uniform (continuous), Exponential and Normal distributions.

MODULE III TWO DIMENSIONAL RANDOM VARIABLES 8+2

Joint, marginal, conditional probability distributions –covariance, correlation - transformation of random variables.

MODULE IV SAMPLING AND ESTIMATION 7+3

Sampling distributions – basic knowledge on Random , simple random , stratified and cluster samplings – Test of Hypotheses - concepts- Point estimation and Interval estimation.

MODULE V THEORY OF INFERENCE 8+2

Large sample tests – test for single and difference on proportions, single mean, difference of means, difference of variances – confidence intervals. Small sample tests – Student's t test, F test and Chi square test on theory of goodness of fit and analyses of independence of attributes.

MODULE VI DESIGN OF EXPERIMENTS 7+3

Analysis of variance – one way classification – two way classification – Completely

Randomised Block Designs – Randomised Block Design – Latin square designs - Interpretations - case studies.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. T.Veerarajan, “Probability and Statistics”, Tata McGraw-Hill Education, 2008.
2. Miller, I., Miller, M.,Freund, J. E., “Mathematical statistics”, 7th Edition, Prentice Hall International, 1999.
3. S.P.Gupta, “Applied Statistics”, Sultan Chand & Sons

REFERENCES:

1. S.M.Ross, “Introduction to Probability and Statistics for Engineers and Scientists” Fifth Edition, Elesvier.
2. S.C.Gupta and V.K.Kapoor, “Fundamentals of Mathematical Statistics” First edition, Sultan Chand and Sons.
3. Arora and Arora, “Comphrensive Statistical Methods”, S. Chand, 2007

OUTCOMES:

On completion of the course, students will be able to

- do basic problems on probability and descriptive statistics.
- derive the probability mass / density function of a random variable.
- calculate probabilities and derive the marginal and conditional distributions of bivariate random variables.
- calculate point and interval estimates.
- apply some large sample tests and small sample tests.
- carry out the data collection representation analysis and implications and the importance of inferences.

MACX 03	RANDOM PROCESSES	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aims of the course are to

- acquire the knowledge of the theory of probability and random variables
- study discrete and continuous probability distributions.
- demonstrate the techniques of two dimensional random variables and its distributions.
- introduce the random process, stationarity, Markov process and the study of correlation function and spectral analysis.

MODULE I Basics of Probability 7+3

Sample space, events- axioms of probability and interpretation – Addition, multiplication rules – conditional probability, Independent events - Total probability – Baye's theorem - Tchebychev's inequality.

MODULE II One dimensional Random variable and Probability Distribution functions 7+3

Discrete random variable –continuous random variable – Expectation - probability distribution - Moment generating function – Binomial, Poisson, Geometric, Uniform (continuous), Exponential and Normal distributions.

MODULE III Two dimensional random variables 7+3

Joint, marginal, conditional probability distributions - covariance, correlation and regression lines - transformation of random variables.

MODULE IV RANDOM PROCESSES 8+2

Classification of Random process - Stationary process - WSS and SSS processes - Poisson process – Markov Chain and transition probabilities.

MODULE V CORRELATION FUNCTIONS 8+2

Autocorrelation function and its properties - Cross Correlation function and its properties - Linear system with random inputs – Ergodicity.

MODULE VI SPECTRAL DENSITY 8+2

Power spectral Density Function - Properties - System in the form of convolution - Unit Impulse Response of the System – Weiner-Khinchine Theorem - Cross Power

Density Spectrum.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Veerarajan T., “Probability, Statistics and Random Processes”, Tata McGraw Hill,3rd edition, 2008.
2. Papoulis, “Probability, Random Variables and Stochastic Processes”, 4th Edition, Tata McGraw Hill Company, 2002.
3. S.M.Ross, “Introduction to Probability and Statistics for Engineers and Scientists” Fifth Edition, Elesvier

REFERENCES:

1. Scott L. Miller,Donald G. Childers, Probability and Random Processes, Academic Press,2009.
2. Trivedi K S, “ Probability and Statistics with reliability, Queueing and Computer Science Applications”,Prentice Hall of India,New Delhi,2nd revised edition, 2002

OUTCOMES:

On completion of the course, students will be able to

- do basic problems on probability.
- derive the probability mass / density function of a random variable.
- calculate probabilities and derive the marginal and conditional distributions of bivariate random variables.
- identify and study the different random processes.
- compute correlation functions and related identities.
- compute power spectral density functions and apply Weiner-Khinchine formula.

MACX 04 APPLIED NUMERICAL METHODS L T P C
3 1 0 4

OBJECTIVES:

The aims of the course are to

- introduce basic computational methods for analyzing problems that arise in engineering and physical sciences.
- acquire knowledge about approximation theory and convergence analysis associated with numerical computation.

MODULE I NUMERICAL SOLUTIONS OF EQUATIONS 7+3

Bisection method - Regula Falsi method – Secant method - Fixed point iteration method - Newton's Raphson method –Gauss Elimination method - Gauss-Jordon method – Gauss Jacobi method - Gauss-Seidel method.

MODULE II INTERPOLATION 8+2

Finite difference operators – Gregory Newton's forward and backward interpolations – Cubic spline interpolation - Lagrange interpolation - Newton's divided difference formula.

MODULE III NUMERICAL DIFFERENTIATION AND INTEGRATION 8+2

Numerical differentiation using Newton's forward and backward formulae – Numerical integration : Trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Gaussian Two Point and Three Point Quadrature formulae – Double integrals using Trapezoidal and Simpson's 1/3 rule.

MODULE IV INITIAL VALUE PROBLEMS FOR FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS 7+3

Numerical solutions by Taylor's Series method, Euler's method, Modified Euler's Method - Runge – Kutta Method of fourth order – Milne's and Adam's Bashforth Predictor and Corrector methods

MODULE V INITIAL AND BOUNDARY VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 8+2

Numerical solutions by Taylor's Series method - Runge – Kutta Method of fourth order of second order ODE. Finite difference methods.

MODULE VI BOUNDARY VALUE PROBLEMS FOR PARTIAL DIFFERENTIAL EQUATIONS **7+3**

Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace equation.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Grewal, B.S., “Numerical methods in Engineering and Science”, 7th edition, Khanna
   Publishers, 2007.
2. C.F.Gerald, P.O.Wheatley, “Applied Numerical Analysis” ,Pearson Education, New Delhi, 2002.

REFERENCES:

1. Chapra S.C, Canale R.P. “Numerical Methods for Engineers”, 5th Ed., McGraw Hill, 2006.
2. M.K.Jain, S.R.K.Iyengar, R.K.Jain, “Numerical methods for Scientific and Engineering Computation”, New Age International Publishers, New Delhi, 2003

OUTCOMES:

At the end of this course, students will be able to

- solve algebraic, transcendental and system of equations.
- apply interpolation techniques.
- carry out numerical differentiation and integration using different methods.
- solve first order ODE using single and multi step methods.
- solve second order ODE, initial and boundary value problems.
- solve the boundary value problems in PDE.

Maths Elective Courses
(To be offered in VI Semester)

MACX 05	MATHEMATICAL PROGRAMMING	L	T	P	C
		2	0	0	2

OBJECTIVES:

The aims of the course are to

- acquire knowledge and training in optimization techniques.
- obtain knowledge about optimization in utilization of resources.
- understand and apply operations research techniques to industrial operations.

MODULE I LINEAR PROGRAMMING PROBLEM 10

Linear programming – formulation of the problem - graphical interpretation of optimality - Simplex method – to obtain basic feasible solution – types of linear programming solution – complications and their resolution.

MODULE II ADVANCED LINEAR PROGRAMMING PROBLEMS 8

Artificial variable - Big M method – Two phase method – alternative optimal solution – unbounded solution - Duality – primal dual relationships.

MODULE III TRANSPORTATION PROBLEM 7

Transportation problems – Initial basic feasible solutions, MODI method, Unbalanced transportation problem, Degeneracy in transportation models,.

MODULE IV ASSIGNMENT PROBLEM 5

Assignment problem – Minimization and Maximization type of problems by Hungarian method.

Total Hours –30

TEXT BOOKS:

1. Hamdy A Taha, “Operations Research - An introduction”, 8th edition, Phil Pearson, 2007.
2. Winston.W.L., “Operations Research”, 4th edition, Thompson-Brooks/Cole, 2003.

REFERENCES:

1. Wayne.L. Winston, “Operations Research Applications and Algorithms”,

4th edition, Thomson learning, 2007.

2. Frederick. S. Hiller and Gerald J Lieberman, “Operations Research Concepts and Cases”, 8th edition (SIE), Tata McGraw – Hill Pub. Co. Ltd., New Delhi, 2006.
3. A. Ravindran, D. T. Phillips and J. J. Solberg, "Operations Research: Principles and Practice", 2nd edition, John Wiley & Sons, New York, 1992.
4. Robertazzi. T.G., “Computer networks and systems-Queuing theory and performance evaluation”, 3rd edition, Springer, 2002.

OUTCOMES:

At the end of the course, students will be able to

- formulate industrial problems as mathematical programming problems.
- solve linear programming problems by different methods.
- solve transportation problems by different methods.
- solve assignment problems by Hungarian method.

MACX 06	STATISTICAL METHODS FOR DATA ANALYSIS	L	T	P	C
		2	0	0	2

OBJECTIVES:

The aim of the course is to

- introduce statistical quality control tools.

MODULE I TESTS OF HYPOTHESES AND STATISTICAL INFERENCES 8

Small sample tests – Student's ' t ' test for single mean , difference of means, paired t test – F test for difference of variances – Chi square test on theory of goodness of fit and analyses of independence of attributes.

MODULE II DESIGN OF EXPERIMENTS 7

Analysis of variance – one way classification – two way classification – Completely Randomised Block Designs – Randomised Block Design – Latin square designs - Statistical analysis -Interpretations - case studies.

MODULE III STATISTICAL QUALITY CONTROL-I 8

Quality improvement and statistics –Statistical quality control- statistical process control – control charts – design of control charts –analysis of patterns on control charts - X bar chart, R chart and S chart.

MODULE IV STATISTICAL QUALITY CONTROL-II 7

Process and product control – attribute charts – P, np and C charts – control charts performance.

Total Hours –30

TEXT BOOKS:

1. Douglas C.Montgomery, George C. Runger "Applied Statistics and probability for Engineers" V Edition – John Wiley & Sons Inc.
2. Miller, I., Miller, M., Freund, J. E. "Mathematical statistics" 7th Edition. Prentice Hall International, 1999.

REFERENCES:

1. Dekking, F.M., Kraaikamp, C., Lopuhaä, H.P., Meester, L.E. "A Modern Introduction to Probability and Statistics" Springer, 2nd Edition.
2. Chin Long chiang "Statistical Methods of Analysis "World Scientific Books,

2003.
3. S.C.Gupta and V.K. Kapoor, “Mathematical Statistics” , Sultan Chand publications.
4. Veerarajan “Fundamentals of Mathematical Statistics” I Edition, Yes Dee Publishing Pvt. Ltd., 2017.

OUTCOMES:

On completion of the course, students will be able to

- develop and test hypothesis for different statistical tests
- design an experiment and case study the experiment with different data.
- analyze the industrial data using quality control design tools statistically.
- analyze the industrial data using process and product control tools statistically.

MACX 07 NUMERICAL METHODS FOR INTEGRATION AND DIFFERENTIAL EQUATIONS

L	T	P	C
2	0	0	2

OBJECTIVES:

- This course aims to solve numerically integral and differential equations.

MODULE I NUMERICAL INTEGRATION 8

Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Two Point and Three point Gaussian quadrature formulae.

MODULE II NUMERICAL DOUBLE INTEGRATION 6

Double integrals using trapezoidal and Simpson's 1/3 rules

MODULE III NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS 8

Milne's Predictor and Corrector Method – Adam's Predictor-Corrector Method - Finite difference methods for two – point Boundary Value problems for Ordinary Differential Equations.

MODULE IV BOUNDARY VALUE PROBLEMS FOR PARTIAL DIFFERENTIAL EQUATIONS 8

Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace and Poisson equations

Total Hours –30

TEXT BOOKS:

1. M.K.Jain, S.R.K.Iyengar, R.K.Jain, "Numerical methods for Scientific and Engineering Computation", New Age International Publishers, New Delhi, 2003.
2. Grewal, B.S., "Numerical methods in Engineering and Science" 7th edition, Khanna Publishers, 2007

REFERENCES:

1. C.F.Gerald, P.O.Wheatley, "Applied Numerical Analysis" Pearson Education, New Delhi 2002.
2. P.Dechaumphai, N. Wansophark, "Numerical Methods in Engineering", Narosa Publications, 2012.

OUTCOMES:

At the end of the course students will be able to

- solve the integration by numerical methods.
- solve the double integration by numerical methods
- find numerical solution of ordinary differential equations in engineering problems.
- find numerical solution of partial differential equations in engineering problems.

MACX 08 MATHEMATICAL MODELLING L T P C
3 0 0 3

OBJECTIVES:

The aims of the course are to

- provide basic idea of formation and use of Mathematical models for different purposes.
- determine the extent to which models are able to replicate real-world phenomena under different conditions

MODULE I PRINCIPLES OF MATHEMATICAL MODELING 7

Mathematics as a modelling language - Classification of models - Building, studying, testing and using models - Black and white box models – Difference equations

MODULE II PHENOMENOLOGICAL MODELS 7

Linear, Multiple linear and nonlinear regression - Neural networks - Fuzzy model - Stability and higher dimensional systems

MODULE III MECHANISTIC MODELS –I 8

Setting up ODE models – Initial and Boundary value problems - Numerical solutions - Fitting ODE to data - Applications

L T P C
2 0 0 2

MODULE IV MECHANISTIC MODELS –II 8

Linear and nonlinear equations - Elliptic, parabolic and hyperbolic equations - Closed form solutions - Finite difference and finite element methods

Total Hours –30

TEXT BOOKS:

1. G . Ledder , “Calculus, modelling , probability and dynamic systems”, Springer 2013
2. Kei Velten, “Mathematical modelling and simulation”, J. Wiley and sons,2009

REFERENCES:

1. Michael D Alder, “An introduction to Mathematical modelling”, Heaven for Books.com
2. Alfio Quarteroni, “Mathematical models in science and engineering”, Notices of AMS
3. J.N. Kapur, “Mathematical models in Biology and Medicine”, Affiliated East-

West Press Private Limited, New Delhi, 1992.

OUTCOMES:

On completion of the course, the students will be able to

- identify the relationship between real world and mathematical models
- Classify the data and choose the appropriate model
- Distinguish between linear and nonlinear models
- identify the relationship between empirical and mechanistic models

MACX 09 **GRAPH THEORY** **L T P C**

3 0 0 3

OBJECTIVES:

The aims of this course are to

- represent the real life situations diagrammatically.
- appraise different methods to find solutions to graph theory problems.

MODULE I INTRODUCTION TO GRAPH THEORY 8

Graphs - finite and infinite graphs - Incident and degree-isolated vertex, pendent vertex and null vertex.

MODULE II PATH AND CIRCUIT 8

Isomorphism – sub graphs-walks, paths and circuits – connected and disconnected graphs- Euler graphs – operation on a graph.

MODULE III TREES AND FUNDAMENTAL CIRCUITS 7

Trees- some properties of trees- pendent vertices in a tree – rooted binary tree-spanning trees-fundamental circuits.

MODULE IV CUT SETS AND CUT VERTICES

Cut sets – some properties of cut sets- fundamental circuits and cut sets-network flows.

Total Hours –30

TEXT BOOKS:

1. NARSINGH DEO, Graph theory with applications to Engineering and Computer Science, Prentice Hall INC, New Delhi,
2. J.A. Pondy and U.S.R. Murthy, North Holland, Oxford, New York Graph theory with applications

REFERENCES:

1. Trembly J.P and Manohar R, “Discrete Mathematical Structures with Applications to Computer Science”, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, 30th Reprint 2011
2. Kenneth H.Rosen, “Discrete Mathematics and its Applications”, 7th Edition, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, Special Indian Edition, 2011

3. Md. Saidur Rahman, “Basic graph theory”, Springer, 2017

OUTCOMES:

At the end of the course, students will be able to

- demonstrate the basic concepts of Graph theory.
- explore connected and disconnected graphs.
- identify the real life problems with trees and circuits.
- bring out the cut set properties and network flows properties.

Humanities Elective I

(To be offered in III Semester)

		L	T	P	C
SSCXO1	**FUNDAMENTALS OF ECONOMICS**	**2**	**0**	**0**	**2**

OBJECTIVES:

- To identify and present the basic concepts of demand, supply and equilibrium.
- To explain and discuss the types and concepts of national income and inflation.
- To illustrate the fundamental concepts of money, banking and public finance.
- To apprise the students about Indian economy and the role of engineers in economic development.

MODULE I DEMAND AND SUPPLY ANALYSIS 8

Classification of economy – open and closed economy, Demand - Types of demand - Determinants of demand – Law of Demand - Demand elasticity - Supply - Determinants of Supply – Law of Supply - Supply elasticity - Pricing strategies.

MODULE II NATIONAL INCOME AND INFLATION 7

Concepts of National income and measurement – Importance and difficulties of estimating National Income in India - Aggregate demand and aggregate supply, Macroeconomic equilibrium – meaning of inflation- types - causes and preventive measures

MODULE III MONEY, BANKING AND PUBLIC FINANCE 9

Money – Meaning, types, functions, importance - Commercial Banks - Central Bank - Monetary policy – meaning, objectives, Methods of Credit Control By RBI, Government Budget – Government revenue and Expenditures – Fiscal policy - Its objectives, instruments and limitations - Deficit Financing - The Fiscal Responsibility and Budget Management Act, 2003 (FRBMA) .

MODULE IV INDIAN ECONOMY AND THE ROLE OF ENGINEERS 6

Economic reforms – Liberalization, Privatization and Globalization - challenges and opportunities, Engineers – Engineers' contributions to the economic growth.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Dutt and Sundharam (2013), *Indian Economy*, S. Chand & Company Pvt. Ltd, New Delhi.
2. Hussain, Moon Moon (2015), *Economics for Engineers*, Himalaya Publishing House, New Delhi.

REFERENCES:

1. Cleaver Tony (2004), "*Economics: The Basics*", Routledge, London.
2. Mell Andrew and Walker Oliver (2014), "*The Rough Guide to Economics*", Rough Guide Ltd.

OUTCOMES:

On successful completion of this course,

- Students will have had exposure to the basic concepts of demand, supply and various pricing strategies.
- Students will have understood the macroeconomic concepts of national income and inflation.
- Students will be able to apply the knowledge of money, banking and public finance in their real life situations.
- Students will have an overview of the economic reforms introduced in Indian economy.

SSCXO2	PRINCIPLES OF SOCIOLOGY.	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To acquaint the students with Concepts and perspectives of Sociology
- To explain the reflection of society in Individuals and vice versa
- To describe the hierarchical arrangement of individuals and groups in society
- To explicate the dimensions, forms and factors of Social change.
- To examine the context, impact and agencies of Globalization

MODULE I THE FOUNDATIONAL CANON 8

Sociology-Definition, scope and importance; Major theoretical perspectives- Functionalism, Conflict Theorising and Interactionism; Elements of social formation- Society, Community, Groups and Association; Associative Social Process- Co-operation, Accommodation and Assimilation; Dissociative Social Process- Competition and Conflict.

MODULE II INDIVIDUAL AND SOCIETY 7

Culture-definition, characteristics, functions, types, cultural lag and civilization, Socialization – definition, process, stages, agencies and anticipatory socialization; Social Control- definition, characteristics, importance, types & agencies.

MODULE III SOCIAL INEQUALITY AND STRATIFICATION 7

Concepts- inequality, hierarchy, differentiation, Social Exclusion, and Social Stratification. Forms of Social Stratification- Caste, Class and Estate. Gender and Social Stratification- sex and gender, patriarchy, factors perpetuating gender stratification; Globalization and gender inequality

MODULE IV SOCIAL CHANGE AND GLOBALIZATION 8

Social Change-definition, nature, direction; Forms- evolution, development, progress and transformation; Factors of social change- demography, economy, technology, polity and culture. Globalization- definition, characteristics, historical and social context and Impact, agencies of globalization- IGOs, INGOs, Nation-State, MNEs and Media

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Giddens A. 1989. “Sociology” Cambridge: Polity Press.
2. Heald Haralambos, R.M(2014) . ‘‘Sociology Themes and Perspectives”, Oxford, New Delhi-92
3. Bhushan Vidya and D.R. Sachdeva (2012). ‘‘Fundamental of Sociology”, Pearson, Delhi.

REFERENCES:

1. Das Gupta, Samir and Paulomi Saha (2012), ‘‘An Introduction to Sociology”, Pearson, Delhi
2. Bottomore, T.B. 1972. *Sociology- A Guide to Literature and Problems*, New Delhi,

OUTCOMES:

On successful completion of this course,

- Students will have exposure to the fundamentals tenets of Sociology.
- Students will be trained to understand social reality with sociological perspective.
- Students will be oriented to constructively analyze human interactions, social relationship and social issues
- Students will gain exposure to the dynamics of human society with special reference to the contemporary trends of globalization.

SSCXO3 SOCIOLOGY OF INDIAN SOCIETY.

L	T	P	C
2	0	0	2

OBJECTIVES:

- To present a portrayal of the components of the Indian Social structure
- To describe the nature and contemporary structure of Indian social Institutions.
- To examine the causality and magnitude of social problem facing the contemporary India.
- To elucidate the processes forms and impact of change and development in Indian society

MODULE I INDIAN SOCIAL STRUCTURE 7

Unity and Diversity; Concepts of unity and diversity- racial, religious, ethnic and linguistic composition of India. Types of communities-rural, urban and tribal; Social backwardness- OBC, SC and ST; Indian minorities- religious, ethnic, linguistic and LGBT

MODULE II INDIAN SOCIAL INSTITUTIONS 7

Family- definition, types, characteristics, functions of family; Joint Family- definition features, utility, changes; Marriage- definition, characteristics, marriage as sacrament or contract. Caste- definition, principles, contemporary changes, dominant caste, caste -class interface.

MODULE III SOCIAL PROBLEMS IN INDIA 8

Social Problem-definition, nature, social disorganization; Population explosion-causes, effects, relationship with development; Child Labour- causes, magnitude and consequences; Unemployment-nature , types, causes and effects; Gender issues-social status of women, violence against women and women in work place; Contemporary issues- communalism, terrorism and corruption.

MODULE IV SOCIAL CHANGE AND DEVELOPMENT IN INDIA 8

Socio-cultural Change- Sanskritization, Westernization, Secularization, Modernization; Processes of Social change- Industrialization, Urbanization, Globalization; Development- definition, elements, role of government, industry and corporate sector. Technology and change- invention and innovation, impact of technology on social institutions, technology and development.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Sharma,K.L.2008. *Indian Social Structure and Change*. Jaipur: Rawat Publications,.
2. Shah, A.M. 1998. *The Family in India: Critical Essays*. New Delhi: Orient Longman,
3. Ahuja Ram. 1999. *Social problems in India*, Rawat Publication: New Delhi.
4. Ahuja Ram. 2014. *Society in India,*, Rawat Publication: New Delhi.

REFERENCES:

1. Jayapalan, N.(2001), **"**Indian Society and Social Institutions" Atlantic Publishers & Distri,
2. Atal, yogesh (2006), "Changing Indian Society" Rawat Publications, Jaipur

OUTCOMES:

On successful completion of this course,

- Students will gain an in-depth understanding of the social structure and social institutions that constitute society in India.
- Students will be sensitized to the various categories ,Inequalities and their challenges
- Students will be exposed to the social problems encountered in contemporary India.
- Students will gain knowledge about the various forms and trends of the social change.
- Students will become aware about the challenges in the path of progress of Indian society and realize relevance of their role in bringing about development

Humanities Elective II

(To be offered in IV Semester)

		L	T	P	C
SSCXO4	**ECONOMICS OF SUSTAINABLE DEVELOPMENT**	**2**	**0**	**0**	**2**

OBJECTIVES:

- To have an increased awareness on the concept and components of sustainable development.
- To develop the ability to demonstrate the need of sustainable development and international responses to environmental challenges.
- To have an insight into global environmental issues and sustainable globalization.
- To establish a clear understanding of the policy instruments of sustainable development.

MODULE I CONCEPT OF SUSTAINABLE DEVELOPMENT 7

Evolution of the Concept – Rio Summit and sustainable development - various definitions of sustainable development - Components of sustainable development: Social, environmental and economic components.

MODULE II NEED FOR SUSTAINABLE DEVELOPMENT 8

Need for sustainability – Global environmental challenges: population growth, resource depletion, pollution, energy use, climate change, pollution, growing water scarcity, other urban problems, loss of biodiversity, hazardous wastes disposal.International responses to environmental challenges - Global policy such as Kyoto Protocol, Montreal Protocol, Basel Convention.

MODULE III GLOBALIZATION AND ENVIRONMENT SUSTAINABILITY 8

Impact of Globalization on sustainable development, Co - existence of globalization and Environment sustainability, Globalization and Global Governance.Green economy - Renewable energy, sustainable transport, sustainable construction, land and water management, waste management.

MODULE IV POLICIES FOR ACHIEVING SUSTAINABLE DEVELOPMENT 7

Principles of environmental policy for achieving sustainable development: precautionary principle and polluter pays principle – Business Charter for Sustainable Development.Policy instruments for sustainable development: direct regulation – market based pollution control instruments such as pollution tax, subsidy, pollution permits.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Anderson, David A (2010), "*Environmental Economics and Natural Resource Management*", Routledge, 3rd edition.
2. Karpagam M (1999), "*Environmental Economics: A Textbook*", Sterling Publishers Pvt. Ltd, New Delhi.

REFERENCES:

1. Karpagam M and Jaikumar Geetha (2010), "*Green Management Theory and Applications*", Ane Books Pvt. Ltd, New Delhi.
2. Sengupta Ramprasad (2004), "*Ecology and Economics: An Approach to Sustainable Development*", Oxford University Press, New Delhi.

OUTCOMES:

On successful completion of this course,

- The students will have understood the concepts and components of sustainable development.
- The students will have a holistic overview on the challenges of sustainable development and International responses to environmental challenges.
- The students will have gained knowledge on the global environment issues and demonstrate responsible globalization through global governance.
- The students will have developed awareness of the ethical, economic, social and political dimensions that influence sustainable development.

SSCXO5 INDUSTRIAL SOCIOLOGY

L	T	P	C
2	0	0	2

OBJECTIVES:

- To introduce sociological approaches and perspectives to understand the social relationship in manufacturing industries and corporate sector.
- To explain the structure and functions of industrial organizations.
- To elucidate the dynamics of organizational behavior, leadership and communication.
- To inculcate professional ethics and values to equip students to work in organizational settings.

MODULE I INTRODUCTION 8

Industrial Sociology- definition, scope and importance; Theoretical approaches- scientific management, human relations approach, theory of bureaucracy, Fordism and post-fordism; Production system- concept and characteristics of factory system, automation and rationalization; Industrial conflict- strike , lockout and trade unions.

MODULE II INDUSTRIAL ORGANIZATION 7

Formal organization- definition, features, utility; Informal organization- definition, characteristics, types and relevance; Structure of industrial organization- features and functions of line organization, characteristics and roles of staff organization, distinction;

Industrial hierarchy-white collar, blue collar, supervisors and managers.

MODULE III DYNAMICS OF INDUSTRIAL RELATIONS 8

Group dynamics- Definition, Group behaviour model, Group decision making process, group cohesiveness; Leadership- definitions, style and effective supervision; Communication- concepts, types, model barriers; Job satisfaction- nature, employee compensation and job satisfaction.

MODULE IV PROFESSIONAL ETHICS AND VALUES 7

Concepts- values- morals, and ethics, Integrity, work ethics , service learning - Civic Virtue - caring - Sharing - Honesty - Courage - Valuing Time - Co-operation - commitment - empathy - Self-Confidence - Environmental Ethics, Cyber issues - computer ethics, cyber crimes, plagiarism Ethical living-concept of harmony in life.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Narender Singh, Industrial Sociology, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2012.
2. Gisbert Pascal, Fundamentals of Industrial Sociology, Tata Mc. Graw Hill Publishing Co., New Delhi, 1972
3. Schneider Engeno. V, Industrial Sociology 2nd Edition, Mc. Graw Hill Publishing Co., New Delhi, 1979.

REFERENCES:

1. Robbins, Stephen, Organizational Behaviour , Prentice Hall of India PVT ltd new Delhi, 1985
2. Devis Keith , Human Behaviour at work place, Mc. Graw Hill Publishing Co., New Delhi,1984

OUTCOMES:

On successful completion of this course,

- Students will have acclimatized with sociological perspectives for dealing with social relationships in production and service organizations.
- Students will be familiar with structure of authority, roles and responsibility in organizational settings.
- Students will imbibe leadership, communication and behavioral acumen to govern organization
- Students will be sensitized to standards of desirable behavior to engage in industrial and corporate sector.

SSCXO6 LAW FOR ENGINEERS L T P C
2 0 0 2

OBJECTIVES:

- To understand the Constitution and Governance of our country.
- To apprise the students of human rights - local and international and redressal mechanism.
- To have an insight into the industrial, corporate and labour laws of our country.
- To establish a clear understanding about the importance of intellectual property related laws.

MODULE I INDIAN CONSTITUTION AND GOVERNANCE 8

Constitution – salient features, Preamble, Citizenship, Fundamental rights, Fundamental duties, Directive principles, Union executive, Legislature – Union – State and union territories – Election Commission – Election for parliament and state legislature, Judiciary- basic functioning of the Supreme Court and High Courts, Right to information Act 2005 – evolution – concept – practice.

MODULE II HUMAN RIGHTS 7

Human rights – meaning and significance, Covenant on civil and political rights, Covenant on Economic, Social and Cultural rights, UN mechanism and agencies, The Protection of Human Rights Act, 1993 – watch on human rights and enforcement.

MODULE III INDUSTRIAL, CORPORATE AND LABOUR LAWS 8

Corporate laws – meaning and scope, Companies Act 1956 – Indian Contract Act 1872 - Principles of Arbitration - Industrial Employment (Standing Orders) Act 1946 - Industrial Disputes Act 1947 - Workmen's Compensation Act 1923 - The Factories Act, 1948.

MODULE IV LAWS RELATED TO IPR 7

IPR – meaning and scope, International organization – WIPO – TRIPS, Major Indian IPR Acts – Copyright laws, Patent and Design Act, Trademarks Act, Trade Secret Act, Geographical Indicator.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. M.P. Jain (2005) *Indian Constitutional Law*, Wadhwa & Co.
2. H. D, Agarwal (2008), *International Law and Human Rights,* Central Law Publications,
3. Rao, Meena (2006), *Fundamental Concepts in Law of Contract*, 3rd edn., Professional offset.
4. Ramappa (2010), *Intellectual Property Rights Law in India*, Asia Law House.
5. Singh, Avtar (2007), *Company Law*, Eastern Book Co.
6. R.F, Rustamji (1967)*, Introduction to the Law of Industrial Disputes*, Asia Publishing House.

REFERENCES:

1. Acts: Right to Information Act, Industrial Employees (standing order) Act, Factories Act, Workmen Compensate Act.

OUTCOMES:

On successful completion of this course,

- Students will `be able to apply the basic concepts of Indian Constitution, Governance and power in their real life situation.
- Students will have gained knowledge in human rights, cultural, social and political rights.
- Students will have synthesized knowledge about industrial, corporate and labour laws of our country.
- Students will have an overview of IPRs and laws related to Intellectual Property Rights.

General Elective Courses
Group I courses
(To be offered in V Semester)

		L	T	P	C
GECX101	**DISASTER MANAGEMENT**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To give an exposure to various environmental hazards and disasters: and various concepts and principles to manage disaster.
- To give exposure to various environmental policies & programs in India for disaster management

MODULE I ENVIRONMENTAL HAZARDS 7

Environmental hazards, Environmental Disasters and Environmental stress-Meaning and concepts. Vulnerability and disaster preparedness.

MODULE II NATURAL DISASTERS 7

Natural hazards and Disasters - Volcanic Eruption, Earthquakes, Tsunamis, Landslides, Cyclones, Lightning, Hailstorms, Floods, Droughts, Cold waves, Heat waves and Fire.

MODULE III MAN-MADE DISASTERS 7

Man induced hazards & Disasters - Soil Erosion, Chemical hazards, Population Explosion

MODULE IV DISASTER MANAGEMENT 8

Emerging approaches in Disaster Management- Preparing hazard zonation maps, Predictability / forecasting & warning, Preparing disaster preparedness plan, Land use zoning, Communication. Disaster resistant house construction, Population reduction in vulnerable areas, Awareness - Rescue training for search & operation at national & regional level - Immediate relief, Assessment surveys, Political, Administrative, Social, Economic, Environmental Aspects.

MODULE V NATURAL DISASTER REDUCTION & MANAGEMENT 8

Provision of Immediate relief measures to disaster affected people, Prediction of Hazards & Disasters, Measures of adjustment to natural hazards

MODULE VI ENVIRONMENTAL POLICIES & PROGRAMMES IN INDIA **8**

Regional survey of Land Subsidence, Coastal Disaster, Cyclonic Disaster & Disaster in Hills with particular reference to India. Ecological planning for sustainability & sustainable development in India, Sustainable rural development: A Remedy to Disasters, Role of Panchayats in Disaster mitigations, Environmental policies & programmes in India- Institutions & National Centers for Natural Disaster reduction, Environmental Legislations in India, Awareness, Conservation Movement, Education & training.

L – 45; Total Hours –45

REFERENCES:

1. Satender, “Disaster Management in Hills”, Concept Publishing Co., New Delhi, 2003.
2. Singh, R.B. (Ed.), “Environmental Geography”, Heritage Publishers, New Delhi,1990.
3. Savinder Singh, “Environmental Geography”, Prayag Pustak Bhawan,1997.
4. Kates, B.I. and White, G.F., “The Environment as Hazards”, Oxford University Press, New York, 1978.
5. Gupta, H.K., (Ed), “Disaster Management”, University Press, India, 2003.
6. Singh, R.B.,“Space Technology for Disaster Mitigation in India (INCED)”, University of Tokyo, 1994.
7. Bhandani, R.K., “An overview on Natural & Manmade Disaster & their Reduction”, IIPA Publication, CSIR, New Delhi, 1994.
8. Gupta, M.C., “Manuals on Natural Disaster management in India”, National Centre for Disaster Management, IIPA Publication, New Delhi, 2001.

OUTCOMES:

At the end of the course, the students will

- achieve sufficient knowledge on the disaster prevention strategy, early warning system, disaster preparedness, response and human resource development.
- be familiar with the National Policy on Disaster Management.

GECX102 TOTAL QUALITY MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the various principles, practices of TQM to achieve quality.
- To get acquainted with the various statistical tools and approaches for quality control and continuous improvement.
- To get aware of the importance of ISO and Quality Systems.

MODULE I INTRODUCTION **8**

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

MODULE II TQM PRINCIPLES **7**

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits.

MODULE III TQM IMPROVEMENT PROCESS **8**

Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

MODULE IV STATISTICAL PROCESS CONTROL (SPC) **8**

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

MODULE V TQM TOOLS 7

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

MODULE VI QUALITY SYSTEMS 7

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System– Elements, Implementation of Quality System, Documentation, Quality Auditing, TS 16949, ISO 14000 – Concept, Requirements and Benefits

L – 45; Total Hours –45

TEXT BOOKS:

1. Dale H.Besterfiled, et al., “Total Quality Management”, Pearson Education, Inc. 2003.

REFERENCES:

1. James R.Evans & William M.Lidsay, “The Management and Control of Quality”, 5th Edition, South-Western (Thomson Learning), 2002.
2. Feigenbaum.A.V., “Total Quality Management”, McGraw-Hill, 1991.
3. Oakland.J.S., “Total Quality Management”, Butterworth Hcinemann Ltd., Oxford, 1989.
4. Narayana V. and Sreenivasan. N.S., “Quality Management – Concepts and Tasks”, New Age International, 1996.
5. Zeiri, “Total Quality Management for Engineers”, Wood Head Publishers, 1991.

OUTCOMES:

The student should be able to

- apply the various statistical tools and approaches for Quality control.
- achieve continuous process improvement through TQM.

GECX103 ENERGY STUDIES L T P C
3 0 0 3

OBJECTIVES:

- To learn the growing demand, supply of energy on global and national levels and the need for renewable energy promotion.
- To understand the basic need for energy conservation and waste heat recovery.
- To learn the important aspects of energy audit and management.
- To get acquainted with the global environmental issues and carbon credits.

MODULE I GLOBAL AND NATIONAL ENERGY SCENARIO 7

Role of energy in economic development, various energy resources - overall energy demand and availability- Energy consumption in various sectors and its changing pattern - Exponential increase in energy consumption and projected future demands. Need for renewable energy.

MODULE II SOLAR ENERGY 8

Solar Radiation – Measurements of Solar Radiation - Flat Plate and Concentrating Collectors – Solar direct Thermal Applications – Solar thermal Power Generation - Fundamentals of Solar Photo Voltaic Conversion – Solar Cells – Solar PV Power Generation – Solar PV Applications.

MODULE III OTHER RENEWABLE ENERGY SOURCES 8

Power from wind – wind turbine working and types, solar thermal power plants – low medium and high power generation, power from wave , tidal, geothermal sources, OTEC system. MHD power plants – working, types, merits and demerits. Energy from biomass.

MODULE IV COGENERATION, WASTE HEAT RECOVERY AND COMBINED CYCLE PLANTS 8

Cogeneration principles- topping and bottoming cycles, role in process industries. Energy from wastes- waste heat recovery- heat recovery from industrial processes. Heat exchange systems – recuperative and regenerative heat exchangers – commercially available waste heat recovery devices. Combined cycle plants – concept, need and

advantages, different combinations and practical scope.

MODULE V ENERGY CONSERVATION AND MANAGEMENT 7

Need for energy conservation – use of energy efficient equipment. Energy conservation opportunities - in educational institutions, residential, transport, municipal, industrial and commercial sectors – concept of green building. Energy audit in industries – need, principle and advantages. Case studies.

MODULE VI GLOBAL ENERGY ISSUES AND CARBON CREDITS 7

Energy crisis, fossil consumption and its impact on environmental climate change. Energy treaties – Montreal and Kyoto protocols - Transition from carbon rich and nuclear to carbon free technologies, carbon foot print – credits – clean development mechanism.

L – 45; Total Hours –45

TEXT BOOKS:

1. S.S. Rao and B.B. Parulekar, “Energy Technology”, 3rd Edition, Khanna Publishers, New Delhi, 2011.
2. O. Callaghn. P.W., “Design and Management for Energy Conservation”, Pergamon Press, Oxford, 1981.

REFERENCES:

1. G.D. Rai, “Non Conventional Energy Sources”, Khanna Publishers, New Delhi, 2011.
2. Archie, W Culp. “Principles of Energy Conservation”, McGraw Hill, 1991.
3. D Patrick and S W Fardo, “Energy Management and Conservation”, PHI,1990
4. P. O’Callaghan: “Energy Management”, McGraw - Hill Book Company, 1993.
5. Kenney, W. F., “Energy Conservation in Process Industries”, Academic Press, 1983.

OUTCOMES:

The student should be able to

- Realize the global and national energy status and need to switch over to renewable energy technology.
- Energy audit and suggest methodologies for energy savings.
- Utilize the available resources in an optimal way.
- Concern about the global environmental issues & promote carbon credits.

GECX104 ROBOTICS

L	T	P	C
3	0	0	3

OBJECTIVES:

To learn about the robots, various components, of Robots, programming and their applications.

MODULE I **8**

Definition- Need - Application, Types of robots – Classifications – Configuration, work volume, control loops, controls and intelligence- basic parts - functions – specifications. of robot, degrees of freedoms, end effectors – types, selection

MODULE II ROBOT DRIVES AND CONTROL **8**

Controlling the Robot motion – Position and velocity sensing devices – Design of drive systems – Hydraulic and Pneumatic drives – Linear and rotary actuators and control valves – Electro hydraulic servo valves, electric drives – Motors – Designing of end effectors – Vacuum, magnetic and air operated grippers.

MODULE III ROBOT SENSORS **8**

Transducers and Sensors – Tactile sensor – Proximity and range sensors – Sensing joint forces – Robotic vision system – Image Representation - Image Grabbing –Image processing and analysis – Edge Enhancement – Contrast Stretching – Band Rationing - Image segmentation – Pattern recognition – Training of vision system.

MODULE IV ROBOT PROGRAMMING & AI TECHNIQUES **7**

Types of Programming – Teach pendant programming – Basic concepts in AI techniques – Concept of knowledge representations – Expert system and its components.

MODULE V ROBOTIC WORK CELLS AND APPLICATIONS OF ROBOTS **7**

Robotic cell layouts – Inter locks – Humanoid robots – Micro robots – Application of robots in surgery, Manufacturing industries, space and underwater.

MODULE VI ROBOT KINEMATICS AND DYNAMICS **7**

Forward and inverse Kinematic equations, Denvit – Hartenbers representations Fundamental problems with D-H representation, differential motion and velocity
of frames - Dynamic equations for sing, double and multiple DOF robots – static force analysis of robots.

L – 45; Total Hours –45

REFERENCES:

1. Yoram Koren," Robotics for Engineers", Mc Graw-Hill, 1987.
2. Kozyrey, Yu, "Industrial Robots", MIR Publishers Moscow, 1985.
3. Richard. D, Klafter, Thomas, A, Chmielewski, Michael Negin, "Robotics Engineering – An Integrated Approach", Prentice-Hall of India Pvt. Ltd., 1984.
4. Deb, S.R. "Robotics Technology and Flexible Automation", Tata Mc Graw-Hill, 1994.
5. Mikell, P. Groover, Mitchell Weis, Roger, N. Nagel, Nicholas G. Odrey, "Industrial Robotics Technology, Programming and Applications", Mc Graw- Hill, Int. 1986.
6. Timothy Jordanides et al,"Expert Systems and Robotics", Springer – Verlag, New York, May 1991.

OUTCOMES:

Students would be able to

- Understand about the robots, its various components.
- Design Robots for industrial applications.
- Do programming for robots and apply them in real time applications.

GECX105	TRANSPORT MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the transport fleet and their related activities for minimizing operational cost.
- To understand the need of maintenance and its importance.
- To understand the functions and applications of various types of transport system.

MODULE I INTRODUCTION 7

Personnel management; objectives and functions of personnel management, psychology, sociology and their relevance to organization, personality problems. Selection process: job description, employment tests, interviewing, introduction to training objectives, advantages, methods of training, training procedure, psychological tests.

MODULE II ORGANISATION AND MANAGEMENT 7

Forms of Ownership – principle of Transport Management – Staff administration – Recruitment and Training – welfare – health and safety. Basic principles of supervising. Organizing time and people. Driver and mechanic hiring - Driver checklist - Lists for driver and mechanic - Trip leasing - Vehicle operation and types of operations.

MODULE III TRANSPORT SYSTEMS 9

Introduction to various transport systems. Advantages of motor transport. Principal function of administrative, traffic, secretarial and engineering divisions. chain of responsibility, forms of ownership by state, municipality, public body and private undertakings.

MODULE IV SCHEDULING AND FARE STRUCTURE 8

Principal features of operating costs for transport vehicles with examples of estimating the costs. Fare structure and method of drawing up of a fare table. Various types of fare collecting methods. Basic factors of bus scheduling. Problems on bus scheduling.

MODULE V MOTOR VEHICLE ACT 7

Traffic signs, fitness certificate, registration requirements, permit insurance, constructional regulations, description of vehicle-tankers, tippers, delivery vans, recovery vans, Power wagons and fire fighting vehicles. Spread over, running time, test for competence to drive.

MODULE VI MAINTENANCE 7

Preventive maintenance system in transport industry, tyre maintenance procedures. Causes for uneven tyre wear; remedies, maintenance procedure for better fuel economy, Design of bus depot layout.

L – 45; Total Hours –45

TEXT BOOKS:

1. John Duke, "Fleet Management", McGraw-Hill Co, USA, 1984.
2. Kitchin.L.D., "Bus Operation", III edition, Illiffee and Sons Co., London, 1992

REFERENCES:

1. Government Motor Vehicle Act, Publication on latest act to be used as on date.

OUTCOMES:

Upon completion of the course, students will

- Know about different aspects related to transport system and management.
- Features of scheduling, fixing the fares
- Know about the motor vehicle act and maintenance aspects of transport.

GECX106	CONTROL SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the system modeling and to derive their transfer function.
- To provide adequate knowledge of time response of systems and steady state error analysis.
- To accord basic knowledge in obtaining the open loop and closed–loop frequency responses of Control systems.

MODULE I BASIC CONCEPTS AND SYSTEM REPRESENTATION 8

Control System - Basic elements in control systems – Open and closed loop systems – Electrical analogy of mechanical and thermal systems – Transfer function – Block diagram reduction techniques – Signal flow graphs.

MODULE II TIME RESPONSE ANALYSIS AND DESIGN 8

Time response – Time domain specifications – Types of test input – First and Second order system - Type I and Type II System – Response - Error coefficients – Generalized error series – Steady state error – P, PI, PID modes of feedback control.

MODULE III FREQUENCY RESPONSE ANALYSIS AND DESIGN 7

Performance specifications - correlation to time domain specifications - bode plots and polar plots – gain and phase margin – constant M and N circles and Nichols chart – all pass and non-minimum phase systems.

MODULE IV STABILITY 8

Characteristics equation – Location of roots in s plane for stability – Routh Hurwitz criterion – Root locus construction – Effect of pole, zero addition – Gain margin and phase margin – Nyquist stability criterion.

MODULE V COMPENSATOR DESIGN 8

Performance criteria – Lag, lead and lag-lead networks – Compensator design using bode plots and root locus technique.

MODULE VI CONTROL SYSTEM COMPONENTS AND APPLICATION OF CONTROL SYSTEMS 6

Synchros – AC servomotors - DC Servo motors - Stepper motors - AC

Tacho generator - DC Tacho generator - Typical applications of control system in industry.

L – 45; Total Hours –45

REFERENCES:

1. K. Ogata, “Modern Control Engineering”, 4th Edition, Pearson Education, New Delhi, 2003.
2. I.J. Nagrath & M. Gopal, “Control Systems Engineering”, New Age International Publishers, 2003.
3. C.J.Chesmond, “Basic Control System Technology”, Viva student edition, 1998.
4. I.J.Nagarath and M.Gopal, “Control System Engineering”, Wiley Eastern Ltd., Reprint, 1995.
5. R.C.Dorf and R.H.Bishop, “Modern Control Systems”, Addison-Wesley (MATLAB Reference), 1995.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Proper understanding of basics of Control Systems.
- Ability and skill to carry-out time domain and frequency domain analysis.
- Capable of determining stability of the system using Routh Hurwitz criterion, Root locus and Nyquist criterion.
- Ability to design lag, lead and lag lead compensator networks.

GECX107 INTRODUCTION TO VLSI DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- Basic concepts of HDL.
- Verilog language and its syntax constructs.
- Programmable Logic Devices and FPGAs
- MOS devices theory
- CMOS based combinational and sequential circuits

PREREQUISITES:

Fundamentals of Electronics

Basics knowledge in Digital Electronics.

MODULE I REVIEW OF BASIC DIGITAL SYSTEMS 7

Boolean algebra, Building blocks of combinational logic design-Adders, multiplexer, encoder, decoder, comparator, Latches & flip-flops, counters, shift registers.

MODULE II LOGIC DESIGN USING VERILOG HDL 8

Overview of Digital Design with Verilog HDL, Levels of Design Description, Concurrency, Hierarchical Modeling Concepts, Modules and Ports, Component instantiation Data flow and RTL, structural, gate level, switch level modeling and Behavioral Modeling.

MODULE III LANGUAGE CONSTRUCTS OF VERILOG HDL 7

Identifiers- gate primitives, gate delays, operators, timing controls, procedural assignments, conditional statements Variable types, arrays and tables, Tasks and functions, Test bench.

MODULE IV BUILDING BLOCKS OF DIGITAL VLSI SYSTEMS 8

HDL Design -Data Path Operations-Addition/Subtraction, Parity Generators, Comparators, Zero/One Detectors, Binary Counters, ALUs, Multiplication, Shifters, Memory Elements. Programmable logic elements and AND-OR arrays, FPGAs programming methods.

MODULE V TRANSISTOR THEORY 7

Introduction to MOS Transistors-NMOS & PMOS Characteristics, Current Equations, Complementary CMOS Inverter-DC Characteristics, Static Load MOS

Inverters.

MODULE VI BASICS OF DIGITAL CMOS DESIGN 8

NMOS & PMOS Logic Gate, CMOS Logic Gate, Basic layout design of simple gate-stick diagram, CMOS Logic Structures-full adder, multiplexers.

Total Hours –45

TEXT BOOKS:

1. M.Morris Mano "Digital Design", 3rd Edition, Prentice Hall of India Pvt. Ltd New Delhi, 2003

REFERENCES:

1. Michael D. Ciletti“Advanced Digital Design with the Verilog HDL" (2nd Edition) Hardcover – January 31, 2010
2. J.Bhasker: Verilog HDL primer, BS publication, 2001.
3. J. P. Uyemura, "Introduction to VLSI Circuits and System", Wiley, 2002
4. Neil Weste and K. Eshragian, “Principles of CMOS VLSI Design: A System Perspective,” 2nd edition, Pearson Education (Asia) Pvt.Ltd., 2000
5. Douglas A Pucknell& Kamran Eshragian , “Basic VLSI Design” PHI 3rd Edition (original edition – 1994)

OUTCOMES:

At the end of the course the students will be able to

- Create basic Register Transfer Level (RTL) models for combinational circuits & Sequential circuits using Verilog HDL.
- Create basic behavioral models for combinational circuits & Sequential circuits using Verilog HDL.
- Describe the usage of Programmable Logic Devices and FPGAs.
- Describe MOS devices theory and inverter circuit DC characteristics
- Design the basic digital building blocks using MOS circuit.
- Apply VLSI design concepts based on the requirements to conduct experiments or projects

GECX108 PLANT ENGINEERING L T P C
3 0 0 4

OBJECTIVES:

- To provide in depth knowledge on Plant Engineering
- To introduce detail engineering and P&ID
- To learn about the support to Instrumentation from other disciplines
- To study about the Installation and commissioning

MODULE I INTRODUCTION OF PLANTS 7

General Project Cycle – Feed – Sales - Plant Description, Component / Areas of Plant, Plant Layout, Plant Interfaces, Plant Location

MODULE II ELEMENTS OF PLANT 8

Main Elements of a Plant, Process Flow Scheme (PFD – Process Flow Diagram) P&ID's, Plant Legend Finalization.

MODULE III DETAIL ENGINEERING 10

P& ID Development with PFD's, Major Discipline Involvement & Inter discipline Interaction, Major Instrumentation & Control Systems - Development Phase – Instrument List , I/O Count, Specification Sheets, Instrument Installation (Hook ups) , Control Philosophy – Detail Engineering.

MODULE IV SUPPORT FROM OTHER DISCIPLINE 8

Other Discipline Supports to Instrumentation – Plot Plan, Piping / Equipment Plan, Electrical Area Classification, Fire Hazardous Classification Telecommunication Systems - Control Network architecture.

MODULE V INSTALLATION AND COMMISSIONING 7

Plant Construction - Key Drawings for Construction Support Construction Activities, System Testing, Startup / Commissioning, Production.

MODULE VI CASE STUDIES 5

Case studies of Water Treatment Plant - Paper Industry – Power Plant etc

L – 45; Total Hours –45

REFERENCES:

1. Duncan C Richardson, Plant Equipment and Maintenance Engineering Handbook, McGraw-Hill Education: New York, Chicago, San Francisco, Athens, London, Madrid, Mexico City, Milan, New Delhi, Singapore, Sydney, Toronto, 2014 McGraw-Hill Education
2. Gabriel Salvendy, Handbook of Industrial Engineering – Technology and operations Management, John Wiley & Sons, 2001.
3. Robert C Rosaler , Standard Handbook of Plant Engineering, Mc Graw Hill third Edition, 2004
4. R. Keith Mobley, Plant Engineer's Handbook, Technology and Engineering, 2001.

OUTCOMES:

At the end of the course, the student will be able to

- Review and correct P&IDs
- Do installation and commissioning of new plants
- Apply plant engineering in design and maintenance of water treatment plant / power plant etc

GECX109	NETWORK SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

The students should be able to

- Discuss the basic concepts of computer security, model and attacks
- Examine the major types of threats and the associated attacks
- Identify the encryption techniques in real time applications
- Understand the special requirements for wireless security and how authentication is implemented in wireless systems
- Understand the functions of Network Security Device Firewall and its types
- Interpret the various network intrusion such as computer viruses, network worms etc

MODULE I INTRODUCTION 6

Computer Security Concepts - The OSI Security Architecture - Security Attacks - Security Services - Security Mechanisms - A Model for Network Security - Standards – classical encryption techniques.

MODULE II SYMMETRIC ENCRYPTION AND MESSAGE CONFIDENTIALITY 7

Symmetric Encryption Principles - Symmetric Block Encryption Algorithms - Random and Pseudorandom Numbers - Stream Ciphers and RC4 - Cipher Block Modes of Operation

MODULE III PUBLIC KEY CRYPTOGRAPHY AND MESSAGE AUTHENTICATION 8

Approaches to Message Authentication - Secure Hash Functions - Message Authentication Codes - Public-Key Cryptography Principles - Public-Key Cryptography Algorithms - Digital Signatures

MODULE IV KEY DISTRIBUTION ,USER AUTHENTICATION AND TRANSPORT-LEVEL SECURITY 8

Symmetric Key Distribution Using Symmetric Encryption - Kerberos - Key Distribution Using Asymmetric Encryption - X.509 Certificates - Public-Key Infrastructure -Federated Identity Management - Web Security Considerations -

Secure Socket Layer and Transport Layer Security - Transport Layer Security

MODULE V WIRELESS NETWORK SECURITY, ELECTRONIC MAIL SECURITY AND IP SECURITY **8**

IEEE 802.11 Wireless LAN Overview -IEEE 802.11i Wireless LAN Security - Wireless Application Protocol Overview - Wireless Transport Layer Security - WAP End-to-End Security - Pretty Good Privacy - S/MIME – Domain Keys Identified Mail- IP Security Overview -IP Security Policy - Encapsulating Security Payload - Combining Security Associations - Internet Key Exchange - Cryptographic Suites

MODULE VI SYSTEM SECURITY **8**

Intruders -Intrusion Detection -Password Management - Types of Malicious Software - Viruses Virus Countermeasures – Worms - Distributed Denial of Service Attacks- The Need for Firewalls - Firewall Characteristics - Types of Firewalls - Firewall Basing - Firewall Location and Configurations

L – 45; Total Hours –45

REFERENCES:

1. William Stallings,"Network security Essentials:Applications and standards", Prentice Hall, Fifth Edition , ISBN-13: 978-0134527338, 2013
2. William Stallings, "Cryptography and Network Security: Principles and Practice", Pearson, ISBN-13:978-0-273-79335-9,2013
3. Behrouz Forouzan, Debdeep Mukhopadhyay,Cryptography and network security (sie) 2nd edition, ISBN-13: 978-0070702080, 2016
4. Wikipedia, "Network Security and Management" , https://en.wikipedia.org/wiki/Book:Network Security and Management, 2014.
5. Nitesh Dhanjani, Justin Clarke, "Network Security Tools", O'Reilly Media, ISBN-13: 9780596007942, 2005.

OUTCOMES:

Students who complete this course will be able to

- Recognize the computer security concepts, architecture attacks and model
- Distinguish the symmetric and asymmetric encryption techniques
- Apply the cryptographic algorithms in different applications
- Express the network security designs using available secure solutions

such as PGP,SSL, IPSec, etc.

- Describe the firewalls principles and different types of firewalls applied in organization
- Identify abnormalities within the network caused by worms, viruses and Network related security treats**.**

GECX110	KNOWLEDGE MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course

- Focuses on positioning knowledge as a valuable commodity, embedded in products and in the tacit knowledge of highly mobile individual employees.
- Presents KM as a deliberate and systematic approach to cultivating and sharing an organization's knowledge base.
- Brings out the paradigm in terms of information technology and intellectual capital.

MODULE I KNOWLEDGE MANAGEMENT 6

KM Myths – KM Life Cycle – Understanding Knowledge – Knowledge, intelligence – Experience – Common Sense – Cognition and KM – Types of Knowledge – History of Knowledge Management - From Physical assets to Knowledge Assets – Expert knowledge – Human Thinking and Learning.

MODULE II KNOWLEDGE MANAGEMENT SYSTEMS AND MODELS 9

Challenges in Building KM Systems – Conventional Vs KM System Life Cycle (KMSLS) – Knowledge Creation and Knowledge Architecture – KM cycle - Different variants of KM cycle - KM models - Implications and practical implementations.

MODULE III CAPTURING KNOWLEDGE AND SHARING 9

Tacit knowledge capture - Explicit knowledge codification – Knowledge taxonomies - Knowledge sharing - Communities - Obstacles to knowledge capture and sharing.

MODULE IV KNOWLEDGE MANAGEMENT TOOLS 9

KM System tools – Neural Network – Association Rules – Classification Trees – Data Mining and Business Intelligence – Knowledge capture and creation tools - Content creation tools - Data mining and knowledge discovery – Content management tools - Knowledge sharing and dissemination tools – Group ware

and Collaboration tools - Intelligent filtering tools.

MODULE V KNOWLEDGE APPLICATION 6

KM at individual level - Knowledge workers - Task analysis and modeling - Knowledge application at group and organizational levels – Knowledge repositories - Knowledge reuse -Case study: e-learning.

MODULE VI VALUE OF KNOWLEDGE MANAGEMENT 6

KM return on investment and metrics - Benchmarking method – Balanced scorecard method - House of quality method - Results based assessment method - Measuring success - Future challenges for KM.

L – 45; Total Hours –45

TEXT BOOKS:

1. Elias M. Awad, Hassan M. Ghaziri, “Knowledge Management”, Prentice Hall, 2nd Edition, 2010.
2. Jay Liebowitz, “Handbooks on Knowledge Management”, 2nd Edition, 2012.
3. Irma Becerra-Fernandez, Rajiv Sabherwal, ”Knowledge Management: Systems and Processes”, 2010.

OUTCOMES:

Students who complete this course will be able to

- Describe the fundamental concepts in the study of knowledge and its creation, acquisition, representation, dissemination, use and re-use, and management.
- Explains the core concepts, methods, techniques, and tools for computer support of knowledge management.
- Critically evaluate current trends in knowledge management and apply it for e-learning

GECX111 CYBER SECURITY L T P C

3 0 0 3

OBJECTIVES:

- To understand the basics of Cyber Security Standards and Policies.
- To know the legal, ethical and professional issues in Cyber security.
- To understand Cyber Frauds and Abuse and its Security Measures.
- To know the technological aspects of Cyber Security.

MODULE I FUNDAMENTALS OF CYBER SECURITY 7

Security problem in computing – Cryptography Basics – History of Encryption – Modern Methods – Legitimate versus Fraudulent Encryption methods – Encryption used in Internet.

MODULE II CYBERCRIME AND CYBEROFFENSES 8

Cybercrime and Information Security – Cybercriminals – Classifications of Cybercrimes – Email Spoofing – Spamming – Cyber defamation – Internet Time Theft – Forgery – Web jacking – Hacking – Online Frauds – Software Piracy – Mail Bombs – Password Sniffing – Cyberoffenses – Categories – Planning the attacks – Cyberstalking – Cybercafe and Cybercrimes – Botnets.

MODULE III CYBERCRIME: MOBILE AND WIRELESS DEVICES 8

Proliferation of Mobile and Wireless Devices – Trends in Mobility – Credit card frauds in Mobile and Wireless Computing – Security Challenges – Authentication Service Security – Attacks on Mobile Phones.

MODULE IV TOOLS AND METHODS USED IN CYBERCRIME 8

Proxy Servers and Anonymizers – Phishing – Password Cracking – Keyloggers and Spywares – Virus and Worms – Trojan Horses and Backdoors – Steganography – DoS and DDoS Attacks.

MODULE V SECURITY POLICIES 7

Introduction - Defining User Policies – Passwords – Internet Use – Email Usage – Installing/ Uninstalling Software – Instant Messaging – Defining System Administrative Policies – Defining Access Control Developmental Policies Standards, Guidelines and Procedures – Basics of assessing a system

MODULE VI COMPUTER FORENSICS 7

General Guidelines – Finding Evidence on the PC - Finding Evidence in System Logs – Windows Logs – Linux Logs – Getting Back Deleted Files – Operating System Utilities – The Windows Registry.

L – 45; Total Hours –45

TEXT BOOKS:

1. Nina Godbole, Sunit Belapure, “Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Wiley, 2011.

2. Chuck Easttom, “Computer Security Fundamentals”, 2nd Edition, Pearson Education, 2012.

REFERENCES:

1. Charles B. Pfleeger, Shari Lawrence Pfleeger, “Security in Computing”, 3rd Edition, Pearson Education, 2003.

2. William Stallings, “Cryptography and Network Security – Principles and Practices”, 3rd Edition, Pearson Education, 2003.

3. Atul Kahate, “Cryptography and Network Security”, Tata McGraw Hill, 2000.

OUTCOMES:

Upon completion of this course, students will be able to

- Explain the general security issues.
- Discuss various cybercrimes and offenses.
- Outline the occurrence of Cybercrime in mobile and wireless environment.
- Use relevant tools and methods in cybercrime
- Apply security policies in cyber forensics.
- Outline the strategies adopted in computer forensics.

GECX112 GENETIC ENGINEERING L T P C
4 0 0 4

OBJECTIVES:

The course aims to provide an advanced understanding of the core principles and topics of Cell and Organism reproduction and the Principles of heredity and their experimental basis, and to enable students to be able to apply these principles in assessment of pedigrees to identify genotypes and predict the mating outcomes.

MODULE I GENETICS AND ORGANISM 10

Genetics and human affairs, Genetics and Biology, Genes and Environment, Techniques of genetic analysis, The chromosome theory of heredity, Sex chromosomes, Sex linkage, The parallel behaviour of autosomal genes and chromosomes.

MODULE II MENDELISM AND LINKAGE 12

Mendel's laws of inheritance, Interaction of genes, Variations on dominance, Multiple alleles, Lethal alleles, Several genes affecting the same character, Penetrance and expressivity, Linkage- Basic eukaryotic chromosome mapping, The discovery of linkage, Recombination linkage symbolism, Linkage of genes on X chromosomes, Linkage maps, Examples of linkage maps.

MODULE III FINE STRUCTURE OF GENES 10

The concept of promoter, Coding sequence, Terminator, Induction of gene for expression. The concept of extranuclear genome in higher plants and animals, Overview of mitochondrial genome, Chloroplast genome.

MODULE IV RECOMBINATION IN BACTERIA AND VIRUSES 10

Conjugation recombination and mapping the E.coli chromosomes, Transformation, Transduction, Chromosome mapping. Population genetics: Darwin's revolution, Variation and its modulation, The effect of sexual reproduction on variation, The sources of variation, Selection quantitative genetics

MODULE V PRINCIPLES OF PLANT BREEDING 9

Objectives, Selfing and crossing techniques, Male sterility,Incompatability, Hybrid vigour.

MODULE VI HUMAN GENOME PROJECT 9

Genetic diseases in humans, Genetics and society

L – 45; T – 15; Total Hours –60

REFERENCES:

1. In Introduction to genetic analysis, Griffiths, Miller, Suzuki, Lewontin and Gelbart, Freeman and Company.
2. Genetics, A.V.S.S. Sambamurty, Narosa Publishing House.
3. Concepts of Genetics, Klug & Cummings, Prientice Hall.
4. Molecular Cloning, Moniatisetal, Cold Spring Harbor Laboratory.

OUTCOMES:

At the end of the course students will be able to

- Describe the structure, function and replication of DNA as the genetic material
- Describe gene structure, expression and regulation
- Describe the chromosomal basis of inheritance and how alterations in chromosome number or structure may arise during mitosis and meiosis

GECX113	FUNDAMENTALS OF PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The students would gain knowledge on

- Technicalities attached to Project Management and Significance of Quality Consideration
- Project management methodologies – tools and techniques, supplemented with examples from case studies
- The importance of Efficient HR team and role of Communication in executing Projects.
- Managing Risks in Project Management

MODULE I INTRODUCTION TO PROJECT MANAGEMENT 9

Introduction to Project and Project Management-Project Management as a Career-Project Management Skill Sets-Project Scope Management: Project Charter, Scope Creep, Scope Validation, Scope Change Control-Type of Organization: Organization Structure-Influence of Organization Structure on Project, Project Stakeholders and Organizational Productivity.

MODULE II PROJECT MANAGEMENT PROCESS, TOOLS AND TECHNIQUES 8

Project life cycle-Initiation, Planning, Execution, Monitoring and Closing Phase; - Link between project management process, process groups and knowledge areas; Project management tools and techniques- Project Stakeholders description and mapping - Stakeholder Management Process

MODULE III PROJECT QUALITY, COST AND SCHEDULE MANAGEMENT 10

Triple constraints of project-quality, cost and schedule-Quality Planning, Quality Assurance and Quality Control, Process Control, Cost of Quality, Seven Tools of Quality Control- Cost Management: Cost Estimating Methods, Estimating Completion Cost, Earned Value Management, Budgeting, Life-Cycle Cost analysis- Project Time Management: Duration Estimation Method, FS/FF/SS/ SF Relations, Lead/Lag, Arrow Diagram Method and Precedence Diagram Method for Scheduling-Resource Allocation

MODULE IV PROJECT HR MANAGEMENT 5

Organizational Goals- (MBO/MBE/MBP)-Responsibility Assignment Matrix (RAM)-Types of Powers- Manage or Lead-Conflict management Techniques-Performance Evaluation Process-Motivation Theories and its Application for execution of Projects-Leadership Styles-Project Team Building-Project Staffing Constraints/Policies

MODULE V COMMUNICATION MANAGEMENT 5

Communication Management: Understanding Body languages of Project Personnel-Effective Communications- Interpersonal Skills for project Managers-PMIS-Communicating with the Customer-Communicating with Management- Formal vs. Informal Communications-Written, Verbal and Non-Verbal Communications.

MODULE VI PROJECT PROCUREMENT & RISK MANAGEMENT 8

Introduction to Project Procure Management: Soliciting RFQ/RFP-Contract Proposals-Contract Negotiation-Contract Closure-Risk Management: Defining risks-Risk management process-Risk identification-Qualitative and Quantitative Risk-Probability and Decision trees-Risk Response strategies / methods-Expected monetary value-Risk vs. life cycle phases

L – 45; Total Hours –45

REFERENCES:

1. Jack. R. Meredith, Samuel. J. Mantel & Scott. M. Shafer, Project Management in Practice, Fifth Edition, Bangalore: Wiley, 2015
2. Bob Hughes, Mike Cotterrel “Software Project Management”, Tata McGraw-Hill, 2009

OUTCOMES:

- Learners will be able to identify the Key Knowledge Areas and apply PM process in hypothetical project assignments given as continuous assessment.
- They would be able to suitably recognize tools and techniques required for various phases included in a project.
- They would also be able to manage scope, time, cost and other major components that would help them to execute the project efficiently.

GECX114 OPERATIONS RESEARCH L T P C
3 0 0 3

OBJECTIVES:

- To acquire knowledge and training in optimization techniques.
- To get knowledge about optimization in utilization of resources.
- To understand and apply operations research techniques to industrial operations

MODULE I LINEAR PROGRAMMING PROBLEM 8

Linear programming – formulation of the problem - graphical interpretation of optimality - Simplex method – to obtain basic feasible solution – types of linear programming solution – complications and their resolution.

MODULE II ARTIFICIAL VARIABLE AND TWO PHASE METHOD, DUALITY 6

Artificial variable - Big M method – Two phase method – alternative optimal solution – unbounded solution - Duality – primal dual relationships - rules of constructing the dual from primal.

MODULE III TRANSPORTATION PROBLEM & ASSIGNMENT PROBLE 8

Transportation problems – Initial basic feasible solutions, MODI method, Unbalance in transportation, Degeneracy in transportation models, Assignment problem – Minimization and Maximization type of problems by Hungarian method.

MODULE IV NETWORK AND SEQUENCING PROBLEMS 8

PERT and CPM – Network diagram – Fulkerson's rule - CPM Probability of achieving completion date – Crash time – Cost analysis. Sequencing N jobs through 2 machines and 3 machines.

MODULE V QUEUING THEORY & SIMULATION 7

Poisson arrivals and exponential service times – characteristics of Queuing models – single channel – Introduction to multi channel models – Random number generation – Monte Carlo Simulation.

MODULE VI INVENTORY CONTROL, REPLACEMENT MODELS AND GAME THEORY 8

Types of inventory- Inventory cost - EOQ - Deterministic inventory problems – Introduction to probabilistic models & system level inventory control - Replacement models – Replacement of items that deteriorate with time – value of money changing with time – not changing with time – Individual and group replacement policy - Game theory – simple games.

L – 45; Total Hours –45

TEXT BOOKS:

3. Hamdy ATaha, “Operations Research an introduction”, 8th edition, Phil Pearson, 2007.
4. Winston.W.L., “Operations Research”, 4th edition, Thompson-Brooks/Cole, 2003.

REFERENCES:

1. Wayne.L. Winston, “Operations Research applications and algorithms”, 4th edition, Thomson learning, 2007.
2. Frederick. S. Hiller and Gerald.J.Lieberman, “Operations Research concepts and cases”, 8th edition (SIE), Tata McGraw – Hill Pub. Co. Ltd., New Delhi, 2006.
3. A. Ravindran, D. T. Phillips and J. J. Solberg, "Operations Research:Principles and Practice", 2nd edition, John Wiley & Sons, New York, 1992.
4. Robertazzi. T.G., “Computer networks and systems-Queuing theory and performance evaluation”, 3rd edition, Springer, 2002.

OUTCOMES:

At the end of the course students will be able to

- solve linear programming problems
- solve transportation and assignment problems.
- solve network and sequencing problems.
- apply the operations research techniques to solve industrial problems.

GECX115 NANO TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES:

- To introduce the basic concepts of Nanoscience relevant to the field of engineering.
- To provide an exposure about the importance of various synthesis method.
- To enrich the knowledge of students in various characterisation techniques.

MODULE I INTRODUCTION & CLASSIFICATION OF NANOMATERIALS 9

Definition - Origin of nanotechnology - Difference between bulk and nanomaterials- Top-down and bottom-up processes - Size dependent properties (magnetic, electronic,transport and optical), Classification based on dimensional property - 0D, 1D, 2D and 3D nanostructures – Kubo gap.

MODULE II TYPES OF NANOMATERIALS 9

Metal oxides and metal nano particles - Ceramic nano particles - Semi conducting quantum dots - Core-shell quantum dots - Nanocomposites - Micellar nanoparticles.

MODULE III PRODUCTION OF NANOPARTICLES 7

Sol-gel, hydrothermal, solvothermal, Plasma Arcing, Electro deposition, RF sputtering, Pulsed laser deposition, Chemical vapour, deposition.

MODULE IV CARBON BASED NANOMATERIALS 6

Carbon nanotubes: Single wall nanotubes (SWNT), Multiwall nanotubes (MWNT) - structures-carbon nanofibre, Fullerenes-Application of carbon nanotubes and Fullerenes.

MODULE V NANOPHOTONICS 7

Light and nanotechnology, Interaction of light and nanotechnology, Nanoholes and photons, nanoparticles and nanostructures; Nanostructured polymers, Photonic Crystals, Solar cells.

MODULE VI CHARACTERISATION TECHNIQUES 7

Basic principles of scanning Electron Microscopy (SEM), Atomic force microscopy (AFM), Scanning tunneling microscopy (STM), Scanning probe

microscopy (SPM) and Transmission electron microscopy (TEM), Particle size analyzer, Luminescence techniques.

L – 45; Total Hours –45

TEXT BOOKS:

1. Hari Singh Nalwa, “Handbook of Nanostructured Materials and Nanotechnology”, Academic Press, 2000.
2. Guozhong Cao, “Nanostructures and Nano materials-Synthesis, Properties and Applications”, Imperial College Press (2011).
3. Zhong Lin Wang, “Handbook of Nanophase and Nanomaterials (Vol 1 and II)”, Springer, 2002.
4. Mick Wilson, Kamali Kannangara, Geoff smith, “Nanotechnology: Basic Science and Emerging Technologies”, Overseas press, 2005.

REFERENCES:

1. A. Nabok, “Organic and Inorganic Nanostructures”, Artech House, 2005.
2. C.Dupas, P.Houdy, M.Lahmani, Nanoscience: “Nanotechnologies and Nanophysics”, Springer-Verlag Berlin Heidelberg, 2007.
3. Mick Wilson, Kamali Kannangara, Michells Simmons and Burkhard Raguse, “Nano Technology – Basic Science and Emerging Technologies”, 1st Edition, Overseas Press, New Delhi,2005.
4. M.S. Ramachandra Rao, Shubra SinghH, “Nanoscience and Nanotechnology: Fundamentals to Frontiers”, Wiley, 2013.

OUTCOMES:

At the end of this course, the students will be able to:

- Apply the knowledge of different types of nanomaterials for various engineering applications.
- Acquire the knowledge of various methods of production of nanomaterials.
- Familiarize with various characterization techniques.

GECX116	VEHICLE MAINTENANCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To know about the various methods of maintaining procedure, vehicle insurance and basic problems in a vehicle.
- The student able to impart knowledge in maintaining of engine components and subsystems.
- The student able to impart knowledge in maintaining of transmission, driveline, steering, suspension, braking and wheels.
- The student able to impart **carefully maintaining their vehicle and can increase driving safety.**

MODULE I MAINTENANCE, WORKSHOP PRACTICES, SAFETY AND TOOLS **7**

Maintenance – Need, importance, primary and secondary functions, policies - classification of maintenance work - vehicle insurance - basic problem diagnosis. Automotive service procedures – workshop operations – workshop manual - vehicle identification. Safety – Personnel, machines and equipment, vehicles, fire safety - First aid. Basic tools – special service tools – measuring instruments – condition checking of seals, gaskets and sealants. Scheduled maintenance services – service intervals - Towing and recovering.

MODULE II ENGINE AND ENGINE SUBSYSTEM MAINTENANCE **8**

General Engine service- Dismantling of Engine components- Engine repair-working on the underside, front, top, ancillaries- Service of basic engine parts, cooling and lubricating system, fuel system, Intake and Exhaust system, electrical system - Electronic fuel injection and engine management service - fault diagnosis- servicing emission controls.

MODULE III TRANSMISSION AND DRIVELINE MAINTENANCE **8**

Clutch- general checks, adjustment and service- Dismantling, identifying, checking and reassembling transmission, transaxle- road testing- Removing and replacing propeller shaft, servicing of cross and yoke joint and constant velocity joints- Rear axle service points- removing axle shaft and bearings- servicing differential assemblies- fault diagnosis.

MODULE IV STEERING AND SUSPENSION MAINTENANCE 7

Maintenance and Service of Mc person strut, coil spring, leaf spring, shock absorbers. Dismantling and assembly procedures. Inspection, Maintenance and Service of steering linkage, steering column, Rack and pinion steering, Recirculating ball steering service- Worm type steering, and power steering system.

MODULE V BRAKE AND WHEEL MAINTENANCE 7

Inspection, Maintenance and Service of Hydraulic brake, Drum brake, Disc brake, parking brake. Bleeding of brakes. Wheel alignment and balance, removing and fitting of tyres, tyre wear and tyre rotation.

MODULE VI AUTO ELECTRICAL AND AIR CONDITIOING MAINTENANCE 8

Maintenance of batteries, starting system, charging system and body electrical - Fault diagnosis using Scan tools. Maintenance of air conditioning parts like compressor, condenser, expansion valve, evaporator - Replacement of hoses- Leak detection- AC Charging- Fault diagnosis Vehicle body repair like panel beating, tinkering, soldering, polishing, painting.

L – 45; Total Hours –45

TEXT BOOKS:

1. Ed May, "Automotive Mechanics Volume One" , Mc Graw Hill Publications, 2003
2. Ed May, "Automotive Mechanics Volume Two" , Mc Graw Hill Publications, 2003
3. Vehicle Service Manuals of reputed manufacturers
4. Vehicle maintenance and garage practice by Jigar A.Doshi Dhru U.Panchal,Jayesh P.Maniar. 2014
5. A Practical Approach to Motor Vehicle Engineering and Maintenance 3rd Edition by Allan Bonnick.

REFERENCES:

1. Bosch Automotive Handbook, Sixth Edition, 2004.
2. Advanced Automotive Fault Diagnosis by Tom Denton 2011.
3. Nissan Patrol Automotive Repair Manual: 1998-2014 by Haynes Manuals Inc.
4. Automobile electrical manual a comprehensive guide by Haynes manual car

repair.

OUTCOMES:

On completion of the course student should be able to

- Prepare maintenance schedules and procedures with appropriate tools.
- Demonstrate the procedure and methods to repair and calibrate the engine**.**
- **Analyze the causes and remedies for fault in transmission and drive line systems.**
- **Analyze the causes and remedies of steering and suspension systems.**
- **Analyze the causes and remedies of brake system.**
- **Demonstrate the procedure for wheel alignment and wheel balanced.**

GECX117	FUNDAMENTALS OF DIGITAL IMAGE PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Describe and explain basic principles of digital image processing
- Design and implement algorithms that perform basic image processing
- Design and implement algorithms for advanced image analysis
- Assess the performance of image processing algorithms and systems

PRE-REQUISITES:

- Basic knowledge of transforms in Mathematics

MODULE I DIGITAL IMAGE FUNDAMENTALS 8

Elements of Image Processing System, Fundamentals steps in Digital Image Processing, Image Sampling & Quantization, Spatial and Gray Level Resolution.

MODULE II COLOR IMAGE PROCESSING 8

Fundamental of color image processing, color models- RGB, CMY, HIS, Pseudo color image processing

MODULE III IMAGE ENHANCEMENT 7

Basic gray level Transformations, Histogram Processing, Spatial Filtering

MODULE IV IMAGE TRANSFORMS 7

2D-DFT, DCT, Haar Transform, Fundamentals of 2D-wavelet transform, sub-band coding

MODULE V IMAGE SEGMENTATION AND RESTORATION 8

Point, line and edge detection methods ,Image Segmentation and its types, Restoration: Noise model, Inverse filter and Wiener filter.

MODULE VI IMAGE COMPRESSION 7

Fundamentals of redundancies, Basic Compression Methods: Huffman coding, Arithmetic coding, JPEG and MPEG Compression standards.

TOTAL HOURS 45

TEXT BOOKS

1. Gonzalez and Woods, "Digital Image Processing", 3rd Edition, Pearson Education, 2016.
2. Anil. K. Jain, "Fundamentals of Digital Image Processing"; 4th Edition, PHI, 2007

REFERENCES

1. Pratt William, "Digital Image Processing", John Wiley & Sons, 2007.
2. Arthur Weeks Jr., "Fundamentals of Digital Image Processing", PHI, 2006.

OUTCOMES:

On completion of the course, students will be able to

- Explain the fundamental concepts of digital image processing.
- Discuss about color image processing
- Recognize & apply various image enhancement techniques.
- Apply various transforms for image processing.
- Apply various techniques for image segmentation and restoration.
- Identify and use appropriate image compression techniques

Group II courses

(To be offered in VII Semester)

		L	T	P	C
GECX201	**GREEN DESIGN AND SUSTAINABILITY**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To impart knowledge to face challenges, the technology poses for water, energy, and climate change by implementing sustainable design.

MODULE I CONCEPTS OF SUSTAINABLE DEVELOPMENT 7

Objectives of Sustainable Development - Need for sustainable development-Environment and development linkages - Globalisation and environment-Population, poverty and pollution- global, regional and local environment issues-Green house gases and climate change.

MODULE II SUSTAINABLE DEVELOPMENT OF SOCIO ECONOMIC SYSTEMS 8

Demographic dynamics of sustainability- Policies for socio economic development- Sustainable Development through trade- Economic growth- Action Plan for implementing sustainable development- Sustainable Energy and Agriculture.

MODULE III FRAME WORK FOR ACHIEVING SUSTAINBAILITY 7

Sustainability indicators- Hurdles to sustainability- Business and Industry – Science and Technology for Sustainable Development- Performance indicators of sustainability and assessment mechanism- Constraints and barriers of Sustainable Development.

MODULE IV GREEN BUILDINGS 8

Introduction to Green Building- Energy- Water- Materials and Resources - Sustainable Sites and Land Use - Indoor Environmental Quality- Life Cycle Assessment- Energy, water and materials efficiency.

MODULE V ENERGY CONSERVATION AND EFFICIENCY 7

Energy savings- Energy Audit- Requirements- Benefits of Energy conservation-Energy conservation measures for buildings- Energy wastage- impact to the environment.

MODULE VI GREEN BUILDINGS DESIGN 8

Elements of Green Buildings Design- Foundation, Electrical, Plumbing, flooring, Decking, roofing, insulation, wall coverings, windows, siding, doors and finishing, LEED certification for Green Buildings, Green Buildings for sustainability.

L – 45; Total Hours –45

TEXT BOOKS:

1. Kirby, J., Okeefe, P., and Timber lake, “Sustainable Development”, Earthscan Publication, London, 1995.

REFERENCES:

1. Charles Kibert, J., “Sustainable Construction: Green Building Design and Delivery”, 2nd Edition, John Wiley and sons, 2007.

OUTCOMES:

At the end of the course, the students will be able to

- Explain the relationship between sustainability and emergence of green building practices.
- Address the economic, environmental, and social concerns.

GECX202 APPROPRIATE TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES:

- To impart students knowledge about the basics and applications of various appropriate technologies in the field of civil engineering.

MODULE I BASICS CONCEPTS 7

Back ground, Tools, Choices and Implications, Appropriate Technology Movement (an overview) - Basic design process, basic financial analysis-discounted cash flow, and energy fundamentals.

MODULE II APPROPRIATE TECHNOLOGY WITH REFERENCE TO BUILDING DESIGN 7

Appropriate Building Materials, Appropriate Energy Saving Techniques, Water Conservation (Indoor), Rain Water Harvesting.

MODULE III WATER, HEALTH AND SANITATION MANAGEMENT 7

Water Storage: Designing Dams and Pipelines, Appropriate Selection for Sanitation Technique, Sewerage, Communal Health and Waste Water Recycling.

MODULE IV WASTE MANAGEMENT 8

Types of Waste - Sources - Collections and On-Site Processing -Transferring Stations - Disposal Systems - Recycling.

MODULE V ENERGY EFFICIENT TECHNIQUES 8

Green building concepts-renewable energy sources- Solar – Steam and wind-Biofuels - Biogas – Electricity.

MODULE VI TECHNOLOGY POLICY 8

Government Policies- Energy Policy-Appropriate technology Development Centre-its function and responsibilities-Building policies-Case Studies.

L – 45; Total Hours –45

TEXT BOOKS:

1. Barrett Hazeltine and Christopher Bull, “Appropriate Technology: Tools Choices and Implications”, Academic Press, Orlando, USA, 1998.
2. Ken Darrow and Mike Saxenian, “Appropriate Technology Source Book : A Guide to Practical Books for Village and Small Community Technology”, Stanford, 1986.

REFERENCES:

1. Richard Heeks, “Technology and Developing Countries: Practical Applications Theoretical Issues”, 1995.
2. John Pickford, “The Worth of Water : Technical Briefs on Health, Water and Sanitation”, Intermediate Technology Publications, 1998.

OUTCOMES:

- At the end of the course, the students will be able to use suitable technologies for various conditions for sustainable development.

GECX203 ENGINEERING SYSTEM MODELLING AND SIMULATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn the concepts, techniques, tools for modeling and simulation systems and environments through the use of computers.
- To study the various aspects of discrete dynamic, stochastic systems modeling and conducting experiments with those models on a computer.

MODULE I INTRODUCTION 6

Systems – Modelling – types – systems components – Steps in model building- Simulation Algorithms and Heuristics; Simulation Languages.

MODULE II RANDOM NUMBERS / VARIATES 7

Random numbers – methods of generation – random variates for standard distributions like uniform, exponential, Poisson, binomial, normal etc. – Testing of Random variates – Monte Carlo Simulation.

MODULE III MODELLING PROCESS 7

Primitive Models : Establishing relationships via physical laws; Establishing relationships via curve fitting; Parameters estimation problems; Elementary state transition models.

MODULE IV DESIGN OF SIMULATION EXPERIMENTS 9

Steps on Design of Simulation Experiments – Development of models using of Highlevel language for systems like Queuing, Inventory, Replacement, Production etc., – Model validation and verification, Output analysis.

MODULE V SIMULATION LANGUAGES 10

Need for simulation Languages – Comparisons & Selection of Languages – GPSSARENA- EXTEND – Study of any one of the languages.

MODULE VI CASE STUDIES USING SIMULATION LANGUAGES 6

Case Study using simulation languages

L – 45; Total Hours –45

REFERENCES:

1. Law, A.M., & W.D. Kelton, “Simulation Modelling and Analysis”, McGraw

Hill, Singapore, 2000.
2. Harrel, C.R., et. al., “System Improvement Using Simulation”, 3rd Edition, JMI Consulting Group and ProModel Corporation, 1995.
3. Harrel, C.R. & T. Kerim, “Simulation Made Easy, A Manager’s Guide”, IIE Press, 1995.
4. Geoffrey Gordon, “Systems Simulation”, Prentice Hall, 2002.
5. David Kelton, Rondall P Sadowski, David T Sturrock, “Simulation with Arena”, Mc Graw Hill, 2004.

OUTCOMES:

The student should be able to

- Model and simulate systems and environments through the use of computers.
- Conduct experiments with discrete dynamic, stochastic system models on a computer.

GECX204 VALUE ANALYSIS AND ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To get acquainted with value analysis and engineering tool for productivity improvement.
- To understand and analyze the theory and methodology of Value Engineering.

MODULE I VALUE ENGINEERING BASICS 8

Origin of Value Engineering, Meaning of value, Definition of Value Engineering and Value analysis, Difference between Value analysis and Value Engineering, Types of Value, function - Basic and Secondary functions, concept of cost and worth, creativity In Value Engineering.

MODULE II VALUE ENGINEERING JOB PLAN AND PROCESS 6

Seven phases of job plan, FAST Diagram as Value Engineering Tool, Behavioural and organizational aspects of Value Engineering, Ten principles of Value analysis, Benefits of Value Engineering.

MODULE III ORIENTATION AND INFORMATION PHASES 8

Launching Value Engineering project work - Objectives and Targets - VE Project work: a time-bound programme - Projects and Teams - Time Schedule - Co-ordination - Consultant. Technical data - Marketing related information - Competition profile - Cost data - Materials Management related information - Quality related information - Manufacturing data.

MODULE IV FUNCTION ANALYSIS AND CREATIVE PHASES 9

Objectives - Function definition - Classification of functions - Higher level functions – Function – Cost – Function – Worth - Value Gap - Value index - How to carry out Function Analysis? – Fast Diagraming - Cost Modelling.

Creativity - How to improve creativity of an individual? – How to promote creativity in the organisation? - Obstacles to Creativity - Mental road blocks - Creativity killer phrases. Positive thinking - Ideas stimulators - Creativity techniques - Brainstorming.

MODULE V EVALUATION, INVESTIGATION AND RECOMMENDATION 6

Paired comparison and Evaluation Matrix techniques - Criteria for selection of

VE solutions. Design – Materials – Quality – Marketing – Manufacturing - Preview session. The report - presentation.

MODULE VI IMPLEMENTATION PHASE AND CASE STUDIES 8

Design department - Materials department - Production Planning & Control - Quality Control – Manufacturing – Marketing - Need for co-ordinated teams - The Action Plan. Value Engineering case studies.

L – 45; Total Hours –45

TEXT BOOKS:

1. Mudge, Arthur E. “Value Engineering- A systematic approach”, McGraw Hill, New York, 2000.
2. Kumar S, Singh R K and Jha J K (Ed), “Value Engineering”, Narosa Publishing House, 2005.

REFERENCES:

1. Park RJ, “Value Engineering: A Plan for Invention”, St.Lucie Press, New York, 1999.
2. Lawrence, D.M., “Techniques of Value Analysis and Engineering”, McGraw Hill 1988.
3. George, E.D., “Engineering Design: a Material and Processing Approach”, McGraw Hill, 1991.
4. Heller, D.E., “Value Management, Value Engineering and Cost Reduction”, Addison Wesley, 1988.

OUTCOMES:

- The student will be able to realize the value of products, processes and implement value analysis to achieve productivity improvement.

GECX205 INDUSTRIAL SAFETY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the various safety measures to be taken in different industrial environments.

MODULE I SAFETY MANAGEMENT **7**

Evolution of modern safety concept- Safety policy - Safety Organization - line and staff functions for safety- Safety Committee- budgeting for safety. safety education and training.

MODULE II SAFETY IN MANUFACTURING **7**

Safety in metal working-Machine guarding -Safety in welding and gas cutting - Safety in cold forming and hot working of metals -Safety in finishing, inspection and testing -Regulation.

MODULE III SAFETY IN CONSTRUCTION **8**

General safety consideration in Excavation, foundation and utilities – Cordoning – Demolition – Dismantling –Clearing debris – Types of foundations – Open footings.

Safety in Erection and closing operation - Safety in typical civil structures – Dams-bridges-water Tanks-Retaining walls-Critical factors for failure-Regular Inspection and monitoring.

MODULE IV ELECTRICAL SAFETY **8**

Electrical Hazards – Energy leakage – Clearance and insulation – Excess energy – Current surges – Electrical causes of fire and explosion – National electrical Safety code.

Selection of Environment, Protection and Interlock – Discharge rods and earthing device – Safety in the use of portable tools - Preventive maintenance.

MODULE V SAFETY IN MATERIAL HANDLING **8**

General safety consideration in material handling devices - Ropes, Chains, Sling, Hoops, Clamps, Arresting gears – Prime movers.

Ergonomic consideration in material handling, design, installation, operation and

maintenance of Conveying equipments, hoisting, traveling and slewing mechanisms.

Storage and Retrieval of common goods of shapes and sizes in a general store of a big industry.

MODULE VI SAFETY EDUCATION AND TRAINING 7

Importance of training-identification of training needs-training methods – programme, seminars, conferences, competitions – method of promoting safe practice - motivation – communication - role of government agencies and private consulting agencies in safety training – creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign – Domestic Safety and Training.

L – 45; Total Hours –45

REFERENCES:

1. Krishnan N.V, “Safety Management in Industry”, Jaico Publishing House, Bombay, 1997.
2. Blake R.B., “Industrial Safety”, Prentice Hall, Inc., New Jersey, 1973.
3. Fulman J.B., “Construction Safety, Security, and Loss Prevention”, John Wiley and Sons, 1979.
4. Fordham Cooper W., “Electrical Safety Engineering”, Butterworths, London, 1986.
5. Alexandrov M.P., “Material Handling Equipment”, Mir Publishers, Moscow, 1981.

OUTCOMES:

Students would be able to

- Acquire knowledge on various safety Hazards.
- Carry out safety measures for different industrial environments.

GECX206 ADVANCED OPTIMIZATION TECHNIQUES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the various advanced optimization tools.
- To provide an understanding to deal with ill identified and fuzzy problems.

MODULE I INTRODUCTION **7**

Review of conventional optimization techniques - limitations - limitation of exhaustive search - need for artificial intelligence - bio mimicking methods

MODULE II HEURISTICS METHODS **8**

Introduction – Advanced methods of algorithm design: Greedy method, Backtracking method, Divide and Conquer method – Dynamic programming – Heuristics exploration algorithms – Greedy search - Local search – Hill climbing – Tabu search – Gradient search – Beam search – Simulated Annealing.

MODULE III GENETIC ALGORITHM **7**

Introduction - Basics of GA – Population – Reproduction – Cross over – Mutation -genetic algorithms in search, optimization and machine learning-practical genetic algorithms.

MODULE IV ANT COLONY OPTIMIZATION **8**

Introduction: Ant Colony Optimization – Meta-heuristic Optimization – History – The ACO Meta-heuristic – ACO Algorithms: Main ACO – Ant system – Ant colony system – Max-Min Ant system – Applications: Routing in telecommunication networks – Travelling salesmen – Graph Coloring – Advantages & Disadvantages

MODULE V FUZZY LOGIC AND ANN **8**

Fuzzy logic, knowledge representation and inference mechanism – Fuzzy and expert control – standard Takagi-Sugeno mathematical characterizations – Design example – Biological foundations to intelligent systems: Artificial neural networks, Back-propagation networks, Radial basis function networks, and recurrent networks.

MODULE VI IMPLEMENTATIONS & APPLICATIONS 7

Reduction of size of an optimization problem – multilevel optimization – parallel processing – multi objective optimization – Job shop scheduling – Vehicle scheduling – Line balancing – Sensor integration.

L – 45; Total Hours –45

REFERENCES:

1. Singiresu S. Rao, “Engineering optimization – Theory and practices”, John Wiley and Sons, 1996.
2. Ravindran – Phillips –Solberg, “Operations Research – Principles and Practice, John Wiley and Sons, 1987.
3. Fredrick S.Hillier and G.J.Liberman, “Introduction to Operations Research”, McGraw Hill Inc. 1995.
4. Kalymanoy Deb, “Optimization for Engineering Design”, PHI, 2003
5. Christos H. Papadimitriou, Kenneth Steiglitz, Combinatorial Optimization, PHI 2006

OUTCOMES:

At the end of the course student will be able to

1. Formulate a real life situation as an optimization the problem.
2. Identify the appropriate solution methodology and provide a solution

GECX207 MATLAB SIMULINK

L	T	P	C
3	0	0	3

OBJECTIVES:

- Teach students how to mathematically model engineering systems
- Teach students how to use computer tools to solve the resulting mathematical models. The computer tool used is MATLAB and the focus will be on developing and solving models of problems encountered in engineering fields

MODULE I INTRODUCTION MATLAB DATA PRESENTATION 7

Vectors, Matrices -Vector/Matrix Operations & Manipulation- Functions vs scripts- Making clear and compelling plots-Solving systems of linear equations numerically and symbolically- Least squares regression -Curve fitting.

MODULE II MATLAB PLOT FUNCTION 7

Introduction- Plot Function – Animation- 3D Plots-Customizing Plots – Plot Applications- Saving &Painting Plots.

MODULE III ROOT FINDING AND COMPUTER REPRESENTATION OF NUMBERS 7

Linearization and solving non-linear systems of equations- The Newton-Rapson method- Integers and rational numbers in different bases- Floating point numbers- Round off and errors in basic arithmetic-Significant digits when reporting results

MODULE IV ORDINARY DIFFERENTIAL EQUATIONS 8

Numerical integration and solving 1^{st} order, ordinary differential equations (Euler's method and Runge-Kutta)- Use of ODE function in MATLAB

MODULE V NON-LINEAR DIFFERENTIAL EQUATIONS 8

Converting 2^{nd} order and higher ODEs to systems of 1^{st} order ODEs- Solving systems of ODEs via Euler's method and Runge-Kutta)- Solving single and systems of non-linear differential equations by linearization-Use of the function ODE in MATLAB to solve differential equations

MODULE VI INTRODUCTION OF SIMULINK 8

Simulink & its relations to MATLAB – Modeling a Electrical Circuit- Modeling a fourth order differential equations- Modeling the solution of three equations with three unknowns- Representing a model as a subsystem-Simulink demos.

L – 45; Total Hours –45

REFERENCES:

1. Griffiths D V and Smith I M, Numerical Methods for Engineers, Blackwell, 1991.
2. Laurene Fausett, Applied Numerical Analysis Using MATLAB, Pearson 2008.
3. Moin P, Fundamentals of Engineering Numerical Analysis, Cambridge University Press, 2001.
4. Wilson HB, Turcotte LH, Advanced mathematics and mechanics applications using MATLAB. CRC Press, 1997
5. Ke Chen, Peter Giblin and Alan Irving , Mathematical Exploration with MATLAB, Cambridge University Press, 1999.

OUTCOMES:

At the end of this unit students will be able to:

1. Use Matlab as a convenient tool for solving a broad range of practical problems in engineering from simple models to real examples.
2. Write programs using first principles without automatic use of built-in ones.
3. Write programs for solving linear and nonlinear systems, including those arising from boundary value problems and integral equations, and for root-finding and interpolation, including piecewise approximations.
4. Be fluent in exploring Matlab's capabilities, such as using matrices as the fundamental data-storage unit, array manipulation, control flow, script and function m-files, function handles, graphical output.
5. Make use of Maltab visual capabilities for all engineering applications.
6. An ability to identify, formulate, and solve engineering problems. This will be accomplished by using MATLAB to simulate the solution to various problems in engineering fields

GECX208	EMBEDDED SYSTEMS AND ITS APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide a detailed overview of embedded system.
- To equip students with the software development skills necessary for practitioners in the embedded systems field.
- To understand entire software development lifecycle and examine the various issues involved in developing software for embedded systems.

MODULE I EMBEDDED SYSTEMS OVERVIEW 8

Introduction –Embedded Systems vs. General computing systems- Fundamental Components of embedded systems- Characteristics- Challenges-Examples- Embedded System design process.

MODULE II EMBEDDED COMPUTING PLATFORM 8

Overview of Processors and hardware units in an embedded system-CPU buses – Memory devices –Memory types- I/O devices – Designing with computing platforms- Consumer electronics architecture-Design example: Alarm clock.

MODULE III REAL TIME EMBEDDED SYSTEMS 8

Programming embedded systems in assembly and C – Real time systems – Hard and Soft real time systems- Need for RTOS in Embedded Systems- Multiple tasks and processes –Context switching-Scheduling policies- Interprocess communication and synchronization.

MODULE IV EMBEDDED SOFTWARE DEVELOPMENT PROCESS and TOOLS 8

Development process of an embedded system-software modules and tools for implementation of an embedded system- Integrated development environment- Host and target machines-cross compiler-cross assembler-Choosing right platform.

MODULE V PROGRAM MODELING IN EMBEDDED SYSTEMS 8

Program Models – Data Flow Graph model-control DFG model-Synchronous DFG model- Finite state machines- UML modeling – UML Diagrams.

MODULE VI EMBEDDED SYSTEMS APPLICATION 5

Application specific embedded system – case study: digital camera hardware and software architecture, embedded systems in automobile, embedded system for a smart card.

Total Hours –45

TEXT BOOKS:

1. Marilyn Wolf , "Computers as components", Elsevier 2012.
2. Shibu. K.V, “Introduction to Embedded Systems”, Tata Mcgraw Hill,2009.
3. Rajkamal, "Embedded Systems Architecture, Programming and Design",1st Reprint,Tata McGraw-Hill, 2003
4. Frank Vahid and Tony Gwargie, "Embedded System Design", John Wiley & sons, 2002.

REFERENCES:

1. Sriram V Iyer and PankajGupta ,”Embedded Realtime Systems Programming ”Tata McGraw-Hill,2008
2. Qing Li and Carolyn Yao," Real-Time Concepts for Embedded Systems", CMPBooks, 2003
3. David E.Simon, "An Embedded Software Primer", Pearson Education, 2003

OUTCOMES:

On completion of this course, the students will be able to

- Identify the suitable processor and peripherals in embedded applications
- Develop embedded programs in assembly and c
- Choose the right platform for designing an embedded system
- Explore different scheduling mechanism in rtos
- Design the program model for embedded applications.
- Analyze different domain specific applications in embedded systems.

GECX209 USABILITY ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

The objective of this course is

- To understand the emerging concept of usability, requirements gathering and analysis.
- To learn about human computer interaction with the help of interfaces that has high usability.

MODULE I INTRODUCTION 6

Cost Savings – Usability Now – Usability Slogans – Discount Usability Engineering – Usability – Definition – Example – Trade-offs – Categories – Interaction Design – Understanding & Conceptualizing Interaction – Cognitive Aspects.

MODULE II USER INTERFACES 8

Generation of User Interfaces – Batch Systems, Line Oriented Interfaces, Full Screen Interfaces, Graphical User Interfaces, Next Generation Interfaces, Long Term Trends – Usability Engineering Life Cycle – Interfaces – Data Gathering – Data Analysis Interpretation and Presentation.

MODULE III INTERACTION DESIGN 8

Process of Interaction Design - Establishing Requirements – Design,Prototyping and Construction - Evaluation and Framework.

MODULE IV USABILITY TESTING 8

Usability Heuristics – Simple and Natural Dialogue, Users' Language, Memory Load, Consistency, Feedback, Clearly Marked Exits, Shortcuts, Error Messages, Prevent Errors, Documentation, Heuristic Evaluation – Usability Testing - Test Goals and Test Plans, Getting Test Users, Choosing Experimenters, Ethical Aspects, Test Tasks, Stages of a Test, Performance Measurement, Thinking Aloud, Usability Laboratories.

MODULE V USABILITY ASSESSMENT METHODS 8

Observation, Questionnaires and Interviews, Focus Groups, Logging Actual Use, User Feedback, Usability Methods – Interface Standards - National, International and Vendor Standards, Producing Usable In-House Standards.

MODULE VI USER INTERFACES 7

International Graphical Interfaces, International Usability Engineering, Guidelines for Internationalization, Resource Separation, Multilocale Interfaces – Future Developments – Case Study.

L – 45; Total Hours –45

TEXT BOOKS:

1. Yvonne Rogers, Helen Sharp, Jenny Preece, “Interaction Design: Beyond Human - Computer Interaction”, John Wiley & Sons, 3rd Edition, 2011 (Module I, II, III).
2. Jakob Nielsen, “Usability Engineering”, Morgan Kaufmann Academic Press, 1994. (Module I – VI).

REFERENCES:

1. Ben Shneiderman, Plaisant, Cohen, Jacobs, “Designing the User Interface: Strategies for Effective Human Interaction”, Pearson Education, 5th Edition, 2010.
2. Laura M. Leventhal, Julie A. Barnes, “Usability Engineering: Process, Products, and Examples”, Pearson/Prentice Hall, 2008

OUTCOMES:

Students who complete this course will be able to

- build effective, flexible and robust user interfaces.
- translate system requirements into appropriate human/computer interaction sequences.
- choose mode, media and device for the application requirements.

GECX210 SUPPLY CHAIN MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

- To understand the various decision phases in a supply chain
- To be aware of the Supply Chain and its drivers
- To design Supply Chain Network
- To build a aggregate plan in supply chain
- To understand Sourcing Decisions in Supply Chain
- To comprehend the influence of Information technology in Supply Chain

MODULE I INTRODUCTION TO SUPPLY CHAIN 7

Understanding Supply Chain - Decision phases - Supply chain performance - Competitive and supply chain strategies - Achieving strategic fit - Expanding strategic scope

MODULE II SUPPLY CHAIN DRIVERS AND DESIGN 7

Drivers of supply chain performance – Designing distribution network - Network Design in the Supply Chain - Network design in Uncertain Environment

MODULE III AGGREGATE PLANNING AND MANAGING SUPPLY, DEMAND AND INVENTORY 8

Aggregate Planning in a Supply chain: role - Managing Supply - Managing Demand in Supply Chain – Cycle and Safety inventory in supply chain – Level of product availability.

MODULE IV MANAGING INVENTORY IN SUPPLY CHAIN 8

Managing Economies of Scale in a Supply Chain : Cycle Inventory- Managing uncertainty in a Supply Chain Safety Inventory- Determining optimal level of Product Availability

MODULE V SOURCING AND TRANSPORTATION 8

Sourcing decision in supply chain - Third and Fourth – Party Logistics providers - Supplier scoring and assessment - Transportation in a Supply Chain – Risk and Trade-offs in transportation design.

MODULE VI INFORMATION TECHNOLOGY IN A SUPPLY CHAIN 7

Information technology in a supply chain – CRM, ISCM, SRM in supply chain -

Over view of recent trends in Supply Chain: e-SRM, e-LRM, e-SCM.

L – 45; Total Hours –45

REFERENCES:

1. Sunil Chopra and Peter Meindl, “Supply Chain Management-Strategy Planning and Operation”, Pearson Education, 5th Indian Reprint, 2013.
2. Jananth Shah “Supply Chain Management – Text and Cases“ Pearson Education, 2008.
3. Altekar Rahul V, “Supply Chain Management-Concept and Cases”, Prentice Hall India, 2005.
4. Monczka et al., “Purchasing and Supply Chain Management”, Thomson Learning, 2nd Edition, 2nd Reprint, 2002.

OUTCOMES:

- After taking up the course the student will be able to brighten his prospects of taking up a career on supply chain management.
- The student decision making capability specific to supply chain issues in an industry is improved.
- The student can plan a well defined execution of supply chain strategy in companies.
- The student will be able to design a optimal distribution network as per the demands of the industry.
- The student can also determine the most favorable transportation plan for a company.
- The student will also be able to bring in company from paper environment to paperless environment.

GECX211 SYSTEMS ANALYSIS AND DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To describe the phases of the systems development life cycle
- To teach the automated tools for system development
- To develop and evaluate system requirements.
- To explain the organizational issues in system implementation
- To teach the usability testing and electronic data interchange
- To elucidate the importance of System analysis and design in electronic commerce.

MODULE I FUNDAMENTALS OF SYSTEM DEVELOPMENT 8

System Concept – Characteristics – Elements of System – Types of System – Modern Approach to System Analysis and Design – System Development Life Cycle – Approaches to Improving Development – Tools for System Development – Succeeding as a System Analyst – Skills – Managing the Project.

MODULE II AUTOMATED TOOLS FOR SYSTEMS DEVELOPMENT 7

What is requirements determination? Fact finding techniques, Tools for documenting procedure and decision-CASE Tools-Need for CASE tools-Reverse engineering and reengineering- phases of the software life cycle-Ranking projects-Value Chain Analysis- Corporate Strategic Planning vs. Information Systems Planning.

MODULE III SYSTEM ANALYSIS 8

Determining System Requirements – Traditional Methods - Modern Methods – Radical Methods – Structuring System Requirements – Process Modeling – Data Flow Diagramming – Logic Modeling – Conceptual Data Modeling – E-R Modeling.

MODULE IV SYSTEM DESIGN 8

System Implementation – Software Application Testing – Installation – Documentation – Training and Support – Organizational Issues in Systems Implementation – Maintaining Information System – Conducting System

Maintenance.

MODULE V USABILITY AND MEASURING USER SATISFACTION 7

Usability Testing-User satisfaction test- A tool for analyzing user satisfaction – Unified Modeling Language(UML)- Case study: System Design: Application in Human Resource-Financial Applications

MODULE VI SAD IN E-COMMERCE 7

Systems analysis and design in the era of electronic commerce: B2B, B2C and C2C e-commerce -advantages and disadvantages of e-commerce. E-commerce system architecture – physical networks, logical network, World Wide Web, web-services - HTML, XML - case studies-El electronic data interchange: EDI standards - virtual private networks - XML and EDI

L – 45; Total Hours –45

REFERENCES:

1. Jeffrey A. Hoffer, Joey F. George, Joseph S. Valacich, “Modern Systems Analysis and Design”,Fifth Edition, Prentice Hall,March 2007.

2.Ned Kock, “Systems Analysis & Design Fundamentals” Sage South Asia, May 2008.

3. Joseph S. Valacich, Jeffrey A. Hoffer, Joey F. George, “Essentials Of System Analysis And Design” Prentice Hall , August 2005.

4. Rumbaugh et al, “Succeeding with Booch and Rambaugh Methods”, Addisson Wesley, second Edition, 1998.

5.Larman, C.,” Applying UML and Patterns. An introduction to Object-Oriented Analysis and Design”. Prentice-Hall PTR, 2002.

OUTCOMES:

- List the characteristics of the system and specify the approaches in the development of the system.
- Summarize the phases of the software life cycle
- Differentiate Corporate Strategic Planning and Information Systems Planning.
- Illustrate the system requirements through various modeling diagrams.
- Use tools and techniques for process and data modeling.
- Solve realistic systems analysis problems and perform user satisfaction test.

GECX212	ADVANCED MATERIALS	L	T	P	C
		3	0	0	3

OBJECTIVES:

To make the student conversant with

- Dielectric materials
- Magnetic materials
- Energy materials
- Nano materials
- Semi conductors
- Smart materials

MODULE I **8**

Dielectric Materials- Polarization and Mechanism-Internal or local field-Clausius-Mossotti relation- Dielectric loss- Temperature and Frequency effect- Measurement of Dielectric constant and loss using Scherring bridge- electric break down- ferro, piezo, pyroelectric materials and its application.

MODULE II **8**

Magnetic Materials- Terminology and classification of magnetic materials (Dia, Para, Ferro & Ferri) – Magnetic moments due to electrospin – Domain theory of Hysteresis – Heisenberg theory of Exchange Interaction (without derivation)- Structure and properties of Ferrites- Properties of Soft and Hard Magnetic Materials- Application: floppy disk, CD ROM, Magneto optical recording.

MODULE III **8**

Energy Materials (Nuclear) - Introduction to nuclear materials- Materials for nuclear fuel in fission and fusion reactors, Fissile and fertile materials- Control & Construction Materials for Nuclear reactors, Moderators, Heat Exchangers- Radiation proof materials- Brief discussion of safety and radioactive waste disposal.

MODULE IV **7**

Nano Materials- The nanosize range- classification of nanomaterials- processing of nanomaterials-properties of nanomaterials- mechanical, electrical, magnetic properties- other properties- carbon based nanomaterials- other nanomaterials and its application.

MODULE V **7**

Semiconductors- The energy gap in solids-Extrinsic Semiconductors- Intrinsic Semiconductors- Hall Effect in semiconductors- Application of Hall Effect- Basic ideas of compound semiconductors -Semiconductor materials- Fabrication of Integrated Circuits- Some semiconductor Devices

MODULE VI **7**

Smart materials- aerospace materials Ni and Co based super alloys, Special steels, Titanium alloys, Intermetallics, ceramics and their composites, New High strength material, Properties of Materials, Materials in Medical Applications, Stainless steel alloys,Cobalt based alloys, titanium based alloys, polymers

L – 45; Total Hours –45

REFERENCES:

1. Materials science and Engineering: A first course by V. RAGHAVAN, 6th ed., Eastern Economy edition,Prentice Hall of India,2015
2. Materials science and Engineering: An Introduction by William D. Callister Jr., 7th ed. John Wiley & Sons Inc. 2007
3. Material science by Dr.M.Arumugam, Anurasha agencies ,third revised edition ,2002

OUTCOMES:

Students will be able to know

- significance of dielectric materials
- types and applications of magnetic materials
- applications of nuclear materials for energy harvesting
- applications of nano materials
- significance of semi conductor devices
- applications of smart materials

GECX213 NATIONAL SERVICE SCHEME

L	T	P	C
2	0	0	2

OBJECTIVES:

Primary Objective: Personality development through community service.
To achieve the above objective, the following should be adhered:

1. To provide an understanding about the aims, structure and programmes and activities of National Service scheme in terms of Nation Building
2. To develop certain basic skills for personality development through community development.
3. Understand the community in which they work and their relation
4. Identify the needs and problems of the community and involve them in problem-solving and
5. Practice national integration and social harmony.

MODULE I INTRODUCTION TO NSS 8

Orientation and structure of NSS,-Aims and Objectives of National Service Scheme- The history of NSS- Symbol and meaning- NSS hierarchy from national to college level – Role and responsibilities of various NSS functionaries

MODULE II PERSONALITY AND COMMUNITY DEVELOPMENT SKILLS 8

Importance of youth Leadership, Traits of Good Leadership and Personality Development. Role of youth in creating awareness through NSS Programmes on Health & Hygiene; Environmental Conservation and Enrichment for Sustainable Development; Sanitation and Swachh Bharat.

MODULE III UNDERSTANDING YOUTH 7

Definition and Profiles of youth categories, Youth Issues, Challenges and Opportunities for Youth, Youth as agent of social change & Community Mobilization .Role of Youth in Nation Building. National Youth Policy.

MODULE IV SOCIAL HARMONY AND NATIONAL INTEGRATION 7

National Integration, Various obstacles in the way of National Integration; such as caste, religion, language and provisional problems etc. Role of youth in Peace building and conflict resolution- Globalization and its Economic Social Political and

Cultural impacts.

L – 30; Total Hours –30

TEXT BOOKS:

1. National Service Scheme – A Youth Volunteers Programme for Under Graduate students as per UGC guidelines J.D.S.Panwar et al. Astral International. New Delhi.
2. National Service Scheme Revised Manual, 2006.Govt. of India. Ministry of Youth Affairs & Sports. New Delhi.
3. Social Problems in India, *Ram Ahuja.*

REFERENCES:

1. National Youth Policy-2014. Ministry of Youth Affairs & Sports. .Govt. of India

OUTCOMES:

On successful completion of this course-

- Students will have exposure to the the aims, structure and programmes and activities of National Service scheme in terms of Nation Building
- Students will be trained to skills for personality development through community development.
- Students will gain knowledge about national integration and social harmony.
- Students will be exposed to the role of youths in Nation building Students will gain

GECX214	AUTOMOTIVE POLLUTION AND CONTROL	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To have a fair knowledge in automotive pollution control.
- To understand the concept of formation and control techniques of pollutants like UBHC, CO, NOx, particulate matter and smoke for both SI and CI engine will be taught to the students.
- To know about the instruments for measurement of pollutants
- To get introduced about emission standards

MODULE I EMISSION FROM AUTOMOBILES 8

Sources of Air Pollution. Various emissions from Automobiles — Formation — Effects of ollutants on environment and human beings. Emission control techniques – Modification of fuel, after treatment devices. Emission standards. Automotive waste management, old vehicle disposal, recycling, tyre recycling

MODULE II SI ENGINE EMISSIONS AND CONTROL 9

Emission formation in SI Engines- Carbon monoxide & Carbon di oxide - Unburned hydrocarbon, NOx, Smoke —Effects of design and operating variables on emission formation – controlling of pollutants - Catalytic converters, Charcoal Canister, Positive Crank case ventilation system, Secondary air injection, thermal reactor

MODULE III CI ENGINE EMISSION AND CONTROL 8

Formation of White, Blue, and Black Smokes, NOx, soot, Effect of Operating variables on Emission formation — Fumigation, Split injection, Catalytic Coating, EGR, Particulate Traps, SCR, Fuel additives — Cetane number Effect.

MODULE IV NOISE POLLUTION FROM AUTOMOBILES 8

Sources of Noise — Engine Noise, Transmission Noise, vehicle structural Noise, aerodynamics noise, Exhaust Noise. Noise reduction in Automobiles — Encapsulation technique for noise reduction —Silencer Design.

MODULE V TEST PROCEDURES 6

Constant Volume Sampling I and 3 (CVSI &CVS3) Systems- Sampling Procedures — Chassis dynamometers - Seven mode and thirteen mode cycles for Emission Sampling.

MODULE VI EMISSION MEASUREMENTS 6

Emission analysers —NDIR, FID, Chemiluminesecent, Smoke meters, Dilution Tunnel, SHED Test, Sound level meters.

L – 45; Total Hours –45

TEXT BOOKS:

1. V.Ganesan, 'Internal combustion Engines', Tata McGraw Hill Book Co, Eighth Reprint, 2005.
2. Crouse and Anglin, 'Automotive Emission Control', McGraw Hill company., Newyork 1993.

REFERENCES:

1. G.P.Springer ad D.J.Patterson, Engine Emissions, Pollutant formation, Plenum Press, New York. 1986.
2. D.J.Patterson and N.A.Henin, 'Emission from Combustion Engine and their control', Anna Arbor Science Publication,1985.
3. L.Lberanek, 'Noise Reduction', Mcgrawhill Company., Newyork1993.
4. C.Duerson, 'Noise Abatment', Butterworths ltd., London1990.
5. A.Alexander, J.P.Barde, C.lomure and F.J. Langdan, 'Road traffic noise', Applied science publisher ltd., London,1987.

OUTCOMES:

On completion of the course student should be able to

- Identify the sources of emission from vehicles.
- Analyse the causes and effects of emissions.
- Analyse causes and effects of noise pollution
- Bring out solutions for control of emissions.
- Demonstrate the test procedures and emission norms.
- Select suitable instruments for measurement of emissions.

GECX215	MOTOR VEHICLE ACT, INSURANCE & POLICY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn about basic act and regulation followed for road vehicle
- To learn about systematic steps involved to get licence and registration of motor vehicle
- To learn arbour various types of motor vehicle polices and insurances

MODULE I BASIC RULES FOR ROAD VEHICLE 8

Display and Use of Number Plates- Attachment of number plates- Number plates in horizontal position- Removal of number plates on transfer- Hours prescribed for lighted lamps- Mounting of lamps and reflectors- Multiple beam headlamps- Daytime running lamps- Auxiliary driving lamps- Parking lamps- Brakes- Stopping distances- Emergency or parking brakes- Horn- Muffler- Mirrors- Inspection of motor vehicles- Standards of safety and repair

MODULE II LICENSING OF DRIVERS OF MOTOR VEHICLES 8

Necessity of driving licence- Age limit in connection with driving of motor vehicle-Responsibility of owners of motor vehicles-Restriction on the holding of driving licence-Grant of learner's licence-Grant of driving licence-Addition to driving licence- Renewal of driving licence-Revocation of driving licence on grounds of disease or disability-Driving licence to drive motor vehicle belonging to the central government- power of court to disqualify- suspension of driving licence in certain cases- suspension or cancellation of driving licence on convection- Endorsement.

MODULE III REGISTRATION OF MOTOR VEHICLE 7

Necessity for registration – Registration Where and how to be made- Special provision for registration of motor vehicle of diplomatic officers-Temporary registration- Production of vehicle at the time of registration- Refusal of registration- renewal of certificate of registration- effectiveness in India of registration- Change of residence or place of business-transfer of ownership-Suspension of registration – cancellation of registration suspended under section 53- certificate of fitness of transport vehicle-cancellation of registration.

MODULE IV INSURANCE OF MOTOR VEHICLE 8

Necessity for insurance against third party – Requirements of policies and limits of liability- - Duty of insurers to satisfy judgements and awards against person insured in respect of third party risks-Duty to give information as to insurance-Settlement between insurers and insured persons- transfer of certificate of insurance-production of certain certificates, licences and permit in certain cases-Special provisions as to compensation in case of hit and run motor accident – Types of motor polices

MODULE V CONTROL OF TRANSPORT VEHICLES 7

Power to State Government to control road transport- Transport authorities-General provision as to applications for permits- Application for stage carriage permit- Procedure of Regional Transport Authority in considering application for stage carriage permit- Scheme for renting of motor cabs- Application for private service vehicle permit- Procedure in applying for and granting permits- Duration and renewal of permits- Transfer of permit- Replacement of vehicles-Temporary permits

MODULE VI OFFENCES AND PUNISHMENT 7

Driving without holding an effective driving licence- Driving by an under-aged person (Minor driving vehicle)- Holding of a driving licence permitting it to be used by other person.- Driving a vehicle at an excessive speed- Driving or permitting to drive a vehicle carrying excess load- Driving dangerously / its Abetment Driving an uninsured vehicle

Rider and pillion rider failing to wear protective head gear (Helmet) -Violation of Mandatory Signs -.e-challan and spot challan

L – 45; Total Hours –45

TEXT BOOKS:

1. The motor vehicle act 1988, Universal law publishing co.cpvt ltd. Newdelhi 2011
2. A Commentary On The Motor Vehicles Act, 1988 by SUKHDEV AGGARWAL The Bright Law House, New Delhi

REFERENCES:

1. The Motor Vehicles Act, 1988 Along with Latest Case Law, Notifications

& Table of Offences and Punishments Asia Law House; 15th edition (2014)

2. Assessment of Compensation in Accidents under Motor Vehicles Act by Karkara Delhi Law House (2013)

OUTCOMES:

On completion of the course students should be able to

- Explain the analysis of rules and regulations for road vehicles
- Analyze the procedure for getting driving license for vehicles at national and international level
- Analyze the procedure for registration of vehicles.
- Analyze the procedure for Insurance of vehicles and claims.
- Analyze the procedure for obtaining Government Permits and renewal
- Analyze the consequences of not following the rules and regulations

GECX216	PRINCIPLES OF COMMUNICATION SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

To introduce the analog and digital modulation techniques.
To elaborate the working of communication receivers in the presence of noise.
To give an overview of various communication systems.

MODULE I LINEAR MODULATION 8

Baseband signals, Amplitude Modulation – Modulation Index, Power Transmitted, Double Side Band and Single Side Band AM, AM Modulators and AM Receivers, AM Radio systems, Frequency Division Multiplexing.

MODULE II ANGLE MODULATION 8

Frequency Modulation and Phase Modulation, Frequency deviation and modulation index, Bandwidth of FM, FM Modulators and FM receivers, FM Radio and FM Stereo Systems

MODULE III SAMPLING AND PULSE MODULATION 7

Sampling, Nyquist's Sampling Theorem, Pulse Modulations - PAM, PPM and PWM, Time Division Multiplexing, Bandwidth of TDM systems.

MODULE IV DIGITAL COMMUNICATION 7

Digital baseband data, Digital Modulations – ASK, FSK, PSK and QPSK. Digital Communication Transmitters and Receivers.

MODULE V NOISE 8

Sources of Noise, Thermal Noise, shot noise, White noise, Narrow band Noise, Effect of noise in communication, SNR, Receiver Noise Temperature and Noise Equivalent Bandwidth.

MODULE VI COMMUNICATION SYSTEMS & NETWORK 7

FM Radio Systems, Cellular Mobile network, Satellite Communications, Optical Fiber Communication.

L – 45; T – 0; Total Hours – 45

TEXT BOOKS:

1. A. Bruce Carlson, Paul B. Crilly, "Communication Systems", 5th Edition,

McGraw Hill Int., 2011.
2. B.P. Lathi, Zhi Ding, Hari M. Gupta, “Modern Digital and Analog Communication Systems”, 4th Edition, Oxford University Press, 2017.

REFERENCES:

1. Herbert Taub, Donald L. Schilling, Goutam Saha, “Principles of Communication Systems” 4th Edition, McGraw Hill Int. 2013.
2. Simon Haykin, “An Introduction To Analog And Digital Communications”, 1st Edition, Wiley India, 2010.
3. Simon Haykin , “Communications Systems” 4th Edition, Wiley India, 2006.
4. Hwei P. Hsu, “Analog and Digital Communications” 3rd Edition,

OUTCOMES:

On completion of the course students will be able to

1. Identify various communication systems and the corresponding modulation schemes.
2. Predict the characteristics of various analog and digital modulation schemes.
3. Interpret the effect of noise and bandwidth in a communication systems
4. Apply the Nyquist criteria for a given baseband signals.
5. Evaluate the performance of communication receivers.
6. Demonstrate the applications of common communication systems.

GECX217 LEAN MANAGEMENT L T P C

3 1 0 4

OBJECTIVES:

The objective of the Course to make the student know about

- the basics of lean production management,
- how Lean principles are applied to the Construction industry to improve the operation management and product development.

MODULE I **8**

lean production? – Introduction, background, and lean thinking. Importance of philosophy, strategy, culture, alignment, focus and systems view. Discussion of Toyota Production System.

MODULE II **8**

Manufacturing systems – an overview of manufacturing strategies. Job shops, batch flow, and flexible manufacturing systems Flow production and lean production systems

MODULE III **7**

Value stream mapping in process design and product development Waste reduction - lead time reduction

Process cycle time and value-added vs. non-value added activities Optimum lot sizing

MODULE IV **8**

Lean production processes, approaches and techniques.—Importance of focusing upon flow. Tools -. Workplace organization – 5S. - Stability. - Just-In-Time – One piece flow – Pull. - . Cellular systems. - . Quick change and set-up reduction methods. f. Total productive maintenance. -. Poka-Yoke – mistake proofing, quality improvement. Standards. - . Leveling. - . Visual management. Just-in-time techniques – SMED and Takt Times - Standard work processes and line balancing Poka-yoke and pull systems material handling reduction and facilities planning

MODULE V **8**

Managing change in the lean organization Human resource management and the lean enterprise Employee involvement – Teams – Training – Supporting and encouraging involvement – Involving people in the change process -- communication -- Importance of culture. Startup of lean processes and examples of applications.

Sustaining improvement and change, auditing, follow-up actions.

7

MODULE VI

The lean enterprise and supply chain management Costs and risks of lean initiatives - Measuring lean initiatives

L – 45; Total Hours –45

TEXT BOOKS:

1. The Toyota Way Fieldbook, Jeffrey Liker and David Meier, McGraw-Hill, 2006. Lean Production Simplified, Pascal Dennis, Productivity Press, 2007.
2. Womack, James P., and Daniel T. Jones. Lean Thinking. New York, NY: Simon and Schuster, 2003. ISBN: 0743249275.
3. Murman, Earll. Lean Enterprise Value. New York, NY: Palgrave Macmillan, 2002. ISBN: 0333976975.

REFERENCES:

1. Readings at http://www.leanconstruction.org/readings.htm
2. Hopp, W. J., and Spearman, M. L. (2011). Factory Physics, Third Edition, Waveland Press, Long Grove, Il. 720 pp.

OUTCOMES:

The student will be able to

- Describe the manufacturing approaches employed and the background and philosophy of lean production.
- Illustrate the concept of waste reduction
- Apply evaluation techniques that can be used in preparation for and use in learn production activities.
- Select the tools that can be used implementing lean production in production operations.
- Discuss the importance of workplace organization, pull production, cellular arrangement and employee involvement, need for employee creativity
- Describe about the Methods for promoting success in implementing lean transformations

GECX218 GEOSPATIAL MODELING & ANALYSIS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To equip the students with fundamental representation and analysis of geospatial phenomena and provides foundations in methods and algorithms used in GIS analysis.
- To focus is on terrain modeling, geomorphometry, watershed analysis and introductory GIS-based modeling of landscape processes (water, sediment). The course includes analysis from lidar data, coastal change assessment and 3D visualization.

MODULE I INTRODUCTION TO GEOSPATIAL DATA 7

Mapping natural phenomena –Concept of continuous fields and discrete sampling – Units, projections, coordinate transformation – Georeferencing, geospatial formats, conversions, geospatial data abstraction library – Raster and vector representation, raster and vector conversions and resampling.

MODULE II DATA DISPLAY AND VISUALIZATION 7

Display of continuous and discrete data, use of color, shading, symbols, to extract the spatial pattern and relationships – 3D visualization: multiple surfaces and volumes, 3D vector objects – visualization for data analysis (lighting, scaling, transparency, cutting planes, animations) – view/create maps/post your data on-line (Google Earth/Maps, GPS visualizer)

MODULE III GEOSPATIAL ANALYSIS 7

Foundations for analysis of continuous and discrete phenomena – neighborhood operations and buffers – analysis and modeling with map algebra – cost surfaces and least cost path – spatial interpolation and approximation (gridding)

MODULE IV TERRAIN MODELING AND ANALYSIS 9

terrain and bathymetry mapping – mathematical and digital representations (point clouds, contour, raster, TIN) – DEM and DSM, working with multiple return lidar data – spatial interpolation of elevation data and topographic analysis, line of sight, view shed analysis – solar irradiation, photovoltaic energy potential, time series of elevation data, analysis of coastal change.

MODULE V FLOW TRACING, WATERSHED ANALYSIS AND LANDFORMS 8

Methods for flow routing and flow accumulation – Extraction of stream networks – Extraction of watershed boundaries and building watershed hierarchies – feature extraction, types of landforms.

MODULE VI MODELING OF GEOSPATIAL PROCESSES 7

Model formulation, input data processing – introduction to GIS-based hydrologic, erosion and environmental modeling – Geocomputational methods, including agent-based modeling, artificial neural networks and evolutionary computing.

L – 45; T – 0; Total Hours –45

TEXT BOOKS:

1. Hassan A, Karimi (2017), *Geospatial Data Science Techniques and Applications*, CRS Press & Co.
2. Sudipto Banerjee, Bradley P, Carlin, Alan E. Gelfand (2014), *Hierarchical Modeling and Analysis for Spatial Data*, CRS Press & Co.

REFERENCES:

1. Maguire, D., M. Batty, and M. Goodchild. 2015. GIS, Spatial analysis, and modeling. ESRI Press (G70.212 .G584 2005)
2. Zeiler, M. 2010. Modeling Our World: The ESRI Guide to Geodatabase Design. Second Ed. ESRI Press, Redlands, California

OUTCOMES:

On successful completion of this course,

- Students will be able to apply the basic concepts of Conceptualize models as representations of real life systems with inputs, outputs, and processes.
- Students will have gained knowledge in spatial tools to make simulations and predictions of real life phenomena.
- Students will have synthesized knowledge about Apply, integrate, and develop models with geospatial data through a GIS.
- Students will have an overview of Evaluate models in terms of accuracy, sensitivity, and uncertainty.
- Students will have Use of a system-based approach for problem solving, with an emphasis on sustainability.

B.S. Abdur Rahman Crescent Institute of Science & Technology

Deemed to be University u/s 3 of the UGC Act, 1956

REGULATIONS 2017

CURRICULUM AND SYLLABI

B.TECH.

ELECTRICAL AND ELECTRONICS ENGINEERING

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

VISION AND MISSION

VISION

To achieve excellence in the programs offered by the Department of Electrical and Electronics Engineering through quality teaching, holistic learning and innovative research.

MISSION

- To offer Under Graduate, Post Graduate & Research programs of industrial and societal relevance.
- To provide knowledge and skill in the Design and realization of Electrical and Electronic circuits and systems.
- To impart necessary managerial and soft skills to face the industrial challenges.
- To pursue academic and collaborative research with industry and research institutions in India and abroad.
- To disseminate the outcome of research and projects through publications, seminars and workshops.
- To provide conducive ambience for higher education, teaching and research.

PROGRAMME EDUCATIONAL OBJECTIVES

- To provide fundamental knowledge of mathematics and science to understand the basic concepts of Electrical and Electronics Engineering.
- To impart theoretical and practical knowledge in the broad areas of Power Generation, transmission, Distribution and Utilization.
- To provide knowledge and skill in using Electrical and Electronic components circuits and systems.
- To develop skills for devising and evaluating solutions including design of components system and their analysis using appropriate tools.

  To enhance the spirit of enquiry through projects and internships to develop creativity, self confidence and team spirit.
- To inculcate self learning capability to enable the students to constantly update themselves with the technological developments.
- To impart necessary managerial and soft skills to face the challenges in core industries and software companies.

PROGRAMME OUTCOMES

On successful completion of the programme, the graduates will

- Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

- Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
- Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
- Design, Simulate and Analyse the Electrical and Magnetic Systems in the areas of Electrical and Electronics Engineering and arrive at appropriate solutions.
- Competent to work professionally in an Industrial Environment.

B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE AND TECHNOLOGY

B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING

CURRICULUM & SYLLABUS, REGULATIONS 2017

SEMESTER I

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	BS	MAC 1181	Differential Calculus and Geometry	3	1	0	4	
2.	HS	ENC 1181/ ISC 1181/ LNC 1181/ LNC 1182 / LNC 1183	English / Arabic / Mandarin / German / Japanese	3	0	0	3	
3.	BS	PHC 1181	Physics	3	0	2	4	
4.	BS	CHC 1181	Chemistry	3	0	2	4	
5.	ESF	GEC 1101	Engineering Graphics	2	0	2	3	
6.	ESF	GEC 1102	Engineering Design	2	0	0	2	
7.	ESF	GEC 1103	Basic Engineering Practices Laboratory	0	0	2	1	
8.	ESF	GEC 1104	Computer Programming I	1	0	2	2	**23**

SEMESTER II

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	BS	MAC 1281	Advanced Calculus	3	1	0	4
2.	BS	-	Physics Elective	2	0	2	3
3.	BS	-	Chemistry Elective	2	0	2	3
4.	ESF	GEC 1211	Basic Engineering Mechanics	3	1	0	4
5.	BS	GEC 1212	Environmental Studies	2	0	0	2
6.	ESF	GEC 1213	Computer Programming II	1	0	2	2

7.	EC	EEC 1211	Electric Circuit Analysis	3	1	0	4	
8.	EC	EEC 1212	Electric Circuits and Simulation Lab	0	0	3	1	**23**

SEMESTER III

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	BS	MAC2181	Partial Differential Equations and Transforms	3	1	0	4	
2.	HS	-	Humanities Elective I	2	0	0	2	
3.	HS	ENC 2181	Oral Communication	0	0	2	1	
4.	EC	EEC2101	Electro Magnetic Theory	3	0	0	3	
5.	EC	EEC2102	Signals and Systems	3	0	0	3	
6.	EC	EEC2103	Electronic Devices & Circuits	3	0	0	3	
7.	EC	EEC2104	Electromechanical Energy Conversion	3	0	2	4	
8.	EC	EEC2105	Electronic Devices & Circuits Lab	0	0	3	1	
9.	EC	EEC2106	Electromechanical Energy Conversion Lab	0	0	3	1	22

SEMESTER IV

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	BS	-	Mathematics Elective I	3	1	0	4
2.	HS	-	Humanities Elective II	2	0	0	2
3.	HS	ENC2282	Written Communication	0	0	2	1
4.	EC	EEC2211	Power System - I	3	1	0	4
5.	EC	EEC2212	AC Machines	3	1	0	4
6.	EC	EEC2213	Power Electronics	3	1	0	4
7.	EC	EEC2214	AC Machines Lab	0	0	3	1

8.	EC	EEC2215	Power Electronics Lab	0	0	3	1	
9.	PE		Programme Elective				3	**24**

SEMESTER V

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	MS	MSC 3181 MSC 3182	Leadership and CEO Training/ Social Entrepreneurship	3	0	0	3	
2.	GE	-	General Elective I	3	0	0	3	
3.	HS	ENC3181	Communication and soft skill I Career Choice	0	0	2	1	
4.	EC	EEC3101	Power System - II	3	1	0	4	
5.	EC	EEC3102	Measurements & Instrumentation	3	0	0	3	
6.	EC	EEC3103	Digital Systems and Integrated Circuits	3	0	0	3	
7.	EC	EEC3104	Power System Simulation Lab	0	0	3	1	
8.	EC	EEC3105	Measurements & Instrumentation Lab	0	0	3	1	
9.	EC	EEC3106	Digital Systems & Integrated Circuits Lab	0	0	3	1	
10.	PE	-	Programme Elective				3	**23**

SEMESTER VI

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	MS	MSC 3181 MSC 3182	Leadership and CEO Training/ Social Entrepreneurship	3	0	0	3	
2.	BS	-	Mathematics Elective II	2	0	0	2	
3.	HS	ENC3281	Communication & soft skill II Confidence Building	0	0	2	1	
4.	EC	EEC3211	Embedded Systems	3	1	0	4	
5.	EC	EEC3212	Control Systems	3	1	0	4	
6.	EC	EEC3213	Embedded Systems Lab	0	0	3	1	

s	EC	EEC3214	Control Systems Lab	0	0	3	1	
8.	EC	EEC3215	Self learning	0	2	0	2	
9.	PE	-	Programme Elective				6	**24**

SEMESTER VII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	GE	-	General Elective II	3	0	0	3	
2.	EC	EEC4101	Power System Protection & Switchgear	3	0	0	3	
3.	EC	EEC4102	Design of Electrical Apparatus	3	0	0	3	
4.	EC	EEC4103	PLC & DCS*****	3	0	2	5	
5.	PE	-	Programme Elective	3	0	0	9	
6.	EC	EEC3216	Internship*				1**	**24**

SEMESTER VIII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	EC		Project Work	0	0	24	12	**12**

Total credits – 175

* 15 days

** Internship will be undertaken during Third year summer vacation. The credit will be awarded in the 7th Semester.

PROGRAMME ELECTIVES

POWER SYSTEM

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	EECX01	Power Distribution System	3	0	0	3
2.	PE	EECX02	Power System Planning & Reliability	3	0	0	3
3.	PE	EECX03	Power System Dynamics	3	0	0	3
4.	PE	EECX04	Power System Transients	3	0	0	3
5.	PE	EECX05	Smart Power Grid	3	0	0	3
6.	PE	EECX06	Wind Energy Conversion systems	3	0	0	3
7.	PE	EECX07	Flexible AC Transmission Systems	3	0	0	3
8.	PE	EECX08	Industrial Power System Analysis & Design	3	0	0	3
9.	PE	EECX09	Electric Energy Generation, Utilization and Conservation	3	0	0	3
10.	PE	EECX10	Restructured power systems	3	0	0	3
11.	PE	EECX11	Solar Energy Technology	2	0	0	2
12.	PE	EECX12	Micro-grid Protection	3	0	0	3
13.	PE	EECX13	Electric Vehicles	1	0	0	1
14.	PE	EECX14	Power System Simulation Software	1	0	0	1
15.	PE	EECX15	Wide Area Measurement Systems	2	0	0	2
16.	PE	EECX16	Energy Auditing	2	0	0	2

POWER ELECTRONICS & DRIVES

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	EECX21	Special Electrical Machines	3	0	0	3
2.	PE	EECX22	CAD for Electrical Apparatus	3	0	0	3
3.	PE	EECX23	Software for Circuit Simulation	3	0	0	3
4.	PE	EECX24	Electromagnetic Field Computation and Modelling	3	0	0	3
5.	PE	EECX25	Solid State AC & DC Drives	3	0	0	3
6.	PE	EECX26	Converters, Applications & Design	3	0	0	3
7.	PE	EECX27	Power Electronics Application to Renewable Energy System	3	0	0	3
8.	PE	EECX28	Embedded Control of Electric Drives	3	0	0	3
9.	PE	EECX29	Power Quality	3	0	0	3
10.	PE	EECX33	IoT for Electrical Engineers	3	0	0	3

HIGH VOLTAGE ENGINEERING

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	EECX36	High Voltage Engineering	3	0	0	3
2.	PE	EECX37	Bio-Electrics	3	0	0	3
3.	PE	EECX38	EHV AC & DC Transmission Engineering	3	0	0	3
4.	PE	EECX39	High Voltage DC Transmission	3	0	0	3
5.	PE	EECX40	Electromagnetic Interference and Electromagnetic Compatibility	3	0	0	3

6.	PE	EECX41	Outdoor Insulators	3	0	0	3
7.	PE	EECX44	High Voltage Testing Techniques	3	0	0	3
8.	PE	EECX45	Pulsed Electric Field and Food Preservation	3	0	0	3

COMPUTER SCIENCE & INFORMATION TECHNOLOGY

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	ITCX81	Database Management Systems	3	0	0	3
4.	PE	ITCX82	Computer Networks	3	0	0	3
5.	PE	ITCX83	Java Programming	2	0	2	3
6.	PE	ITCX84	Computer Hardware and Interfacing	2	0	2	3
7.	PE	ITCX85	Cloud Computing	3	0	0	3
8.	PE	ITCX86	Operating Systems	3	0	0	3
9.	PE	ITCX87	Internet of Things	3	0	0	3
10.	PE	ITCX88	Python Programming	3	0	0	3

ELECTRONICS, COMMUNICATION, INSTRUMENTATION AND CONTROL

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	ECCX81	Image Processing	3	0	0	3
2.	PE	ECCX82	VLSI Design	3	0	0	3
3.	PE	ECCX83	Integrated Circuits and System Design	3	0	0	3
4.	PE	ECCX84	Communication System Security	3	0	0	3

5.	PE	ECCX85	Embedded Hardware & Software System Design	3	0	0	3
6.	PE	ECCX86	Digital Signal Processors	3	0	0	3
7.	PE	EICX81	Bio Instrumentation and Signal Analysis	3	0	0	3
8.	PE	EICX82	Sensors for Bio-Medical Application	3	0	0	3
9.	PE	EICX83	Intelligent Control	3	0	0	3
10.	PE	EICX84	Advanced Control System	3	0	0	3
11.	PE	EICX85	Power Plant Instrumentation	3	0	0	3
12.	PE	EICX86	Instrumentation and Control in Petrochemical Industries	3	0	0	3

Physics Elective Courses
(To be offered in II Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	PHCX 01	Fundamentals of Engineering Materials	2	0	2	3
2.	PHCX 02	Heat and Thermodynamics	2	0	2	3
3.	PHCX 03	Introduction to Nanoscience and Technology	2	0	2	3
4.	PHCX 04	Lasers and their applications	2	0	2	3
5.	PHCX 05	Materials Science	2	0	2	3
6.	PHCX 06	Non-Destructive Testing	2	0	2	3
7.	PHCX 07	Properties of Matter and Acoustics	2	0	2	3
8.	PHCX 08	Properties of Matter and Nondestructive Testing	2	0	2	3
9.	PHCX 09	Semiconductor Physics and Optoelectronics	2	0	2	3

Chemistry Elective Courses
(To be offered in II Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	CHCX01	Analytical Instrumentation	2	0	2	3
2.	CHCX02	Corrosion and its Control	2	0	2	3
3.	CHCX03	Electrical Materials and Batteries	2	0	2	3
4.	CHCX04	Engineering Materials	2	0	2	3
5.	CHCX05	Fuels and Combustion	2	0	2	3
6.	CHCX06	Fundamentals of Physical Chemistry	2	0	2	3
7.	CHCX07	Green Technology	2	0	2	3
8.	CHCX08	Organic Chemistry of Biomolecules	2	0	2	3
9.	CHCX09	Polymer Science and Technology	2	0	2	3

Maths Elective Courses

(To be offered in IV Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	MACX 01	Discrete Mathematics And Graph Theory	3	1	0	4
2.	MACX 02	Probability And Statistics	3	1	0	4
3.	MACX 03	Random Processes	3	1	0	4
4.	MACX 04	Applied Numerical Methods	3	1	0	4

Maths Elective Courses

(To be offered in VI Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	MACX 05	Mathematical Programming	2	0	0	2
2.	MACX 06	Statistical Methods for Data Analysis	2	0	0	2
3.	MACX 07	Numerical Methods for Integral and Differential Equations	2	0	0	2
4.	MACX 08	Mathematical Modelling	2	0	0	2
5.	MACX 09	Graph Theory	2	0	0	2

Humanities Elective I

(To be offered in III Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	SSCX01	Fundamentals of Economics	2	0	0	2
2.	SSCX02	Principles of Sociology	2	0	0	2
3.	SSCX03	Sociology of Indian Society	2	0	0	2

Humanities Elective II

(To be offered in IV Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	SSCX04	Economics of Sustainable Development	2	0	0	2
2.	SSCX05	Industrial Sociology	2	0	0	2
3.	SSCX06	Law for Engineers	2	0	0	2

General Elective

Group I Courses

(To be offered in V semester)

Sl. No.	Course Code	Course Title	Offering Department
1.	GECX101	Disaster Management	Civil
2.	GECX102	Total Quality Management	Mechanical
3.	GECX103	Energy Studies	Mechanical
4.	GECX104	Robotics	Mechanical
5.	GECX105	Transport Management	Automobile
6.	GECX106	Control Systems	EEE
7.	GECX107	Introduction to VLSI Design	ECE
8.	GECX108	Plant Engineering	EIE
9.	GECX109	Network Security	CSE
10.	GECX110	Knowledge management	CSE
11.	GECX111	Cyber security	IT
12.	GECX112	Genetic Engineering	LS
13.	GECX113	Fundamentals of Project Management	CBS
14.	GECX114	Operations Research	Mathematics
15.	GECX115	Nano Technology	Physics / Chemistry
16.	GECX116	Vehicle Maintenance	Automobile
17.	GECX117	Fundamentals of Digital Image Processing	ECE

Group II Courses

(To be offered in VII semester)

Sl. No.	Course Code	Course Title	Offering Department
1.	GECX201	Green Design and Sustainability	Civil
2.	GECX202	Appropriate Technology	Civil / Mechanical
3.	GECX203	Engineering System Modelling and Simulation	Mechanical
4.	GECX204	Value Analysis and Engineering	Mechanical
5.	GECX205	Industrial Safety	Mechanical
6.	GECX206	Advanced Optimization Techniques	Mechanical
7.	GECX207	Mat Lab Simulation	EEE
8.	GECX208	Embedded Systemsand its Applications	ECE
9.	GECX209	Usability Engineering	CSE
10.	GECX210	Supply Chain Management	CBS
11.	GECX211	System Analysis and Design	CA
12.	GECX212	Advanced Materials	Physics & Chemistry
13.	GECX213	National Service Scheme	School of Humanities
14.	GECX214	Automotive Pollution and Control	Automobile
15.	GECX215	Motor Vehicle Act, Insurance and Policy	Automobile
16.	GECX216	Principles of Communication Systems	ECE
17.	GECX217	Lean Management	Civil
18.	GECX218	Spatial Data Modeling & Analysis	Civil

SEMESTER I

MAC 1181	DIFFERENTIAL CALCULUS AND GEOMETRY	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aims of this course are to

- introduce eigen values and eigenvectors of matrix algebra.
- make the student knowledgeable in the area of Three Dimensional Analytical Geometry.
- demonstrate the application of Differential Calculus.
- familiarize the student with the functions of several variables.
- develop the use of ODE solvable techniques necessary for engineering applications.
- motivate the students with some basic engineering application problems in ODE.

MODULE I **MATRICES** **8+2**

Characteristic Equation- Eigenvalues and Eigenvectors of a real matrix –Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton Theorem (without proof) – Orthogonal matrices – orthogonal transformations of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation.

MODULE II **THREE DIMENSIONAL ANALYTICAL GEOMETRY** **7+3**

Direction cosines and ratios – angle between two lines – equations of a plane – equations of a straight line, coplanar lines - shortest distance between skew lines - sphere – tangent plane – plane section of a sphere – orthogonal spheres.

MODULE III **DIFFERENTIAL GEOMETRY** **7+3**

Curvature – Cartesian and polar coordinates – centre and radius of curvature – circle of curvature – involutes and evolutes – envelopes.

MODULE IV **DIFFERENTIAL CALCULUS OF SEVERAL VARIABLES** **8+2**

Functions of two variables – partial derivatives – total differential – Implicit Functions – Jacobian - Taylor's series expansion – Optima of two variables – Lagrange's multiplier method.

MODULE V ORDINARY DIFFERENTIAL EQUATIONS 8+2

Linear equations of second order with constant and variable coefficients – Simultaneous first order linear equations with constant coefficients – homogeneous equations of Euler's type – method of undetermined coefficients, method of variation of parameters

MODULE VI APPLICATIONS OF ORDINARY DIFFERENTIAL EQUATIONS 7+3

Solution of Ordinary Differential Equation Related to Electric Circuits – Bending of Beams- Motion of a Particle in a resisting medium – Simple harmonic motion.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Ramana, B.V, "Higher Engineering Mathematics" Tata McGraw Hill Publishing Co. New Delhi, 2006.
2. Grewal B.S., "Higher Engineering Mathematics" (43rd edition), Khanna Publishers, New Delhi, 2012.
3. John W. Cell "Engineering Problems Illustrating Mathematics" Mc Graw Hill Publishing Co., New York 1943.

REFERENCES:

1. Veerarajan.T., "Engineering Mathematics" (5th edition) Tata Mc Graw Hill Publishing Co. New Delhi, 2012
2. Kreyszig, E., "Advanced Engineering Mathematics", 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
3. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th edition, Cengage Learning, 2011.
4. Dennis G. Zill, Warren S. Wright, "Advanced Engineering Mathematics", 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
5. Alan Jeffrey, "Advanced Engineering Mathematics", Academic Press, USA, 2002.
6. Venkataraman, M.K., "Engineering Mathematics", Volume I, 2nd edition,

National Publishing Co., Chennai, 2003.

7. James Stewart ".Calculus" (7th edition),Brooks/Cole cengage learning,UK

OUTCOMES:

After completing the course, student will be able to

- Understand the matrix techniques and compute eigen values and eigenvectors of a given matrix.
- Do the problems based on three dimensional analytic geometry.
- Apply differential calculus in engineering problems.
- Differentiate more than one variable and their applications.
- Solve the differential equations with constant coefficient and variable coefficient.
- Form and solve differential equations.

ENC 1181	ENGLISH	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To train students to use appropriate vocabulary in academic and technical contexts.
- To facilitate students to speak effectively while exchanging ideas and making presentations.
- To develop students' listening skill for comprehending and analyzing information.
- To develop their reading skill through sub skills like skimming , scanning and critical reading of a text.
- To sharpen their academic writing skills.
- To expose them to the correct usage of language and help them to apply that knowledge appropriately.

MODULE I **8**

L: Listening for general information

S : Self Introduction, Introducing one another.

R: Predicting the content

W: Paragraph Writing

Language Focus: Affixes, Simple Present tense , Connective & Prepositions.

MODULE II **8**

L: Listening for specific information (from dialogues)

S:Exchanging opinion.

R: Skimming technical Passages

W: Argumentative Writing (using the concept of Flipped Learning), Letter to the Editor.

Language Focus: Idioms, use of Modals, Simple Past tense & use of "Wh" and question tags.

MODULE III **7**

L: Learning the ways of describing images and presenting specific information (focusing on note making)

S: Making Presentations using visuals.

R : Scanning short texts for gist of information

W: Letter of Invitation, Expository Writing

Language Focus: Homophones, Homographs, Simple Future & Collocations.

MODULE IV **7**

L: Understanding prepared presentation techniques through videos

S: Short Presentations.

R: Reading for coherence and cohesion

W: Letter seeking permission for Industrial Visit

Language Focus: S-V agreement, Euphemism

MODULE V **8**

L : Understanding Non- Verbal Communications while listening to narration of incidents.

S: Narrating an expereince

R: Inferential Reading

W: Process Description – Transcoding a Flow chart.

Language Focus: Interchange of Active & passive voice, Impersonal Passive voice.

MODULE VI **7**

L: Learning Story telling techniques (stories & visuals) through audio files

S: Discussion in groups

R: Reading for critical appreciation

W: Developing an idea, Slogan writing, Interpreting a Bar Chart.

Language Focus: If clause and phrasal verbs.

TOTAL HOURS :45

REFERENCES:

1. Carol Rosenblun perry(2011). The Fine Art of Technical Writing. Create Space Independent Publishing Platform, New Delhi.
2. Dutt, P.K. Rajeevan. G and Prakash , C.L.N. (2007) A course in Communication Skills. Cambridge Univesity Press, India.
3. Kala, Abdul & Arun Tiwari (2004). Wings of Fire: An Autobiography (Simplified and A bridged by Mukul Chowdhri). Hyderabad Univeristy Press.
4. Sen, Leena. (2004) Communication Skills. Prentice Hall, New Delhi.

5. Matt Firth, Chris Sowton et.al. (2012). Academic English: An Integrated Skills Course for EAP. Cambridge University Press, Cambridge.

OUTCOMES:

After completion of the course, students will have the ability to

- Demonstrate their range of vocabulary in academic and technical contexts
- Exchange ideas and make presentations
- Comprehend and respond appropriately to listening tasks.
- Read a text efficiently and process information.
- Create and draft different kinds of academic documents
- Communicate effectively using grammatically correct expressions.

ISC1181	ARABIC	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To read and write in Arabic language.
- To learn vocabulary of different fields
- To develop situational communication skills.

MODULE I PREPARATORY ARABIC 7

Introducing Arabic Alphabets.
Listening and Reading.
Audio & Video aided listening, Tajweed listening,
Writing Arabic Alphabets (connected & unconnected).
Introducing words.
Reading simple sentences.
Learning names of the things in and around the class room.
Exercises.

MODULE II FUNCTIONAL ARABIC 7

Listening Arabic texts, stories and action verbs
Communicating Simple sentences.
Jumla' Ismiyya and Jumla' Fi'liyya
Situational Conversation:
Greetings, Introduction.
Classroom, College, Picnic.
Dining and Kitchen.
Reading skills.
Exercises

MODULE III FUNCTIONAL ARABIC 8

Implication of effective listening.
Audio aids.
Writing Simple sentences.
Communicating ordinal and cardinal numbers.
Situational communication:

Playground, library.
Forms of plural – Sample sentences.
Introduction to tenses.
Exercises.

MODULE IV FUNCTIONAL ARABIC 8

Communication:
Family, travel
Market, Prayer hall
Writing skills:
Note making.
Sequencing of sentences.
Developing answers from the questions.
Exercises.

MODULE V TECHNICAL ARABIC 8

Importance of technical communication.
Reading and writing skills.
Audio & Video aided listening.
Introduction to Arabic terms related to administration.
Situation communication:
Air travel, Office administration, passport, visa.
Exercises

MODULE VI TECHNICAL ARABIC 7

Situation communication:
Contractual work, machineries and equipments..
Computer, internet browsing.
Banking,
Exercises.

TOTAL HOURS :45

TEXT BOOKS:

1. Arabic for professionals and employees, Kilakarai Bukhari Aalim Arabic College, Chennai, India, 2013.

REFERENCES:

1. Arabic Reader for Non Arabs (Ummul Qura University, Makkah), Kilakarai Bukhari Aalim Arabic College, 2005.

OUTCOMES:

On successful completion of the course, the student will be able to:

- Write correct sentences in Arabic.
- Communicate in Arabic at primary level in working situations in the fields of engineering and administration.

LNC1181	MANDARIN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To improve the proficiency of students in Mandarin language.
- To develop their knowledge of vocabulary.
- To train them in using appropriate grammatical forms during communications.
- To empower them for successful communication in social and academic contexts.
- To make them appreciate the language usage in real life situations.

MODULE I **8**

· General Introduction to Chinese • Pinyin and Tones • Introduction to the Writing System: basic strokes and stroke order · Numbers 1-100, song · Days of the Week · Months of the Year

MODULE II **8**

· Chinese names and related culture · Chinese family structures and values · Greetings

· Introducing Yourself · Family members · Occupations

MODULE III **7**

· Languages and Nationalities · Daily Routine · Chinese breakfast · Negative Sentences and Interrogative Sentences · Asking for Personal Information · The Verb *shi* and Basic Sentence Structures

MODULE IV **7**

· Answering an Affirmative-negative Question · Food and drinks · Transportation · Likes and dislikes · Adverbs *bu*, *jiu* and *dou* · Verb-absent Sentences

MODULE V **8**

·*Jisui* and *duoda* Questions · S+V+O Construction · Routines and Daily Activities ·*Haishi* Questions · Modal Verbs · Hobbies and Habits

MODULE VI **7**

· Making Suggestions with *haoma* ·Colors · Clothing · Body parts · Talking about Likes and Dislikes · Measurement Words in Chinese

TOTAL HOURS :45

TEXT BOOKS:

1.Ma, Yanmin, and Li, Xinying. *Easy Steps to Chinese, Vol*. *1 Textbook*. Beijing: Beijing Language and Culture University Press, 2006. Print.

2. Ma, Yanmin, and Li, Xinying. *Easy Steps to Chinese, Vol. 1 Workbook*. Beijing: Beijing Language and Culture University Press, 2006. Print.

OUTCOMES:

On completion of the course, students will be able to

- Exhibit proficiency in Chinese Language.
- Use vocabulary in appropriate contexts.
- Use appropriate grammatical forms effectively.
- Use the language in social and academic contexts.
- Appreciate the use of language forms.

LNC1182	GERMAN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To improve the proficiency of students in German language.
- To create awareness of using vocabulary among students.
- To expose them to correct grammatical forms of the language.
- To empower them for successful communication in social and academic contexts.

MODULE I **8**

Introduction to German alphabets, phonetics and pronunciation- Introducing themselves and others using simple sentences and answer to some basic personal questions-: Introduction to different types of articles and verbs, Nouns

MODULE II **8**

Understanding and responding to everyday queries like instruction, questions, -number & gender, pronouns, present and past tense.

MODULE III **7**

Short telephone messages, requests etc., if spoken slowly and clearly-- Detailed overview of articles, adjectives with/without articles, Prepositions

MODULE IV **7**

Ask and giving directions using simple prepositions- Ability to fill basic information on forms while registering for courses / classes.

MODULE V **8**

Ability to extract and understand relevant information in a public announcement, broadcast, newspaper, radio etc-- dative & accusative

MODULE VI **7**

Ability to describe about people, work, immediate environment, education and other topics related to personal needs in a concise manner-- Understanding of matters that are familiar and are encountered regularly like instances at school, work, at public places, places of leisure etc.

TOTAL HOURS :45

TEXT BOOKS:

1. Course book : Tangram aktuell 1 – Lektion 1–4 (Kursbuch + Arbeitsbuch mit Audio-CD zum Arbeitsbuch), Rosa-Maria Dallapiazza, Eduard von Jan, Til Schönherr, Hueber Publisher, ISBN 978-3-19-001801-7
2. Practice book: Tangram aktuell 1 – Lektion 1–4 (Kursbuch + Arbeitsbuch mit Audio-CD zum Arbeitsbuch), Rosa-Maria Dallapiazza, Eduard von Jan, Til Schönherr, Hueber Publisher, ISBN 978-3-19-001801-7.

REFERENCES:

1. NETZWERK A1 TEXTBOOK, Deutsch als Fremdsprache,Stefanie Dengler,Paul Rusch, Helen Schmitz, Tanja Sieber, Langenscheidt and Klett, ISBN : 9788183076968
2. STUDIO D A1 (SET OF 3 BOOKS + CD), Hermann Funk. Cornelsen, ISBN: 9788183073509
3. Willkommen! Beginner's course. Paul Coggle, Heiner Schenke. 2nd edition. (chapter 1 - 6) ISBN: 9781444165159 –
4. Willkommen! Beginner's course. Paul Coggle, Heiner Schenke. ISBN: 978-1-444-16518-0
5. An Introduction to the German Language and Culture for Communication, Updated Edition Lovik, Thomas A., J. Douglas Guy & Monika Chavez. Vorsprung -. New York, Houghton Mifflin Company, 1997/2002. ISBN 0-618-14249-5.

OUTCOMES:

On completion of the course, students will be able to

- Show their proficiency in German Language.
- Use appropriate vocabulary in real life contexts.
- Use appropriate grammatical forms while communicating with people.
- Effectively use the language in social and academic contexts.

LNC1183	JAPANESE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To train students to use appropriate vocabulary in academic and technical contexts.
- To facilitate students to speak effectively while exchanging ideas and making presentations.
- To develop their reading skill through sub skills like skimming, scanning and critical reading of a text.
- To sharpen their academic writing skills.
- To expose them to the correct usage of language and help them to apply that knowledge appropriately.

MODULE I **7**

Introduction of the Japanese writing system, i.e. *Hiragana*, *Katakana* and *Kanji*, word-building, writing foreign names and loan words in Katakana.

MODULE II **8**

Oral practice of pronunciation and intonation of Japanese sounds, Japanese greetings, self introduction, identifying things, time of the day, calendar; counting using Japanese numerical classifiers; describing things;

MODULE III **7**

Making comparisons; talking of daily activities, kinship terms used for address and reference, seasons, giving and receiving, shopping; making requests, talking of one’s likes and dislikes.

MODULE IV **8**

Extensive practice of basic patterns at the lower intermediate level through drills and exercises.

MODULE V **7**

Comprehension of passages in simple Japanese and writing of composition in Japanese applying lower intermediate grammatical patterns.

MODULE VI **8**

Diverse texts based on Japanese culture, customs, history, food habits, and science etc, for the development of communicative competence of students; skimming, scanning of texts with emphasis on advanced sentence patterns, grammatical structures and idiomatic phrases, reading and writing of approximately

TOTAL HOURS :45

REFERENCES:

1. Nihongo I, Kokusaigakuyukai, and other supplementary material
2. Exersice book 1of Nihongo 1, and other supplementary material
3. Nippon, the Land and its People & Encyclopedia of Contemporary Japanese
4. Japani: Japanese Conversation for Improving Spoken Proficiency, By P.A. George, Inoue Yoriko and Itsuko Nandi, Books Plus.
5. Chukyu Nihongo, Tokyo Gaikokugo Daigaku; Nihongo II, Kokusaigakuyukai, and other supplementary material.

OUTCOMES:

After completion of the course, students will have the ability to

- Demonstrate their range of vocabulary in academic and technical contexts
- Exchange ideas and make presentations
- Comprehend and respond appropriately to listening tasks.
- Read a text efficiently and process information.
- Create and draft different kinds of academic documents
- Communicate effectively using grammatically correct expressions.

PHC 1181	PHYSICS	L	T	P	C
		3	0	2	4

OBJECTIVES:

To make students conversant with the

- basic concepts of crystal physics and its structures
- production and applications of ultrasonic waves
- study of thermal conductivities of good and bad conductors
- phenomenon of wave optics and its applications
- principle of fibre optic communication and its applications to sensors
- wave mechanics principle and its applications in electron microscopy
- green energy physics and its environmental impacts to society

MODULE I CRYSTAL PHYSICS **8**

Crystalline and amorphous solids – Unit Cell – Seven Crystal Systems – Bravais Lattice – Miller Indices – Interplanar Spacing – Characteristics of Unit Cell - Calculation of Number of atoms per unit cell, Atomic Radius, Coordination Number and Packing Factor for SC, BCC, FCC and HCP and Diamond structures –Defects in crystals-Point defects –Edge and screw dislocations and their significance - Surface Defects.

MODULE II ULTRASONICS AND THERMAL PHYSICS **8**

Introduction to Ultrasonics - Properties - Production methods - Magnetostriction Oscillator method- Piezoelectric Oscillator method – Detection of Ultrasonics – Thermal method – Piezoelectric method – Kundt's tube method – Applications of Ultrasonics – Acoustic Grating – SONAR – Depth of sea – Velocity of blood flow, Ultrasonic Flaw detector (qualitative).

Transmission of heat – Conduction, Convection and Radiation – Thermal Conductivity of good Conductor – Forbe's method- Thermal Conductivity of bad Conductor – Lee's Disc method.

MODULE III APPLIED OPTICS **8**

Interference – Air Wedge – Michelson's Interferometer – Determination of wavelength of light and thickness of thin transparent sheet.

Introduction to Laser – Characteristics of Laser – Spontaneous and Stimulated Emissions – Einstein's Coefficients - Population inversion – Pumping Mechanism –

Laser Action – Types of Laser: He-Ne laser, CO2 laser and Nd:YAG laser - Applications : Laser Materials Processing .

MODULE IV FIBRE OPTICS 7

Optical fibre – Principle and propagation of light in optical fibre – Numerical aperture and acceptance angle – Types of optical fibres – Attenuation – Absorption, Scattering losses, Bending losses and Dispersion in Optical fibres – Fiber Connectors and Couplers - Applications – Fibre optic communication system (block diagram only)- Fibre optic sensors - displacement and pressure sensors (qualitative) - Medical endoscope.

MODULE V QUANTUM MECHANICS 7

Black body radiation – Planck's theory of radiation – Deduction of Wien's displacement law and Rayleigh – Jean's law from Planck's theory –Dual nature of matter – de Broglie's wavelength- Physical significance of wave function – Schrodinger wave equation – Time independent and time dependent wave equation – Particle in one dimensional box – Harmonic oscillator(qualitative).

MODULE VI RENEWABLE ENERGY SOURCES 7

Present Energy sources and sustainability - Solar energy - Solar photovoltaics - Solar cells – Bioenergy - Biomass – production of liquid fuels from biomass – Wind energy – Wind turbines – energy and power from wind turbines - Geothermal energy - Ocean energy: Wave energy – Wave energy conversion devices – Tidal energy – Tidal power basics – power generation –Tidal energy potential – Environmental benefits and impacts of renewable energy sources

PRACTICALS

1. Determination of Velocity of Ultrasonic waves in a given liquid using Ultrasonic Interferometer.
2. Determination of wavelength of ultrasonic waves using Kundt's tube method.
3. Determination of thickness of a thin wire using Air Wedge method.
4. Determination of wavelength of light using spectrometer diffraction grating.
5. Determination of angle of divergence of a laser beam using He-Ne laser.
6. Determination of particle size of lycopodium powder using semiconductor laser.
7. Determination of wavelength of laser light using semiconductor laser diffraction.

8. Determination of Acceptance angle and Numerical Aperture using fiber optic cable.
9. Determination of thermal conductivity of a good conductor by Forbe's method.
10. Determination of thermal conductivity of a bad conductor by Lee's disc method.
11. Determination of solar cell characteristics.

L – 45; P – 30; TOTAL HOURS – 75

REFERENCES :

1. Gaur R.K. and Gupta S.L., "Engineering Physics'', 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2013.
2. Palanisamy P.K., Physics for Engineers, Vol1 & Vol2, 2nd Edition, Scitech Publications, 2003.
3. Serway R.A. and Jewett, J.W. "Physics for Scientists and Engineers with Modern Physics". Brooks/cole Publishing Co., 2010.
4. Tipler P.A. and Mosca, G.P., "Physics for Scientists and Engineers with Modern Physics", W.H. Freeman, 2007.
5. Markert J.T., Ohanian. H. and Ohanian, M. "Physics for Engineers and Scientists". W.W. Norton & Co. 2007.
6. Godfrey Boyle, "Renewable Energy: Power for sustainable future", 2nd edition, Oxford University Press, UK, 2009.

OUTCOMES:

At the end of the course, students will be able to

- understand the different types of crystal structures
- apply the concept of ultrasonic principle in engineering and medical field
- calculate thermal conductivities of good and bad conductors
- differentiate the various laser systems and its applications in engineering and medical field
- apply the principle of fibre optics for communication and sensor applications
- formulate wave mechanics principle for applications in electron microscopy
- Correlate the different renewable energy sources for societal needs.
- To complement the knowledge acquired in the theory class.
- To correlate the experimental results for application.

CHC1181	CHEMISTRY	L	T	P	C
		3	0	2	4

OBJECTIVES:

The students should be conversant with

- the basic problems like hardness, alkalinity, dissolved oxygen associated with the water used for domestic and industrial purpose and treatment process involved.
- the synthesis, properties and applications of nanomaterials.
- the importance of renewable energy sources like solar, wind, biogas, biomass, geothermal, ocean and their limitations.
- the basic analytical techniques like UV-Visible, FT-IR, NMR, AAS, AES, Circular Dichroism and XRD etc.
- photochemistry concepts related to physical processes and chemical reactions induced by photon absorption and their applications.
- basic principles of electrochemistry, cell construction and evaluation and to understand general methodologies for construction & design of electrochemical cell

MODULE I WATER TECHNOLOGY 9

Impurities present in water, hardness : types of hardness, demerits of hard water in boilers, estimation of hardness by EDTA method (problems) – alkalinity : estimation of alkalinity (problems) – dissolved oxygen: estimation of dissolved oxygen – conditioning methods : external treatment method: – lime soda and zeolite process (principle only), Ion exchange process – Internal treatment : colloidal, carbonate, phosphate and calgon methods – drinking water: standards (BIS), treatment of domestic water {screening, sedimentation, coagulation, filtration, disinfection }– desalination: electrodialysis, reverse osmosis.

MODULE II NANOCHEMISTRY 6

Introduction – distinction between molecules, bulk materials and nanoparticles – classification based on dimension with examples – synthesis (top-down and bottom-up approach} : sol-gel, thermolysis (hydrothermal and solvothermal), electrodeposition, chemical vapour deposition, laser ablation – properties and applications (electronic, magnetic and catalytic) – risk factors and future perspectives.

MODULE III ENERGY SOURCES 8

Energy: past, today, and future – a brief history of energy consumption – present energy scenario of conventional and renewable energy sources – renewable energy : needs of renewable energy, advantages and limitations of renewable energy – solar energy: basics, solar energy in the past , photovoltaic, advantages and disadvantages – bioenergy: conversion, bio degradation, biogas generation, biomass gasifier, factors affecting biogas generation, advantages and disadvantages – geothermal energy: geothermal resources (hot dry rock and magma resources, natural and artificial), advantages and disadvantages – wind energy: wind resources, wind turbines, advantages and disadvantages – ocean energy: wave energy, wave energy conversion devices, ocean thermal energy, advantages and disadvantages.

MODULE IV PHOTOCHEMISTRY 7

Introduction: absorption and emission, chromophores, auxochromes – laws of photochemistry : Grotthus-Draper law, Stark Einstein law – quantum yield (problems) –photo physical processes : fluorescence and phosphorescence - Jablonski diagram (electronic states and transitions) – quenching, annihilation – photosensitization: principle and applications – chemiluminescence, bioluminescence.

MODULE V ANALYTICAL TECHNIQUES 7

Spectroscopy: electromagnetic radiation and spectrum – types of transitions – types of spectra (atomic and molecular with their chemical usefulness) – Beer-Lamberts law (problems) – principles, instrumentation and applications of: Colourimetry – UV-Vis spectrophotometer – atomic absorption spectroscopy – atomic emission spectroscopy – principles and applications of: IR, NMR, mass and X-ray diffraction analysis.

MODULE VI ELECTROCHEMISTRY 8

Electrochemistry - types of electrodes (principle and working) : gas (SHE), metal/metal ion electrode, metal-metal insoluble salt (calomel electrode), ion-selective (glass electrode and fluoride ion selective electrode) – Electrolytic and galvanic cells, construction of cell, EMF measurement and applications (problems), standard cell (Weston-cadmium), reversible and irreversible cell, concentration cell. Determination of fluoride ion using fluoride ion selective electrode – Chemically modified electrodes (CMEs) : concept, approaches and applications.

PRACTICALS

1. Estimation of hardness in given water sample.
2. Estimation of the alkalinity of the given water sample.
3. Estimation of strong acid by conductometry.
4. Estimation of Fe^{2+} present in the given sample by potentiometry.
5. Verification of Beer-Lamberts law and estimation of Cu^{2+} present in unknown sample.
6. Estimation of sodium and potassium present in the given sample by flame photometry.
7. Determination of molecular weight and degree of polymerisation of a polymer by viscosity method.
8. Synthesis of thermosetting polymer.

L – 45; P – 30; TOTAL HOURS – 75

REFERENCES:

1. S. Vairam, P. Kalyani and Suba Ramesh, “Engineering Chemistry”, Wiley India Ltd., New Delhi, 2011.
2. G.A. Ozin and A.C. Arsenault, “Nanochemistry: A Chemical Approach to Nanomaterials”, RSC Publishing, Thomas Graham House, Cambridge, 2005.
3. P.C Jain & Monica Jain, Engineering Chemistry Dhanpatrai Publishing Company (P) Ltd., New Delhi (2013).
4. S S Umare & S S Dara, A text Book of Engineering Chemistry, S. Chand& Company Ltd, New Delhi, 2014.
5. G.D.Rai, “Non conventional energy sources,” Khanna Publishers, New Delhi, 2011.
6. John Twidell and Tony Weir, “Renewable Energy Resources, Taylor & Francis Ltd, London, United Kingdom, 2005
7. Principles of molecular photochemistry: An introduction, Nicholas J. Turro, V.Ramamurthy and Juan C. Scaiano, University Science Books, Sausalito, CA, 2009.

OUTCOMES:

The students will be able to

- solve problems related to hardness, alkalinity, dissolved oxygen associated with the water and describe the treatment processes.
- classify nanomaterials and apply the nanochemistry approach to synthesize

the nanomaterials.

- explain the principle and enumerate the advantages and disadvantages of various renewable energy sources.
- state the principle and illustrate the instrumentation of various analytical techniques.
- apply the concepts of photochemistry to elaborate various photo-physical and photochemical reactions.
- construct a electrochemical cell and describe the various types of electrodes and determine the fluoride content.

GEC 1101	ENGINEERING GRAPHICS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To introduce the students of all engineering programs, the basic concepts of engineering drawing, which is the basic communication medium for all engineers
- To provide practical exposure on important aspects like drawing analytic curves, orthographic projections, section of solids, development of surfaces, isometric projection, perspective projection and free hand drawing.
- To introduce computerized drafting.

MODULE I BASICS AND ENGINEERING CURVES 10

Drawing instruments, dimensioning, BIS conventions, types of lines, simple geometric constructions.

Conic sections: ellipse, parabola, hyperbola.

Special curves: cycloid, epicycloid, hypocycloid and involutes.

MODULE II ORTHOGRAPHIC PROJECTION 8

Orthographic projection – first angle, second angle, third angle and fourth angle projections –setup - assumptions, principle. Free hand sketching of orthographic views of simple machine parts as per first angle projection. Orthographic projection of points in all quadrants. Some commands and demonstration of drafting packages.

MODULE III PROJECTION OF STRAIGHT LINES AND PLANES 10

Projection of straight lines in first quadrant – true length and true inclinations – Rotating line and trapezoidal methods –traces of straight line.

Projection of plane lamina in first quadrant and its traces

MODULE IV PROJECTION OF SOLIDS 10

Projection of solids in first quadrant: Axis inclined to one reference plane only- prism, pyramid, cone, cylinder – change of position and auxiliary projection methods.

MODULE V SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES 12

Section of solids: prism, pyramid, cone, cylinder, and sphere – sectional view – true shape of section Solids in simple position and cutting plane inclined to one reference

plane only.

Development of surface of truncated solids: prism, pyramid, cone cylinder – frustum of cone, pyramid and simple sheet metal parts.

MODULE VI PICTORIAL PROJECTIONS 10

Isometric projection: Isometric scale – isometric axes- iso sheet - Isometric projection and view of prism, pyramid, cylinder, cone, frustums, truncated solids and simple products

Perspective projection: station point – vanishing point – Perspective projection and views of prism, pyramid, cylinder and frustums by Visual ray method.

L – 30; P – 30; TOTAL HOURS – 60

TEXT BOOKS:

1. N.D. Bhatt, 'Engineering Drawing' Charotar Publishing house, 53rd Edtion, (2014)

REFERENCES:

1. K.V. Natarajan, 'A text book of Engineering Graphics', Dhanalakshmi publishers, Chennai. (2009)
2. Venugopal. K, and V. Prabhu Raja, Engineering Graphics, New Age International (P) Ltd., Publication, Chennai. (2011)

OUTCOMES:

- Students should be able to read the specifications and standards of technical drawing and able to draw conic sections and special curves.
- Students should be able to understand the insight of orthographic projection and to draw the various views of orthographic projection of a point and various components.
- Students should be able to draw the orthographic views of straight lines and plane figures.
- Students should be able to draw the orthographic views of simple solids.
- Students should be able to draw the sections of solids and development of solid surfaces.
- Students should be able to draw the isometric and perspective projection of simple solids and components.

GEC 1102	ENGINEERING DESIGN	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To understand the role of design in Engineering
- To understand the basic design concepts
- To understand the role of innovation in design

MODULE I DESIGN AS A CENTRAL ACTIVITY IN ENGINEERING 08

Product design – products and processes – product design methodology Design of systems; Software design

MODULE II NEED ANALYSIS AND CONCEPT DEVELOPMENT 07

Voice of customers – product specification - need analysis Bench marking Product architecture – concept generation and evaluation;

MODULE III CASE STUDIES IN ENGINEERING DESIGN 08

Product design – process design; system design; software design -Ergonomics – usability

MODULE IV INNOVATION AND DESIGN 07

Role of innovation in Engineering – incremental changes and systemic changes; scientific approach to driving innovation – case studies.

TOTAL HOURS – 30

REFERENCES:

1. Clive L. Dym and David C. Brown,“Engineering Design: Representation and Reasoning”, 2nd Edition, Cambridge University Press, New Delhi, 2011.
2. Daniel G. Dorner, G. E. Gorman and Philip J. Calvert, “Information Needs Analysis: Principles and practice in information organizations”, Published by Faced Publishing, London. 2015.
3. Cliff Matthews, “Case Studies in Engineering Design”, John Wiley & Sons Pvt. Ltd, New York, 1998.
4. Bengt-Arne Vedin, “The Design-Inspired Innovation Workbook”, World Scientific, 2011.
5. Navi Radjou, Jaideep Prabhu and Simone Ahuja, “Jugaad Innovation”,

Published by Random House India, 2012.

OUTCOMES:

The students will be able to

- Apply the basic knowledge of design in engineering products / process / service.
- Analyse the problems and give innovative solutions.
- Correlate the basic knowledge of design in the real world problems.
- Apply innovative approaches to engineering design.

GEC1103	BASIC ENGINEERING PRACTICES LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To provide a practical exposure to basic engineering practices like carpentry, fitting, plumbing, welding and making of simple electrical and electronic circuits
- To have an understanding on the use of various tools, instruments and methods
- To enable the students to appreciate the practical difficulties and safety issues

CIVIL ENGINEERING PRACTICE

1. Study of plumbing in general household and industrial systems
2. Making a small window frame with Lap and Mortise & Tenon Joints
3. Introduction to power tools

MECHANICAL ENGINEERING PRACTICE

1. Fabrication of a small Table frame with Butt, Lap and Fillet Joints
2. Machining of a simple component like a table weight using lathe
3. Mold preparation for simple component

ELECTRICAL ENGINEERING PRACTICE

1. Comparison of incandescent, Fluorescent, CFL and LED lamps.
2. Study of Protection Circuits (small relay, fuse, MCB, HRC, MCCB, ECCB).
3. Familiarization of households Electrical Gadgets (Iron Box, Wet Grinder).
4. Understanding of Domestic and Industrial wiring.
5. Earthing and its significance.
6. Troubleshooting in Electrical Circuits.
7. Study of inverter fed UPS/Emergency lamp

ELECTRONICS ENGINEERING PRACTICE

1. Identifications symbolic representation of active and passive electronic components
2. Soldering and tracing of electronic circuits and checking its continuity
3. Assembling of A.C. to D.C, D.C to A.C. Circuits in bread Board and Mini

project.

TOTAL HOURS – 30

OUTCOMES:

Upon the completion of the course, students should be able to

- Appreciate the practical skills needed even in making of simple objects, assemblies and circuits
- Attend minor defects especially in items used in day to day life
- Aware of the safety aspects involved in using tools and instruments

GEC 1104	COMPUTER PROGRAMMING I	L	T	P	C
		1	0	2	2

OBJECTIVES:

- To identify the hardware and software components of the computer.
- To know the basic concept of operating system and get knowledge about different operating systems.
- To learn various database concepts and operations
- To develop efficient algorithms for solving a problem.
- To implement the algorithms in C language.
- To use arrays in solving problems.

MODULE I COMPUTER FUNDAMENTALS **7**

Introduction -. Number System - Planning the computer program - Computer Software - Basic operating system concepts - Database Operations

MODULE II PROGRAMMING IN C **8**

Introduction to C Programming Language – Operators - Control statements - Iterative statements - Arrays.

LIST OF EXPERIMENTS:

1. Computer organization –Hardware in a typical computer Identification – Booting- error messages and what it means
2. Types of Operating systems – Windows and Linux
3. Structure of a basic program - Hello world program – Debugging it
4. Data types: Type conversions
5. Input / Output: Formatted functions – Unformatted functions – Library functions
6. Properties of operators – Priority of operators – Arithmetic relational logical and bitwise operators
7. If – if else- nested if else- goto- switch case – nested switch case – for loops – nested for loops – while loop – do-while loop – break and continue statement
8. Arrays – Operation with arrays
9. Sorting and searching.

L – 15; P – 30; TOTAL HOURS – 45

REFERENCES:

1. Ashok N Kamthane, “Computer Programming”, Pearson Education, 2nd

Edition, ISBN 13: 9788131704370, 2012

2. Paul J. Deitel, Deitel & Associates, “C How to Program”, Pearson Education, 7th Edition, ISBN-13: 978-0132990448, 2012

OUTCOMES:

Students who complete this course will be able to

- Recognize Modular design, logic flow, data abstraction
- Analyze the working of the programming constructs, functions, and I/O.
- Write down programs for sorting and searching algorithms
- Write down programs developing cycle for different applications
- Debug the programs and solve some practical problems in programming
- Develop programs using arrays.

SEMESTER II

MAC 1281	ADVANCED CALCULUS	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aims of this course are to

- train the students in solving problems using multiple integration.
- provide knowledge in using special functions to find out the area and volume of a region.
- acquire knowledge in tangent and normal vectors.
- gain knowledge in finding the areas of a curve and surface using vector integration.
- learn about the analytic functions and their properties along with bilinear transformation.
- know complex integration using Cauchy's theorems.

MODULE I **MULTIPLE INTEGRATION AND ITS APPLICATIONS** **8+2**

Multiple integrals– Cartesian and Polar coordinates – change of order of integration – Multiple integral to compute area and volume.

MODULE II **TRANSFORMATION OF COORDINATES AND SPECIAL FUNCTIONS** **7+3**

Change of variables between Cartesian, polar, cylindrical and spherical coordinates - Beta and Gamma functions – Properties and applications.

MODULE III **VECTOR DIFFERENTIATION** **7+3**

Operations on vectors – Scalar Product, Vector Product, Projection of Vectors - Angle between two vectors - Gradient, divergence and curl

MODULE IV **VECTOR INTEGRATION** **8+2**

Line, surface and volume integrals – Green's Theorem, Gauss Divergence Theorem and Stokes Theorem (statement only) – verification and evaluation of integrals.

MODULE V ANALYTIC FUNCTION 8+2

Analytic function - Necessary and Sufficient condition (statement only) – Cauchy-Riemann equations in polar coordinates - properties of analytic function – determination of analytic function – conformal mapping (w = z+a, az and 1/z) and bilinear transformation.

MODULE VI COMPLEX INTEGRATION 7+3

Statement and application of Cauchy's integral theorem – Cauchy's integral formula – Taylor's series and Laurent's series expansion – singularities - classification – residues - Cauchy's residue theorem – contour integration – Unit circle and semi circular contours (excluding poles on the real axis).

L – 45; T – 15; TOTAL HOURS – 60

TEXT BOOKS:

1. Veerarajan.T., "Engineering Mathematics "(5th edition) Tata Mc Graw Hill Publishing Co. New Delhi, 2012
2. Grewal B.S., "Higher Engineering Mathematics" (43rd edition), Khanna Publishers, New Delhi, 2012.
3. John W. Cell "Engineering Problems Illustrating Mathematics" Mc Graw Hill Publishing Co., New York 1943

REFERENCES:

1. Kreyszig, E., "Advanced Engineering Mathematics", 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
2. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th edition, Cengage Learning, 2011.
3. Dennis G. Zill, Warren S. Wright, "Advanced Engineering Mathematics", 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
4. Alan Jeffrey, "Advanced Engineering Mathematics", Academic Press, USA, 2002.
5. Ramana, B.V., "Higher Engineering Mathematics" Tata Mc Graw Hill Publishing Co. New Delhi, 2006.
6. Venkataraman, M.K., "Engineering Mathematics", Volume 2, 2nd edition, National Publishing Co., Chennai, 2003.
7. James Stewart ".Calculus" (7th edition),Brooks/Cole cengage learning,UK.

OUTCOMES:

After completing the course, student will be able to

- compute the area and volume using multiple integrals.
- apply special functions to solve integration problems.
- apply differentiation in scalar and vector fields.
- find area and volume of a region using vector integration.
- verify analyticity, conformity and bilinearity of complex functions.
- evaluate complex integrals.

GEC 1211	BASIC ENGINEERING MECHANICS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To impart knowledge about the basic laws of statics and dynamics and their applications in problem solving
- To acquaint both with scalar and vector approaches for representing forces and moments acting on particles and rigid bodies and their equilibrium
- To give on exposure on inertial properties of surfaces and solids
- To provide an understanding on the concept of work energy principle, friction, kinematics of motion and their relationship

MODULE I VECTOR APPROACH TO MECHANICS **07**

Introduction - Units and Dimensions- Vectors – Vectorial representation of forces and moments –Vector Algebra and its Physical relevance in Mechanics - Laws of Mechanics – Parallelogram and triangular Law of forces -Lame's theorem, Coplanar Forces – Resolution and Composition of forces- Equilibrium of a particle.

MODULE II EQUILIBRIUM OF PARTICLE **06**

Forces in space - Equilibrium of a particle in space - Equivalent systems of forces – Principle of transmissibility – Single equivalent force

MODULE III EQUILIBRIUM OF RIGID BODY **06**

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis –Vectorial representation of moments and couples – Scalar components of a moment –Varignon's theorem - Equilibrium of Rigid bodies in two dimensions - Examples

MODULE IV PROPERTIES OF SURFACES **08**

Determination of Areas – First moment of area and the Centroid of sections – Rectangle, circle, triangle from integration – T section, I section, Angle section, Hollow section by using standard formula – second and product moments of plane area – Physical relevance - Rectangle, triangle, circle from integration - T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia- Mass moment of

Area

MODULE V FRICTION 08

Introduction to friction- types of friction- Laws of Coloumb friction- Frictional force – simple contact friction – Rolling resistance –ladder friction

MODULE VI LAWS OF MOTION 10

Review of laws of motion – Newton's law – Work Energy Equation of particles– Impulse and Momentum – Impact of elastic bodies.

L – 45; T – 15; TOTAL HOURS – 60

REFERENCES:

1. Beer, F.P and Johnston Jr. E.R, "Vector Mechanics for Engineers, Dynamics & Statics", Third SI Metric Edition, Tata McGraw-Hill International Edition, 2001.
2. Hibbeller, R.C., Engineering Mechanics, Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., 2000.
3. Irving H. Shames, Engineering Mechanics – Statics and Dynamics, IV Edition Pearson Education Asia Pvt. Ltd., 2003.

OUTCOMES:

On completion of this course students should be able

- Analyse and resolve forces, moments and solve problems using various principles and laws of Mechanics
- Apply the concept of equilibrium to particles and solve problems
- Apply the concept of equilibrium to rigid bodies and solve problems
- Analyse and determine the properties of surfaces
- Analyse and evaluate the fractional forces between the bodies
- Apply the laws of motion in solving dynamics problems

GEC 1212	ENVIRONMENTAL STUDIES	L	T	P	C
		2	0	0	2

OBJECTIVES:

The student will be conversant with the

- various natural resources, availability, utilisation and its current scenario
- different ecosystems, energy transfer, values, threats and conservation of biodiversity
- levels of different pollutants and its impact and the causes and effects of natural disasters
- impacts of human population, impact assessment, human rights and environmental acts and sustainable development

MODULE I NATURAL RESOURCES **8**

Land resources: land degradation, soil erosion and desertification - Forest resources: use and over-exploitation, deforestation - Water resources: use and over-utilisation of surface and ground water, conflicts over water (inter-state and international), dams (benefits and problems), water conservation (rainwater harvesting and watershed management) - Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources, mining - Food resources: world food problems, changes in land use by agriculture and overgrazing, modern agriculture and its effects, fertilizer and pesticide problems, water logging and salinity - Energy resources: increasing energy needs, renewable and non-renewable, use of alternate energy sources.

MODULE II ECOSYSTEM AND BIODIVERSITY **8**

Ecosystem- energy flow in the ecosystem - food chains, food webs and ecological pyramids - characteristics, structure and function of (a) Terrestrial ecosystems (forest, grassland, desert) and (b) Aquatic fresh water ecosystems (pond, lake, river) (c) Aquatic salt water ecosystems (ocean, estuary) - ecological succession.

Biodiversity - genetic, species and ecosystem diversity – hot-spots of biodiversity –biogeographic classification of India - endangered, endemic, extinct and invasive species of India - red data book - values of biodiversity: consumptive, productive, social, ethical, aesthetic and option values - threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts - conservation of biodiversity: in-situ and ex-situ conservation of biodiversity

MODULE III ENVIRONMENTAL POLLUTION AND NATURAL DISASTER **8**

Definition, cause, effects and control measures of (a) air pollution (b) water pollution (c) soil pollution (d) marine pollution (e) noise pollution (f) thermal pollution (g) nuclear hazards - ill-effects of fireworks and upkeep of clean environment - solid waste management: types (urban, industrial, biomedical and electronic wastes), collection, processing and disposal (incineration, composting and land-fill) - natural disaster and management: flood, cyclone, drought, landslide, avalanche, volcanic eruptions, earthquake and tsunami.

MODULE IV HUMAN POPULATION, HEALTH AND SOCIAL ISSUES **6**

Population and population growth, population variation among nations, population explosion, family welfare programme.

Human health: air-borne, water borne diseases, infectious diseases, risks due to chemicals in food and environment.

Sustainable development - environmental legislation and laws: water act, air act, wildlife protection act, forest conservation act, environment protection act - environmental impact assessment, steps in EIA - human rights - women and child welfare.

Case studies related to current situation

TOTAL HOURS – 30

TEXT BOOKS:

1. Erach Bharucha, Textbook for Environmental Studies For Undergraduate Courses of all Branches of Higher Education for University Grants Commission, Orient Blackswan Pvt Ltd, Hyderabad, India, 2013.
2. Benny Joseph, Environmental Studies, Tata McGraw-Hill Education, India, 2009.
3. Ravikrishnan A, Environmental Science and Engineering, Sri Krishna Publications, Tamil Nadu, India, 2015.
4. Raman Sivakumar, Introduction to Environmental Science and Engineering, McGraw Hill Education, India, 2009.
5. Venugopala Rao P, Principles of Environmental Science and Engineering, Prentice Hall India Learning Private Limited; India, 2006.

6. Anubha Kaushik and Kaushik C.P., Environmental Science and Engineering, New Age International Pvt Ltd., New Delhi, India, 2009.

REFERENCES:

1. Masters G.M., Introduction to Environmental Engineering and Science, Prentice Hall, New Delhi, 1997.
2. Henry J.G. and Heike G.W., Environmental Science and Engineering, Prentice Hall International Inc., New Jersy, 1996.
3. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co. Boston, USA, 2016.

OUTCOMES:

The student will be able to

- predict the scenario of various natural resources and suggest remedies to curb the exploitation of these resources.
- identify food chain and web and its role in various ecosystems, assess the impacts on biodiversity and provide solutions to conserve it.
- analyse the impacts of pollutants in the environment and propose suitable method to alleviate the pollutants and the natural disasters.
- assess on the impact of human population and the health related issues and the ethics to be followed for sustainable life.

GEC 1213	COMPUTER PROGRAMMING II	L	T	P	C
		1	0	2	2

OBJECTIVES:

- To provide knowledge about the benefits of Object Oriented Programming over Procedure oriented programming.
- To learn various File operations
- To expose fundamental concepts of object-oriented programming in classes, invoking methods and functions.
- To prepare students to get full use of code reusability using object oriented programming.
- To implement the basic concepts of object oriented programming using C++concepts.
- To focus on solving problems based on analyzing, designing and implementing programs in C and C++.

MODULE I PROGRAMMING IN C 7

Functions - Storage Classes - Structures and Unions – Pointers -Self Referential Structures and Linked Lists - File Processing.

MODULE II PROGRAMMING IN C++ 8

Programming in C++ - Overview of OOP in C – Inheritance - Polymorphism - Type Casting – Exceptions.

LIST OF EXPERIMENTS:

1. Functions
2. One dimensional arrays, Pointers
3. Recursion
4. Multi dimensional arrays, Linked lists.
5. Operating on Files.
6. Simple C++ program with Control statements.
7. Getting input from user console.
8. Classes, Object and Constructors.
9. Method overloading.
10. Inheritance

L – 15; P – 30; TOTAL HOURS – 45

REFERENCES:

1. Bjarne Stroustrup," The C++ Programming Language", Addison Wesley, 4th edition, ISBN-13: 978-0321563842, 2013.
2. Brian W. Kernighan and Dennis M. Ritchie, " The C Programming Language", Prentice Hall, ISBN 0-13-110362-8, 2015.
3. Bjarne Stroustrup, "Programming: Principles and Practice Using C++ ", Addison Wesley, 2nd edition, ISBN-13: 978-0321992789, 2014.
4. Brian W. Kernighan and Dennis M. Ritchie, " The C Programming Language (Ansi C Version)", Prentice Hall India Learning Private Limited, 2nd edition, ISBN-13: 978-8120305960, 1990.

OUTCOMES:

Students who complete this course will be able to

- Develop efficient algorithms for solving problems
- Handle files in C
- Use simple data structures like arrays and linked lists in solving problems.
- Write simple programs using concepts of object oriented programming.
- Implement algorithms in C++ Language.
- Demonstrate the Object Oriented Programming concepts applied in networking, web development and Database applications.

EEC1211	ELECTRIC CIRCUIT ANALYSIS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To learn circuit laws, theorems and circuit solution methods
- To be able to analyze DC and AC circuits
- To be able to analyze magnetic circuits and magnetically coupled electric circuits

MODULE I DC CIRCUITS **8**

Circuit elements : R, L and C - sources : Independent (ideal and practical), and dependent voltage and current sources - ohm's and Kirchhoff's laws - power and energy - solution of DC circuits - use of source transformations - network reduction by Y-Δ transformations.

MODULE II AC FUNDAMENTALS **7**

Sinusoidal voltages and currents : Average and RMS Values, peak and form factors - concept of phasor and its use in representing sinusoidal voltages and currents - impedance and admittance - Real, reactive and apparent power – Power factor and its practical importance -Analysis of simple series and parallel circuits.

MODULE III AC NETWORK ANALYSIS **7**

Solution of series-parallel AC circuits - Resonance: RLC series and parallel resonance, resonant frequency, half-power frequencies, Q-factor – Design of Resonant circuits - Node voltage and mesh current method of analysis - concept of super nodes and super meshes.

MODULE IV NETWORK THEOREMS **8**

Network Theorems: Superposition theorem, Millman's Theorem, Thevenin's Theorem, Norton's Theorem and Maximum power transfer theorem - Application to DC and AC networks

MODULE V MAGNETIC CIRCUITS **8**

Magnetic circuits : Definition of magnetic quantities i.e., permeability, flux, flux

density, field intensity and their units and relationships - magnetic curves of ferromagnetic materials - magnetic circuit concept and analogies - magnetic circuit computations - Hysteresis and eddy current losses.

MODULE VI COUPLED AND THREE PHASE CIRCUITS 7

Magnetically coupled circuits : self and mutual inductances, Dot rule for coupled circuits, coupled circuits analysis and applications - Three phase circuits: generation of 3 - phase voltages - star and delta connection - relation between phase and line quantities - balanced and unbalanced 3 - phase loads - power measurement by 2 - wattmeter method- Application of two wattmeter method of power measurement.

L – 45; T – 15; TOTAL HOURS – 60

REFERENCES:

1. Electrical and Electronic Technology, Edward Hughes, PH (UK) 9th edition (2004), 11th revised edition (2012)
2. Vincent Del Toro, “Principles of Electrical Engineering”, 2nd Edition, Prentice - Hall of India, 1984
3. William H.Hayt, Jr.Jack E.Kemmerly, Steven M.Durbin, “Engineering Circuit Analysis”, 6th Edition, Tata McGraw - Hill Edition, 2002.
4. Joseph A.Edminister, Mahmood Nahvi, ‘Electric Circuits’, Schaum’s Series, Tata McGraw Hill publishing Co. Ltd., New Delhi 2001.
5. Sudhakar A and Shyam Mohan SP, “Circuits and Network Analysis and Synthesis”, Tata McGraw Hill, 2007.
6. R.C. Dorf, ‘Introduction to Electric Circuits’, John Wiley & Sons Inc, New York, 2nd Edition, 2003.

OUTCOMES:

At the end of the course, the student will be able to

- Calculate currents, voltages and powers in typical DC electric circuits.
- Analyze circuits with ideal, independent, and controlled voltage and current sources.
- Apply node-voltage analysis and mesh-current analysis techniques to analyze circuit behavior.

- Reduce circuits into equivalent circuits by applying network theorems.
- Perform steady state analysis on AC circuits and to design resonant circuits
- Implement the concept of magnetic circuits and coupled circuits in magnetic circuits .
- Perform the calculations on three phase circuits and implement in practical circuits.

EEC1212	ELECTRIC CIRCUITS AND SIMULATION LABORATORY	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To impart hands on experience in verification of Electric Circuit laws and Theorems
- To verify Electric Circuit laws and theorems using Mat Lab / PSpice
- To implement power measurement methods for three phase circuits.

LIST OF EXPERIMENTS:

1. Verification of Kirchhoff's Voltage and Current Laws
2. Verification of Thevinin's and Norton's Theorem
3. Verification of Superposition and Maximum Power Transfer Theorem
4. Study of Oscilloscope and measurement of sinusoidal voltage, frequency and power factor
5. Study of the effect of Q on frequency response of series and parallel resonant circuits
6. Measurement of real power, reactive power, power factor and impedance of RL, RC and RLC circuits using 3 voltmeters and 3 ammeters
7. Power measurement in a three phase circuit using two wattmeter method
8. Verification of Kirchhoff's Voltage and Current Laws using MatLab / PSpice
9. To obtain Thevenin's and Norton's equivalent circuits using PSpice / MatLab
10. To verify Maximum power Transfer theorem and Superposition theorem using PSpice / MatLab
11. Simulation of three phase power measurement by two wattmeter method using MatLab

TOTAL HOURS – 30

REFERENCES:

1. Saroj K Dash, Smruti R Khuntia, Basic Electrical Engineering with MATLAB, Yes Dee Publication, Chennai.

2. Muhammad H.Rashid , Introduction to PSpice Using OrCAD for circuits and Electronics, Prentice Hall of India Pvt Ltd, 2008,Third Edition.

OUTCOMES:

At the end of the course, the student will be able to

- Conduct basic laboratory experiments involving electrical circuits using laboratory

test equipments such as power supplies, signal generators, oscilloscopes, multimeters etc.

- Implement and verify network theorems
- Implement three phase power measurement method using two wattmeter method
- Relate physical observations and measurements involving electrical circuits to theoretical principles.
- To simulate various electric circuits using PSpice and MaTLab simulation.
- For electric circuits the performance evaluations can be done using simulation tools.

SEMESTER III

		L	T	P	C
MAC 2181	**PARTIAL DIFFERENTIAL EQUATIONS AND TRANSFORMS**	**3**	**1**	**0**	**4**

OBJECTIVES:

The aims of this course are to

- Familiarize in solving partial differential equation of first, second and higher orders.
- Introduce basics and engineering applications of Fourier series, Laplace Transform, Fourier Transform and Z- Transform.

MODULE I PARTIAL DIFFERENTIAL EQUATIONS 8 + 2

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solution of standard types of first order partial differential equations – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients.

MODULE II FOURIER SERIES 8+2

Fourier Series and Dirichlet's conditions - General Fourier series - Half range Fourier series - Parseval's identity - Harmonic Analysis.

MODULE III FOURIER TRANSFORMS 7+3

Fourier integral theorem (without proof) - Fourier transform pair - Fourier Inverse Transform – Properties - Convolution theorem - Parseval's identity.

MODULE IV APPLICATIONS OF FOURIER SERIES AND FOURIER TRANSFORMS 7+3

Applications of Fourier series and Fourier Transform to solution of PDEs having constant coefficients with special reference to Heat & Wave equations, Discrete & point Spectrum and Single pulse.

MODULE V LAPLACE TRANSFORM 8+2

Introduction to Laplace transform - Existence of Laplace Transform - Properties of Laplace Transforms - Initial & Final Value Theorems - Inverse Laplace Transform - Convolution Theorem – Circuits to signal square wave: Integral equations with unrepeated complex factors – Damped forced vibrations: repeated complex factors – Resonance - Solution of differential equations

MODULE VI Z – TRANSFORM 7+3

Introduction and Definition of Z-transform - Properties of Z- Transform - Convolution Theorem of Z-Transform - Inverse Z–transform - Convolution Theorem of Inverse Z-Transform - Formation of difference equations - Solving Difference Equations using Z-Transform.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Kreyszig .E., “Advanced Engineering Mathematics“, 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
2. Grewal B.S., “Higher Engineering Mathematics”, 42nd edition, Khanna Publishers, New Delhi, 2012.
3. Ramana, B.V, “Higher Engineering Mathematics” Tata Mc Graw Hill Publishing Co. New Delhi, 2006.

REFERENCES:

1. Veerarajan.T., “Engineering Mathematics“, 5th edition, Tata Mc Graw Hill Publishing Co. New Delhi, 2012.
2. Peter V. O'Neil, “Advanced Engineering Mathematics**”**, 7th edition, Cengage Learning, 2011.
3. Dennis G. Zill, Warren S. Wright, “Advanced Engineering Mathematics”, 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
4. Alan Jeffrey, “Advanced Engineering Mathematics”, Academic Press, USA, 2002.

OUTCOMES:

After completing the course, student will be able to

- solve the partial differential equations.
- derive a Fourier series of a given periodic function by evaluating Fourier coefficients.
- apply integral expressions for the forward and inverse Fourier transform to a range of non-periodic waveforms.
- solve wave equation and heat flow equation.
- solve ordinary differential equations using Laplace transform.
- solve difference equation using Z-transform.

ENC2181	ORAL COMMUNICATION	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To expose students to a range of professional contexts through podcasts for learning appropriate expressions.
- To train them in making poster presentations.
- To enable them to make effective business presentations.
- To help them learn persuasive and negotiation skills.
- To train them to debate on issues of current relevance
- To train them to participate in group discussions on current affairs

MODULE I **4**

Orientation to the Importance of Oral Communication -– Verbal and non-verbal communication -Paralinguistic features.

One-minute presentations (using Audacity/Voicethread) – Just a minute (JAM) on random topics

MODULE II **4**

Negotiating and persuading through effective arguments – to arrive at a conclusion (pair-work)

Understanding Negotiation, persuasion and marketing skills through Podcasts

Listening to short conversations and monologues for understanding real life conversations

MODULE III **4**

Making Poster presentations on current issues

Understanding nuances of making effective presentations (TED Videos)

MODULE IV **6**

Deliberation on social and scientific issues – Debates (focus on rebuttal skills and deconstructing arguments)

Viewing videos on debates (NDTV Discussions)

MODULE V **6**

Discussing social issues or current affairs in groups

Viewing group discussions and listening for specific information

MODULE VI **6**

Making full length presentation (through Voicethread) with the focus on one's career plans and prospects (discipline specific)

Listening to interviews for understanding speakers' perception (on industry related issues)

P – 30; Total Hours –30

REFERENCES:

1. Hancock, Mark (2012). *English Pronunciation in Use*. Cambridge University Press, UK.
2. Anderson, Kenneth & et.al (2007). *Study Speaking: A Course in Spoken English for Academic Purposes* (Second Edition). Cambridge University Press, UK.
3. Hurlock, B.Elizabeth (2011). *Personality Development*. Tata McGraw Hill, New York.
4. Dhanavel,S.P (2015). *English and Soft Skills*. Orient Blackswan, Chennai.
5. Whitby, Norman (2014). *Business Benchmark: Pre-Intermediate to Intermediate.* Cambridge University Press, UK.

OUTCOMES:

On completion of the course, students will be able to

- Listen to business conversations and do related tasks.
- Deliver effective poster presentations.
- Make effective business presentations.
- Use persuasive and negotiating skills for justifying arguments.
- Participate effectively in debates.
- Speak English intelligibly, fluently and accurately in group discussions.

EEC2101 ELECTROMAGNETIC THEORY L T P C
3 0 0 3

OBJECTIVES:

- To introduce the basic mathematical concepts related to electromagnetic vector fields.
- To provide knowledge on the concepts of electrostatics, magneto statics,electrical potential, energy density and their application.
- To impart knowledge on the concepts of Faraday's law, induced EMF and Maxwell's equations.
- To deliver knowledge on the concepts of electromagnetic wave and Poynting vector.

MODULE I CO-ORDINATE SYSTEM AND VECTOR CALCULUS 7

Cartesian Coordinates, Circular Cylindrical Coordinates, Spherical Coordinates, Constant-Coordinate Surfaces, Differential Length, Area, and Volume, Line, Surface, and Volume Integrals, Del Operator, Gradient of a Scalar, Divergence of a Vector and Divergence Theorem, Curl of a Vector and Stokes's Theorem, Laplacian of a Scalar, Classification of Vector Fields

MODULE II ELECTROSTATIC FIELDS 7

Coulomb's Law and Field Intensity, Electric Fields due to Continuous Charge Distributions, Electric Flux Density, Gauss's Law—Maxwell's Equation, Applications of Gauss's Law, ElectricPotential, Relationship between E and V—Maxwell's Equation, An Electric Dipole and Flux Lines, Energy Density in Electrostatic Fields

MODULE III ELECTRIC FIELDS IN MATERIAL SPACE 9

Properties of Materials, Convection and Conduction Currents, Conductors, Polarization in Dielectric, Dielectric Constant and Strength Linear, Isotropic, and Homogeneous Dielectrics Continuity Equation and Relaxation Time, Boundary Conditions. Poisson's and Laplace's Equations - Uniqueness Theorem - General Procedure for Solving Poisson's or Laplace's Equation - Resistance and Capacitance - Method of Images.

MODULE IV MAGNETOSTATIC FIELDS 8

Biot-Savart's Law, Ampere's Circuit Law—Maxwell's Equation, Applications of Ampere's Law , Magnetic Flux Density—Maxwell's Equation, Maxwell's Equations for

Static EM Fields, Magnetic Scalar and Vector Potentials , Derivation of Biot-Savart's Law and Ampere's Law, Forces due to Magnetic Fields, Magnetic Torque and Moment, A Magnetic Dipole, Magnetization in Materials, Classification of Magnetic Materials, Magnetic Boundary Conditions, Inductors and Inductances, Magnetic Energy, Magnetic Circuits, Force on Magnetic Materials.

MODULE V ELECTRO MAGNETIC INDUCTION 8

Faraday's Law, Transformer and Motional EMFs, Displacement Current, Maxwell's Equations in Final Forms, Time-Varying Potentials, Time-Harmonic Fields.

MODULE VI ELECTROMAGNETIC WAVE PROPAGATION 7

Waves in General, Wave Propagation in Lossy Dielectrics, Plane Waves in Lossless Dielectrics, Plane Waves in Free Space, Plane Waves in Good Conductors, Power and the Poynting Vector, Reflection of a Plane Wave at Normal Incidence, Reflection of a Plane Wave at Oblique Incidence.

Total Hours –45

REFERENCES:

. Matthew N.O. Sadiku & S.V.Kulkarni ,Principles of Electromagnetics, Oxford University Press, Asian Edition, 2015.

2. Zahn Markus, Electromagnetic Field Theory: A Problem-Solving Approach. Malabar, FL: Krieger Publishing Company, 2003.

3.William Hayt , "Engineering Electromagnetics", McGraw Hill, New York,1989.

4. John D. Kraus, "Electromagnetics", McGraw Hill, 1999.

5.Joseph A.Edminister, M.S.E, "Schaum's Outline of Theory and Properties ofElectromagnetics", McGraw Hill Book Company,1998.

6.http://ocw.mit.edu/terms

7. nptel.ac.in/courses/108104087

OUTCOMES:

At the end of the course, the student is expected to

- Relate the concepts of vector calculus and coordinate systems in the study of electromagnetics.
- Appreciate the fundamental laws and concepts of electrostatic fields .
- Apply the fundamental laws of electrostatics to material space and to solve electrostatic boundary value problems.
- Explain the fundamental laws and concepts of magnetostatic fields.

- Apply the concepts of Maxwell's equations in electromagnetic field theory.
- Correlate the concepts of wave propagation in various media.

EEC 2102 SIGNALS AND SYSTEMS

L	T	P	C
3	1	0	4

OBJECTIVES:

- To introduce the students to the concept of Signals and Linear Time-Invariant Systems
- To illustrate various mathematical tools such as Fourier, Laplace, z-Transform etc. for signal processing applications
- To impart the fundamentals of digital filter and its design.

MODULE I INTRODUCTION TO SIGNALS AND SYSTEMS 10

Signals: classification (analog and digital, energy and power, even and odd, periodic and aperiodic, deterministic and random, stationary and non-stationary) - standard signals (unit step, unit impulse, ramp, exponential, sinusoids) - transformations of the independent variable.

Systems: system classification (continuous and discrete, causal and non-causal, stable and unstable, stable/unstable oscillatory, linear and non-linear, time-invariant and variant, invertible etc.) - continuous and discrete time LTI systems - Impulse response of an LTI system - convolution integral, graphical convolution - LTI system properties - interconnection of LTI systems - Differential and Difference Equation representation of LTI systems

MODULE II II LAPLACE TRANSFORM 7

Unilateral and Bilateral Laplace transform - region of convergence (ROC) - properties of Laplace transforms - poles and zeros - inverse Laplace transformation – brief introduction to solving differential equations with initial conditions - the concept of transfer function.

MODULE III FOURIER SERIES AND FOURIER TRANSFORM 9

Fourier Series representation of signals - properties of Fourier Series - Continuous / discrete - Time Fourier transform and its properties - Frequency Response of CT-LTI Systems - phase delay and group delay – Discrete Time Fourier Transform (DTFT) and its properties - Discrete Fourier Transform (DFT) and its properties – Fast Fourier Transform (FFT).

MODULE IV Z- TRANSFORM 6

Z-Transform, z-Plane and ROC - properties of z-Transform - poles and zeros - inverse

z-Transform - Transfer Function of DT-LTI Systems. Causality and Stability.

MODULE V SAMPLING 6

Representation of a Continuous-Time Signal by Its Samples - Shannon's Sampling Theorem - reconstruction of a signal from its samples using interpolation - effect of under sampling - Aliasing - discrete-time processing of continuous time signals.

MODULE VI INTRODUCTION TO DIGITAL FILTERS 7

Representation of linear digital networks – different types of filters - network structures for infinite impulse response (IIR) and finite impulse response (FIR) filters – introduction to design of IIR and FIR filters.

L – 45; T – 15; Total Hours –60

REFERENCES:

1. Alan V. Oppenheim, Alan S. Willsky , S. Hamid Nawab, "Signals & Systems", 2nd Edition, Pearson Education,1997.
2. Simon Haykin, Barry Van Veen, "Signals and Systems", 2nd Edition, John Wiley & Sons Pvt Ltd., 2004.
3. John G. Proakis and Dimitris G. Manolakis, "Digital Signal Processing - Principles, Algorithms and Applications", 3rd Edition, Prentice Hall of India, 2000
4. Hwei P. Hsu, "Signals And Systems", 2nd Edition,Schaum's Outlines, McGraw Hill, 1995.
5. . M. J. Roberts, "Signals and Systems Analysis using Transform method and MATLAB", 1st Edition,Tata McGraw Hill, 2003.
6. K. Lindner, "Signals and Systems", 2nd Edition, McGraw Hill International, 1999.
7. Chi-Tsong Chen, "Signals and Systems", 3rd Edition, Oxford University Press, 2004.
8. Roger E. Ziemer, William H. Tranter, D.R. Fannin, "Signals & Systems: Continuous and Discrete", 4th Edition, Prentice Hall, 1998.
9. Ashok Amhardar, "Analog and Digital Signal Processing", 2nd Edition, Thomson, 2002.

OUTCOMES:

On completion of the course the students will be able to

- Classify, identify and mathematically represent different types of signals and

systems.

- Use Laplace transform to analyze continuous time systems.
- Apply z- transform to analyze discrete time systems.
- Use Fourier series and Fourier transform to analyze the different signals and systems.
- Discretize analog signals and reconstruct them back from the samples
- Follow the design procedure to design digital filters.

EEC2103 ELECTRONIC DEVICES AND CIRCUITS L T P C

3 0 0 3

OBJECTIVES:

- To familiarize the student with the principle of operation, capabilities and limitation of various electronic devices and their applications.
- To familiarize the student with the principle of operation of operational amplifier and its various application circuits
- To familiarize the student with the principle of operation of feedback amplifiers and oscillators

MODULE I PN JUNCTION DIODE 8

Diodes- PN junction- current equation, junction capacitance, breakdown characteristics, V-I characteristics, PN junction diode ratings. Diode Applications- Clippers, clampers and rectifiers (Half wave and Full wave). Zener diode - V-I characteristics, applications- LED and Photo diode

MODULE II BIPOLAR JUNCTION TRANSISTOR (BJT) 7

Physical behavior of a BJT – Ebers–Moll model - Modes of transistor operation – Common Base, Common Emitter and Common Collector configurations, Input and output characteristics, Early effect, Thermal runaway. AC and DC load lines - Need for stability of Q -Point, Bias stability –fixed bias, collector to base bias, self-bias. Transistor switching times, Transistor as a switch and an amplifier rating, photo transistors.

MODULE III FIELD EFFECT TRANSISTOR (FET) 7

JFET operation - V-I characteristics, transfer characteristics, regions of operation. DC analysis - JFET biasing, JFET as a switch, Voltage variable resistor and an amplifier. MOSFET- Constructional details- Operation of Enhancement and Depletion type MOSFET, V-I characteristics, Transfer characteristics, MOSFET biasing, MOSFET as a switch, resistor and amplifier, generalized small signal model.

MODULE IV OPAMP FUNDAMENTALS AND CHARACTERISTICS 7

Operational amplifier: block diagram representation, Transfer characteristics of a typical Op Amp circuit, ideal Op Amp characteristics -Non-ideal characteristics- DC characteristics – Input bias current-Input offset voltage- Input offset current- Thermal drift- AC characteristics- Frequency response- Frequency compensation- Slew rate, Internal circuit operation of operational amplifier - differential amplifier.

MODULE V OP AMP APPLICATIONS 9

Mathematical operations using operational amplifier - inverting amplifier, non inverting amplifier, summer, subtractor, multiplier, divider, integrator, differentiator, zero crossing detector - Instrumentation amplifier - Precision rectifier - comparator -Schmitt Trigger, Astable and Monostable Multivibrator, Active Filters: I and II order low pass filter.

MODULE VI FEEDBACK AMPLIFIERS AND OSCILLATOR USING OPAMP 7

Amplifier classification - Feedback concept - Characteristics - effect of feedback on input and output characteristics. Oscillator-Principle, Stability of feedback circuits using Barkhausen criteria, RC oscillator- Wien bridge oscillator and Phase shift oscillator, LC oscillator - Hartley oscillator, Colpitts oscillator, Crystal oscillator.

Total Hours –45

REFERENCES:

Boylestead L.R., Nashelsky L.,“Electronic Devices and Circuit Theory”, Pearson Education India Series, New Delhi, 10th Edition, 2009.

2. Gupta.J.B. “Electronic Devices and Circuits”, 3rd Edition, S.K.Kataria& Sons,New Delhi, 2010.

3. Millman J., C.C.Halkias, Sathyabratha Jit, “Electronic Devices and Circuits”,Tata McGraw-Hill Publishing company limited, 2nd Edition, 2007.

4. R. Gayakwad, Op-Amps and Linear Integrated Circuits, 4th ed., Pearson Education, Delhi, 2000.

5. R. Coughlin and F. Driscoll, Operational Amplifiers and Linear IntegratedCircuits, 6th ed., Pearson Education, Delhi, 2003

6. D. R. Choudhury and S. Jain, Linear Integrated Circuits, New Age International, New Delhi, 2002

OUTCOMES:

At the end of the course, the student is expected to

- apply the fundamentals of PN junction and Zener diode to design practical circuits.
- apply the concepts of BJT to design practical circuits .
- analyse the working of FET and its applications.
- characterize opamp behaviour in practical circuits.
- synthesize opampcircuits to perform various mathematical operations
- design feedback amplifiers and oscillators using opamps.

EEC2104	ELECTROMECHANICAL ENERGY CONVERSION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To relate the concepts of electromechanical energy conversion principles to working of electrical machines.
- To impart knowledge on working and classification of DC machines; determination of their characteristics and methods of speed control of motors.
- To estimate the various losses taking place in DC machines and to study the different testing methods to arrive at their performance.
- To familiarize the constructional details, the principle of operation, prediction of performance, the methods of testing the transformers and three phase transformer connections.

MODULE I ELECTROMECHANICAL ENERGY CONVERSION SYSTEMS 8

Principles of Electromechanical Energy Conversion-Conservative force field-Energy Balance Relationships in Electromechanical Systems-Conservation of Energy-Concept of co-energy.

MODULE II DC GENERATOR 8

Construction – Principle of Operation – classification– types of armature windings – EMF equation -OCC & Load characteristics – Power Flow diagram – Losses and efficiency- Armature reaction – Commutation

MODULE III DC MOTOR 8

Construction – Principle of operation – Torque – Types and characteristics – Power Flow diagram – Starters – Speed Control - Solid state DC drives (Qualitative treatment only).

MODULE IV BRUSHLESS DC MOTORS 6

Brushless Concept – Construction and operation of Brushless DC motors (BLDCM) – Characteristics – Concept of control of BLDCM – Control Circuitry – Applications

MODULE V TRANSFORMER 8

Construction and principle of operation – EMF equation – Transformer on no load and load –Phasor diagram - Equivalent circuit - Voltage regulation – Losses & Efficiency - Auto Transformer - All day efficiency- 3-phase transformer- connections-

applications.

MODULE VI TRANSFORMER TESTING &PARALLEL OPERATION 7

OC and SC tests — computation of Voltage regulation, losses & efficiency using OC and SC tests - polarity test – Sumpner's test - Parallel Operation of transformers.

Total Hours –45

REFERENCES:

1. Fitgerald, A.E., Charles Kingsely Jr. Stephen D.Umans, “Electric Machinery”, McGraw Hill Books Company,6th edition 2002.
2. Hill Stephen, Chapman.J, “Electric Machinery Fundamentals”, McGraw Hill Book Co., New Delhi, 4th edition 2005.
3. Nagrath I. J and Kothari D. P. ‘Electric Machines’, Fourth Edition, Tata McGraw Hill Publishing Company Ltd, 2010.
4. M.N.Bandyopadhyay, Electrical Machines Theory and Practice, PHI Learning PVT LTD., New Delhi, 2009.

OUTCOMES:

At the end of this course, the student will possess knowledge and skills on the following:

- apply the concepts of electromagnetism in electromechanical energy conversion systems.
- analyze the performance and characteristicsof DC Generators.
- compare performance characteristics of DC Motors for various applications.
- test and troubleshoot DC Motors and DC Generators.
- analyze the performance and characteristicsofBLDCM and Transformers.
- compute voltage regulation, losses and efficiency of transformers by conducting appropriate test.

EEC 2105 ELECTRONIC DEVICES & CIRCUITS LAB

L	T	P	C
0	0	2	1

OBJECTIVES:

- To get practical exposure of the various electronic devices and its applicationcircuitry.
- To design and implement rectifiers and oscillators.
- To provide hands-on experience on opamp application circuits.

LIST OF EXPERIMENTS:

1. VI characteristics of PN junction diode and Zener diode.
2. Characteristics of BJT.
3. Characteristics of LED and photo transistor.
4. Characteristics of JFET.
5. Frequency response of FET amplifier.
6. Analysis of Bridge Rectifier.
7. Measurement of important Opamp parameters such as CMRR, slew rate, open loop gain, input and output impedances, GBW product.
8. Gain of inverting and non-inverting amplifier
9. Op Amp application circuits - Integrator and differentiator
10. Astable and Schmitt Trigger using Opamp.
11. Design of RC Phase shift oscillator using Opamp .
12. Design of Hartley and Colpitts oscillator using Opamp.

Total Hours –30

OUTCOMES:

The student should have the ability to

- practically construct and verify the various characteristics of semiconductor devices
- demonstrate the working of amplifiers.
- demonstrate the working of various oscillator circuits.
- analyze applications of photo diode and photo transistor.
- demonstrate the working of a bridge rectifier.
- demonstrate the working of opamp application circuits.

EEC2106	ELECTROMECHANICAL ENERGY CONVERSION LAB	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To experimentally verify the performance and characteristics of DC machines and 1-phase transformers.
- Know the necessity to predetermine the performance of DC machines and transformers.
- To apply DC machines and transformers to various applications.

LIST OF EXPERIMENTS

1. OCC and Load characteristics of a separately excited DC generator.
2. OCC and Load characteristics of a self-excited DC shunt generator.
3. Load characteristics of a DC shunt motor.
4. Load characteristics of a DC series motor.
5. Load characteristics of a DC compound motor.
6. Speed control of DC shunt motor.
7. Swinburne’s test.
8. Hopkinson's test
9. Load test on a 1-phase transformer.
10. OC and SC tests on a 1-phase transformer.
11. Sumpner’s test.
12. Polarity test and 3-phase transformer connections.
13. Speed control of BLDC motors.

Total Hours –30

OUTCOMES:

At the end of the course, the student will have ability to:

- Plot the OCC and load characteristics of DC generators.
- Conduct load test on various types of DC motors.
- Choose appropriate speed control methodology for DC and BLDC motors.
- Predetermine the efficiency of DC machines by conducting indirect tests.
- Predetermine the efficiency of transformers by conducting indirect tests.
- Identify the polarity of different three phase transformer connections.

SEMESTER IV

ENC2282	**WRITTEN COMMUNICATION**	**L**	**T**	**P**	**C**
		0	**0**	**2**	**1**

OBJECTIVES:

- To help students identify content specific vocabulary and learn its usage.
- To expose them to reading for specific purposes, especially in professional contexts.
- To expose them to the process of different kinds of formal writing.
- To help them learn corporate correspondence for different purposes.
- To train them in preparing effective applications with résumé
- To make them write different types of reports.

MODULE I **4**

Introduction - process of writing – Fundamentals of academicand professional writing –Understanding short, real world notices, messages, etc.

MODULE II **4**

Reading industry related texts (ex. Manufacturing, textile, hospitality sector etc.) for specific information.

Writing Instructions and recommendations

MODULE III **6**

Understanding format and conventions of writing email, memo, fax, agenda and minutes of the meeting.

Writing email, memo, fax, agenda and minutes of the meeting for various purposes (industry specific)

MODULE IV **6**

Viewing letter of application and Résumé, letter calling for an interview, letter of inquiry and Promotional letter

Writing Functional résumé and letter of application using Edmodo,

MODULE V **6**

Viewing a Video and reading a case study (industry specific) – collaborative writing using Edmodo –reading and information transfer

Writing reports- Survey, feasibility and progress – exposure to discipline specific reports

MODULE VI **4**

Writing Statement of purpose (Higher Education)-- Justifying and writing about one's preparedness for job (Statement of Purpose highlighting strengths and weaknesses) – Peer evaluation skills through Edmodo.

P – 30; Total Hours –30

REFERENCES:

1. Riordan,D (2013). *TechnicalReport Writing Today*. Cengage Learning, 10th edition. USA.
2. Oliu, W. E., Brusaw, C.T., & Alred, G.J.(2012). *Writing that Works: Communicating Effectively on the Job* . Bedford/St. Martin's. Eleventh Edition.
3. Garner, B.A. (2013). *HBR Guide to Better Business Writing (HBR Guide Series)*. Harvard Business Review Press. USA.
4. Sharma, R.C. & Krishna M. (2002). *Business Correspondence and Report Writing*. Tata MacGraw – Hill Publishing Company Limited, New Delhi.
5. Macknish, C. (2010). *Academic and Professional Writing for Teachers*. McGraw-Hill Education. USA.
6. Whitby, Norman (2014). *Business Benchmark: Pre-Intermediate to Intermediate.* Cambridge University Press, UK.

OUTCOMES:

On completion of the course, the students will have the ability to

- Identify content specific vocabulary and also use them in appropriate contexts.
- Demonstrate reading skills with reference to business related texts.
- Draft professional documents by using the three stages of writing.
- Create different types of documents for various corporate correspondences.
- Write effective letter of applications, résumé and statement of purpose.
- Write business related reports efficiently.

EEC2211	POWER SYSTEM - I	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To provide the students the knowledge and skills to model and analyze the transmission lines in electric power systems.
- To provide fundamental design considerations for insulator strings, cables and overhead lines.
- To make the students understand the different bus-bar arrangements in substations and distribution schemes
- To provide the knowledge and skills to model large-scale power systems.

MODULE I INTRODUCTION AND TRANSMISSION LINE PARAMETERS 12

Structure of electric power system - Generation, transmission and distribution - EHV AC and HVDC transmission – break-even distance.

Transmission line parameters of single and three phase transmission lines with single and double circuits: resistance, inductance and capacitance of solid, stranded and bundled conductors - symmetrical and unsymmetrical spacing – transposition of conductors - self and mutual GMD - skin and proximity effects – communication interference.

MODULE II MODELING AND PERFORMANCE OF TRANSMISSION LINES 12

Classification of lines: short, medium and long lines - equivalent circuits and mathematical models - attenuation constant, phase constant, surge impedance - transmission efficiency and voltage regulation - real and reactive power flow in lines – power angle diagram - surge-impedance loading - shunt and series compensation - Ferranti effect and corona loss.

MODULE III III INSULATORS, CABLES AND MECHANICAL DESIGN OF OVERHEAD LINES 11

Insulators: Types - voltage distribution in insulator string - string efficiency - improvement of string efficiency.

Underground cables: Constructional features of LT and HT cables – capacitance-dielectric stress and grading - thermal characteristics.

Mechanical design of overhead lines: Sag in overhead lines - calculation of sag and

tension – supports at equal and unequal heights – effects of wind and ice.

MODULE IV SUBSTATION AND DISTRIBUTION SYSTEM 10

Types of substations - bus-bar arrangements - substation bus schemes: single bus scheme, double bus with double breaker, double bus with single breaker, main and transfer bus, ring bus, breaker-and-a-half with two main buses, double bus-bar with bypass isolators - radial and ring-main distributors – interconnectors - AC distribution: AC distributor with concentrated load; three-phase, four-wire distribution system

MODULE V POWER SYSTEM REPRESENTATION 8

Balanced three phase systems and per phase analysis, per phase models of generator, load, transmission line and transformers - equivalent circuit of transformers with off-nominal tap ratio - single line diagram – per unit system - impedance and reactance diagrams.

MODULE VI NETWORK MODELING 7

Network modeling by network matrices - Bus admittance matrix: formation of bus admittance matrix by inspection method (two rule method) - basic graph theory – node incidence matrix – formation of bus admittance matrix by singular transformation.

L – 45; T – 15; Total Hours –60

REFERENCES:

1. Kothari I, D P, "Power System Engineering", Tata Mcgraw Hill, 2nd Edition,2008.
2. S.N. Singh, 'Electric Power Generation, Transmission and Distribution', Prentice Hall of India Pvt. Ltd, New Delhi, 2002.
3. Luces Fualkenberry, Walter Coffer, 'Electrical Power Distribution and Transmission', Pearson Education, 1996.
4. John J. Grainger and Stevenson Jr. W.D., 'Power System Analysis', McGraw Hill International Edition, 1994.
5. Hadi Saadat, 'Power System Analysis', Tata Mc Graw Hill, 2002.
6. Stagg, G.W. and El-Abiad, A.H., 'Computer Methods in Power System Analysis', McGraw Hill International Book Company.
7. M.A. Pai, ‘Computer Methods in Power System Analysis’ McGraw Hill Education (India) Pvt. Ltd., 2006.

OUTCOMES:

At the end of the course, the students will be able to

- Calculate the electrical parameters of the single and phase transmission lines with different configurations.
- Model short, medium and long transmission lines and analyze their performance.
- Follow the fundamental design considerations for insulator strings, cables and laying of transmission lines.
- Choose appropriate bus schemes for substations and distribution schemes, based on the requirement.
- Draw and interpret single line diagrams and per unit impedance diagrams of a given power system with all the related equipment.
- Model an electrical power network using bus admittance matrix.

EEC2212	AC MACHINES	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To give exposure to the students about synchronous machines including their constructional details, principle of operation and performance analysis.
- To learn the characteristics of induction machines and relate their use for various applications.
- To enable the students to compute various parameters of AC rotating machines by performing suitable experiments.
- To enable the students to solve analytical problems on AC machines.

MODULE I SYNCHRONOUS GENERATOR 8

Construction – Principle of Operation – EMF equation – Synchronous impedance – Voltage Regulation-Application.

MODULE II PERFORMANCE STUDY OF SYNCHRONOUS GENERATOR 8

Armature Reaction – Parallel operation – Synchronizing current and torque – Effect of change in excitation and mechanical input – Two reaction theory – Slip test.

MODULE III SYNCHRONOUS MOTOR 9

Principle of Operation – Starters – Power developed and torque – Power stages and efficiency – Motor on load with varying excitations and varying loads – V and inverted V curves- Application.

MODULE IV THREE PHASE INDUCTION MOTOR 8

Construction – Types – Principle of operation –Slip-torque characteristics - Various torques - T_{st}, T_{max} etc., – Losses and efficiency –Starters and Speed Control-Application.

MODULE V PREDICTION OF PARAMETERS FOR THREE PHASE INDUCTION MOTOR 8

No load and blocked rotor tests – Equivalent circuit – Circle diagram –

Cogging torque and crawling- induction machines with deep bar and double cage rotors.

MODULE VI SINGLE PHASE INDUCTION MOTOR 5

Constructional details of single phase induction motor - Double revolving field theory and operation - Equivalent circuit - No load and blocked rotor test - Performance analysis - Starting methods of single-phase induction motors.

L – 45; T – 15; Total Hours –60

REFERENCES:

1. Edward Hughes, Electrical Technology, Tata McGraw Hill Publication, 2001.
2. H. Cotton, Electrical Technology, Tata McGraw Hill Publication, 1999.
3. A.E. Fitzgerald et.al. Electrical Machinery, Tata McGraw Hill Publications, 2003.
4. Alexander S. Langsdorf, “Theory of Alternating current Machinery” SecondEdition, TATA McGRAW-HILL, 1983.
5. P.S.Bhimbra, Electrical Machinery, Khanna Publishers, 2014.

OUTCOMES:

At the end of this course, the student will have ability to:

- Identify different types of synchronous and induction machines.
- Explain how synchronous and induction machines works.
- Do basic calculation on synchronous and induction machines.
- Identify areas of application of synchronous and induction machines
- Assess the performance of Induction motor using equivalent circuits.
- Analyze the performance of single phase induction motor.

EEC2213	POWER ELECTRONICS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To experimentally reinforce and support the fundamental concepts in Power Electronics.
- To provide an important bridge between theory and application and promoting active design-based learning.
- To expose the students to the digital controller based controlling techniques.
- To introduce the students to state-of-the-art industrial-grade experimentation tools.
- To equip the next generation of power electronics design engineers with the skills to tackle problems make them more adaptable for industry with less effort on job training.

MODULE I PHASE CONTROLLED RECTIFIERS 9

Construction and characteristics of DIAC, SCR - Understanding the specification parameters of SCR and DIAC - Case study: MOC 30XX series optically isolated Thyristor drivers – single phase controlled rectifiers: single pulse, two pulse and semi converters with R and R-L Loads – three phase controlled rectifiers: three pulse and six pulse converters with R and R-L loads -Design of RC Snubber.

MODULE II AC TO AC CONVERTERS 9

Construction and characteristics of TRIAC - Understanding the specification parameters of TRIAC - AC Voltage controllers: SCR based single phase AC phase angle controller with R and RL loads – Integral controller –AC voltage controller for Incandescent Light Dimming and Motor Speed Control - Digital AC Lamp intensity controller with zero crossing detection - Matrix converter.

MODULE III DC-DC CONVERTERS 9

Construction and characteristics of Fast recovery diode, MOSFET and IGBT- Understanding the specification parameters of Fast recovery diode, MOSFET and IGBT- High side and Low side switching- High side, Low side and half bridge gate drivers – optically isolated gate drivers – Basics and generation of PWM - operation of Non-Isolated DC/DC Converters: Buck, Boost and Buck-Boost converters \

MODULE IV INVERTERS 6

Single phase and Three phase (both 120°and 180°Modes) Inverters - Sine-PWM - Space Vector PWM – Multilevel inverters: Capacitor-Clamped Inverter – Cascaded H-Bridge Inverter- Uninterruptible power supplies.

MODULE V SWITCH MODE POWER SUPPLIES 6

operation of Isolated DC/DC Converters: Flyback Converter - Forward Converter - Bridge Converters. Design Specifications - SMPS Transformer Design –Selection of the Semiconductors: Selection of the Output Rectifiers and Power Switch - Design of the SMPS Controller - UC3843current mode PWM controller Implementation.

MODULE VI MODELING AND SIMULATION OF POWER ELECTRONIC CONVERTER USING PSIM 6

Phase controlled Rectifiers – DC-DC converters - closed loop control of Choppers and fly back converters– SPWM inverters.

L – 45; T – 15; Total Hours –60

REFERENCES:

1. Ned Mohan,Undeland and Robbin, "Power Electronics - converters, Application and design", John Wiley and sons.Inc, New York,1995.
2. Rashid M.H., "Power Electronics Circuits, Devices and Applications ", PrenticeHall India, New Delhi, 1995.
3. Rashid M.H., "Power Electronics Hand Book", Academic Press, USA 2007.
4. Ned Mohan, "Power Electronics: A First Course", John Wiley and sons.Inc, New York, 2012.
5. P.S.Bimbra, "Power Electronics", Khanna Publishers, 11th Edition, 2003.
6. DC/DC Book of Knowledge Practical tips for the User By Steve Roberts © 2014 All rights RECOM Engineering GmbH & Co KG, Austria.
7. *Marty Brown* Mokorola Semiconductor "Practical Switching Power Supply Design" Academic PressA Harcourl Science and Technology Company525 B Street. Suite IWO. San Diego. California 92101-4495. USA 1990.

OUTCOMES:

At the end of the course, the student is expected to

- Select appropriate power electronics device and control IC for different applications.
- analyze and design controlled rectifiers and AC voltage regulators.

- analyze and design DC- DC converters and inverters.
- use micro controller in power electronic applications.
- design Switch Mode Power Supplies.
- modify and scale the converter design to fit real time applications and simulate power electronic circuits using PSIM software.

EEC2214	AC MACHINES LAB	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To experimentally verify the performance and characteristics of Alternator, Synchronous motor, 3-phase induction motor.
- To perform tests on the various types of electric motors and generators
- To introduce students to the operating principles, methods of starting and area of applications of synchronous and induction machines.
- To perform speed control in various AC machines.
- To synchronize AC machines and to regulate the voltage.

LIST OF EXPERIMENTS:

1. Regulation of alternators by EMF method.
2. Regulation of alternators by MMF method.
3. Regulation of alternators by Potier Triangle method.
4. Load test on a 3-phase alternator.
5. Regulation of a salient pole alternator by Slip test.
6. Synchronization of alternators
7. V and inverted V curves of a synchronous motor.
8. Load test on a 3-phase squirrel cage induction motor.
9. No load and blocked rotor tests on a 3-phase induction motor to draw the equivalent circuit and circle diagram.
10. Load test on single phase induction motor.
11. Performance study of induction generator.

Total Hours –30

OUTCOMES:

At the end of the course, the student will have the ability to:

- estimate voltage regulation of alternators by EMF, MMF and Potier triangle methods.
- evaluate the performanceof synchronous and induction machines by plotting their characteristic curves.
- analyze the working of any electrical machine under loaded and unloaded conditions.

EEC2215	POWER ELECTRONICS LAB	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To acquire knowledge on design and operation of several common circuits relevant to the field of power electronics.
- To provide the students with hands-on experience in design and prototyping the power electronic converters.
- To expose the students to the Micro Controller based controlling techniques.
- To describe the real time implementation of DC-DC converters and Inverters.
- To provide an introduction to the dSPACE Control Desk and MATLAB/Simulink software.

LIST OF EXPERIMENTS:

1. Design and fabrication of Half wave controlled rectifier using RC Firing Circuit.
2. Design and fabrication of SCR and TRIAC gate driving circuits using MOC 30XX series optically isolated Thyristor drivers.
3. Design and fabrication of zero crossing detector circuit for SCR and TRIAC triggering.
4. Design and Implementation of digital control of Half wave controlled rectifier using PIC Microcontroller.
5. Design and Implementation of TRIAC based AC Lamp intensity control and Heat Control Using PIC Microcontroller.
6. Design and fabrication of gate driving stage using half bridge gate driver IC with High speed opto-coupler.
7. Designing and fabrication of gate driving stage using optically isolated gate driver IC.
8. Design and fabrication of Buck Converter.
9. Design and fabrication of Boost Converter.
10. Design and fabrication of Flyback Converter.
11. Design and fabrication of Half bridge Inverter using Half bridge gate driver IC.
12. Design and fabrication of H- Bridge Inverter.
13. ControlDesk and Matlab/Simulink software

Total Hours –30

OUTCOMES:

At the end of the course the student is expected to:

- Design the driving and interfacing stages of switching power converters and inverters.
- Implement and interface digital controller in power electronics circuits.
- Fabricate the different types of converters and inverters.
- Implement fabricated converters and inverters to control the AC and DC Motors.
- Be Proficient in using the dSPACE Control Desk and Matlab /Simulink software.

SEMESTER V

		L	T	P	C
MSC 3181	**LEADERSHIP & CEO TRAINING**	**3**	**0**	**0**	**3**

OBJECTIVES:

The course aims at

- Bringing about positive transformation in students' attitude.
- Building unique leadership competencies that would ensure successful transition of students across all career stages.
- Sensitizing students to identify their strengths & weakness and training them to deal with it.
- Assisting students in enhancing their expressive ability and inducing a high level of self-confidence to manage both business and emotions
- Training students to become more adaptable and flexible to changing business environment

MODULE I INTRODUCTION TO LEADERSHIP 12

Leadership concept - meaning, definitions, importance of leadership, leadership traits. Leadership functions- general functions, listening, observing, managing and decision making. Components of leadership - leaders, followers and situation. Leadership theories – Trait theory, Skills theory, Style theory, Situational theory, Transformational theory, Transactional theory, Path Goal Theory and LMX. Assessing emotional intelligence and exploring the capabilities and inherent traitsthrough psychometric tests - Multi factor leadership questionnaire and personal reflections

MODULE II LEADERSHIP STYLE AND COMMUNICATION 8

Leadership styles-visionary, Coaching, Affiliative, Democratic, Pacesetting Commanding, Transformational, Transactional. Autocratic, Participative, Laissez-Faire Leader versus Managers. Leadership communication - Rationale, tactic, assertive, formal, informal, communication in crisis- leadership and negotiations, Leadership Presentations-convincing and impressive style

MODULE III LEADERSHIP ROLES 8

Facets of leadership- Leader as an individual – personality and leadership, values, attitudes and ethics of a leader. Leader as a relationship builder- empowering people to meet higher order needs, initiating organization wide motivational programs, involvement with all stakeholders- focusing on organization growth. Leader as an inspirer- motivation and leadership, recognizing and appreciating contributions,

empowering others to lead Leader as an innovator –leader's role in shaping culture and values in an organization. Leader as a Liaison- Leader as team player.

MODULE IV LEADERSHIP CHALLENGES AND STRATEGIES 9

Challenges in leadership: Perception of organization culture and values, interpreting the power dynamics in the organization, establishing work life balance. Bad leadership – Reasons and impact. -Case Study of Marissa Mayer-Yahoo.Inc Organizational transformation through efficient leaders-Case study of Apple Inc. Blue Ocean Leadership-Steps to Blue ocean Leadership-Four Pillars of Blue Ocean leadership-Blue Ocean leadership grid.

MODULE V LEADERSHIP AND CEO TRAINING 8

Leader as a CEO: Traits of a successful CEO, Key responsibilities of a CEO, the path to be a CEO ,Training on Board Room Discussions, Meeting the CEO –Live sessions with industry CEO's. Requirements of Leadership: - Cognitive skills, Interpersonal skills, Business skills, Strategic skills. Role of Emotional Intelligence in taking up key-positions in the organization.

MODULE VI TEACHING PEDAGOGY

Nurturing – Based on the identified strengths and weaknesses, training will be given to enhance the strengths and overcome the weakness.

Assessment - Continuous evaluation will be effected through group discussions, oratory assignments and situational enactments. Pre-and post-training assessment through peer reviews and faculty feedback.

Sustained development – Training will be imparted for self-development and monitoring of leadership skills to ensure sustained applicability of the skills learnt.

Total Hours –45

REFERENCES:

1. Andrew J DuBrin. "Leadership: Research Findings, Practice, and Skills", 8th Edition, South-Western College Pub, 2015.
2. Yukl G , "Leadership in Organisations", 8th Edition, Pearson Education, 2013.
3. Richard L Daft , "Leadership", 5th Edition, South Western Cengage Learning 2012.
4. Stephen P. Robbins and Timothy A. Judge. "Organizational Behaviour", 15th Edition, New Delhi: Pearson, 2013.

5. Fred Luthans, “Organizational Behavior, An Evidence Based Approach”, 12th Edition, New Delhi: McGraw Hill Education, 2013.

6. Emotional Intelligence, Why it can matter no more than IQ by Daniel Goleman (include a book) Publisher: Bloomsbury Publishing India Private Limited; Latest edition (2017)

7. Primal Leadership: Unleashing the Power of Emotional Intelligence by Prof Daniel Goleman , Richard Boyatzis and McKee ,Harvard Business Review Press.

Recommended Readings:

1. Jim Collins, (2001). “Good To Great: Why Some Companies Make the Leap...And Others Don't”, Random House Publishers India Pvt.Ltd, New Delhi.
2. George, B. with Sims, P. True North: Discover Your Authentic Leadership, The Times Group Books; First edition (1 October 2015)
3. Kim, W. C., & Mauborgne, R. A. (2014). Blue ocean strategy, expanded edition: How to create uncontested market space and make the competition irrelevant. Harvard business review Press.
4. Leadership Wisdom by Robin Sharma Jaico Publishing House;

OUTCOMES:

The students will be able to

- Explore through self-introspection one’s own leadership style, their strength and weakness
- Gain self confidence to lead a team in the organization
- Realize the role of leadership in making or breaking of an organization
- Acquire the practice of self introspection and development of leadership competencies thorough continuous efforts
- Manage their own emotions as well as other resulting in successful relationship building with all stakeholders

MSC 4181	SOCIAL ENTREPRENEURSHIP	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To be able to understand the field of social entrepreneurship and Social problems
- To be able to describe and understand the traits of social entrepreneurs
- To recognize the social business opportunities
- To synthesize the resource mobilization ways for social entrepreneurship
- To understand the social entrepreneurship models
- To recognize the impact of social entrepreneurship on societies.

MODULE I INTRODUCTION TO SOCIAL ENTREPRENEURSHIP 7

Introduction - Emergence and Development of Social Entrepreneurship. Social Problems in India: An Overview. Social Development: The Indian Scenario. Emergence of Social Entrepreneurs and Sustainable Solutions to Social Problem. Characteristics and Context of Social Entrepreneurship. The Role of Social Entrepreneurship in Societies & Economies.

MODULE II SOCIAL ENTREPRENEURSHIP: DRIVERS AND CHALLENGES 7

The Drivers of Social Entrepreneurship. Elements of the Social Entrepreneurial Personality. Challenges of financial constraints. Challenge to attract and cultivate talented workers. Challenge of evaluation of social entrepreneur impact. Challenge of scaling and its impact. Cases.

MODULE III SOCIAL ENTREPRENEURSHIP: OPPORTUNITY RECOGNITION 7

Opportunity Recognition and Planning Process. Opportunities for Social Entrepreneurs. The Nature of Social Entrepreneurial Opportunities. Social Problems into Opportunities. Idea development and conceptualization of social problem. Cases

MODULE IV RESOURCE MOBILIZATION FOR SOCIAL VENTURE 8

Resources at Initial Stage. Social Network as a role of Social Capital. Team and Collective Efforts. Need and Determination of Important Resources. Resource of Knowledge, Skills and Abilities. overview of venture capital and angel investment. Cases

MODULE V **BUSINESS MODELS AND BUSINESS PLAN FOR SOCIAL ENTERPRISES** **8**

Design Principles of Social Entrepreneurship Business Models, Evaluation of the Root Cause of a Societal Problem. Developing business plan for social ventures. Developing an investor presentation. Feasibility study and report. How to start a business - Procedures for registration of small scale industry

MODULE VI **THE IMPACT OF SOCIAL ENTREPRENEURSHIP ON SOCIETIES AND CASES** **8**

Static Impact of Social Entrepreneurship. Impact of Charitable NGOs vs. Social Entrepreneurship, Impact of For-Profit Companies vs. Social Entrepreneurship. Social entrepreneurship report preparation by students.

Case Study of Social Entrepreneurs

Total Hours –45

REFERENCES:

1. “Social Entrepreneurship : New models of sustainable social change” . Alex Nicholls, Oxford University Press 2006
2. The Process of social value creation : A multiple case study on Social Entrepreneurship in India , Archana Singh Springer 2016
3. “Social Entrepreneurship and social business” Christine K Volkmann, Springer Gabler 2012
4. “Social Entrepreneurship” Manuel London ,Routlege, 2010.

OUTCOMES:

The students can be able to

- Conceptualize social entrepreneurship in terms of a theoretical frameworkbetween changing social values and institutions
- Think and communicate about social values
- Learn about practical models of social change to launch, lead, manage, and evaluate a social venture
- Analyze funding needs and sources for the social venture
- Experience the ideas can be critically and collaboratively examined prior to commitment.

ENC 3181	COMMUNICATION AND SOFT SKILLS - I CAREER CHOICE	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To create awareness of industrial trends and market demands.
- To encourage students to explore career opportunities in an industry and evaluate themselves in relation to industry preparedness

MODULE I **6**

Knowledge about specific industry-Discussion with industry experts --Self evaluating career prospects through survey questionnaire (based on his/her eligibility for taking up a job (industry preparedness)

MODULE II **6**

. Knowing case studies of industries(pertaining to students' choice of career)- Reading and discussing about job markets-goal setting, working on creativity.

MODULE III **4**

SWOC analysis and discussing outcomes--exploring mini projects or case studies of latest industries.

MODULE IV **6**

Writing statement of purpose pertaining to career choice---- Outcomes

MODULE V **8**

Project or case study presentations (Presentation in pairs) -mini project report or case study report.

Total Hours – 30

REFERENCES:

1. Brown,D.(2002). Career Choice and Development. Wiley,J. & Sons.USA
2. Lore,N.(1998). The Pathfinder: How to Choose or Change Your Career for a Lifetime of Satisfaction and Success. Simon & Schuster.USA.
3. Shell, G.R.(2013). Springboard Launching your Personal Search for Success.Portfolio.USA.

OUTCOMES:

After the completion of the course, students would be able to

- Speak about their career choice.
- Self evaluate their strengths and weaknesses and speak about it.
- Make effective presentations on case studies or relating to projects.
- Write the statement of purpose relating to their career choice.

EEC3101 POWER SYSTEM - II

L	T	P	C
3	1	0	4

OBJECTIVES:

- To provide the student the computational skills required to model and analyze large-scale power systems under normal and abnormal operating conditions.
- To make the students understand the usage of efficient numerical techniques suitable for computer application which are required for planning and operation of power systems.
- To provide the fundamentals of power system control and economic operation.

MODULE I POWER FLOW ANALYSIS 11

Introduction to power system analysis: power flow, fault and stability analyses.

Power flow analysis: Problem definition - bus classification - derivation of power flow equation in rectangular and polar forms - review of Gauss-Siedel and Newton-Raphson methods for solution of non-linear algebraic equations.

Power flow solution by Gauss-Siedel, Newton-Raphson, Decoupled and FDPF methods - computation of slack bus power, transmission loss and line flows – development of power flow diagrams.

MODULE II SYMMETRICAL FAULT ANALYSIS 10

Need for short circuit study - symmetrical short circuit analysis by internal emf and Thevenin's equivalent circuit methods - short circuit current and MVA calculation - Thevenin's impedance and bus impedance matrix - bus impedance matrix building algorithm (without mutual impedance) - symmetrical short circuit analysis by bus impedance matrix - selection of circuit breakers.

MODULE III SYMMETRICAL COMPONENTS AND UNSYMMETRICAL FAULT ANALYSIS 10

Symmetrical components - sequence impedances of synchronous machines, transformers, transmission lines and loads - formation of sequence networks for unsymmetrical fault analysis.Unsymmetrical fault analysis: LG, LL and LLG faults with and without fault impedance - effect of ground impedance.

MODULE IV STABILITY ANALYSIS 10

Basic concepts of steady state, transient and dynamic stabilities - swing equation for SMIB system - power angle equation and curve- steady state stability limit - transient

stability: equal area criterion, critical clearing time and angle - numerical solution of swing equation by modified Euler method - methods to improve steady state and transient stabilities.

MODULE V POWER SYSTEM OPERATION AND CONTROL 12

Types of load – load characteristics – load curves and load duration curves – generation reserves - Energy control center: functions – monitoring, data acquisition and control system hardware configuration – SCADA and EMS functions – power system security – various operation states.

Real power control: Fundamentals of speed governing mechanism and its modeling – speed load characteristics – load sharing between two synchronous generators in parallel – need for frequency control - automatic generation control - concept of control area – load frequency control in single and two area systems - modeling and static analysis.

Introduction to reactive power control: Generation and absorption of reactive power – role of excitation systems and AVR.

MODULE VI ECONOMIC OPERATION OF POWER SYSTEMS 7

Economic dispatch: concept of incremental cost - incremental cost curves - classical economic dispatch without and with losses - loss coefficients.

Unit commitment: need, constraints, solution methods – unit commitment by priority listingscheme.

L – 45; T – 15; Total Hours –60

REFERENCES:

1. John J. Grainger and Stevenson Jr. W.D., 'Power System Analysis', McGraw Hill International Edition, 1994.
2. Hadi Saadat, 'Power System Analysis', Tata Mc Graw Hill, 2002.
3. Stagg, G.W. and El-Abiad, A.H., 'Computer Methods in Power System Analysis', McGraw Hill International Book Company.
4. M.A. Pai, ‘Computer Methods in Power System Analysis’ McGraw Hill Education (India) Pvt. Ltd., 2006.
5. Olle I. Elgerd, 'Electric Energy and System Theory - An Introduction', Tata McGraw Hill Publishing Company, New Delhi. 1983.
6. Kirchmayer .L.K. 'Economic Operation of Power System', John wiley & Sons, 1953.
7. Allen J.Wood, Bruce F.Wollenberg, 'Power Generation Operation and Control', John Wiley and Sons, 1984.

8. Kothari, D.P and Nagrath, I.J., 'Modern Power System Analysis', Third Edition, Tata McGraw Hill Education, New Delhi, 2003.
9. Kundur, 'Power System Stability and Control', McGraw-Hill Pub. Co., 1994.

OUTCOMES:

The students will be able to

- Write a program to perform load flow analysis using Gauss Seidel / Newton Raphson method for simple systems.
- Perform symmetrical fault analysis in power systems.
- Transform unbalanced power systems into a set of balanced systems using symmetrical component transformation for unsymmetrical fault analysis.
- Analyze the given power system for small signal / transient stability and compute critical clearing angle and critical clearing time for simple systems using equal area criterion.
- Perform load frequency control in single and two area systems with the understanding of basic concepts in power system operation.
- Prepare generation schedules considering economic operation of power systems.

EEC3102 MEASUREMENTS AND INSTRUMENTATION

L	T	P	C
3	0	0	3

OBJECTIVES:

To impart Knowledge on -

1. Various instrument systems and their errors in them.
2. Various signal conditioning circuits.
3. Principle of various active and passive transducers.
4. Various storage and display devices.
5. Instruments for measuring the various electrical quantities.
6. Working principles of biomedical instruments that are actually in use at the present day.

MODULE I INTRODUCTION 7

Functional elements of an Instrument - Static and Dynamic characteristics - Errors in measurement - statistical evaluation of measurement of data - Standards and Calibration.

MODULE II TRANSDUCERS 9

Classification of transducers - selection of transducer - resistive, capacitive and inductive transducer - Piezo- electric transducer - optical and digital transducers. Transducers for measurement of displacement,temperature,level, pressure, velocity and acceleration.

MODULE III SIGNAL CONDITIONING CIRCUITS AND DISPLAYS 9

Bridge Circuits - differential and Instrumentation amplifier -filter circuits- V/f and f/V converters - multiplexing and demultiplexing - data acquisition systems - digital CRO.

MODULE IV ELECTRICAL INSTRUMENTS 6

Principle and types of analog and digital ammeters and voltmeters – Single and three phase watt meters and energy meter –magnetic measurements –

MODULE V BIOMEDICAL INSTRUMENTS 6

Introduction to biomedical instruments - Blood pressure measurement methods - Blood flow measurement methods - CT scanner - MRI scanner.

MODULE VI ASSISTING AND THERAPEUTIC EQUIPMENTS 8

Pacemakers - Defibrillators - Ventilators - Nerve and muscle stimulators - Diathermy -

Audio meters - Dialyzers (Haemodialysis Machine)

Total Hours –45

REFERENCES:

1. Doebelin E.O., "Measurement Systems - Application and Design", McGraw Hill Publishing Company, 1990.

2. Murthy, D.V.S., "Transducer and Instrumentation", Prentice Hall of India Pvt. Ltd., 1995.

3. Stout ,M.B., "Basic Electrical Measurement", Prentice Hall of India

4 Morris, A.S ,"Principle of Measurement and Instrumentation", Prentice Hall of India, 1999.

5 Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer, 'Bio-Medical Instrumentation and Measurements', II Edition, Pearson Education, 2002 / PHI.

6 R.S.Khandpur, 'Handbook of Bio-Medical instrumentation', Tata McGraw Hill Publishing Co Ltd., 2003.

7 M.Arumugam, 'Bio-Medical Instrumentation', Anuradha Agencies, 2003.

OUTCOMES:

At the end of the course, the student is expected to

1. understand the functional blocks of various Instruments and their standards.
2. Study and select transducers based on their working principle.
3. Understand the working of signal conditioning circuits.
4. Understand the working principles of electrical instruments.
5. Understand the working of Biomedical instruments
6. Understand the working of therapeuticequipment.

EEC3103	DIGITAL SYSTEMS & INTEGRATED CIRCUITS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce basic postulates of Boolean algebra, the methods for simplifying Boolean expressions and shows the correlation between Boolean expressions
- To outline the formal procedures for the analysis and design of combinational circuits and sequential circuits.

MODULE I Number Systems and Boolean Algebra 8

Review of binary, octal and hexadecimal number systems - conversion methods- number representations - signed, unsigned, fixed point, floating point numbers – Binary code BCD, Gray code - error detection and correction codes - parity codes- Boolean algebra – basic postulates, theorems – canonical forms-Simplification of Boolean function using Karnaugh map and Quine-McClusky method – Implementations of logic functions using gates, NAND –NOR implementations –Multi level gate implementations- Multi output gate implementations.

MODULE II Combinational Logic Design

Design Procedure**-** Implementation of combinational logic functions –Half adder, full adder– Half subtraction – full subtract or – parallel adder, Carry look ahead adder – binary adder – Magnitude comparator – encoder and decoders – multiplexers – code converters – parity generator/checker- implementation of combinational circuits using de-multiplexers.

MODULE III Analysis of Sequential Circuits

General model of sequential circuits- flip-flops- latches – level triggering, edge triggering- master slave configuration - concept of state – state diagram - state table, state reduction procedures -Design of synchronous sequential circuits -up/down, modulus counters - shift registers - Ring counter - Johnson counter - timing diagram – serial adder - parity checker - sequence detector.

MODULE IV Monolithic IC Processes and fabrication

Basic planar processes-fabrication of a typical circuit,Refining and growth of Si ystals, Si wafer preparation, Diffusion of dopant impurities, Ion implantation, thermal oxidation, photo lithography, fine line lithography, relative plasma etching, chemical

vapor deposition, metallization.

MODULE V VHDL MODELING AND DESIGN FLOW

Introduction to VLSI - Basics of Verilog, operators, hierarchy procedures and assignments, timing controls and delays, tasks and functions, control statements. VHDL: Syntax and semantics, identifiers, and literals, entities and architectures, packages and libraries interface, type and other declarations, sequential statements, operators, arithmetic operators, VHDL and logic synthesis, Verilog and logic synthesis – Sequential, Data flow, and Structural Modeling – Functions, Procedures and attributes - Test benches, Synthesizable, and non synthesizable statements - packages and configurations - Modeling in VHDL with examples of circuits such as counters, shift registers, bidirectional bus.

MODULE VI PROGRAMMABLE LOGIC DEVICES & SEQUENTIAL LOGIC PRINCIPLES

Introduction to the CPLDs - Study of architecture of CPLD and Study of the Architecture of FPGA .Sequential Circuits – Meta-stability Synchronization – Design of Finite State. Machines and State minimization - FSM CASE STUDIES - Traffic Light control - Lift Control and UART STA and DTA.

Total Hours –45

OUTCOMES:

Students will be able to :

- Apply the concepts and techniques associated with the number systems and codes and to minimize the logical expressions using Boolean postulates.
- To design various combinational and sequential circuits.
- An in-depth understanding of fundamentals of Op-amps and its application circuits.
- Develop design skills to design various circuits using different data conversion systems using op-amps
- Knowledge regarding the various signal generator circuits and the power amplifiers using op-amp

EEC3104	POWER SYSTEM SIMULATION LAB	L	T	P	C
		0	0	2	1

OBJECTIVES:

To develop simple C programs for the following basic requirements and to acquire experience in the usage of standard packages for the following analysis / simulation / control functions.

a) Formation of bus admittance and impedance matrices and network solution.

b) Power flow solution of small systems using simple method, Gauss-Seidel P.F.method.

c) Unit Commitment and Economic Dispatch.

d) Steady-state analysis of large system using NRPF and FDPF methods.

e) Quasi steady-state (Fault) analysis for balanced and unbalanced faults.

f) Transient stability simulation of multimachine power system.

g) Simulation of Load-Frequency Dynamics and control of power system.

LIST OF EXPERIMENTS:

1. Computation of Parameters and Modeling of Transmission Lines
2. Formation of Network Matrices and Solution of Networks.
3. Power Flow Analysis I: Solution of Power Flow using Gauss-Seidel Method.
4. Power Flow Analysis II: Solution of Power Flow using Newton-Raphson and Fast-Decoupled Methods.
5. Short Circuit Analysis.
6. Transient and Small Signal Stability Analysis: Single-Machine Infinite Bus System.
7. Transient Stability Analysis of Multi machine Power Systems.
8. Electromagnetic Transients in Power Systems.
9. Load - Frequency Dynamics of Single and Two-Area Power Systems.
10. Unit Commitment and Economic Dispatch in Power Systems.

TOTAL HOURS: 30

OUTCOMES:

At the end of the course, the student will be able to

- Determine the performance characteristics of a long transmission line and its reactive power requirement.
- Perform load flow studies using Gauss Seidal , Newton Raphson and fast decoupled method.

- Perform contingency analysis and selection methods to improve system security.
- Solve various faults on power system elements using fault analysis techniques.
- Perform transient and small signal stability study.
- Perform load frequency dynamics of single area and two area power systems.
- Implement optimal scheduling using economic dispatch programme.

EEC3105	MEASUREMENTS AND INSTRUMENTATION LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

• To select appropriate instruments for the measurement of various process parameters.

• To calibrate various instruments.

LIST OF EXPERIMENTS

1. Study of Displacement and pressure transducers.
2. Design of AC Bridges (Schering and Maxwell).
3. Design of DC Bridges (Wheatstone and Kelvin).
4. Design of Instrumentation Amplifiers.
5. Study of A/ D and D/A converters.
6. Study of Transients.
7. Calibration of Single Phase Energy meter.
8. Calibration of Current Transformer.
9. Measurement of three phase Reactive Power and Power factor.
10. Measurement of Iron Loss.

OUTCOMES:

To enable the student to

1. Study the various types of transducers and their characteristics
2. Design Instrumentation amplifiers.
3. Calibrate the various instruments
4. Measure the electrical quantities like power and power factor
5. Design Inductive and capacitive bridge circuits.
6. Measure the iron loss in a specimen.

EEC3106	DIGITAL SYSTEMS & INTEGRATED CIRCUITS LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To provide hands-on experience on design, testing, and analysis of various digital circuits.
- To provide hands-on experience on design, testing, and analysis of Op Amp Circuits

LIST OF EXPERIMENTS:

1. Design and implementation of combinational circuits using basic gates and universal gates for arbitrary functions.
2. Design and implementation of multiplexers and Demultiplexers.
3. Design and implementation of Code converters
4. Design and implementation of encoder and decoder
5. Design and implementation of synchronous counters and Asynchronous Counters.
6. Study of ADCs and DACs: Verification of A/D conversion using dedicated ICs.
7. Astable and Monostable Multivibrators and Schmitt Trigger using 555 timers.
8. Memory chips

a. Simple exercises like READ and WRITE involving memory chips

b. Expansion of Memory Size

9. Simulation and verification of Combinational Circuits using verilog HDL

- Simple Gates
- Simple Boolean Expressions
- Adder and subtractor
- Parallel Adder design

10. Simulation and verification of sequential Circuits using verilog HDL

- Flip-flops
- Registers
- Counters

11. Design of traffic light controller using VHDL

TOTAL HOURS: 30

OUTCOMES:

At the end of the course, the student is expected to

• Be trained to design and implement combinational and sequential digital circuits.

• Have skills to design and implement various signal generation circuits

SEMESTER VI

ENC 3281	COMMUNICATION AND SOFT SKILLS - II	L	T	P	C
	CONFIDENCE BUILDING	0	0	2	1

OBJECTIVES:

- To develop professional skills like work ethics, analytical skills, presentation skills etc.
- To train them in problem solving skills and leadership skills pertaining to industries.
- To train them in team building skills.
- To train in setting up career goals

MODULE I **6**

Brief about Multinational companies- Analysing work ethics of multinational companies and small industries- discussing as pairs-Knowledge about etiquette (different types)

MODULE II **6**

Visit to an Industry and prepare reports --Critically reading of industry specific journal articles and write ups-- preparing reports.

MODULE III **4**

Analysing problem solving situations in industries (relating to application of core subject to specific jobs) and discussing about them- working on a sample case

MODULE IV **6**

Developing Leadership in team projects-- debating about various aspects of leadership: for example, responsibility and reliability-time management

MODULE V **8**

Team building skills-- group discussions pertaining to industries-- presenting career goals. -- preparing for interviews- interpersonal skills

Total Hours – 30

REFERENCES:

1. Covey,S.R. (2004). The 7Habits of Highly Effective People: Powerful Lessons in Personal Change. Free Press.UK
2. Fine, P.M.& Alice Olins. (2016).Step up: Confidence, Success and Your Stellar Career in 10 Minutes a Day. Vermilion.UK
3. Pai, A. (1993).How to Develop Self-Confidence. Amazon.com
4. Wentz,F.H.(2012). Soft skills training: A Workbook to Develop Skills for Employment. Amazon.com

OUTCOMES:

After completing the course students would be able to

- Exhibit critical reading skills through review of industry specific articles.
- Provide solutions to problem based situations.
- Exhibit leadership qualities by debating over industry specific issues.
- Participate in group discussions confidently.
- Present their career goals.

EEC3211 EMBEDDED SYSTEMS

L	T	P	C
3	1	0	4

OBJECTIVES:

To impart Knowledge on -

- Hardware architecture of 8085 processors.
- Concept of addressing modes, need and use of interrupts.
- Simple machine language programming using 8085.
- Different peripherals and their interfacing concepts with microcontroller
- positively and appropriately apply knowledge in doing open ended project

MODULE I INTRODUCTION TO 8085 PROCESSOR 9

Overview of 8085 microprocessor – The salient features of 8085- 8085 Architecture - Functional Block Diagram - Memory - Interrupts - Serial communication – DMA – Registers -Instruction Set -Addressing mode - Assembly language : Simple examples

.

MODULE II INTRODUCTION TO EMBEDDED SYSTEMS 8

Components of Embedded systems - Evolution in Microcontroller technology - Introduction to PIC family - Features of PIC16F877A - PIC Families - Harvard Architecture vs Von Neoman - PIC16F877A Architecture - Pin description and Oscillator Types - System Reset.

I/O PORTS AND REGISTERS OF PIC16F877A

Memory Organization - Input/output - Ports - Registers - Status Register - Option Register - Memory Organization - Port I/O configuration - Introduction to Software Tools - MikroC and Pickit2 programmer. Simple programmes in MikroC: Digital input/output and Delay loop Applications – Push Button interfacing, Flasher and Counter.

MODULE III INTERRUPTS AND ON-CHIP ANALOG TO DIGITAL CONVERTOR 8

Interrupts in PIC 16F877A - INTCON Register - Option Register - Interrupt Sources - PIE and PIR registers - Enabling Interrupts - Peripheral Interrupts - Interrupt Service Routine (ISR). - On-Chip Analog-to-Digital Converter (ADC) block diagram - PIC16F877A ADC pins - ADC Configuration- ADC PORT configuration - ADC Channel Selection – ADC voltage reference selection - Resolution - ADC conversion clock source - Interrupt control - ADC result format - ADC Registers: ADCON0 and ADCON1 - Sample Interrupt Codes in MikroC.

MODULE IV TIMER MODULES IN PIC 16F877A 9

TIMER0 module Block Diagram - Timer Calculation and TMR0 Register – Configuring the TIMER0 module using the INTCON and OPTION registers – TIMER1 module Block Diagram - Timer Calculation and TMR1H:TMR1L Register - Register Configuring the TIMER1using T1CON, PIR1 and PIE1control registers – TIMER2 module Block Diagram - Timer Calculation and TMR2 Register - Register Configuring the TIMER2 using T2CON, PIR1 and PIE1control registers - sample codes to generate time delay.

MODULE V CAPTURE/COMPARE/PWM MODULES 8

CAPTURE and COMARE modes operation block diagram - CCP1CON/CCP2CON Registers - TIMER1 mode selection - software interrupt - CCP prescaler - PWM mode-simplified PWM block diagram- PWM period - PWM duty cycle - setup for PWM operation – Generation of PWM in mikroC using the CCP module.

MODULE VI PIC 16F877A SERIAL COMMUNICATION MODULES 10

Master SSP (MSSP) Module – Control registers - SPI Mode – Master/Slave mode - Inter-Integrated Circuit (I^2C) Mode - Universal Synchronous Asynchronous Receiver Transmitter (USART) module- Master/Slave mode – Sample MikroC source codes: PIC to PIC Communication.

L – 45; T – 15; Total Hours –60

REFERENCES:

1. Douglas V.Hall, Microprocessor and Interfacing, Programming and Hardware.
2. Revised second Edition, Indian edition 2007. Tata McGraw Hill
3. Krishna Kant, " Microprocessor and Microcontroller Architecture, programming
4. and system design using 8085, 8086, 8051 and 8096, PHI, 2007
5. John Main, “PIC Microcontroller C”, 2006-2007 Edition, 2007.
6. Mikro C- Compiler for PIC Microchip controllers- mikro Electronik, 2012.
7. Martin P. Bates,” Programming 8-bit PIC Microcontrollers in C: With Interactive Hardware Simulation.
8. Martin P. Bates,” PIC Microcontrollers –An Introduction” Newnes,2011.
9. Han-Way Huang, Leo Chartrand, "PIC Microcontroller: An Introduction to Software & Hardware Interfacing", Delmar Cengage Learning, 2004.
10. Ramesh Gaonkar, "Fundamentals of Microcontrollers and Applications.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Internal organization of some popular microprocessors/microcontrollers.
- Hardware and software interaction and integration.
- Design of microprocessors/microcontrollers-based systems.
- Interface PIC microcontroller with hardware for given application.
- Develop small microcontroller based applications.
- analyze a problem and formulate appropriate computing solution for microcontroller based applications.

EEC 3212 **CONTROL SYSTEMS** **L T P C**

3 1 0 4

OBJECTIVES:

- To analyze the system modeling and various methods of representation.
- To provide adequate knowledge on time response analysis of systems and steady state error calculations.
- To educate the necessity for frequency domain analysis using numerous plots.
- To provide knowledge on the design procedure of compensators and its applications.
- To provide knowledge on state space approach, state of systems, controllers and observers for different processes.
- To enhance knowledge on stability analysis of multivariable processes.

MODULE I SYSTEM REPRESENTATION AND ANALYSIS 8

Open loop and closed loop control systems – Transfer Function – Mechanical, Electrical and Electromechanical Systems – Block diagram representation – Block diagram reduction – Signal flow graphs – Mason's Gain formula – Characteristics Equation.

MODULE II TIME DOMAIN ANALYSIS 8

Transient and Steady State response – Test Signals – Time domain specifications – First and Second order system, Steady state error and error constants – P, PI, PID modes of feedback control – Tuning of PID Controller using MATLAB.

MODULE III FREQUENCY DOMAIN ANALYSIS 8

Frequency domain specifications – Relation between time and frequency domain parameters – Analysis based on bode plot and polar plot – Gain and phase margin – Nichols chart.

MODULE IV COMPENSATOR DESIGN 7

Compensator design using bode plots: Lag, Lead, Lead-Lag Compensator. Realization of Lag, lead and Lead-Lag networks.

MODULE V MODELING IN STATE SPACE 7

Introduction to State Space Approach – System representation in state variable form –Controllability and Observability–System analysis using state space approach in MATLAB.

MODULE VI SYSTEM STABILITY 7

Stability analysis by locating roots in s plane – Routh Hurwitz criterion– Root locus construction and performance analysis – Stability analysis in frequency domain – Nyquist stability criterion- Case Study- Modelling and parameter analysis of a closed loop control system.

L – 45; T – 15; Total Hours –60

REFERENCES:

1. K. Ogata, 'Modern Control Engineering', 4th edition, Pearson Education, New Delhi, 2003.
2. I.J. Nagrath& M. Gopal, 'Control Systems Engineering', New Age InternationalPublishers, 2003.
3. Benjamin C Kuo, "Control Systems", Tata McGraw Hill, 2002
4. C.J.Chesmond.'Basic Control System Technology', Viva low priced student edition, 1998.
5. John S. Bay, "Fundamentals of Linear State Space Systems", McGraw-Hill 1999.
6. R.C.Dorf and R.H.Bishop, 'Modern Control Systems', Addison-Wesley, 1995 (MATLAB Reference).

OUTCOMES:

At the end of the course, the student will have knowledge and achieve skills on the following:

- Ability to analyze complex systems using mathematical models.
- Get the time response of first and second order systems analytically and interpret the response.
- Perform frequency response analysis of physical systems and interpret the response.
- Design appropriate compensator for the given system to meet the desired specifications
- Perform stability analyses of the system using conventional mathematical approach.
- Implement state space approach for the process and obtain the solution.

EEC3213	EMBEDDED SYSTEMS LAB	L	T	P	C
		0	0	2	1

OBJECTIVES:

• Simple Assembly Language programming using 8086 and 8051 Instruction set.

• Framing and implementing of algorithms.

• Subroutines, nesting and interrupts need and usage.

LIST OF EXPERIMENTS

1. Programs on arithmetic operations: addition / division using 8085
2. Programs on logical operations: Largest / Descending using 8085
3. Introduction to Software Tools MikroC, PicKit2 programmer
4. Blinking LED and Square wave generation using PIC Microcontroller – MikroC
5. Using Push Button Switch with PIC Microcontroller
6. Interfacing Relay with PIC Microcontroller
7. Using Interrupt with PIC Microcontroller
8. Analog to Digital Conversion using in-built ADC Module
9. Interfacing DC Motor with PIC Microcontroller using L293D
10. Interfacing Matrix Keypad with PIC Microcontroller
11. Using Internal EEPROM of PIC Microcontroller
12. Interfacing Stepper Motor with PIC Microcontroller
13. Interfacing Real Time Clock (RTC) DS1307 with PIC Microcontroller
14. Using Analog Comparator in PIC Microcontroller
15. Generating PWM with PIC Microcontroller using CCP Module
16. PIC to PIC Communication using UART

TOTAL HOURS: 30

OUTCOMES:

At the end of the course the student is expected to possess knowledge and achieve skills on the following.

• Usage of arithmetic, logical branching and control instructions.

• Interfacing of peripheral devices and waveform generation.

• Design and implementation of simple projects using peripheral devices and processors and controllers.

EEC3214	CONTROL SYSTEMS LAB	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To provide a platform for understanding the basic concepts of linear control theory and its application to practical systems.

LIST OF EXPERIMENTS

1. Transfer function of separately excited DC Generator and determine the stability pole-zero map.
2. Transfer function of Armature controlled and field controlled DC Motor and dete the stability using pole-zero map.
3. State space model of a DC Servomotor.
4. State space model of an AC Servomotor.
5. Digital simulation of an Automatic cruise control to maintain a constant vehicle s despite external disturbances.
6. Time response analysis of a Type-1 system with the standard test inputs.
7. Stability analysis of a DC Motor speed control using Bode plot.
8. Stability analysis of a DC Motor position control using Root locus/Nyquist plot.
9. Lag, Lead and Lag-Lead compensator design.
10. Design of P, PI and PID controller for a second order system.
11. Study of synchro for angle detection in Radar.
12. Study of application of stepper motor in Robotics.

TOTAL HOURS: 30

OUTCOMES:

At the end of the course, the student will have knowledge and achieve skills on the following:

- Ability to determine the transfer function of D.C generator, D.C motor, D.C and A.C servomotors.
- Ability to simulate the response of I and II order systems using MATLAB.
- Capable to analyze the output of systems with different TYPES and Order.
- Capable to analyze the stability of different systems using Bode, Root locus, Nyquist plot etc
- Able to design lag, lead and lag-lead compensators.
- Capable to predict the performance of synchro, stepper motor etc.

SEMESTER VII

		L	T	P	C
EEC4101	**POWER SYSTEM PROTECTION AND SWITCHGEAR**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To introduce students to power system protection and switchgear
- To discuss the causes of abnormal operating conditions (faults, lightning and switching surges) of the apparatus and system.
- To understand the characteristics and functions of relays and protection schemes.
- To understand the problems associated with circuit interruption by a circuit breaker.
- Ability to discuss understand and Re-striking.
- To develop an ability and skill to design the feasible protection systems needed for each main part of a power system in students.

MODULE I INTRODUCTION 6

Importance of Protective schemes for electrical apparatus and power system- Qualitative review of faults and fault currents – relay terminology – definitions– essential qualities of protection - CT's and PT's and their applications in protective schemes.

MODULE II PROTECTION AGAINST OVER VOLTAGES AND NEUTRALGROUNDING 7

Generation of Over Voltages in Power Systems - Protection against Lightning Over Voltages –Shielding – Nonmetallic shielding methods - Valve type and Zinc-Oxide Lighting Arresters – Impulse Ratio -Standard Impulse Test Wave - Volt-Time Characteristics - BIL - Insulation Coordination.

MODULE III OPERATING PRINCIPLES AND RELAY CHARACTERISTICS 8

Electromagnetic relays – overcurrent, directional and non-directional, distance, negative sequence, differential and under frequency relays – Introduction to static relays.

MODULE IV APPARATUS PROTECTION 8

Main considerations in apparatus protection – transformer, generator and motor protection – protection of bus bars. Transmission line protection – zones of

protection.

MODULE V THEORY OF CIRCUIT INTERRUPTION 8

Physics of arc phenomena and arc interruption – DC and AC circuit breaking– restriking voltage and recovery voltage – rate of rise of recovery voltage – resistance switching – current chopping – interruption of capacitive current.

MODULE VI CIRCUIT BREAKERS 8

Types of circuit breakers – air blast, air break, oil, SF6 and vacuum circuit breakers – comparative merits of different circuit breakers – testing of circuit breakers.

Total Hours –45

REFERENCES:

1. Ravinranath.B and Chander.N, “PowerSystem Protection and Switchgear”, New Age International (P) Publishers,1977 (2005 Reprint).
2. Chakrabarti.A.Soni.M.L Gupta, P.V. “A Text book on Power System Engineering”, Dhanpat Co. Pvt. Ltd., 2008.
3. C.L.Wadhwa; “Electrical Power Systems”, New Age International Pvt. Ltd., 2006.
4. Patra S.Basu S.K & Choudary.S, “Power System Protection”, Oxford and IBH Publishing Co. Ltd.,1983.
5. Sunil S.Rao, “Switch Gear and Protection”, Khanna Publishers, New Delhi, 1986.

OUTCOMES:

At the end of the course, the student is expected to

- gain knowledge on different Protective Equipment or Power Systems
- Know about various protective systems- how it works and where it works
- apply Oil Circuit Breaker, Air Blast circuit Breakers, SF6 Circuit Breaker in the appropriate places.
- identify Rotor, Stator Faults, inter turn faults and their protection.
- Analyze the fault level and accordingly design the protective devices in a power system for power frequency voltages and currents.
- Ability to design insulation co – ordination between protected equipment and protective devices so that major equipment are protected against surges.

EEC4102	DESIGN OF MACHINES AND ELECTRICALAPPARATUS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To know about the various types of materials used for designing an electrical apparatus
- To get knowledge about the magnetic equivalent circuit of electrical apparatus
- To understand and design the basic principles of DC and AC machine
- To know about the design stator and rotor of induction machines.
- To understand the heating cooling system design of electrical apparatus
- To study about modeling of turbo generator and micro turbine generator.

MODULE I INTRODUCTION AND MAGNETIC CIRCUITS 8

Major design considerations – Classification of Electrical Engineering materials – Calculation of total MMF – carter's co – efficient and gap contraction factor – Real and apparent flux density – problems – magnetic leakage calculation for parallel sided slot, tapered slot and circular slot.

MODULE II MAIN DIMENSIONS OF DC MACHINE 8

Introduction – Output equation – main dimensions – Design of armature – magnetic circuit calculations.

MODULE III FIELD AND COMMUTATOR DESIGN 6

Design of field, interpoles, commutator & brushes and efficiency

MODULE IV TRANSFORMERS 7

Introduction: Discussions on Power and distributed type transformer, Core, winding, tank, tapping, oil, relay– construction and design of single phase and three phase transformers – resistance and reactance from design data – cooling tank design

MODULE V INDUCTION MOTORS 8

Introduction – Output equation – main dimensions – Design of slots – bar current – end ring current - resistance and reactance from design data – wound rotor design.

MODULE VI TURBO GENERATOR 8

Turbo generator: Types, dynamic design of large turbo generator. Micro turbine generator: Power generation – finite element model. Designing the cooling systems

for the world's most powerful turbo generator.

Total Hours – 45

REFERENCES:

1. Sawhney, A.K., 'A Course in Electrical Machine Design', Dhanpat Rai & Sons, New Delhi, 1987.
2. M.G.Say, 'The Performance and Design of Alternating Current Machines',CBS 3rd EDITION,2005.
3. A.E.Clayton and N.N.Hancock, 'Performance and design of Direct current machines' CBS 1st edition July 2004.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieveskills on the following:

- To design an electrical machine considering dynamic and thermal quantities.
- Can be able to troubleshoot and rectify the design bugs in any types of electrical apparatus
- Able to transform application demands to simple design specification
- Can be able to justify the given magnetic equivalent circuit design
- Ability to design an efficient transformer
- To design and model a turbo generator

EEC4103 **PLC & DCS** **L T P C**

3 1 0 4

OBJECTIVES:

- To provide fundamental knowledge about the PLC networks.
- To give an introductory knowledge about PLC and the programming languages.
- To give adequate knowledge about the applications of PLC and DCS
- To give basic knowledge in the architecture of DCS
- To know how to design a automated system in a process industry
- To give adequate knowledge about programming and controlling with PLC and DCS

MODULE I PLC **8**

Evolution of PLCs – controller and hardware — PLC Architecture – PLC sizes and its application –PLC Vs. Computer– International Electrotechnical Commission (IEC) programming languages – Programming of PLC — relay logic – Ladder logic – Fundamentals of logic circuits – Programming: Timers and Counters.

MODULE II COMMUNICATION IN PLCS

Program control instructions - Data manipulation Instructions - Arithmetic instructions - Sequencer instructions. Requirement of communication networks for PLC – computer networks – PLC applications in Industrial Automation.

MODULE III DISTRIBUTED CONTROL SYSTEMS

Evolution - Different architectures - Local control unit - Operator interface - Display's - Engineering interface. Case study - DCS - Study of two popular DCS available in market - Factors to be considered in selecting DCS – Operator and Engineering Interface.

MODULE IV HART AND FIELD BUS

Introduction - Evolution of signal standard - HART Communication protocol - Communication modes - HART networks - HART commands - HART field controller implementation - HART and OSI model - Field bus – Introduction profibus, Mod bus - Foundation field bus - General field bus architecture - basic requirements of field bus standard - Field bus topology -Interoperability CAN & LIN bus.

MODULE V PLC PROGRAMMING

Logic gates – Boolean Conversions – Combination logic circuits – Decoder – Encoder – Flip flop – Annunciator – Math Instructions – Jump Instructions.

MODULE VI PROCESS CONTROL SYSTEM

Design of Level control system, Temperature control system, Controlling of pumps in sequence, Conveyor control, density based traffic control system. Batch process: Heating, mixing, and filling. Programming using Functional Block Diagram in Delta – V.

L – 45; T – 15; Total Hours –60

REFERENCES:

1. G.K.Mc-Millan, "Process / Industrial Instrument and controls and handbook", McGraw Hill, New York, 1999.
2. Frank D Petrezeulla, "Programmable Controllers", 4th edition,Mc-Graw Hill, 2010
3. Hughes T, "Programmable Logic Controllers", ISA Press, 1989.
4. Michael P.Lucas, "Distributed Control System", Van Nastrand Reinhold Company, New York, 1986.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- To design all types of logic gates and sequences using PLC
- Able to design and execute ladder logic program for any industrial system
- Will be able to interface any type of PLC to achieve the required operation
- Be able to write the sequence of operation for any industrial/process control plant
- Be able to communicated with DCS
- Design a DCS based system for any plant

PROGRAMME ELECTIVES

POWER SYSTEM

		L	T	P	C
EECX01	**POWER DISTRIBUTION SYSTEM**	**3**	**0**	**0**	**3**

OBJECTIVES:

To impart knowledge on

- The importance of the design of distribution systems.
- Various components of the distribution systems.
- The methods of analysis of distribution systems.
- Protection of the distribution systems.
- Concepts of demand side management.

MODULE I INTRODUCTION TO DISTRIBUTION SYSTEMS 7

General - Introduction to distribution system, an overview of the role of computers in distribution system planning. Load modeling and characteristics: Definition of basic terms like demand factor, utilization factor, load factor, plant factor, diversity factor, coincidence factor, contribution factor and loss factor - Relationship between the load factor and loss factor - Classification of loads (Residential, Commercial, Agricultural and Industrial) and their characteristics

MODULE II DISTRIBUTION FEEDERS 7

Design consideration of Distribution feeders - voltage levels – different types of feeder loading.

MODULE III SUBSTATIONS AND GROUNDING SYSTEM 9

Types of substations - Design considerations of the secondary distribution system - Bus-bar arrangements - Substation bus schemes - Location of substations - Rating of a distribution substation - Service area with primary feeder - Resistance of grounding systems - Grounding grids - Design principles of substation grounding system.

MODULE IV DISTRIBUTION SYSTEM ANALYSIS 8

Voltage drop and power loss calculations - Derivation for volt-drop and power loss in lines – dc distribution – ac distribution –three phase balanced primary lines- Non-three-phase primary lines.

MODULE V PROTECTIVE DEVICES AND COORDINATION 8

Objectives of distribution system protection - Types of common faults and procedure for fault calculation. Protective devices - Principle of operation of

fuses, circuit reclosers, line sectionalizer and circuit breakers. Coordination of protective devices - General coordination procedure

MODULE VI CONCEPTS AND METHODS OF DSM, LOAD CONTROL 6

Load control - Energy efficiency - Load management - DSM planning, design, marketing, impact assessment - Direct, distributed and local control – Assessment of impact on load shape.

TOTAL HOURS ; 45

REFERENCES:

1. Turan Gonen, “Electric Power Distribution System Engineering”, Mc.Graw-Hill Book Company, 1986.
2. A.S.Pabla, “Electric Power Distribution”, Tata Mc Graw-Hill Publishing Company, 5th Edition, 2003.
3. V.Kamaraju, “Electrical Power Distribution Systems”, Tata Mc Graw Hill publication, 2009.
4. S.N. Singh, “Electric Power Generation, Transmission and Distribution”, Prentice Hall of India Pvt. Ltd, New Delhi, 2002.
5. Luces M.Fualkenberry, Walter Coffer, “Electrical Power Distribution and Transmission”, Pearson Education, 1996.
6. Hadi Saadat, “Power System Analysis”, Tata McGraw Hill Publishing Company, 2003
7. Gellings, C.W. and Chamberlin, J. H., “Demand-Side Management: Concepts & Methods”, Firmont Press, 1993.
8. Gellings, C.W. and Chamberlin, J. H., ‘Demand-Side Management Planning’, Firmont Press, 1993.
9. B.R.Gupta, ‘Power System Analysis and Design’, S.Chand, New Delhi, 2003.

OUTCOMES:

At the end of the course, the student will

- be attaining skills on various components of the distribution systems.
- be able to design distribution feeders
- have ability to implement grounding system in substations.
- have ability to perform analysis of voltage drop and power loss on feeders
- be able to carry out fault analysis and Co-ordination of protective devices in distribution systems.
- be able to do demand side management.

EECX02	POWER SYSTEM PLANNING AND RELIABILITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

To impart knowledge on:

- Load forecasting in power systems.
- Basic probability theory and concepts of reliability analysis.
- Factors influencing the reliability of generation systems, transmission systems and distribution systems.
- Expansion planning.

MODULE I LOAD FORECASTING 8

Objectives of forecasting - Load growth patterns and their importance in planning - Load forecasting based on discounted multiple regression technique – Procedure for Weather sensitive load forecasting - Determination of annual forecasting.

MODULE II INTRODUCTION TO RELIABILITY ANALYSIS 7

Review of probability distribution, binomial distribution and exponential distribution – Network modeling and evaluation of simple systems - Series and parallel systems - reliability evaluation using probability distributions – Frequency and duration techniques — MARKOV process - Recursive technique– Bathtub curve - Meantime to failure

MODULE III GENERATION SYSTEM RELIABILITY ANALYSIS 8

Probabilistic generation and load models - Determination of reliability of isolated systems - Procedure for determination of reliability of interconnected systems.

MODULE IV TRANSMISSION SYSTEM RELIABILITY ANALYSIS 7

Deterministic contingency analysis - Probabilistic load flow - Probabilistic transmission system reliability analysis - Determination of reliability indices like LOLP and expected value of demand not served isolated system.

MODULE V EXPANSION PLANNING 7

Basic concepts on expansion planning - A perspective: brief introduction to structure of power systems, growth of power system in India, present Indian power industry, GRID formation, concept of National GRID - Procedure followed to integrate transmission system planning, current practice in India - Capacitor placement

problems in transmission systems and radial distribution systems.

MODULE VI DISTRIBUTION SYSTEM PLANNING AND RELIABILITY 8

Introduction, sub transmission lines and distribution substations - Design primary and secondary systems - Distribution system protection and coordination of protective devices. Distribution system reliability evaluation.

Total Hours –45

REFERENCES:

1. R.L .Sullivan, "Power System Planning", Heber Hill, 1987.
2. Roy Billington, “Power System Reliability Evaluation”, Gordan & Breach Scain Publishers, 1990.
3. A.S.Pabla, “Electric Power Distribution”, Tata Mc Graw-Hill Publishing Company, 5th edition, 2003.
4. Turen Gonen, “Electric Power Distribution System Engineering”, McGraw Hill, 1986.
5. Turen Gonen, “Electric Power Transmission System Engineering Analysis and Design”, McGraw Hill, 2nd Edition, 2010.
6. Eodrenyi, J., “Reliability Modelling in Electric Power System”, John Wiley, 1980.
7. B.R. Gupta, “Power Sytem Analysis and Design”, S.Chand, New Delhi, 2003.

OUTCOMES:

At the end of the course, the Students are expected to possess knowledge andachieve skills on following:

- Understand the importance of maintaining reliability of power system components
- Apply the probabilistic methods for evaluating the reliability of generation and transmission systems.
- Assess the different models of system components in reliability studies.
- Understanding some advanced concepts of power system planning.
- Familiarity with load forecasting techniques
- Expansion planning of power systems.

EECX03 POWER SYSTEM DYNAMICS L T P C

3 0 0 3

OBJECTIVES:

- To impart knowledge on dynamic modelling of a synchronous machine in detail.
- To describe the modelling of excitation and speed governing system in detail.
- To understand the fundamental concepts of stability of dynamic systems and its classification.
- To understand and enhance small signal stability problem of power systems.

MODULE I INTRODUCTION 8

Concepts and importance of stability in power system operation and design-Basic concepts and definition-Classification of power system stability-complexity of stability problem in large system-Need for reduced models-stability of interconnected systems.

MODULE II SYNCHRONOUS MACHINE MODELLING 8

Physical description-Park's transformation :flux linkage equations ,voltage equation and torque equation-per unit conversion-normalizing the equation-equivalent circuit-flux linkage state space model with transient and sub transient inductances and time constants- Simplified models(one axis and constant flux linkage), steady state equations and pharsor equation.

MODULE III MODELLING OF EXCITATION AND SPEED GOVERNINGSYSTEMS 8

Excitation system requirements-Elements of Excitation system-Types of Excitation system-Typical excitation system configuration-block diagram and state space representation of IEEE type 1 excitation system-saturation function-stabilizing circuit. Function of speed governing systems-block diagram and state space representation of IEEE steam turbine and hydraulic governor.

MODULE IV TRANSIENT STABILITY 8

State equation for multimachine –transient stability simulation of multimachine power system with one axis machine model including excitation system and speed governing system using R-K method of fourth order (Gill's Technique), Power system stabilizer.

MODULE V SMALL SIGNAL STABILITY 8

System response to small disturbance –Linear model of the synchronous machine

and load -modes of oscillation-effect of excitation on dynamic stability-approximation system representation-supplementary stabilizing signals-small signal performance measures.

MODULE VI ENHANCEMENT OF SMALL SIGNAL STABILITY ANDTRANSIENT STABILITY **5**

Methods of enhancing transient stability –methods based on reduction of disturbance severity-methods by increasing synchronizing forces-methods of enhancing small signal stability-Power system stabilizers-delta-omega stabilizer.

Total Hours –45

REFERENCES:

1. P.Kundur, “Power System Stability and Control”, Mc Graw-Hill ,1993.
2. P.M.Anderson and A.A Fouad, “Power System Control and stability”, Lowa State university Press, Ames, lowa,1978.
3. R.Ramanujam, “Power system dynamics, Analysis and simulation”, Prentice Hall India Learning Pvt.Ltd., New Delhi, 2009.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Understanding of detailed modeling of the electrical and mechanical parts of a three phase synchronous machine, excitation system and turbine.
- Mathematically model the basic controllers, excitation and turbine governing systems for dynamics studies.
- Perform simple power system stability study on a small multi-machine power system model using commercial software AU POWER LAB, ETAP, CYME. Report and critically assess the results of the study.
- Analyze the methodology for small-signal stability and transient stability without controller.
- Assess power system stability for small disturbances and transient disturbances.
- Understand the enhancement of power system stability for both small signal and large signal.

EECX04 **POWER SYSTEM TRANSIENTS** **L T P C**

3 0 0 3

OBJECTIVES:

- To identify and analyze the cause of surges and their propagation and their effect on power system components.
- To understand & distinguish between power frequency and surge voltages and currents and accordingly model the power system components.

MODULE I **8**

Types of power system transients – modeling of lines for surges and power frequency over voltages – effect of transients & power system components – importance of study of transients in planning.

MODULE II **8**

Lightning phenomenon: charge formation in clouds, rate of charging of thunder clouds, mechanism of lightning strokes, characteristic of lightning strokes - protection against lightning over voltage by shielding and non shielding methods.

MODULE III **8**

Circuit closing transients in RL and RLC circuits with sinusoidal excitation to simulate faults – circuit breaker restriking and recovery voltage – double frequency transients.

MODULE IV **8**

Generation of system over voltages - current chopping – reclosing circuit breaker and compound transients – control of switching over voltages.

MODULE V **8**

Wave equations and its solution- travelling voltage and current waves: velocity, attenuation and distortion-reflection,refraction of travelling waves – behaviour at line termination multiple reflections – Lattice diagram.

MODULE VI **5**

Over voltage in integrated power system and its simulation and analysis using EMTP.

Total Hours –45

REFERENCES:

1. Allan Greenwood, “Electrical Transients in Power Systems”, Wiley Interscience, NewYork, 2nd edition,1991.

2. R.D. Begamudre, “Extra High Voltage AC Transmission Engineering”, Wiley Eastern Limited,1986.
3. Pritidra Choudary, “Electromagnetic Transients in Power System”, John Wiley and sons Inc,1996.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and skills on the following:

1. Identify the occurrence of transient disturbance in the power system
2. Analyse the lightning stroke current
3. Calculate the stress on the insulator strings
4. Design the protective schemes against transient disturbance
5. Calculate the multiple reflections in power system due to travelling waves
6. Analyse the power system using EMTP software

EECX05 SMART POWER GRID

L	T	P	C
3	0	0	3

OBJECTIVES:

- Introduce the fundamentals of smart grids.
- Introduce modeling of devices associated with smart grids.
- Introduce the different automation and networking standards.
- Introduce the concept of Wide area measuring systems and Phasor measurement units.(PMU)

MODULE I SMART GRID FUNDAMENTALS 9

Smart grid structure – Interactive grid – Micro grid – Distributed Resources modeling – communication infrastructure – sensing and Control devices – smart grid characteristics.

MODULE II COMPONENTS AND STANDARDS 9

Smart grid components – Metering – Virtual power plants-Benefits and cost elements – Pricing regulations – Networking Standards and integration – Analytics.

MODULE III AUTOMATION TECHNOLOGIES 9

Control centre systems – Data management principles – Smart Grid implementation standards and procedure – Advanced Metering Infrastructure – Outage management – Distribution and Substation automation .

MODULE IV WIDE AREA MEASUREMENT SYSTEMS AND PMU 6

Wide area measurement systems –Phasor Measurement Units-Optimal placement algorithm for PMUs. Smart grid experimentation plan for load forecasting.

MODULE V CASE STUDY I 6

Smart meters – Cloud computing and security issues -Forecasting – Coordination between cloud computing andSmart power grids – Development of power system modelsand control and communication software.

MODULE VI RECENT TRENDS IN SMART POWER GRIDS 6

Demand Response – concepts and models.Real time pricingmodels for practical applications-SCADA in smart grids.

Total Hours –45

REFERENCES:

1. Ali Keyhani :" Design of Smart Power Grid Renewable Energy Systems ", First Edition , John Wiley Inc., 2011
2. Tony Flick and Justin Morehouse : "Securing the Smart Grid –Next generation Power Grid security ", Elsevier Publications,2011.
3. Krzysztof Iniewski:Smart Grid Infrastructure and Networking , 1st Edition , 2012.
4. Stephen F Bush :Smart Grid Communication – Enabled Intelligencefor Electric Power Grid, Wiley IEEE .,2014
5. James Momoh : Smart Grids , Fundamentals of Design andAnalysis .,2014.
6. Mini . S. Thomas :Power System SCADA and Smart Grids.
7. Kenneth . C.Budka , Jayant G.Deshpande :Communication Networks for Smart Grids:Making Smart Grid Real , 2014

OUTCOMES:

At the end of the course the student is expected to

- design and implement smart Power Grid Power Systems
- apply the concept of demand response in Smart grids.
- apply smart grid concepts to real time applications.
- implement optimal location strategies of PMU in smart grids.
- coordinate the use of cloud computing application for smart grids.
- apply the concept of SCADA in smart grids.

EECX06 WIND ENERGY CONVERSION SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the demand for electrical power generation from the renewable wind energy and fundamentals of wind power.
- To study and understand about the wind turbine components, power generation machinery, control systems.

MODULE I INTRODUCTION **8**

Historical development and current status of Wind power-Generators and power electronics for wind turbines - Impacts of wind power-Wind speed estimation-Wind speed measurements-Rayleigh distribution-Maximum Power obtainable-Bertz limit-Power coefficient –Aerodynamics of wind rotor-Blade element theory-Aerodynamic efficiency-Wind energy conversion system components.

MODULE II WIND TURBINE **8**

Types of Wind Turbine-Rotor design considerations-Tip speed ratio-Blade profile-Power regulation-Yaw control –Pitch angle control-Stall control-Schemes for maximum power extraction.

MODULE III FIXED SPEED AND VARIABLE SPEED SYSTEMS **8**

Fixed speed and variable speed wind turbine- Need of variable speed systems-Power-wind speed characteristics-Generation schemes with fixed and variable speed turbines-Comparison of different schemes.

MODULE IV MODELING AND SIMULATION OF FIXED SPEED ANDVARIABLE SPEED WIND GENERATORS **8**

Modeling of fixed speed Induction generator - axes transformation - flux linkage equations - voltage equations-state equations-modeling of variable speed DFIG for wind energy conversion systems-converter control system- transient stability simulation of fixed speed induction generator using EUROSTAG - Doubly Fed Induction Generator(DFIG) modeling - controller modelling - Modelling of DFIG in EUROSTAG - Transient stability simulation of power systems with induction generators using EUROSTAG.

MODULE V POWER ELECTRONICS IN WIND ENERGY CONVERSIONSYSTEM **8**

Induction generator-Controlled firing angle scheme with AC and DC side Capacitor-

Scalar method-flux vector scheme-Control scheme for synchronous generator with variable speed drive-Variable speed synchronous generator control with boost converter.

MODULE VI GRID CONNECTED SYSTEMS 5

Stand alone and grid connected WECS system-Grid connection Issues-Impacts of wind power on power system stability-wind plant reactive power capability and its requirements-voltage control and active power control - Storage technologies.

Total Hours –45

REFERENCES:

1. S.N.Bhadra,D.Kasthra,S.Banerjee, “Wind Electrical Systems,”Oxford Higher Eduction, 2005.
2. Thomas Ackermann,”Wind Power in Power system, ”Wiley 2012.
3. L.L.Freris "Wind Energy conversion Systems", Prentice Hall, 1990.
4. Jian Zhang, Adam Dysko, John O'Reilly, William E. Leithead," Modeling and performance of fixed-speed induction generators in power system oscillation stability studies", Electric Power System Research Vol. 78 (2008) 1416-1424.
5. Andre´s Feijoo, Jose Cidras, Camilo Carrillo, "A third order model for the doubly-fed induction machine", Electric Power Systems Research 56 (2000) 121-127.
6. Eurostag 4.3 Theory Manual Part I.
7. Ion Boldea, "Variable speed generators", Taylor & Francis group, 2006.
8. E.W.Golding "The generation of Electricity by wind power", Redwood burn Ltd., Trowbridge, 1976. S.Heir "Grid Integration of WECS", Wiley 1998

OUTCOMES:

At the end of the course, the student will be able to:

- recognize the need of renewable energy technologies and their role in the world energy demand.
- identify and mathematically model the wind turbine components, calculate the available wind power, predict mechanical loads based on design, and discuss the generation of electrical power.
- to numerically simulate the wind turbine dynamic system behavior with integration of components, sensors, and control for given real time application.
- mathematically model and simulate the transient and steady state performance of the stand-alone and grid connected wind generators using EUROSTAG, MATLAB, CYME packages.

- analyze the wind power integration issues and their mitigation techniques.
- identify the present and the future energy storage technologies used for standalone operation and grid connected operation .

EECX07 FLEXIBLE AC TRANSMISSION SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the need for reactive power compensation in AC transmission system.
- To become familiar with modeling and operation of thyristor and voltage source inverter based FACTS controllers.
- To study the effect of FACTS controllers on AC transmission system.

MODULE I REACTIVE POWER CONTROL IN TRANSMISSIONSYSTEM **8**

Reactive power - uncompensated transmission lines - load compensation - system compensation - lossless distributed parameter lines -symmetrical lines - midpoint conditions of a symmetrical line case study - passive compensation - shunt compensation -series compensation effect on power-transfer capacity.

MODULE II CONVENTIONAL FACTS DEVICES **8**

Types, definitions and representation of various FACTS controllers - synchronous Condensers - saturated Reactor (SR) - thyristor-controlled reactor (TCR) - operating characteristics of a TCR- fixed Capacitor–thyristor-controlled reactor (FC–TCR)- thyristor-switched capacitor (TSC)- thyristor-switched capacitor–thyristor-controlled reactor (TSC–TCR).

MODULE III STATIC VAR COMPENSATOR **8**

Voltage Control - V-I characteristics of the SVC - dynamic Characteristics-steady-State characteristic advantages of the slope in the SVC dynamic characteristic influence of the SVC on system voltage.

MODULE IV THYRISTOR-CONTROLLED SERIES CAPACITOR (TCSC) **8**

Fixed-series compensation - need for variable series compensation-advantages of the TCSC - TCSC controller- operation of the TCSC - modes of TCSC operation - capability characteristics - single-module TCSC- multi - module TCSC - variable-reactance model of TCSC.

MODULE V EMERGING FACTS CONTROLLERS **8**

STATCOM : principle of operation - V-I characteristic - SSSC : principle ofoperation -

UPFC : principle of operation.

MODULE VI APPLICATIONS OF FACTS DEVICES 5

Increase in steady-state power-transfer capacity - enhancement of transient stability. - TCSC applications - applications of STATCOM , SSSC and UPFC.

Total Hours –45

REFERENCES:

1. Mohan Mathur.R., Rajiv. K.Varma, “Thyristor – Based Facts Controllers for Electrical Transmission Systems”, IEEE press and John Wiley & Sons, Inc 2000.
2. Narain G. Hingorani, “Understanding FACTS -Concepts and Technology of Flexible AC Transmission Systems”, Standard Publishers Distributors, Delhi, 2001.
3. A.T.John, “Flexible A.C. Transmission Systems”, Institution of Electrical and Electronic Engineers (IEEE), 1999.

OUTCOMES:

At the end of the course, the student is expected to

- Compute power transmission capability of a transmission system and apply reactive compensation methods for its improvement
- Comprehend the operating principles, control systems and modeling of different conventional FACTS devices
- Understand the influence of measurement systems and the performance of shunt compensators
- Understand the performance of series compensating devices.
- Analyse and utilize the emerging FACTS devices in the utility networks.
- Apply the techniques of FACTS controller design for enhancing power transfer, increasing stability, augmenting system damping, mitigating sub-synchronous resonances, preventing voltage instability, performing load compensation, etc.

EEBX08	INDUSTRIAL POWER SYSTEM ANALYSIS AND DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide practical knowledge in the field of power system analysis and design for industrial applications.
- To introduce the fundamentals of smart grid and associated Information Technology services.
- To derive expressions for the computation of transmission line parameters.
- To understand the problems associated with circuit interruption by a circuit breaker.

MODULE I ELECTRICAL POWER SYSTEM BACKGROUND 7

Overview of power systems generation, transmission and distribution- utilityscale systems versus industrial power systems; utility restructuring and deregulation- smart grid.

MODULE II POWER SYSTEM STUDIES 9

Load flow – short circuits – protective coordination – arc flash hazard calculation – harmonic analysis – power system stability – simple calculation.

MODULE III TRANSMISSION LINE MODELING AND TRANSFORMER 8

Line configurations and physical parameters- lumped circuit equivalent models- applications- Transformer – types – transformer for non linear loads – instrument transformers.

MODULE IV FAULTS AND SYSTEM PROTECTION 7

Symmetrical components- symmetrical and unsymmetrical faults- protection devices.

MODULE V SWITCHGEAR CIRCUIT BREAKER- MOTOR CONTROL CENTRE 7

Switchgear: low voltage medium voltage – load interrupt switchgear – power fuse – medium and high voltage circuit breaker – SF6 gas insulated switchgear – low and medium voltage motor control centre.

MODULE VI APPLICATION & PROTECTION OF MEDIUM VOLTAGE MOTORS 7

Introduction overview – load characteristics – squirrel cage induction motor –wound

rotor induction motor – synchronous motor – electric motor for variable frequency drives – motor controllers and starting methods.

TOTAL HOURS: 45

REFERENCES:

1. J Duncan Glover, “Power system analysis and design”, 4th edition, Thompson, USA.
2. Arnold, C.P., Arrillaga, J. &Harker, B. J., “Computer Modelling of Electrical Power Systems”, John Wiley & Sons, 1983.
3. Davies, T., “Protection of Industrial Power Systems”, 2nd edition, 1998.
4 Shoaib khan, “Industrial Power Systems”, CRC publication, 1997.
5. Elgerd, O. I., “Electric Energy Systems Theory”, 2nd edition, McGraw-Hill, 1983.
6. Kusic, G., “Computer-Aided Power Systems Analysis”, 2nd edition, CRC, 2008.
7. John J. Grainger and William D. Stevenson, Jr., “Power system analysis”, McGraw-Hill, Inc,, 2000.
8. T. K. Nagsarkar and M.S.Sukhija, “Power system analysis”, Oxford University press.
9. PrabhaKundur, “Power system stability and control”, McGraw-Hill, Inc, 1999.

OUTCOMES:

At the end of the course, the student is expected to

- understand the operation of deregulated power system and smart grids
- perform power flow studies
- determine voltage regulation and efficiency for short, mediumand long lines.
- perform fault calculations.
- design circuit breaker ratings
- select an induction motor and synchronous motor for a particular industrial application

EECX09	ELECTRIC ENERGY GENERATION, UTILIZATION AND CONSERVATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

To impart knowledge on

- Generation of electrical power by conventional and non-conventional methods.
- Electrical energy conservation, energy auditing and power quality.
- Principle and design of illumination systems and methods of heating and welding.
- Electric traction systems and their performance.
- Industrial applications of electric drives.

MODULE I CONVENTIONAL METHODS OF POWER GENERATION 6

Thermal, hydro and nuclear based power generation- Selection of site for power plants- schematic arrangement- merits and demerits of power plants.

MODULE II NON-CONVENTIONAL METHODS OF POWERGENERATION 6

Fuel cells-tidal waves-wind- geothermal -solar- bio mass - municipal waste. Co generation. Effect of distributed generation on power system operation.

MODULE III ECONOMIC ASPECTS OF GENERATION 8

Economic aspects of power generation - load and load duration curves - number and size of units - cost of electrical energy - tariff. Economics of power factor improvement - power capacitors - power quality. Importance of electrical energy conservation - methods - energy efficient equipments. Introduction to energy auditing.

MODULE IV ILLUMINATION 8

Importance of lighting - properties of good lighting scheme - laws of illumination - photometry - types of lamps - lighting calculations - basic design of illumination schemes for residential, commercial, street lighting, and sports ground - energy efficiency lamps.

MODULE V HEATING AND WELDING 8

Introduction - advantages of electric heating - modes of heat transfer - methods of electric heating -resistance heating - arc furnaces - induction heating - dielectric heating - electric welding - types -resistance welding - arc welding - power supply for arc welding - radiation welding.

MODULE VI ELECTRIC DRIVES AND TRACTION 9

Fundamentals of electric drive - choice of an electric motor - application of motors for particular services - traction motors - characteristic features of traction motor - systems of railway electrification -electric braking - train movement and energy consumption - traction motor control .

Total Hours –45

TEXT BOOKS:

1. Wadhwa, C.L. "Generation, Distribution and Utilization of Electrical Energy", New Age International Pvt. Ltd, 2003.
2. Gupta B.R., "Generation of Electrical Energy", Eurasia Publishing House (P) Ltd, New Delhi, 2003.

REFERENCES:

1. Partab.H, "Art and Science of Utilisation of Electrical Energy", Dhanpat Rai and Co, New Delhi, 2004.
2. Openshaw Taylor.E, "Utilization of Electrical Energy in SI Units", Orient Longman Pvt. Ltd, 2003.
3. Gupta.J.B, "Utilization of Electric Power and Electric Traction", S.K.Kataria and Sons, 2002
4. R.K.Rajput, Utilisation of Electric Power, Laxmi publications Private Limited.,2007

OUTCOMES:

At the end of the course the student will be able to

- understand the concepts conventional power generation systems
- implement small renewable based power generation systems
- find the number and size of units from load curve, compute tariff and power factor correction for practical system and carry out energy management and auditing.
- compute illumination and suggest lighting scheme for various application.
- understand practical implications of electric heating and welding
- select suitable motor for different applications including traction system.

EECX10 RESTRUCTURED POWER SYSTEMS L T P C
3 0 0 3

OBJECTIVES:

To provide the student a background on restructuring of power system which has taken place in many countries in the world including our country

- To provide insight on new trends in operation and control in deregulated power systems
- To highlight electric energy trading in the electricity market.
- To compare and calculate various pricing strategies in restructured environment.

MODULE I INTRODUCTION TO RESTRUCTURING 7

Restructuring Models: PoolCo Model, Bilateral Contracts Model, Hybrid Model-Independent System Operator (ISO): The Role of ISO - Power Exchange(PX):Market Clearing Price (MCP) - Market operations: Day-ahead and Hour-Ahead Markets, Elastic and Inelastic Markets - Market Power.

MODULE II KEY ISSUES IN RESTRUCTURING 8

Transmission Pricing: Contract Path Method, The MW-Mile Method -Congestion Pricing: Congestion Pricing Methods, Management of Inter-Zonal/Intra Zonal Congestion: Solution procedure.

MODULE III ELECTRIC UTILITY MARKETS IN THE UNITED STATES 7

California Markets- New York Market: Market operations - PJM interconnection - Ercot ISO - New England ISO .

MODULE IV OASIS: OPEN ACCESS SAME-TIME INFORMATION SYSTEM 8

Structure of OASIS: Functionality and Architecture of OASIS-Transfer Capability on OASIS: Definitions, Transfer Capability Issues, ATC Calculation, TTC Calculation, TRM Calculation, CBM Calculation - Transmission Services - Methodologies to Calculate ATC.

MODULE V ELECTRIC ENERGY TRADING 7

Essence of Electric Energy Trading - Energy Trading Framework: The Qualifying factors - Derivative Instruments of Energy Trading: Forward Contracts, Futures Contracts, Options, Swaps, Applications of Derivatives in Electric Energy Trading .

MODULE VI SPECIAL COMPUTATIONAL TECHNIQUES 8

Formulation of D.C. Optimal Power Flow (DCOPF) model for assessment of Available Transfer Capability (ATC), assessment of Simultaneous ATC (SATC) and Congestion Management.

Total Hours –45

REFERENCES:

1.Mohammad Shahidehpour and Muwaffaq Almoush, “Restructured Electrical Power systems: Operation, Trading and Volatility”, Marcel Dekkar, Inc., 2001.

2 G.Zaccour, “Deregulation of Electric Utilities”, Kluwer Academic Publishers,1998.

3 M.Ilic, F. Galiana and L.Fink, "Power Systems Restructuring : Engineering and Economics", Kluwer Academic Publishers, 2000.

4 Editor: Loi Lei Lai, "Power System Restructuring and Deregulation: Trading, Performance and Information Technology", John Wiley and sons Ltd, 2001

5.K.Bhattacharya, M.H.J.Bollen and J.E.Daader, "Operation of Restructured Power Systems", Kluwer Academic Publishers, 2001.

6 J.H.Chow,F.F.Wu and J.A.Momoh, "Applied Mathematics for restructured electric power systems: Optimization, Control and Computation Intelligence", Springer 2004.

7 F.C.Schweppe, M.C.Caramanis, R.D.Tabors and R.E.Bohn, "Spot Pricing of Electricity", Kluwer Academic Publishers, 2002.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- understand the various process of restructuring.
- perform the various steps of electricity trading operation such as market clearing and settlement for an exchange.
- Explain the operation of different electricity markets in United States.
- Compute transmission pricing and perform congestion Use and interpret the real time information available in an OASIS.
- Perform the various steps of trading such as forecasting of energy requirement and billing of supply offers / demand bids for GENCOS / DISCOS
- Compute the ATC and perform congestion management in restructured power systems.

EECX11	SOLAR ENERGY TECHNOLOGY	L	T	P	C
		1	0	0	1

OBJECTIVES:

The primary objectives of the course is to deliver knowledge at fundamental and advanced levels in the following topics:

- Solar energy technologies and their design principles
- Sources of energy consumption in buildings.
- Solar thermal and photovoltaic (PV) technologies for application in buildings.

MODULE **15**

- Solar Energy – Need, types- Physics of Solar Energy Energy Policies
- Solar PV Technologies- olar Cells & types - Balance of System
- Design of PV System - Types of PV System - Design of Off-Grid PV System - Design of On-Grid PV System
- Solar Power Plant - Grid Tie Plants - Off grid Plants - Hybrid Plants - Maintenance of plant

Total Hours : 15

OUTCOMES:

After studying this course, the student should be able to:

- explain the principles that underlie the ability of various natural phenomena to deliver solar energy.
- outline the technologies that are used to harness the power of solar energy

EECX12 MICRO-GRID PROTECTION L T P C

3 0 0 3

OBJECTIVES:

To familiarize the students with

- The concepts of microgrid, its types, modes of operation and importance.
- Control aspects of microgrid
- Various microgrid pilots and microgrid components

MODULE I INTRODUCTION 8

Microgrid basic concepts – architecture - operational conditions, Microgrid : merits and demerits - functionalities and variables in microgrid - issues in microgrid. Types of microgrid (LV microgrid, MV microgrid - DC microgrid, AC microgrid, hybrid) - Microgrid as part of smarter grid.

MODULE II DISTRIBUTED ENERGY RESOURCES AND STORAGE DEVICES 8

Distributed Energy Resources: solar – wind – CHP – MCHP – Microturbine - Diesel generators –geo thermal. Storage devices-Batteries - fuel cells - super capacitors.

MODULE III MICRO-GRID PROTECTION AND CONTROL 8

Requirements of protection - issues in protection (LOM, Blinding of protection, unwanted islanding, lack of selectivity) - challenges in protection scheme -design of digital relays : under/over voltage relay- over current relay- differential relay – directional over current relay.

Modes of operation : grid connected mode - islanded mode - transition between grid connected mode and islanded mode.primary control strategy - secondary control strategy- Control of distribution generation - demand side management - Opportunities and risk of different market players.

MODULE IV CONTROLLERS FOR MICROGRID 7

Three phase converter - Three phase Voltage source Inverter (VSI) – Boost Converter – PWM Techniques - P-Q Control -Structure of the VSI PQ Controller - Power Voltage (PV) Control Scheme - Frequency (V/f) Control Scheme -generation Control Based on Droop Concept - adaptive droop control, Phase locked loop for synchronisation.

MODULE V COMMUNICATION FOR MICROGRIDS 7

Communication lines in power system : PLC - Microwave – fiber optic links - PMU basic concepts- International Electrotechnical Commission (IEC) 61850, 61850-7-

420, 61850-8. Renewable Microgrid controller RMC 600. Review / Comparison on simulation packages used for Microgrid Protection

MODULE VI MICROGRID COMPONENTS 7

Microgrid pilots : KERI – CERTS - Intelligent Electronic Devices (IED) - Microgrid Management system (MMS) - Static Transfer switch (STS) - RTU/ gateway - Smart metering –Sensing Devices.

Total Hours –45

REFERENCES:

1. Jukka Ihamäki, “Integration of microgrids into electricity distribution networks” Master’s Thesis in Lappeenranta University of Technology, 2012, pages-105
2. Amirhossein Hajimiragha, “Generation Control in Small Isolated Power Systems” ,Master of Science Thesis -Royal Institute of Technology, Department of Electrical EngineeringStockholm 2005.
3. Juan Carlos V´asquez Quintero, “Decentralized Control Techniques Applied to Electric Power Distributed Generation in Microgrids dissertation submitted for the degree of European Doctor of Philosophy, June 10, 2009.
4. Stanley H.Horowitz and Arun G. Phadke, “ Power System Relaying third edition, John Wiley & sons
5. Renewable Microgrid controller RMC 600 – ABB Brochure
6. Taha Selim Ustun, Cagil Ozansoy and Aladin Zayegh, “ Fault current coefficient and time delay assignment for microgrid protection system with central protection unit” IEEE Transaction (accepted for publication in future issue of the journal-DOI-10.1109/TPWRS.2012.2214489
7. Taha Selim Ustun, Cagil Ozansoy and Aladin Zayegh, “ Modelling of a centralized Microgrid Protection system and Distributed Energy Resources according to IEC 61850-7-420” IEEE Transaction on power systems, vol 27, No.3, pp 1560-1567, 2012.
8. M. Amin Zamani, Amirnaser Yazdani, and Tarlochan S. , “A Communication-Assisted Protection Strategy for Inverter-Based Medium-Voltage Microgrids”, IEEE Transactions on Smart Grid, Vol. 3, No. 4,pp.2088-2099, 2012
9. Eric Sorotomme, S.S. Venkata, Joydeep Mitra, “ Microgrid protection using communication assisted digital relays” IEEE transaction on power delivery, vol.25, No.4, pp.2789-2796, 2010

OUTCOMES:

The students will be able to

- Know the significance of microgrid and its types.
- Know various control strategies of microgrid.
- Realize various issues involved in microgrid protection.
- Incorporate communication techniques and standards for microgrid protection.
- Have an idea of various microgrid components

EECX13 ELECTRIC VEHICLE TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the concept of Electric Vehicles.
- To familiarize the basic energy transfer processes that govern existing and proposed methods of power generation for Electric Vehicles.
- To familiarize with the traditional and non-traditional sources for Electric Vehicles in terms of energy content, accessibility, required processing steps and projected remaining reserves

MODULE I INTRODUCTION 8

A Brief History - Types of Electric Vehicle in Use Today : Battery electric vehicles - The IC engine/electric hybrid vehicle - Fuelled electric vehicles - Electric vehicles using supply lines - Solar powered vehicles - Electric vehicles which use flywheels or super capacitors.

MODULE II BATTERIES 7

Battery Parameters - Lead Acid Batteries - Nickel-based Batteries - Sodium-based Batteries - Lithium Batteries - Metal Air Batteries - Battery Charging - Choice of Battery - Use of Batteries in Hybrid - Vehicles - Battery Modelling.

MODULE III FUEL CELLS 8

Hydrogen Fuel Cells - Fuel Cell Thermodynamics - Connecting Cells in Series - Water Management in the PEM Fuel Cell - Thermal Management of the PEM Fuel Cell - A Complete Fuel Cell System - Hydrogen Supply - Fuel Reforming - Hydrogen Storage.

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MODULE IV ELECTRIC VEHICLE MODELLING AND DESIGNCONSIDERATIONS 7

Tractive Effort - Modelling Vehicle Acceleration - Modelling Electric Vehicle Range - Aerodynamic Considerations - Transmission Efficiency - Electric Vehicle Chassis and Body Design - General Issues in Design.

MODULE V DESIGN OF ANCILLARY SYSTEMS 7

Heating and Cooling Systems - Design of the Controls - Power Steering - Choice of Tyres - Wing Mirrors, Aerials and Luggage Racks - Electric Vehicle Recharging and Refuelling Systems.

MODULE VI ELECTRIC VEHICLES AND THE ENVIRONMENT 8

Vehicle Pollution - The Effects - Vehicles Pollution - A Quantitative Analysis - Vehicle Pollution in Context - Alternative and Sustainable Energy Used via the Grid - Using Sustainable Energy with Fuelled Vehicles.

Total Hours –45

REFERENCES:

1. James Larminie and John Lowry, “Electric Vehicle Technology Explained”, John Wiley & Sons Ltd, 2003.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- analyze and quantify the important energy transfer for Batteries and fuel cell schemes.
- use the techniques, opportunities and challenges of advances in Electric Vehicles.
- develop a strong functional literacy in automotive power electronics.
- apply power electronic converters to control the Electric Vehicles including actuator drivers and motor drives.
- analyze the Solar powered vehicles including selection of power devices and thermal management.
- design Electric Vehicles to meet desired needs within realistic constraints such as economic, environmental, manufacturability, and sustainability.

EECX14 POWER SYSTEM SIMULATION SOFTWARE

L	T	P	C
0	0	2	1

OBJECTIVES:

To expose the students to various proprietary and open source software for simulation of power systems.

COURSE DESCRIPTION: **8**

Study of both proprietary and open source software for simulation of power systems:

PROPRIETARY SOFTWARE

- ETAP
- CYME
- PSCAD
- EUROSTAG

OPEN SOURCE SOFTWARE

- UWPFLOW
- PSAT
- InterPSS
- DCOPFJ
- OpenDSS
- MatDyn
- minpower
- Dome
- GridLAB-D
- OpenPMU

Assessment I: A presentation on the proprietary software available in the department and the latest open source software.

Assessment II: Comparative study by simulating the same problem over multiple software.

Semester End: Solving a given power system problem using any one of the software.

EECX15 WIDE AREA MEASUREMENT SYSTEMS

L	T	P	C
2	0	0	2

OBJECTIVES:

To understand the operating principle of wide area measurement systems and performance of phasor measurement units.

MODULE I MATHEMATICAL BACKGROUND 8

Phasor representation of sinusoids - Fourier series and Fourier transform and DFT Phasor representation - Phasor Estimation of Nominal Frequency Signals - Formulas for updating phasors - Nonrecursive updates - Recursive updates - Frequency Estimation

MODULE II SYNCHRO PHASOR MEASUREMENTS 10

Need of Synchro phasor Measurements, Phasor Measurement Unit : Architecture,Functions, Optimal Placement of PMUs, phasor data concentrators and associated communication system. Visualization tools to enhance visibility and control within transmission system, PMU measurements and sampling rates State Estimation & observability by using PMU, phasor data use for real time operation, frequency stability monitoring and trending, power oscillation, voltage monitoring and trending. Alarming and setting system operating limits. Dynamic line rating and congestion management, outage restoration. Application of PMU for wide area monitoring and control.

MODULE III WIDE AREA MEASUREMENT SYSTEM 6

Architecture, Components of WAMS, GUI (Graphical User Interface), Applications: Voltage Stability Assessment, Frequency stability Assessment, Power Oscillation Assessment, Communication needs of WAMS, WAMPAC (Wide Area Monitoring Protection & Control), RAS (Remedial Action Scheme). Standards: IEEE 1344, IEEE C37.118 (2005), IEEE Standard C37.111-1999 (COMTRADE), IEC61850 GOOSE

MODULE IV PERFORMANCE OF A GENERIC PMU 6

The global positioning system - Hierarchy for phasor measurement systems, - Functional requirements of PMUs - Transient Response of Phasor Measurement Units - of instrument transformers, filters, during electromagnetic transients – Transient response during power swings

Total Hours: 30

REFERENCES:

1. A.G. Phadke, J.S. Thorp, 'Synchronized Phasor Measurements and Their Applications', Springer Publications, 2008
2. Joseph Euzebe Tate "Event detection and visualization based on phasor measurement units for improved situational awareness", UMI Dissertation Publishing.
3. Fahd Hashiesh, M. M. Mansour , Hossam E. Mostafa Fahd Hashiesh , M. M. Mansour , Hossam E. Mostafa ,"Wide Area Monitoring, Protection and Control: The Gateway to Smart Grids",
4. Dr. Arun G. Phadke, Dr. James S. Thorp,."Computer Relaying for Power Systems", Wiley Publication, Second Edition.
5. Krzysztof Iniewski "SMART GRID Infrastructure & Networking", Tata McGraw Hill.

OUTCOMES:

Upon finishing the course, students are expected to,

- Model the phasor measurement system mathematically.
- Define and demonstrate the concept of Wide area measurement systems
- Use the wide area measurement systems for assessing power system oscillations and stability.
- Analyze the performance of a generic phasor measurement unit.

EECX16 ENERGY AUDITING

L	T	P	C
2	0	0	2

OBJECTIVES:

- To introduce the general concepts and methodologies of energy auditing.
- To understand the procedures and techniques involved in energy auditing
- To systematically explore the possibilities of energy saving.
- To expose the students to different instruments involved in energy auditing.

MODULE I GENERAL ASPECTS, METHODOLOGY AND APPROACH **9**

General Philosophy and need of Energy Audit and Management. Definition and Objective of Energy Management, General Principles of Energy Management - Energy Audit: Need, Types - Understanding Energy Costs, Bench marking, Energy performance, Matching energy usage to requirements, Maximizing system efficiency, Optimizing the input energy requirements, Fuel and Energy substitution.

MODULE II PROCEDURES AND TECHNIQUES **8**

Data gathering : Level of responsibilities, energy sources, control of energy and uses of energy get Facts, figures and impression about energy /fuel and system operations, Past and Present operating data, Special tests, Questionnaire for data gathering. Analytical Techniques: Incremental cost concept, mass and energy balancing techniques, inventory of Energy inputs and rejections, Heat transfer calculations, Evaluation of Electric load characteristics, process and energy system simulation.

MODULE III EVALUATION OF SAVING OPPORTUNITIES **7**

Determining the savings in Rs, Noneconomic factors, Conservation opportunities, estimating cost of implementation. Energy Audit Reporting: The plant energy study report- Importance, contents, effective organization, report writing and presentation - Identification of losses, Improvements. Energy Balance sheet

MODULE IV ENERGY AUDIT INSTRUMENTS **6**

Basic measurements – Electrical measurements, Light, Pressure, Temperature and heat flux, Velocity and Flow rate, Vibrations, etc. Instruments Used in Energy systems: Load and power factor measuring equipments, Wattmeter, flue gas analysis, Temperature and thermal loss measurements, air quality analysis

Total Hours: 30

REFERENCES:

W.R.Murphy, G.Mckay ‘Energy Management’ Butterworths

2. C.B.Smith‘Energy Management Principles’, Pergamon Press

3. I.G.C.Dryden‘Efficient Use of Energy’, Butterworth Scientific

4. A.V.Desai‘Energy Economics’, Wieley Eastern

5. D.A. Reay ‘Industrial Energy Conservation’, Pergammon Press

6. W.C. Turner ‘Energy Management Handbook, John Wiley and Sons, AWiley Interscience Publication

7. L.C. Witte, P.S. Schmidt, D.R. Brown ‘Industrial Energy Management andUtilization’, Hemisphere Publication, Washington

8. ‘Industrial Energy Conservation Manuals’, MIT Press, Mass, 1982

9. Patrick/Patrick/Fardo ‘Energy Conservation guide book’, Prentice Hall

10. Handbook on Energy efficiency

11. ASHRAEE Energy Use (4 Volumes)

12. CIBSI Guide –Users Manual (U.K.)

13. CRC Handbook of Energy Efficiency – CRC Press.

OUTCOMES:

At the end of the course, the students will be able to

- Demonstrate the importance of energy auditing.
- Use the right technique and procedure for energy auditing
- Explore the possibilities of reducing the losses and saving the energy systematically.
- Use appropriate instruments in the process of energy auditing.

POWER ELECTRONICS & DRIVES

EECX21 SPECIAL ELECTRICAL MACHINES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge on the constructional features and operating principles of various types of special electrical machines.
- To review the fundamental concept of stepper motor and high speed application .
- To impart knowledge on principle of operation, control and performance of Synchronous Reluctance, SRM and linear induction motor.
- To expose the students to the principle of operation, emf and Torque speed characteristics of PM brushless and PM synchronous motors.

MODULE I STEPPER MOTORS 6

Constructional features, Principle of operation, Permanent magnet stepper motor, Variable reluctance motor, Hybrid motor, Single and multistack configurations, Torque equations, Modes of excitations, Characteristics, Drive circuits, Control of stepping motors..

MODULE II HIGH-SPEED OPERATION OF STEPPER MOTORS 8

Pull-out torque/speed, characteristics of Hybrid stepper motors, calculation of pull-out torque, pull-out torque/speed characteristics for the VR stepper-motors, calculation of the pull out torque.

MODULE III SWITCHED RELUCTANCE MOTORS 8

Constructional features – Principle of operation – Torque prediction –Power controllers – Non-linear analysis – Microprocessor basedcontrol – Characteristics.

MODULE IV LINEAR INDUCTION AND SYNCHRONOUS MOTORS: 8

Development of a Double sided LIM from Rotary type IM- Schematic of LIM drive for electric traction, Development of one-sided LIM, Equivalent circuit of LIM,Linear Synchronous motor.

MODULE V PERMANENT MAGNET BRUSHLESS D.C. MOTORS AND SYNCHRONOUS MOTORS 8

Permanent magnet brushless D.C. Motors, Permanent magnet synchronous motors and axial flux machine:Principle of operation – EMF and torque equations – Phasor

diagram – Power controllers - Torque speed characteristics.

MODULE VI MODELLING OF MACHINES 8

Mathematical model of switched reluctance motor, PMBLDC motor, PM synchronous Motor ,axial flux motor.

Total Hours –45

REFERENCES:

1. Miller, T. J. E., “Brushless Permanent Magnet and Reluctance Motor Drives”, Clarendon Press, 1989.
2. Taylor E.O., “The Performance and Design of AC Commutator Motors”, Sir Issac Pitmanand Sons, 1998.
3. T. Kenjo, S. Nagamori, “Permanent Magnet and Brushless DC Motors”, Clarendon Press, London, 1988.
4. Kenjo T., “Stepping Motors and their Microprocessor Controls”, Clarendon Press, 1984.
5. Murphy J.M.D., “Power Electronics Control of AC Drives”, Pergamon Press, 1988.
6. Naser A. and Boldea L., “Linear Electric Motors: Theory Design and Practical Applications”, Prentice Hall of India, 1987.
7. T.J.E. Miller, 'Brushless Permanent Magnet and Reluctance Motor Drives', Clarendon Press, Oxford, 1989.
8. M. Gopal, 'Digital Control and State Variable Methods', Tata McGraw-Hill,1997

OUTCOMES:

At the end of the course, the student is expected to

- understand the operating principle performance and Applications of Stepping Motors.
- understand the construction, principle of operation, control and performance of switched reluctance motors.
- understand the construction, principle of operation, control and performance of Synchronous Reluctance.
- Select the suitable Machines for Real Time Applications to maximize the torque output.

EECX22 CAD FOR ELECTRICAL APPARATUS L T P C

3 0 0 3

OBJECTIVES:

- To impart knowledge on using electromagnetic field theory in understanding the modeling concepts of Electrical Apparatus.
- Applying Maxwell's equation to model Electrical Apparatus.
- Providing numerical solutions for the analysis of Electrical Apparatus, using finite element approach.

MODULE I INTRODUCTION 5

Conventional design methodology – limitation -need for field analysis based design - computer aided design aspects – Advantages.

MODULE II ELECTROMAGNETICS AND ELECTROSTATICS 5

Basic field equations – calculation of field distribution – flux linkages – voltage induced – storage energy in electric field and magnetic field inductance – capacitance - Laplace and Poisson equation.

MODULE III CAD PACKAGES 8

Recent developments – preprocessing – modeling – boundary conditions – material characteristics – problem formulation – solution – post processing.

MODULE IV FINITE ELEMENT ANALYSIS 9

Mathematical formulation – differential and integral equation-FDM-discretisation – shape functions – stiffness matrix – solution techniques – post processing.

MODULE V V FUNDAMENTAL DESIGN PROBLEMS 8

Design of actuator – solenoid –Inductance – transformer with EMF equation.

MODULE VI DESIGN PROBLEMS IN MOTORS 10

Induction motor - switched reluctance motor – stepper motor – P.M. machines-Torque calculation.

Total Hours: 45

REFERENCES:

1. Sheppard J.Salon, “Finite Element Analysis of Electrical Machines”, Springer Edition, 2009.
2. Nicola Bianchi, “Electrical Machines Analysis Using Finite Elements”, Taylor & Francis group, 2009.
3. P.P. Silvester and Ferrari, “Finite Element for Electrical Engineers”, Cambridge University Press, 1984.
4. D.A. Lowther and P.P. Silvester, “Computer Aided Design in Magnetics”, Springer Verlag, Newyork, 1986.
5. M.V.K. Chari and P.P. Silvester, “Finite Elements in Electric and Magnetic Field Problems”, John Wiley, 1980.

OUTCOMES:

At the end of the course, the students are expected to possess knowledge and achieve skills on following:

- To understand/learn the importance of CAD method.
- understand the basic electromagnetic field equation and problem formulation for CAD application.
- Apply theoretical concepts in designing of Electrical Apparatus.
- Ability to design actuators, solenoid, transformer and AC Machines using MAGNET software.
- Ability to Model any Electrical Apparatus.
- Apply FEM for the designing of differential eqaution.

EECX23 SOFTWARE FOR CIRCUIT SIMULATION L T P C
3 0 0 3

OBJECTIVES:

- To gain the hands-on experience to simulate, verify, examine, and design electrical, mechanical and electronic circuits using electrical software such as PSPICE, MATLAB, MagNet and Lab View
- To possess the intuitive analysis skill to forecast / illustrate the circuit simulation results.

MODULE I INTRODUCTION 7

Importance of simulation – General purpose circuit analysis – programs –Method of analysis of power electronic systems – Review of modeling of powerelectronic components and systems - Future trends in computer simulation.

MODULE II PSPICE 8

Introduction – PSpice overview – DC circuit Analysis –AC circuit analysis –Transient and the time domain analysis – Fourier Series and Harmoniccomponents – Modelling of devices like BJT, FET and MOSFET as amplifiersand oscillators and their analysis.

MODULE III MATLAB 7

Introduction - function description – Data types – Tool boxes – Graphical Display- Import and Export of data - programs for the solution of state equations.

MODULE IV MAGNET 8

Introduction - 2D mesh adaption tools - 2D boundary conditions – Modellingand predicting the performance of any electromagnetic or electromechanicaldevice such as Electric Motors / Generators and Transformers.

MODULE V LABVIEW 8

Introduction – Lab view concepts - Environment basics – Graphicalprogramming basics - Common tools - Debugging tools.

MODULE VI DESIGN 7

Solve electrical and electronics circuits and systems by modeling in PSpice,Matlab, MagNet and Labview.

Total Hours –45

REFERENCES:

1. Rajagopalan V., Marcell Dekker, “Computer aided analysis of power electronicsystems”, 1987.
2. Paul Tobin Morgan, “Pspice for Circuit Theory and Electronic Devices”, Claypoolpublishers, 2007.
3. John Keown, “Microsim Pspice and Circuit analysis”, Prentice Hall Inc, 1998.
4. “Matlab / Simulink manual”, MathWork, 2010.
5. Robert H., “Learning with Labview 2009”, Bishop prentice Hall, 2009.

OUTCOMES:

- At the end of the course, the student is expected to possess knowledge and achieve skills on the following:
- Basic concepts of simulation software tools and its applications.
- Describe the techniques to model and solve the application problems.
- Apply modern simulation tools such as PSPICE – MATLAB – MagNet – Labview for the design, analyses, and performance evaluations of electrical and electronics circuits and systems.

EECX24	ELECTROMAGNETIC FIELD COMPUTATION AND MODELING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart knowledge on the mathematical modelling of physical systems for analysis.
- To make the students analyse the system based on controllability and observability methods.
- To Introduce design techniques for effective control.
  To provide concept for analysing the stability of a system.

MODULE I INTRODUCTION 9

Review of basic field theory – electric and magnetic fields – Maxwell's equations– Laplace, Poisson and Helmoltz equations – principle of energy conversion – force/torque calculation – Electro thermal formulation.

MODULE II SOLUTION OF FIELD EQUATIONS I 8

Limitations of the conventional design procedure, need for the field analysis based design, problem definition, solution by analytical methods-direct integration method – variable separable method – method of images, solution by numerical methods- Finite Difference Method.

MODULE III SOLUTION OF FIELD EQUATIONS II 9

Finite element method (FEM) – Differential / integral functions – Variational method – Energy minimization – Discretisation – Shape functions –Stiffness matrix –1D and 2D planar and axial symmetry problem.

MODULE IV FIELD COMPUTATION FOR BASIC CONFIGURATIONS 7

Computation of electric and magnetic field intensities– Capacitance and Inductance – Force, Torque, Energy for basic configurations

MODULE V BASIC EXERCISES IN FEA PACKAGES 6

Modeling – Pre-processing – A vector and flux plot calculations – deriving point quantities in Post-processing.

MODULE VI DESIGN APPLICATIONS 6

Insulators- Bushings – Cylindrical magnetic actuators – Transformers – Rotating machines.

Total Hours –45

REFERENCES:

1. K.J.Binns, P.J.Lawrenson, C.W Trowbridge, “The analytical and numerical solution of Electric and magnetic fields”, John Wiley & Sons, 1993.
2. Nathan Ida, Joao P.A.Bastos, “Electromagnetics and calculation of fields”, Springer-Verlage, 1992.
3. Nicola Biyanchi, “Electrical Machine analysis using Finite Elements”, Taylor and Francis Group, CRC Publishers, 2005.
4. S.J Salon, “Finite Element Analysis of Electrical Machines.” Kluwer Academic Publishers, London distributed by TBH Publishers, India, 2007.
5. User manuals of MAGNET, MAXWELL & ANSYS software.
6. Silvester and Ferrari, “Finite Elements for Electrical Engineers” Cambridge University press, 1983.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Model the physical systems in terms of mathematical model for easier analysis. Analyse the system controllability and observability.
- Ability to model electric systems in finite element analysis scenario.
- Ability to calculate any electrical or magnetic parameter from the analysis and co-relate it.
- Design and develop modal control technique for systems.
- Analyse the systems stability using Lyapunov’s theory.

EECX25 SOLID STATE AC & DC DRIVES L T P C
3 0 0 3

OBJECTIVES:

- To study and understand the operation of electrical drives - D.C. motor drives, Induction motor drives, Synchronous motor drives.
- To analyze the closed-loop control of both DC and AC drives.
- To understand the differences between induction motor drives and synchronous motor drives.

MODULE I ELECTRIC MOTOR CHARACTERISTICS 7

Characteristics of DC motors - Induction motors - Synchronous motors - Constant torque and constant HP operations – Four quadrant operations – Rating of motors - Selection of drives.

MODULE II CONVERTER FED DC DRIVES 8

Single phase semi and full converter fed drives – three phase semi and full converter fed drives – continuous and discontinuous modes – closed loop converter fed drives.

MODULE III CHOPPER FED DC DRIVES 7

Operation of Class A, B, C, D, E chopper fed DC drives - four quadrant operations – closed loop chopper fed drives.

MODULE IV IV STATOR CONTROLLED INDUCTION MOTOR DRIVES 7

AC voltage controller fed induction motor drive – VSI and CSI fed drives – closed loop stator controlled induction motor drives - Braking methods for induction motors.

MODULE V ROTOR CONTROLLED INDUCTION MOTOR DRIVES 8

Rotor resistance control – slip power recovery scheme - Scherbius drive - sub synchronous operation, Kramers drive – super synchronous operation – closed loop rotor controlled drives.

MODULE VI SYNCHRONOUS MOTOR DRIVES 8

Operation of wound field cylindrical and salient pole synchronous motor for constant voltage and constant frequency source – brushless excitation – closed

loop self controlled synchronous motor drives.

Total Hours –45

REFERENCES:

1. Gopal K.Dubey, “Power semiconductor controlled drives”, Prentice Hall international, 1989.
2. Vedam subramanyan, “Thyristor Control of Electrical Drives”, Tata McGraw-Hill Co.Ltd., 1988.
3. Murphy, J.M.D and Turnbull.F.G., “Thyristor control of AC Motors”, Pergamon Press, 1988.
4. B.K. Bose, “Power Electronics and AC Drives”, Prentice Hall Onglewood cliffs, New Jersey, 1986.
5. S.B. Dewan, Gordon R. Slemon and A. Straughen, “Power Semiconductor Drives”, John Wiley Pub., 1996.

OUTCOMES:

At the end of the course the student will be able to

- Apply suitable motor for different applications
- Apply suitable power electronic controller for electric drives.
- Design and analyze converter fed DC drive
- Design and analyze chopper fed AC drive
- Apply power electronic controllers for the speed control of induction motor drives
- Apply power electronic controllers for the speed control of synchronous motor drives

EECX26	CONVERTERS, APPLICATIONS & DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To get an overview of different types of power semi-conductor devices andtheir switching characteristics.
- To understand the operation, characteristics and performance parameters ofcontrolled rectifiers.
- To design & implement real time industrial application of Power Electronicequipments.
- To know the practical application for power electronics converters in conditioning the power supply.

MODULE I PROTECTION OF POWER ELECTRONIC DEVICES 7

SCR – Triac – MOSFET - IGBT - Protection Circuits - Snubber Circuits –Ratings - safe operating Area - Heat sink Design.

MODULE II DESIGN OF CONTROLLED CONVERTERS 8

Gate pulse generating circuits - conventional methods, gate pulse generationusing microcontroller, gate drive circuits - Pulse Transformers - Opto Triacs - Synchronisation Circuits - fully controlled fed DC motor - Open loop, closedloop.

MODULE III DC-DC CONVERTERS 7

Half Bridge and Full Bridge Driver ICs for MOSFET and IGBT - Phase shiftedseries Resonant Converters - ZCS – ZVS – DC to DC Converter for ElectricVehicle.

MODULE IV PHASE CONTROLLERS 8

Photosensors - Temperature sensors - Micro controller Programming for phaseangle control - Implementation of phase controller for illuminating lights &Electric furnace control using micro controller -Maximum power point trackers Grid connected inverter - Implementation of converters for solar panel.

MODULE V SWITCHING POWER SUPPLIES 8

Design of PWM inverters - SPPWM inverters - Design and implementation ofUPS and SMPS - Harmonic analysis of inverters using Harmonic Analyser.

MODULE VI CASE STUDY 7

Mini Project Model – Hardware Fabrication – converter – DC to DC ConverterDC Drives.

Total Hours –45

REFERENCES:

1. M.H. Rashid, “Power Electronics Handbook”, Elsevier Press, Micro C Manual,2003.
2. Nihal Kularatna, “Power Electronics Design Handbook”, “Low-PowerComponents and Applications”, 1999.
3. Keith H. Sueker, “Power Electronics Design - A Practitioner’s Guide”, 1998.
4. “International Rectifiers”, Application note Catalogue.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Practical exposure in DC-DC converter and control.
- Knowledge in power control devises.
- Experience to selection of converter for various application.
- Design controllers for drives.

EECX27	POWER ELECTRONICS APPLICATION TO RENEWABLE ENERGY SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide basic understanding of the emerging power electronics technologies to Renewable systems.
- To enable students to design power electronics circuit that can control active and reactive power flow in grids.
- To integrate theory and practical knowledge of power system protection.

MODULE I OVERVIEW OF ENERGY CONVERSION AND RENEWABLE ENERGY SYSTEMS 7

Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment (cost-GHG Emission) - Qualitative study of different renewable energy resources: Solar, wind, ocean, Biomass, Fuel cell, Hydrogen energy systems and hybrid renewable energy systems -Block diagram.

MODULE II ELECTRICAL ENERGY CONVERSION SYSTEMS 8

Review of reference theory fundamentals - principle of operation and analysis: IG, PMSG, SCIG and DFIG - different conversion schemes - fixed and variable speed operation - drive selection - power control - braking systems - grid integration issues.

MODULE III POWER CONVERSION IN RENEWABLE SYSTEMS 8

Principle of operation: line commutated converters (inversion-mode) - Boost and buck-boost converters - Inverters for high power applications: Multi-level Inverters, Analysis of their performance, Selection of inverter, Battery sizing, Array sizing, harmonics, Interaction with power grid.

MODULE IV ANALYSIS OF WIND ENERGY SYSTEMS 8

Stand alone operation of fixed and variable speed wind energy conversion systems - electrical design - power collection systems – earthing - electrical protection - reactive VAR issues - compensators -remote monitoring and control - economic aspects.

MODULE V ANALYSIS OF PV SYSTEMS 8

Technical and non-technical considerations - system size and module choice -

mounting systems and building integration- power conditioning system - lightning protection - earthing - metering Stand-alone systems: Modules-Batteries - charge controllers -sizing of PV arrays – applications.

MODULE VI HYBRID RENEWABLE ENERGY SYSTEMS 6

Need for Hybrid Systems- Range and type of Hybrid systems- micro wind systems and solar system- Grid integrated PMSG and SCIG Based WECS - Case studies.

Total Hours –45

REFERENCES:

1. Rashid M. H, "Power electronics Hand book", Academic press, 2001.
2. Rai. G.D, "Non conventional energy sources", Khanna publishes, 1993.
3. Rai. G.D," Solar energy utilization", Khanna publishes, 1993.
4. Gray, L. Johnson, "Wind energy system", Prentice Hall Inc, 1995.
5. B.H.Khan, “Non-conventional Energy sources”, Tata McGraw-hill Publishing Company, New Delhi.

OUTCOMES:

- The ability to understand different renewable energy resources : Solar, Wind Biomass, Fuel cell, Hydrogen energy systems and hybrid renewable energy syst
- Nurturing the ability to develop RE systems considering sustainable developmen
- Knowledge on the advancements in designing of power electronics equipments renewable energy sources.
  Identifying power electronics topologies for used in controlling active and
- reactive power in a RES.
- The capability to understand Grid Connection Issues in the RES plant.
  Identifying integrating and justifying techniques to be used in the planning and operation of grid control with renewable energy sources

EECX28	EMBEDDED CONTROL OF ELECTRIC DRIVES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To make the student into a competent and independent practitioner in the field of embedded systems.
- To provide an In-depth study both of microcontroller design, and of the Power Electronic Converters and Electric Drives to which the microcontroller must interface.
- Study and application of a Real Time Operating System using programming in C.

MODULE I PIC16F8XX- MICROCONTROLLERS 8

Function - I/O Ports – Timers - CCP Modules - Serial Communication Modules - Analog Modules - EEPROM.

MODULE II MICROCONTROLLER C 8

Mikro C Compiler reference - mikro C Libraries: ADC, PWM, Keypad, LCD, Trigonometric Libraries –Preprocessor - Statements.

MODULE III ALGORITHM AND PROGRAMMING IN MIKROC 8

Source codes in Mikro C: ADC and PWM – Unipolar SPWM – Phase Angle Control with Zero Crossing Detection- LCD with Key Pad - Speed Measurement.

MODULE IV ISOLATORS AND SENSORS 10

High Speed Opto-Couplers – Zero Crossing Detectors - Optically Isolated High Voltage and High Current sensing circuits –Optical Encoders – Tachogenerators.

MODULE V CLOSED LOOP CONTROL OF ELECTRIC DRIVES 6

Closed Loop Control - Hardware and Software Implementation: DC Motor control using PWM based DC-DC converters and Controlled Rectifiers – AC Motor Control Using TRIAC Phase Controller, SPWM inverter fed single and three phase induction motors.

MODULE VI MICRO C BUILDING APPLICATIONS 5

Micro C IDE - Code Editor- Code Explorer – Debugger – Error Window – Statistics – Integrated Tools - Building applications - Projects – Source Files -

Search Paths – Managing Source Files – Compilation - Output Files – Assembly View – Error Messages - Burning Software - Overview of Microbar - ICSP port .

Total Hours –45

REFERENCES:

1. John Main, “PIC Microcontroller C”, 2007.
2. “Mikro C- Compiler for PIC Microchip controllers”, Mikro Electronika.
3. Martin P. Bates, “Programming 8-bit PIC Microcontrollers in C: With Interactive Hardware Simulation”, 2006.
4. Tim Wilmshurst, “Designing Embedded Systems with PIC Microcontrollers- Principles and applications”, Newnes, 2007.
5. Martin P. Bates, “PIC Microcontrollers–An Introduction”, Newnes, 2011.

OUTCOMES:

At the end of the course, the student will have:

- A thorough understanding on PIC Microcontroller and its modules.
- Able to provide details of hardware and software development of modern embedded systems.
- The ability to form algorithm and execute programming in mikroc.
- The capability to design power electronics equipments related to renewable energy sources.
- The ability to simulate closed loop Control of Electric Drives.
- The capability to apply micro c compiler for real time operating systems.

EECX29	POWER QUALITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To acquire knowledge on factors affecting Power Quality.
- To analyze and control power quality problems.

MODULE I POWER QUALITY TERMS AND DEFINITIONS 8

Introduction – transients - short duration/long duration voltage variations -voltage imbalance - waveform distortion - voltage fluctuations – power frequency variation. Power Quality Problems - Poor load power factor – loads containing harmonics - notching in load voltage -DC offset in loads – unbalanced loads - disturbance in supply voltage.

MODULE II VOLTAGE SAGS AND INTERRUPTIONS 8

Sources of sags and interruptions - end user issues - Ferro resonant transformer - on-line UPS - hybrid UPS - motor generator set, SMES etc. -motor starting sags - utility system fault clearing issues.

Transient over Voltage - Sources of transient over voltages - principles of over voltage protection - devices for over voltage protection - utility capacitor switching transients - utility lightning protection - load-switching transient problems.

MODULE III LONG DURATION VOLTAGE VARIATIONS 8

Devices for voltage regulation - Utility voltage regulator applications – capacitors for voltage regulation- end-user capacitor application - regulating Utility voltage with dispersed sources.

Quality and Reliability of Power Supply - Reliability of power supply – reliability measurements consumer interruption cost - distribution automation – substation grounding - energy auditing.

MODULE IV HARMONICS 7

Voltage and current harmonics distortions - harmonics of single-phase power supplies - three phase power converters - arcing devices - storable devices -effects of harmonics distortion - system response characteristics – locating sources of harmonics, peripherals for controlling harmonics - devices for filtering harmonics.

MODULE V WIRING AND GROUNDING 7

Harmonics study procedure - symmetrical components - modeling harmonics sources - harmonic filter design - telecommunication interferences – Reason for grounding -

typical wiring and grounding problems and their solutions.

MODULE VI POWER QUALITY MONITORING AND CUSTOM POWER DEVICES **7**

Power quality related standards - standard test waveform and detailed power quality monitoring - power quality measurement equipments. Custom Power Devices: Utility customer interface - network reconfiguring device load compensation using shunt compensators - voltage regulation using shunt compensators - dynamic voltage restorer - unified power quality conditioner - Computer tools for harmonic analysis.

Total Hours –45

REFERENCES:

1. Roger C.Dugan, Mark F. Mc Granhgan, Surya Santoso," Electrical Power System Quality", Mc Graw hill, 2nd Edition, 2001.
2. Arindam Ghosh and Gerard Ledwich, "Power Quality Enhancement using custom power devices", Kulwer academic publisher, 2004.
3. C.L Wadhwa, "Generation and Distribution utilization of electrical Energy", New Age International.
4. C. Sankarm, "Power Quality" CRC Press USA, 2000.
5. Barry W. Kennedy, "Power Quality Primer "McGraw Hill, 2000.
6. Wilson E. Kazibwe, Van Nostrand Reinhold, "Electrical power quality controls techniques".

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Understand the power quality issues and its importance.
- Evaluate the characteristics of power quality disturbances.

EECX33 IoT FOR ELECTRICAL ENGINEERS L T P C
3 0 2 3

OBJECTIVES:

- The objective of this course is to introduce IoT in Electrical and Electronics Engineering
- Introduces CLOUD PLATFORMS and PROTOCOLS.
- To provide practical experience with IoT and microcontroller systems
- Demonstrates the use of the IoT.

MODULE I INTRODUCTION TO INTERNET OF THINGS(IoT) 4

Introduction - Overview of the Architecture of Internet of Thing- Overview of the top-level components: the device, gateway and cloud - IOT enabling technologies.

MODULE II IOT COMPONENTS 5

Device platforms : Raspberry Pi - Arduino controller – Overview of Device platforms and interfacing - USB – GPIO - Inter-Integrated Circuit serial bus Serial Peripheral Interface Bus, Universal Asynchronous Receiver/Transmitter (UART) -Sensors: Temperature and Humidity, Moisture, light, Voltage , Current, IR, PIR and Hall sensors.

MODULE III COMMUNICATION PROTOCOLS FOR IoT 6

Basics of the MQTT, HTTP, CoAP Protocols –installing the Arduino MQTT Libraries - testing MQTT.

MODULE IV OVERVIEW OF CLOUD PLATFORMS 10

Overview of Cloud platforms - AWS IoT Platform -Microsoft Azure IoT Hub - IBM Watson/Bluemix cloud IoT Platform - Google Cloud Platform - SAP Cloud Platform - General Electric's Predix cloud - Node-RED programming tool - Arduino Ethernet Shield, GSM module, Wi-Fi module and NodeMCU.

MODULE V INTERFACING CLOUD PLATFORM WITH HARDWARE 12

LM 35 Temperature sensor and calibration – interfacing LM 35 with Arduino – Interfacing Ethernet shield with Arduino – sending data from arduino to cloud platform – monitoring temperature in the cloud.

MODULE VI APPLICATION OF IOT IN SMART GRID 8

Case Study: Advanced metering infrastructure (AMI) – remote control operation of

energy consuming devices – virtual power plants and smart metering.

Total Hours –45

REFERENCES:

1 Peter Waher "Learning Internet of Things" Copyright © 2015 Packt Publishing
2 Pradeeka Seneviratne, "Internet of Things with Arduino Blueprints", Published by Packt Publishing Ltd. UK. © 2015
3 Internet of Things:Converging Technologies for Smart Environments and Integrated Ecosystems Dr. Ovidiu Vermesan,Dr. Peter Friess *Published by* River Publishers Denmark © 2013.
4 John Soldatos "Building Blocks for IoT Analytics Internet-of-Things Analytics" ©2017 River Publishers, Denmark
5 Martin P. Bates,"Programming 8-bit PIC Microcontrollers in C: With Interactive Hardware Simulation.
6 Michael Margolis "Arduino Cookbook" O'Reilly Media, Inc., 1005 Gravenstein Highway North, Sebastopol, CA 95472.@ March 2011.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Work on different projects making use of the IoT .
- Implement sensor interfaces in various Cloud systems by using various interfacing techniques.
- Enable the student to design IoT based monitoring to interact with real-world systems
- Design and develop Arduino microcontroller and NodeMCU based automation systems.
- Develop and demonstrate how to accomplish a given task using IoT with Arduino microcontroller.
- Demonstrate a working knowledge of the necessary steps and methods used to interface a IoT system to devices such as relays, meters,motor controls and sensors, etc.

HIGH VOLTAGE ENGINEERING

EECX36	HIGH VOLTAGE ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide fundamental knowledge on effects of overvoltges in power sytems
- To understand breakdown mechanisms in gaseous, liquids
- To perceive breakdown mechanisms in solid and composite dielectrics.
- To understand the generation of High voltages and currents.
- To summarise different measurement techniques for High voltages and currents.
- To analyze various High voltage testing methods.

MODULE I OVER VOLTAGE PHENOMENON AND INSULATIONCO-ORDINATION 8

Natural causes for over voltages – Lightning phenomenon, Overvoltage due to switching surges, system faults and other abnormal conditions, Principles of Insulation Coordination on High voltage and Extra High Voltage power systems.

MODULE II BREAK DOWN IN GASEOUS AND LIQUID DIELECTRICS 7

Gases as insulating media, collision process, Ionization process, Townsend's criteria of breakdown in gases, Paschen's law - Streamer theory-Breakdown in non uniform fields and corona discharges. Liquid as Insulator, pure and commercial liquids, breakdown in pure and commercial liquids.

MODULE III BREAK DOWN IN SOLID DIELECTRICS 8

Intrinsic breakdown, electromechanical breakdown, thermal breakdown, breakdown of solid dielectrics in practice, Breakdown in composite dielectrics, Solid dielectrics used in practice.

MODULE IV GENERATION OF HIGH VOLTAGES AND CURRENTS 8

Generation of High Direct Current Voltages, Generation of High alternating voltages, Generation of Impulse Voltages, Generation of Impulse currents, Triggering and control of impulse generators.

MODULE V MEASUREMENT OF HIGH VOLTAGES AND CURRENTS 7

Measurement of High DC, AC and impulse voltages, Measurement of High DC, AC and impulse currents, Digital techniques in high voltage measurements.

MODULE VI HIGH VOLTAGE TESTING 7

High voltage testing of Transformers, Insulators and bushings, cables, Isolators and circuit breakers, surge Arresters- Radio Interference measurements.

Total Hours –45

REFERENCES:

1. C.L.Wadhwa, “High Voltage Engineering”, by New Age Internationals (P) Limited, 1997.
2. Ravindra Arora, Wolfgang Mosch, “High Voltage Insulation Engineering”, by New Age International (P) Limited, 1995.
3. M.S.Naidu and V. Kamaraju - High Voltage Engineering”, by – TMH Publications, 3rd Edition, 2000.
4. E.Kuffel, W.S.Zaengl, J.Kuffel, “High Voltage Engineering”, Fundamentals by Elsevier, 2nd Edition, 1999.

OUTCOMES:

At the end of the course, the student will be able to

- understand the causes of abnormal operating conditions (faults, lightning and switching surges) in power systems and the principles of insulation coordination in high voltage and extra high voltage systems.
- gain the Knowledge of the various breakdown mechanisms in, liquid and gaseous dielectrics
- analyze the fundamental behaviour and breakdown mechanisms in solid and composite dielectrics.
- generate high AC,DC and impulse voltages and currents.
- gain knowledge on measurement of high AC, DC and impulse voltages and impulse currents.
- select appropriate type of test for each high voltage power apparatus.

EECX37 BIOELECTRICS L T P C

3 0 0 3

OBJECTIVES:

- To teach the students, some of the basic concepts of bioelectrics through pulsed power principles.
- To impart a detailed knowledge on pulsed power systems.
- To study about various applications of electroporation
- To gain a detailed knowledge on electroporation
- To study about equipments used for electroporation
- Applications of electroporation

MODULE I BIOELECTRICITY 8

Introduction – Diffusion – Comparison of gravity and diffusion – Membrane potential – membrane capacitance – Ion selectivity – Channel density – Channel conductance – Channel number, channel conductance and membrane potential – Channel conductance and random switch – Probability – Membrane potential revisited – Diffusion potential – More realistic view of cell potential – Channel opening probability – Channels in membranes – Classes of selective holes – Total membrane conductance and potential.

MODULE II PULSED SYSTEMS: DESIGN PRINCIPLES 7

Lumped parameter pulsed systems - Principle schemes for pulse generation – Voltage multiplication and transformation. Pulse generation using long lines - Generation of nanosecond pulses – voltage multiplication in line based generators – pulse systems with segmented and non uniform lines.

MODULE III APPLICATIONS OF PULSED POWER AND PLASMAS TOBIOSYSTEMS AND LIVING ORGANSISMS 8

Pulsed power source using magnetic compression system – discharge plasma by pulsed power – action of pulsed power and discharge plasma to bio-systems.

MODULE IV ELECTROPORATION 7

Introduction to Electroporation – Electroporation and cellular physiology – the cell in the electric field.

MODULE V EQUIPMENT FOR ELECTROPORATION

Pulse generator – Applicator – Electrode – Electrochemotherapy – Gene

Electrotransfer – DNA Vaccination – Irreversible Electroporation.

MODULE VI APPLICATIONS OF ELECTROPORATION 7

Case Study.

Total Hours –45

REFERENCES:

1. Louis J. Defelice, “Electrical Properties of Cells: Patch Clamp for Biologists”, Plenum press, 1997.
2. Eberhard Neumann, Arthur.E.Sowers, Carol A. Jordan, “Electroporation and Electrofusion in cell biology”, Plenum press, New York, 1989.
3. Gennadii Andreevich Mesiats, “Pulsed power”, Springer, 2005.
4. Yoshinobu Kawai, Hideo Ikegami, Noriyoshi Sato, Akihisa Matsuda, Kiichiro Uchino, Masayuki Kuzuya, Akira Mizuno, “Industrial Plasma Technology”, 2007.
5. Stephen T.Lee, Julie Gehl, Edward W.Lee, “Clinical aspects of Electroporation”, Springer, 2011.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Pulsed power principles and bioelectricity.
- Illustrate the design principles of pulse forming networks
- appraise the pulse and plasma transmission to biosystems and living organisms
- Understand the concept of electroporation and its application in cellular physiology
- identify and apply an appropriate equipment for electroporation technique
- Electroporation and applications of electroporation through conducting of case studies

EECX38	EHV AC AND DC TRANSMISSION ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide an in depth understanding of the different aspects of Extra High Voltage AC and DC transmission system analysis and design.
- To acquire knowledge about the various parameters of EHV lines
- To study about the various EHV AC transmission schemes
- To acquire knowledge about the various EHV testing methods and techniques.
- Compare EHVAC and HVDC systems and suggest appropriate transmission systems based on requirement and constraints
- Understand about the overvoltage and its effects on power system. Complete analysis of harmonics and basis of protection for HVDC systems

MODULE I INTRODUCTION 8

Need of EHV transmission-standard transmission voltages-comparison of EHV AC and HVDC transmission systems and their applications & limitations-surface voltage gradients in conductor- distribution of voltage gradients on sub-conductors- mechanical considerations of transmission lines-modern trends in EHV AC and HVDC transmission.

MODULE II PARAMETERS OF EHV LINES 8

Resistance of conductors- bundle conductors-inductance of EHV Line configurations line capacitance-sequence inductance and capacitance- line parameters for modes of propagation- resistance and Inductance of ground returns.

MODULE III EHV AC TRANSMISSION 7

Corona loss formulas- corona current- audible noise – generation and characteristics corona pulses their generation and properties- radio interference (RI) effects- over voltage due to switching- ferroresonance-reduction of switching surges on EHV system.

MODULE IV EXTRA HIGH VOLTAGE TESTING AND DESIGN OF EHVLINES 7

Characteristics and generation of impulse voltage -generation of high AC and DC voltages- measurement of high voltages by sphere gaps and potential dividers- Consideration for Design of EHV Lines: Design factors under steady

state limits- EHV line insulation design based upon transient over voltages- Effects of pollution on performance of EHV lines.

MODULE V HVDC TRANSMISSION 7

Types of dc links- converter station-choice of converter configuration and pulse number- effect of source inductance on operation of converters- Principle of dc link control- converter controls characteristics- firing angle control- current and excitation angle control- power control-starting and stopping of dc link.

MODULE VI CONTROL AND PROTECTION OF HVDC LINE 8

Converter faults- protection against over currents and over voltages-smoothing reactors-generation of harmonics-ac and dc filters- Multi Terminal DC systems (MTDC): Types, control- protection and applications-control of HVDC system desired features of control-control characteristics

Total Hours –45

REFERENCES:

1. Rakosh Das Begamudre, “Extra High Voltage AC Transmission Engineering” Revised Second Edition, John Wiley.
2. K.R. Padiyar, “HVDC Power Transmission System”, Second revised Edition, New Age Int. 2012
3. S. Rao, “EHV-AC and HV DC Transmission Engineering Practice”, Khanna Publishers, 2000.
4. Arrillaga J “High Voltage Direct current Transmission” 2nd Edition (London) Peter Peregrinus, IEEE.
5. Hingorani HG and Gyugyi L “Understanding FACTS-concepts and Technology of Flexible AC Transmissions Systems” New York, IEEE Press, 2010.
6. Padiyar K R “FACTS controllers in Power Transmission and distribution” New Delhi, New Age Int. publishers.
7. Clayton R.Paul, “Analysis of multi-conductor transmission lines”, Wiley publication, 2000.

OUTCOMES:

At the end of the course, the student will be able to

- Compute the surface voltage gradient for bundled conductors.
- Compute the line parameters for EHVAC transmission lines.
- Explain the issues, such as corona, radio interference and switching surges, in EHVAC systems.

- Design an EHVAC transmission system for the given requirement and explain the methods of testing EHVAC systems.
- Explain the operation of converters in HVDC transmission systems.

- Analyze a HVDC systems for faults and identify suitable methods to control and protect it.

EECX39	HIGH VOLTAGE DIRECT CURRENT TRANSMISSION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand the evolution of HVDC conversion and transmission
- To develop the skills in the area of HVDC power transmission with the analysis of HVDC converters, harmonics and design of filters.
- To understand about the various control schemes associated with HVDC systems
- To analyze AC/DC system interactions and know the operation and control of various MTDC systems.
- To acquire knowledge about the power flow analysis in HVDC systems
- To study about different applications of HVDC systems.

MODULE I INTRODUCTION TO TRANSMISSION SYSTEMS 8

Introduction – Evolution of HVDC Transmission systems – Comparison of HVAC and HVDC transmission systems – Types of HVDC transmission systems – Components of HVDC transmission systems.

MODULE II ANALYSIS OF HVDC CONVERTERS AND HVDC SYSTEM 8

Analysis of simple rectifier circuits – Bridge Rectifier analysis – Analysis of HVDC Converter: Different modes of converter operation - Output voltage waveforms and DC voltage in rectification - Output voltage waveforms and dc in inverter operation - thyristor voltages - Equivalent electrical circuit.

MODULE III HVDC SYSTEM CONTROL 8

HVDC System control features – Control modes - Control schemes – Control comparisons.

MODULE IV MULTITERMINAL DC SYSTEMS 10

Converter mal-operations – Commutation failure – starting and shutting down the converter Bridge – Converter Protection - Smoothing reactor and dc lines – Reactive power requirements – Harmonic Analysis – Filter Design

MODULE V POWER FLOW ANALYSIS IN AC/DC SYSTEMS 6

Component Models for the Analysis of AC and DC Systems - Power flow analysis of AC-DC systems - Transient stability analysis - Dynamic stability

analysis.

MODULE VI APPLICATIONS OF HVDC SYSTEMS 5

Multi-terminal HVDC system - Advances in HVDC transmission - HVDC system application in wind power generation.

Total Hours –45

REFERENCES:

1. KR Padiyar, “HVDC Power Transmission Systems”, Willey Eastern Limited, Second edition, 2001.
2. J Arrillaga, “High Voltage Direct current Transmission”, Peter Peregrinus Ltd, UK, 1999.
3. EW Kimbark, “Direct Current Transmission”, Wiley-Interscience, New York, 2000.
4. SN Singh, “Electric Power Generation, “Transmission and Distribution”, PHI, New Delhi 2nd edition, 2008.
5. P. Kundur, “Power System Stability and Control”, McGraw-Hill, 1993.
6. Additional reading - Research Papers.
7. Erich Uhlmann, “Power Transmission by Direct Current”, BS Publications, 2004.
8. V.K.Sood, HVDC and FACTS controllers – “Applications of Static Converters in Power System”, Kluwer Academic Publishers, 2004.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and skills on the following:

(i) Ability to identify and design the various components of HVDC system.
(ii) Ability to analyse the HVDC converters for different modes of operation.
(iii) Ability to design the different control schemes for HVDC system.
(iv) Ability to design the protection schemes for converters and filters to overcome harmonics in multi terminal HVDC system operations
(v) Ability to perform power flow analysis ,transient stability and dynamic stability analysis in HVDC systems

Ability to implement the HVDC system for different applications

EECX40	ELECTROMAGNETIC INTERFERENCE ANDELECTROMAGNETIC COMPATIBILITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

This course conveys essential facts on:

- Different electromagnetic Interference problems occurring in Intersystem and their possible mitigation techniques in Electronic design.
- EMI Sources, EMI problems and their solution methods in PCB level / Subsystem and system level design.
- Characteristics and design of electromagnetic compatibility
- Methods of coupling and grounding summarize filtering, shielding and coating methods
- Explain the digital logic noise and ground noise
- Standard and laboratory techniques forpossible EMC standards

MODULE I BASIC CONCEPTS 6

Definition of EMI and EMC with examples - Classification of EMI/EMC - CE, RE, CS, RS Modules of parameters - Sources of EMI - EMI coupling modes - CM and DM, ESD phenomena and effects - Transient phenomena and suppression.

MODULE II EMI MEASUREMENTS 8

Basic principles of RE, CE, RS and CS measurements - EMI measuring instruments- Antennas, LISN, Feed through capacitor, current probe, EMC analyzer and detection technique - Open area site - shielded anechoic chamber - TEM cell.

MODULE III EMC STANDARD AND REGULATIONS 8

National and Intentional standardizing organizations- FCC, CISPR, ANSI, DOD, IEC, CENEEC, FCC CE and RE standards - CISPR, CE and RE Standards - IEC/EN, CS standards - Frequency assignment - spectrum conversation.

MODULE IV EMI CONTROL METHODS AND FIXES 8

Shielding – Grounding – Bonding – Filtering - EMI gasket - Isolation transformer - Opto isolator.

MODULE V GROUNDING FOR THE EMI CONTROL 8

Characteristics of grounding systems: Impedance characteristics - Antenna characteristics – Ground, related interference - Circuit, Equipment, and System

grounding: Single-point grounding scheme - Multipoint grounding Scheme - Selection of a grounding Scheme - Ground system confgurations - EMI control devices and techniques.

MODULE VI EMC DESIGN AND INTERCONNECTION TECHNIQUES 7

Cable routing and connection - Component selection and mounting - PCB design - Trace routing - Impedance control – decoupling - Zoning and grounding.

Total Hours – 45

REFERENCES:

1. Prasad Kodali.V, “Engineering Electromagnetic Compatibility”, S.Chand& Co, New Delhi, 2000.
2. Clayton R.Paul, “Introduction to Electromagnetic compatibility”, John Wiley & Sons, 1992.
3. Keiser, “Principles of Electromagnetic Compatibility”, Artech House, 3rd Edition, 1994.
4. Donwhite Consultant Incorporate, “Handbook of EMI / EMC - Vol I”, 1985.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieveskills on the following:

- Ability to understand Electromagnetic Interference problems and their mitigation techniques and grounding systems for EMI control.
- Real-world EMC design constraints and make appropriate tradeoffs to achieve the most cost-effective design that meets all requirements.
- Designing electronic systems that function without errors or problems related to electromagnetic compatibility
- To design systems with Electromagnetic compatibility and to diagnose and solve basic electromagnetic compatibility problems
- To able to design systems to mitigate the effects of Electromagnetic Interference.
- Knowledge and awareness on EMC design and interconnection techniques.

EECX41 OUTDOOR INSULATORS

L	T	P	C
3	0	0	3

OBJECTIVES:

The course aims at giving a comprehensive knowledge on

- Outdoor Insulators, which are mainly, used for Transmission and Distribution systems.
- Exposure to a range of insulation materials and composites used in HV insulation systems and their electrical properties
- Learn a comprehensive range of testing and measurement techniques to characterise insulation materials
- Acquire knowledge on design and manufacture of insulators
- Acquire knowledge of partial discharges, condition monitoring and insulation quality assessment
- Selection,design and maintainence of insulation system according to IEC standards.

MODULE I INTRODUCTION 7

Overview – Important Definitions – Types of Outdoor Insulators – Uses of Outdoor Insulators – Stresses Encountered in Service – Electrical Performance– Mechanical Performance – Role of Insulators on Overall Power System Reliability – Shapes of Outdoor Insulators – Mechanical and Electrical Ratings of Insulators – Comparison of Porcelain, Glass and Composite Insulators – Life Expectancy.

MODULE II NONCERAMIC INSULATOR TECHNOLOGY 7

Introduction - Materials for Weathersheds / Housings – Shed Design – Insulator Core – Hardware – Establishing Equivalency to Porcelain/Glass – Manufacturing Changes and Quality Control (QC) – Un-standardization/ Propagation - Live-line Maintenance Handling, Cleaning and Packaging - Brittle Fracture – Water Drop Corona – Aging and Longevity – Grading Control Rings.

MODULE III DESIGN AND MANUFACTURE OF INSULATORS 8

Porcelain Insulators – Manufacture of Porcelain Insulators – The Porcelain Suspension Insulator – Porcelain Pin-type Insulators – Porcelain Multicone Insulators – Porcelain Long-rod and Post Insulators – Porcelain Insulators Glazes - Porcelain Insulator Hardware – Porcelain Insulator Cement – The Porcelain Dielectric.

Nonceramic Insulators - Nonceramic Suspension Insulator – Line Post Insulator – Hollow Core Insulator – Manufacture of Nonceramic Insulators – The Composite

Dielectric – Voltage Stress Control.

MODULE IV TESTING STANDARDS FOR INSULATORS 8

Need for Standards – Standards Producing Organizations – Insulator Standards– Classification of Porcelain / Glass Insulator Tests – Brief Description and Philosophy of Various Tests for Cap and Pin Porcelain/Glass Insulators – Summary of Standards for Porcelain/Glass Insulators – Standards of Nonceramic (Composite) Insulators – Classification of Tests, Philosophy and Brief Description – Standards for Nonceramic Insulators.

MODULE V DETECTION OF DEFECTIVE INSULATORS 7

Detecting defective porcelain insulators – principles involved – electrical methods – thermography - Detecting defective non ceramic insulators – detection prior to installation – detecting degraded insulator during service.

MODULE VI SELECTION AND MAINTENANCE OF INSULATORS 8

Introduction – Cost and Weight – National Electricity Safety Code (NESC) – Basic Lightning Impulse Insulation Level (BIL) – Contamination Performance– Experience with Silicone Rubber Insulators in Salt Areas – Compaction – Grading Rings for Nonceramic Insulators - Maintenance of Insulators - Maintenance Inspection – Hotline washing – equivalent salt deposit.

Total Hours –45

REFERENCES:

1. Ravi S. Gorur, Edward A. Cherney and Jeffrey T. Burnham, “Outdoor Insulators”, Ravi S. Gorur. Inc., 1999.
2. J.S.T. Looms, “Insulators for High Voltages”, Peter Peregrinus Ltd., 1988.
3. A.O. Austin, “Porcelain Insulators”, Ohio Brass Company, 1980.
4. IEC 1109, “Composite Insulators for AC overhead lines with a Nominal Voltage Greater than 1000V, Definition, Test Methods and Acceptance Criteria”, 1992.
5. EPRI, “Transmission Lines Reference Book – 345kV and above”, 1982.
6. ANSI C 29.1, “Electrical Power Insulator – Test Methods”, 1992.

OUTCOMES:

Upon completing the Course, the student will be able to do the following:

- Become familiar with different stresses encountered in the service of the insulator as well as the types and performance of Insulators.

- Able to connect the current area of Research in insulators including non-ceramic insulators.
- Design and Manufacturing process of insulators can be understood.
- Ability to understand the various testing standards of insulating materials
- Ability to perform quality check of insulating materials.
- The testing standards, selection and maintenance of insulators will also be made aware.

EECX44 HIGH VOLTAGE TESTING TECHNIQUES L T P C
3 0 0 3

OBJECTIVES:

To acquire knowledge on,

- basics of condition monitoring of high voltage equipments
- pre-testing procedures by statistical evaluation methods.
- different types of testing and measurement techniques.

MODULE I INTRODUCTION 6

Objectives of high voltage testing, classification of testing methods- self restoration and non-self restoration systems-standards and specifications measurement techniques ,Diagnostic testing online measurement, standard test cells.

MODULE II STATISTICAL EVALUTION OF MEASURED RESULTS 8

Determination of probability values, Distribution function of a measured quantity, confidence limits of the mean values of disruptive discharges - 'Up and Down' method for determining the 50% disruptive discharge voltage, multi stress ageing, life data analysis.

MODULE III TESTING TECHNIQUES FOR ELECTRICAL EQUIPMENT 8

Testing of insulators, bushings, air break switches, isolators, circuit breakers, power transformers, voltage transformers, current transformers, surge diverters ,cable - testing methodology-recording of oscillograms - interpretation of test results.

MODULE IV NON-DESTRUCTIVE INSULATION TEST TECHNIQUES 8

Dynamic properties of dielectrics-dielectric loss and capacitance measurement-partial discharge measurements-basic partial discharge (PD) circuit - PD currents- PD quantities -Digital PD instruments and measurements, acoustic emission technique and UHF Techniques for PD identification, Corona and RIV measurements on line hardware.

MODULE V POLLUTION TESTS AND DESIGN OF HIGH VOLTAGE LAB 8

Artificial Pollution tests- salt-fog method, solid layer method, Dimensions of High voltage laboratory, equipment- fencing, earthing and shielding, circuits for high voltage experiments.

MODULE VI APPLICATION OF HIGH VOLTAGE ENGINEERING IN INDUSTRY **9**

Introduction – Electrostatic applications – Electrostatic precipitation, separation, painting coating,spraying, imaging, printing – Transport of materials – Sandpaper Manufacture – Smoke particle detector – Electrostatic spinning, pumping, propulsion – Ozone generation – Biomedical applications.

Total Hours – 45

REFERENCES:

1. Dieter Kind, Kurt Feser, "High voltage test techniques", SBA Electrical Engineering Series, New Delhi,1999.
2. Naidu M.S. and Kamaraju V., "High voltage Engineering", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2004.
3. Kuffel, E., Zaengl, W.S. and Kuffel J., "High Voltage Engineering Fundamentals", Elsvier India P Ltd, 2005
4. Gallagher, T.J., and Pearmain A., "High Voltage Measurements, Testing and Design", John Willey & Sons, New York, 1983.
5. IS, IEC and IEEE standards for "Dielectric Testing of High Voltage Apparatus" W.Nelson, Applied Life Data Analysis, John Wiley and Sons, New York, 1982.
6. W.Kennedy, "Recommended Dielectric Tests and Test Procedures for Converter Transformer and Smoothing Reactors", IEEE Transactions on Power Delivery, Vol.1, No.3, pp 161-166, 1986.
7. IEC - 60270, "HV Test technique - Partial Discharge Mechanism", 3rd Edition December 2000.
8. M.D Judd, Liyang, Ian BB Hunter, "P.D Monitoring of Power Transformers using UHF Sensors" Vol.21, No.2, pp5-14, 2004.
9. M.D Judd, Liyang, Ian BB Hunter "P.D Monitoring of Power Transformers using UHF Sensors Part II, Vol.21, No.3, pp 5-13, 2004.

OUTCOMES:

At the end of the course the student will be able to

- coordinate the various standards for testing of HV equipments
- Ability to evaluate the results by using statistical tools.
- familiarize with different testing techniques.
- To identify an appropriate non destructive testing technique for high voltage applications
- To demonstrate the pollution performance tests on high voltage equipments

- Ability to select, apply and perform testing on various high voltage electrical equipment using appropriate testing technique

EECX45	PULSED ELECTRIC FIELD AND FOOD PRESERVATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To acquire skills in the area of food preservation using pulsed electric field treatment.
- To study about different inactivation techniques used in pulsed electric field.

MODULE I FUNDAMENTALS OF PULSED ELECTRIC FIELD 7

Introduction- Methods of Applying Electricity – High Intensity PEF Processing System – Basics of High Intensity PEF – Energy Requirements – Applications of PEF in Food Preservation – Disadvantages of PEF.

MODULE II DESIGN OF PEF PROCESSING EQUIPMENT 8

Introduction – High Voltage Pulsers – Switches – Treatment Chambers – Cooling system – Typical Measurements in PEF system – Packaging and Storaging.

MODULE III MICROBIAL INACTIVATION IN ELECTRIC FIELDS 7

Introduction – Transmembrane Potential – Electromechanical Compression and instability – Osmotic Balance – Viscoelastic Model – Hydrophobic and Hydrophilic pores - Theories based on conformational changes – Electric Field induced structural changes.

MODULE IV PEF INDUCED BIOLOGICAL CHANGES 8

Introduction – Electropermeabilization – Electrofusion – Disruption and Biological Alteration – Electrical and Thermal Gradients induced by PEF on microbial cell membranes – Main factors in Microbial inactivation.

MODULE V PEF INACTIVATION OF VEGETATIVE CELLS SPORES AND ENZYMES IN FOODS AND FOOD PROCESSING BY PEF 7

Introduction – Microbial Inactivation – Inactivation of yeasts - E.Coli - S.Aureus– Lactobacillus – Bacillus – Salmonella – Pseuomonas - Inactivation of other microorganisms - Spore Inactivation – Standardization of inactivation assessment - Enzyme inactivation.

MODULE VI FOOD PROCESSING BY PEF 8

Microbial Analysis – Chemical and Physical Analysis – Sensory evaluation and Shelf life studies - Quality and Shelf Life Evaluation of PEF products – Processing of Apple

Juice, Orange Juice, Milk, Eggs and Green Pea Soup - Processing of Brine solutions and water in cooling systems.

Total Hours – 45

REFERENCES:

1. Gustavo V. Barbosa Canovas, M. Marcela gongora nieto, Usha R. Pothakamury, Barry G. Swanson, “Preservation of Foods with Pulsed Electric Fields”, Academic Press, 1999.
2. Javier Raso, Volker Heinz, “Pulsed electric field technology for the food industry, Fundamentals and applications”, Springer Science and Business Media, 2006.
3. Huub L. M. Lelieveld, S. L. H. Notermans, S. W. H. De Haan, “Food preservation by pulsed electric fields from research to application”, Wood head publishing limited, 2007.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Understand and analyze the PEF concept in different applications.
- Ability to study about the design of PEF processing equipments
- Ability to understand the various microbial inactivation techniques in electric feilds
- Ability to analyse electrical and thermal Gradients induced by PEF
- Study different inactivation techniques used in pulsed electric field.
- Ability to perform microbial ,chemical and physical analysis for food processing by PEF

COMPUTER SCIENCE & INFORMATION TECHNOLOGY

ITCX82	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

To enable the students to

- know the computer networking basics and the functions of different layers in OSI Model and TCP-IP Model.
- acquire the knowledge about the different error detection and correction methods and how the data flow is controlled in data communication.
- learn the internetworking protocols and how to apply the sub netting scheme to efficiently use the IP addresses by reducing the wastage of addresses.
- be conversant with the various transmission control protocols and congestion control mechanisms.
- be familiar with various application layer protocols .
- learn about cryptographic techniques and algorithms for network security.

Prerequisite: Computer Fundamentals

MODULE I DATACOMMUNICATIONS 8

Components - Direction of Data flow - networks - Components and Categories- types of Connections - Topologies -Protocols and Standards - OSI and TCP-IP Model- Transmission Media – Twisted Pair Cable - Coaxial Cable – Optical Fiber Cable - Line Coding .

MODULE II DATA LINKLAYER 8

Error detection and correction - Parity - CRC - Hamming code - Flow and Error control - stop and wait - go back-N ARQ - selective repeat ARQ- sliding window - HDLC - LAN - Ethernet IEEE 802.3 - IEEE 802.11 - Bridges.

MODULE III NETWORK LAYER 8

Internetworks - Packet Switching and Datagram approach – IPv4 and IPv6 - IP addressing methods - Sub netting – Routers - Routing - Distance Vector Routing - Link State Routing. Link State Routing

MODULE IV TRANSPORT LAYER 7

Process to Process delivery – Port Addressing - Multiplexing - Demultiplexing - Sockets - User Datagram Protocol (UDP) - Transmission Control Protocol (TCP) - Congestion Control - Quality of services (QOS).

MODULE V APPLICATION LAYER **7**

Domain Name System – Simple Message Transfer Protocol – Post Office Protocol – Internet Message Access Protocol - File Transfer Protocol – Hyper Text Transfer Protocol – World Wide Web.

MODULE VI CRYPTOGRAPHY **7**

Introduction – Symmetric Key Cryptography – Traditional ciphers – Simple Modern Ciphers – Modern Round Ciphers – Mode of operation – Asymmetric Key Cryptography – RSA Algorithm.

Total Hours – 45

TEXT BOOKS:

1. BehrouzA .Forouzan ,"Data Communication and Networking", 4th Edition, TataMcGraw-Hill,2017.

REFERENCES:

1. James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", Fifth Edition,PearsonEducation,2017.

2. Andrew S. Tanenbaum, David.J. Wetherall "Computer Networks", Fifth Edition, Pearson Education,2013.

3. William Stallings, "Data and Computer Communication", Tenth Edition,Pearson Education, 2017.

4. Paul Goransson ,Chuck Black, and Timothy Culver **"**Software Defined Networks: A Comprehensive Approach" Second Edition, Pearson Education, 2016.

OUTCOMES:

On successful completion of the course, the students will be able to

- Discuss the terminology and concepts of the OSI referencemodel & TCP-IP model and the various technologies & standards related networks.
- apply the error detection & correction methods and compare various flow control mechanisms in data communication
- design and apply appropriate sub netting scheme upon analyzing the requirements of the organization networking structure.
- illustrate the role of various transmission control protocols , how congestion in the networks can be controlled .
- explain the various services provided by network and the protocols related with each service.

- apply cryptographic techniques and algorithms for network security.
- design and apply appropriate sub netting scheme upon analyzing the requirements of the organization networking structure.
- illustrate the role of various transmission control protocols , how congestion in the networks can be controlled .
- explain the various services provided by network and the protocols related with each service.
- apply cryptographic techniques and algorithms for network security.

ITCX84 COMPUTER HARDWARE & INTERFACING

L	T	P	C
3	0	0	3

OBJECTIVES:

To enable the students to

- get a detailed knowledge of all the hardware components that make up a computer and understand the different interfaces required for connecting these hardware devices.
- know the insight about the CPU and memory
- understand the components of motherboard
- learn about the various storage devices
- study about the different I/O Peripherals and Bus Architecture
- learn the configuration of PC system

Prerequisite: Computer Architecture

MODULE I CPU AND MEMORY **8**

CPU essentials – Processor modes – Modern CPU concepts – Architectural performance features – The Intel's CPU – CPU over clocking – Over clocking requirements – over clocking the system – Over clocking the Intel processors – Essential memory concepts – Memory organizations – Memory packages –modules – Logical memory organizations – Memory considerations – Memory types – Memory techniques – Selecting and installing memory.

MODULE II MOTHERBOARDS **7**

Active motherboards – Sockets and slots – Intel D850GB – Pentium 4 mother board – expansion slots – Form factor – Upgrading a mother board – Chipsets – North bridge – South bridge – CMOS – CMOS optimization tactics – Configuring the standard CMOS setup – Motherboard BIOS – POST – BIOS features – BIOS and Boot sequences – BIOS shortcomings and compatibility issues – Power supplies and power management – Concepts of switching regulation – Potential power problems – Power management.

MODULE III STORAGE DEVICES **8**

The floppy drive – Magnetic storage – Magnetic recording principles – Data and disk organization – Floppy drive – Hard drive – Data organization and hard drive – Sector layout – IDE drive standard and features – Hard drive electronics – CD-ROM drive – Construction – CDROM electronics – DVDROM – DVD media – DVD drive and decoder.

MODULE IV I/O PERIPHERALS 7

Parallel port – Signals and timing diagram – IEEE1284 modes – Asynchronous communication - Serial port signals – Video adapters – Graphic accelerators – 3D graphics accelerator issues – DirectX – Mice – Modems – Keyboards –sound boards – Audio bench marks.

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MODULE V BUS ARCHITECTURE 8

Buses – Industry standard architecture (ISA), peripheral component Interconnect (PCI) – Accelerated Graphics port (AGP) – Plug-and-play devices – SCSI concepts – USB architecture.

MODULE VI PC SYSTEM 7

Scanners- types. Web and Digital camera. Printers – Dot Matrix – Laser, Inkjet. MODEMS and standards – Lap Top specifications – Configuration and Assembling of a latest PC System.

Total Hours –45

REFERENCES:

1. Craig Zacker & John Rourke, “The complete reference: PC hardware”, Tata McGraw-Hill, New Delhi, 2017.
2. Stephen J. Bigelow, “Trouble Shooting, maintaining and Repairing PCs”, Tata McGraw-Hill, New Delhi, 5th edition, 2001.
3. B. Ram and Sanjay kumar, “Computer Fundamentals Architecture & Organisation”, Fourth Edition, New Age International Pvt. Ltd., Publishers, 5th edition, 2014.
4. B. Govindarajulu, “IBM PC and Clones: Hardware, Troubleshooting and Maintenance”, TATA McGraw Hill, Second edition,2002.

OUTCOMES:

On successful completion of the course, the students will be able to

- describe and explain the difference between various analyses in computer field.
- differentiate issues related to CPU and memory.
- discuss about the various components of motherboard.
- explain the various storage devices
- feature the different I/O peripheral devices and their interfaces.
  design the PC System

ITCX86 **OPERATING SYTEMS** **L T P C**

3 0 0 3

OBJECTIVES:

To enable the students to

- Understand the overview of computer system and the operating system, the concepts of process, memory, and I/O management.
- summarize the various approaches for solving the problem of mutual exclusion in an operating system.
- compare and contrast the various CPU scheduling algorithms.
- elaborate conditions that lead to deadlock.
- enrich knowledge in memory hierarchy and cost-performance trade-offs.

Prerequisite: Programming concepts

MODULE I OPERATING SYSTEM TYPES 7

Introduction - Mainframe systems - Desktop Systems - Multiprocessor Systems- Distributed Systems - Clustered Systems - Real Time Systems – Handheld Systems - Hardware Protection - System Components - Operating System Services - System Calls .

MODULE II PROCESS SCHEDULING 8

Process Concept - Process Scheduling - Operations on Processes - Cooperating Processes - Inter-process Communication - CPU Scheduling - Basic Concepts - Scheduling Criteria - Scheduling Algorithms

MODULE III PROCESS SYNCHRONIZATION 7

The Critical-Section Problem - Synchronization Hardware - Semaphores - Classic problems of Synchronization – Monitors- Threads.

MODULE IV DEADLOCKS 7

System Model - Deadlock Characterization - Methods for handling Deadlocks - Deadlock Prevention - Deadlock avoidance - Deadlock detection – Recovery from Deadlocks.

MODULE V MEMORY MANAGEMENT 8

Swapping - Contiguous Memory allocation - Paging - Segmentation - Virtual Memory - Demand Paging - Page Replacement.

MODULE VI FILE SYSTEM & DISK MANAGEMENT 8

File Concept - Access Methods - Directory Structure - Protection - File System Structure - File System Implementation - Directory Implementation - Allocation Methods - Disk Structure - Disk Scheduling.

Total Hours –45

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 9 th Edition, John Wiley & Sons (ASIA) Pvt. Ltd, 2012.

REFERENCES:

1. Harvey M. Deitel, "Operating Systems", 2nd Edition, Pearson Education Pvt Ltd, 2004.
2. Andrew S. Tanenbaum, "Modern Operating Systems", Prentice Hall of India Pvt Ltd, 2014.
3. William Stallings, "Operating System", 5 th Edition, Prentice Hall of India, 2006
4. Dhamdhere D M, “Operating Systems”, Tata Mc Graw Hill, New Delhi, 2012.
5. Pramod Chandra P. Bhatt, "An Introduction to Operating Systems, Concepts and Practice", PHI, 2014.

OUTCOMES:

On successful completion of the course, the students will be able to

- discuss the different types of systems and operating system services.
- implement the various scheduling techniques and evaluate their performance.
- analyze the issues in process synchronization and implement multithreaded programs using synchronization tools.
- analyze and manage deadlocks in multi process environment.
- discuss the concepts of primary and virtual memory management.
- elaborate the concepts of file and disk management.

ITCX81 DATABASE MANAGEMENT SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

To enable the students to

- Describe essential features of database management systems and its use.
- Be familiar to identify about the procedural and non-procedural language.
- Mastering the design principles of databases, as well as in the normalization approach.
- Provide the description of physical file structures and access methods.
- Be familiar with the basic concepts of transaction processing and concurrency control.
- Master in the advanced topics and current trends.

Prerequisite: Knowledge on Programming,Data structures and Algorithm.

MODULE I INTRODUCTORY CONCEPTS 7

General Introduction to database-Traditional file system and database-Database system three tier architecture- various components of database- Data models-Modeling using ER model.

MODULE II RELATIONAL ALGEBRA AND SQL LANGUAGE 8

Unary Operations: Select and Project-Relational Set operations -Binary Relational operators.SQL: Data definition Language in SQL-Basic constraints in SQL- Basic Queries in SQL- Joins and Aggregate functions.

MODULE III DATABASE DESIGN AND DATA STORAGE 8

Functional dependencies- Normal forms up to BCNF- Dependency preserving and Lossless decomposition. Storage File organization: Memory Hierarchies-Secondary Storage devices-Magnetic tape storage device. Files - Operations on files.

MODULE IV INDEXING AND TRANSACTION PROCESSING 8

Indexing -Different type of index - B tree and B+ trees: Insertion and Deletion.

Introduction to transaction processing: Need for Concurrency and recovery-Transaction states- ACID properties- Schedules based on Serializability. Characterizing schedules based on Recoverability: Recoverable-Non-recoverable schedules.

MODULE V CONCURRENCY AND RECOVERY TECHNIQUES 8

Concurrency control techniques: Locking, Basic Two-phase locking (2PL) protocol, Timestamp-ordering based protocol, Deadlock. Database recovery techniques: Immediate update, deferred update, Shadow paging, and Checkpoint.

MODULE VI ENHANCED DATA MODEL FOR SPECIFIC APPLICATIONS 6

Overview of object oriented concepts- Temporal databases-Introduction to multimedia and spatial databases- Distributed databases and issues-Types of distributed database systems-XML documents and XML Querying-Data mining concepts.

Total Hours –45

TEXT BOOKS:

1. Elmasri, R., & Navathe, S. B. “Fundamentals of database systems” (7th Edition) Pearson Education, 2017.
2. Silberschatz, A., Korth, H. F., & Sudarshan, “Database system concepts” McGraw-Hill. ,(International Edition) (6th ed.). New York, 2011.

REFERENCES:

1. Raghu Ramakrishnan, “Database Management System”, 3rd Edition, Tata McGraw-Hill Publishing Company, 2003.
2. Peter Rob and Corlos Coronel- “Database System, Design, Implementation and Management”, 5th edition, 2003.
3. C J Date, “An Introduction to Database System”, 8th Edition, 2004.

OUTCOMES:

On successful completion of the course, the students will be able to

- Summarize the vital concepts and architecture associated with DBMS
- Describe relational database using SQL.
- Apply normalization techniques in database design.
- Understand database file organization and indexing.
- Use the transaction processing and concurrency control for application software.

  Apply the knowledge in current trends of database system.

ITCX88 PYTHON PROGRAMMING

L	T	P	C
2	0	1	3

OBJECTIVES:

- To understand the fundamentals of python programming.
- To develop python programs with conditional loops.
- To define and declare functions and call them.
- To explore file input and output operations.
- To develop simple data structures using python.

To study OOPS concepts using python programming

Pre requisites: Computer Fundamentals, Programming in 'C' or C++.

MODULE I PYTHON BASICS 8

Overview and fundamentals of python, executing simple programs, exploring python variables, operators and comprehend python blocks.

MODULE II DATA TYPES AND PROGRAM FLOW CONTROLS 7

Basic data types, numeric data types, string and string operations, list data types and slicing, tuples and its types, conditional blocks, control statements, looping statements, break statements, for loop, while loop using strings and dictionaries.

MODULE III FUNCTIONS , PACKAGES AND MODULES 8

Organize functions using python code, import libraries and methods internally and externally, usage of external packages, powerful functions in python, understanding packages.

MODULE IV BULIDING BLOCKS OF PYTHON – METHODS 7

String and dictionary manipulations, list manipulation using in build methods, programming using string, list and inbuilt functions. Exception handling and programs

.

LABORATORY PRACTICE:

1. Implementation of simple python program by installing and exploring python IDE.
2. Programs to implement basic data types, tuples, strings, numeric data types and list data types.
3. Implement control statements and conditional blocks.
4. Implement looping statements – for, while and do-while.

5. Implement strings and dictionaries.
6. Programming using functions in python
7. Programming powerful functions in python.
8. Import basic packages and libraries and execute programs
9. Build methods using list and basic data structures.
10. Implement exception handling using python programs

L – 30; P – 30; Total Hours –60

TEXT BOOKS:

1. Kenneth A. Lambert, “Fundamentals of Python: First Programs”, CENGAGE Learning, 2012.
2. Charles Dierbach, “Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.

REFERENCES:

1. John V Guttag, “Introduction to Computation and Programming Using Python’’, Revised and expanded Edition, MIT Press , 2013.
2. Kenneth A. Lambert, “Fundamentals of Python: First Programs”, CENGAGE Learning, 2012.
3. Robert Sedgewick, Kevin Wayne, Robert Dondero, “Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.
4. Timothy A. Budd, “Exploring Python”, Mc-Graw Hill Education (India) Private Ltd., 2015.

OUTCOMES:

Upon Completion of course the students will be able to :

- write and execute python programs
- develop simple python programs to solve problems.
- explore libraries in python and molder programs to functions
- develop data structures based on python programs

ITCX83 JAVA PROGRAMMING L T P C

2 0 2 3

OBJECTIVES:

To enable the students to

- understand the basic concepts of object oriented programming using java.
- acquire knowledge and skills for developing Graphical User Interface (GUI) using java.

  understand java database connectivity for web and enterprise application development.

MODULE I JAVA FUNDAMENTALS 7

Introduction to java- Features - Java virtual machine - Byte code interpretation - Programming structures- Data types - variable-expressions- operators-arrays-,strings-input -output and control structures.

MODULE II OBJECTS AND CLASSES 8

Introduction to object oriented programming-Classes -objects-constructors-static fields-static methods-packages- inheritance-polymorphism-abstract class-reflection-interface and inner class.

MODULE III EXCEPTION HANDLING AND IO STREAMS 7

Exception handling fundamentals-types- Try -catch- finally – throws - java's built-in exceptions-IO basics-byte streams-character streams-reading and writing files- Java Thread model - Thread Life cycle - thread class-runnable interface-thread creation.

MODULE IV GUI AND DATABASE PROGRAMMING 8

Swing components – JApplet, JButton, JFrame -Event handling -Actions-Mouse events- Layout managers- Design of JDBC-JDBC configuration -sql query execution-results set -row sets -transactions.

LIST OF EXPERIMENTS

1. Java program using control statements,loop statements and decision making.
2. Java program for string handling
3. Java program to demonstrate inheritance and polymorphism.
4. Implementing Exception handling using java program,
5. Java programs to implement thread using thred class and runnable interface.

6. Java programs for database connectivity using JDBC-ODBC connectivity.
7. Java programs for layout manager.
8. Java program using swing GUI components and applets.

L – 30; P – 30; Total Hours –60

TEXT BOOKS:

1. Cay S. Horstmann and Gary Cornell, “Core Java: Volume I – Fundamentals”, 9th Edition, Prentice Hall, 2013.
2. Cay S. Horstmann and Gary Cornell, “Core Java: Volume II–Advanced features”, 9th Edition, Prentice Hall, 2013.

REFERENCES:

1. Herbert Schildt, "Java: The Complete Reference", 9th Edition, Oracle Press,2017.

   K. Arnold and J. Gosling, “The JAVA programming language”, 4th Edition, Addison Wesley Professional,2005.

OUTCOMES:

OUTCOMES:

At the end of the course completion, the student is able to :

- Express the basic concepts of java programming.
- Apply the knowledge of objects, classes, streams, multi-threading and GUI for developing java application.
- Develop small scale customised applications using java.

ITCX87 INTERNET OF THINGS L T P C

3 0 0 3

OBJECTIVES:

- To introduce the basics of Internet of things.
- Utilize IoT features and create applications based on IoT middleware and protocols.
- To discuss the features of cloud of things.
- Outline the embedded prototyping and apply the use of IoT devices in IoT Technology.
- To explain real world IoT design with API techniques.

MODULE I INTRODUCTION 8

IoT Functional Requirements –Motivation – IoT Architecture (IoT-A) – Ubiquitous IoT Applications – Vertical IoT Applications - Four Pillars of IoT – M2M (Internet of Devices) – RFID (Internet of Objects) – WSN (Internet of Transducers) – SCADA (Internet of Controllers) DNA of IoT – DCM – Device – Things that Talk – Connect – Via Pervasive Networks – Manage – To Create New Business Value Middleware for IoT: Overview – Communication middleware for IoT.

MODULE II MIDDLEWARE & PROTOCOLS FOR IOT 8

Overview of Middleware – Communication Middleware for IoT – MTC/M2M – SCADA – RFID – WSN – Protocol Standardization for IoT – M2M and WSN Protocols - SCADA and RFID Protocols - – Issues with IoT Standardization - – Unified Data Standards - Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus – KNX – ZigBee.

MODULE III CLOUD OF THINGS 8

Cloud Computing – Cloud Middleware – Cloud Standards – Cloud Providers and Systems - Mobile Cloud Computing - Cloud of Things Architecture – Deployment Models – Vertical Applications – Essential Features – Technological Pillars – Layers of IoT Systems

MODULE IV DESIGN PRINCIPLES OF CONNECTED DEVICES 7

Technology for design – Privacy in storing data – Internet principles for connected devices- Prototypes and production – Changing embedded platform – Open source versus closed source.

MODULE V PROTOTYPING EMBEDDED DEVICES 7

Prototyping embedded devices – Electronics- Sensors – Actuators – Arduino – Raspberry PI – Beagle Bone Black – Electric Imp.

MODULE VI **PROTOTYPING ONLINE COMPONENTS AND EMBEDDED CODING** **7**

Sketch – Iterate and Explore – Preparation of physical prototype – Getting started with API – Writing New API – Other Protocols – Techniques for Writing Embedded code – Libraries and Debugging.

Total Hours –45

TEXT BOOKS:

1. Honbo Zhou, “The Internet of Things in the Cloud: A Middleware Perspective”, CRC Press, 2012.
   Olivier Hersent, David Boswarthick, Omar Elloumi, “The Internet of Things – Key applications and Protocols”, Wiley, 2012.

REFERENCES:

1. Adrian McEwen & Hakim Cassimally, “Designing internet of things”, Jhon Wiley and Sons, 2014.
2. Dieter Uckelmann; Mark Harrison; Florian Michahelles-(Eds.), “Architecting the Internet of Things” Springer, 2011.

OUTCOMES:

Upon Completion of course the students will be able to :

- Identify and analyze the new models for market strategic interaction
- Analyze various middleware and protocols for IoT
- Analyze Cloud of things with features and applications
- Design the principles of connected devices
- Identify the prototyping with various embedded devices
- Analyze and design different prototypes for embedded devices and API techniques

ITCX85	CLOUD COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn about cloud computing basics.
- To know the various technologies available for cloud platforms.
- To understand the cloud storage service and standards to access cloud service providers.
- To learn virtualization technology over various open source cloud tools to monitor the cloud performance.
- To understand security and challenges in cloud.
-

MODULE I CLOUD COMPUTINGBASICS 8

Cloud Computing Overview- Cloud Components – Infrastructure – Services- Applications- Storage – Database services- Intranets and Cloud- Components- Hypervisor applications- Cloud providers- Amazon, Google, Microsoft- Benefits and Limitations of Cloud.

MODULE II CLOUD COMPUTINGTECHNOLOGY 7

Hardware and Infrastructure – Thick and thin clients –Security–Network- Services- Accessing the cloud – Cloud Platforms– Web Applications – Web API"s – Web Browsers – Google App Engine.

MODULE III CLOUD STORAGE 8

Storage as a Service – Cloud Storage Providers – Amazon S3- Nirvanix- Google Big Table Data store- Standards- Application- Client- Infrastructure-Service-Google File System.

MODULE IV VIRTUALIZATION TECHNOLOGY 7

Virtualization Technology - Overview - Virtual Machines Provisioning and Manageability - Virtual Machine Migration Services - VM Provisioning and Migrationin Action – VMLife Cycle N and VM Monitoring – Amazon Elastic Compute Cloud.

MODULE V DEVELOPING APPLICATIONS 7

Google- Payment- Force.com and Google- Google Gears- Microsoft- Live Services- Microsoft SQL services- Microsoft Share point services- Dynamic CRM Services- Development- Google App Engine-Salesforce.com- Microsoft Windows Azure.

MODULE VI SECURITY MANAGEMENT 8

Cloud Security Fundamentals- Security requirements- Security Management in cloud- Availability management – Access control- Vulnerability management- Patch management-Configuration Management- Security Management functions for Cloud Delivery models-security responsibilities for customers of public cloud services-Case Study example for IaaS, PaaS, SaaS.

Total Hours –45

TEXT BOOKS:

1. AnthonyT.Velte,TobyJ.Velte,RobertElsenpeter,"CloudComputing:A PracticalApproach",McGraw-Hill,2010.
2. Tim Malhar, S.Kumaraswammy, S.Latif, "Cloud Security & Privacy",SPD, O"REILLY2009.
3. RajkumarBuyya,JamesBroberg,AndrzejGoscinski,"CloudComputingPrinciples and Paradigms", John Wiley & Sons, Inc Publications,2011

REFERENCES:

1. Kai Hwang, Fox and Dongarra, Morgan Kaufmann, "Distributed andCloudComputing", 1st Edition, Elseiver,2012.
2. ScottGranneman,"GoogleAppsDeciphered:Computeinthecloudto streamline your desktop", Pearson Education,2009.
3. Thomas Erl , Ricardo Puttini , Zaigham Mahmood, "Cloud Computing: Concepts, Technology & Architecture", Prentice –Hall, 2013

OUTCOMES:

- Discuss the core concepts of cloud computing paradigm.
- Analyze services, systems, platforms, frameworks to support cloud computing.
- Illustrate the concepts of cloud storage system services.
- Assess virtualization technology services in open source cloud computing environment.
- Can deploy the applications developed in cloud.
- Identify cloud security issues to demonstrate real time applications.

ELECTRONICS, COMMUNICATION, INSTRUMENTATION AND CONTROL

ECCX81	IMAGE PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Describe and explain basic principles of digital image processing;
- Design and implement algorithms that perform basic image processing
- Design and implement algorithms for advanced image analysis
- Assess the performance of image processing algorithms and systems

MODULE I DIGITAL IMAGE FUNDAMENTALS 8

Components of Image Processing System, Elements of Visual Perception, MTF of VisualSystem, Image Sensing and Acquisition, Image formation model, Image Sampling &Quantization Spatial and Gray Level Resolution, Basic Relationships between Pixels.Statistical parameters, Measures and their significance, Mean, standard deviation,variance, SNR, PSNR.

MODULE II IMAGE ENHANCEMENT 7

Enhancement in Spatial Domain: basic gray level transformations, histogram processing,equalization, Arithmetic and logical operations between images, Basics of spatial filtering,smoothening and sharpening spatial filters. Image Enhancement in frequency Domain:smoothening and sharpening frequency domain filters. Fundamental of color imageprocessing: color models, RGB, CMY, YIQ, HIS. Pseudo Color Image processing: Intensityfiltering, gray level to color transformation, Basics of full color image processing.

MODULE III IMAGE TRANSFORMS 7

2D-DFT, FFT, DCT, the KL Transform, Walsh/Hadamard Transform, Haar Transform.

MODULE IV IMAGE CODING AND COMPRESSION 7

Image Coding Fundamentals, Image Compression Model, fundamentals-redundancy: coding, interpixel, psychovisual, fidelity criteria, elements of information theory. Error FreeCompression - variable length, bit plane, Lossless Predictive, Lossy Compression- LossyPredictive. Fundamentals of JPEG, MPEG, fractals.

MODULE V IMAGE ANALYSIS 7

Edge detection, spatial feature and boundary extraction, boundary representation by

chain codes and B splines, Hough Transform. Morphological Image Processing: Dilation, Erosion, Opening, Closing on Binary Images, Segmentation: Point, line. Edge detection, Boundary detection and Thersholding.

MODULE VI IMAGE RESTORATION AND IMAGE PROCESSING APPLICATIONS 9

Image Degradation Model, Noise Models, and Restoration in Presence of Noise in spatial Domain, Linear Filtering, Applications: Character Recognition, Fingerprint Recognition, Remote Sensing. Applications using different Imaging modalities such as acoustic Imaging, Medical imaging, electron microscopy etc.

Total Hours –45

TEXT BOOKS:

1. Gonzalez and Woods, "Digital Image Processing", Pearson Education, 2009.
2. Arthur Weeks Jr., "Fundamentals of Digital Image Processing", PHI, 2006.

REFERENCES:

1. A. K. Jain, "Fundamentals of Digital Image Processing"; PHI, 2006
2. Pratt William, "Digital Image Processing", John Wiley & Sons, 2007.

OUTCOMES:

At the completion of the course, students will be able to

- Explain the fundamental concepts of digital image processing.
- Recognize & apply various image enhancement techniques.
- Apply various transforms for image processing.
- Identify and use appropriate image compression techniques
- Apply various techniques for image analysis and restoration.
- Apply suitable image processing techniques in different applications

ECCX82	VLSI DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

This course teaches:

- Basic concepts of HDL.
- Verilog language and its syntax constructs.
- Programmable Logic Devices and FPGAs
- MOS devices theory
- CMOS based combinational and sequential circuits

MODULE I REVIEW OF BASIC DIGITAL SYSTEMS 7

Boolean algebra, Building blocks of combinational logic design-Adders, multiplexer,
encoder, decoder, comparator, Latches & flip-flops, counters, shift registers, State diagram,
State Reduction and State Assignments.

MODULE II LOGIC DESIGN USING VERILOG HDL 8

Overview of Digital Design with Verilog HDL, Levels of Design Description, Concurrency,
Hierarchical Modeling Concepts, Modules and Ports, Component instantiation Data flow
and RTL, structural, gate level, switch level modeling and Behavioral Modeling.

MODULE III LANGUAGE CONSTRUCTS OF VERILOG HDL 7

Identifiers- gate primitives, gate delays, operators, timing controls, procedural assignments,
conditional statements Variable types, arrays and tables, Tasks and functions, Test bench.

MODULE IV BUILDING BLOCKS OF DIGITAL VLSI SYSTEMS 8

HDL Design -Data Path Operations-Addition/Subtraction, Parity Generators, Comparators,
Zero/One Detectors, Binary Counters, ALUs, Multiplication, Shifters, Memory Elements,
Control-FSM, Control Logic Implementation. Programmable logic elements and AND-OR
arrays, FPGAs and CPLD, programming methods.

MODULE V TRANSISTOR THEORY 7

Introduction to MOS Transistors-NMOS & PMOS Characteristics, Current Equations, Complementary CMOS Inverter-DC Characteristics, Static Load MOS Inverters, Differential
Inverter, Tri State Inverter, BiCMOS logic.

MODULE VI BASICS OF DIGITAL CMOS DESIGN 8

NMOS & PMOS Logic Gate, CMOS Logic Gate, Basic layout design of simple gate-stick
diagram, CMOS Logic Structures-full adder, multiplexers,pass transistor circuits, Transmission Gate, Dynamic CMOS circuit techniques

Total Hours –45

REFERENCES:

1. M.Morris Mano "Digital Design", 3rd Edition, Prentice Hall of India Pvt. Ltd New Delhi 2003
2. Michael D. Ciletti“Advanced Digital Design with the Verilog HDL" (2nd Edition) Hardcover – January 31, 2010
3. J.Bhasker: Verilog HDL primer, BS publication, 2001.
4. J. P. Uyemura, "Introduction to VLSI Circuits and System", Wiley, 2002
5. Neil Weste and K. Eshragian, “Principles of CMOS VLSI Design: A System Perspective,” 2nd edition, Pearson Education (Asia) Pvt.Ltd., 2000
6. Douglas A Pucknell& Kamran Eshragian , “Basic VLSI Design” PHI 3rd Edition (original edition – 1994)

OUTCOMES:

At the end of the course the students will be able to

- Create basic Register Transfer Level (RTL) models for combinational circuits &
- Sequential circuits using Verilog HDL.
- Create basic behavioral models for combinational circuits & Sequential circuits using
- Verilog HDL.
- Describe the usage of Programmable Logic Devices and FPGAs.
- Describe MOS devices theory and inverter circuit DC characteristics
- Design the basic digital building blocks using MOS circuit.
- Apply VLSI design concepts based on the requirements to conduct

experiments or projects.

ECCX83	INTEGRATED CIRCUITS AND SYSTEM DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

.To introduce the students to active and passive components available in CMOS and their parasitic elements of first order transistor modelling for initial manual design and the limits of applicability.

• To teach the student behaviour and design of basic analogue and digital circuit primitives, including quantitative treatment of matching.

• The students are introduced to switched capacitor techniques and continuous time filters.

MODULE I BASIC SEMICONDUCTOR PHYSICS 7

Quantum mechanical concepts and atomic states – Solid state structure – Intrinsic, Extrinsic and compensated semiconductors – Lattice vibrations – Electron and hole mobilities and drift velocities.

MODULE II DEVICES 7

Diode - CMOS – Wire models – CMOS inverter - Static behavior, Dynamic Behavior, Power, Energy.

MODULE III DIGITAL SYSTEMS 7

DTL IC – HTL IC – TTL IC – ECL IC – Basic digital circuits – Special Purpose gates – Flip flops – Clock and waveform generators.

MODULE IV SEQUENTIAL AND COMBINATIONAL LOGIC DESIGN 8

Ripple Adder, Look Ahead Carry Generator, Binary Parallel Adder, n-Bit Parallel Subtractor, Priority Encoder, Design considerations of the above combinational logic circuits with relevant Digital ICs. MSI Registers - Shift Registers - Modes of Operation of Shift Registers, Ring Counter, Johnson Counter -Basic sequential logic Design steps - Design considerations of the above sequential logic circuits with relevant Digital ICs.

MODULE V ANALOGUE INTEGRATED CIRCUIT DESIGN 8

CMOS amplifier basics – Current and Voltage sources – CMOS operational amplifiers – Data conversion circuits.

MODULE VI SYSTEM DESIGN EXAMPLES 8

Frequency counter – DACs and ADCs – Filter design - Filter response, Low pass RC active filter, Bandpass RC active filter, Switched C filter – Combinational logic design.

Total Hours –45

REFERENCES:

1. Michael Shur, “Physics of Semiconductor Devices”, Prentice Hall, 2004.
2. B.S. Sonde, “Introduction to system design”, New Age International, 2003.
3. Razavi B., “Design of Analog CMOS Integrated Circuits”, McGraw Hill, 1998.
4. John F. Wakerly, “Digital Design Principles & Practices”, PHI Publications, 3rd Edition, 2005.
5. Jan M.Rabaey, Anantha Chandrakasan, Borivoje Nikolic, “Digital Integrated Circuits-A Design Perspective Pearson Education”, 2005.
6. Alan B. Marcovitz, “Introduction to Logic Design”, TMH, 2nd Edition, 2005.
7. Mano, “Digital Logic and Computer Design”, Pearson Education, 2000.

OUTCOMES:

. At the end of the course, the student is expected to posses knowledge and achieve skills on the following:

• The student has a thorough understanding of the characteristic and design aspects of IC circuits.
• The student will be able to build simple digital and analogue ICs.

ECCX84 COMMUNICATION SYSTEM SECURITY

L	T	P	C
3	0	0	3

OBJECTIVES:

• To familiarize the students with the issues and technologies involved in designing a communication network system that is robust against attack.

• Students will gain an understanding of the various ways in which a network can be attacked and the tradeoffs in protecting it.

MODULE I NETWORK FUNDAMENTALS AND PHYSICAL LAYER 7

Introduction to Networks - definition of layers – services - interface and protocols - OSI reference model - layers and duties - TCP/IP reference model – layers and duties - Physical layer - general description – characteristics - signaling media types – topologies - examples physical layer (RS232C, ISDN, ATM, SONET).

MODULE II INTRODUCTION ON SECURITY 7

Security Goals, Types of Attacks - Passive attack, active attack, attacks on confidentiality, attacks on Integrity and availability - Security services and mechanisms, Techniques – Cryptography - Steganography - Revision on Mathematics for Cryptography.

MODULE III SYMMETRIC & ASYMMETRIC KEY ALGORITHMS 7

Substitution Ciphers - Transposition Ciphers - Stream and Block Ciphers - Data Encryption Standards (DES) - Advanced Encryption Standard (AES) - RC4 - principle of asymmetric key algorithms - RSA Cryptosystem.

MODULE IV INTEGRITY, AUTHENTICATION AND KEY MANAGEMENT 8

Message Integrity - Hash functions – SHA - Digital signatures - Digital signature standards - Authentication Entity Authentication – Biometrics - Key management Techniques.

MODULE V NETWORK SECURITY, FIREWALLS AND WEB SECURITY 8

Introduction on Firewalls - Types of Firewalls - Firewall Configuration and Limitation of Firewall - IP Security Overview - IP security Architecture - authentication Header - Security payload - security associations - Key Management - Web security requirement - secure sockets layer - transport layer security - secure electronic

transaction - dual signature.

MODULE VI WIRELESS NETWORK SECURITY 8

Security Attack issues specific to Wireless systems - Worm hole – Tunneling - DoS.WEP for Wi-Fi network - Security for 4G networks - Secure Ad hoc Network - Secure Sensor Network.

Total Hours –45

REFERENCES:

1. Behrouz.A. Forouzan, “Data Communication And Networking”, 4th Edition, Tata McGraw Hill, 2007.
2. John C. Bellamy, “Digital Telephony”, 3rd Edition, John Wiley 2006.
3. Nichols and Lekkas, “Wireless Security – Models, Threats, and Solutions,” McGraw-Hill, 2002.
4. Behrouz A. Fourcuzan, “Cryptography and Network security”, Tata McGraw-Hill, 2008.
5. William Stallings, "Cryptography and Network security- principles and practice", 2nd Edition, Prentice Hall of India, New Delhi, 2002.
6. Atul Kahate, ”Cryptography and Network security”, 2nd Edition, Tata McGraw Hill, 2008.
7. R.K.Nichols and P.C. Lekkas , “Wireless Security”, 2000.

OUTCOMES:

.At the end of the course, the student is expected to posses knowledge and achieve skills on the following:

• Students will gain an appreciation of the need to develop an understanding of underlying system applications and potential security issues early in the design process.

ECCX85 EMBEDDED HARDWARE & SOFTWARE SYSTEM DESIGN **L T P C 3 0 0 3**

OBJECTIVES:

• The objective of this course is to present to the student the computation devices, peripherals and networks associated with an embedded system.

• The students are introduced to embedded - C used in the design of a modern day embedded system.

MODULE I ARCHITECTURE OF EMBEDDED SYSTEMS 7

Categories of Embedded Systems - Specifications of Embedded systems -Resent trends in Embedded Systems - Hardware Architecture - Software Architecture - Communication software - Process of generation of executable image- development/testing tools.

MODULE II HARDWARE FUNDAMENTALS 7

Buses – DMA – interrupts – Built-ins on the microprocessor – Conventions used on schematics – Microprocessor Architectures – Software Architectures – RTOS Architectures – Selecting and Architecture. PIC microcontroller - Architecture of PIC 16c6x/7x – FSR - Reset action – Oscillatory connection - Memory organization - Instructions - Addressing modes - I/O ports – Interrupts – Timers – ADC - Assembly language programming.

MODULE III RTOS 7

Tasks and Task states – Semaphores – Shared data – Message queues, Mail boxes and pipes – Memory management – Interrupt routines – Encapsulating semaphore and queues – Hard Real-time scheduling – Power saving.

MODULE IV PROGRAMMING EMBEDDED SYSTEMS 8

Embedded Program – Role of Infinite loop – Compiling, Linking and locating – downloading and debugging – Emulators and simulators processor – External peripherals – Memory testing – Flash Memory.

MODULE V OPERATING SYSTEM 8

Embedded operating system – Real time characteristics – Selection process – Flashing the LED – serial ports – Zilog 85230 serial controlled code efficiency – Code size – Reducing memory usage.

MODULE VI EMBEDDED SOFTWARE DEVELOPMENT TOOLS 8

Host and target machines – Linkers / Locators for Embedded Software – Debugging techniques – Instruction set simulators Laboratory tools – Practical example – Source code.

Total Hours –45

REFERENCES:

1. David E.Simon, “An Embedded Software Primer”, Pearson Education, 2003.
2. Michael Bass, “Programming Embedded Systems in C and C++”, Oreilly, 2003.
3. K.V.K.K.Prasad, “Embedded /Real-Time Systems-Concepts, Design and Programming”, Dream tech, Wiley, 2003.
4. Ajay V Deshmukh, “Microcontroller Theory and Applications”, Tata McGraw Hill, 2005.
5. Raj Kamal, “Embedded Systems Architecture Programming and Design”, 2nd Edition, TMH, 2008.
6. David E Simon, “An Embedded Software Primer”, Pearson Education, 2003.
7. Daniel 5.W Lewis, “Fundamentals of Embedded Software”, Pearson Education, 2001.
8. Peatman, “Designing with PIC Micro Controller”, Pearson, 2003.

OUTCOMES:

.At the end of the course, the student is expected to posses knowledge and achieve skills on the following:

• Will provide a knowledge foundation which will enable students to pursue subsequent courses in real-time embedded systems software and computer design.

ECCX86 DIGITAL SIGNAL PROCESSORS L T P C
3 0 0 3

OBJECTIVES:

- To impart knowledge on the architectural details and instruction set of TMS320F2812 processor.
- To provide practical experience with Digital Signal Processors.
- To Introduce Code Composer Studio IDE for C 2000 Processors.
- To implement DSP Processor in real time Digital Motor Control application.

MODULE I ARCHITECTURE OF F2812 6

TMS320F2812 Architecture - The F2812 CPU-F2812 Math Units-Data Memory Access -Internal Bus Structure- Atomic Arithmetic Logic Unit (ALU) -Instruction Pipeline - Memory Map - Code Security Module - Interrupt Response- Operating Modes - Reset Behaviour.

MODULE II PROGRAM DEVELOPMENT TOOLS 8

Code Composer Studio IDE - The Software Flow - Code Composer Studio – Basics - Lab Hardware Setup - Code Composer Studio – Step by Step procedure - Createa project - Setup Build Options Linker Command File - Download code into DSP - beginner's project - Objective Procedure - Open Files, Create Project File- C28xFlash Programming - C28x Start-up Sequences -C28x Flash Memory SectorsFlash Flash Configuration Registers - Flash Programming Procedure .

MODULE III DIGITAL I/O 7

Data Memory Mapped Peripherals - The Peripheral Frames - Unit Digital I/O Registers Module - Watchdog Timer - System Control and Status Register - Low Power Mode – Digital Input / Output programmes.

MODULE IV INTERRUPT SYSTEM 8

C28x Core Interrupt Lines - The C28x RESET - Reset Bootloader - Interrupt Sources - Maskable Interrupt Processing - Peripheral Interrupt Expansion - C28x CPU Timers - Serial Peripheral Interface (SPI) Data Transfer - SPI Registers - SPI communication.

MODULE V C28X EVENT MANAGER AND C28X ANALOGUE DIGITAL CONVERTER 8

Event Manager Block Diagram - General Purpose Timer Timer Operating Modes - Interrupt Sources - GP Timer Registers - GP Timer Interrupts - Event

ManagerCompare Units Capture Units - Quadrature Encoder Pulse Unit (QEP).- Generate a PWM sine wave -.ADC Module Overview - ADC in Cascaded Mode -ADC in Dual Sequencer Mode - ADC Register Block .

MODULE VI DIGITAL MOTOR CONTROL APPLICATIONS 8

C28x IQ – Math Library - IQ – Math Library Functions - IQ- Math Application- FOC - C28x FIR – Filter - Texas Instruments C28x Filter Library - C28x Digital Motor Control - Field Orientated Control (FOC) Core Math Operations - PARK Transform - CLARKE Transform - Texas Instruments Digital Motor Control Library Modules. FOC for PMSM - Hardware Laboratory Setup - PMSM control project – Build levels.

Total Hours –45

REFERENCES:

1. Code Composer Studio User's Guide Literature Number: SPRU328February 2000, Copyright © 1999-2000, Texas Instruments Incorporated.

2. TMS320F2810, TMS320F2811, TMS320F2812, TMS320C2810,TMS320C2811, TMS320C2812 Digital Signal Processors Data Manual,Copyright © 2001–2012, Texas instrument Incorporated.

3. TMS320F2812 DIGITAL SIGNAL PROCESSOR IMPLEMENTATIONTUTORIAL – Texas instruments.

4. B. B. Venkatramani & M.Bhaskar, " Digital Signal Procesors architecture,Programming and applications, Tata McGraw Hill 2002.

5. TMS320F/C24/X DSP controllers, Refernce guide literature No : SPRU160c, June 1994.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Programming Knowledge in DSP and its real time application.
- To configure DSPBIOS to handle hardware interrupts (HWI)
- Implementing Digital Motor Control Library Modules.
- Computing steps necessary to build a control scheme for Field Oriented
- Control (FOC).
- Board level operations of the Digital Signal Processors (DSP)based on the
- Texas Instruments TMS320F2812 Processor.

EICX81	BIO INSTRUMENTATION AND SIGNAL ANALYSIS	L	T	P	C
		3	0	0	3

OBJECTIVES:

• To provide an acquaintance of the physiology of the brain , heart and lungs.

• To introduce the student to the biosensors, electrodes and amplifiers.

• To introduce the typical measurement and devices of bio-electric origin.

• To provide the latest ideas on devices of imaging techniques and monitoringand awareness of electrical safety of medical equipments.

• To bring out the importance of bio-signal analysis and diagnosis.

MODULE I ANATOMY AND PHYSIOLOGY 7

Basic components of a biomedical system, Cell and its structure – Action and resting – Potential propagation of action potential – Sodium pump – Nervous system – Nerve cell – Synapse – Cardio pulmonary system – Physiology of heart and lungs – Circulation and respiration.

MODULE II TRANSDUCERS AND AMPLIFIERS 7

Transducers – Different types – Piezo-electric, ultrasonic, resistive, capacitive, inductive transducers – Selection criteria. Electrodes – Micro, needle and surface electrodes – Amplifiers – Preamplifiers, differential amplifiers, chopper amplifiers – Isolation amplifier- ECG isolation amplifiers.

MODULE III ELECTRO – PHYSIOLOGICAL MEASUREMENTS 7

ECG – EEG – EMG – ERG – Lead systems and recording methods – Typical waveforms.

MODULE IV MEDICAL IMAGING AND PMS 7

X-ray machine - Radio graphic and fluoroscopic techniques – Computer tomography – MRI – Ultrasonography – types of biotelemetry systems and patient monitoring systems (PMS) – Electrical safety.

MODULE V BIO SIGNAL ANALYSIS 8

Objectives of biomedical signal analysis – Fundamental of Biosignals – classification of biosignals - Difficulties encountered in biomedical signal acquisition and analysis – Filtering for removal of artifacts – biosignal processing algorithms – time domain alaysis and frequency domain analysis – Computer aided diagnosis.

MODULE VI CASE STUDY **9**

Problem statement: Connect up to 8/16 ECG input leads with ECG system or get available ECG data. Use automated analysis features for HRV, to classify heartbeats, identify arrhythmias, perform ECG averaging and report.

Total Hours –45

REFERENCES:

1. R.S.Khandpur, “Hand Book of Bio-Medical instrumentation’, 12th reprint, Tata McGraw Hill Publishing Co Ltd., 2008.
2. J.Webster, “Medical Instrumentation – Application and Design”, 4th Edition, John Wiley & Sons, 2009.
3. M.Arumugam, “Bio-Medical Instrumentation”, Anuradha Agencies, 2006.
4. L.A. Geddes and L.E.Baker, “Principles of Applied Bio-Medical Instrumentation”, John Wiley & Sons, 1975.
5. Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer, “Bio-Medical Instrumentation and Measurements”, 2nd Edition, Pearson Education, 2008.
6. Rangaraj M. Rangayan, “Biomedical signal analysis”, John Wiley and sons (ASIA) Pvt Ltd., 2009.

OUTCOMES:

At the end of the course, the student is expected to posses knowledge and achieve skills on the following:

• Students will have an exposure of the physiology of the brain ,heart and lungs.
• Students will be well equipped to choose the proper electrodes and required amplifiers for specific bioapplication.
• They will be able to analyze typical waveforms of bio potentials.

EICX82 SENSORS FOR BIO-MEDICAL APPLICATION

L	T	P	C
3	0	0	3

OBJECTIVES:

• To introduce the student to the various principles, technologies, methods andapplications of biosensors and bioinstrumentation.

• To link engineering principles to understanding of bio systems in sensors andbioelectronics.

• To bring out the important and modern methods of sensor techniques.

• To provide the student with detail methods and procedures used in the design,fabrication and application of biosensors and bio electronic devices.

MODULE I INTRODUCTION TO BIOSENSORS 8

Introduction to biosensors - Types of bio sensors – Bio transducers – Different types - active and passive transducer – factors influencing and selection criteria of transducers for physiological parameters - Transducer for biomedical application.

MODULE II BIO RESISTIVE SENSORS 7

Resistive Transducers – Strain Gauge - types, construction, selection materials, Gauge factor, Bridge circuit and calibration - Strain Gauge type Blood pressure transducers - Thermistor used for cardiac output measurement - nasal airflow measurement - Photoelectric type resistive transducer.

MODULE III NON CONTACT TYPE BIOSENSORS 7

Non contact type infrared thermometry; Optical pyrometer – Electrochemical Biosensors – Electrochemical principles - Glucose biosensors – piezo electricsensors – ultrasonic sensors.

MODULE IV BIO ELECTRODES AND AMPLIFIERS 8

Electrodes – Micro needle and surface electrodes – Amplifiers – Preamplifiers, differential amplifiers, and chopper amplifiers – Isolation amplifier – ECG isolation amplifiers.

MODULE V BIO-CHEMICAL SENSORS AND NON ELECTRICAL MEASUREMENT 8

pH - pO2 - pCO2 – Electrophoresis – photometer - Auto analyzer - Blood flow sensors – phonocardiogram - respiratory measurement – pulse - Blood cell counters.

MODULE VI CASE STUDY **7**

To analyse a diabetic patient using glucose biosensors – to analyse an asthmapatient using respiratory sensors – selection of temperature, pressure andflow sensors for biomedical application.

Total Hours –45

REFERENCES:

1. R.S. Khandpar, “Hand Book of Biomedical Instrumentation and measurement”, McGraw Hill publishing Co., 2009.
2. Aston, “Principles of Biomedical Instrumentation and measurements”, McGraw Hill publishing Co., 2007.
3. Arumugam, “Biomedical Instrumentation”, Anuradha Agencies Publishers, 2008.
4. John G. Webster, “Medical Instrumentation application and design”, 3rd Edition, Wiley, 1997.
5. E.A.H.Hall, “Biosensors”, Advanced Reference Series, Engineering, Prentice Hall, New Jersey, 1991.

OUTCOMES:

At the end of the course, the student is expected to posses knowledge and achieve skills on the following:

• On bio sensing and transducing techniques, design and construct biosensors instrumentation.
• Possess knowledge of detailed methods and procedures used in the design, fabrication and application of biosensors and bio electronic devices.
• To apply the above techniques for biomedical applications.

EICX83 INTELLIGENT CONTROL L T P C

3 0 0 3

OBJECTIVES:

• This course will obtain a basic understanding of artificial neural networks, fuzzy logic control and intelligent technique.

• Students will know how these techniques are applied to engineering problems, including control systems.

MODULE I INTRODUCTION TO INTELLIGENT CONTROL 7

Introduction and motivation - Approaches to intelligent control - Architecturefor intelligent control - Symbolic reasoning system - rule-based systems - theAI approach - Knowledge representation - Expert systems.

MODULE II MATHEMATICAL MODELING 7

Concept of Artificial Neural Networks and its basic mathematical model -McCulloch-Pitts neuron model - simple perceptron - Adaline and Madaline -Feed-forward Multilayer Perceptron - Learning and Training the neural network- Data Processing - Scaling, Fourier transformation - principal-componentanalysis and wavelet transformations.

MODULE III NEURAL NETWORKS 7

Networks: Hopfield network - Self-organizing network and recurrent network- Neural Net based controller. Case studies: Identification and control of linearand nonlinear dynamic systems using Matlab - Neural Network toolbox.

MODULE IV INTRODUCTION TO FUZZY LOGIC 8

Introduction to crisp sets and fuzzy sets - basic fuzzy set operation and approximate reasoning - Introduction to fuzzy logic modeling and control –Fuzzification - inference and defuzzification - Fuzzy knowledge and rule bases- Fuzzy modeling and control schemes for nonlinear systems - Fuzzy logic control for nonlinear time-delay system - Implementation of fuzzy logic controller using Matlab fuzzy - logic toolbox.

MODULE V FUZZY LOGIC SYSTEM 8

Fuzzy logic system: Basic concepts of Fuzzy logic approaches – classic alsets & Fuzzy sets - linguistic variables - membership functions - basic operation- Fuzzy relations - numbers and arithmetic & logical operations - different de-Fuzzification techniques - Fuzzy rule based model & model based controllers- PID controllers, and

application of Fuzzy controllers.

MODULE VI GENETIC ALGORITHM 8

Genetic Algorithm: Basic concept of Genetic algorithm and detail algorithmicsteps - adjustment of free parameters - Solution of typical control problemsusing genetic algorithm.

Total Hours –45

REFERENCES:

1. Freeman, “Neural network: Algorithms Applications and ProgrammingTechniques”, 2005.
2. Goldberg, “Genetic Algorithm in Search, Optimization, and Machine Learning”, Addison Wesley Publishing Company Inc., 1989.
3. Millon W.T., Sutton R.S., and Webrose P.J., “Neural Networks for control”,MIT Press, 1992.
4. MATLAB Neural Network Tool Box Manual.
5. MATLAB Fuzzy Logic Tool Box Manual.
6. R. Eberhart, P.Simpson and R. Dobbins, “Computional Intelligence” PC Tools,2004.
7. Laurence Fausett, “Fundamentals of Neural Networks”, Prentice Hall,Englewood cliffs, N.J., Professional, Boston, 1996.
8. Jacek M.Zurada, “Introduction to Artificial Neural Systems”, Jaico PublishingHouse, 1997.
9. Timothy J.Ross, “Fuzzy Logic with Engineering Applications”, McGraw Hill Inc., 1997.

OUTCOMES:

At the end of the course, the student is expected to posses knowledge and achieve skills on the following:

• Students will be able to design control systems using fuzzy logic and artificial neural networks.
• Students will understand the advantages and disadvantages of these methods relative to other control methods.
• Students will be aware of current research trends and issues

EICX84 ADVANCED CONTROL SYSTEM L T P C

3 0 0 3

OBJECTIVES:

- To provide a basic understanding of state space analysis of the system.
- To impart knowledge state space model for discrete systems.
- To provide knowledge about the nonlinear control systems.
-

MODULE I STATE SPACE ANALYSIS OF SYSTEMS 7

Classical Vs modern control theory ,concept of state, state space and state variables, state model for typical linear sytems, construction of state model using differential equations, state variable diagram and block diagram representation of state models, state space model for electrical circuits,mechanical systems, electro-mechanical system-DC motors, solution of time in variant state equation, state transition matrix from cayleigh -hamilton theorem,solution of linear time varying state equation. Simulation of state space model of electrical circuits, mechanical systems, electro-mechanical system-DCmotors using control system toolbox.

MODULE II TRANSFORMATION IN STATE SPACE MODEL 7

State space model from transfer functions - decomposition methods, state model for a multi input muti output system from block diagrams, similarity transformation, non uniqueness of state space model, transfer from statespace model, different canonical models like phase variable form ,observable canonical model, diagonal canonical model, Jordan canonical model, state variable description of discrete time systems.

MODULE III STATE FEEDBACK AND OBSERVER DESIGN 8

State and output controllability of systems - criterion for controllability ofcontinuous and discrete time systems, observability of systems, criterion forobservabilty of a system, significance of controllability and observability ,statefeedback controller design using pole placement for plant represented in phase variable form, determination of feedback gain using ackerman’s formula,design of full state and reduced order observers. State feedback and observer design using control system toolbox.

MODULE IV STATE SPACE ANALYSIS OF DISCRETE TIME CONTROL SYSTEM 7

Discrete time systems - analogies with continuous time systems - Z-transforms(review), mathematical models for LTI discrete time systems. State model

oflinear discrete-time systems, state models from linear difference equations/system functions, derivation of system function from state model, solution of state equations-state transition matrix, controllability and observability conditions.

MODULE V NONLINEAR CONTROL SYSTEMS 8

Introduction to nonlinearities and non linear phenomenon, nonlinear system behavior. Methods of linearization, Phase Plane Analysis: Concepts of Phase Plane Analysis: Phase Portraits; Singular Points; Symmetry in Phase PlanePortraits, Methods of Constructing Phase Portraits: Analytical method, the method of Isoclines, Determining time form Phase Portraits, Phase Plane Analysis of linear systems, Phase Plane Analysis of nonlinear systems, limit cycles and existence of limit cycle

MODULE VI DESCRIBING FUNCTION METHOD 8

Describing function fundamentals: An example of describing functions; Computing describing functions, Derivations of describing functions of common online arities, Describing function analysis of nonlinear systems.

Total Hours –45

TEXT BOOKS:

1. Benjamin C. Kuo, “Digital Control Systems”, Oxford University Press, 2002.
2. George J. Thaler, “Automatic Control Systems”, Jaico Publishers, 2004.

REFERENCES:

1. I.J. Nagrath and M. Gopal, “Control Systems Engineering”, New Age International Publishers, 2003.
2. Raymond T. Stefani & Co., “Design of Feed back Control systems”, Oxford University, 2002.
3. William L. Luyben and Michael L. Luyben, “Essentials of Process Control”, McGraw Hill International Editions, Chemical Engineering Series, 1997.

OUTCOMES:

At the end of the course, the students will be able to,

- Derive mathematical models in terms of state space of the system.
- Design and analyse discrete systems using state space techniques
- Apply describing functions for nonlinear systems

EICX85 POWER PLANT INSTRUMENTATION L T P C

3 0 0 3

OBJECTIVES:

To provide an overview of different methods of Power Generation, with a particular emphasis on thermal power Generation.

• To get knowledge about the various measurements involved in power generation plants.

• To provide knowledge about the different types of analysers used for analysis.

• To impart knowledge about the different types of controls and control loops.

• To familiarize the student with the methods of monitoring different parameters like speed, vibration of turbines and their control.

MODULE I OVERVIEW OF POWER GENERATION 7

Brief survey of methods of power generation – Hydro, thermal, nuclear, solar and wind power – importance of instrumentation in power generation – Thermal power plants – Block diagram – Details of boiler processes – P & I diagram of boiler – Cogeneration.

MODULE II MEASUREMENTS IN POWER PLANTS 8

Measurements – Flow of feed water, fuel, air and steam with correction factor for temperature – Steam pressure and steam temperature – Drum level measurement – Smoke density measurement – Dust monitor.

MODULE III ANALYSERS IN POWER PLANTS 8

Flue gas oxygen analyser – Analysis of impurities in feed water and steam – Dissolved oxygen analyser – Chromatography – pH meter – Fuel analyser – Pollution monitoring instruments, conductivity meter; Silica Analyser.

MODULE IV CONTROL LOOPS IN BOILER & PROTECTION 8

Combustion control - Air fuel ratio control – Furnace draft control – Drum level control – Main steam and reheat steam temperature control – Super heater control – Air temperature – Deaerator Control – Distributed control system in power plants – Interlocks in boiler operation.

MODULE V TURBINE MONITORING 7

Speed, vibration, shell temperature monitoring and control – Lubricant oil temperature control – Cooling system.

MODULE VI TURBINE CONTROL & PROTECTION 7

Steam pressure control, L.P.Heater, H.P. Heater, Condenser Hotwell Control, Interlocks In turbine operation.

Total Hours –45

TEXT BOOKS:

1. Sam G.Dukelow, “The Control of Boilers”, Instrument Society of America, 1991.

2. P.K.Nag, “Power Plant Engineering”, Tata McGraw Hill, 2001.

3. “Modern Power Station Practice” Vol. 6, Instrumentation controls and Testing, Pergaman Press.

REFERENCES:

1. S.M.Elonka and A.L.Kohal, “Standard Boiler Operations”, Tata McGraw Hill, New Delhi, 1994.

2. R.K.Jain, “Mechanical and Industrial Measurements”, Khanna Publishers, New Delhi, 1995. 3. E.Al. Wakil, “Power Plant Engineering”, Tata McGraw Hill, 1984.

OUTCOMES:

At the end of the course, the student will be able to

- Apply effectively the different methods of Power Generation in operation and maintenance of power generation in a core industry.
- Monitor and analyze different parameters like speed, vibration of turbines and their control.
- Control the power plant using control loops effectively.

EICX86	INSTRUMENTATION AND CONTROL IN PETROCHEMICAL INDUSTRIES	L	T	P	C
		3	0	0	3

OBJECTIVES:

To familiarize the students with raw material pertaining to making of petroleum process

- To get knowledge about various operations.
- To expose to measurement, automation and control system in respect of petrochemical industry.
- To provide an overview of computer application in petrochemical industry.

MODULE I PETROLEUM PROCESSING 8

Petroleum exploration – recovery techniques – oil – gas separation processing wet gases – refining of crude oil.

MODULE II UNIT OPERATIONS IN PETROLEUM INDUSTRY 8

Thermal cracking – catalytic cracking – catalytic reforming – polymerisation – alkylation – isomerization – production of ethylene, acetylene and propylene from petroleum.

MODULE III CHEMICALS FROM PETROLEUM PRODUCTS 8

Chemical from petroleum – methane derivatives – acetylene derivatives – acetylene derivatives – ethylene derivatives – propylene derivatives – other products.

MODULE IV MEASUREMENTS IN PETROCHEMICAL INDUSTRY 6

Parameters to be measured in refinery and petrochemical industry – selection and maintenance of measuring instruments – intrinsic safety of instruments.

MODULE V CONTROL LOOPS IN PETROCHEMICAL INDUSTRY 10

Process control in refinery and petrochemical industry – control of distillation column – control of catalytic crackers and pyrolysis unit – automatic control of polyethylene production – control of vinyl chloride and PVC production.

MODULE VI CASE STUDY 5

Unique problem solving in petrochemical industries

Total Hours –45

TEXT BOOKS:

1. Waddams A.L, “Chemical from petroleum”, Butter and Janner Ltd., 1968

2. Balchan.J.G. and Mumme K.I., “Process Control Structures and Applications”, Van Nostrand Reinhold Company, New York, 1988.

REFERENCES:

1. Austin G.T.Shreeves, “Chemical Process Industries”, McGraw Hill International student edition, Singapore, 1985.

2. Liptak B.G., “Instrumentation in Process Industries”, Chilton Book Company, 1994.

OUTCOMES:

At the end of the course, the student will be able

• To implement the concept of different measurement techniques and control systems in Petrochemical Industry.

• To implement the methods of computer control in petrochemical industry.

Physics Elective Courses
(To be offered in II Semester)

PHCX 01	FUNDAMENTALS OF ENGINEERING MATERIALS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To help students to acquire the properties and applications of conducting and semiconducting materials.
- To familiarize students with basic ideas about the properties of dielectric and magnetic materials and their applications.
- To familiarize students with basic knowledge of nanomaterials and its electrical, electronic, mechanical and magnetic properties.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I CONDUCTING AND SEMICONDUCTING MATERIALS 7

Conductors: properties, Fermi distribution function, Fermi energy in metals- density of states- conducting polymers-properties-applications, semiconductors: intrinsic and extrinsic semiconductors-carrier concentration, conductivity and energy band gap, semiconducting polymers- properties- applications.

MODULE II DIELECTRIC MATERIALS 8

Polarization- dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – Internal field - Clausius Mosotti relation - dielectric loss – dielectric breakdown – applications of dielectric materials (capacitors and transformers) – Pyroelectricity, Piezoelectricity, ferroelectricity and applications in Ferroelectric Random Access Memory (FeRAM) - multiferroic materials and its applications.

MODULE III MAGNETIC MATERIALS 7

Origin of magnetism-magnetic moment, susceptibility, permeability – Bohr magneton – Dia, Para and Ferro magnetism –Spontaneous magnetization- Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites and its application - Giant Magneto-resistance effect (GMR) - Magnetic resonance imaging(MRI).

MODULE IV NANOMATERIALS 8

Properties of nanomaterials – size effect on thermal, electrical, electronic, mechanical,

optical and magnetic properties – quantum confinement – classification of nanomaterials – quantum well, quantum wire, quantum dot - nanoporous materials - carbon nanotubes, graphene - nanocomposites – applications of nano materials.

PRACTICALS

1. Determination of energy band gap of a semiconductor.
2. Determination of resistivity of metals by four point probe method.
3. Determination of dielectric constant of dielectric material.
4. Determination of time constant of a capacitor using RC circuit.
5. Determination of paramagnetic susceptibility of given liquid.
6. Determination of hysteresis loss in a transformer using BH curve.
7. Analysis of size effect on the absorption spectrum of nanomaterials.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. William D. Callister, “Material Science and Engineering”, Wiley Publications, 2006.
2. Raghavan, V., “Materials Science and Engineering”, 5th edition, Printice Hall of India Pvt Ltd. New Delhi, 2004.
3. Wahab. M.A, “Solid State Physics: Structure and Properties of Materials”, Narosa Publishing House Pvt. Ltd., New Delhi , 2nd Edition, 2010.
4. Pillai, S.O., “Solid State Physics”, New Age International, New Delhi, 2005.
5. Charles P. Poole and Frank J. Owens, ”Introduction to nanotechnology”, Wiley (India), 2009.
6. Pradeep. T., “Textbook of Nanoscience and Nanotechnology”, McGraw Hill Education (India) Private Limited, New York, 2012.

OUTCOMES:

On completion of this course, the student will be able to

- apply the concepts of conducting and semiconducting materials for solid state devices.
- comprehend the significance of properties of dielectric magnetic materials and derive these properties from synthesized materials.
- differentiate between the properties of the nanomaterials compared to bulk materials.
- complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 02	HEAT AND THERMODYNAMICS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To familiarize students with basic concepts of heat.
- To help students acquire the fundamentals of heat conduction and radiation.
- To enable students acquaint with the basics of thermodynamic concepts.
- To make students understand the fundamentals of heat based experiments.

MODULE I CONCEPTS OF HEAT **10**

Definition of temperature, thermal and thermodynamic equilibrium - relationship between temperature and kinetic energy - definition of solid, liquid, gas - Introduction to phase transitions, critical and triple points- definition of heat capacity, mechanical equivalent of heat -Joule's calorimeter- latent heat- microscopic model of ideal gas - equation of state, internal energy, equipartition theorem- equation of state for non-ideal gases.

MODULE II CONDUCTION AND RADIATION **10**

Thermal conductivity – rectilinear flow of heat – thermal conductivity of a good conductor – Forbe’s method – thermal conductivity of a bad conductor – Lee’s disc method – conduction of heat through compound media - radiation – Planck’s law of blackbody radiation – Wien’s law – Stefan’s law – Newton’s law of cooling from Stefan’s law – Solar constant – Pyrometry.

MODULE III FUNDAMENTALS OF THERMODYNAMICS **10**

Thermodynamic equilibrium – zeroth law of thermodynamics – first law of thermodynamics – Reversible and irreversible processes – second law of thermodynamics - Heat engine – Carnot’s engine – Carnot’s theorem – Internal combustion engines – petrol and diesel engines (qualitative) – Entropy and available energy – temperature – entropy diagram for Carnot’s cycle - Third Law of thermodynamics (qualitative).

PRACTICALS

1. Determination of mechanical equivalent of heat by Joule’s calorimeter.
2. Relation between temperature of a body and time by plotting a cooling curve-Newton’s law of cooling.

3. Determination of specific heat capacity of liquid by cooling.
4. Determination of thermal conductivity of a good conductor-Forbe's method
5. Determination of thermal conductivity of a bad conductor-Lee's disc method

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Mathur. D.S, “Heat & Thermodynamics”, S.Chand & Co., 2009.
2. Brijlal & Subramaniam, “Heat and Thermodynamics”, S.Chand & Co, Delhi, 2010.
3. Gupta. A.B and Roy. H, “Thermal Physics”, Books and Allied Ltd., 2002.
4. Sharma. J.K and Sarkar. K.K, “Thermodynamics and statistical Physics”, Himalaya Publishing House, 1988.

OUTCOMES:

On completion of this course, the student will be able to

- understand the concepts of heat and its properties.
- comprehend the ideas governing the conduction and radiation processes.
- apply the knowledge of laws of thermodynamics in thermodynamic systems.
- perform heat based experiments and determine its various properties.

PHCX 03	INTRODUCTION TO NANOSCIENCE AND TECHNOLOGY	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To acquire basic knowledge about the nanomaterials and applications.
- To learn about the synthesis and imaging techniques of nanomaterials.
- To gain the basic concepts of fabrication techniques.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I NANOMATERIALS AND APPLICATIONS **10**

Properties of nanomaterials – size effect on thermal, electrical, electronic, mechanical, optical and magnetic properties – quantum confinement – classification of nanomaterials – quantum well, quantum wire, quantum dot - nanoporous materials - zeolite, mesoporous materials, carbon nanotubes, grapheme - nanocomposites - applications (qualitative): Molecular electronics-nanoelectronics – nanophotonics - single electron transistor-drug delivery.

MODULE II SYNTHESIS AND IMAGING TECHNIQUES **12**

Top-down and bottom up approaches – mechanical alloying and mechanical ball milling - sol-gel approach - hydrothermal method - precipitation method - spray pyrolysis - spin coating-self assembled monolayer (SAM) - Chemical vapour deposition method – Physical vapour deposition method: laser ablation method, sputtering method.

Optical microscopy – Phase contrast and interference microscopy – confocal microscopy - high resolution Scanning electron microscope (HRSEM) - high resolution Transmission electron microscope (HRTEM) - Atomic force microscope - Scanning Tunnelling microscope (STM).

MODULE III NANOFABRICATION **8**

Photolithgraphy - electron beam lithography - X-ray and Ion beam lithography - nanoimprint lithography - soft lithograpy - nanoelectromechnical systems (NEMS) - nanoindentation principles.

PRACTICALS

1. Synthesis of nanomaterials by sol-gel method.

2. Synthesis of nanomaterials by hydrothermal method.
3. Synthesis of nanomaterials by solid state reaction method.
4. Synthesis of nanomaterials by chemical bath deposition method.
5. Synthesis of nanomaterials by co-precipitation method.
6. Synthesis of nano thin films by spray pyrolysis method.
7. Synthesis of nano thin films by pulsed laser deposition (PLD) method.
8. Analysis of size effect on the absorption spectrum of nanomaterials.
9. SEM characterization of nanomaterials.
10. AFM characterization of nano thin films.
11. Phase confirmation by XRD.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Charles P.Poole and Frank J. Owens, ”Introduction to nanotechnology”, Wiley (India), 2009.
2. Cao. G., “Nanostructures & Nanomaterials: Synthesis, Properties & Applications”, Imperial College Press, 2004.
3. Gaddand. W., Brenner. D., Lysherski. S. and Infrate. G.J., “Handbook of NanoScience Engineering and Technology”, CRC Press, 2002.
4. Pradeep. T., “Textbook of Nanoscience and Nanotechnology”, McGraw Hill Education (India) Private Limited, New York, 2012.
5. Chris Mack, “Fundamental Principles of Optical Lithography: The Science of Microfabrication”, John Wiley & Sons, 2008.
6. Bandyopadhyay A.K., “Nano Materials”, New Age International Publishers, New Delhi, 2008.

OUTCOMES:

At the end of the course, the students will be able to

- understand the importance and basic concepts of the nanomaterials.
- comprehend the imaging techniques for nanomaterials.
- illustrate the various nanofabrication techniques.
- complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 04	LASERS AND THEIR APPLICATIONS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To recognize the fundamentals of laser and its characteristics.
- To comprehend and compare the different laser systems.
- To apply lasers in metrology and material processing.
- To understand the working of laser instrumentation.
- To correlate the experimental results for applications.

MODULE I LASER THEORY **8**

Spontaneous and stimulated emission - Population inversion – Einstein's A & B coefficients - Threshold condition – super-radiance Laser – Three level and four level laser systems -conditions for CW and pulsed laser action. Q-Switching - experimental methods - cavity dumping - Mode locking - experimental methods - Spatial and Temporal coherence.

MODULE II DIFFERENT LASER SYSTEMS **8**

Laser systems – General description - Laser structure - excitation mechanism - Different laser systems- He-Ne laser, Carbon-dioxide laser - Excimer laser – Free electron laser- Alexandrite laser - Ti-Sapphire laser – Semiconductor diode laser - Diode pumped solid state laser - Pulsed-CW dye laser- Fibre laser.

MODULE III METROLOGICAL AND MATERIAL PROCESSING APPLICATIONS **8**

CW and Pulsed laser beam characteristics and its measurements - Beam focusing effects - spot size - Power and Energy density Measurements - Distance measurement - Interferometric techniques - LIDARS - different experimental arrangements - Pollution monitoring by remote sensing - Laser gyroscope - Laser welding, drilling, machining and cutting - Laser surface treatment - Laser vapour deposition – Biophotonic applications.

MODULE IV LASER INSTRUMENTATION **7**

Laser for measurement of length, current and voltage – Laser Doppler Velocimetry - Holography and speckle in displacement and deformation measurements - Laser for communication with fiber optics as channel.

PRACTICALS

1. Tuning of Dye Laser using DFDL Arrangement
2. Determination of Brewster Angle using He-Ne laser
3. Study of transversely Pumped Dye Lasers
4. Study of longitudinally Pumped Dye Lasers
5. Determination of power and wavelength using Distributed Feedback Dye Laser (DFDL)
6. Determination of fibre optic losses using semiconductor laser.
7. Bandgap determination of a semiconductor diode.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. William T. Silfvast, “Laser Fundamentals”, Cambridge University Press, 2009.
2. Ghatak. A. & Thyagarajan. K. “Optical Electronics”, Cambridge University, 1994.
3. Laud.B.B., “Laser and Non-Linear Optics”, Second Edition, New Age International (p) Limited Publishers, 2011.
4. Nambiar. K.R., “Lasers Principle, Types and Applications”, New Age International (p) Ltd, 2004.
5. Wilson. J. & Hawkes. J.F.B., “Opto Electronics - An Introduction”, Prentice Hall, 1992.
6. William M.Steen, ”Laser Material Processing”, Springer-Verlag, Berlin, Third Edn., 2005.

OUTCOMES:

At the end of the course, the students will be able

- To complement the knowledge acquired in the theory class.
- To work with dye lasers for tunability of laser wavelength.
- To measure the loss of information involved in fibre optic communication.
- To correlate the results for application.

PHCX 05	MATERIALS SCIENCE	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To gain basic knowledge in conducting and semiconducting materials and their properties.
- To provide basic understanding of properties and applications of dielectric materials.
- To impart knowledge on magnetic and optical materials and their properties & applications.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I CONDUCTING AND SEMICONDUCTING MATERIALS 10

Quantum free electron theory of metals and its importance - Energy distribution of electrons in metals - Fermi distribution function - Density of energy states and carrier concentration in metals - Fermi energy – Classification of solids into conductors, semiconductors and insulators on the basis of Band theory – Introduction to Elemental and Compound semiconductors - Carrier concentration derivation for Intrinsic semiconductors - Density of electrons in conduction band & Density of holes in valence band- intrinsic carrier concentration - Fermi energy & Variation of Fermi energy level with temperature - Mobility and electrical conductivity - Band gap determination.

MODULE II DIELECTRIC MATERIALS 7

Introduction to dielectric materials & basic definitions – Electronic, Ionic, Orientation & Space charge polarizations - Total polarization – Frequency and temperature dependence of polarization - Internal field in a dielectric material - Deduction of Clausius - Mosotti's relation - dielectric loss & loss tangent – Different types of dielectric breakdown – Applications of dielectric materials : Capacitors and Transformers.

MODULE III MAGNETIC MATERIALS 6

Introduction to magnetic materials & origin of magnetic moment - Different types of

magnetic materials and their properties - Ferromagnetism & Domain theory of ferromagnetism - Hysteresis, Soft and Hard magnetic materials - Antiferromagnetic materials - Ferrites and its applications – Applications of magnetic materials : Data storage.

MODULE IV OPTICAL MATERIALS 7

Optical properties of semiconductors - Direct and Indirect bandgap semiconductors – Traps, recombination centre, color center and exciton – Luminescence : Fluorescence and Phosphorescence - Liquid crystal display : twisted nematic crystal display – Applications of Optical materials - Optical Sources : light emitting diode and laser diode - Photo detectors : PIN photodiode and Avalanche Photodiode - Pyroelectric devices - Electro optic effect : Kerr effect and Faraday effect.

PRACTICALS

1. Resistivity measurement of a semiconductor using four point probe method.
2. Determination of band gap of a semiconductor diode.
3. Determination of Hall coefficient of a given semiconductor material.
4. Determination of dielectric constant of a given non-polar liquid.
5. Determination of magnetic susceptibility of a given paramagnetic liquid using Quincke's method.
6. Determination of energy loss of a given transformer core using hysteresis method.
7. To study the I-V characteristics of a photodiode.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Palanisamy P.K., ''Physics II'', Material Science for ECE, Scitech Publications (India) Pvt. Ltd., 2006.
2. Kasap. S.O., ''Principles of Electronic materials and devices'', McGraw Hill Publishers, 3rd Edition, 2007.
3. Arumugam. M, "Physics II'', Material Science for ECE, Anuradha Publishers, 5th Edition, 2005.
4. Sze. S.M., ''Semiconductor Devices – Physics and Technology'', John Wiley, 2nd Edition. 2002.
5. Raghavan. V, ''Materials Science and Engineering'', Prentice Hall of India, 5th Edition, 2004.

OUTCOMES:

On the completion of this course, the students will be able to

- Gain knowledge about fundamentals of conducting and semiconducting materials.
- Understand concepts and applications of Dielectric and Magnetic materials.
- Familiarize Optical materials and their applications in Engineering and Medical fields.
- Complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 06	NON-DESTRUCTIVE TESTING	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To study the process and applications of ultrasonic inspection method.
- To understand the basic concepts of radiographic inspection method.
- To acquire the knowledge about the various surface Non-Destructive Testing (NDT) techniques.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I ULTRASONIC INSPECTION METHOD **10**

Ultrasonic Testing - Principle of operations - types of sound waves - types of Transducers - transmission and pulse-echo method - straight beam and angle beam, instrumentation - calibration methods - ultrasonic testing technique- data representation, A Scan, B-scan, C-scan. Phased Array Ultrasound, Time of Flight. Diffraction - thickness determination - advantages, disadvantages and applications.

MODULE II RADIOGRAPHIC INSPECTION METHOD **10**

Radiographic testing – Principle - Interaction of X-ray with matter - X-ray radiography - method of generation-industrial radiography inspection techniques – Equipment - Exposure charts - Types of films – Fluoroscopy - Xero-Radiography – Limitations - Gamma radiography - Equipment, radiation sources - method of generation - film processing - interpretations of radiography - safety in industrial radiography.

MODULE III SURFACE NDT TECHNIQUES **10**

Liquid Penetrant Testing – Principles, Characteristics and types of liquid penetrants – developers - advantages and disadvantages of various methods - Inspection Procedure and Interpretation of results. Applications of Liquid Penetrant testing.

Magnetic Particle Testing - Principle-magnetizing technique - procedure –equipment - Interpretation and evaluation of test indications - applications and limitations - demagnetization.

PRACTICALS

1. Inspection of welds using solvent removable visible dye penetrant.
2. Inspection of welds using solvent removable fluorescent dye penetrant.

3. Inspection on non magnetic materials by eddy current method.
4. Inspection on magnetic materials by eddy current method.
5. Inspection of welds by Eddy current Testing.
6. Inspection of welds by Magnetic Particle Testing - Dry method.
7. Inspection of welds by Magnetic Particle Testing - Wet method.
8. Ultrasonic flaw detector - Inspection of defects.
9. Demonstration of Radiographic inspection.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Baldev Raj., Jayakumar T.,Thavasimuthu., “Practical Non-Destructive Testing”, Narosa Publishing House, 2009.
2. Ravi Prakash., “Non-Destructive Testing Techniques”, 1st revised edition, New Age International Publishers, 2010.
3. ASM Metals Handbook of Non-Destructive Evaluation and Quality Control, American Society of Metals, Metals Park, Ohio, USA, Volume-17, 2000.
4. Paul E Mix,”Introduction to Non-destructive testing: a training guide”, Wiley, 2nd Edition New Jersey, 2005.
5. Charles J., Hellier, “Handbook of Nondestructive evaluation”, McGraw Hill, New York, 2001.

OUTCOMES:

Upon completion of this course, the students will be able to

- illustrate the ultrasonic inspection methods of NDT.
- understand the basic concept of radiographic inspection method.
- test the surfaces by the various surface NDT techniques.
- complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 07	PROPERTIES OF MATTER AND ACOUSTICS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To understand principles and properties of elasticity.
- To understand the basic concepts and application of viscosity.
- To analysis acoustic of building.
- To know about photoelasticity and its applications.

MODULE I ELASTICITY **8**

Stress and strain - Hooke's Law of elasticity - Elastic moduli - Stress-Strain Diagram - Poisson's Ratio - Relation between elastic constants - Work done in stretching and twisting a wire - Twisting couple on a cylinder- Expression for bending moment - Cantilever–Expression for depression - Uniform bending and Non-uniform bending of beams (theory & experiment) - I form Girders (qualitative treatment) and applications.

MODULE II VISCOSITY **8**

Viscosity- Newton’s formula for viscous flow - Streamline and turbulent motion - Reynolds number - Poiseuille's formula - Determination of coefficient of viscosity- factors affecting viscosity - capillary flow method - Stoke's formula- viscosity of highly viscous liquids – Stoke’s method - Lubricants and its applications –viscosity measurements - Viscometer - Variation of Viscosity with Temperature.

MODULE III ACOUSTICS OF BUILDING **7**

Basic requirement for the acoustically good halls - Reverberation and time of reverberation – Sabine’s formula for reverberation time - Absorption coefficient and its measurement -Transmission of sound and transmission loss - Factors affecting the architectural acoustics and their remedy-sound absorbing materials - vibration and noise control systems for buildings.

MODULE IV PHOTOELASTICITY **7**

Polarization - double refraction - Theory of Plane, Circularly and Elliptically polarized light - Quarter wave plate and half wave plate - photo elasticity - Theory of photo-elasticity - Stress optic relations - model materials - analysis techniques - Photo elastic bench - Three dimensional photo elasticity - Digital photo elasticity - Photo elastic

coatings.

PRACTICALS

1. Determination of viscosity of liquid by Poiseuille's method.
2. Determination of viscosity of liquid by Stoke's method.
3. Analysis of stress by photo elastic method.
4. Verification of Hooke's law by spring method.
5. Determination of Young's modulus of the cantilever beam.
6. Determination of rigidity modulus by static torsion method.
7. Visit to acoustically good auditorium and identifying the sound absorbing materials in the auditorium.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Mathur D.S., "Elements of Properties of Matter", S.Chand & Co, Delhi, 2009.
2. Gaur R.K., Gupta S.L.,"Engineering Physics", Dhanpat Rai Publishers, 2010.
3. Brijlal and Subramaniam.," Properties of Matter", Eurasia Publishing Co, New Delhi, 2002.
4. Smith C.J.," General Properties of Matter", Orient & Longman,1960.
5. Kenneth G. Budinski and Michel K., Budinski, "Engineering Materials Properties and Selection", Pearson, Singapore, 2002.

OUTCOMES:

Upon completion of this course, the students will be able to

- understand the basic concepts of the elasticity of materials.
- comprehend the concepts of viscosity of liquid and measurement.
- demonstrate the acoustical aspects of building and its importance in construction.
- apply the fundamental concept of photo elasticity for the stress analysis of the object.

PHCX 08	PROPERTIES OF MATTER AND NONDESTRUCTIVE TESTING	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To impart knowledge about the principles and properties of elasticity.
- To learn the laws governing the dynamic of rigid bodies.
- To acquire the knowledge of the various techniques of Non-Destructive Testing (NDT) of materials.
- To understand the principle and basic concept of low temperature applications.

MODULE I ELASTICITY **8**

Stress and strain - Hooke's Law of elasticity - Elastic moduli - Stress-Strain Diagram - Poisson's Ratio - Relation between elastic constants - Work done in stretching and twisting a wire - Twisting couple on a cylinder- Expression for bending moment- Cantilever–Expression for depression - Uniform Bending and Non-uniform bending of beams (theory & experiment) - I form Girders (qualitative treatment) and applications.

MODULE II DYNAMICS OF RIGID BODIES **8**

Rigid bodies - angular acceleration - Torque on a particle - angular momentum - law of conservation of angular momentum - moment of inertia and its significance - Theorem of parallel and perpendicular axis - moment of inertia of a thin uniform bar - moment of inertia of a rectangular lamina - moment of inertia of uniform circular disc - Moment of inertia of hollow and solid cylinders – flywheel
(qualitative) - kinetic energy of rotating body – Routh rule.

MODULE III NDT TECHNIQUES **6**

Ultrasonic Testing- types of Transducers-transmission and pulse-echo method- Radiographic testing- Principle-Interaction of X-ray with matter-X-ray radiography-method of generation-industrial radiography inspection techniques- Liquid Penetrant Testing**-** Inspection Procedure and Interpretation of results.

MODULE IV LOW TEMPERATURE PHYSICS **8**

Definition of Refrigeration and Air-Conditioning - Types of **Refrigeration Systems-**

Applications- Comfort Air Conditioning, Industrial Refrigeration, Food processing and food chain - **Cryogenic treatment - Low temperature properties of engineering materials: Mechanical properties, Thermal properties, Electrical properties.**

PRACTICALS

1. Verification of Hooke's law by spring method.
2. Determination of Young's modulus of the beam by bending method.
3. Inspection of welds using solvent removable visible dye penetrant.
   Inspection of welds using solvent removable fluorescence dye penetrant.
5. Inspection of welds by Magnetic Particle Testing.
6. Determination of moment of inertia of the disc by torsion pendulum method.
7. Determination of moment of inertia of the disc by static torsion method.
8. Demonstration of working of flywheel.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Mathur D.S.,"Elements of Properties of Matter", S.Chand & Co, Delhi, 2009.
2. Brijlal & Subramaniam," Properties of Matter", Eurasia Publishing Co, Delhi, 2002.
3. Gaur R.K., Gupta S.L., "Engineering Physics" Dhanpat Rai Publishers, 2010.
4. Baldev Raj.,Jayakumar T., Thavasimuthu M.,"Practical Non-Destructive testing", Narosa Publishing House, 2009.
5. Brijlal & Subrahmanyam., "Heat and Thermodynamics" S.Chand & Company Ltd, 2002.
6. Paul E Mix.," Introduction to Non-destructive testing: a training guide", Wiley, 2nd Edition, New Jersey, 2005.
7. Charles J., Hellier.," Handbook of Nondestructive evaluation", McGraw Hill, New York, 2001.

OUTCOMES:

Upon completion of this course, the students will be able to

- understand the basic of concept of elasticity of materials.
- comprehend the basic concepts of motion of rigid bodies and its applications.
- demonstrate the various NDT techniques and its importance.
- know the low temperature systems and its applications.

PHCX 09	SEMICONDUCTOR PHYSICS AND OPTOELECTRONICS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To understand the Physics of Semiconductor devices.
- To make the students learn the fundamentals of Photoluminous - semiconductors, Optoelectronic devices, Optical modulators/detectors.
- To make them understand the technology behind latest Display devices like LCD, Plasma and LED Panels.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I PHYSICS OF SEMICONDUCTORS **8**

Elemental and compound semiconductors – Drift and diffusion current - Intrinsic semiconductors – Carrier concentration (derivation) – Fermi energy – Variation of Fermi energy level with temperature – Mobility and electrical conductivity – Band gap determination – Extrinsic semiconductors – Carrier concentration in n-type and p-type semiconductor (derivation) – Variation of Fermi level with temperature and impurity concentration – Variation of Electrical conductivity with temperature – Hall effect – Experiment and applications of Hall effect.

MODULE II OPTOELECTRONIC DEVICES **7**

Light Emitting Diodes (LED) – power and efficiency - double hetero LED - LED structure - LED characteristics - White LED – Applications. Liquid crystal displays – Dynamic scattering and Twisted nematic display, Semiconductor Lasers, Homojunction and Heterojunction laser diodes - Optical processes in semiconductor lasers.

MODULE III OPTICAL MODULATORS **7**

Modulation of light – birefringence –Modulation Techniques - Electro optic effect – Electro optic materials –Types of Electro optic Modulators : Kerr and Pockel modulators –- Magneto optic effect - Magneto optic Modulators – Acousto Optic modulators.

MODULE IV OPTICAL DETECTORS **8**

Photo detectors - photodiodes - phototransistors - noise characteristics - PIN diode – Avalanche Photodiode (APD) characteristics - APD design of detector arrays – Charged Couple Device - Solar cells - Materials and design considerations, Thin film

solar cells, amorphous silicon solar cells.

PRACTICALS

1. Resistivity measurement of a semiconductor using four point probe method.
2. Determination of band gap of a semiconductor diode.
3. Determination of Hall coefficient of a given semiconductor material.
4. Determination of the wavelength of a given laser source using diffraction grating.
5. Determination of Planck's constant using LED.
6. To study the I-V characteristics of photodiode and phototransistor.
7. To study the characteristics of a solar cell.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Arumugam. M, "Physics II", Anuradha Publishers, 5th Edition, 2005.
2. Sze. S.M., "Semiconductor Devices – Physics and Technology", 2nd edn. John Wiley, 2002.
3. Wilson & J.F.B. Hawkes, "Optoelectronics – An Introduction", Prentice Hall, India, 1996.
4. Bhattacharya, "Semiconductor optoelectronic devices", Second Edn, Pearson Education, 2002.
5. Safa O. Kasap, "Optoelectronics & Photonics:Principles & Practices", Second Edn, Pearson Education,2013.
6. Palanisamy P.K., "Semiconductor physics and optoelectronics" Scitech Publications, 2003.

OUTCOMES:

On completion of this course, the student will be able to

- understand the principles of Physics behind semiconductor devices.
- choose the correct semiconductors for electronic devices and display.
- differentiate the working principle of LED and Diode Laser.
- apply the knowledge of modulation of light for different types of optical modulators.
- select suitable photodetectors for different types of applications.
- complement the knowledge acquired in the theory class and correlate the results for applications.

Chemistry Elective Courses
(To be offered II Semester)

CHCX01	ANALYTICAL INSTRUMENTATION	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make the student conversant with

- principles, instrumentation and applications of different electroanalytical techniques
- different chromatographic techniques
- principles, instrumentation and applications of various types of absorption and emission spectroscopy
- different thermal analytical methods and their applications

MODULE I ELECTROANALYTICAL TECHNIQUES **7**

Principle and applications: conductometric titrations – potentiometrIc titrations, ion-selective electrodes and pH-metry – coulometry – voltammetry - polarography, amperometric titrations.

MODULE II CHROMATOGRAPHY **8**

Basic concepts of chromatography – paper chromatography – column chromatography – thin layer chromatography – gas chromatography – high performance liquid chromatography – gel permeation chromatography.

MODULE III SPECTROSCOPY **8**

Absorption spectroscopy (principle, instrumentation and applications): Colorimetric analysis – UV-Visible spectroscopy – FTIR spectroscopy - Emission Spectroscopy (principle, instrumentation and applications): fluorescence, phosphorescence and chemiluminescence – Atomic absorption spectroscopy – flame emission spectroscopy.

MODULE IV THERMAL ANALYSIS **7**

Principle, instrumentation and applications: Thermo gravimetric analysis – Differential thermal analysis – Differential scanning calorimetry

PRACTICALS

1. Conductometric titrations: acid-base and precipitation titrations

2. Potentiometric titrations
3. Determination of pH of the unknown solution
4. Estimation of alkali metals using flame emission spectroscopy
5. Estimation of metal ions of coloured solutions using colorimetric analysis
6. Separation of compounds using gas chromatography
7. Separation of compounds using high performance liquid chromatography
8. Analysis of the given sample and interpretation of the data using IR, UV-Visible spectroscopy
9. Demonstration of TGA/DTA and DSC and interpretation of data.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Skoog D.A., West D.M., Holler F.J. and Crouch S.R., Fundamentals of Analytical Chemistry, 8th Edition, Thomson Brooks/Cole Publication., Singapore, 2004.
2. Willard H.H., Merritt L.L., Dean J.A. and Settle F.A., Instrumental Methods of Analysis, 7th Edition, CBS Publication, New Delhi Reprint, 2004.
3. A.I. Vogel, Vogel's Textbook of Practical Organic Chemistry, 5th Edition, Prentice Hall, London, 2008.
4. Christian G.D., Analytical Chemistry, 6th Edition, John Wiley, Singapore, 2003.
5. Fifield F.W. and Kealey D., Principles and Practice of Analytical Chemistry, 5th Edition, Blackwell Publication, London, 2000.
6. Settle F. (Editor), Handbook of Instrumental Techniques for Analytical Chemistry, Pearson Education, Singapore, 2004.

OUTCOMES:

The student will be able to

- state the principle and applications of various electro-analytical techniques
- identify the right separation method for a given sample using different chromatographic techniques
- explain the principle, instrumentation & applications of various spectroscopic methods and also to interpret the data
- elaborate the principle, instrumentation and applications of various thermal analytical techniques and interpret the data.

CHCX02	CORROSION AND ITS CONTROL	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students should be conversant with the

- Basic concepts, principles and factors affecting corrosion
- Types and mechanism of corrosion
- Control measures of corrosion by material selection, proper design and by applying organic coatings
- Control of corrosion by applying inorganic coating

MODULE I BASIC CONCEPTS OF CORROSION 8

Corrosion – causes and impacts of corrosion – mechanism of corrosion: Dry corrosion- oxidation corrosion - corrosion by other gases – Pilling-Bedworth rule- Corrosion by hydrogen: hydrogen blistering, hydrogen embritttlement, decarburization and hydrogen attack – corrosion of silver and copper by sulphur compounds – liquid metal corrosion (embritttlement or cracking) – Wet corrosion : hydrogen evolution – presence and absence of oxygen and absorption of oxygen – difference between dry and wet corrosion-factors influencing corrosion-polarization-passivity-emf series and galvanic series- corrosion current -rate of corrosion.

MODULE II FORMS OF CORROSION 7

Forms of corrosion-conditions for electrochemical corrosion –galvanic corrosion – differential aeration corrosion: pitting, water line, wire fencing, crevice and filiform corrosion – stress corrosion – Intergranular corrosion- erosion corrosion – soil corrosion – microbiological corrosion- fretting corrosion- corrosion in composites.

MODULE III CORROSION CONTROL AND ORGANIC COATINGS 8

Corrosion control – selection of materials and designing- cathodic protection – sacrificial anode and impressed current cathodic protection – corrosion inhibitors: anodic, cathodic and vapour phase inhibitors.

Organic protective coatings – paints: constituents – functions – varnishes : types-constituents – functions – lacquers : constituents – functions –enamels-constituents – functions – special paints : fire retardant, water repellant, heat resistant, temperature indicating and luminous paints.

MODULE IV INORGANIC COATINGS 7

Treatment of metal surface-inorganic coatings- classification- metallic coatings : anodic and cathodic coatings-hot dipping : galvanizing and tinning- electroplating—electroless plating – cementation (diffusion) : sherardizing, calorizing and chromizing – metal cladding-metal spraying – non metallic coatings (chemical conversion coatings) : phosphate, chromate, oxide coatings and anodizing – comparison of anodic and cathodic protection.

PRACTICALS

1. Determination and comparison of rate of corrosion of metals in the presence of acid, base and neutral medium by weight loss method.
2. Determination of rate of corrosion of iron in the presence of various acids by weight loss method.
3. Determination of rate of corrosion of iron in the presence and absence of anodic Inhibitor by weight loss method.
4. Determination of rate of corrosion of iron in the presence and absence of cathodic Inhibitor by weight loss method.
5. Electroplating of base metal with copper.
6. Electrolessplating of base metal with copper
7. Chemical conversion coatings such as chromate and phosphate coatings.
8. Demonstration on the study of rate of corrosion by using cyclic voltametry.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. P.C Jain & Monica Jain, Engineering Chemistry Dhanpatrai Publishing Company (P) Ltd., New Delhi (2013).
2. S S Umare & S S Dara, A text Book of Engineering Chemistry, S. Chand& Company Ltd, New Delhi, 2014.
3. M.G. Fontana and N.G. Green, Corrosion Engineering, McGraw Hill Book Company, NewYork, 1984.
4. S. Banerjee, A.K. Tyagi, Functional Materials- Preparation, Processing and Applications, ELSEVIER Publications, London ; Waltham, MA : 2011

OUTCOMES:

Students will be able to

- explain the mechanism, compare and enumerate the factors affecting

corrosion

- describe and identify the place and types for a given situation.
- choose and elaborate the suitable organic coating method for a given real time situation.
- apply a suitable metallic coating for a given situation

CHCX03	ELECTRICAL MATERIALS AND BATTERIES	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students should be conversant with

- preparation, properties and applications of plastics used in electrical and electronic applications
- properties and uses of electrical engineering materials
- classification and description of different types of batteries.
- classification and types of fuel cells

MODULE I POLYMERS FOR ELECTRICAL AND ELECTRONIC APPLICATIONS **8**

Preparation, properties and applications **:** polyethylene, polypropylene, EPDM, Nylon-6,6, PVC, PTFE, polycarbonates, ABS, phenol formaldehyde, urea formaldehyde, epoxy resins – polymer blends and alloys.

MODULE II ELECTRICAL ENGINEERING MATERIALS **7**

Conductors: Silver, Copper, Gold, Aluminum – Semiconductors: Germanium, Silicon, Gallium Arsenic – Insulating Materials: Rubbers, Mica, Plastics, Ceramics, Insulating papers – Magnetic Materials: ferromagnetic materials, paramagnetic materials, diamagnetic materials, antiferromagnetic materials, ferrites

MODULE III BATTERIES **7**

Electrochemical and electrolytic cell – batteries: types (primary, secondary and flow cell) – primary batteries: dry cells, alkaline batteries – secondary batteries: nickel-cadmium cell – lead acid storage cell, lithium battery: primary and secondary type – solar cell – dye sensitized solar cell.

MODULE IV FUEL CELLS **8**

Difference between batteries and fuel cells - chemistry of fuel cells - types of fuel cell (based on temperature and electrolyte) – principle, characteristic features, advantages, disadvantages and applications of polymer electrolyte membrane or proton exchange membrane fuel cell (PEMFC), direct methanol fuel cell (DMFC), alkaline fuel cell (AFC), phosphoric acid fuel cell (PAFC), molten carbonate fuel cell (MCFC) and solid oxide

fuel cells (SOFC).

PRACTICALS

1. Free radical polymerization of styrene.
2. Free radical polymerization of PMMA.
3. Preparation of phenol-formaldehyde.
4. Preparation of urea-formaldehyde.
5. Synthesis of epoxy resin.
6. Demonstration of mechanical properties of insulating materials using UTM
7. Demonstration of electrical properties of insulating materials
8. Construction of batteries using natural resources
9. Measurement of EMF for different batteries.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Jain P.C. and Renuka Jain, Engineering Chemistry, Dhanpat Rai Publication Co. (P) Ltd., New Delhi, 2013.
2. Michael L. Berins, Plastics Engineering Hand Book, 5th Edition, Chapman and Hall, New York, 1991.
3. H.F. Mark and N. Gaylord, Encyclopedia of Polymer Science and Technology, Vol. 1 to XIV Interscience, 2nd Ed. 1988.
4. Gowarikar V.R., Viswanathan N.V and Jayadev Sreedhar, Polymer Science, Wiley Eastern Limited, Madras, 1981.
5. R.K. Rajput,A Textbook of Electrical Engineering Materials, Firewall Media, 2004
6. Vladimir S. Bagotsky, Fuel Cells: Problems and Solutions, 2nd Edition, John Wiley and Sons, 2012.
7. B. Viswanathan and M. Aulice Scibioh, Fuel Cells: Principles and Applications, Taylor and Francis Group, 2007.

OUTCOMES:

The student will be able to

- summarise the preparation, properties and applications of plastics used in electrical and electronic applications
- enumerate the properties and uses of electrical engineering materials
- illustrate various types of batteries with the aid of a diagram
- classify the fuel cells and elaborate the different types of fuel cells.

CHCX04	ENGINEERING MATERIALS	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students should be conversant with

- properties and uses of different types of refractories and abrasives
- adhesives, cements and lime, setting of cements and their chemical behaviors.
- types, properties and uses of lubricants.
- various types of composite materials.

MODULE I REFRACTORIES AND ABRASIVES **8**

Introduction refractory: -classification - based on chemical nature- characteristic and selection of good refractory - general manufacture of refractory- preparation properties and uses of: silica refractory - magnesite refractory - zirconia refractory, properties of refractories: refractoriness - refractoriness under load - thermal spalling - porosity and dimensional stability, Cermets - super refractory.

Abrasives : introduction - Moh's scale - natural abrasives: diamond – corundum – emery - garnet and quartz, synthetic abrasives: preparation properties and uses: carborundum (silicon carbide)– alundum - boron (norbide) carbide

MODULE II ADHESIVES AND BINDING MATERIALS **7**

Introduction - classification of adhesives –advantage –limitation of adhesive bonding – development of adhesive- factors influencing adhesive action: chemical and physical, application techniques of adhesive – Lime: classification – manufacture - setting and hardening, Gypsum: -Manufacture and properties and uses - Cement : chemical composition- Manufacture – setting and hardening – concrete – weathering of cement and concrete and its prevention- special cements: high alumina cement - sorel cement - white portland cement – water proof cement.

MODULE III LUBRICANTS **7**

Introduction –functions of lubricant- mechanism of lubrication - classification of lubricant – liquid lubricant: vegetable and animal oils – mineral oils, semisolid: grease(calcium, lithium, aluminium) – petroleum jelly, solid lubricant: graphite - molybdenum disulphide, Properties of lubricant: viscosity - viscosity index - flash point and fire point - cloud point and pour point – oiliness - aniline point - carbon residue.

MODULE IV COMPOSITE MATERIALS 7

Introduction – advantageous characteristics of composites, applications of composites, main constituent of composites, types and applications of composites: RCC fibre-reinforced plastics (glass , carbon and aramid) - particulate composite - metal matrix composite - layered composites - failures in fibre-reinforced composites, ceramic matrix composites (CMC) – properties and applications.

PRACTICALS

1. Preparation of refractory bricks
2. Preparation of abrasive papers/cloth
3. Preparation of simple adhesives
4. Estimation of alkalinity in cements
5. Determination of cloud point and pour point
6. Determination of flash point and fire point
7. Preparation of fibre-reinforced composite

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. P.C Jain & Monica Jain, Engineering Chemistry Dhanpatrai Publishing Company (P) Ltd., New Delhi (2013).
2. B.Sivasnakar, “Engineering Chemistry”, Tata McGrow-Hill Publication Limited, New Delhi, second reprint 2008.
3. Engineering Chemistry, Wiley India Editorial Team, Willey India Publisher, New Delhi, 2011.
4. S S Umare & S S Dara, A text Book of Engineering Chemistry, S. Chand& Company Ltd, New Delhi, 2014.

OUTCOMES:

The student will be able to

- classify and describe the manufacture the refractories and enumerate the properties and uses of abrasive materials.
- elaborate the manufacture, properties and uses of various adhesives and binding materials.
- classify lubricants and describe the properties and uses of them
- enumerate the properties and uses of various composite materials.

CHCX05	FUELS AND COMBUSTION	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make the students conversant with the

- three types of fuels available and the different processes involved in it.
- analysis of fuel characteristics and manufacture of fuels
- calculations involved in calorific values and minimum air requirement for complete combustion.
- classification, functions, mechanism and properties of lubricants.

MODULE I SOLID FUELS **7**

Characteristics of good fuel. Solid fuel – Wood, Coal – Ranking of coal – selection of coal. Analysis of coal – Proximate analysis. Pulverized coal – Metallurgical coke – Carbonization of coal – types. Manufacture of metallurgical coke – Beehive oven and Otto Hoffman's by-product oven methods.

MODULE II LIQUID AND GASEOUS FUELS **8**

Liquid fuel: Petroleum: Refining of petroleum, Liquid fuels derived from petroleum – Cracking: Thermal (Liquid and Vapour phase) – Catalytic (fixed bed and moving bed cracking – Synthetic petrol: Fischer-Tropsch method– Knocking in petrol and diesel engine: octane number and antiknocking – cetane number and improvement of cetane number – biodiesel (trans-esterification) – Gaseous fuels: Compressed natural gas (CNG) – LPG – oil gas – producer gas – water (blue) gas – biogas.

MODULE III COMBUSTION **8**

Calorific value: Gross and net caloric value – Bomb Calorimeter, Gas calorimeter - Definition of combustion – calculation of minimum requirement of air (problems) – theoretical calculation of calorific values (Dulong's formula), Gross and net calorific values ((problems) – Analysis of flue gas: Orsat's gas analysis method, explosive range, Ignition temperature. Introduction to air pollution from IC (Internal combustion) engines, photochemical smog, primary and secondary pollutants.

MODULE IV LUBRICANTS **7**

Friction and wear – lubricants: definition, functions and mechanism of lubrication

(thick film and thin film) –classification: liquid lubricants: animal and vegetable origin, mineral oil, blended oils, lubricating emulsions and silicones – properties of lubricating oils: viscosity and viscosity index; Flash and fire-point, Cloud and pour point, oiliness, emulsification number, volatility, carbon residue, aniline point – semisolid lubricant: greases and waxes – solid lubricant: graphite and molybdenum disulphide –nanolubricants.

PRACTICALS

1. Testing of fuels - proximate analysis (moisture, volatile matter, ash content and fixed carbon present in coal, coke, charcoal etc)
2. Ash content and carbon residue test
3. Biodiesel synthesis by trans-esterification method (from coconut, groundnut, mustard oil, palm oil)
4. Determination of calorific value of a solid fuel using Bomb calorimeter (coal, charcoal, coke etc)
5. Determination of calorific value of a liquid fuel using Bomb calorimeter (petrol, diesel, biodiesel etc)
6. Determination of cloud point and pour point of a lubricant
7. Determination of flash and fire point of diesel.
8. Aniline Point of diesel
9. Viscosity Index of lubricants and Fuels by Viscometer
10. Flue gas analysis by Orsat's gas analysis method – Demonstration
11. Working of internal combustion engine – Demonstration

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai and Sons, New Delhi, 2001.
2. Engineering Chemistry, Wiley India Editorial Team, Willey India Publisher, New Delhi, 2011.
3. John Griswold, Fuels Combustion and Furnaces, Mc-Graw Hill Book Company Inc. University of Michigan, 1946.
4. J.B. Heywood, Internal Combustion Engine Fundamentals, McGraw Hill International Editions, 1989.
5. Bahl B.S., Tuli and Arun Bahl, Essentials of Physical Chemistry, S. Chand and Company Ltd., New Delhi, 2004.

OUTCOMES:

The students will be able to

- compare and contrast the solid, liquid and gaseous fuels and also describe the processes involved in liquid and gaseous fuels.
- analyse the fuel properties such as moisture, votalite matter, ash content, calorific value etc
- calculate minimum air required for complete combustion and calorific values of fuels.
- categorize different lubricants into three types, explain the preparation and determine their properties.

CHCX06	FUNDAMENTALS OF PHYSICAL CHEMISTRY	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students will be conversant with the

- various thermodynamic terms and relate the laws of thermodynamics in chemical processes
- molecularity and order of reaction and derive the rate constant for different order of reactions
- basics of adsorption of different materials and propose mechanisms and surface area measurement
- conditions for equilibrium and learn different components at equilibrium

MODULE I BASIC THERMODYNAMICS **8**

Introduction - Thermodynamic terms - Thermodynamic equilibrium and processes - 1st law of thermodynamics: internal energy, enthalpy, heat capacity, isothermal and adiabatic expansion, Joule-Thomson effect - Zeroth law of thermodynamics: absolute temperature - 2nd law of thermodynamics: - spontaneous and cyclic process, Entropy in isothermal, isobaric and isochoric processes, work and free energy function, Maxwell's relation - 3rd law of thermodynamics

MODULE II CHEMICAL KINETICS **8**

Rate of chemical reaction - order and molecularity of a reaction - Rate constant - kinetics of opposing, parallel and consecutive and chain reactions - isotope effects - effect of temperature on reaction rate - collision theory - absolute reaction rate theory - kinetics in enzyme catalysis

MODULE III SURFACE SCIENCE AND CATALYSIS **8**

Adsorption - adsorption isotherms - uni and bimolecular adsorption reactions - parahydrogen conversion - factors affecting adsorption – Langmuir adsorption isotherm - Hinshelwood mechanism and *Eley-Rideal* mechanism with example - adsorption of gases on solids and surface area measurement by BET method - Terms in catalysis - homogeneous and heterogeneous and enzyme catalysis with example

MODULE IV PHASE RULE **6**

Terms involved - Conditions for equilibrium - application of phase rule to water, lead-silver system, freezing mixtures, thermal analysis: cooling curves.

PRACTICALS

1. Determination of the heat capacity of benzoic acid, internal energy of combustion of camphor using Bomb calorimeter. Calculation of enthalpy of combustion and formation for camphor.
2. Determination of adsorption isotherm of (i) acetic acid on charcoal (ii) oxalic acid on charcoal.
3. *Kineticsoffirst and second order reactions.*
4. Phase rule experiments with organic compounds: (i) naphthalene and p-dichloro benzene (ii) naphthalene and diphenyl (iii) m-dinitrobenzenzene and p-nitro toluene.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Rajaram J. and Kuriacose J.C., Chemical Thermodynamics: Classical, Statistical and Irreversible, Pearson Education, India, 2013.
2. Samuel Glasstone, Thermodynamics for Chemists, Read Books, United Kingdom, 2007.
3. James E. House, Principles of Chemical Kinetics, 2nd Edition, Academic Press, United States of America, 2007.
4. Keith J. Laidler, Chemical Kinetics, Pearson Education, India, 1987.
5. Douglas M. Ruthven, Principles of Adsorption and Adsorption Processes, John Wiley & Sons, 1984.
6. Puri B.R., Sharma L.R. and Pathania M.S., Principles of Physical Chemistry, 47th Edition, Vishal Publishing Co. India, 2016.

OUTCOMES:

The student will be able to

- calculate entropy, enthalpy and free energy change for different chemical processes
- calculate the rate constant for any chemical and biochemical processes
- differentiate the adsorption processes and calculate the surface area and predict the suitability of catalysts for different chemical processes
- predict the equilibrium conditions for water, alloys, freezing mixtures and draw the thermal curves for phase transition

CHCX07	GREEN TECHNOLOGY	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make students conversant with the

- basic principles of green chemistry and green technology.
- wastes that causes hazards to human health
- chemicals that harms our environment
- need for green processes in various industries

MODULE I GREEN CHEMISTRY PROTOCOL **7**

Need – Significance – 12 Principles with examples – R4 model – Life cycle analysis – sustainable and cleaner production - Green Technology: definition, examples: CFC free refrigerants, green building, energy, 3D printers, nanotechnology – Awards for Green chemistry – organization promoting green chemistry.

MODULE II WASTE & WASTE MINIMISATION **8**

Source of wastes: domestic, industrial, medical, nuclear, e-waste; problems; prevention – economy of waste disposal – Waste minimization techniques: general waste treatment and recycling – alternate waste water treatment technologies: hybrid process – Green computing: goals, green cloud, green ICT - Pollution statistics from various industries (Industrial case studies).

MODULE III GREEN SYNTHESIS **7**

Introduction - Solvent free reactions - green reagents, green solvents in synthesis - microwave and ultrasound assisted reactions – supercritical fluid extraction – green oxidation and photochemical reactions – catalyst and biocatalysts.

MODULE IV GREEN INDUSTRIAL PROCESSES **8**

Polymer industry: biodegradable polymer - textile industry: greener approaches of dyeing, waste disposal – ecofriendly agrochemicals: biofertilizers, biopesticides – Pharmaceutical industry: atom economy, reduction of toxicity, use of biocatalyst, zero waste disposal – Leather industry: greener process in tanning, crusting, surface coating – ecofriendly batteries & fuel cells.

PRACTICALS

1. Synthesis of an ionic liquids (Ex: imidazolium) and testing the solubility of organic

chemicals.

2. Green bromination of stilbene (using pyridine hydrobromide).
3. Green synthesis: Photocatalytic reactions, solvent-free organic reaction – Aldol; green oxidation, green reduction.
4. Microwave assisted chemical reaction. (synthesis of aspirin, pinacol-pinacolone reaction, etc).
5. Comparison of conventional reaction with microwave assisted reactions (atom economy, solvent, etc) [Ex: aldehyde and ketones with hydrazines to give hydrazones].
6. Diels-Alder reaction in eucalyptus oil (green process).

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai and Sons, New Delhi. 2001.
2. V. K. Ahluwalia, Green Chemistry: Environmentally Benign Reactions, Ane Books India, New Delhi, 2006.
3. Paul Anastas, John C.Warner, John Warner Joint; Green Chemistry: Theory & Practice New Ed Edition; Oxford University press, USA, 2000.
4. Rashmi Sanghi, M. M. Srivastava, Green chemistry, Narosa publishers, New Delhi, 2003.

OUTCOMES:

The students will be able to

- outline the principles and implications of green chemistry.
- comprehend the potential risks of waste generated and analyse the threats to human and environment.
- integrate information into design of molecules to avoid/eliminate toxic solvents & reagents or reduce toxic products.
- identify various alternate greener technologies for various industries.

CHCX08	ORGANIC CHEMISTRY OF BIOMOLECULES	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make students conversant with the

- basic concepts in organic chemistry
- types and structure of carbohydrates and lipids
- formation of different structures of proteins from amino acid
- structure of nucleic acids

MODULE I BASIC CONCEPTS IN ORGANIC CHEMISTRY **8**

Classification and IUPAC nomenclature of organic compounds – stereochemistry – optical, stereo and geometrical isomerism – types of reagents: electrophiles and nucleophiles – types of reactions: addition, substitution, elimination and rearrangement reactions.

MODULE II CARBOHYDRATES, LIPIDS AND VITAMINS **7**

Structure and functions of carbohydrates: mono, di, oligo and polysaccharides – lipids: phospholipids, glycolipids, sphingolipids – cholesterol – steroids – Structure, functions and deficiency disorders of fat soluble vitamins: A, D, E & K - Water soluble vitamins B & C: Thiamine, riboflavin, pantothenic acid, niacin, pyridoxine, biotin, cobalamine, folic acid and ascorbic acid.

MODULE III AMINO ACIDS, PEPTIDES AND PROTEINS **7**

Aminoacids: classification, properties - peptides – polypeptides – proteins: primary, secondary, tertiary and quaternary structure – glycoproteins – lipoproteins – Enzymes: classification and functions

MODULE IV NUCLEIC ACIDS **8**

Nucleic acids – importance - structure of purines and pyrimidines – nucleotides – polynucleotides - RNA – types & structure - DNA – phosphodiester bonds – chemical, helical structure and functions – DNA replication – gene modification.

PRACTICALS

1. Qualitative tests to identify carbohydrates.

2. Quantitative estimation of carbohydrates.
3. Separation of sugars – TLC and/or paper chromatography.
4. Quantitative estimation of lipids.
5. Separation of amino acids – TLC and/or paper chromatography.
6. Quantitative estimation of proteins by Lowry's method.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. V. K. Ahluwalia, Organic Reaction Mechanism, Narosa Publishers, New Delhi, 2002.
2. Johnson Arthur T., Biology for Engineers, CRC Press, Finland, 2011.
3. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai and Sons, New Delhi. 2001.
4. David L. Nelson, Michael M. Cox, Lehninger Principles of biochemistry, Macmillan press, London, 2010

OUTCOMES:

The students will be able to

- classify organic compounds and explain the mechanism of various organic reactions.
- draw the structures and enumerate the functions of carbohydrate, lipids and vitamins.
- correlate the relationship among amino acids, peptides and proteins.
- recognize the role of nucleic acid in the formation of RNA & DNA and differentiate DNA & RNA using their structure and function.

CHCX09	POLYMER SCIENCE AND TECHNOLOGY	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make the student conversant with the

- basic concepts of polymers, classification, types of polymerization and molecular weight & its distribution
- preparation, properties and applications of thermoplastics and introduction to biodegradable polymers
- properties and applications of thermosets, elastomers and FRP
- different types of moulding techniques

MODULE I BASIC CONCEPTS OF POLYMERS **8**

Definitions: monomer, polymer, functionality, degree of polymerization – classification of polymers: source, structure, application, thermal processing behavior (thermoplastics and thermosets), composition and structure (addition and condensation), mechanism (chain growth and step-wise growth) – copolymer: types – Definition –nomenclature of polymers – tacticity – types of polymerization : free radical, cationic and anionic polymerization (concepts only) – average molecular weight of polymer: number, weight – molecular weight distribution (problems)

MODULE II THERMOPLASTICS AND BIODEGRADABLE POLYMERS **8**

Preparation, properties and applications : LDPE, HDPE, polypropylene, PVC, PTFE, PET, polyamides (Nylon-6 and Nylon 6,6) and polycarbonates – polymer blends and alloys – basics of biodegradable polymers.

MODULE III THERMOSET RESINS, ELASTOMERS AND FRP **7**

Thermoset resins : phenolic resins, amino resins (urea and melamine formaldehyde), epoxy resins, unsaturated polyesters – polyurethanes – elastomers : vulcanization of natural rubber, diene based elastomers –fibre reinforced plastics: glass, aramid and carbon.

MODULE IV MOULDING TECHNIQUES **7**

Moulding constituents**:** functions – moulding techniques**:** compression, injection, extrusion (single screw), blow moulding, thermoforming, (mechanical and vacuum

forming), lamination.

PRACTICALS

1. Determination of molecular weight and degree of polymerization using Oswald's viscometer.
2. Free radical polymerization of styrene.
3. Free radical polymerization of PMMA.
4. Preparation of phenol-formaldehyde.
5. Preparation of urea-formaldehyde.
6. Synthesis of epoxy resin.
7. Synthesis of unsaturated polyester.
8. Preparation of FRP laminates.
9. Demonstration of injection moulding, compression moulding and blow moulding.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Billmeyer F.N., Text Book of Polymer Science, 3rd Edition, John Wiley and Sons, New York, 1994.
2. George Odian, Principles of Polymerisation, 3rd Edition, McGraw Hill Book Company, New York, 1991.
3. Michael L. Berins, Plastics Engineering Hand Book, 5th Edition, Chapman and Hall, New York, 1991.
4. Jacqueline I., Kroschwitz, Concise Encyclopedia of Polymer Science and Engineering, John Wiley and Sons, New York, 1998.
5. Encyclopedia of Polymer Science and Technology, Vol. 1 to XIV, H.F. Mark and N. Gaylord, Interscience, 2nd Ed. 1988.
6. Gowarikar V.R., Viswanathan N.V and Jayadev Sreedhar, Polymer Science, Wiley Eastern Limited, Madras, 1981.

OUTCOMES:

The student will be able to

- classify various polymers, name the polymers and types of polymerization reactions, calculate molecular weight of polymers,
- summarise preparation, properties and applications of thermoplastics and give examples of biodegradable polymers

- elaborate the properties and applications of thermosets, elastomers and FRP
- select the appropriate moulding technique for a given polymer, based on the application

Maths Elective Courses

(to be offered in IV

Semester)

MACX 01	**DISCRETE MATHEMATICS AND GRAPH THEORY**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

OBJECTIVES:

The aims of this course are to

- introduce Logical and Mathematical ability to deal with abstraction.
- familiarize the basic mathematical ideas and terminologies used in computer science.
- translate real life situations into diagrammatic representations.

MODULE I PROPOSITIONAL CALCULUS 8

Propositions – Logical connectives – Compound propositions – Conditional and biconditional propositions – Truth tables – Tautologies and contradictions – Contrapositive – Logical equivalences and implications – DeMorgan's Laws – Normal forms – Principal conjunctive and disjunctive normal forms – Rules of inference – Arguments – Validity of arguments.

MODULE II PREDICATE CALCULUS 7+3

Predicates – Statement function – Variables – Free and bound variables – Quantifiers – Universe of discourse – Logical equivalences and implications for quantified statements – Theory of inference – The rules of universal specification and generalization – Validity of arguments.

MODULE III FUNCTIONS 7+3

Functions – Classification of functions –– Composition of functions – Inverse functions – Binary and n–ary operations – Characteristic function of a set – Hashing functions – Recursive functions – Permutation functions.

MODULE IV ALGEBRAIC SYSTEMS 8+2

Groups, Cyclic Groups, Subgroups, Cosets, Lagrange's theorem, Normal subgroups – Codes and group codes – Basic notions of error correlation – Error recovery in group codes.

MODULE V GRAPH THEORY 7+3

Graphs – incidence and degree – subgraphs – isomorphism – complement of a graph – operations on graphs

MODULE VI PATH AND CIRCUIT 8+2

Walks, trails and paths – Eulerian graphs – Konigsburg bridge problem - Hamiltonian graphs

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1 Trembly J.P and Manohar R, “Discrete Mathematical Structures with Applications to Computer Science”, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, 30th Reprint 2011.

2 Kenneth H.Rosen, “Discrete Mathematics and its Applications:, 7th Edition, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, Special Indian Edition, 2011.

REFERENCES:

1 Ralph.P.Grimaldi, “Discrete and Combinatorial Mathematics: An Introduction”, 4th Edition, Pearson Education Asia, Delhi, 2007.

2 Thomas Koshy, “Discrete Mathematics with Applications”, Elsevier Publications, 2006.

3 C.L.Liu, D.P.Mohapatra, “Elements of Discrete Mathematics”, 4th Edition, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, 2012.

OUTCOMES:

At the end of the course, student will be able to

- use the concepts of propositional calculus.
- use the concepts of predicate calculus.
- identify types of functions and their importance.
- decode and encode the messages using group theory concepts.
- apply the basic concepts of graph theory.
- represent some real life situations into diagrammatic representation.

MACX 02 PROBABLITY AND STATISTICS L T P C
3 1 0 4

OBJECTIVES:

The aims of this course are to impart the

- knowledge of the theory of probability and random variables
- techniques to carry out probability calculations and identifying probability distributions
- application of statistical inference in practical data analysis

MODULE I BASICS OF PROBABILITY AND STATISTICS 8+2

Sample space, events- axioms of probability and interpretation – Addition, multiplication rules – conditional probability, Independent events - Total probability – Baye's theorem - Descriptive Statistics.

MODULE II ONE DIMENSIONAL RANDOM VARIABLE AND PROBABILITY DISTRIBUTION FUNCTIONS 7+3

Discrete random variable –continuous random variable – Expectation - probability distribution - Moment generating function – Binomial, Poisson, Geometric, Uniform (continuous), Exponential and Normal distributions.

MODULE III TWO DIMENSIONAL RANDOM VARIABLES 8+2

Joint, marginal, conditional probability distributions –covariance, correlation - transformation of random variables.

MODULE IV SAMPLING AND ESTIMATION 7+3

Sampling distributions – basic knowledge on Random , simple random , stratified and cluster samplings – Test of Hypotheses - concepts- Point estimation and Interval estimation.

MODULE V THEORY OF INFERENCE 8+2

Large sample tests – test for single and difference on proportions, single mean, difference of means, difference of variances – confidence intervals. Small sample tests – Student's t test, F test and Chi square test on theory of goodness of fit and analyses of independence of attributes.

MODULE VI DESIGN OF EXPERIMENTS 7+3

Analysis of variance – one way classification – two way classification – Completely

Randomised Block Designs – Randomised Block Design – Latin square designs - Interpretations - case studies.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. T.Veerarajan, “Probability and Statistics”, Tata McGraw-Hill Education, 2008.
2. Miller, I., Miller, M.,Freund, J. E., “Mathematical statistics”, 7th Edition, Prentice Hall International, 1999.
3. S.P.Gupta, “Applied Statistics”, Sultan Chand & Sons

REFERENCES:

1. S.M.Ross, “Introduction to Probability and Statistics for Engineers and Scientists” Fifth Edition, Elesvier.
2. S.C.Gupta and V.K.Kapoor, “Fundamentals of Mathematical Statistics” First edition, Sultan Chand and Sons.
3. Arora and Arora, “Comphrensive Statistical Methods”, S. Chand, 2007

OUTCOMES:

On completion of the course, students will be able to

- do basic problems on probability and descriptive statistics.
- derive the probability mass / density function of a random variable.
- calculate probabilities and derive the marginal and conditional distributions of bivariate random variables.
- calculate point and interval estimates.
- apply some large sample tests and small sample tests.
- carry out the data collection representation analysis and implications and the importance of inferences.

MACX 03	RANDOM PROCESSES	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aims of the course are to

- acquire the knowledge of the theory of probability and random variables
- study discrete and continuous probability distributions.
- demonstrate the techniques of two dimensional random variables and its distributions.
- introduce the random process, stationarity, Markov process and the study of correlation function and spectral analysis.

MODULE I Basics of Probability 7+3

Sample space, events- axioms of probability and interpretation – Addition, multiplication rules – conditional probability, Independent events - Total probability – Baye's theorem - Tchebychev's inequality.

MODULE II One dimensional Random variable and Probability Distribution functions 7+3

Discrete random variable –continuous random variable – Expectation - probability distribution - Moment generating function – Binomial, Poisson, Geometric, Uniform (continuous), Exponential and Normal distributions.

MODULE III Two dimensional random variables 7+3

Joint, marginal, conditional probability distributions - covariance, correlation and regression lines - transformation of random variables.

MODULE IV RANDOM PROCESSES 8+2

Classification of Random process - Stationary process - WSS and SSS processes - Poisson process – Markov Chain and transition probabilities.

MODULE V CORRELATION FUNCTIONS 8+2

Autocorrelation function and its properties - Cross Correlation function and its properties - Linear system with random inputs – Ergodicity.

MODULE VI SPECTRAL DENSITY 8+2

Power spectral Density Function - Properties - System in the form of convolution - Unit Impulse Response of the System – Weiner-Khinchine Theorem - Cross Power

Density Spectrum.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Veerarajan T., “Probability, Statistics and Random Processes”, Tata McGraw Hill,3rd edition, 2008.
2. Papoulis, “Probability, Random Variables and Stochastic Processes”, 4th Edition, Tata McGraw Hill Company, 2002.
3. S.M.Ross, “Introduction to Probability and Statistics for Engineers and Scientists” Fifth Edition, Elesvier

REFERENCES:

1. Scott L. Miller,Donald G. Childers, Probability and Random Processes, Academic Press,2009.
2. Trivedi K S, “ Probability and Statistics with reliability, Queueing and Computer Science Applications”,Prentice Hall of India,New Delhi,2nd revised edition, 2002

OUTCOMES:

On completion of the course, students will be able to

- do basic problems on probability.
- derive the probability mass / density function of a random variable.
- calculate probabilities and derive the marginal and conditional distributions of bivariate random variables.
- identify and study the different random processes.
- compute correlation functions and related identities.
- compute power spectral density functions and apply Weiner-Khinchine formula.

MACX 04 APPLIED NUMERICAL METHODS L T P C
3 1 0 4

OBJECTIVES:

The aims of the course are to

- introduce basic computational methods for analyzing problems that arise in engineering and physical sciences.
- acquire knowledge about approximation theory and convergence analysis associated with numerical computation.

MODULE I NUMERICAL SOLUTIONS OF EQUATIONS 7+3

Bisection method - Regula Falsi method – Secant method - Fixed point iteration method - Newton's Raphson method –Gauss Elimination method - Gauss-Jordon method – Gauss Jacobi method - Gauss-Seidel method.

MODULE II INTERPOLATION 8+2

Finite difference operators – Gregory Newton's forward and backward interpolations – Cubic spline interpolation - Lagrange interpolation - Newton's divided difference formula.

MODULE III NUMERICAL DIFFERENTIATION AND INTEGRATION 8+2

Numerical differentiation using Newton's forward and backward formulae – Numerical integration : Trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Gaussian Two Point and Three Point Quadrature formulae – Double integrals using Trapezoidal and Simpson's 1/3 rule.

MODULE IV INITIAL VALUE PROBLEMS FOR FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS 7+3

Numerical solutions by Taylor's Series method, Euler's method, Modified Euler's Method - Runge – Kutta Method of fourth order – Milne's and Adam's Bashforth Predictor and Corrector methods

MODULE V INITIAL AND BOUNDARY VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 8+2

Numerical solutions by Taylor's Series method - Runge – Kutta Method of fourth order of second order ODE. Finite difference methods.

MODULE VI BOUNDARY VALUE PROBLEMS FOR PARTIAL DIFFERENTIAL EQUATIONS 7+3

Finite difference solution of one dimensional heat equation by explicit and implicit

methods – One dimensional wave equation and two dimensional Laplace equation.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Grewal, B.S., “Numerical methods in Engineering and Science”, 7th edition, Khanna
   Publishers, 2007.
2. C.F.Gerald, P.O.Wheatley, “Applied Numerical Analysis” ,Pearson Education, New Delhi, 2002.

REFERENCES:

1. Chapra S.C, Canale R.P. “Numerical Methods for Engineers”, 5th Ed., McGraw Hill, 2006.
2. M.K.Jain, S.R.K.Iyengar, R.K.Jain, “Numerical methods for Scientific and Engineering Computation”, New Age International Publishers, New Delhi, 2003

OUTCOMES:

At the end of this course, students will be able to

- solve algebraic, transcendental and system of equations.
- apply interpolation techniques.
- carry out numerical differentiation and integration using different methods.
- solve first order ODE using single and multi step methods.
- solve second order ODE, initial and boundary value problems.
- solve the boundary value problems in PDE.

Maths Elective Courses
(To be offered in VI Semester)

MACX 05	MATHEMATICAL PROGRAMMING	L	T	P	C
		2	0	0	2

OBJECTIVES:

The aims of the course are to

- acquire knowledge and training in optimization techniques.
- obtain knowledge about optimization in utilization of resources.
- understand and apply operations research techniques to industrial operations.

MODULE I LINEAR PROGRAMMING PROBLEM 10

Linear programming – formulation of the problem - graphical interpretation of optimality - Simplex method – to obtain basic feasible solution – types of linear programming solution – complications and their resolution.

MODULE II ADVANCED LINEAR PROGRAMMING PROBLEMS 8

Artificial variable - Big M method – Two phase method – alternative optimal solution – unbounded solution - Duality – primal dual relationships.

MODULE III TRANSPORTATION PROBLEM 7

Transportation problems – Initial basic feasible solutions, MODI method, Unbalanced transportation problem, Degeneracy in transportation models,.

MODULE IV ASSIGNMENT PROBLEM 5

Assignment problem – Minimization and Maximization type of problems by Hungarian method.

Total Hours –30

TEXT BOOKS:

1. Hamdy A Taha, “Operations Research - An introduction”, 8th edition, Phil Pearson, 2007.
2. Winston.W.L., “Operations Research”, 4th edition, Thompson-Brooks/Cole, 2003.

REFERENCES:

1. Wayne.L. Winston, “Operations Research Applications and Algorithms”,

4th edition, Thomson learning, 2007.

2. Frederick. S. Hiller and Gerald J Lieberman, “Operations Research Concepts and Cases”, 8th edition (SIE), Tata McGraw – Hill Pub. Co. Ltd., New Delhi, 2006.
3. A. Ravindran, D. T. Phillips and J. J. Solberg, "Operations Research: Principles and Practice", 2nd edition, John Wiley & Sons, New York, 1992.
4. Robertazzi. T.G., “Computer networks and systems-Queuing theory and performance evaluation”, 3rd edition, Springer, 2002.

OUTCOMES:

At the end of the course, students will be able to

- formulate industrial problems as mathematical programming problems.
- solve linear programming problems by different methods.
- solve transportation problems by different methods.
- solve assignment problems by Hungarian method.

MACX 06	STATISTICAL METHODS FOR DATA ANALYSIS	L	T	P	C
		2	0	0	2

OBJECTIVES:

The aim of the course is to

- introduce statistical quality control tools.

MODULE I TESTS OF HYPOTHESES AND STATISTICAL INFERENCES 8

Small sample tests – Student's ' t ' test for single mean , difference of means, paired t test – F test for difference of variances – Chi square test on theory of goodness of fit and analyses of independence of attributes.

MODULE II DESIGN OF EXPERIMENTS 7

Analysis of variance – one way classification – two way classification – Completely Randomised Block Designs – Randomised Block Design – Latin square designs - Statistical analysis -Interpretations - case studies.

MODULE III STATISTICAL QUALITY CONTROL-I 8

Quality improvement and statistics –Statistical quality control- statistical process control – control charts – design of control charts –analysis of patterns on control charts - X bar chart, R chart and S chart.

MODULE IV STATISTICAL QUALITY CONTROL-II 7

Process and product control – attribute charts – P, np and C charts – control charts performance.

Total Hours –30

TEXT BOOKS:

1. Douglas C.Montgomery, George C. Runger "Applied Statistics and probability for Engineers" V Edition – John Wiley & Sons Inc.
2. Miller, I., Miller, M., Freund, J. E. "Mathematical statistics" 7th Edition. Prentice Hall International, 1999.

REFERENCES:

1. Dekking, F.M., Kraaikamp, C., Lopuhaä, H.P., Meester, L.E. "A Modern Introduction to Probability and Statistics" Springer, 2nd Edition.
2. Chin Long chiang "Statistical Methods of Analysis "World Scientific Books,

2003.
3. S.C.Gupta and V.K. Kapoor, “Mathematical Statistics” , Sultan Chand publications.
4. Veerarajan “Fundamentals of Mathematical Statistics” I Edition, Yes Dee Publishing Pvt. Ltd., 2017.

OUTCOMES:

On completion of the course, students will be able to

- develop and test hypothesis for different statistical tests
- design an experiment and case study the experiment with different data.
- analyze the industrial data using quality control design tools statistically.
- analyze the industrial data using process and product control tools statistically.

MACX 07 NUMERICAL METHODS FOR INTEGRATION AND DIFFERENTIAL EQUATIONS

L	T	P	C
2	0	0	2

OBJECTIVES:

- This course aims to solve numerically integral and differential equations.

MODULE I NUMERICAL INTEGRATION **8**

Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Two Point and Three point Gaussian quadrature formulae.

MODULE II NUMERICAL DOUBLE INTEGRATION **6**

Double integrals using trapezoidal and Simpson's 1/3 rules

MODULE III NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS **8**

Milne's Predictor and Corrector Method – Adam's Predictor-Corrector Method - Finite difference methods for two – point Boundary Value problems for Ordinary Differential Equations.

MODULE IV BOUNDARY VALUE PROBLEMS FOR PARTIAL DIFFERENTIAL EQUATIONS **8**

Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace and Poisson equations

Total Hours –30

TEXT BOOKS:

1. M.K.Jain, S.R.K.Iyengar, R.K.Jain, "Numerical methods for Scientific and Engineering Computation", New Age International Publishers, New Delhi, 2003.
2. Grewal, B.S., "Numerical methods in Engineering and Science" 7th edition, Khanna Publishers, 2007

REFERENCES:

1. C.F.Gerald, P.O.Wheatley, "Applied Numerical Analysis" Pearson Education, New Delhi 2002.
2. P.Dechaumphai, N. Wansophark, "Numerical Methods in Engineering", Narosa Publications, 2012.

OUTCOMES:

At the end of the course students will be able to

- solve the integration by numerical methods.
- solve the double integration by numerical methods
- find numerical solution of ordinary differential equations in engineering problems.
- find numerical solution of partial differential equations in engineering problems.

MACX 08 MATHEMATICAL MODELLING

L	T	P	C
3	0	0	3

OBJECTIVES:

The aims of the course are to

- provide basic idea of formation and use of Mathematical models for different purposes.
- determine the extent to which models are able to replicate real-world phenomena under different conditions

MODULE I PRINCIPLES OF MATHEMATICAL MODELING 7

Mathematics as a modelling language - Classification of models - Building, studying, testing and using models - Black and white box models – Difference equations

MODULE II PHENOMENOLOGICAL MODELS 7

Linear, Multiple linear and nonlinear regression - Neural networks - Fuzzy model - Stability and higher dimensional systems

MODULE III MECHANISTIC MODELS –I 8

Setting up ODE models – Initial and Boundary value problems - Numerical solutions - Fitting ODE to data - Applications

L	T	P	C
2	0	0	2

MODULE IV MECHANISTIC MODELS –II 8

Linear and nonlinear equations - Elliptic, parabolic and hyperbolic equations - Closed form solutions - Finite difference and finite element methods

Total Hours –30

TEXT BOOKS:

1. G . Ledder , “Calculus, modelling , probability and dynamic systems”, Springer 2013
2. Kei Velten, “Mathematical modelling and simulation”, J. Wiley and sons,2009

REFERENCES:

1. Michael D Alder, “An introduction to Mathematical modelling”, Heaven for Books.com
2. Alfio Quarteroni, “Mathematical models in science and engineering”, Notices of AMS
3. J.N. Kapur, “Mathematical models in Biology and Medicine”, Affiliated East-

West Press Private Limited, New Delhi, 1992.

OUTCOMES:

On completion of the course, the students will be able to

- identify the relationship between real world and mathematical models
- Classify the data and choose the appropriate model
- Distinguish between linear and nonlinear models
- identify the relationship between empirical and mechanistic models

MACX 09 **GRAPH THEORY** **L T P C**

3 0 0 3

OBJECTIVES:

The aims of this course are to

- represent the real life situations diagrammatically.
- appraise different methods to find solutions to graph theory problems.

MODULE I INTRODUCTION TO GRAPH THEORY 8

Graphs - finite and infinite graphs - Incident and degree-isolated vertex, pendent vertex and null vertex.

MODULE II PATH AND CIRCUIT 8

Isomorphism – sub graphs-walks, paths and circuits – connected and disconnected graphs- Euler graphs – operation on a graph.

MODULE III TREES AND FUNDAMENTAL CIRCUITS 7

Trees- some properties of trees- pendent vertices in a tree – rooted binary tree-spanning trees-fundamental circuits.

MODULE IV CUT SETS AND CUT VERTICES

Cut sets – some properties of cut sets- fundamental circuits and cut sets-network flows.

Total Hours –30

TEXT BOOKS:

1. NARSINGH DEO, Graph theory with applications to Engineering and Computer Science, Prentice Hall INC, New Delhi,
2. J.A. Pondy and U.S.R. Murthy, North Holland, Oxford, New York Graph theory with applications

REFERENCES:

1. Trembly J.P and Manohar R, “Discrete Mathematical Structures with Applications to Computer Science”, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, 30th Reprint 2011
2. Kenneth H.Rosen, “Discrete Mathematics and its Applications”, 7th Edition, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, Special Indian Edition, 2011

3. Md. Saidur Rahman, “Basic graph theory”, Springer, 2017

OUTCOMES:

At the end of the course, students will be able to

- demonstrate the basic concepts of Graph theory.
- explore connected and disconnected graphs.
- identify the real life problems with trees and circuits.
- bring out the cut set properties and network flows properties.

Humanities Elective I

(To be offered in III Semester)

		L	T	P	C
SSCXO1	**FUNDAMENTALS OF ECONOMICS**	**2**	**0**	**0**	**2**

OBJECTIVES:

- To identify and present the basic concepts of demand, supply and equilibrium.
- To explain and discuss the types and concepts of national income and inflation.
- To illustrate the fundamental concepts of money, banking and public finance.
- To apprise the students about Indian economy and the role of engineers in economic development.

MODULE I DEMAND AND SUPPLY ANALYSIS 8

Classification of economy – open and closed economy, Demand - Types of demand - Determinants of demand – Law of Demand - Demand elasticity - Supply - Determinants of Supply – Law of Supply - Supply elasticity - Pricing strategies.

MODULE II NATIONAL INCOME AND INFLATION 7

Concepts of National income and measurement – Importance and difficulties of estimating National Income in India - Aggregate demand and aggregate supply, Macroeconomic equilibrium – meaning of inflation- types - causes and preventive measures

MODULE III MONEY, BANKING AND PUBLIC FINANCE 9

Money – Meaning, types, functions, importance - Commercial Banks - Central Bank - Monetary policy – meaning, objectives, Methods of Credit Control By RBI, Government Budget – Government revenue and Expenditures – Fiscal policy - Its objectives, instruments and limitations - Deficit Financing - The Fiscal Responsibility and Budget Management Act, 2003 (FRBMA) .

MODULE IV INDIAN ECONOMY AND THE ROLE OF ENGINEERS 6

Economic reforms – Liberalization, Privatization and Globalization - challenges and opportunities, Engineers – Engineers' contributions to the economic growth.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Dutt and Sundharam (2013), *Indian Economy*, S. Chand & Company Pvt. Ltd, New Delhi.
2. Hussain, Moon Moon (2015), *Economics for Engineers*, Himalaya Publishing House, New Delhi.

REFERENCES:

1. Cleaver Tony (2004), "*Economics: The Basics*", Routledge, London.
2. Mell Andrew and Walker Oliver (2014), "*The Rough Guide to Economics*", Rough Guide Ltd.

OUTCOMES:

On successful completion of this course,

- Students will have had exposure to the basic concepts of demand, supply and various pricing strategies.
- Students will have understood the macroeconomic concepts of national income and inflation.
- Students will be able to apply the knowledge of money, banking and public finance in their real life situations.
- Students will have an overview of the economic reforms introduced in Indian economy.

SSCXO2 PRINCIPLES OF SOCIOLOGY.

L	T	P	C
2	0	0	2

OBJECTIVES:

- To acquaint the students with Concepts and perspectives of Sociology
- To explain the reflection of society in Individuals and vice versa
- To describe the hierarchical arrangement of individuals and groups in society
- To explicate the dimensions, forms and factors of Social change.
- To examine the context, impact and agencies of Globalization

MODULE I THE FOUNDATIONAL CANON 8

Sociology-Definition, scope and importance; Major theoretical perspectives- Functionalism, Conflict Theorising and Interactionism; Elements of social formation- Society, Community, Groups and Association; Associative Social Process- Co-operation, Accommodation and Assimilation; Dissociative Social Process- Competition and Conflict.

MODULE II INDIVIDUAL AND SOCIETY 7

Culture-definition, characteristics, functions, types, cultural lag and civilization, Socialization – definition, process, stages, agencies and anticipatory socialization; Social Control- definition, characteristics, importance, types & agencies.

MODULE III SOCIAL INEQUALITY AND STRATIFICATION 7

Concepts- inequality, hierarchy, differentiation, Social Exclusion, and Social Stratification. Forms of Social Stratification- Caste, Class and Estate. Gender and Social Stratification- sex and gender, patriarchy, factors perpetuating gender stratification; Globalization and gender inequality

MODULE IV SOCIAL CHANGE AND GLOBALIZATION 8

Social Change-definition, nature, direction; Forms- evolution, development, progress and transformation; Factors of social change- demography, economy, technology, polity and culture. Globalization- definition, characteristics, historical and social context and Impact, agencies of globalization- IGOs, INGOs, Nation-State, MNEs and Media

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Giddens A. 1989. “Sociology” Cambridge: Polity Press.

2. Heald Haralambos, R.M(2014) . ‘‘Sociology Themes and Perspectives”, Oxford, New Delhi-92
3. Bhushan Vidya and D.R. Sachdeva (2012). ‘‘Fundamental of Sociology”, Pearson, Delhi.

REFERENCES:

1. Das Gupta, Samir and Paulomi Saha (2012), ‘‘An Introduction to Sociology”, Pearson, Delhi
2. Bottomore, T.B. 1972. *Sociology- A Guide to Literature and Problems*, New Delhi,

OUTCOMES:

On successful completion of this course,

- Students will have exposure to the fundamentals tenets of Sociology.
- Students will be trained to understand social reality with sociological perspective.
- Students will be oriented to constructively analyze human interactions, social relationship and social issues
- Students will gain exposure to the dynamics of human society with special reference to the contemporary trends of globalization.

SSCXO3	SOCIOLOGY OF INDIAN SOCIETY.	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To present a portrayal of the components of the Indian Social structure
- To describe the nature and contemporary structure of Indian social Institutions.
- To examine the causality and magnitude of social problem facing the contemporary India.
- To elucidate the processes forms and impact of change and development in Indian society

MODULE I INDIAN SOCIAL STRUCTURE 7

Unity and Diversity; Concepts of unity and diversity- racial, religious, ethnic and linguistic composition of India. Types of communities-rural, urban and tribal; Social backwardness- OBC, SC and ST; Indian minorities- religious, ethnic, linguistic and LGBT

MODULE II INDIAN SOCIAL INSTITUTIONS 7

Family- definition, types, characteristics, functions of family; Joint Family- definition features, utility, changes; Marriage- definition, characteristics, marriage as sacrament or contract. Caste- definition, principles, contemporary changes, dominant caste, caste -class interface.

MODULE III SOCIAL PROBLEMS IN INDIA 8

Social Problem-definition, nature, social disorganization; Population explosion-causes, effects, relationship with development; Child Labour- causes, magnitude and consequences; Unemployment-nature , types, causes and effects; Gender issues-social status of women, violence against women and women in work place; Contemporary issues- communalism, terrorism and corruption.

MODULE IV SOCIAL CHANGE AND DEVELOPMENT IN INDIA 8

Socio-cultural Change- Sanskritization, Westernization, Secularization, Modernization; Processes of Social change- Industrialization, Urbanization, Globalization; Development- definition, elements, role of government, industry and corporate sector. Technology and change- invention and innovation, impact of technology on social institutions, technology and development.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Sharma,K.L.2008. *Indian Social Structure and Change*. Jaipur: Rawat Publications,.
2. Shah, A.M. 1998. *The Family in India: Critical Essays*. New Delhi: Orient Longman,
3. Ahuja Ram. 1999. *Social problems in India*, Rawat Publication: New Delhi.
4. Ahuja Ram. 2014. *Society in India,*, Rawat Publication: New Delhi.

REFERENCES:

1. Jayapalan, N.(2001), **"**Indian Society and Social Institutions" Atlantic Publishers & Distri,
2. Atal, yogesh (2006), "Changing Indian Society" Rawat Publications, Jaipur

OUTCOMES:

On successful completion of this course,

- Students will gain an in-depth understanding of the social structure and social institutions that constitute society in India.
- Students will be sensitized to the various categories ,Inequalities and their challenges
- Students will be exposed to the social problems encountered in contemporary India.
- Students will gain knowledge about the various forms and trends of the social change.
- Students will become aware about the challenges in the path of progress of Indian society and realize relevance of their role in bringing about development

Humanities Elective II

(To be offered in IV Semester)

		L	T	P	C
SSCXO4	**ECONOMICS OF SUSTAINABLE DEVELOPMENT**	**2**	**0**	**0**	**2**

OBJECTIVES:

- To have an increased awareness on the concept and components of sustainable development.
- To develop the ability to demonstrate the need of sustainable development and international responses to environmental challenges.
- To have an insight into global environmental issues and sustainable globalization.
- To establish a clear understanding of the policy instruments of sustainable development.

MODULE I CONCEPT OF SUSTAINABLE DEVELOPMENT 7

Evolution of the Concept – Rio Summit and sustainable development - various definitions of sustainable development - Components of sustainable development: Social, environmental and economic components.

MODULE II NEED FOR SUSTAINABLE DEVELOPMENT 8

Need for sustainability – Global environmental challenges: population growth, resource depletion, pollution, energy use, climate change, pollution, growing water scarcity, other urban problems, loss of biodiversity, hazardous wastes disposal.International responses to environmental challenges - Global policy such as Kyoto Protocol, Montreal Protocol, Basel Convention.

MODULE III GLOBALIZATION AND ENVIRONMENT SUSTAINABILITY 8

Impact of Globalization on sustainable development, Co - existence of globalization and Environment sustainability, Globalization and Global Governance.Green economy - Renewable energy, sustainable transport, sustainable construction, land and water management, waste management.

MODULE IV POLICIES FOR ACHIEVING SUSTAINABLE DEVELOPMENT 7

Principles of environmental policy for achieving sustainable development:

precautionary principle and polluter pays principle – Business Charter for Sustainable Development.Policy instruments for sustainable development: direct regulation – market based pollution control instruments such as pollution tax, subsidy, pollution permits.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Anderson, David A (2010), "*Environmental Economics and Natural Resource Management*", Routledge, 3rd edition.
2. Karpagam M (1999), "*Environmental Economics: A Textbook*", Sterling Publishers Pvt. Ltd, New Delhi.

REFERENCES:

1. Karpagam M and Jaikumar Geetha (2010), "*Green Management Theory and Applications*", Ane Books Pvt. Ltd, New Delhi.
2. Sengupta Ramprasad (2004), "*Ecology and Economics: An Approach to Sustainable Development*", Oxford University Press, New Delhi.

OUTCOMES:

On successful completion of this course,

- The students will have understood the concepts and components of sustainable development.
- The students will have a holistic overview on the challenges of sustainable development and International responses to environmental challenges.
- The students will have gained knowledge on the global environment issues and demonstrate responsible globalization through global governance.
- The students will have developed awareness of the ethical, economic, social and political dimensions that influence sustainable development.

SSCXO5 INDUSTRIAL SOCIOLOGY

L	T	P	C
2	0	0	2

OBJECTIVES:

- To introduce sociological approaches and perspectives to understand the social relationship in manufacturing industries and corporate sector.
- To explain the structure and functions of industrial organizations.
- To elucidate the dynamics of organizational behavior, leadership and communication.
- To inculcate professional ethics and values to equip students to work in organizational settings.

MODULE I INTRODUCTION 8

Industrial Sociology- definition, scope and importance; Theoretical approaches- scientific management, human relations approach, theory of bureaucracy, Fordism and post-fordism; Production system- concept and characteristics of factory system, automation and rationalization; Industrial conflict- strike , lockout and trade unions.

MODULE II INDUSTRIAL ORGANIZATION 7

Formal organization- definition, features, utility; Informal organization- definition, characteristics, types and relevance; Structure of industrial organization- features and functions of line organization, characteristics and roles of staff organization, distinction;

Industrial hierarchy-white collar, blue collar, supervisors and managers.

MODULE III DYNAMICS OF INDUSTRIAL RELATIONS 8

Group dynamics- Definition, Group behaviour model, Group decision making process, group cohesiveness; Leadership- definitions, style and effective supervision; Communication- concepts, types, model barriers; Job satisfaction- nature, employee compensation and job satisfaction.

MODULE IV PROFESSIONAL ETHICS AND VALUES 7

Concepts- values- morals, and ethics, Integrity, work ethics , service learning - Civic Virtue - caring - Sharing - Honesty - Courage - Valuing Time - Co-operation - commitment - empathy - Self-Confidence - Environmental Ethics, Cyber issues - computer ethics, cyber crimes, plagiarism Ethical living-concept of harmony in life.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Narender Singh, Industrial Sociology, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2012.
2. Gisbert Pascal, Fundamentals of Industrial Sociology, Tata Mc. Graw Hill Publishing Co., New Delhi, 1972
3. Schneider Engeno. V, Industrial Sociology 2nd Edition, Mc. Graw Hill Publishing Co., New Delhi, 1979.

REFERENCES:

1. Robbins, Stephen, Organizational Behaviour , Prentice Hall of India PVT ltd new Delhi, 1985
2. Devis Keith , Human Behaviour at work place, Mc. Graw Hill Publishing Co., New Delhi,1984

OUTCOMES:

On successful completion of this course,

- Students will have acclimatized with sociological perspectives for dealing with social relationships in production and service organizations.
- Students will be familiar with structure of authority, roles and responsibility in organizational settings.
- Students will imbibe leadership, communication and behavioral acumen to govern organization
- Students will be sensitized to standards of desirable behavior to engage in industrial and corporate sector.

SSCXO6 **LAW FOR ENGINEERS** **L T P C**
2 0 0 2

OBJECTIVES:

- To understand the Constitution and Governance of our country.
- To apprise the students of human rights - local and international and redressal mechanism.
- To have an insight into the industrial, corporate and labour laws of our country.
- To establish a clear understanding about the importance of intellectual property related laws.

MODULE I INDIAN CONSTITUTION AND GOVERNANCE 8

Constitution – salient features, Preamble, Citizenship, Fundamental rights, Fundamental duties, Directive principles, Union executive, Legislature – Union – State and union territories – Election Commission – Election for parliament and state legislature, Judiciary- basic functioning of the Supreme Court and High Courts, Right to information Act 2005 – evolution – concept – practice.

MODULE II HUMAN RIGHTS 7

Human rights – meaning and significance, Covenant on civil and political rights, Covenant on Economic, Social and Cultural rights, UN mechanism and agencies, The Protection of Human Rights Act, 1993 – watch on human rights and enforcement.

MODULE III INDUSTRIAL, CORPORATE AND LABOUR LAWS 8

Corporate laws – meaning and scope, Companies Act 1956 – Indian Contract Act 1872 - Principles of Arbitration - Industrial Employment (Standing Orders) Act 1946 - Industrial Disputes Act 1947 - Workmen's Compensation Act 1923 - The Factories Act, 1948.

MODULE IV LAWS RELATED TO IPR 7

IPR – meaning and scope, International organization – WIPO – TRIPS, Major Indian IPR Acts – Copyright laws, Patent and Design Act, Trademarks Act, Trade Secret Act, Geographical Indicator.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. M.P. Jain (2005) *Indian Constitutional Law*, Wadhwa & Co.

2. H. D, Agarwal (2008), *International Law and Human Rights,* Central Law Publications,
3. Rao, Meena (2006), *Fundamental Concepts in Law of Contract*, 3rd edn., Professional offset.
4. Ramappa (2010), *Intellectual Property Rights Law in India*, Asia Law House.
5. Singh, Avtar (2007), *Company Law*, Eastern Book Co.
6. R.F, Rustamji (1967)*, Introduction to the Law of Industrial Disputes*, Asia Publishing House.

REFERENCES:

1. Acts: Right to Information Act, Industrial Employees (standing order) Act, Factories Act, Workmen Compensate Act.

OUTCOMES:

On successful completion of this course,

- Students will `be able to apply the basic concepts of Indian Constitution, Governance and power in their real life situation.
- Students will have gained knowledge in human rights, cultural, social and political rights.
- Students will have synthesized knowledge about industrial, corporate and labour laws of our country.
- Students will have an overview of IPRs and laws related to Intellectual Property Rights.

General Elective Courses

Group I courses

(To be offered in V Semester)

		L	T	P	C
GECX101	**DISASTER MANAGEMENT**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To give an exposure to various environmental hazards and disasters: and various concepts and principles to manage disaster.
- To give exposure to various environmental policies & programs in India for disaster management

MODULE I ENVIRONMENTAL HAZARDS 7

Environmental hazards, Environmental Disasters and Environmental stress-Meaning and concepts. Vulnerability and disaster preparedness.

MODULE II NATURAL DISASTERS 7

Natural hazards and Disasters - Volcanic Eruption, Earthquakes, Tsunamis, Landslides, Cyclones, Lightning, Hailstorms, Floods, Droughts, Cold waves, Heat waves and Fire.

MODULE III MAN-MADE DISASTERS 7

Man induced hazards & Disasters - Soil Erosion, Chemical hazards, Population Explosion

MODULE IV DISASTER MANAGEMENT 8

Emerging approaches in Disaster Management- Preparing hazard zonation maps, Predictability / forecasting & warning, Preparing disaster preparedness plan, Land use zoning, Communication. Disaster resistant house construction, Population reduction in vulnerable areas, Awareness - Rescue training for search & operation at national & regional level - Immediate relief, Assessment surveys, Political, Administrative, Social, Economic, Environmental Aspects.

MODULE V NATURAL DISASTER REDUCTION & MANAGEMENT 8

Provision of Immediate relief measures to disaster affected people, Prediction of Hazards & Disasters, Measures of adjustment to natural hazards

MODULE VI ENVIRONMENTAL POLICIES & PROGRAMMES IN INDIA **8**

Regional survey of Land Subsidence, Coastal Disaster, Cyclonic Disaster & Disaster in Hills with particular reference to India. Ecological planning for sustainability & sustainable development in India, Sustainable rural development: A Remedy to Disasters, Role of Panchayats in Disaster mitigations, Environmental policies & programmes in India- Institutions & National Centers for Natural Disaster reduction, Environmental Legislations in India, Awareness, Conservation Movement, Education & training.

L – 45; Total Hours –45

REFERENCES:

1. Satender, “Disaster Management in Hills”, Concept Publishing Co., New Delhi, 2003.
2. Singh, R.B. (Ed.), “Environmental Geography”, Heritage Publishers, New Delhi,1990.
3. Savinder Singh, “Environmental Geography”, Prayag Pustak Bhawan,1997.
4. Kates, B.I. and White, G.F., “The Environment as Hazards”, Oxford University Press, New York, 1978.
5. Gupta, H.K., (Ed), “Disaster Management”, University Press, India, 2003.
6. Singh, R.B.,“Space Technology for Disaster Mitigation in India (INCED)”, University of Tokyo, 1994.
7. Bhandani, R.K., “An overview on Natural & Manmade Disaster & their Reduction”, IIPA Publication, CSIR, New Delhi, 1994.
8. Gupta, M.C., “Manuals on Natural Disaster management in India”, National Centre for Disaster Management, IIPA Publication, New Delhi, 2001.

OUTCOMES:

At the end of the course, the students will

- achieve sufficient knowledge on the disaster prevention strategy, early warning system, disaster preparedness, response and human resource development.
- be familiar with the National Policy on Disaster Management.

GECX102 TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

- To understand the various principles, practices of TQM to achieve quality.
- To get acquainted with the various statistical tools and approaches for quality control and continuous improvement.
- To get aware of the importance of ISO and Quality Systems.

MODULE I INTRODUCTION 8

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

MODULE II TQM PRINCIPLES 7

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits.

MODULE III TQM IMPROVEMENT PROCESS 8

Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

MODULE IV STATISTICAL PROCESS CONTROL (SPC) 8

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

MODULE V TQM TOOLS 7

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

MODULE VI QUALITY SYSTEMS 7

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System– Elements, Implementation of Quality System, Documentation, Quality Auditing, TS 16949, ISO 14000 – Concept, Requirements and Benefits

L – 45; Total Hours –45

TEXT BOOKS:

1. Dale H.Besterfiled, et al., “Total Quality Management”, Pearson Education, Inc. 2003.

REFERENCES:

1. James R.Evans & William M.Lidsay, “The Management and Control of Quality”, 5th Edition, South-Western (Thomson Learning), 2002.
2. Feigenbaum.A.V., “Total Quality Management”, McGraw-Hill, 1991.
3. Oakland.J.S., “Total Quality Management”, Butterworth Hcinemann Ltd., Oxford, 1989.
4. Narayana V. and Sreenivasan. N.S., “Quality Management – Concepts and Tasks”, New Age International, 1996.
5. Zeiri, “Total Quality Management for Engineers”, Wood Head Publishers, 1991.

OUTCOMES:

The student should be able to

- apply the various statistical tools and approaches for Quality control.
- achieve continuous process improvement through TQM.

GECX103 ENERGY STUDIES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn the growing demand, supply of energy on global and national levels and the need for renewable energy promotion.
- To understand the basic need for energy conservation and waste heat recovery.
- To learn the important aspects of energy audit and management.
- To get acquainted with the global environmental issues and carbon credits.

MODULE I GLOBAL AND NATIONAL ENERGY SCENARIO 7

Role of energy in economic development, various energy resources - overall energy demand and availability- Energy consumption in various sectors and its changing pattern - Exponential increase in energy consumption and projected future demands. Need for renewable energy.

MODULE II SOLAR ENERGY 8

Solar Radiation – Measurements of Solar Radiation - Flat Plate and Concentrating Collectors – Solar direct Thermal Applications – Solar thermal Power Generation - Fundamentals of Solar Photo Voltaic Conversion – Solar Cells – Solar PV Power Generation – Solar PV Applications.

MODULE III OTHER RENEWABLE ENERGY SOURCES 8

Power from wind – wind turbine working and types, solar thermal power plants – low medium and high power generation, power from wave , tidal, geothermal sources, OTEC system. MHD power plants – working, types, merits and demerits. Energy from biomass.

MODULE IV COGENERATION, WASTE HEAT RECOVERY AND COMBINED CYCLE PLANTS 8

Cogeneration principles- topping and bottoming cycles, role in process industries. Energy from wastes- waste heat recovery- heat recovery from industrial processes. Heat exchange systems – recuperative and regenerative heat exchangers – commercially available waste heat recovery devices. Combined cycle plants – concept, need and

advantages, different combinations and practical scope.

MODULE V ENERGY CONSERVATION AND MANAGEMENT 7

Need for energy conservation – use of energy efficient equipment. Energy conservation opportunities - in educational institutions, residential, transport, municipal, industrial and commercial sectors – concept of green building. Energy audit in industries – need, principle and advantages. Case studies.

MODULE VI GLOBAL ENERGY ISSUES AND CARBON CREDITS 7

Energy crisis, fossil consumption and its impact on environmental climate change. Energy treaties – Montreal and Kyoto protocols - Transition from carbon rich and nuclear to carbon free technologies, carbon foot print – credits – clean development mechanism.

L – 45; Total Hours –45

TEXT BOOKS:

1. S.S. Rao and B.B. Parulekar, “Energy Technology”, 3rd Edition, Khanna Publishers, New Delhi, 2011.
2. O. Callaghn. P.W., “Design and Management for Energy Conservation”, Pergamon Press, Oxford, 1981.

REFERENCES:

1. G.D. Rai, “Non Conventional Energy Sources”, Khanna Publishers, New Delhi, 2011.
2. Archie, W Culp. “Principles of Energy Conservation”, McGraw Hill, 1991.
3. D Patrick and S W Fardo, “Energy Management and Conservation”, PHI,1990
4. P. O’Callaghan: “Energy Management”, McGraw - Hill Book Company, 1993.
5. Kenney, W. F., “Energy Conservation in Process Industries”, Academic Press, 1983.

OUTCOMES:

The student should be able to

- Realize the global and national energy status and need to switch over to renewable energy technology.
- Energy audit and suggest methodologies for energy savings.
- Utilize the available resources in an optimal way.
- Concern about the global environmental issues & promote carbon credits.

GECX104 ROBOTICS L T P C

3 0 0 3

OBJECTIVES:

To learn about the robots, various components, of Robots, programming and their applications.

MODULE I **8**

Definition- Need - Application, Types of robots – Classifications – Configuration, work volume, control loops, controls and intelligence- basic parts - functions – specifications. of robot, degrees of freedoms, end effectors – types, selection

MODULE II ROBOT DRIVES AND CONTROL **8**

Controlling the Robot motion – Position and velocity sensing devices – Design of drive systems – Hydraulic and Pneumatic drives – Linear and rotary actuators and control valves – Electro hydraulic servo valves, electric drives – Motors – Designing of end effectors – Vacuum, magnetic and air operated grippers.

MODULE III ROBOT SENSORS **8**

Transducers and Sensors – Tactile sensor – Proximity and range sensors – Sensing joint forces – Robotic vision system – Image Representation - Image Grabbing –Image processing and analysis – Edge Enhancement – Contrast Stretching – Band Rationing - Image segmentation – Pattern recognition – Training of vision system.

MODULE IV ROBOT PROGRAMMING & AI TECHNIQUES **7**

Types of Programming – Teach pendant programming – Basic concepts in AI techniques – Concept of knowledge representations – Expert system and its components.

MODULE V ROBOTIC WORK CELLS AND APPLICATIONS OF ROBOTS **7**

Robotic cell layouts – Inter locks – Humanoid robots – Micro robots – Application of robots in surgery, Manufacturing industries, space and underwater.

MODULE VI ROBOT KINEMATICS AND DYNAMICS 7

Forward and inverse Kinematic equations, Denvit – Hartenbers representations Fundamental problems with D-H representation, differential motion and velocity
of frames - Dynamic equations for sing, double and multiple DOF robots – static force analysis of robots.

L – 45; Total Hours –45

REFERENCES:

1. Yoram Koren," Robotics for Engineers", Mc Graw-Hill, 1987.
2. Kozyrey, Yu, "Industrial Robots", MIR Publishers Moscow, 1985.
3. Richard. D, Klafter, Thomas, A, Chmielewski, Michael Negin, "Robotics Engineering – An Integrated Approach", Prentice-Hall of India Pvt. Ltd., 1984.
4. Deb, S.R. "Robotics Technology and Flexible Automation", Tata Mc Graw-Hill, 1994.
5. Mikell, P. Groover, Mitchell Weis, Roger, N. Nagel, Nicholas G. Odrey, "Industrial Robotics Technology, Programming and Applications", Mc Graw- Hill, Int. 1986.
6. Timothy Jordanides et al,"Expert Systems and Robotics", Springer – Verlag, New York, May 1991.

OUTCOMES:

Students would be able to

- Understand about the robots, its various components.
- Design Robots for industrial applications.
- Do programming for robots and apply them in real time applications.

GECX105 TRANSPORT MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the transport fleet and their related activities for minimizing operational cost.
- To understand the need of maintenance and its importance.
- To understand the functions and applications of various types of transport system.

MODULE I INTRODUCTION 7

Personnel management; objectives and functions of personnel management, psychology, sociology and their relevance to organization, personality problems. Selection process: job description, employment tests, interviewing, introduction to training objectives, advantages, methods of training, training procedure, psychological tests.

MODULE II ORGANISATION AND MANAGEMENT 7

Forms of Ownership – principle of Transport Management – Staff administration – Recruitment and Training – welfare – health and safety. Basic principles of supervising. Organizing time and people. Driver and mechanic hiring - Driver checklist - Lists for driver and mechanic - Trip leasing - Vehicle operation and types of operations.

MODULE III TRANSPORT SYSTEMS 9

Introduction to various transport systems. Advantages of motor transport. Principal function of administrative, traffic, secretarial and engineering divisions. chain of responsibility, forms of ownership by state, municipality, public body and private undertakings.

MODULE IV SCHEDULING AND FARE STRUCTURE 8

Principal features of operating costs for transport vehicles with examples of estimating the costs. Fare structure and method of drawing up of a fare table. Various types of fare collecting methods. Basic factors of bus scheduling. Problems on bus scheduling.

MODULE V MOTOR VEHICLE ACT 7

Traffic signs, fitness certificate, registration requirements, permit insurance, constructional regulations, description of vehicle-tankers, tippers, delivery vans, recovery vans, Power wagons and fire fighting vehicles. Spread over, running time, test for competence to drive.

MODULE VI MAINTENANCE 7

Preventive maintenance system in transport industry, tyre maintenance procedures. Causes for uneven tyre wear; remedies, maintenance procedure for better fuel economy, Design of bus depot layout.

L – 45; Total Hours –45

TEXT BOOKS:

1. John Duke, "Fleet Management", McGraw-Hill Co, USA, 1984.
2. Kitchin.L.D., "Bus Operation", III edition, Illiffee and Sons Co., London, 1992

REFERENCES:

1. Government Motor Vehicle Act, Publication on latest act to be used as on date.

OUTCOMES:

Upon completion of the course, students will

- Know about different aspects related to transport system and management.
- Features of scheduling, fixing the fares
- Know about the motor vehicle act and maintenance aspects of transport.

GECX106 CONTROL SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the system modeling and to derive their transfer function.
- To provide adequate knowledge of time response of systems and steady state error analysis.
- To accord basic knowledge in obtaining the open loop and closed–loop frequency responses of Control systems.

MODULE I BASIC CONCEPTS AND SYSTEM REPRESENTATION **8**

Control System - Basic elements in control systems – Open and closed loop systems – Electrical analogy of mechanical and thermal systems – Transfer function – Block diagram reduction techniques – Signal flow graphs.

MODULE II TIME RESPONSE ANALYSIS AND DESIGN **8**

Time response – Time domain specifications – Types of test input – First and Second order system - Type I and Type II System – Response - Error coefficients – Generalized error series – Steady state error – P, PI, PID modes of feedback control.

MODULE III FREQUENCY RESPONSE ANALYSIS AND DESIGN **7**

Performance specifications - correlation to time domain specifications - bode plots and polar plots – gain and phase margin – constant M and N circles and Nichols chart – all pass and non-minimum phase systems.

MODULE IV STABILITY **8**

Characteristics equation – Location of roots in s plane for stability – Routh Hurwitz criterion – Root locus construction – Effect of pole, zero addition – Gain margin and phase margin – Nyquist stability criterion.

MODULE V COMPENSATOR DESIGN **8**

Performance criteria – Lag, lead and lag-lead networks – Compensator design using bode plots and root locus technique.

MODULE VI CONTROL SYSTEM COMPONENTS AND APPLICATION OF CONTROL SYSTEMS **6**

Synchros – AC servomotors - DC Servo motors - Stepper motors - AC

Tacho generator - DC Tacho generator - Typical applications of control system in industry.

L – 45; Total Hours –45

REFERENCES:

1. K. Ogata, “Modern Control Engineering”, 4th Edition, Pearson Education, New Delhi, 2003.
2. I.J. Nagrath & M. Gopal, “Control Systems Engineering”, New Age International Publishers, 2003.
3. C.J.Chesmond, “Basic Control System Technology”, Viva student edition, 1998.
4. I.J.Nagarath and M.Gopal, “Control System Engineering”, Wiley Eastern Ltd., Reprint, 1995.
5. R.C.Dorf and R.H.Bishop, “Modern Control Systems”, Addison-Wesley (MATLAB Reference), 1995.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Proper understanding of basics of Control Systems.
- Ability and skill to carry-out time domain and frequency domain analysis.
- Capable of determining stability of the system using Routh Hurwitz criterion, Root locus and Nyquist criterion.
- Ability to design lag, lead and lag lead compensator networks.

GECX107 INTRODUCTION TO VLSI DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- Basic concepts of HDL.
- Verilog language and its syntax constructs.
- Programmable Logic Devices and FPGAs
- MOS devices theory
- CMOS based combinational and sequential circuits

PREREQUISITES:

Fundamentals of Electronics

Basics knowledge in Digital Electronics.

MODULE I REVIEW OF BASIC DIGITAL SYSTEMS 7

Boolean algebra, Building blocks of combinational logic design-Adders, multiplexer, encoder, decoder, comparator, Latches & flip-flops, counters, shift registers.

MODULE II LOGIC DESIGN USING VERILOG HDL 8

Overview of Digital Design with Verilog HDL, Levels of Design Description, Concurrency, Hierarchical Modeling Concepts, Modules and Ports, Component instantiation Data flow and RTL, structural, gate level, switch level modeling and Behavioral Modeling.

MODULE III LANGUAGE CONSTRUCTS OF VERILOG HDL 7

Identifiers- gate primitives, gate delays, operators, timing controls, procedural assignments, conditional statements Variable types, arrays and tables, Tasks and functions, Test bench.

MODULE IV BUILDING BLOCKS OF DIGITAL VLSI SYSTEMS 8

HDL Design -Data Path Operations-Addition/Subtraction, Parity Generators, Comparators, Zero/One Detectors, Binary Counters, ALUs, Multiplication, Shifters, Memory Elements. Programmable logic elements and AND-OR arrays, FPGAs programming methods.

MODULE V TRANSISTOR THEORY 7

Introduction to MOS Transistors-NMOS & PMOS Characteristics, Current Equations, Complementary CMOS Inverter-DC Characteristics, Static Load MOS Inverters.

MODULE VI BASICS OF DIGITAL CMOS DESIGN 8

NMOS & PMOS Logic Gate, CMOS Logic Gate, Basic layout design of simple gate-stick diagram, CMOS Logic Structures-full adder, multiplexers.

Total Hours –45

TEXT BOOKS:

1. M.Morris Mano "Digital Design", 3rd Edition, Prentice Hall of India Pvt. Ltd New Delhi, 2003

REFERENCES:

1. Michael D. Ciletti“Advanced Digital Design with the Verilog HDL" (2nd Edition) Hardcover – January 31, 2010
2. J.Bhasker: Verilog HDL primer, BS publication, 2001.
3. J. P. Uyemura, "Introduction to VLSI Circuits and System", Wiley, 2002
4. Neil Weste and K. Eshragian, “Principles of CMOS VLSI Design: A System Perspective,” 2nd edition, Pearson Education (Asia) Pvt.Ltd., 2000
5. Douglas A Pucknell& Kamran Eshragian , “Basic VLSI Design” PHI 3rd Edition (original edition – 1994)

OUTCOMES:

At the end of the course the students will be able to

- Create basic Register Transfer Level (RTL) models for combinational circuits & Sequential circuits using Verilog HDL.
- Create basic behavioral models for combinational circuits & Sequential circuits using Verilog HDL.
- Describe the usage of Programmable Logic Devices and FPGAs.
- Describe MOS devices theory and inverter circuit DC characteristics
- Design the basic digital building blocks using MOS circuit.
- Apply VLSI design concepts based on the requirements to conduct experiments or projects

GECX108 PLANT ENGINEERING

L	T	P	C
3	0	0	4

OBJECTIVES:

- To provide in depth knowledge on Plant Engineering
- To introduce detail engineering and P&ID
- To learn about the support to Instrumentation from other disciplines
- To study about the Installation and commissioning

MODULE I INTRODUCTION OF PLANTS 7

General Project Cycle – Feed – Sales - Plant Description, Component / Areas of Plant, Plant Layout, Plant Interfaces, Plant Location

MODULE II ELEMENTS OF PLANT 8

Main Elements of a Plant, Process Flow Scheme (PFD – Process Flow Diagram) P&ID's, Plant Legend Finalization.

MODULE III DETAIL ENGINEERING 10

P& ID Development with PFD's, Major Discipline Involvement & Inter discipline Interaction, Major Instrumentation & Control Systems - Development Phase – Instrument List , I/O Count, Specification Sheets, Instrument Installation (Hook ups) , Control Philosophy – Detail Engineering.

MODULE IV SUPPORT FROM OTHER DISCIPLINE 8

Other Discipline Supports to Instrumentation – Plot Plan, Piping / Equipment Plan, Electrical Area Classification, Fire Hazardous Classification Telecommunication Systems - Control Network architecture.

MODULE V INSTALLATION AND COMMISSIONING 7

Plant Construction - Key Drawings for Construction Support Construction Activities, System Testing, Startup / Commissioning, Production.

MODULE VI CASE STUDIES 5

Case studies of Water Treatment Plant - Paper Industry – Power Plant etc

L – 45; Total Hours –45

REFERENCES:

1. Duncan C Richardson, Plant Equipment and Maintenance Engineering Handbook, McGraw-Hill Education: New York, Chicago, San Francisco, Athens, London, Madrid, Mexico City, Milan, New Delhi, Singapore, Sydney, Toronto, 2014 McGraw-Hill Education
2. Gabriel Salvendy, Handbook of Industrial Engineering – Technology and operations Management, John Wiley & Sons, 2001.
3. Robert C Rosaler , Standard Handbook of Plant Engineering, Mc Graw Hill third Edition, 2004
4. R. Keith Mobley, Plant Engineer's Handbook, Technology and Engineering, 2001.

OUTCOMES:

At the end of the course, the student will be able to

- Review and correct P&IDs
- Do installation and commissioning of new plants
- Apply plant engineering in design and maintenance of water treatment plant / power plant etc

GECX109	NETWORK SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

The students should be able to

- Discuss the basic concepts of computer security, model and attacks
- Examine the major types of threats and the associated attacks
- Identify the encryption techniques in real time applications
- Understand the special requirements for wireless security and how authentication is implemented in wireless systems
- Understand the functions of Network Security Device Firewall and its types
- Interpret the various network intrusion such as computer viruses, network worms etc

MODULE I INTRODUCTION 6

Computer Security Concepts - The OSI Security Architecture - Security Attacks - Security Services - Security Mechanisms - A Model for Network Security - Standards – classical encryption techniques.

MODULE II SYMMETRIC ENCRYPTION AND MESSAGE CONFIDENTIALITY 7

Symmetric Encryption Principles - Symmetric Block Encryption Algorithms - Random and Pseudorandom Numbers - Stream Ciphers and RC4 - Cipher Block Modes of Operation

MODULE III PUBLIC KEY CRYPTOGRAPHY AND MESSAGE AUTHENTICATION 8

Approaches to Message Authentication - Secure Hash Functions - Message Authentication Codes - Public-Key Cryptography Principles - Public-Key Cryptography Algorithms - Digital Signatures

MODULE IV KEY DISTRIBUTION ,USER AUTHENTICATION AND TRANSPORT-LEVEL SECURITY 8

Symmetric Key Distribution Using Symmetric Encryption - Kerberos - Key Distribution Using Asymmetric Encryption - X.509 Certificates - Public-Key Infrastructure -Federated Identity Management - Web Security Considerations -

Secure Socket Layer and Transport Layer Security - Transport Layer Security

MODULE V WIRELESS NETWORK SECURITY, ELECTRONIC MAIL SECURITY AND IP SECURITY **8**

IEEE 802.11 Wireless LAN Overview -IEEE 802.11i Wireless LAN Security - Wireless Application Protocol Overview - Wireless Transport Layer Security - WAP End-to-End Security - Pretty Good Privacy - S/MIME – Domain Keys Identified Mail- IP Security Overview -IP Security Policy - Encapsulating Security Payload - Combining Security Associations - Internet Key Exchange - Cryptographic Suites

MODULE VI SYSTEM SECURITY **8**

Intruders -Intrusion Detection -Password Management - Types of Malicious Software - Viruses Virus Countermeasures – Worms - Distributed Denial of Service Attacks- The Need for Firewalls - Firewall Characteristics - Types of Firewalls - Firewall Basing - Firewall Location and Configurations

L – 45; Total Hours –45

REFERENCES:

1. William Stallings,"Network security Essentials:Applications and standards", Prentice Hall, Fifth Edition , ISBN-13: 978-0134527338, 2013
2. William Stallings, "Cryptography and Network Security: Principles and Practice", Pearson, ISBN-13:978-0-273-79335-9,2013
3. Behrouz Forouzan, Debdeep Mukhopadhyay,Cryptography and network security (sie) 2nd edition, ISBN-13: 978-0070702080, 2016
4. Wikipedia, "Network Security and Management" , https://en.wikipedia.org/wiki/Book:Network Security and Management, 2014.
5. Nitesh Dhanjani, Justin Clarke, "Network Security Tools", O'Reilly Media, ISBN-13: 9780596007942, 2005.

OUTCOMES:

Students who complete this course will be able to

- Recognize the computer security concepts, architecture attacks and model
- Distinguish the symmetric and asymmetric encryption techniques
- Apply the cryptographic algorithms in different applications
- Express the network security designs using available secure solutions

such as PGP,SSL, IPSec, etc.

- Describe the firewalls principles and different types of firewalls applied in organization
- Identify abnormalities within the network caused by worms, viruses and Network related security treats**.**

GECX110	KNOWLEDGE MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course

- Focuses on positioning knowledge as a valuable commodity, embedded in products and in the tacit knowledge of highly mobile individual employees.
- Presents KM as a deliberate and systematic approach to cultivating and sharing an organization's knowledge base.
- Brings out the paradigm in terms of information technology and intellectual capital.

MODULE I KNOWLEDGE MANAGEMENT 6

KM Myths – KM Life Cycle – Understanding Knowledge – Knowledge, intelligence – Experience – Common Sense – Cognition and KM – Types of Knowledge – History of Knowledge Management - From Physical assets to Knowledge Assets – Expert knowledge – Human Thinking and Learning.

MODULE II KNOWLEDGE MANAGEMENT SYSTEMS AND MODELS 9

Challenges in Building KM Systems – Conventional Vs KM System Life Cycle (KMSLS) – Knowledge Creation and Knowledge Architecture – KM cycle - Different variants of KM cycle - KM models - Implications and practical implementations.

MODULE III CAPTURING KNOWLEDGE AND SHARING 9

Tacit knowledge capture - Explicit knowledge codification – Knowledge taxonomies - Knowledge sharing - Communities - Obstacles to knowledge capture and sharing.

MODULE IV KNOWLEDGE MANAGEMENT TOOLS 9

KM System tools – Neural Network – Association Rules – Classification Trees – Data Mining and Business Intelligence – Knowledge capture and creation tools - Content creation tools - Data mining and knowledge discovery – Content management tools - Knowledge sharing and dissemination tools – Group ware

and Collaboration tools - Intelligent filtering tools.

MODULE V KNOWLEDGE APPLICATION 6

KM at individual level - Knowledge workers - Task analysis and modeling - Knowledge application at group and organizational levels – Knowledge repositories - Knowledge reuse -Case study: e-learning.

MODULE VI VALUE OF KNOWLEDGE MANAGEMENT 6

KM return on investment and metrics - Benchmarking method – Balanced scorecard method - House of quality method - Results based assessment method - Measuring success - Future challenges for KM.

L – 45; Total Hours –45

TEXT BOOKS:

1. Elias M. Awad, Hassan M. Ghaziri, “Knowledge Management”, Prentice Hall, 2nd Edition, 2010.
2. Jay Liebowitz, “Handbooks on Knowledge Management”, 2nd Edition, 2012.
3. Irma Becerra-Fernandez, Rajiv Sabherwal, ”Knowledge Management: Systems and Processes”, 2010.

OUTCOMES:

Students who complete this course will be able to

- Describe the fundamental concepts in the study of knowledge and its creation, acquisition, representation, dissemination, use and re-use, and management.
- Explains the core concepts, methods, techniques, and tools for computer support of knowledge management.
- Critically evaluate current trends in knowledge management and apply it for e-learning

GECX111 CYBER SECURITY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the basics of Cyber Security Standards and Policies.
- To know the legal, ethical and professional issues in Cyber security.
- To understand Cyber Frauds and Abuse and its Security Measures.
- To know the technological aspects of Cyber Security.

MODULE I FUNDAMENTALS OF CYBER SECURITY 7

Security problem in computing – Cryptography Basics – History of Encryption – Modern Methods – Legitimate versus Fraudulent Encryption methods – Encryption used in Internet.

MODULE II CYBERCRIME AND CYBEROFFENSES 8

Cybercrime and Information Security – Cybercriminals – Classifications of Cybercrimes – Email Spoofing – Spamming – Cyber defamation – Internet Time Theft – Forgery – Web jacking – Hacking – Online Frauds – Software Piracy – Mail Bombs – Password Sniffing – Cyberoffenses – Categories – Planning the attacks – Cyberstalking – Cybercafe and Cybercrimes – Botnets.

MODULE III CYBERCRIME: MOBILE AND WIRELESS DEVICES 8

Proliferation of Mobile and Wireless Devices – Trends in Mobility – Credit card frauds in Mobile and Wireless Computing – Security Challenges – Authentication Service Security – Attacks on Mobile Phones.

MODULE IV TOOLS AND METHODS USED IN CYBERCRIME 8

Proxy Servers and Anonymizers – Phishing – Password Cracking – Keyloggers and Spywares – Virus and Worms – Trojan Horses and Backdoors – Steganography – DoS and DDoS Attacks.

MODULE V SECURITY POLICIES 7

Introduction - Defining User Policies – Passwords – Internet Use – Email Usage – Installing/ Uninstalling Software – Instant Messaging – Defining System Administrative Policies – Defining Access Control Developmental Policies Standards, Guidelines and Procedures – Basics of assessing a system

MODULE VI COMPUTER FORENSICS 7

General Guidelines – Finding Evidence on the PC - Finding Evidence in System Logs – Windows Logs – Linux Logs – Getting Back Deleted Files – Operating System Utilities – The Windows Registry.

L – 45; Total Hours –45

TEXT BOOKS:

1. Nina Godbole, Sunit Belapure, “Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Wiley, 2011.

2. Chuck Easttom, “Computer Security Fundamentals”, 2nd Edition, Pearson Education, 2012.

REFERENCES:

1. Charles B. Pfleeger, Shari Lawrence Pfleeger, “Security in Computing”, 3rd Edition, Pearson Education, 2003.
2. William Stallings, “Cryptography and Network Security – Principles and Practices”, 3rd Edition, Pearson Education, 2003.
3. Atul Kahate, “Cryptography and Network Security”, Tata McGraw Hill, 2000.

OUTCOMES:

Upon completion of this course, students will be able to

- Explain the general security issues.
- Discuss various cybercrimes and offenses.
- Outline the occurrence of Cybercrime in mobile and wireless environment.
- Use relevant tools and methods in cybercrime
- Apply security policies in cyber forensics.
- Outline the strategies adopted in computer forensics.

GECX112 GENETIC ENGINEERING L T P C
4 0 0 4

OBJECTIVES:

The course aims to provide an advanced understanding of the core principles and topics of Cell and Organism reproduction and the Principles of heredity and their experimental basis, and to enable students to be able to apply these principles in assessment of pedigrees to identify genotypes and predict the mating outcomes.

MODULE I GENETICS AND ORGANISM 10

Genetics and human affairs, Genetics and Biology, Genes and Environment, Techniques of genetic analysis, The chromosome theory of heredity, Sex chromosomes, Sex linkage, The parallel behaviour of autosomal genes and chromosomes.

MODULE II MENDELISM AND LINKAGE 12

Mendel's laws of inheritance, Interaction of genes, Variations on dominance, Multiple alleles, Lethal alleles, Several genes affecting the same character, Penetrance and expressivity, Linkage- Basic eukaryotic chromosome mapping, The discovery of linkage, Recombination linkage symbolism, Linkage of genes on X chromosomes, Linkage maps, Examples of linkage maps.

MODULE III FINE STRUCTURE OF GENES 10

The concept of promoter, Coding sequence, Terminator, Induction of gene for expression. The concept of extranuclear genome in higher plants and animals, Overview of mitochondrial genome, Chloroplast genome.

MODULE IV RECOMBINATION IN BACTERIA AND VIRUSES 10

Conjugation recombination and mapping the E.coli chromosomes, Transformation, Transduction, Chromosome mapping. Population genetics: Darwin's revolution, Variation and its modulation, The effect of sexual reproduction on variation, The sources of variation, Selection quantitative genetics

MODULE V PRINCIPLES OF PLANT BREEDING 9

Objectives, Selfing and crossing techniques, Male sterility,Incompatability, Hybrid vigour.

MODULE VI HUMAN GENOME PROJECT **9**

Genetic diseases in humans, Genetics and society

L – 45; T – 15; Total Hours –60

REFERENCES:

1. In Introduction to genetic analysis, Griffiths, Miller, Suzuki, Lewontin and Gelbart, Freeman and Company.
2. Genetics, A.V.S.S. Sambamurty, Narosa Publishing House.
3. Concepts of Genetics, Klug & Cummings, Prientice Hall.
4. Molecular Cloning, Moniatisetal, Cold Spring Harbor Laboratory.

OUTCOMES:

At the end of the course students will be able to

- Describe the structure, function and replication of DNA as the genetic material
- Describe gene structure, expression and regulation
- Describe the chromosomal basis of inheritance and how alterations in chromosome number or structure may arise during mitosis and meiosis

GECX113	FUNDAMENTALS OF PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The students would gain knowledge on

- Technicalities attached to Project Management and Significance of Quality Consideration
- Project management methodologies – tools and techniques, supplemented with examples from case studies
- The importance of Efficient HR team and role of Communication in executing Projects.
- Managing Risks in Project Management

MODULE I INTRODUCTION TO PROJECT MANAGEMENT 9

Introduction to Project and Project Management-Project Management as a Career-Project Management Skill Sets-Project Scope Management: Project Charter, Scope Creep, Scope Validation, Scope Change Control-Type of Organization: Organization Structure-Influence of Organization Structure on Project, Project Stakeholders and Organizational Productivity.

MODULE II PROJECT MANAGEMENT PROCESS, TOOLS AND TECHNIQUES 8

Project life cycle-Initiation, Planning, Execution, Monitoring and Closing Phase; - Link between project management process, process groups and knowledge areas; Project management tools and techniques- Project Stakeholders description and mapping - Stakeholder Management Process

MODULE III PROJECT QUALITY, COST AND SCHEDULE MANAGEMENT 10

Triple constraints of project-quality, cost and schedule-Quality Planning, Quality Assurance and Quality Control, Process Control, Cost of Quality, Seven Tools of Quality Control- Cost Management: Cost Estimating Methods, Estimating Completion Cost, Earned Value Management, Budgeting, Life-Cycle Cost analysis- Project Time Management: Duration Estimation Method, FS/FF/SS/ SF Relations, Lead/Lag, Arrow Diagram Method and Precedence Diagram Method for Scheduling-Resource Allocation

MODULE IV PROJECT HR MANAGEMENT 5

Organizational Goals- (MBO/MBE/MBP)-Responsibility Assignment Matrix (RAM)-Types of Powers- Manage or Lead-Conflict management Techniques-Performance Evaluation Process-Motivation Theories and its Application for execution of Projects-Leadership Styles-Project Team Building-Project Staffing Constraints/Policies

MODULE V COMMUNICATION MANAGEMENT 5

Communication Management: Understanding Body languages of Project Personnel-Effective Communications- Interpersonal Skills for project Managers-PMIS-Communicating with the Customer-Communicating with Management- Formal vs. Informal Communications-Written, Verbal and Non-Verbal Communications.

MODULE VI PROJECT PROCUREMENT & RISK MANAGEMENT 8

Introduction to Project Procure Management: Soliciting RFQ/RFP-Contract Proposals-Contract Negotiation-Contract Closure-Risk Management: Defining risks-Risk management process-Risk identification-Qualitative and Quantitative Risk-Probability and Decision trees-Risk Response strategies / methods-Expected monetary value-Risk vs. life cycle phases

L – 45; Total Hours –45

REFERENCES:

1. Jack. R. Meredith, Samuel. J. Mantel & Scott. M. Shafer, Project Management in Practice, Fifth Edition, Bangalore: Wiley, 2015
2. Bob Hughes, Mike Cotterrel “Software Project Management”, Tata McGraw-Hill, 2009

OUTCOMES:

- Learners will be able to identify the Key Knowledge Areas and apply PM process in hypothetical project assignments given as continuous assessment.
- They would be able to suitably recognize tools and techniques required for various phases included in a project.
- They would also be able to manage scope, time, cost and other major components that would help them to execute the project efficiently.

GECX114 OPERATIONS RESEARCH **L T P C**
3 0 0 3

OBJECTIVES:

- To acquire knowledge and training in optimization techniques.
- To get knowledge about optimization in utilization of resources.
- To understand and apply operations research techniques to industrial operations

MODULE I LINEAR PROGRAMMING PROBLEM 8

Linear programming – formulation of the problem - graphical interpretation of optimality - Simplex method – to obtain basic feasible solution – types of linear programming solution – complications and their resolution.

MODULE II ARTIFICIAL VARIABLE AND TWO PHASE METHOD, DUALITY 6

Artificial variable - Big M method – Two phase method – alternative optimal solution – unbounded solution - Duality – primal dual relationships - rules of constructing the dual from primal.

MODULE III TRANSPORTATION PROBLEM & ASSIGNMENT PROBLE 8

Transportation problems – Initial basic feasible solutions, MODI method, Unbalance in transportation, Degeneracy in transportation models, Assignment problem – Minimization and Maximization type of problems by Hungarian method.

MODULE IV NETWORK AND SEQUENCING PROBLEMS 8

PERT and CPM – Network diagram – Fulkerson's rule - CPM Probability of achieving completion date – Crash time – Cost analysis. Sequencing N jobs through 2 machines and 3 machines.

MODULE V QUEUING THEORY & SIMULATION 7

Poisson arrivals and exponential service times – characteristics of Queuing models – single channel – Introduction to multi channel models – Random number generation – Monte Carlo Simulation.

MODULE VI INVENTORY CONTROL, REPLACEMENT MODELS AND GAME THEORY 8

Types of inventory- Inventory cost - EOQ - Deterministic inventory problems –

Introduction to probabilistic models & system level inventory control - Replacement models – Replacement of items that deteriorate with time – value of money changing with time – not changing with time – Individual and group replacement policy - Game theory – simple games.

L – 45; Total Hours –45

TEXT BOOKS:

1. Hamdy ATaha, “Operations Research an introduction”, 8th edition, Phil Pearson, 2007.
2. Winston.W.L., “Operations Research”, 4th edition, Thompson-Brooks/Cole, 2003.

REFERENCES:

1. Wayne.L. Winston, “Operations Research applications and algorithms”, 4th edition, Thomson learning, 2007.
2. Frederick. S. Hiller and Gerald.J.Lieberman, “Operations Research concepts and cases”, 8th edition (SIE), Tata McGraw – Hill Pub. Co. Ltd., New Delhi, 2006.
3. A. Ravindran, D. T. Phillips and J. J. Solberg, "Operations Research:Principles and Practice", 2nd edition, John Wiley & Sons, New York, 1992.
4. Robertazzi. T.G., “Computer networks and systems-Queuing theory and performance evaluation”, 3rd edition, Springer, 2002.

OUTCOMES:

At the end of the course students will be able to

- solve linear programming problems
- solve transportation and assignment problems.
- solve network and sequencing problems.
- apply the operations research techniques to solve industrial problems.

GECX115	NANO TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the basic concepts of Nanoscience relevant to the field of engineering.
- To provide an exposure about the importance of various synthesis method.
- To enrich the knowledge of students in various characterisation techniques.

MODULE I INTRODUCTION & CLASSIFICATION OF NANOMATERIALS 9

Definition - Origin of nanotechnology - Difference between bulk and nanomaterials- Top-down and bottom-up processes - Size dependent properties (magnetic, electronic,transport and optical), Classification based on dimensional property - 0D, 1D, 2D and 3D nanostructures – Kubo gap.

MODULE II TYPES OF NANOMATERIALS 9

Metal oxides and metal nano particles - Ceramic nano particles - Semi conducting quantum dots - Core-shell quantum dots - Nanocomposites - Micellar nanoparticles.

MODULE III PRODUCTION OF NANOPARTICLES 7

Sol-gel, hydrothermal, solvothermal, Plasma Arcing, Electro deposition, RF sputtering, Pulsed laser deposition, Chemical vapour, deposition.

MODULE IV CARBON BASED NANOMATERIALS 6

Carbon nanotubes: Single wall nanotubes (SWNT), Multiwall nanotubes (MWNT) - structures-carbon nanofibre, Fullerenes-Application of carbon nanotubes and Fullerenes.

MODULE V NANOPHOTONICS 7

Light and nanotechnology, Interaction of light and nanotechnology, Nanoholes and photons, nanoparticles and nanostructures; Nanostructured polymers, Photonic Crystals, Solar cells.

MODULE VI CHARACTERISATION TECHNIQUES 7

Basic principles of scanning Electron Microscopy (SEM), Atomic force microscopy (AFM), Scanning tunneling microscopy (STM), Scanning probe

microscopy (SPM) and Transmission electron microscopy (TEM), Particle size analyzer, Luminescence techniques.

L – 45; Total Hours –45

TEXT BOOKS:

1. Hari Singh Nalwa, “Handbook of Nanostructured Materials and Nanotechnology”, Academic Press, 2000.
2. Guozhong Cao, “Nanostructures and Nano materials-Synthesis, Properties and Applications”, Imperial College Press (2011).
3. Zhong Lin Wang, “Handbook of Nanophase and Nanomaterials (Vol 1 and II)”, Springer, 2002.
4. Mick Wilson, Kamali Kannangara, Geoff smith, “Nanotechnology: Basic Science and Emerging Technologies”, Overseas press, 2005.

REFERENCES:

1. A. Nabok, “Organic and Inorganic Nanostructures”, Artech House, 2005.
2. C.Dupas, P.Houdy, M.Lahmani, Nanoscience: “Nanotechnologies and Nanophysics”, Springer-Verlag Berlin Heidelberg, 2007.
3. Mick Wilson, Kamali Kannangara, Michells Simmons and Burkhard Raguse, “Nano Technology – Basic Science and Emerging Technologies”, 1st Edition, Overseas Press, New Delhi,2005.
4. M.S. Ramachandra Rao, Shubra SinghH, “Nanoscience and Nanotechnology: Fundamentals to Frontiers”, Wiley, 2013.

OUTCOMES:

At the end of this course, the students will be able to:

- Apply the knowledge of different types of nanomaterials for various engineering applications.
- Acquire the knowledge of various methods of production of nanomaterials.
- Familiarize with various characterization techniques.

GECX116	VEHICLE MAINTENANCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To know about the various methods of maintaining procedure, vehicle insurance and basic problems in a vehicle.
- The student able to impart knowledge in maintaining of engine components and subsystems.
- The student able to impart knowledge in maintaining of transmission, driveline, steering, suspension, braking and wheels.
- The student able to impart **carefully maintaining their vehicle and can increase driving safety.**

MODULE I MAINTENANCE, WORKSHOP PRACTICES, SAFETY AND TOOLS **7**

Maintenance – Need, importance, primary and secondary functions, policies - classification of maintenance work - vehicle insurance - basic problem diagnosis. Automotive service procedures – workshop operations – workshop manual - vehicle identification. Safety – Personnel, machines and equipment, vehicles, fire safety - First aid. Basic tools – special service tools – measuring instruments – condition checking of seals, gaskets and sealants. Scheduled maintenance services – service intervals - Towing and recovering.

MODULE II ENGINE AND ENGINE SUBSYSTEM MAINTENANCE **8**

General Engine service- Dismantling of Engine components- Engine repair- working on the underside, front, top, ancillaries- Service of basic engine parts, cooling and lubricating system, fuel system, Intake and Exhaust system, electrical system - Electronic fuel injection and engine management service - fault diagnosis- servicing emission controls.

MODULE III TRANSMISSION AND DRIVELINE MAINTENANCE **8**

Clutch- general checks, adjustment and service- Dismantling, identifying, checking and reassembling transmission, transaxle- road testing- Removing and replacing propeller shaft, servicing of cross and yoke joint and constant velocity joints- Rear axle service points- removing axle shaft and bearings- servicing differential assemblies- fault diagnosis.

MODULE IV STEERING AND SUSPENSION MAINTENANCE 7

Maintenance and Service of Mc person strut, coil spring, leaf spring, shock absorbers. Dismantling and assembly procedures. Inspection, Maintenance and Service of steering linkage, steering column, Rack and pinion steering, Recirculating ball steering service- Worm type steering, and power steering system.

MODULE V BRAKE AND WHEEL MAINTENANCE 7

Inspection, Maintenance and Service of Hydraulic brake, Drum brake, Disc brake, parking brake. Bleeding of brakes. Wheel alignment and balance, removing and fitting of tyres, tyre wear and tyre rotation.

MODULE VI AUTO ELECTRICAL AND AIR CONDITIOING MAINTENANCE 8

Maintenance of batteries, starting system, charging system and body electrical -Fault diagnosis using Scan tools. Maintenance of air conditioning parts like compressor, condenser, expansion valve, evaporator - Replacement of hoses- Leak detection- AC Charging- Fault diagnosis Vehicle body repair like panel beating, tinkering, soldering, polishing, painting.

L – 45; Total Hours –45

TEXT BOOKS:

1. Ed May, "Automotive Mechanics Volume One" , Mc Graw Hill Publications, 2003
2. Ed May, "Automotive Mechanics Volume Two" , Mc Graw Hill Publications, 2003
3. Vehicle Service Manuals of reputed manufacturers
4. Vehicle maintenance and garage practice by Jigar A.Doshi Dhru U.Panchal,Jayesh P.Maniar. 2014
5. A Practical Approach to Motor Vehicle Engineering and Maintenance 3rd Edition by Allan Bonnick.

REFERENCES:

1. Bosch Automotive Handbook, Sixth Edition, 2004.
2. Advanced Automotive Fault Diagnosis by Tom Denton 2011.
3. Nissan Patrol Automotive Repair Manual: 1998-2014 by Haynes Manuals Inc.
4. Automobile electrical manual a comprehensive guide by Haynes manual car repair.

OUTCOMES:

On completion of the course student should be able to

- Prepare maintenance schedules and procedures with appropriate tools.
- Demonstrate the procedure and methods to repair and calibrate the engine.
- **Analyze the causes and remedies for fault in transmission and drive line systems.**
- **Analyze the causes and remedies of steering and suspension systems.**
- **Analyze the causes and remedies of brake system.**
- **Demonstrate the procedure for wheel alignment and wheel balanced.**

GECX117	FUNDAMENTALS OF DIGITAL IMAGE PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Describe and explain basic principles of digital image processing
- Design and implement algorithms that perform basic image processing
- Design and implement algorithms for advanced image analysis
- Assess the performance of image processing algorithms and systems

PRE-REQUISITES:

- Basic knowledge of transforms in Mathematics

MODULE I DIGITAL IMAGE FUNDAMENTALS 8

Elements of Image Processing System, Fundamentals steps in Digital Image Processing, Image Sampling & Quantization, Spatial and Gray Level Resolution.

MODULE II COLOR IMAGE PROCESSING 8

Fundamental of color image processing, color models- RGB, CMY, HIS, Pseudo color image processing

MODULE III IMAGE ENHANCEMENT 7

Basic gray level Transformations, Histogram Processing, Spatial Filtering

MODULE IV IMAGE TRANSFORMS 7

2D-DFT, DCT, Haar Transform, Fundamentals of 2D-wavelet transform, sub-band coding

MODULE V IMAGE SEGMENTATION AND RESTORATION 8

Point, line and edge detection methods ,Image Segmentation and its types, Restoration: Noise model, Inverse filter and Wiener filter.

MODULE VI IMAGE COMPRESSION 7

Fundamentals of redundancies, Basic Compression Methods: Huffman coding, Arithmetic coding, JPEG and MPEG Compression standards.

TOTAL HOURS 45

TEXT BOOKS

1. Gonzalez and Woods, "Digital Image Processing", 3rd Edition, Pearson Education, 2016.
2. Anil. K. Jain, "Fundamentals of Digital Image Processing"; 4th Edition, PHI, 2007

REFERENCES

1. Pratt William, "Digital Image Processing", John Wiley & Sons, 2007.
2. Arthur Weeks Jr., "Fundamentals of Digital Image Processing", PHI, 2006.

OUTCOMES:

On completion of the course, students will be able to

- Explain the fundamental concepts of digital image processing.
- Discuss about color image processing
- Recognize & apply various image enhancement techniques.
- Apply various transforms for image processing.
- Apply various techniques for image segmentation and restoration.
- Identify and use appropriate image compression techniques

Group II courses

(To be offered in VII Semester)

GECX201	GREEN DESIGN AND SUSTAINABILITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart knowledge to face challenges, the technology poses for water, energy, and climate change by implementing sustainable design.

MODULE I CONCEPTS OF SUSTAINABLE DEVELOPMENT 7

Objectives of Sustainable Development - Need for sustainable development-Environment and development linkages - Globalisation and environment-Population, poverty and pollution- global, regional and local environment issues-Green house gases and climate change.

MODULE II SUSTAINABLE DEVELOPMENT OF SOCIO ECONOMIC SYSTEMS 8

Demographic dynamics of sustainability- Policies for socio economic development- Sustainable Development through trade- Economic growth- Action Plan for implementing sustainable development- Sustainable Energy and Agriculture.

MODULE III FRAME WORK FOR ACHIEVING SUSTAINBAILITY 7

Sustainability indicators- Hurdles to sustainability- Business and Industry – Science and Technology for Sustainable Development- Performance indicators of sustainability and assessment mechanism- Constraints and barriers of Sustainable Development.

MODULE IV GREEN BUILDINGS 8

Introduction to Green Building- Energy- Water- Materials and Resources - Sustainable Sites and Land Use - Indoor Environmental Quality- Life Cycle Assessment- Energy, water and materials efficiency.

MODULE V ENERGY CONSERVATION AND EFFICIENCY 7

Energy savings- Energy Audit- Requirements- Benefits of Energy conservation-Energy conservation measures for buildings- Energy wastage- impact to the environment.

MODULE VI GREEN BUILDINGS DESIGN 8

Elements of Green Buildings Design- Foundation, Electrical, Plumbing, flooring, Decking, roofing, insulation, wall coverings, windows, siding, doors and finishing, LEED certification for Green Buildings, Green Buildings for sustainability.

L – 45; Total Hours –45

TEXT BOOKS:

1. Kirby, J., Okeefe, P., and Timber lake, “Sustainable Development”, Earthscan Publication, London, 1995.

REFERENCES:

1. Charles Kibert, J., “Sustainable Construction: Green Building Design and Delivery”, 2nd Edition, John Wiley and sons, 2007.

OUTCOMES:

At the end of the course, the students will be able to

- Explain the relationship between sustainability and emergence of green building practices.
- Address the economic, environmental, and social concerns.

GECX202 APPROPRIATE TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart students knowledge about the basics and applications of various appropriate technologies in the field of civil engineering.

MODULE I BASICS CONCEPTS **7**

Back ground, Tools, Choices and Implications, Appropriate Technology Movement (an overview) - Basic design process, basic financial analysis-discounted cash flow, and energy fundamentals.

MODULE II APPROPRIATE TECHNOLOGY WITH REFERENCE TO BUILDING DESIGN **7**

Appropriate Building Materials, Appropriate Energy Saving Techniques, Water Conservation (Indoor), Rain Water Harvesting.

MODULE III WATER, HEALTH AND SANITATION MANAGEMENT **7**

Water Storage: Designing Dams and Pipelines, Appropriate Selection for Sanitation Technique, Sewerage, Communal Health and Waste Water Recycling.

MODULE IV WASTE MANAGEMENT **8**

Types of Waste - Sources - Collections and On-Site Processing -Transferring Stations - Disposal Systems - Recycling.

MODULE V ENERGY EFFICIENT TECHNIQUES **8**

Green building concepts-renewable energy sources- Solar – Steam and wind-Biofuels - Biogas – Electricity.

MODULE VI TECHNOLOGY POLICY **8**

Government Policies- Energy Policy-Appropriate technology Development Centre-its function and responsibilities-Building policies-Case Studies.

L – 45; Total Hours –45

TEXT BOOKS:

1. Barrett Hazeltine and Christopher Bull, “Appropriate Technology: Tools Choices and Implications”, Academic Press, Orlando, USA, 1998.
2. Ken Darrow and Mike Saxenian, “Appropriate Technology Source Book : A Guide to Practical Books for Village and Small Community Technology”, Stanford, 1986.

REFERENCES:

1. Richard Heeks, “Technology and Developing Countries: Practical Applications Theoretical Issues”, 1995.
2. John Pickford, “The Worth of Water : Technical Briefs on Health, Water and Sanitation”, Intermediate Technology Publications, 1998.

OUTCOMES:

- At the end of the course, the students will be able to use suitable technologies for various conditions for sustainable development.

GECX203 ENGINEERING SYSTEM MODELLING AND SIMULATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn the concepts, techniques, tools for modeling and simulation systems and environments through the use of computers.
- To study the various aspects of discrete dynamic, stochastic systems modeling and conducting experiments with those models on a computer.

MODULE I INTRODUCTION 6

Systems – Modelling – types – systems components – Steps in model building- Simulation Algorithms and Heuristics; Simulation Languages.

MODULE II RANDOM NUMBERS / VARIATES 7

Random numbers – methods of generation – random variates for standard distributions like uniform, exponential, Poisson, binomial, normal etc. – Testing of Random variates – Monte Carlo Simulation.

MODULE III MODELLING PROCESS 7

Primitive Models : Establishing relationships via physical laws; Establishing relationships via curve fitting; Parameters estimation problems; Elementary state transition models.

MODULE IV DESIGN OF SIMULATION EXPERIMENTS 9

Steps on Design of Simulation Experiments – Development of models using of Highlevel language for systems like Queuing, Inventory, Replacement, Production etc., – Model validation and verification, Output analysis.

MODULE V SIMULATION LANGUAGES 10

Need for simulation Languages – Comparisons & Selection of Languages – GPSSARENA- EXTEND – Study of any one of the languages.

MODULE VI CASE STUDIES USING SIMULATION LANGUAGES 6

Case Study using simulation languages

L – 45; Total Hours –45

REFERENCES:

1. Law, A.M., & W.D. Kelton, “Simulation Modelling and Analysis”, McGraw

Hill, Singapore, 2000.
2. Harrel, C.R., et. al., “System Improvement Using Simulation”, 3rd Edition, JMI Consulting Group and ProModel Corporation, 1995.
3. Harrel, C.R. & T. Kerim, “Simulation Made Easy, A Manager’s Guide”, IIE Press, 1995.
4. Geoffrey Gordon, “Systems Simulation”, Prentice Hall, 2002.
5. David Kelton, Rondall P Sadowski, David T Sturrock, “Simulation with Arena”, Mc Graw Hill, 2004.

OUTCOMES:

The student should be able to

- Model and simulate systems and environments through the use of computers.
- Conduct experiments with discrete dynamic, stochastic system models on a computer.

GECX204 VALUE ANALYSIS AND ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To get acquainted with value analysis and engineering tool for productivity improvement.
- To understand and analyze the theory and methodology of Value Engineering.

MODULE I VALUE ENGINEERING BASICS 8

Origin of Value Engineering, Meaning of value, Definition of Value Engineering and Value analysis, Difference between Value analysis and Value Engineering, Types of Value, function - Basic and Secondary functions, concept of cost and worth, creativity In Value Engineering.

MODULE II VALUE ENGINEERING JOB PLAN AND PROCESS 6

Seven phases of job plan, FAST Diagram as Value Engineering Tool, Behavioural and organizational aspects of Value Engineering, Ten principles of Value analysis, Benefits of Value Engineering.

MODULE III ORIENTATION AND INFORMATION PHASES 8

Launching Value Engineering project work - Objectives and Targets - VE Project work: a time-bound programme - Projects and Teams - Time Schedule - Co-ordination - Consultant. Technical data - Marketing related information - Competition profile - Cost data - Materials Management related information - Quality related information - Manufacturing data.

MODULE IV FUNCTION ANALYSIS AND CREATIVE PHASES 9

Objectives - Function definition - Classification of functions - Higher level functions – Function – Cost – Function – Worth - Value Gap - Value index - How to carry out Function Analysis? – Fast Diagraming - Cost Modelling.

Creativity - How to improve creativity of an individual? – How to promote creativity in the organisation? - Obstacles to Creativity - Mental road blocks - Creativity killer phrases. Positive thinking - Ideas stimulators - Creativity techniques - Brainstorming.

MODULE V EVALUATION, INVESTIGATION AND RECOMMENDATION 6

Paired comparison and Evaluation Matrix techniques - Criteria for selection of

VE solutions. Design – Materials – Quality – Marketing – Manufacturing - Preview session. The report - presentation.

MODULE VI IMPLEMENTATION PHASE AND CASE STUDIES 8

Design department - Materials department - Production Planning & Control - Quality Control – Manufacturing – Marketing - Need for co-ordinated teams - The Action Plan. Value Engineering case studies.

L – 45; Total Hours –45

TEXT BOOKS:

1. Mudge, Arthur E. “Value Engineering- A systematic approach”, McGraw Hill, New York, 2000.
2. Kumar S, Singh R K and Jha J K (Ed), “Value Engineering”, Narosa Publishing House, 2005.

REFERENCES:

1. Park RJ, “Value Engineering: A Plan for Invention”, St.Lucie Press, New York, 1999.
2. Lawrence, D.M., “Techniques of Value Analysis and Engineering”, McGraw Hill 1988.
3. George, E.D., “Engineering Design: a Material and Processing Approach”, McGraw Hill, 1991.
4. Heller, D.E., “Value Management, Value Engineering and Cost Reduction”, Addison Wesley, 1988.

OUTCOMES:

- The student will be able to realize the value of products, processes and implement value analysis to achieve productivity improvement.

GECX205 INDUSTRIAL SAFETY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the various safety measures to be taken in different industrial environments.

MODULE I SAFETY MANAGEMENT **7**

Evolution of modern safety concept- Safety policy - Safety Organization - line and staff functions for safety- Safety Committee- budgeting for safety. safety education and training.

MODULE II SAFETY IN MANUFACTURING **7**

Safety in metal working-Machine guarding -Safety in welding and gas cutting - Safety in cold forming and hot working of metals -Safety in finishing, inspection and testing -Regulation.

MODULE III SAFETY IN CONSTRUCTION **8**

General safety consideration in Excavation, foundation and utilities – Cordoning – Demolition – Dismantling –Clearing debris – Types of foundations – Open footings.

Safety in Erection and closing operation - Safety in typical civil structures – Dams-bridges-water Tanks-Retaining walls-Critical factors for failure-Regular Inspection and monitoring.

MODULE IV ELECTRICAL SAFETY **8**

Electrical Hazards – Energy leakage – Clearance and insulation – Excess energy – Current surges – Electrical causes of fire and explosion – National electrical Safety code.

Selection of Environment, Protection and Interlock – Discharge rods and earthing device – Safety in the use of portable tools - Preventive maintenance.

MODULE V SAFETY IN MATERIAL HANDLING **8**

General safety consideration in material handling devices - Ropes, Chains, Sling, Hoops, Clamps, Arresting gears – Prime movers.

Ergonomic consideration in material handling, design, installation, operation and

maintenance of Conveying equipments, hoisting, traveling and slewing mechanisms.

Storage and Retrieval of common goods of shapes and sizes in a general store of a big industry.

MODULE VI SAFETY EDUCATION AND TRAINING 7

Importance of training-identification of training needs-training methods – programme, seminars, conferences, competitions – method of promoting safe practice - motivation – communication - role of government agencies and private consulting agencies in safety training – creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign – Domestic Safety and Training.

L – 45; Total Hours –45

REFERENCES:

1. Krishnan N.V, “Safety Management in Industry”, Jaico Publishing House, Bombay, 1997.
2. Blake R.B., “Industrial Safety”, Prentice Hall, Inc., New Jersey, 1973.
3. Fulman J.B., “Construction Safety, Security, and Loss Prevention”, John Wiley and Sons, 1979.
4. Fordham Cooper W., “Electrical Safety Engineering”, Butterworths, London, 1986.
5. Alexandrov M.P., “Material Handling Equipment”, Mir Publishers, Moscow, 1981.

OUTCOMES:

Students would be able to

- Acquire knowledge on various safety Hazards.
- Carry out safety measures for different industrial environments.

GECX206 ADVANCED OPTIMIZATION TECHNIQUES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the various advanced optimization tools.
- To provide an understanding to deal with ill identified and fuzzy problems.

MODULE I INTRODUCTION **7**

Review of conventional optimization techniques - limitations - limitation of exhaustive search - need for artificial intelligence - bio mimicking methods

MODULE II HEURISTICS METHODS **8**

Introduction – Advanced methods of algorithm design: Greedy method, Backtracking method, Divide and Conquer method – Dynamic programming – Heuristics exploration algorithms – Greedy search - Local search – Hill climbing – Tabu search – Gradient search – Beam search – Simulated Annealing.

MODULE III GENETIC ALGORITHM **7**

Introduction - Basics of GA – Population – Reproduction – Cross over – Mutation -genetic algorithms in search, optimization and machine learning-practical genetic algorithms.

MODULE IV ANT COLONY OPTIMIZATION **8**

Introduction: Ant Colony Optimization – Meta-heuristic Optimization – History – The ACO Meta-heuristic – ACO Algorithms: Main ACO – Ant system – Ant colony system – Max-Min Ant system – Applications: Routing in telecommunication networks – Travelling salesmen – Graph Coloring – Advantages & Disadvantages

MODULE V FUZZY LOGIC AND ANN **8**

Fuzzy logic, knowledge representation and inference mechanism – Fuzzy and expert control – standard Takagi-Sugeno mathematical characterizations – Design example – Biological foundations to intelligent systems: Artificial neural networks, Back-propagation networks, Radial basis function networks, and recurrent networks.

MODULE VI IMPLEMENTATIONS & APPLICATIONS 7

Reduction of size of an optimization problem – multilevel optimization – parallel processing – multi objective optimization – Job shop scheduling – Vehicle scheduling – Line balancing – Sensor integration.

L – 45; Total Hours –45

REFERENCES:

1. Singiresu S. Rao, “Engineering optimization – Theory and practices”, John Wiley and Sons, 1996.
2. Ravindran – Phillips –Solberg, “Operations Research – Principles and Practice, John Wiley and Sons, 1987.
3. Fredrick S.Hillier and G.J.Liberman, “Introduction to Operations Research”, McGraw Hill Inc. 1995.
4. Kalymanoy Deb, “Optimization for Engineering Design”, PHI, 2003
5. Christos H. Papadimitriou, Kenneth Steiglitz, Combinatorial Optimization, PHI 2006

OUTCOMES:

At the end of the course student will be able to

1. Formulate a real life situation as an optimization the problem.
2. Identify the appropriate solution methodology and provide a solution

GECX207 **MATLAB SIMULINK** **L T P C**
3 0 0 3

OBJECTIVES:

- Teach students how to mathematically model engineering systems
- Teach students how to use computer tools to solve the resulting mathematical models. The computer tool used is MATLAB and the focus will be on developing and solving models of problems encountered in engineering fields

MODULE I INTRODUCTION MATLAB DATA PRESENTATION 7

Vectors, Matrices -Vector/Matrix Operations & Manipulation- Functions vs scripts- Making clear and compelling plots-Solving systems of linear equations numerically and symbolically- Least squares regression -Curve fitting.

MODULE II MATLAB PLOT FUNCTION 7

Introduction- Plot Function – Animation- 3D Plots-Customizing Plots – Plot Applications- Saving &Painting Plots.

MODULE III ROOT FINDING AND COMPUTER REPRESENTATION OF NUMBERS 7

Linearization and solving non-linear systems of equations- The Newton-Rapson method- Integers and rational numbers in different bases- Floating point numbers- Round off and errors in basic arithmetic-Significant digits when reporting results

MODULE IV ORDINARY DIFFERENTIAL EQUATIONS 8

Numerical integration and solving 1^{st} order, ordinary differential equations (Euler's method and Runge-Kutta)- Use of ODE function in MATLAB

MODULE V NON-LINEAR DIFFERENTIAL EQUATIONS 8

Converting 2^{nd} order and higher ODEs to systems of 1^{st} order ODEs- Solving systems of ODEs via Euler's method and Runge-Kutta)- Solving single and systems of non-linear differential equations by linearization-Use of the function ODE in MATLAB to solve differential equations

MODULE VI INTRODUCTION OF SIMULINK 8

Simulink & its relations to MATLAB – Modeling a Electrical Circuit- Modeling a fourth order differential equations- Modeling the solution of three equations with three unknowns- Representing a model as a subsystem-Simulink demos.

L – 45; Total Hours –45

REFERENCES:

1. Griffiths D V and Smith I M, Numerical Methods for Engineers, Blackwell, 1991.
2. Laurene Fausett, Applied Numerical Analysis Using MATLAB, Pearson 2008.
3. Moin P, Fundamentals of Engineering Numerical Analysis, Cambridge University Press, 2001.
4. Wilson HB, Turcotte LH, Advanced mathematics and mechanics applications using MATLAB. CRC Press, 1997
5. Ke Chen, Peter Giblin and Alan Irving , Mathematical Exploration with MATLAB, Cambridge University Press, 1999.

OUTCOMES:

At the end of this unit students will be able to:

1. Use Matlab as a convenient tool for solving a broad range of practical problems in engineering from simple models to real examples.
2. Write programs using first principles without automatic use of built-in ones.
3. Write programs for solving linear and nonlinear systems, including those arising from boundary value problems and integral equations, and for root-finding and interpolation, including piecewise approximations.
4. Be fluent in exploring Matlab's capabilities, such as using matrices as the fundamental data-storage unit, array manipulation, control flow, script and function m-files, function handles, graphical output.
5. Make use of Maltab visual capabilities for all engineering applications.
6. An ability to identify, formulate, and solve engineering problems. This will be accomplished by using MATLAB to simulate the solution to various problems in engineering fields

GECX208	EMBEDDED SYSTEMS AND ITS APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide a detailed overview of embedded system.
- To equip students with the software development skills necessary for practitioners in the embedded systems field.
- To understand entire software development lifecycle and examine the various issues involved in developing software for embedded systems.

MODULE I EMBEDDED SYSTEMS OVERVIEW 8

Introduction –Embedded Systems vs. General computing systems- Fundamental Components of embedded systems- Characteristics- Challenges-Examples- Embedded System design process.

MODULE II EMBEDDED COMPUTING PLATFORM 8

Overview of Processors and hardware units in an embedded system-CPU buses – Memory devices –Memory types- I/O devices – Designing with computing platforms- Consumer electronics architecture-Design example: Alarm clock.

MODULE III REAL TIME EMBEDDED SYSTEMS 8

Programming embedded systems in assembly and C – Real time systems – Hard and Soft real time systems- Need for RTOS in Embedded Systems- Multiple tasks and processes –Context switching-Scheduling policies- Interprocess communication and synchronization.

MODULE IV EMBEDDED SOFTWARE DEVELOPMENT PROCESS and TOOLS 8

Development process of an embedded system-software modules and tools for implementation of an embedded system- Integrated development environment- Host and target machines-cross compiler-cross assembler-Choosing right platform.

MODULE V PROGRAM MODELING IN EMBEDDED SYSTEMS 8

Program Models – Data Flow Graph model-control DFG model-Synchronous DFG model- Finite state machines- UML modeling – UML Diagrams.

MODULE VI EMBEDDED SYSTEMS APPLICATION 5

Application specific embedded system – case study: digital camera hardware and software architecture, embedded systems in automobile, embedded system for a smart card.

Total Hours –45

TEXT BOOKS:

1. Marilyn Wolf , "Computers as components", Elsevier 2012.
2. Shibu. K.V, “Introduction to Embedded Systems”, Tata Mcgraw Hill,2009.
3. Rajkamal, "Embedded Systems Architecture, Programming and Design",1st Reprint,Tata McGraw-Hill, 2003
4. Frank Vahid and Tony Gwargie, "Embedded System Design", John Wiley & sons, 2002.

REFERENCES:

1. Sriram V Iyer and PankajGupta ,”Embedded Realtime Systems Programming ”Tata McGraw-Hill,2008
2. Qing Li and Carolyn Yao," Real-Time Concepts for Embedded Systems", CMPBooks, 2003
3. David E.Simon, "An Embedded Software Primer", Pearson Education, 2003

OUTCOMES:

On completion of this course, the students will be able to

- Identify the suitable processor and peripherals in embedded applications
- Develop embedded programs in assembly and c
- Choose the right platform for designing an embedded system
- Explore different scheduling mechanism in rtos
- Design the program model for embedded applications.
- Analyze different domain specific applications in embedded systems.

GECX209 USABILITY ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

The objective of this course is

- To understand the emerging concept of usability, requirements gathering and analysis.
- To learn about human computer interaction with the help of interfaces that has high usability.

MODULE I INTRODUCTION 6

Cost Savings – Usability Now – Usability Slogans – Discount Usability Engineering – Usability – Definition – Example – Trade-offs – Categories – Interaction Design – Understanding & Conceptualizing Interaction – Cognitive Aspects.

MODULE II USER INTERFACES 8

Generation of User Interfaces – Batch Systems, Line Oriented Interfaces, Full Screen Interfaces, Graphical User Interfaces, Next Generation Interfaces, Long Term Trends – Usability Engineering Life Cycle – Interfaces – Data Gathering – Data Analysis Interpretation and Presentation.

MODULE III INTERACTION DESIGN 8

Process of Interaction Design - Establishing Requirements – Design,Prototyping and Construction - Evaluation and Framework.

MODULE IV USABILITY TESTING 8

Usability Heuristics – Simple and Natural Dialogue, Users' Language, Memory Load, Consistency, Feedback, Clearly Marked Exits, Shortcuts, Error Messages, Prevent Errors, Documentation, Heuristic Evaluation – Usability Testing - Test Goals and Test Plans, Getting Test Users, Choosing Experimenters, Ethical Aspects, Test Tasks, Stages of a Test, Performance Measurement, Thinking Aloud, Usability Laboratories.

MODULE V USABILITY ASSESSMENT METHODS 8

Observation, Questionnaires and Interviews, Focus Groups, Logging Actual Use, User Feedback, Usability Methods – Interface Standards - National, International and Vendor Standards, Producing Usable In-House Standards.

MODULE VI USER INTERFACES 7

International Graphical Interfaces, International Usability Engineering, Guidelines for Internationalization, Resource Separation, Multilocale Interfaces – Future Developments – Case Study.

L – 45; Total Hours –45

TEXT BOOKS:

1. Yvonne Rogers, Helen Sharp, Jenny Preece, “Interaction Design: Beyond Human - Computer Interaction”, John Wiley & Sons, 3rd Edition, 2011 (Module I, II, III).
2. Jakob Nielsen, “Usability Engineering”, Morgan Kaufmann Academic Press, 1994. (Module I – VI).

REFERENCES:

1. Ben Shneiderman, Plaisant, Cohen, Jacobs, “Designing the User Interface: Strategies for Effective Human Interaction”, Pearson Education, 5th Edition, 2010.
2. Laura M. Leventhal, Julie A. Barnes, “Usability Engineering: Process, Products, and Examples”, Pearson/Prentice Hall, 2008

OUTCOMES:

Students who complete this course will be able to

- build effective, flexible and robust user interfaces.
- translate system requirements into appropriate human/computer interaction sequences.
- choose mode, media and device for the application requirements.

GECX210 SUPPLY CHAIN MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the various decision phases in a supply chain
- To be aware of the Supply Chain and its drivers
- To design Supply Chain Network
- To build a aggregate plan in supply chain
- To understand Sourcing Decisions in Supply Chain
- To comprehend the influence of Information technology in Supply Chain

MODULE I INTRODUCTION TO SUPPLY CHAIN 7

Understanding Supply Chain - Decision phases - Supply chain performance - Competitive and supply chain strategies - Achieving strategic fit - Expanding strategic scope

MODULE II SUPPLY CHAIN DRIVERS AND DESIGN 7

Drivers of supply chain performance – Designing distribution network - Network Design in the Supply Chain - Network design in Uncertain Environment

MODULE III AGGREGATE PLANNING AND MANAGING SUPPLY, DEMAND AND INVENTORY 8

Aggregate Planning in a Supply chain: role - Managing Supply - Managing Demand in Supply Chain – Cycle and Safety inventory in supply chain – Level of product availability.

MODULE IV MANAGING INVENTORY IN SUPPLY CHAIN 8

Managing Economies of Scale in a Supply Chain : Cycle Inventory- Managing uncertainty in a Supply Chain Safety Inventory- Determining optimal level of Product Availability

MODULE V SOURCING AND TRANSPORTATION 8

Sourcing decision in supply chain - Third and Fourth – Party Logistics providers - Supplier scoring and assessment - Transportation in a Supply Chain – Risk and Trade-offs in transportation design.

MODULE VI INFORMATION TECHNOLOGY IN A SUPPLY CHAIN 7

Information technology in a supply chain – CRM, ISCM, SRM in supply chain -

Over view of recent trends in Supply Chain: e-SRM, e-LRM, e-SCM.

L – 45; Total Hours –45

REFERENCES:

1. Sunil Chopra and Peter Meindl, “Supply Chain Management-Strategy Planning and Operation”, Pearson Education, 5th Indian Reprint, 2013.
2. Jananth Shah “Supply Chain Management – Text and Cases“ Pearson Education, 2008.
3. Altekar Rahul V, “Supply Chain Management-Concept and Cases”, Prentice Hall India, 2005.
4. Monczka et al., “Purchasing and Supply Chain Management”, Thomson Learning, 2nd Edition, 2nd Reprint, 2002.

OUTCOMES:

- After taking up the course the student will be able to brighten his prospects of taking up a career on supply chain management.
- The student decision making capability specific to supply chain issues in an industry is improved.
- The student can plan a well defined execution of supply chain strategy in companies.
- The student will be able to design a optimal distribution network as per the demands of the industry.
- The student can also determine the most favorable transportation plan for a company.
- The student will also be able to bring in company from paper environment to paperless environment.

GECX211 SYSTEMS ANALYSIS AND DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To describe the phases of the systems development life cycle
- To teach the automated tools for system development
- To develop and evaluate system requirements.
- To explain the organizational issues in system implementation
- To teach the usability testing and electronic data interchange
- To elucidate the importance of System analysis and design in electronic commerce.

MODULE I FUNDAMENTALS OF SYSTEM DEVELOPMENT 8

System Concept – Characteristics – Elements of System – Types of System – Modern Approach to System Analysis and Design – System Development Life Cycle – Approaches to Improving Development – Tools for System Development – Succeeding as a System Analyst – Skills – Managing the Project.

MODULE II AUTOMATED TOOLS FOR SYSTEMS DEVELOPMENT 7

What is requirements determination? Fact finding techniques, Tools for documenting procedure and decision-CASE Tools-Need for CASE tools-Reverse engineering and reengineering- phases of the software life cycle-Ranking projects-Value Chain Analysis- Corporate Strategic Planning vs. Information Systems Planning.

MODULE III SYSTEM ANALYSIS 8

Determining System Requirements – Traditional Methods - Modern Methods – Radical Methods – Structuring System Requirements – Process Modeling – Data Flow Diagramming – Logic Modeling – Conceptual Data Modeling – E-R Modeling.

MODULE IV SYSTEM DESIGN 8

System Implementation – Software Application Testing – Installation – Documentation – Training and Support – Organizational Issues in Systems Implementation – Maintaining Information System – Conducting System Maintenance.

MODULE V USABILITY AND MEASURING USER SATISFACTION 7

Usability Testing-User satisfaction test- A tool for analyzing user satisfaction – Unified Modeling Language(UML)- Case study: System Design: Application in Human Resource-Financial Applications

MODULE VI SAD IN E-COMMERCE 7

Systems analysis and design in the era of electronic commerce: B2B, B2C and C2C e-commerce -advantages and disadvantages of e-commerce. E-commerce system architecture – physical networks, logical network, World Wide Web, web-services - HTML, XML - case studies-El electronic data interchange: EDI standards - virtual private networks - XML and EDI

L – 45; Total Hours –45

REFERENCES:

1. Jeffrey A. Hoffer, Joey F. George, Joseph S. Valacich, “Modern Systems Analysis and Design”,Fifth Edition, Prentice Hall,March 2007.

2.Ned Kock, “Systems Analysis & Design Fundamentals” Sage South Asia, May 2008.

3. Joseph S. Valacich, Jeffrey A. Hoffer, Joey F. George, “Essentials Of System Analysis And Design” Prentice Hall , August 2005.

4. Rumbaugh et al, “Succeeding with Booch and Rambaugh Methods”, Addisson Wesley, second Edition, 1998.

5.Larman, C.,” Applying UML and Patterns. An introduction to Object-Oriented Analysis and Design”. Prentice-Hall PTR, 2002.

OUTCOMES:

- List the characteristics of the system and specify the approaches in the development of the system.
- Summarize the phases of the software life cycle
- Differentiate Corporate Strategic Planning and Information Systems Planning.
- Illustrate the system requirements through various modeling diagrams.
- Use tools and techniques for process and data modeling.
- Solve realistic systems analysis problems and perform user satisfaction test.

GECX212 **ADVANCED MATERIALS** **L T P C**

3 0 0 3

OBJECTIVES:

To make the student conversant with

- Dielectric materials
- Magnetic materials
- Energy materials
- Nano materials
- Semi conductors
- Smart materials

MODULE I **8**

Dielectric Materials- Polarization and Mechanism-Internal or local field-Clausius-Mossotti relation- Dielectric loss- Temperature and Frequency effect- Measurement of Dielectric constant and loss using Scherring bridge- electric break down- ferro, piezo, pyroelectric materials and its application.

MODULE II **8**

Magnetic Materials- Terminology and classification of magnetic materials (Dia, Para, Ferro & Ferri) – Magnetic moments due to electrospin – Domain theory of Hysteresis – Heisenberg theory of Exchange Interaction (without derivation)- Structure and properties of Ferrites- Properties of Soft and Hard Magnetic Materials- Application: floppy disk, CD ROM, Magneto optical recording.

MODULE III **8**

Energy Materials (Nuclear) - Introduction to nuclear materials- Materials for nuclear fuel in fission and fusion reactors, Fissile and fertile materials- Control & Construction Materials for Nuclear reactors, Moderators, Heat Exchangers- Radiation proof materials- Brief discussion of safety and radioactive waste disposal.

MODULE IV **7**

Nano Materials- The nanosize range- classification of nanomaterials- processing of nanomaterials-properties of nanomaterials- mechanical, electrical, magnetic properties- other properties- carbon based nanomaterials- other nanomaterials and its application.

MODULE V **7**

Semiconductors- The energy gap in solids-Extrinsic Semiconductors- Intrinsic Semiconductors- Hall Effect in semiconductors- Application of Hall Effect- Basic ideas of compound semiconductors -Semiconductor materials- Fabrication of Integrated Circuits- Some semiconductor Devices

MODULE VI **7**

Smart materials- aerospace materials Ni and Co based super alloys, Special steels, Titanium alloys, Intermetallics, ceramics and their composites, New High strength material, Properties of Materials, Materials in Medical Applications, Stainless steel alloys,Cobalt based alloys, titanium based alloys, polymers

L – 45; Total Hours –45

REFERENCES:

1. Materials science and Engineering: A first course by V. RAGHAVAN, 6th ed., Eastern Economy edition,Prentice Hall of India,2015
2. Materials science and Engineering: An Introduction by William D. Callister Jr., 7th ed. John Wiley & Sons Inc. 2007
3. Material science by Dr.M.Arumugam, Anurasha agencies ,third revised edition ,2002

OUTCOMES:

Students will be able to know

- significance of dielectric materials
- types and applications of magnetic materials
- applications of nuclear materials for energy harvesting
- applications of nano materials
- significance of semi conductor devices
- applications of smart materials

GECX213	NATIONAL SERVICE SCHEME	L	T	P	C
		2	0	0	2

OBJECTIVES:

Primary Objective: Personality development through community service.
To achieve the above objective, the following should be adhered:

1. To provide an understanding about the aims, structure and programmes and activities of National Service scheme in terms of Nation Building
2. To develop certain basic skills for personality development through community development.
3. Understand the community in which they work and their relation
4. Identify the needs and problems of the community and involve them in problem-solving and
5. Practice national integration and social harmony.

MODULE I INTRODUCTION TO NSS 8

Orientation and structure of NSS,-Aims and Objectives of National Service Scheme- The history of NSS- Symbol and meaning- NSS hierarchy from national to college level – Role and responsibilities of various NSS functionaries

MODULE II PERSONALITY AND COMMUNITY DEVELOPMENT SKILLS 8

Importance of youth Leadership, Traits of Good Leadership and Personality Development. Role of youth in creating awareness through NSS Programmes on Health & Hygiene; Environmental Conservation and Enrichment for Sustainable Development; Sanitation and Swachh Bharat.

MODULE III UNDERSTANDING YOUTH 7

Definition and Profiles of youth categories, Youth Issues, Challenges and Opportunities for Youth, Youth as agent of social change & Community Mobilization .Role of Youth in Nation Building. National Youth Policy.

MODULE IV SOCIAL HARMONY AND NATIONAL INTEGRATION 7

National Integration, Various obstacles in the way of National Integration; such as caste, religion, language and provisional problems etc. Role of youth in Peace building and conflict resolution- Globalization and its Economic Social Political and

Cultural impacts.

L – 30; Total Hours –30

TEXT BOOKS:

1. National Service Scheme – A Youth Volunteers Programme for Under Graduate students as per UGC guidelines J.D.S.Panwar et al. Astral International. New Delhi.
2. National Service Scheme Revised Manual, 2006.Govt. of India. Ministry of Youth Affairs & Sports. New Delhi.
3. Social Problems in India, *Ram Ahuja.*

REFERENCES:

1. National Youth Policy-2014. Ministry of Youth Affairs & Sports. .Govt. of India

OUTCOMES:

On successful completion of this course-

- Students will have exposure to the the aims, structure and programmes and activities of National Service scheme in terms of Nation Building
- Students will be trained to skills for personality development through community development.
- Students will gain knowledge about national integration and social harmony.
- Students will be exposed to the role of youths in Nation building Students will gain

GECX214	AUTOMOTIVE POLLUTION AND CONTROL	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To have a fair knowledge in automotive pollution control.
- To understand the concept of formation and control techniques of pollutants like UBHC, CO, NOx, particulate matter and smoke for both SI and CI engine will be taught to the students.
- To know about the instruments for measurement of pollutants
- To get introduced about emission standards

MODULE I EMISSION FROM AUTOMOBILES 8

Sources of Air Pollution. Various emissions from Automobiles — Formation — Effects of ollutants on environment and human beings. Emission control techniques – Modification of fuel, after treatment devices. Emission standards. Automotive waste management, old vehicle disposal, recycling, tyre recycling

MODULE II SI ENGINE EMISSIONS AND CONTROL 9

Emission formation in SI Engines- Carbon monoxide & Carbon di oxide - Unburned hydrocarbon, NOx, Smoke —Effects of design and operating variables on emission formation – controlling of pollutants - Catalytic converters, Charcoal Canister, Positive Crank case ventilation system, Secondary air injection, thermal reactor

MODULE III CI ENGINE EMISSION AND CONTROL 8

Formation of White, Blue, and Black Smokes, NOx, soot, Effect of Operating variables on Emission formation — Fumigation, Split injection, Catalytic Coating, EGR, Particulate Traps, SCR, Fuel additives — Cetane number Effect.

MODULE IV NOISE POLLUTION FROM AUTOMOBILES 8

Sources of Noise — Engine Noise, Transmission Noise, vehicle structural Noise, aerodynamics noise, Exhaust Noise. Noise reduction in Automobiles — Encapsulation technique for noise reduction —Silencer Design.

MODULE V TEST PROCEDURES 6

Constant Volume Sampling I and 3 (CVSI &CVS3) Systems- Sampling Procedures — Chassis dynamometers - Seven mode and thirteen mode cycles for Emission Sampling.

MODULE VI EMISSION MEASUREMENTS 6

Emission analysers —NDIR, FID, Chemiluminesecent, Smoke meters, Dilution Tunnel, SHED Test, Sound level meters.

L – 45; Total Hours –45

TEXT BOOKS:

1. V.Ganesan, 'Internal combustion Engines', Tata McGraw Hill Book Co, Eighth Reprint, 2005.
2. Crouse and Anglin, 'Automotive Emission Control', McGraw Hill company., Newyork 1993.

REFERENCES:

1. G.P.Springer ad D.J.Patterson, Engine Emissions, Pollutant formation, Plenum Press, New York. 1986.
2. D.J.Patterson and N.A.Henin, 'Emission from Combustion Engine and their control', Anna Arbor Science Publication,1985.
3. L.Lberanek, 'Noise Reduction', Mcgrawhill Company., Newyork1993.
4. C.Duerson, 'Noise Abatment', Butterworths ltd., London1990.
5. A.Alexander, J.P.Barde, C.lomure and F.J. Langdan, 'Road traffic noise', Applied science publisher ltd., London,1987.

OUTCOMES:

On completion of the course student should be able to

- Identify the sources of emission from vehicles.
- Analyse the causes and effects of emissions.
- Analyse causes and effects of noise pollution
- Bring out solutions for control of emissions.
- Demonstrate the test procedures and emission norms.
- Select suitable instruments for measurement of emissions.

GECX215	MOTOR VEHICLE ACT, INSURANCE & POLICY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn about basic act and regulation followed for road vehicle
- To learn about systematic steps involved to get licence and registration of motor vehicle
- To learn arbour various types of motor vehicle polices and insurances

MODULE I BASIC RULES FOR ROAD VEHICLE 8

Display and Use of Number Plates- Attachment of number plates- Number plates in horizontal position- Removal of number plates on transfer- Hours prescribed for lighted lamps- Mounting of lamps and reflectors- Multiple beam headlamps- Daytime running lamps- Auxiliary driving lamps- Parking lamps- Brakes- Stopping distances- Emergency or parking brakes- Horn- Muffler- Mirrors- Inspection of motor vehicles- Standards of safety and repair

MODULE II LICENSING OF DRIVERS OF MOTOR VEHICLES 8

Necessity of driving licence- Age limit in connection with driving of motor vehicle-Responsibility of owners of motor vehicles-Restriction on the holding of driving licence-Grant of learner's licence-Grant of driving licence-Addition to driving licence- Renewal of driving licence-Revocation of driving licence on grounds of disease or disability-Driving licence to drive motor vehicle belonging to the central government- power of court to disqualify- suspension of driving licence in certain cases- suspension or cancellation of driving licence on convection- Endorsement.

MODULE III REGISTRATION OF MOTOR VEHICLE 7

Necessity for registration – Registration Where and how to be made- Special provision for registration of motor vehicle of diplomatic officers-Temporary registration- Production of vehicle at the time of registration- Refusal of registration- renewal of certificate of registration- effectiveness in India of registration- Change of residence or place of business-transfer of ownership- Suspension of registration – cancellation of registration suspended under section 53- certificate of fitness of transport vehicle-cancellation of registration.

MODULE IV INSURANCE OF MOTOR VEHICLE 8

Necessity for insurance against third party – Requirements of policies and limits of liability- - Duty of insurers to satisfy judgements and awards against person insured in respect of third party risks-Duty to give information as to insurance-Settlement between insurers and insured persons- transfer of certificate of insurance-production of certain certificates, licences and permit in certain cases-Special provisions as to compensation in case of hit and run motor accident – Types of motor polices

MODULE V CONTROL OF TRANSPORT VEHICLES 7

Power to State Government to control road transport- Transport authorities-General provision as to applications for permits- Application for stage carriage permit- Procedure of Regional Transport Authority in considering application for stage carriage permit- Scheme for renting of motor cabs- Application for private service vehicle permit- Procedure in applying for and granting permits- Duration and renewal of permits- Transfer of permit- Replacement of vehicles-Temporary permits

MODULE VI OFFENCES AND PUNISHMENT 7

Driving without holding an effective driving licence- Driving by an under-aged person (Minor driving vehicle)- Holding of a driving licence permitting it to be used by other person.- Driving a vehicle at an excessive speed- Driving or permitting to drive a vehicle carrying excess load- Driving dangerously / its Abetment Driving an uninsured vehicle

Rider and pillion rider failing to wear protective head gear (Helmet) -Violation of Mandatory Signs -.e-challan and spot challan

L – 45; Total Hours –45

TEXT BOOKS:

1. The motor vehicle act 1988, Universal law publishing co.cpvt ltd. Newdelhi 2011
2. A Commentary On The Motor Vehicles Act, 1988 by SUKHDEV AGGARWAL The Bright Law House, New Delhi

REFERENCES:

1. The Motor Vehicles Act, 1988 Along with Latest Case Law, Notifications & Table of Offences and Punishments Asia Law House; 15th edition

(2014)

2. Assessment of Compensation in Accidents under Motor Vehicles Act by Karkara Delhi Law House (2013)

OUTCOMES:

On completion of the course students should be able to

- Explain the analysis of rules and regulations for road vehicles
- Analyze the procedure for getting driving license for vehicles at national and international level
- Analyze the procedure for registration of vehicles.
- Analyze the procedure for Insurance of vehicles and claims.
- Analyze the procedure for obtaining Government Permits and renewal
- Analyze the consequences of not following the rules and regulations

GECX216	PRINCIPLES OF COMMUNICATION SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

To introduce the analog and digital modulation techniques.
To elaborate the working of communication receivers in the presence of noise.
To give an overview of various communication systems.

MODULE I LINEAR MODULATION 8

Baseband signals, Amplitude Modulation – Modulation Index, Power Transmitted, Double Side Band and Single Side Band AM, AM Modulators and AM Receivers, AM Radio systems, Frequency Division Multiplexing.

MODULE II ANGLE MODULATION 8

Frequency Modulation and Phase Modulation, Frequency deviation and modulation index, Bandwidth of FM, FM Modulators and FM receivers, FM Radio and FM Stereo Systems

MODULE III SAMPLING AND PULSE MODULATION 7

Sampling, Nyquist's Sampling Theorem, Pulse Modulations - PAM, PPM and PWM, Time Division Multiplexing, Bandwidth of TDM systems.

MODULE IV DIGITAL COMMUNICATION 7

Digital baseband data, Digital Modulations – ASK, FSK, PSK and QPSK. Digital Communication Transmitters and Receivers.

MODULE V NOISE 8

Sources of Noise, Thermal Noise, shot noise, White noise, Narrow band Noise, Effect of noise in communication, SNR, Receiver Noise Temperature and Noise Equivalent Bandwidth.

MODULE VI COMMUNICATION SYSTEMS & NETWORK 7

FM Radio Systems, Cellular Mobile network, Satellite Communications, Optical Fiber Communication.

L – 45; T – 0; Total Hours – 45

TEXT BOOKS:

1. A. Bruce Carlson, Paul B. Crilly, "Communication Systems", 5th Edition,

McGraw Hill Int., 2011.
2. B.P. Lathi, Zhi Ding, Hari M. Gupta, “Modern Digital and Analog Communication Systems”, 4th Edition, Oxford University Press, 2017.

REFERENCES:

1. Herbert Taub, Donald L. Schilling, Goutam Saha, “Principles of Communication Systems” 4th Edition, McGraw Hill Int. 2013.
2. Simon Haykin, “An Introduction To Analog And Digital Communications”, 1st Edition, Wiley India, 2010.
3. Simon Haykin , “Communications Systems” 4th Edition, Wiley India, 2006.
4. Hwei P. Hsu, “Analog and Digital Communications” 3rd Edition,

OUTCOMES:

On completion of the course students will be able to

1. Identify various communication systems and the corresponding modulation schemes.
2. Predict the characteristics of various analog and digital modulation schemes.
3. Interpret the effect of noise and bandwidth in a communication systems
4. Apply the Nyquist criteria for a given baseband signals.
5. Evaluate the performance of communication receivers.
6. Demonstrate the applications of common communication systems.

GECX217 **LEAN MANAGEMENT** **L T P C**

3 1 0 4

OBJECTIVES:

The objective of the Course to make the student know about

- the basics of lean production management,
- how Lean principles are applied to the Construction industry to improve the operation management and product development.

MODULE I **8**

lean production? – Introduction, background, and lean thinking. Importance of philosophy, strategy, culture, alignment, focus and systems view. Discussion of Toyota Production System.

MODULE II **8**

Manufacturing systems – an overview of manufacturing strategies. Job shops, batch flow, and flexible manufacturing systems Flow production and lean production systems

MODULE III **7**

Value stream mapping in process design and product development Waste reduction - lead time reduction

Process cycle time and value-added vs. non-value added activities Optimum lot sizing

MODULE IV **8**

Lean production processes, approaches and techniques.—Importance of focusing upon flow. Tools -. Workplace organization – 5S. - Stability. - Just-In-Time – One piece flow – Pull. - . Cellular systems. - . Quick change and set-up reduction methods. f. Total productive maintenance. -. Poka-Yoke – mistake proofing, quality improvement. Standards. - . Leveling. - . Visual management. Just-in-time techniques – SMED and Takt Times - Standard work processes and line balancing Poka-yoke and pull systems material handling reduction and facilities planning

MODULE V **8**

Managing change in the lean organization Human resource management and the lean enterprise Employee involvement – Teams – Training – Supporting and encouraging involvement – Involving people in the change process -- communication -- Importance of culture. Startup of lean processes and examples of applications.

Sustaining improvement and change, auditing, follow-up actions.

7

MODULE VI

The lean enterprise and supply chain management Costs and risks of lean initiatives - Measuring lean initiatives

L – 45; Total Hours –45

TEXT BOOKS:

1. The Toyota Way Fieldbook, Jeffrey Liker and David Meier, McGraw-Hill, 2006. Lean Production Simplified, Pascal Dennis, Productivity Press, 2007.
2. Womack, James P., and Daniel T. Jones. Lean Thinking. New York, NY: Simon and Schuster, 2003. ISBN: 0743249275.
3. Murman, Earll. Lean Enterprise Value. New York, NY: Palgrave Macmillan, 2002. ISBN: 0333976975.

REFERENCES:

1. Readings at http://www.leanconstruction.org/readings.htm
2. Hopp, W. J., and Spearman, M. L. (2011). Factory Physics, Third Edition, Waveland Press, Long Grove, Il. 720 pp.

OUTCOMES:

The student will be able to

- Describe the manufacturing approaches employed and the background and philosophy of lean production.
- Illustrate the concept of waste reduction
- Apply evaluation techniques that can be used in preparation for and use in learn production activities.
- Select the tools that can be used implementing lean production in production operations.
- Discuss the importance of workplace organization, pull production, cellular arrangement and employee involvement, need for employee creativity
- Describe about the Methods for promoting success in implementing lean transformations

GECX218 GEOSPATIAL MODELING & ANALYSIS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To equip the students with fundamental representation and analysis of geospatial phenomena and provides foundations in methods and algorithms used in GIS analysis.
- To focus is on terrain modeling, geomorphometry, watershed analysis and introductory GIS-based modeling of landscape processes (water, sediment). The course includes analysis from lidar data, coastal change assessment and 3D visualization.

MODULE I INTRODUCTION TO GEOSPATIAL DATA 7

Mapping natural phenomena –Concept of continuous fields and discrete sampling – Units, projections, coordinate transformation – Georeferencing, geospatial formats, conversions, geospatial data abstraction library – Raster and vector representation, raster and vector conversions and resampling.

MODULE II DATA DISPLAY AND VISUALIZATION 7

Display of continuous and discrete data, use of color, shading, symbols, to extract the spatial pattern and relationships – 3D visualization: multiple surfaces and volumes, 3D vector objects – visualization for data analysis (lighting, scaling, transparency, cutting planes, animations) – view/create maps/post your data on-line (Google Earth/Maps, GPS visualizer)

MODULE III GEOSPATIAL ANALYSIS 7

Foundations for analysis of continuous and discrete phenomena – neighborhood operations and buffers – analysis and modeling with map algebra – cost surfaces and least cost path – spatial interpolation and approximation (gridding)

MODULE IV TERRAIN MODELING AND ANALYSIS 9

terrain and bathymetry mapping – mathematical and digital representations (point clouds, contour, raster, TIN) – DEM and DSM, working with multiple return lidar data – spatial interpolation of elevation data and topographic analysis, line of sight, view shed analysis – solar irradiation, photovoltaic energy potential, time series of elevation data, analysis of coastal change.

MODULE V FLOW TRACING, WATERSHED ANALYSIS AND LANDFORMS **8**

Methods for flow routing and flow accumulation – Extraction of stream networks – Extraction of watershed boundaries and building watershed hierarchies – feature extraction, types of landforms.

MODULE VI MODELING OF GEOSPATIAL PROCESSES **7**

Model formulation, input data processing – introduction to GIS-based hydrologic, erosion and environmental modeling – Geocomputational methods, including agent-based modeling, artificial neural networks and evolutionary computing.

L – 45; T – 0; Total Hours –45

TEXT BOOKS:

1. Hassan A, Karimi (2017), *Geospatial Data Science Techniques and Applications*, CRS Press & Co.
2. Sudipto Banerjee, Bradley P, Carlin, Alan E. Gelfand (2014), *Hierarchical Modeling and Analysis for Spatial Data*, CRS Press & Co.

REFERENCES:

1. Maguire, D., M. Batty, and M. Goodchild. 2015. GIS, Spatial analysis, and modeling. ESRI Press (G70.212 .G584 2005)
2. Zeiler, M. 2010. Modeling Our World: The ESRI Guide to Geodatabase Design. Second Ed. ESRI Press, Redlands, California

OUTCOMES:

On successful completion of this course,

- Students will be able to apply the basic concepts of Conceptualize models as representations of real life systems with inputs, outputs, and processes.
- Students will have gained knowledge in spatial tools to make simulations and predictions of real life phenomena.
- Students will have synthesized knowledge about Apply, integrate, and develop models with geospatial data through a GIS.
- Students will have an overview of Evaluate models in terms of accuracy, sensitivity, and uncertainty.
- Students will have Use of a system-based approach for problem solving, with an emphasis on sustainability.

B.S. Abdur Rahman Crescent Institute of Science & Technology

Deemed to be University u/s 3 of the UGC Act, 1956

REGULATIONS 2017

CURRICULUM AND SYLLABI

B.TECH.

ELECTRONICS AND COMMUNICATION ENGINEERING

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

VISION AND MISSION

VISION

Department of Electronics and Communication Engineering envisions to be a leader in providing state of the art education through excellence in teaching, training, and research in contemporary areas of Electronics and Communication Engineering and aspires to meet the global and socio economic challenges of the country.

MISSION

- The Department of Electronics and Communication Engineering endeavours to produce globally competent Engineers prepared to face challenges of the society.
- To enable the students to formulate, design and solve problems in applied science and engineering.
- To provide excellent teaching and research environment using state of the art facilities.
- To provide adequate practical training to meet the requirement of the Electronics & communication industry.
- To train the students to take up leadership roles in their career or to pursue higher education and research.

PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES

B.Tech. (Electronics and Communication Engineering)

PROGRAMME EDUCATIONAL OBJECTIVES

- To provide fundamental knowledge in Mathematics and Basic Sciences to solve problems in Electronics and Communication Engineering.
- To impart necessary knowledge and skills in the area of Microelectronics, Signal Processing, Telecommunication and Networking.
- To impart practical knowledge and skill sets with the state of the art industrial hardware and software tools to meet the industrial requirement.
- To provide knowledge in related disciplines of electronics engineering through elective courses to enable them to work in multidisciplinary areas.
- To train in soft skills to attain leadership roles in industries.

PROGRAMME OUTCOMES

On successful completion of the programme, the graduates will be able to:

- **Engineering knowledge:** Apply the knowledge of Mathematics, Science and Electronics & communication Engineering fundamentals to solve the complex engineering problems.
- **Problem analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions using first principle of Mathematics, Electronics and Communication Engineering sciences.
- **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal and environmental considerations.
- **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.

- **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
- **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of and need for sustainable development.
- **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
- **Communication Systems:** Analyze and assess various aspects of communication systems and communication mediums for efficient utilization of resources.
- **Signal Processing:** Apply the concepts of signal processing to real world data for effective analysis and optimization of Information systems.
- **Electronic Systems:** Design and develop appropriate electronic subsystem to address the application needs of complex engineering problems.

B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE AND TECHNOLOGY

B.TECH. ELECTRONICS AND COMMUNICATION ENGINEERING

CURRICULUM & SYLLABUS, REGULATIONS 2017

SEMESTER I

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	BS	MAC1181	Differential Calculus and Geometry	3	1	0	4	
2.	HS	ENC1181/ ISC 1181/ LNC1181/ LNC1182 / LNC1183	English / Arabic / Mandarin / German / Japanese	3	0	0	3	
3.	BS	PHC1181	Physics	3	0	2	4	
4.	BS	CHC1181	Chemistry	3	0	2	4	
5.	ESF	GEC1101	Engineering Graphics	2	0	2	3	
6.	ESF	GEC1102	Engineering Design	2	0	0	2	
7.	ESF	GEC1103	Basic Engineering Practices Laboratory	0	0	2	1	
8.	ESF	GEC1104	Computer Programming I	1	0	2	2	**23**

SEMESTER II

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	BS	MAC1281	Advanced Calculus	3	1	0	4
2.	BS	-	Physics Elective	2	0	2	3
3.	BS	-	Chemistry Elective	2	0	2	3
4.	ESF	GEC1211	Engineering Mechanics	3	1	0	4
5.	BS	GEC1212	Environmental Science	2	0	0	2
6.	ESF	GEC1213	Computer Programming II	1	0	2	2
7.	EC	ECC1201	Circuit and Network Analysis	2	0	2	3

8.	EC	ECC1202	Electron Devices	3	0	0	3	
9.	EC	ECC1203	Electron Devices Laboratory	0	0	3	1	**25**

SEMESTER III

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	BS	MAC2181	Partial Differential Equations and Transforms	3	1	0	4	
2.	HS	-	Humanities Elective I	2	0	0	2	
3.	HS	ENC2181	Oral Communication	0	0	2	1	
4.	EC	ECC2101	Electronic Circuits	3	1	0	4	
5.	EC	ECC2102	Signals and Systems	3	0	2	4	
6.	EC	ECC2103	Digital Electronics	3	0	0	3	
7.	EC	ECC2104	Electromagnetic Fields and Transmission Lines	3	1	0	4	
8.	EC	ECC2105	Electronic Circuits Laboratory	0	0	2	1	
9.	EC	ECC2106	Digital Electronics Laboratory	0	0	2	1	**24**

SEMESTER IV

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	BS	-	Mathematics Elective I	3	1	0	4	
2.	HS	-	Humanities Elective II	2	0	0	2	
3.	HS	ENC2282	Written Communication	0	0	2	1	
4.	EC	ECC2201	Digital Signal Processing	3	1	0	4	
5.	EC	ECC2202	Linear Integrated Circuits	3	0	0	3	
6.	EC	ECC2203	Communication Theory and systems	3	0	0	3	
7.	EC	ECC2204	Microprocessors and Microcontrollers	3	0	0	3	
8.	EC	ECC2205	Microprocessor & Microcontroller Laboratory	0	0	2	1	
9.	EC	ECC2206	Digital Signal Processing Laboratory	0	0	2	1	
10.	EC	ECC2207	Linear Integrated Circuits Laboratory	0	0	2	1	**23**

SEMESTER V

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	MS	MSC 3181/ MSC 3182	Leadership and CEO Training/ Social Entrepreneurship	3	0	0	3	
2.	GE	-	General Elective I	3	0	0	3	
3.	HS	ENC3181	Communication and soft skill – I Career Choice	0	0	2	1	
4.	EC	ECC3101	Digital Communication	3	1	0	4	
5.	EC	ECC3102	Computer Networks	3	0	0	3	
6.	EC	ECC3103	VLSI Design	3	0	0	3	
7.	EC	ECC3104	VLSI Laboratory	0	0	2	1	
8.	EC	ECC3105	Computer Networks Laboratory	0	0	2	1	
9.	EC	ECC3106	Communication System Laboratory	0	0	2	1	
10.	PE	-	Professional Elective I	3	0	0	3*	
11.	PE	-	Professional Elective II	3	0	0	3*	**26**

SEMESTER VI

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	MS	MSC 3181/ MSC 3182	Leadership and CEO Training/ Social Entrepreneurship	3	0	0	3
2.	BS	-	Mathematics Elective II	2	0	0	2
3.	HS	ENC3281	Communication and soft skill – II Confidence Building	0	0	2	1
4.	EC	ECC3201	RF & Microwave Engineering	3	0	0	3
5.	EC	ECC3202	Embedded Systems	3	0	0	3
6.	EC	ECC3203	RF and Microwave Laboratory	0	0	2	1
7.	EC	ECC3204	Embedded System Design Laboratory	0	0	2	1

8.	PE	-	Professional Elective III	3	0	0	3*	
9.	PE	-	Professional Elective IV	3	0	0	3*	
10.	PE	-	Professional Elective V	3	0	0	3*	**23**

SEMESTER VII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	GE		General Elective II	3	0	0	3	
2.	EC	ECC4101	Introduction to Wireless Communication	3	0	0	3	
3.	EC	ECC4102	Optical Communication	3	0	0	3	
4.	EC	ECC4103	Optical Communication Laboratory	0	0	2	1	
5.	EC	ECC4104	Wireless Communication Laboratory	0	0	2	1	
6.	PE		Professional Elective VI	3	0	0	3*	
7.	PE		Professional Elective VII	3	0	0	3*	
8.	PE		Professional Elective VIII	3	0	0	3*	
9.	EC	ECC4105	Internship / Industry Training / Mini Project				1#	**21**

SEMESTER VIII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	EC	ECC4201	Project Work	0	0	24	12	**12**

Total credits – 177

Industrial training will be undertaken during Third year summer vacation for 15 days.

The credit will be awarded in the 7th Semester.

* Student has to take courses for a minimum of 3 credits from the list of electives for the corresponding semester.

PROFESSIONAL ELECTIVES
RF COMMUNICATION STREAM

SEMESTER V

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	ECCX01	Digital System Design	3	0	0	3
2.	PE	ECCX02	Computer Architecture	3	0	0	3
3.	PE	ECCX03	Control Systems	3	0	0	3
4.	PE	ECCX04	Biomedical Electronics	3	0	0	3
5.	PE	ECCX05	Image Processing	2	0	2	3
6.	PE	ECCX07	PCB Design	1	0	2	2
7.	PE	ECCX08	Data structure and its algorithms	1	0	2	2
8.	PE	ECCX09	Java Programming	1	0	0	1

SEMESTER VI

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	ECCX13	Telecommunication Switching Networks	3	0	0	3
2.	PE	ECCX14	Artificial Intelligence	3	0	0	3
3.	PE	ECCX15	Wireless Networks & its Applications	3	0	3	3
4.	PE	ECCX16	Multimedia Communication Systems	3	0	0	3
5.	PE	ECCX17	Principles of Wireless Sensor network	3	0	0	3
6.	PE	ECCX18	Fundamentals of Nano technology	3	0	0	3
7.	PE	ECCX20	Introduction to Network Security	3	0	0	3
8.	PE	ECCX21	Information coding Techniques	3	0	0	3

9.	PE	ECCX22	Python Programming	1	0	0	1
10.	PE	ECCX23	Design using EDA Tools	0	0	2	1
11.	PE	ECCX24	Predictive analytics	1	0	0	1
12.	PE	ECCX25	IC technology	3	0	0	3
13.	PE	ECCX26	Simulation of RF Circuits and Components	0	0	2	1
14.	PE	ECCX27	RF Test and measurement	1	0	0	1

SEMESTER VII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	ECCX35	Electromagnetic Interference & Compatibility	3	0	0	3
2.	PE	ECCX36	Introduction to Internet of Things	3	0	0	3
3.	PE	ECCX37	RF System Design	3	0	0	3
4.	PE	ECCX38	Introduction to Satellite Communication	3	0	0	3
5.	PE	ECCX39	Microwave & Millimeter Wave Systems	3	0	0	3
6.	PE	ECCX40	Radar & Navigational Aids	3	0	0	3
7.	PE	ECCX41	Advanced Antenna Design	2	0	2	3
8.	PE	ECCX42	Introduction to Error control coding	3	0	0	3
9.	PE	ECCX43	Satellite Image processing	3	0	0	3
10.	PE	ECCX44	Software defined radio	3	0	0	3
11.	PE	ECCX45	GNU radio realization through python and C^{++}	1	0	2	2
12.	PE	ECCX46	Implementation of GSM 2G, 3G stack	1	0	2	2
13.	PE	ECCX47	IoT for Industrial Applications	1	0	2	2
14.	PE	ECCX48	Television Engineering	1	0	2	2

15.	PE	ECCX49	Mobile Networks	1	0	0	1
16.	PE	ECCX50	Optical networks	1	0	0	1
17.	PE	ECCX51	Adaptive signal processing	1	0	0	1
18.	PE	ECCX52	Study on Network Simulators	1	0	0	1
19.	PE	ECCX53	MIMO OFDM Technology	1	0	0	1

SIGNAL PROCESSING STREAM

SEMESTER V

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	ECCX01	Digital System Design	3	0	0	3
2.	PE	ECCX02	Computer Architecture	3	0	0	3
3.	PE	ECCX03	Control Systems	3	0	0	3
4.	PE	ECCX04	Biomedical Electronics	3	0	0	3
5.	PE	ECCX05	Image Processing	2	0	2	3
6.	PE	ECCX07	PCB Design	1	0	2	2
7.	PE	ECCX08	Data structure and its algorithms	1	0	2	2
8.	PE	ECCX09	Java Programming	1	0	0	1
9.	PE	ECCX10	MATLAB Programming	1	0	0	1

SEMESTER VI

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	ECCX12	Biomedical Signal Processing	3	0	0	3
2.	PE	ECCX14	Artificial Intelligence	3	0	0	3
3.	PE	ECCX16	Multimedia Communication Systems	3	0	0	3
4.	PE	ECCX17	Principles of Wireless Sensor network	3	0	0	3

5.	PE	ECCX20	Introduction to Network Security	3	0	0	3
6.	PE	ECCX28	DSP Architecture and Programming	3	0	0	3
7.	PE	ECCX21	Information coding Techniques	3	0	0	3
8.	PE	ECCX27	RF Test and measurement	1	0	0	1
9.	PE	ECCX22	Python Programming	1	0	0	1
10.	PE	ECCX23	Design using EDA Tools	0	0	2	1
11.	PE	ECCX24	Predictive analytics	1	0	0	1
12.	PE	ECCX26	Simulation of RF Circuits and Components	0	0	2	1
13.	PE	ECCX29	DSP applications	0	0	2	1

SEMESTER VII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	ECCX34	VLSI Signal Processing	3	0	0	3
2.	PE	ECCX36	Introduction to Internet of Things	3	0	0	3
3.	PE	ECCX44	Software defined radio	3	0	0	3
4.	PE	ECCX54	Medical Image Processing	3	0	0	3
5.	PE	ECCX55	Computer Vision and its Applications	3	0	0	3
6.	PE	ECCX56	Signal Detection and Estimation	3	0	0	3
7.	PE	ECCX45	GNU radio realization through python and C^{++}	1	0	2	2
8.	PE	ECCX46	Implementation of GSM (2G), 3G stack	1	0	2	2
9.	PE	ECCX47	IoT for Industrial Applications	1	0	2	2
10.	PE	ECCX48	Television Engineering	1	0	2	2
11.	PE	ECCX57	Video Processing Techniques	2	0	0	2
12.	PE	ECCX49	Mobile Networks	1	0	0	1
13.	PE	ECCX50	Optical networks	1	0	0	1

14.	PE	ECCX51	Adaptive signal processing	1	0	0	1
15.	PE	ECCX52	Study on Network Simulators	1	0	0	1
16.	PE	ECCX53	MIMO OFDM Technology	1	0	0	1

VLSI & EMBEDDED SYSTEM STREAM

SEMESTER V

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	ECCX01	Digital System Design	3	0	0	3
2.	PE	ECCX02	Computer Architecture	3	0	0	3
3.	PE	ECCX03	Control Systems	3	0	0	3
4.	PE	ECCX04	Biomedical Electronics	3	0	0	3
5.	PE	ECCX05	Image Processing	2	0	2	3
6.	PE	ECCX06	Advanced Microprocessor and Microcontrollers	3	0	0	3
7.	PE	ECCX11	Introduction to ASIC Design	3	0	0	3
8.	PE	ECCX07	PCB Design	1	0	2	2
9.	PE	ECCX08	Data structure and its algorithms	1	0	2	2
10.	PE	ECCX09	Java Programming	1	0	0	1
11.	PE	ECCX10	MATLAB Programming	1	0	0	1

SEMESTER VI

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	ECCX14	Artificial Intelligence	3	0	0	3
2.	PE	ECCX17	Principles of Wireless Sensor Network	3	0	0	3
3.	PE	ECCX18	Fundamentals of Nano technology	3	0	0	3
4.	PE	ECCX19	Embedded Signal Processing	3	0	0	3

5.	PE	ECCX20	Introduction to Network Security	3	0	0	3
6.	PE	ECCX28	DSP Architecture and Programming	3	0	0	3
7.	PE	ECCX30	Introduction to Reconfigurable Computing	3	0	0	3
8.	PE	ECCX31	Programming in Embedded systems	3	0	0	3
9.	PE	ECCX32	Multicore Architecture and Parallel Programming	3	0	0	3
10.	PE	ECCX21	Information coding Techniques	3	0	0	3
11.	PE	ECCX22	Python Programming	1	0	0	1
12.	PE	ECCX23	Design using EDA Tools	0	0	2	1
13.	PE	ECCX25	IC technology	3	0	0	3
14.	PE	ECCX26	Simulation of RF Circuits and Components	0	0	2	1

SEMESTER VII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	ECCX33	Robotics	3	0	0	3
2.	PE	ECCX34	VLSI Signal Processing	3	0	0	3
3.	PE	ECCX36	Introduction to Internet of Things	3	0	0	3
4.	PE	ECCX58	Digital VLSI Testing	3	0	0	3
5.	PE	ECCX59	Fin FET Technology	3	0	0	3
6.	PE	ECCX60	Real Time Embedded Systems	3	0	0	3
7.	PE	ECCX61	Introduction to RTOS	3	0	0	3
8.	PE	ECCX62	Mechatronics	3	0	0	3
9.	PE	ECCX45	GNU radio realization through python and C^{++}	1	0	2	2
10.	PE	ECCX46	Implementation of GSM(2G), 3G stack	1	0	2	2
11.	PE	ECCX47	IoT for Industrial Applications	1	0	2	2

12.	PE	ECCX48	Television Engineering	1	0	2	2
13.	PE	ECCX57	Video Processing Techniques	2	0	0	2
14.	PE	ECCX49	Mobile Networks	1	0	0	1
15.	PE	ECCX50	Optical networks	1	0	0	1
16.	PE	ECCX52	Study on Network Simulators	1	0	0	1

Physics Elective Courses

(to be offered in II Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	PHCX 01	Fundamentals of Engineering Materials	2	0	2	3
2.	PHCX 02	Heat and Thermodynamics	2	0	2	3
3.	PHCX 03	Introduction to Nanoscience and Technology	2	0	2	3
4.	PHCX 04	Lasers and their applications	2	0	2	3
5.	PHCX 05	Materials Science	2	0	2	3
6.	PHCX 06	Non-Destructive Testing	2	0	2	3
7.	PHCX 07	Properties of Matter and Acoustics	2	0	2	3
8.	PHCX 08	Properties of Matter and Nondestructive Testing	2	0	2	3
9.	PHCX 09	Semiconductor Physics and Optoelectronics	2	0	2	3

Chemistry Elective Courses

(to be offered in II Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	CHCX01	Analytical Instrumentation	2	0	2	3
2.	CHCX02	Corrosion and its Control	2	0	2	3
3.	CHCX03	Electrical Materials and Batteries	2	0	2	3
4.	CHCX04	Engineering Materials	2	0	2	3
5.	CHCX05	Fuels and Combustion	2	0	2	3
6.	CHCX06	Fundamentals of Physical Chemistry	2	0	2	3
7.	CHCX07	Green Technology	2	0	2	3
8.	CHCX08	Organic Chemistry of Biomolecules	2	0	2	3
9.	CHCX09	Polymer Science and Technology	2	0	2	3

Maths Elective Courses

(to be offered in IV Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	MACX 01	Discrete Mathematics And Graph Theory	3	1	0	4
2.	MACX 02	Probability And Statistics	3	1	0	4
3.	MACX 03	Random Processes	3	1	0	4
4.	MACX 04	Applied Numerical Methods	3	1	0	4

Maths Elective Courses

(to be offered in VI Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	MACX 05	Mathematical Programming	2	0	0	2
2.	MACX 06	Statistical Methods for Data Analysis	2	0	0	2
3.	MACX 07	Numerical Methods for Integral and Differential Equations	2	0	0	2
4.	MACX 08	Mathematical Modelling	2	0	0	2
5.	MACX 09	Graph Theory	2	0	0	2

Humanities Elective I

(to be offered in III Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	SSCX01	Fundamentals of Economics	2	0	0	2
2.	SSCX02	Principles of Sociology	2	0	0	2
3.	SSCX03	Sociology of Indian Society	2	0	0	2

Humanities Elective II

(to be offered in IV Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	SSCX04	Economics of Sustainable Development	2	0	0	2
2.	SSCX05	Industrial Sociology	2	0	0	2
3.	SSCX06	Law for Engineers	2	0	0	2

General Elective

Group I Courses

(To be offered in V semester)

Sl. No.	Course Code	Course Title	Offering Department
1.	GECX101	Disaster Management	Civil
2.	GECX102	Total Quality Management	Mechanical
3.	GECX103	Energy Studies	Mechanical
4.	GECX104	Robotics	Mechanical
5.	GECX105	Transport Management	Automobile
6.	GECX106	Control Systems	EEE
7.	GECX107	Introduction to VLSI Design	ECE
8.	GECX108	Plant Engineering	EIE
9.	GECX109	Network Security	CSE
10.	GECX110	Knowledge management	CSE
11.	GECX111	Cyber security	IT
12.	GECX112	Genetic Engineering	LS
13.	GECX113	Fundamentals of Project Management	CBS
14.	GECX114	Operations Research	Mathematics
15.	GECX115	Nano Technology	Physics / Chemistry
16.	GECX116	Vehicle Maintenance	Automobile
17.	GECX117	Fundamentals of Digital Image Processing	ECE

Group II Courses

(To be offered in VII semester)

Sl. No.	Course Code	Course Title	Offering Department
1.	GECX201	Green Design and Sustainability	Civil
2.	GECX202	Appropriate Technology	Civil / Mechanical
3.	GECX203	Engineering System Modelling and Simulation	Mechanical
4.	GECX204	Value Analysis and Engineering	Mechanical
5.	GECX205	Industrial Safety	Mechanical
6.	GECX206	Advanced Optimization Techniques	Mechanical
7.	GECX207	Mat Lab Simulation	EEE
8.	GECX208	Embedded Systemsand its Applications	ECE
9.	GECX209	Usability Engineering	CSE
10.	GECX210	Supply Chain Management	CBS
11.	GECX211	System Analysis and Design	CA
12.	GECX212	Advanced Materials	Physics & Chemistry
13.	GECX213	National Service Scheme	School of Humanities
14.	GECX214	Automotive Pollution and Control	Automobile
15.	GECX215	Motor Vehicle Act, Insurance and Policy	Automobile
16.	GECX216	Principles of Communication Systems	ECE
17.	GECX217	Lean Management	Civil
18.	GECX218	Spatial Data Modeling & Analysis	Civil

SEMESTER I

MAC 1181	DIFFERENTIAL CALCULUS AND GEOMETRY	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aims of this course are to

- introduce eigen values and eigenvectors of matrix algebra.
- make the student knowledgeable in the area of Three Dimensional Analytical Geometry.
- demonstrate the application of Differential Calculus.
- familiarize the student with the functions of several variables.
- develop the use of ODE solvable techniques necessary for engineering applications.
- motivate the students with some basic engineering application problems in ODE.

MODULE I **MATRICES** **8+2**

Characteristic Equation- Eigenvalues and Eigenvectors of a real matrix – Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton Theorem (without proof) – Orthogonal matrices – orthogonal transformations of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation.

MODULE II **THREE DIMENSIONAL ANALYTICAL GEOMETRY** **7+3**

Direction cosines and ratios – angle between two lines – equations of a plane – equations of a straight line, coplanar lines - shortest distance between skew lines - sphere – tangent plane – plane section of a sphere – orthogonal spheres.

MODULE III **DIFFERENTIAL GEOMETRY** **7+3**

Curvature – Cartesian and polar coordinates – centre and radius of curvature – circle of curvature – involutes and evolutes – envelopes.

MODULE IV **DIFFERENTIAL CALCULUS OF SEVERAL VARIABLES** **8+2**

Functions of two variables – partial derivatives – total differential – Implicit Functions – Jacobian - Taylor's series expansion – Optima of two variables – Lagrange's multiplier method.

MODULE V **ORDINARY DIFFERENTIAL EQUATIONS** **8+2**

Linear equations of second order with constant and variable coefficients – Simultaneous first order linear equations with constant coefficients – homogeneous equations of Euler's type – method of undetermined coefficients, method of variation of parameters

MODULE VI **APPLICATIONS OF ORDINARY DIFFERENTIAL EQUATIONS** **7+3**

Solution of Ordinary Differential Equation Related to Electric Circuits – Bending of Beams- Motion of a Particle in a resisting medium – Simple harmonic motion.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Ramana, B.V, "Higher Engineering Mathematics" Tata McGraw Hill Publishing Co. New Delhi, 2006.
2. Grewal B.S., "Higher Engineering Mathematics" (43rd edition), Khanna Publishers, New Delhi, 2012.
3. John W. Cell "Engineering Problems Illustrating Mathematics" Mc Graw Hill Publishing Co., New York 1943.

REFERENCES:

1. Veerarajan.T., "Engineering Mathematics" (5th edition) Tata Mc Graw Hill Publishing Co. New Delhi, 2012
2. Kreyszig, E., "Advanced Engineering Mathematics", 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
3. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th edition, Cengage Learning, 2011.
4. Dennis G. Zill, Warren S. Wright, "Advanced Engineering Mathematics", 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
5. Alan Jeffrey, "Advanced Engineering Mathematics", Academic Press, USA, 2002.
6. Venkataraman, M.K., "Engineering Mathematics", Volume I, 2nd edition, National Publishing Co., Chennai, 2003.
7. James Stewart ".Calculus" (7th edition),Brooks/Cole cengage learning,UK

OUTCOMES:

After completing the course, student will be able to

- Understand the matrix techniques and compute eigen values and eigenvectors of a given matrix.
- Do the problems based on three dimensional analytic geometry.
- Apply differential calculus in engineering problems.
- Differentiate more than one variable and their applications.
- Solve the differential equations with constant coefficient and variable coefficient.
- Form and solve differential equations.

ENC 1181	ENGLISH	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To train students to use appropriate vocabulary in academic and technical contexts.
- To facilitate students to speak effectively while exchanging ideas and making presentations.
- To develop students' listening skill for comprehending and analyzing information.
- To develop their reading skill through sub skills like skimming , scanning and critical reading of a text.
- To sharpen their academic writing skills.
- To expose them to the correct usage of language and help them to apply that knowledge appropriately.

MODULE I **8**

L: Listening for general information

S : Self Introduction, Introducing one another.

R: Predicting the content

W: Paragraph Writing

Language Focus: Affixes, Simple Present tense , Connective & Prepositions.

MODULE II **8**

L: Listening for specific information (from dialogues)

S:Exchanging opinion.

R: Skimming technical Passages

W: Argumentative Writing (using the concept of Flipped Learning), Letter to the Editor.

Language Focus: Idioms, use of Modals, Simple Past tense & use of "Wh" and question tags.

MODULE III **7**

L: Learning the ways of describing images and presenting specific information (focusing on note making)

S: Making Presentations using visuals.

R : Scanning short texts for gist of information

W: Letter of Invitation, Expository Writing

Language Focus: Homophones, Homographs, Simple Future & Collocations.

MODULE IV **7**

L: Understanding prepared presentation techniques through videos

S: Short Presentations.

R: Reading for coherence and cohesion

W: Letter seeking permission for Industrial Visit

Language Focus: S-V agreement, Euphemism

MODULE V **8**

L : Understanding Non- Verbal Communications while listening to narration of incidents.

S: Narrating an expereince

R: Inferential Reading

W: Process Description – Transcoding a Flow chart.

Language Focus: Interchange of Active & passive voice, Impersonal Passive voice.

MODULE VI **7**

L: Learning Story telling techniques (stories & visuals) through audio files

S: Discussion in groups

R: Reading for critical appreciation

W: Developing an idea, Slogan writing, Interpreting a Bar Chart.

Language Focus: If clause and phrasal verbs.

TOTAL HOURS :45

REFERENCES:

1. Carol Rosenblun perry(2011). The Fine Art of Technical Writing. Create Space Independent Publishing Platform, New Delhi.
2. Dutt, P.K. Rajeevan. G and Prakash , C.L.N. (2007) A course in Communication Skills. Cambridge Univesity Press, India.
3. Kala, Abdul & Arun Tiwari (2004) . Wings of Fire : An Autobiography(Simplified and Abridged by Mukul Chowdhri). Hyderabad Univeristy Press.
4. Sen, Leena. (2004) Communication Skills. Prentice Hall, New Delhi.
5. Matt Firth, Chris Sowton et.al. (2012). Academic English: An Integrated Skills Course for EAP. Cambridge University Press, Cambridge.

OUTCOMES:

After completion of the course, students will have the ability to

- Demonstrate their range of vocabulary in academic and technical contexts
- Exchange ideas and make presentations
- Comprehend and respond appropriately to listening tasks.
- Read a text efficiently and process information.
- Create and draft different kinds of academic documents
- Communicate effectively using grammatically correct expressions.

ISC1181	ARABIC	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To read and write in Arabic language.
- To learn vocabulary of different fields
- To develop situational communication skills.

MODULE I PREPARATORY ARABIC **7**

Introducing Arabic Alphabets.
Listening and Reading.
Audio & Video aided listening, Tajweed listening,
Writing Arabic Alphabets (connected & unconnected).
Introducing words.
Reading simple sentences.
Learning names of the things in and around the class room.
Exercises.

MODULE II FUNCTIONAL ARABIC **7**

Listening Arabic texts, stories and action verbs
Communicating Simple sentences.
Jumla' Ismiyya and Jumla' Fi'liyya
Situational Conversation:
Greetings, Introduction.
Classroom, College, Picnic.
Dining and Kitchen.
Reading skills.
Exercises

MODULE III FUNCTIONAL ARABIC **8**

Implication of effective listening.
Audio aids.
Writing Simple sentences.
Communicating ordinal and cardinal numbers.
Situational communication:

Playground, library.
Forms of plural – Sample sentences.
Introduction to tenses.
Exercises.

MODULE IV FUNCTIONAL ARABIC 8

Communication:
Family, travel
Market, Prayer hall
Writing skills:
Note making.
Sequencing of sentences.
Developing answers from the questions.
Exercises.

MODULE V TECHNICAL ARABIC 8

Importance of technical communication.
Reading and writing skills.
Audio & Video aided listening.
Introduction to Arabic terms related to administration.
Situation communication:
Air travel, Office administration, passport, visa.
Exercises

MODULE VI TECHNICAL ARABIC 7

Situation communication:
Contractual work, machineries and equipments..
Computer, internet browsing.
Banking,
Exercises.

TOTAL HOURS :45

TEXT BOOKS:

1. Arabic for professionals and employees, Kilakarai Bukhari Aalim Arabic College, Chennai, India, 2013.

REFERENCES:

1. Arabic Reader for Non Arabs (Ummul Qura University, Makkah), Kilakarai Bukhari Aalim Arabic College, 2005.

OUTCOMES:

On successful completion of the course, the student will be able to:

- Write correct sentences in Arabic.
- Communicate in Arabic at primary level in working situations in the fields of engineering and administration.

LNC1181	MANDARIN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To improve the proficiency of students in Mandarin language.
- To develop their knowledge of vocabulary.
- To train them in using appropriate grammatical forms during communications.
- To empower them for successful communication in social and academic contexts.
- To make them appreciate the language usage in real life situations.

MODULE I **8**

· General Introduction to Chinese • Pinyin and Tones • Introduction to the Writing System: basic strokes and stroke order · Numbers 1-100, song · Days of the Week · Months of the Year

MODULE II **8**

· Chinese names and related culture · Chinese family structures and values · Greetings

· Introducing Yourself · Family members · Occupations

MODULE III **7**

· Languages and Nationalities · Daily Routine · Chinese breakfast · Negative Sentences and Interrogative Sentences · Asking for Personal Information · The Verb *shi* and Basic Sentence Structures

MODULE IV **7**

· Answering an Affirmative-negative Question · Food and drinks · Transportation · Likes and dislikes · Adverbs *bu*, *jiu* and *dou* · Verb-absent Sentences

MODULE V **8**

·*Jisui* and *duoda* Questions · S+V+O Construction · Routines and Daily Activities ·*Haishi* Questions · Modal Verbs · Hobbies and Habits

MODULE VI **7**

· Making Suggestions with *haoma* ·Colors · Clothing · Body parts · Talking about Likes and Dislikes · Measurement Words in Chinese

TOTAL HOURS :45

TEXT BOOKS:

1.Ma, Yanmin, and Li, Xinying. *Easy Steps to Chinese, Vol*. *1 Textbook*. Beijing: Beijing Language and Culture University Press, 2006. Print.

2. Ma, Yanmin, and Li, Xinying. *Easy Steps to Chinese, Vol. 1 Workbook*. Beijing: Beijing Language and Culture University Press, 2006. Print.

OUTCOMES:

On completion of the course, students will be able to

- Exhibit proficiency in Chinese Language.
- Use vocabulary in appropriate contexts.
- Use appropriate grammatical forms effectively.
- Use the language in social and academic contexts.
- Appreciate the use of language forms.

LNC1182	GERMAN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To improve the proficiency of students in German language.
- To create awareness of using vocabulary among students.
- To expose them to correct grammatical forms of the language.
- To empower them for successful communication in social and academic contexts.

MODULE I **8**

Introduction to German alphabets, phonetics and pronunciation- Introducing themselves and others using simple sentences and answer to some basic personal questions-: Introduction to different types of articles and verbs, Nouns

MODULE II **8**

Understanding and responding to everyday queries like instruction, questions, -number & gender, pronouns, present and past tense.

MODULE III **7**

Short telephone messages, requests etc., if spoken slowly and clearly-- Detailed overview of articles, adjectives with/without articles, Prepositions

MODULE IV **7**

Ask and giving directions using simple prepositions- Ability to fill basic information on forms while registering for courses / classes.

MODULE V **8**

Ability to extract and understand relevant information in a public announcement, broadcast, newspaper, radio etc-- dative & accusative

MODULE VI **7**

Ability to describe about people, work, immediate environment, education and other topics related to personal needs in a concise manner-- Understanding of matters that are familiar and are encountered regularly like instances at school,

work, at public places, places of leisure etc.

TOTAL HOURS :45

TEXT BOOKS:

1. Course book :Tangram aktuell 1 – Lektion 1–4 (Kursbuch + Arbeitsbuch mit Audio-CD zum Arbeitsbuch), Rosa-Maria Dallapiazza, Eduard von Jan, Til Schönherr, Hueber Publisher, ISBN 978-3-19-001801-7
2. Practice book:Tangram aktuell 1 – Lektion 1–4 (Kursbuch + Arbeitsbuch mit Audio-CD zum Arbeitsbuch), Rosa-Maria Dallapiazza, Eduard von Jan, Til Schönherr, Hueber Publisher, ISBN 978-3-19-001801-7.

REFERENCES:

1. NETZWERK A1 TEXTBOOK, Deutsch als Fremdsprache,Stefanie Dengler,Paul Rusch, Helen Schmitz, Tanja Sieber, Langenscheidt and Klett, ISBN : 9788183076968
2. STUDIO D A1 (SET OF 3 BOOKS + CD), Hermann Funk. Cornelsen, ISBN: 9788183073509
3. Willkommen! Beginner's course. Paul Coggle, Heiner Schenke. 2nd edition. (chapter 1 - 6) ISBN: 9781444165159 –
4. Willkommen! Beginner's course. Paul Coggle, Heiner Schenke. ISBN: 978-1-444-16518-0
5. An Introduction to the German Language and Culture for Communication, Updated Edition Lovik, Thomas A., J. Douglas Guy & Monika Chavez. Vorsprung -. New York, Houghton Mifflin Company, 1997/2002. ISBN 0-618-14249-5.

OUTCOMES:

On completion of the course, students will be able to

- Show their proficiency in German Language.
- Use appropriate vocabulary in real life contexts.
- Use appropriate grammatical forms while communicating with people.
- Effectively use the language in social and academic contexts.

LNC1183	JAPANESE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To train students to use appropriate vocabulary in academic and technical contexts.
- To facilitate students to speak effectively while exchanging ideas and making presentations.
- To develop their reading skill through sub skills like skimming, scanning and critical reading of a text.
- To sharpen their academic writing skills.
- To expose them to the correct usage of language and help them to apply that knowledge appropriately.

MODULE I **7**

Introduction of the Japanese writing system, i.e. *Hiragana*, *Katakana* and *Kanji*, word-building, writing foreign names and loan words in Katakana.

MODULE II **8**

Oral practice of pronunciation and intonation of Japanese sounds, Japanese greetings, self introduction, identifying things, time of the day, calendar; counting using Japanese numerical classifiers; describing things;

MODULE III **7**

Making comparisons; talking of daily activities, kinship terms used for address and reference, seasons, giving and receiving, shopping; making requests, talking of one’s likes and dislikes.

MODULE IV **8**

Extensive practice of basic patterns at the lower intermediate level through drills and exercises.

MODULE V **7**

Comprehension of passages in simple Japanese and writing of composition in Japanese applying lower intermediate grammatical patterns.

MODULE VI **8**

Diverse texts based on Japanese culture, customs, history, food habits, and science etc, for the development of communicative competence of students; skimming, scanning of texts with emphasis on advanced sentence patterns, grammatical structures and idiomatic phrases, reading and writing of approximately

TOTAL HOURS :45

REFERENCES:

1. Nihongo I, Kokusaigakuyukai, and other supplementary material
2. Exersice book 1of Nihongo 1, and other supplementary material
3. Nippon, the Land and its People & Encyclopedia of Contemporary Japanese
4. Japani: Japanese Conversation for Improving Spoken Proficiency, By P.A. George, Inoue Yoriko and Itsuko Nandi, Books Plus.
5. Chukyu Nihongo, Tokyo Gaikokugo Daigaku; Nihongo II, Kokusaigakuyukai, and other supplementary material.

OUTCOMES:

After completion of the course, students will have the ability to

- Demonstrate their range of vocabulary in academic and technical contexts
- Exchange ideas and make presentations
- Comprehend and respond appropriately to listening tasks.
- Read a text efficiently and process information.
- Create and draft different kinds of academic documents
- Communicate effectively using grammatically correct expressions.

PHC 1181	PHYSICS	L	T	P	C
		3	0	2	4

OBJECTIVES:

To make students conversant with the

- basic concepts of crystal physics and its structures
- production and applications of ultrasonic waves
- study of thermal conductivities of good and bad conductors
- phenomenon of wave optics and its applications
- principle of fibre optic communication and its applications to sensors
- wave mechanics principle and its applications in electron microscopy
- green energy physics and its environmental impacts to society

MODULE I CRYSTAL PHYSICS **8**

Crystalline and amorphous solids – Unit Cell – Seven Crystal Systems – Bravais Lattice – Miller Indices – Interplanar Spacing – Characteristics of Unit Cell - Calculation of Number of atoms per unit cell, Atomic Radius, Coordination Number and Packing Factor for SC, BCC, FCC and HCP and Diamond structures –Defects in crystals-Point defects –Edge and screw dislocations and their significance - Surface Defects.

MODULE II ULTRASONICS AND THERMAL PHYSICS **8**

Introduction to Ultrasonics - Properties - Production methods - Magnetostriction Oscillator method- Piezoelectric Oscillator method – Detection of Ultrasonics – Thermal method – Piezoelectric method – Kundt's tube method – Applications of Ultrasonics – Acoustic Grating – SONAR – Depth of sea – Velocity of blood flow, Ultrasonic Flaw detector (qualitative).

Transmission of heat – Conduction, Convection and Radiation – Thermal Conductivity of good Conductor – Forbe's method- Thermal Conductivity of bad Conductor – Lee's Disc method.

MODULE III APPLIED OPTICS **8**

Interference – Air Wedge – Michelson's Interferometer – Determination of wavelength of light and thickness of thin transparent sheet.

Introduction to Laser – Characteristics of Laser – Spontaneous and Stimulated Emissions – Einstein's Coefficients - Population inversion – Pumping Mechanism – Laser Action – Types of Laser: He-Ne laser, CO2 laser and Nd:YAG laser - Applications : Laser Materials Processing .

MODULE IV FIBRE OPTICS **7**

Optical fibre – Principle and propagation of light in optical fibre – Numerical aperture and

acceptance angle – Types of optical fibres – Attenuation – Absorption, Scattering losses, Bending losses and Dispersion in Optical fibres – Fiber Connectors and Couplers - Applications – Fibre optic communication system (block diagram only)- Fibre optic sensors - displacement and pressure sensors (qualitative) - Medical endoscope.

MODULE V QUANTUM MECHANICS 7

Black body radiation – Planck's theory of radiation – Deduction of Wien's displacement law and Rayleigh – Jean's law from Planck's theory –Dual nature of matter – de Broglie's wavelength- Physical significance of wave function – Schrodinger wave equation – Time independent and time dependent wave equation – Particle in one dimensional box – Harmonic oscillator(qualitative).

MODULE VI RENEWABLE ENERGY SOURCES 7

Present Energy sources and sustainability - Solar energy - Solar photovoltaics - Solar cells – Bioenergy - Biomass – production of liquid fuels from biomass – Wind energy – Wind turbines – energy and power from wind turbines - Geothermal energy - Ocean energy: Wave energy – Wave energy conversion devices – Tidal energy – Tidal power basics – power generation – Tidal energy potential – Environmental benefits and impacts of renewable energy sources

PRACTICALS

1. Determination of Velocity of Ultrasonic waves in a given liquid using Ultrasonic Interferometer.
2. Determination of wavelength of ultrasonic waves using Kundt's tube method.
3. Determination of thickness of a thin wire using Air Wedge method.
4. Determination of wavelength of light using spectrometer diffraction grating.
5. Determination of angle of divergence of a laser beam using He-Ne laser.
6. Determination of particle size of lycopodium powder using semiconductor laser.
7. Determination of wavelength of laser light using semiconductor laser diffraction.
8. Determination of Acceptance angle and Numerical Aperture using fiber optic cable.
9. Determination of thermal conductivity of a good conductor by Forbe's method.
10. Determination of thermal conductivity of a bad conductor by Lee's disc method.
11. Determination of solar cell characteristics.

L – 45; P – 30; TOTAL HOURS – 75

REFERENCES :

1. Gaur R.K. and Gupta S.L., "Engineering Physics'', 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2013.

2. Palanisamy P.K., Physics for Engineers, Vol1 & Vol2, 2nd Edition, Scitech Publications, 2003.
3. Serway R.A. and Jewett, J.W. “Physics for Scientists and Engineers with Modern Physics”. Brooks/cole Publishing Co., 2010.
4. Tipler P.A. and Mosca, G.P., “Physics for Scientists and Engineers with Modern Physics”, W.H. Freeman, 2007.
5. Markert J.T., Ohanian. H. and Ohanian, M. “Physics for Engineers and Scientists”. W.W. Norton & Co. 2007.
6. Godfrey Boyle, “Renewable Energy: Power for sustainable future”, 2nd edition, Oxford University Press, UK, 2009.

OUTCOMES:

At the end of the course, students will be able to

- understand the different types of crystal structures
- apply the concept of ultrasonic principle in engineering and medical field
- calculate thermal conductivities of good and bad conductors
- differentiate the various laser systems and its applications in engineering and medical field
- apply the principle of fibre optics for communication and sensor applications
- formulate wave mechanics principle for applications in electron microscopy
- Correlate the different renewable energy sources for societal needs.
- To complement the knowledge acquired in the theory class.
- To correlate the experimental results for application.

CHC1181	CHEMISTRY	L	T	P	C
		3	0	2	4

OBJECTIVES:

The students should be conversant with

- the basic problems like hardness, alkalinity, dissolved oxygen associated with the water used for domestic and industrial purpose and treatment process involved.
- the synthesis, properties and applications of nanomaterials.
- the importance of renewable energy sources like solar, wind, biogas, biomass, geothermal, ocean and their limitations.
- the basic analytical techniques like UV-Visible, FT-IR, NMR, AAS, AES, Circular Dichroism and XRD etc.
- photochemistry concepts related to physical processes and chemical reactions induced by photon absorption and their applications.
- basic principles of electrochemistry, cell construction and evaluation and to understand general methodologies for construction & design of electrochemical cell

MODULE I WATER TECHNOLOGY 9

Impurities present in water, hardness : types of hardness, demerits of hard water in boilers, estimation of hardness by EDTA method (problems) – alkalinity : estimation of alkalinity (problems) – dissolved oxygen: estimation of dissolved oxygen – conditioning methods : external treatment method: – lime soda and zeolite process (principle only), Ion exchange process – Internal treatment : colloidal, carbonate, phosphate and calgon methods – drinking water: standards (BIS), treatment of domestic water {screening, sedimentation, coagulation, filtration, disinfection }– desalination: electrodialysis, reverse osmosis.

MODULE II NANOCHEMISTRY 6

Introduction – distinction between molecules, bulk materials and nanoparticles – classification based on dimension with examples – synthesis (top-down and bottom-up approach} : sol-gel, thermolysis (hydrothermal and solvothermal), electrodeposition, chemical vapour deposition, laser ablation – properties and applications (electronic, magnetic and catalytic) – risk factors and future perspectives.

MODULE III ENERGY SOURCES 8

Energy: past, today, and future – a brief history of energy consumption – present energy scenario of conventional and renewable energy sources – renewable energy : needs of renewable energy, advantages and limitations of renewable energy – solar energy: basics, solar energy in the past , photovoltaic, advantages and disadvantages – bioenergy: conversion, bio degradation, biogas generation, biomass gasifier, factors affecting biogas generation, advantages and disadvantages – geothermal energy: geothermal resources (hot dry rock and magma resources, natural and artificial), advantages and disadvantages – wind energy: wind resources, wind turbines, advantages and disadvantages – ocean energy: wave energy, wave energy conversion devices, ocean thermal energy, advantages and disadvantages.

MODULE IV PHOTOCHEMISTRY 7

Introduction: absorption and emission, chromophores, auxochromes – laws of photochemistry : Grotthus-Draper law, Stark Einstein law – quantum yield (problems) – photo physical processes : fluorescence and phosphorescence - Jablonski diagram (electronic states and transitions) – quenching, annihilation – photosensitization: principle and applications – chemiluminescence, bioluminescence.

MODULE V ANALYTICAL TECHNIQUES 7

Spectroscopy: electromagnetic radiation and spectrum – types of transitions – types of spectra (atomic and molecular with their chemical usefulness) – Beer-Lamberts law (problems) – principles, instrumentation and applications of: Colourimetry – UV-Vis spectrophotometer – atomic absorption spectroscopy – atomic emission spectroscopy – principles and applications of: IR, NMR, mass and X-ray diffraction analysis.

MODULE VI ELECTROCHEMISTRY 8

Electrochemistry - types of electrodes (principle and working) : gas (SHE), metal/metal ion electrode, metal-metal insoluble salt (calomel electrode), ion-selective (glass electrode and fluoride ion selective electrode) – Electrolytic and galvanic cells, construction of cell, EMF measurement and applications (problems), standard cell (Weston-cadmium), reversible and irreversible cell, concentration cell. Determination of fluoride ion using fluoride ion selective electrode – Chemically modified electrodes (CMEs) : concept, approaches and applications.

PRACTICALS

1. Estimation of hardness in given water sample.
2. Estimation of the alkalinity of the given water sample.
3. Estimation of strong acid by conductometry.
4. Estimation of Fe^{2+} present in the given sample by potentiometry.
5. Verification of Beer-Lamberts law and estimation of Cu^{2+} present in unknown sample.
6. Estimation of sodium and potassium present in the given sample by flame photometry.
7. Determination of molecular weight and degree of polymerisation of a polymer by viscosity method.
8. Synthesis of thermosetting polymer.

L – 45; P – 30; TOTAL HOURS – 75

REFERENCES:

1. S. Vairam, P. Kalyani and Suba Ramesh, “Engineering Chemistry”, Wiley India Ltd., New Delhi, 2011.
2. G.A. Ozin and A.C. Arsenault, “Nanochemistry: A Chemical Approach to Nanomaterials”, RSC Publishing, Thomas Graham House, Cambridge, 2005.
3. P.C Jain & Monica Jain, Engineering Chemistry Dhanpatrai Publishing Company (P) Ltd., New Delhi (2013).
4. S S Umare & S S Dara, A text Book of Engineering Chemistry, S. Chand& Company Ltd, New Delhi, 2014.
5. G.D.Rai, “Non conventional energy sources,” Khanna Publishers, New Delhi, 2011.
6. John Twidell and Tony Weir, “Renewable Energy Resources, Taylor & Francis Ltd, London, United Kingdom, 2005
7. Principles of molecular photochemistry: An introduction, Nicholas J. Turro, V.Ramamurthy and Juan C. Scaiano, University Science Books, Sausalito, CA, 2009.

OUTCOMES:

The students will be able to

- solve problems related to hardness, alkalinity, dissolved oxygen associated with the water and describe the treatment processes.
- classify nanomaterials and apply the nanochemistry approach to synthesize the

nanomaterials.

- explain the principle and enumerate the advantages and disadvantages of various renewable energy sources.
- state the principle and illustrate the instrumentation of various analytical techniques.
- apply the concepts of photochemistry to elaborate various photo-physical and photochemical reactions.
- construct a electrochemical cell and describe the various types of electrodes and determine the fluoride content.

GEC 1101	ENGINEERING GRAPHICS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To introduce the students of all engineering programs, the basic concepts of engineering drawing, which is the basic communication medium for all engineers
- To provide practical exposure on important aspects like drawing analytic curves, orthographic projections, section of solids, development of surfaces, isometric projection, perspective projection and free hand drawing.
- To introduce computerized drafting.

MODULE I BASICS AND ENGINEERING CURVES **10**

Drawing instruments, dimensioning, BIS conventions, types of lines, simple geometric constructions.

Conic sections: ellipse, parabola, hyperbola.

Special curves: cycloid, epicycloid, hypocycloid and involutes.

MODULE II ORTHOGRAPHIC PROJECTION **8**

Orthographic projection – first angle, second angle, third angle and fourth angle projections –setup - assumptions, principle. Free hand sketching of orthographic views of simple machine parts as per first angle projection. Orthographic projection of points in all quadrants. Some commands and demonstration of drafting packages.

MODULE III PROJECTION OF STRAIGHT LINES AND PLANES **10**

Projection of straight lines in first quadrant – true length and true inclinations – Rotating line and trapezoidal methods –traces of straight line.

Projection of plane lamina in first quadrant and its traces

MODULE IV PROJECTION OF SOLIDS **10**

Projection of solids in first quadrant: Axis inclined to one reference plane only- prism, pyramid, cone, cylinder – change of position and auxiliary projection methods.

MODULE V SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES **12**

Section of solids: prism, pyramid, cone, cylinder, and sphere – sectional view – true shape of section Solids in simple position and cutting plane inclined to one reference plane only.

Development of surface of truncated solids: prism, pyramid, cone cylinder – frustum of

cone, pyramid and simple sheet metal parts.

MODULE VI PICTORIAL PROJECTIONS 10

Isometric projection: Isometric scale – isometric axes- iso sheet - Isometric projection and view of prism, pyramid, cylinder, cone, frustums, truncated solids and simple products
Perspective projection: station point – vanishing point – Perspective projection and views of prism, pyramid, cylinder and frustums by Visual ray method.

L – 30; P – 30; TOTAL HOURS – 60

TEXT BOOKS:

1. N.D. Bhatt, 'Engineering Drawing' Charotar Publishing house, 53rd Edtion, (2014)

REFERENCES:

1. K.V. Natarajan, 'A text book of Engineering Graphics', Dhanalakshmi publishers, Chennai. (2009)
2. Venugopal. K, and V. Prabhu Raja, Engineering Graphics, New Age International (P) Ltd., Publication, Chennai. (2011)

OUTCOMES:

- Students should be able to read the specifications and standards of technical drawing and able to draw conic sections and special curves.
- Students should be able to understand the insight of orthographic projection and to draw the various views of orthographic projection of a point and various components.
- Students should be able to draw the orthographic views of straight lines and plane figures.
- Students should be able to draw the orthographic views of simple solids.
- Students should be able to draw the sections of solids and development of solid surfaces.
- Students should be able to draw the isometric and perspective projection of simple solids and components.

GEC 1102	ENGINEERING DESIGN	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To understand the role of design in Engineering
- To understand the basic design concepts
- To understand the role of innovation in design

MODULE I DESIGN AS A CENTRAL ACTIVITY IN ENGINEERING 08

Product design – products and processes – product design methodology Design of systems; Software design

MODULE II NEED ANALYSIS AND CONCEPT DEVELOPMENT 07

Voice of customers – product specification - need analysis Bench marking Product architecture – concept generation and evaluation;

MODULE III CASE STUDIES IN ENGINEERING DESIGN 08

Product design – process design; system design; software design -Ergonomics – usability

MODULE IV INNOVATION AND DESIGN 07

Role of innovation in Engineering – incremental changes and systemic changes; scientific approach to driving innovation – case studies.

TOTAL HOURS – 30

REFERENCES:

1. Clive L. Dym and David C. Brown,“Engineering Design: Representation and Reasoning”, 2nd Edition, Cambridge University Press, New Delhi, 2011.
2. Daniel G. Dorner, G. E. Gorman and Philip J. Calvert, “Information Needs Analysis: Principles and practice in information organizations”, Published by Faced Publishing, London. 2015.
3. Cliff Matthews, “Case Studies in Engineering Design”, John Wiley & Sons Pvt. Ltd, New York, 1998.
4. Bengt-Arne Vedin, “The Design-Inspired Innovation Workbook”, World Scientific, 2011.
5. Navi Radjou, Jaideep Prabhu and Simone Ahuja, “Jugaad Innovation”,

Published by Random House India, 2012.

OUTCOMES:

The students will be able to

- Apply the basic knowledge of design in engineering products / process / service.
- Analyse the problems and give innovative solutions.
- Correlate the basic knowledge of design in the real world problems.
- Apply innovative approaches to engineering design.

GEC1103	BASIC ENGINEERING PRACTICES LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To provide a practical exposure to basic engineering practices like carpentry, fitting, plumbing, welding and making of simple electrical and electronic circuits
- To have an understanding on the use of various tools, instruments and methods
- To enable the students to appreciate the practical difficulties and safety issues

CIVIL ENGINEERING PRACTICE

1. Study of plumbing in general household and industrial systems
2. Making a small window frame with Lap and Mortise & Tenon Joints
3. Introduction to power tools

MECHANICAL ENGINEERING PRACTICE

1. Fabrication of a small Table frame with Butt, Lap and Fillet Joints
2. Machining of a simple component like a table weight using lathe
3. Mold preparation for simple component

ELECTRICAL ENGINEERING PRACTICE

1. Comparison of incandescent, Fluorescent, CFL and LED lamps.
2. Study of Protection Circuits (small relay, fuse, MCB, HRC, MCCB, ECCB).
3. Familiarization of households Electrical Gadgets (Iron Box, Wet Grinder).
4. Understanding of Domestic and Industrial wiring.
5. Earthing and its significance.
6. Troubleshooting in Electrical Circuits.
7. Study of inverter fed UPS/Emergency lamp

ELECTRONICS ENGINEERING PRACTICE

1. Identifications symbolic representation of active and passive electronic components
2. Soldering and tracing of electronic circuits and checking its continuity
3. Assembling of A.C. to D.C, D.C to A.C. Circuits in bread Board and Mini

project.

TOTAL HOURS – 30

OUTCOMES:

Upon the completion of the course, students should be able to

- Appreciate the practical skills needed even in making of simple objects, assemblies and circuits
- Attend minor defects especially in items used in day to day life
- Aware of the safety aspects involved in using tools and instruments

GEC 1104	COMPUTER PROGRAMMING I	L	T	P	C
		1	0	2	2

OBJECTIVES:

- To identify the hardware and software components of the computer.
- To know the basic concept of operating system and get knowledge about different operating systems.
- To learn various database concepts and operations
- To develop efficient algorithms for solving a problem.
- To implement the algorithms in C language.
- To use arrays in solving problems.

MODULE I COMPUTER FUNDAMENTALS **7**

Introduction -. Number System - Planning the computer program - Computer Software - Basic operating system concepts - Database Operations

MODULE II PROGRAMMING IN C **8**

Introduction to C Programming Language – Operators - Control statements -Iterative statements - Arrays.

LIST OF EXPERIMENTS:

1. Computer organization –Hardware in a typical computer Identification – Booting-error messages and what it means
2. Types of Operating systems – Windows and Linux
3. Structure of a basic program - Hello world program – Debugging it
4. Data types: Type conversions
5. Input / Output: Formatted functions – Unformatted functions – Library functions
6. Properties of operators – Priority of operators – Arithmetic relational logical and bitwise operators
7. If – if else- nested if else- goto- switch case – nested switch case – for loops – nested for loops – while loop – do-while loop – break and continue statement
8. Arrays – Operation with arrays
9. Sorting and searching.

L – 15; P – 30; TOTAL HOURS – 45

REFERENCES:

1. Ashok N Kamthane, “Computer Programming”, Pearson Education, 2nd Edition, ISBN 13: 9788131704370, 2012

2. Paul J. Deitel, Deitel & Associates, “C How to Program”, Pearson Education, 7th Edition, ISBN-13: 978-0132990448, 2012

OUTCOMES:

Students who complete this course will be able to

- Recognize Modular design, logic flow, data abstraction
- Analyze the working of the programming constructs, functions, and I/O.
- Write down programs for sorting and searching algorithms
- Write down programs developing cycle for different applications
- Debug the programs and solve some practical problems in programming
- Develop programs using arrays.

SEMESTER II

MAC 1281	ADVANCED CALCULUS	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aims of this course are to

- train the students in solving problems using multiple integration.
- provide knowledge in using special functions to find out the area and volume of a region.
- acquire knowledge in tangent and normal vectors.
- gain knowledge in finding the areas of a curve and surface using vector integration.
- learn about the analytic functions and their properties along with bilinear transformation.
- know complex integration using Cauchy's theorems.

MODULE I MULTIPLE INTEGRATION AND ITS APPLICATIONS 8+2

Multiple integrals– Cartesian and Polar coordinates – change of order of integration – Multiple integral to compute area and volume.

MODULE II TRANSFORMATION OF COORDINATES AND SPECIAL FUNCTIONS 7+3

Change of variables between Cartesian, polar, cylindrical and spherical coordinates - Beta and Gamma functions – Properties and applications.

MODULE III VECTOR DIFFERENTIATION 7+3

Operations on vectors – Scalar Product, Vector Product, Projection of Vectors - Angle between two vectors - Gradient, divergence and curl

MODULE IV VECTOR INTEGRATION 8+2

Line, surface and volume integrals – Green's Theorem, Gauss Divergence Theorem and Stokes Theorem (statement only) – verification and evaluation of integrals.

MODULE V ANALYTIC FUNCTION 8+2

Analytic function - Necessary and Sufficient condition (statement only) – Cauchy-Riemann equations in polar coordinates - properties of analytic function – determination

of analytic function – conformal mapping (w = z+a, az and 1/z) and bilinear transformation.

MODULE VI COMPLEX INTEGRATION **7+3**

Statement and application of Cauchy's integral theorem – Cauchy's integral formula – Taylor's series and Laurent's series expansion – singularities - classification – residues - Cauchy's residue theorem – contour integration – Unit circle and semi circular contours (excluding poles on the real axis).

L – 45; T – 15; TOTAL HOURS – 60

TEXT BOOKS:

1. Veerarajan.T., "Engineering Mathematics "(5th edition) Tata Mc Graw Hill Publishing Co. New Delhi, 2012
2. Grewal B.S., "Higher Engineering Mathematics" (43rd edition), Khanna Publishers, New Delhi, 2012.
3. John W. Cell "Engineering Problems Illustrating Mathematics" Mc Graw Hill Publishing Co., New York 1943

REFERENCES:

1. Kreyszig, E., "Advanced Engineering Mathematics", 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
2. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th edition, Cengage Learning, 2011.
3. Dennis G. Zill, Warren S. Wright, "Advanced Engineering Mathematics", 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
4. Alan Jeffrey, "Advanced Engineering Mathematics", Academic Press, USA, 2002.
5. Ramana, B.V., "Higher Engineering Mathematics" Tata Mc Graw Hill Publishing Co. New Delhi, 2006.
6. Venkataraman, M.K., "Engineering Mathematics", Volume 2, 2nd edition, National Publishing Co., Chennai, 2003.
7. James Stewart ".Calculus" (7th edition),Brooks/Cole cengage learning,UK.

OUTCOMES:

After completing the course, student will be able to

- compute the area and volume using multiple integrals.
- apply special functions to solve integration problems.

- apply differentiation in scalar and vector fields.
- find area and volume of a region using vector integration.
- verify analyticity, conformity and bilinearity of complex functions.
- evaluate complex integrals.

GEC 1211 BASIC ENGINEERING MECHANICS

L	T	P	C
3	1	0	4

OBJECTIVES:

- To impart knowledge about the basic laws of statics and dynamics and their applications in problem solving
- To acquaint both with scalar and vector approaches for representing forces and moments acting on particles and rigid bodies and their equilibrium
- To give on exposure on inertial properties of surfaces and solids
- To provide an understanding on the concept of work energy principle, friction, kinematics of motion and their relationship

MODULE I VECTOR APPROACH TO MECHANICS 07

Introduction - Units and Dimensions- Vectors – Vectorial representation of forces and moments –Vector Algebra and its Physical relevance in Mechanics - Laws of Mechanics – Parallelogram and triangular Law of forces -Lame's theorem, Coplanar Forces – Resolution and Composition of forces- Equilibrium of a particle.

MODULE II EQUILIBRIUM OF PARTICLE 06

Forces in space - Equilibrium of a particle in space - Equivalent systems of forces – Principle of transmissibility – Single equivalent force

MODULE III EQUILIBRIUM OF RIGID BODY 06

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem - Equilibrium of Rigid bodies in two dimensions –Examples

MODULE IV PROPERTIES OF SURFACES 08

Determination of Areas – First moment of area and the Centroid of sections – Rectangle, circle, triangle from integration – T section, I section, Angle section, Hollow section by using standard formula – second and product moments of plane area – Physical relevance - Rectangle, triangle, circle from integration - T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia- Mass moment of Area

MODULE V FRICTION 08

Introduction to friction- types of friction- Laws of Coloumb friction- Frictionalforce – simple contact friction – Rolling resistance –ladder friction

MODULE VI LAWS OF MOTION 10

Review of laws of motion – Newton's law – Work Energy Equation of particles– Impulse and Momentum – Impact of elastic bodies.

L – 45; T – 15; TOTAL HOURS – 60

REFERENCES:

1. Beer, F.P and Johnston Jr. E.R, "Vector Mechanics for Engineers, Dynamics & Statics", Third SI Metric Edition, Tata McGraw-Hill International Edition, 2001.
2. Hibbeller, R.C., Engineering Mechanics, Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., 2000.
3. Irving H. Shames, Engineering Mechanics – Statics and Dynamics, IV Edition Pearson Education Asia Pvt. Ltd., 2003.

OUTCOMES:

On completion of this course students should be able

- Analyse and resolve forces, moments and solve problems using various principles and laws of Mechanics
- Apply the concept of equilibrium to particles and solve problems
- Apply the concept of equilibrium to rigid bodies and solve problems
- Analyse and determine the properties of surfaces
- Analyse and evaluate the fractional forces between the bodies
- Apply the laws of motion in solving dynamics problems

GEC 1212	ENVIRONMENTAL STUDIES	L	T	P	C
		2	0	0	2

OBJECTIVES:

The student will be conversant with the

- various natural resources, availability, utilisation and its current scenario
- different ecosystems, energy transfer, values, threats and conservation of biodiversity
- levels of different pollutants and its impact and the causes and effects of natural disasters
- impacts of human population, impact assessment, human rights and environmental acts and sustainable development

MODULE I NATURAL RESOURCES 8

Land resources: land degradation, soil erosion and desertification - Forest resources: use and over-exploitation, deforestation - Water resources: use and over-utilisation of surface and ground water, conflicts over water (inter-state and international), dams (benefits and problems), water conservation (rainwater harvesting and watershed management) - Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources, mining - Food resources: world food problems, changes in land use by agriculture and overgrazing, modern agriculture and its effects, fertilizer and pesticide problems, water logging and salinity - Energy resources: increasing energy needs, renewable and non-renewable, use of alternate energy sources.

MODULE II ECOSYSTEM AND BIODIVERSITY 8

Ecosystem- energy flow in the ecosystem - food chains, food webs and ecological pyramids - characteristics, structure and function of (a) Terrestrial ecosystems (forest, grassland, desert) and (b) Aquatic fresh water ecosystems (pond, lake, river) (c) Aquatic salt water ecosystems (ocean, estuary) - ecological succession.

Biodiversity - genetic, species and ecosystem diversity – hot-spots of biodiversity – biogeographic classification of India - endangered, endemic, extinct and invasive species of India - red data book - values of biodiversity: consumptive, productive, social, ethical, aesthetic and option values - threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts - conservation of biodiversity: in-situ and ex-situ conservation of biodiversity

MODULE III ENVIRONMENTAL POLLUTION AND NATURAL DISASTER **8**

Definition, cause, effects and control measures of (a) air pollution (b) water pollution (c) soil pollution (d) marine pollution (e) noise pollution (f) thermal pollution (g) nuclear hazards - ill-effects of fireworks and upkeep of clean environment - solid waste management: types (urban, industrial, biomedical and electronic wastes), collection, processing and disposal (incineration, composting and land-fill) - natural disaster and management: flood, cyclone, drought, landslide, avalanche, volcanic eruptions, earthquake and tsunami.

MODULE IV HUMAN POPULATION, HEALTH AND SOCIAL ISSUES **6**

Population and population growth, population variation among nations, population explosion, family welfare programme.

Human health: air-borne, water borne diseases, infectious diseases, risks due to chemicals in food and environment.

Sustainable development - environmental legislation and laws: water act, air act, wildlife protection act, forest conservation act, environment protection act - environmental impact assessment, steps in EIA - human rights - women and child welfare.

Case studies related to current situation

TOTAL HOURS – 30

TEXT BOOKS:

1. Erach Bharucha, Textbook for Environmental Studies For Undergraduate Courses of all Branches of Higher Education for University Grants Commission, Orient Blackswan Pvt Ltd, Hyderabad, India, 2013.
2. Benny Joseph, Environmental Studies, Tata McGraw-Hill Education, India, 2009.
3. Ravikrishnan A, Environmental Science and Engineering, Sri Krishna Publications, Tamil Nadu, India, 2015.
4. Raman Sivakumar, Introduction to Environmental Science and Engineering, McGraw Hill Education, India, 2009.
5. Venugopala Rao P, Principles of Environmental Science and Engineering, Prentice Hall India Learning Private Limited; India, 2006.
6. Anubha Kaushik and Kaushik C.P., Environmental Science and Engineering, New Age International Pvt Ltd., New Delhi, India, 2009.

REFERENCES:

1. Masters G.M., Introduction to Environmental Engineering and Science, Prentice Hall, New Delhi, 1997.
2. Henry J.G. and Heike G.W., Environmental Science and Engineering, Prentice Hall International Inc., New Jersy, 1996.
3. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co. Boston, USA, 2016.

OUTCOMES:

The student will be able to

- predict the scenario of various natural resources and suggest remedies to curb the exploitation of these resources.
- identify food chain and web and its role in various ecosystems, assess the impacts on biodiversity and provide solutions to conserve it.
- analyse the impacts of pollutants in the environment and propose suitable method to alleviate the pollutants and the natural disasters.
- assess on the impact of human population and the health related issues and the ethics to be followed for sustainable life.

GEC 1213	COMPUTER PROGRAMMING II	L	T	P	C
		1	0	2	2

OBJECTIVES:

- To provide knowledge about the benefits of Object Oriented Programming over Procedure oriented programming.
- To learn various File operations
- To expose fundamental concepts of object-oriented programming in classes, invoking methods and functions.
- To prepare students to get full use of code reusability using object oriented programming.
- To implement the basic concepts of object oriented programming using C++concepts.
- To focus on solving problems based on analyzing, designing and implementing programs in C and C++.

MODULE I PROGRAMMING IN C 7

Functions - Storage Classes - Structures and Unions – Pointers -Self Referential Structures and Linked Lists - File Processing.

MODULE II PROGRAMMING IN C++ 8

Programming in C++ - Overview of OOP in C – Inheritance - Polymorphism - Type Casting – Exceptions.

LIST OF EXPERIMENTS:

1. Functions
2. One dimensional arrays, Pointers
3. Recursion
4. Multi dimensional arrays, Linked lists.
5. Operating on Files.
6. Simple C++ program with Control statements.
7. Getting input from user console.
8. Classes, Object and Constructors.
9. Method overloading.
10. Inheritance

L – 15; P – 30; TOTAL HOURS – 45

REFERENCES:

1. Bjarne Stroustrup," The C++ Programming Language", Addison Wesley, 4th edition, ISBN-13: 978-0321563842, 2013.
2. Brian W. Kernighan and Dennis M. Ritchie, " The C Programming Language", Prentice Hall, ISBN 0-13-110362-8, 2015.
3. Bjarne Stroustrup, " Programming: Principles and Practice Using C++ ", Addison Wesley, 2nd edition, ISBN-13: 978-0321992789, 2014.
4. Brian W. Kernighan and Dennis M. Ritchie, " The C Programming Language (Ansi C Version)", Prentice Hall India Learning Private Limited, 2nd edition, ISBN-13: 978-8120305960, 1990.

OUTCOMES:

Students who complete this course will be able to

- Develop efficient algorithms for solving problems
- Handle files in C
- Use simple data structures like arrays and linked lists in solving problems.
- Write simple programs using concepts of object oriented programming.
- Implement algorithms in C++ Language.
- Demonstrate the Object Oriented Programming concepts applied in networking, web development and Database applications.

ECC1201 CIRCUIT AND NETWORK ANALYSIS L T P C

2 0 2 3

OBJECTIVES:

- To explicate the fundamental laws and theorems of electrical circuit and network.
- To familiarize with the concepts of steady state and transient analysis in RL, RC and RLC circuits.
- To learn the significance of two port networks

PREREQUISITES:

- Basic idea about active and passive elements
- Mathematical knowledge especially in linear algebra and Matrix theory
- Basic knowledge about voltage, current and power.

MODULE I BASICS OF CIRCUITS AND NETWORKS 5+4

Ideal sources – Dependent and Independent sources – Linear relation between voltage and current of Network elements – source Transformation – Types of Networks – Network reduction – voltage division – current division.

Laboratory Practice: Circuit Simulation for Network Reduction

MODULE II ANALYSIS OF CIRCUITS 5+4

Star - delta transformation - Formation of matrix equations and analysis of complex circuits using Mesh current method and nodal method.

Laboratory Practice: Circuit Simulation of Mesh current method and nodal method

MODULE III NETWORK THEOREMS 7+4

Thevenin’s Theorem - Norton’s Theorem - Superposition theorem - Maximum power transfer theorem, Substitution theorem, Reciprocity theorem.

Laboratory Practice: Circuit Simulation of verification of Thevenin’s Theorem- Norton’s Theorem - Maximum power transfer theorem.

MODULE IV TRANSIENTS 7+6

Steady state and transient response – DC response of an RL, RC and RLC circuits -Sinusoidal response of an RL, RC and RLC circuits.

Laboratory Practice: Circuit Simulation of DC response of an RL, RC, RLC circuits and Sinusoidal response of RL, RC and RLC circuits.

MODULE V TWO PORT NETWORKS 6+4

Open circuit Impedance (Z) Parameters - short Circuit Admittance(Y) Parameters, Transmission (ABCD) Parameters and Inverse Transmission Parameters-Hybrid (h) Parameters and Inverse Hybrid Parameter-Conversion between parameters-interconnection of two-port networks

Laboratory Practice: Study the network parameters for various types of network connections using simulation

MODULE VI NETWORK TOPOLOGY 4+4

Introduction -Tree and co-tree- Twigs and links-Incidence matrix – properties of Incidence matrix-Tie-set matrix-cut-set-tree branch voltage.

Laboratory Practice: use PSpice simulation to identify tree, co-tree, twigs and branches.

TOTAL HOURS – 60

TEXT BOOKS:

1. William H.Hayt, Jr, J.E.Kemmerly& Steven M.Durban, "Engineering Circuit Analysis" 6th Edition, Mc Graw Hill, 2013
2. A.Sudhakar &ShyammohanS.Palli "Circuits &Network; Analysis& Synthesis", 4th Edition, Tata Mc Graw Hill, 2010
3. Someshwar C. Gupta, Jon W. Bayless, Behrouz Peikari, “Circuit Analysis - with computer applications to problem-solving", Wiley-Eastern Ltd., 1991.
4. Van Valkenburg, "Network Analysis", Prentice Hall of India Pvt. Ltd., New Delhi, 2006

REFERENCES:

1. M.L Soni& J.C. Gupta, "Electric Circuit Analysis", Dhanpat Rai& Sons, New Delhi, 1999.
2. Joseph Edminister, "Electric Circuits", Schaum's Outline Series, Mc Graw Hill 5th Edition, 2011
3. Franklin F.Kuo, "Network Analysis and Synthesis", John Wiley, 2nd Edition, 2006.

OUTCOMES:

On completion of the course, students will be able to

- Describe and apply fundamental concepts of network analysis in solving and analyzing different electrical networks.
- Analyze the electrical networks in various network reduction techniques.
- Select appropriate and relevant technique for solving the Electrical network under different conditions.
- Analyze resonant circuits both in time and frequency domains.
- Reconstruct the electrical networks using graph theory
- Learn to use PSpice in the analysis of circuits.

ECC1202	ELECTRON DEVICES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To brief about the semi-conductor devices and their types.
- To describe the working of different diodes and transistors with their applications.
- To analyze the characteristics of diodes and transistors.
- To explain the working of different power control devices.

PREREQUISITES:

- Fundamentals of semiconductors.
- Electrical and physical characteristics of conductors, semiconductors and insulators.

MODULE I PN JUNCTION DIODE 8

Introduction to semiconductors – PN junction diode – Characteristics - Current Components –Temperature dependence – Breakdown - Transition and diffusion capacitance – switching characteristics – Application of PN junction diode : Clipper, clamper and slicer.

MODULE II SPECIAL SEMICONDUCTOR DEVICES 8

Zener Diode - Varactor Diode - Backward diode - Schottky Diode - Tunnel Diode - Current regulator Diode - PNPN diode – LDR – Characteristics and applications.

MODULE III BIPOLAR JUNCTION TRANSISTORS 8

Construction, Configurations and Characteristics of BJT - Current components - Hybrid Model - Transistor switching times.

MODULE IV FIELD EFFECT TRANSISTORS 9

Construction, Configuration and Characteristics of JFET -Relation between Pinch off Voltage and drain current - Applications of JFET. Construction, Configuration and Characteristics of MOSFET - Applications of MOSFET- Comparison of BJT and FET.

MODULE V RECTIFIERS AND REGULATORS 6

Analysis of half wave Rectifier, Full wave Rectifiers: Center tap and Bridge without filters and with C, L and LC filters - series and shunt regulators.

MODULE VI POWER CONTROL DEVICES 6

Construction, characteristics and applications: UJT, SCR, TRIAC and DIAC - IGBT - Power MOSFET

TOTAL HOURS – 45

TEXT BOOKS:

1. J.Millman, C.C.Halkias, and Satyabratha Jit, “Electronic Devices and Circuits” Tata McGraw Hill, 2nd Ed., 2007.
2. Thomas L.Floyd ,”Electron Devices (Electron Flow Version), 8th edition, Pearson -2008
3. Ben G.Streetman and Sanjay Banerjee, Solid State Electronic Devices, Pearson Education 2000.

REFERENCES:

1. Donald A.Neaman, “Semiconductor Physics and Devices” 3 rd Ed., Tata McGraw Hill 2002.
2. Nandita Das Gupta and Amitava Das Gupta, “Semiconductor Devices – Modeling and Technology”, Prentice Hall of India, 2004.
3. David A Bell, ‘Electronic Devices and Circuits’, 5th edition, Oxford University Press, 2008.

OUTCOMES:

On completion of the course, students will be able to

- Infer the charge carrier transport mechanisms of semiconductors.
- Summarize the basic understanding of the static and dynamic behavior of
- P-N junction diodes.
- Identify the applications of different diodes and special diodes.
- Analyze the characteristics of bipolar junction transistor.
- Analyze the characteristics of FET and MOSFET.
- Describe the working of various power control devices

SEMESTER III

MAC 2181	PARTIAL DIFFERENTIAL EQUATIONS AND TRANSFORMS	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aims of this course are to

- Familiarize in solving partial differential equation of first, second and higher orders.
- Introduce basics and engineering applications of Fourier series, Laplace Transform, Fourier Transform and Z- Transform.

MODULE I PARTIAL DIFFERENTIAL EQUATIONS 8 + 2

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solution of standard types of first order partial differential equations – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients.

MODULE II FOURIER SERIES 8+2

Fourier Series and Dirichlet's conditions - General Fourier series - Half range Fourier series - Parseval's identity - Harmonic Analysis.

MODULE III FOURIER TRANSFORMS 7+3

Fourier integral theorem (without proof) - Fourier transform pair - Fourier Inverse Transform – Properties - Convolution theorem - Parseval's identity.

MODULE IV APPLICATIONS OF FOURIER SERIES AND FOURIER TRANSFORMS 7+3

Applications of Fourier series and Fourier Transform to solution of PDEs having constant coefficients with special reference to Heat & Wave equations, Discrete & point Spectrum and Single pulse.

MODULE V LAPLACE TRANSFORM 8+2

Introduction to Laplace transform - Existence of Laplace Transform - Properties of Laplace Transforms - Initial & Final Value Theorems - Inverse Laplace Transform - Convolution Theorem – Circuits to signal square wave: Integral equations with unrepeated complex factors – Damped forced vibrations: repeated complex

factors – Resonance - Solution of differential equations

MODULE VI Z – TRANSFORM 7+3

Introduction and Definition of Z-transform - Properties of Z- Transform - Convolution Theorem of Z-Transform - Inverse Z–transform - Convolution Theorem of Inverse Z-Transform - Formation of difference equations - Solving Difference Equations using Z-Transform.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Kreyszig .E., “Advanced Engineering Mathematics“, 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
2. Grewal B.S., “Higher Engineering Mathematics”, 42nd edition, Khanna Publishers, New Delhi, 2012.
3. Ramana, B.V, “Higher Engineering Mathematics” Tata Mc Graw Hill Publishing Co. New Delhi, 2006.

REFERENCES:

1. Veerarajan.T., “Engineering Mathematics“, 5th edition, Tata Mc Graw Hill Publishing Co. New Delhi, 2012.
2. Peter V. O'Neil, “Advanced Engineering Mathematics**”**, 7th edition, Cengage Learning, 2011.
3. Dennis G. Zill, Warren S. Wright, “Advanced Engineering Mathematics”, 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
4. Alan Jeffrey, “Advanced Engineering Mathematics”, Academic Press, USA, 2002.

OUTCOMES:

After completing the course, student will be able to

- solve the partial differential equations.
- derive a Fourier series of a given periodic function by evaluating Fourier coefficients.
- apply integral expressions for the forward and inverse Fourier transform to a range of non-periodic waveforms.
- solve wave equation and heat flow equation.
- solve ordinary differential equations using Laplace transform.
- solve difference equation using Z-transform.

ENC 2181	ORAL COMMUNICATION	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To expose students to a range of professional contexts through podcasts for learning appropriate expressions.
- To train them in making poster presentations.
- To enable them to make effective business presentations.
- To help them learn persuasive and negotiation skills.
- To train them to debate on issues of current relevance
- To train them to participate in group discussions on current affairs

MODULE I **4**

Orientation to the Importance of Oral Communication -– Verbal and non-verbal communication -Paralinguistic features.

One-minute presentations (using Audacity/Voicethread) – Just a minute (JAM) on random topics

MODULE II **4**

Negotiating and persuading through effective arguments – to arrive at a conclusion (pair-work)

Understanding Negotiation, persuasion and marketing skills through Podcasts

Listening to short conversations and monologues for understanding real life conversations

MODULE III **4**

Making Poster presentations on current issues

Understanding nuances of making effective presentations (TED Videos)

MODULE IV **6**

Deliberation on social and scientific issues – Debates (focus on rebuttal skills and deconstructing arguments)

Viewing videos on debates (NDTV Discussions)

MODULE V **6**

Discussing social issues or current affairs in groups

Viewing group discussions and listening for specific information

MODULE VI **6**

Making full length presentation (through Voicethread) with the focus on one's career plans and prospects (discipline specific)

Listening to interviews for understanding speakers' perception (on industry related issues)

P – 30; Total Hours –30

REFERENCES:

1. Hancock, Mark (2012). *English Pronunciation in Use*. Cambridge University Press, UK.
2. Anderson, Kenneth & et.al (2007). *Study Speaking: A Course in Spoken English for Academic Purposes* (Second Edition). Cambridge University Press, UK.
3. Hurlock, B.Elizabeth (2011). *Personality Development*. Tata McGraw Hill, New York.
4. Dhanavel,S.P (2015). *English and Soft Skills*. Orient Blackswan, Chennai.
5. Whitby, Norman (2014). *Business Benchmark: Pre-Intermediate to Intermediate.* Cambridge University Press, UK.

OUTCOMES:

On completion of the course, students will be able to

- Listen to business conversations and do related tasks.
- Deliver effective poster presentations.
- Make effective business presentations.
- Use persuasive and negotiating skills for justifying arguments.
- Participate effectively in debates.
- Speak English intelligibly, fluently and accurately in group discussions.

ECC2101	ELECTRONIC CIRCUITS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To introduce the biasing concepts of BJT, JFET and MOSFET
- To familiarize the design and analysis of BJT and FET amplifiers.
- To study the feedback amplifiers and oscillators.
- To impart knowledge on Tuned amplifiers, Power amplifiers, Multivibrators, blocking oscillators and time based generators.

PREREQUISITES:

- Basic concepts on Network analysis
- Basic knowledge on Electronic devices

MODULE I BIASING CIRCUITS 6

DC Load line, operating point, various biasing methods for BJT-Design-Stability-Bias compensation Biasing circuits of BJT, JFET and MOSFET.

MODULE II SMALL SIGNAL ANALYSIS AND FREQUENCY RESPONSE OF AMPLIFIERS 9

Small signal models of BJT and MOSFET, Small signal Analysis of Common Emitter, Common Collector and common Base amplifiers. Small signal analysis of FET amplifiers, AC Load line, Voltage swing limitations, Differential amplifiers. Low frequency response of BJT and FET amplifiers-high frequency response of BJT and FET amplifiers, Miller effect capacitance.

MODULE III FEEDBACK AMPLIFIERS AND OSCILLATORS 9

Basic feedback concepts - Properties of Negative feedback -Four feedback topologies with amplifier circuit. Examples - Analysis of series - shunt feedback amplifiers.

Oscillators :Barkhausen criteria for oscillator - Analysis of RC oscillators - LC oscillators –Crystal oscillator

MODULE IV POWER AMPLIFIERS AND TUNED AMPLIFIERS 7

Classification of large signal amplifiers – Class A amplifier– Class B amplifier –Class AB amplifier– Class C amplifier and Efficiency – Thermal stability and heat sink-Basic principles - Inductor losses - Use of transformers – Single tuned amplifier - Double tuned amplifier - Synchronously tuned amplifiers-impedance matching to improve gain.

MODULE V MULTIVIBRATOR CIRCUITS 7

Collector coupled and Emitter coupled Astable multivibrator – Monostable

multivibrator- Bistable multivibrators. Triggering methods: Storage delay and calculation of switching times - Speed up capacitors - Schmitt trigger circuit.

MODULE VI BLOCKING OSCILLATORS AND TIME BASE GENERATORS 7

Pulse transformers - Monostable Blocking Oscillators using Emitter and base timing - Astable blocking oscillator - Voltage sweep generators - Current sweep generators

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Boylested and Nashlesky, “Electronic Devices and Circuit theory”, 11th edition, Prentice Hall of India, 2015.
2. Donald .A.Neamen, “Electronic Circuit Analysis and Design” 2nd edition,Tata McGraw Hill, 2009.
3. David A. Bell, "Solid State Pulse Circuits", 4thedition, Eastern economic edition, Prentice Hall of India, 2006.
4. D. L. Schilling, C. Belove, Tuvia Apelewicz and Raymond J Saccardi, “Electronic Circuits: Discrete and Integrated”, Tata McGraw Hill, 2002.

REFERENCES:

1. Adel.S.Sedra, Kenneth C. Smith, Micro Electronic circuits, 6th Edition, Oxford University Press, 2010.
2. David A. Bell Electronic Devices and Circuits, Oxford Higher Education press, 5thEdition, 2010
3. Millman .J. and Halkias C.C, Integrated Electronics, McGraw Hill, 2001.
4. Millman J. and Taub H., "Pulse Digital and Switching waveform", 3rd Edition McGraw-Hill International, 2000.

OUTCOMES:

On completion of the course, students will be able to

- Calculate the DC voltages and currents of an amplifier.
- Design and analyze the BJT and FET amplifiers
- Classify and construct the feedback amplifiers and oscillators.
- Estimate lower and upper cut off frequencies of an amplifier.
- Explain the concepts of tuned amplifiers and power amplifiers.
- Design and develop circuits to generate non-sinusoidal waveforms.

ECC2102 SIGNALS AND SYSTEMS

L	T	P	C
3	0	2	4

OBJECTIVES:

- To introduce the concepts of Signals and Linear Time-Invariant Systems
- To illustrate various Transform such as Fourier, Laplace, Z-Transform etc. for signal processing applications
- To interpret the signals and it's processing through computer simulation.

PREREQUISITES:

- Fundamentals of Engineering Mathematics
- Basic knowledge in computer programming

MODULE I INTRODUCTION TO SIGNALS 7

Time-Domain Representation of Discrete and Continuous Signals. Standard elementary signals - and complex signal. Basic Time-Domain operations on signals. Energy, Power and Correlation of signals. Signal Classification and Symmetry. Periodicity of discrete-time signals. Synthesis of simple signals.

Practical Exercises:

1. Generation of standard signals using MATLAB
2. Energy & Power Estimation of signals
3. Even and Odd Components of the signal.

MODULE II INTRODUCTION TO LTI SYSTEMS 6

Continuous-Time and Discrete-Time Systems. Characteristics of Systems. Linear and Time-Invariant (LTI) Systems and its Properties. Impulse Response, convolution sum and convolution integral. Interconnection of LTI Systems. Differential and Difference Equation representation of LTI systems.

Practical Exercises:

4. Correlation of signals
5. Convolution of DT and CT signals
6. Functional Implementation of a given LTI System

MODULE III FOURIER SERIES AND FOURIER TRANSFORM ANALYSIS 6

Fourier Series representation of signals. Properties of Fourier Series. Continuous-Time Fourier Transform and its properties. Frequency Response of CT-LTI Systems. Discrete-Time Fourier Transform (DTFT) and its properties. Discrete Fourier

Transform (DFT) and its properties.

Practical Exercises:

7. DFT of CT and DT signals
8. FFT
9. Power Spectral Density
10. First Order Low-Pass and High Pass-Filters

MODULE IV LAPLACE TRANSFORM ANALYSIS 5

Unilateral and Bilateral Laplace Transform. Region of Convergence (ROC), Properties of Laplace Transforms. Poles and Zeros. Inverse Laplace Transformation. The Transfer Function and Frequency Response of CT-LTI Systems.

Practical Exercises:

11. Laplace & Inverse Laplace Transform
12. Plotting of poles and zeros.

MODULE V Z- TRANSFORM ANALYSIS 9

Z-Transform. Z-Plane and ROC. Properties of Z-Transform. Poles and Zeros. Methods for Inverse Z-Transform. Transfer Function of DT-LTI Systems. Causality and Stability.

Practical Exercises:

13. Z- Transform of Time limited signals
14. Impulse response of given DT Systems.
15. Plotting of poles and zeros.

MODULE VI APPLICATION OF TRANSFORMS 10

Application of Fourier Transform to communication systems - Spectrum of AM, DSB and SSB AM. Computational Structures for Implementing Discrete-Time LTI systems using z-Transform.

Practical Exercises:

16. Generation of AM signal and it's spectrum.
17. Generation of DSB – AM signal and it's spectrum
18. First order and Second order Butterworth Filters

L – 45; T – 30; Total Hours –75

TEXT BOOKS:

1. Alan V. Oppenheim, Alan S. Willsky , with S. Hamid Nawab, "Signals and

Systems", 2nd Edition, Pearson Education, 2015. (ISBN: 9789332550230)
2. Simon Haykin, Barry Van Veen, "Signals and Systems", 2nd Edition, Wiley India Pvt Ltd., 2007. (ISBN: 9788126512652)

REFERENCES:

1. Hwei P. Hsu, "Signals And Systems", 3rdEdition,Schaum's Outlines, McGraw Hill Education, 2017.
2. Won Young Yang, "Signals and Systems with MATLAB", 1st Edition, Springer, 2011.
3. Simon Haykin & Michael Moher, “Communication Systems”, 5th Edition, Wiley India Pvt Ltd., 2009.
4. John G. Proakis & Dimitris G Manolakis , “Digital Signal Processing : Principles, Algorithms, and Applications”, 4 Edition, Pearson India, 2007.

OUTCOMES:

On completion of the course, students will be able to

- Mathematically represent and classify the signals
- Evaluate and manipulate signals mathematically.
- Identify, and characterize common LTI Systems.
- Apply the tools such as Fourier Transform, Laplace Transform, and Z-Transform in problem solving.
- Synthesize discrete-time systems from basic component block
- Justify the spectral behavior of communication systems.

ECC2103	DIGITAL ELECTRONICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the methods for simplifying Boolean expressions.
- To learn the procedures for the analysis and design of combinational circuits and sequential circuits.
- To introduce the concept of memories and programmable logic devices.
- To illustrate the concepts of HDL

PREREQUISITES:

- Knowledge on Boolean Algebra
- Knowledge on Number System
- Familiarity in Electronics

MODULE I BOOLEAN ALGEBRA AND LOGIC GATES 8

Binary number systems- Binary Arithmetic- Binary codes-Boolean algebra and theorems- Boolean functions- Karnaugh map and Quine- Mc Cluskey Method-Logic gates-Implementations of Logic Functions using gates. Digital IC families -DTL, TTL, ECL, MOS, CMOS.

MODULE II COMBINATIONAL CIRCUITS 8

Analysis and design procedures- Circuits for arithmetic operations - Multiplexer/ Demultiplexer- Encoder / decoder - Parity checker- Code converters.

MODULE III FUNDAMENTALS OF SEQUENTIAL CIRCUITS 10

Edge triggering – Level Triggering, Flip flops- SR, JK, T, D, Master slave–Conversion of flip flops, Counters, Shift registers – Types.

MODULE IV SEQUENTIAL CIRCUITS DESIGN 8

Classification of sequential circuits - Moore and Mealy circuits-Analysis and Design of sequential circuits, Asynchronous sequential circuits-Hazards, Hazards elimination.

MODULE V SEMICONDUCTOR MEMORIES 6

Memory organization, Classification, and characteristics of memories, Sequential memories, ROMs, R/W memories, Content Addressable memories, Charged-Coupled Device memory, PLA, PAL and Gate Array, CPLD and FPGA architectures.

MODULE VI VERILOG HARDWARE DESCRIPTION LANGUAGE 5

Introduction to Verillog HDL, Language Constructs and Conventions, Gate Level Modeling, Modeling at Dataflow Level, Behavioral Modeling, Switch Level Modeling.

Total Hours –45

TEXT BOOKS:

1. M. Morris Mano ,Michael D. Ciletti "Digital Design With an Introduction to the Verilog HDL",5th Edition, Pearson Education, 2013
2. William Stallings, "Computer Organization and Architecture", 8th Edition, Pearson Education Asia, 2010.

REFERENCES:

1. Charles H. Roth, "Fundamentals of Logic Design", 7th Edition, Global Engineering: Tim Anderson, 2014.
2. Donald P. Leach and Albert Paul Malvino, "Digital Principles and Applications", 6th Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2009.
3. R.P. Jain, "Modern Digital Electronics", Tata McGraw Hill, 4th Edition. New Delhi, 2010.
4. Thomas L. Floyd, "Digital Fundamentals", 10th Edition Pearson Education, Inc, New Delhi, 2008
5. Donald D. Givone, "Digital Principles and Design", Tata McGraw Hill Publishing company limited, New Delhi, 2003.

OUTCOMES:

On completion of the course, students will be able to

- Describe concepts and terminology of digital electronics
- Formulate and employ a Karnaugh map to reduce Boolean expressions
- Analyze and design digital combinational circuits and sequential circuits
- Design digital circuits for various applications
- Implement combinational logic circuits using programmable logic devices
- Develop HDL codes for various digital circuits

ECC2104	ELECTROMAGNETIC FIELDS AND TRANSMISSION LINES	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To interpret the relation between the fields under time varying situations
- To introduce principles of propagation of uniform plane waves.
- To familiarize with propagation of signals through transmission lines and waveguides.
- To analyze the characteristics of transmission lines and waveguides.
- To study in detail various modes of radio propagation.

PREREQUISITES:

- Basic properties of Electric and magnetic fields
- Knowledge on engineering mathematics
- Familiarity of electromagnetic spectrum

MODULE I REVIEW OF STATIC FIELDS 9

Coulomb's Law in Vector Form - Electric Field due to discrete charges - Electric field due to continuous charge distribution - Electric Scalar Potential-Relationship between potential and electric field -Gauss Law-The Biot-Savart Law in vector form - Magnetic Field intensity due to a finite and infinite wire carrying a current I - Magnetic field intensity on the axis of a circular and rectangular loop carrying a current I - Ampere's circuital law.

MODULE II TIME VARYING FIELDS 8

Displacement current - Ampere's circuital law in integral form - Modified form of Ampere's circuital law - Maxwell's first equation in integral form - Equation expressed in point form.– Faraday's law - Maxwell's Second Equation in integral form from Faraday's Law –Equation expressed in point form - Poynting Vector and the flow of power - Power flow in a co-axial cable - Instantaneous Average and Complex Poynting Vector.

MODULE III ELECTROMAGNETIC WAVES 9

Derivation of Wave Equation - Uniform Plane Waves - Maxwell's equation in Phasor form - Wave equation in Phasor form - Plane waves in free space and in a homogenous material.Wave equation for a conducting medium - Plane waves in lossy

dielectrics - Propagation in good conductors - Skin effect. Linear, Elliptical and circular polarization - Reflection of Plane Wave from a conductor-normal incidence - Reflection of Plane Waves by a perfect dielectric - normal and oblique incidence. Dependence on Polarization. Brewster angle.

MODULE IV WAVE PROPAGATION IN TRANSMISSION LINES 7

Lumped and distributed element models of transmission lines, characteristic impedance, terminated transmission line - reflection coefficient, wavelength and velocities of propagation, Transfer Impedance, Standing waves, Impedance matching, Smith Chart - impedance and admittance chart, scattering matrix.

MODULE V WAVE PROPAGATION IN GUIDED MEDIUM 8

Planar waveguides, TE and TM waves - characteristics, velocities of propagation, Rectangular waveguides - dominant mode, cut-off wavelength, phase velocity, group velocity, characteristic impedances,

MODULE VI RADIO WAVE PROPAGATION 4

The three basic types of propagation; ground wave, space wave and sky wave propagation. Wave tilt of surface wave, Tropospheric wave, Structure of atmosphere, ionospheric propagation, virtual height, critical frequency, MUF, space wave propagation, ground wave propagation, forward scatter propagation.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. M.N.O.Sadiku: "Elements of Engineering Electromagnetics", 4th Edition, Oxford University Press, 2007.
2. Edward C. Jordan and Kenneth G. Balmain, "Electromagnetic Waves and Radiating Systems", 2nd Edition, Prentice Hall Int., 2009.
3. John D Ryder, "Networks, Lines and Fields", 2nd Edition, Pearson India, 2015.
4. William H.Hayt "Engineering Electromagnetics", 8th Edition, Tata McGraw - Hill, 2014

REFERENCES:

1. John D Kraus, Ronald J Marhefka, Ahmad S Khan, "Antennas and Wave Propagation", 3rd Edition, Tata McGraw Hill, 2006.
2. David M.Pozar, "Microwave Engineering", 4th Edition, John Wiley, 2013.
3. Ramo, Whinnery and Van Duzer: "Fields and Waves in Communications Electronics", 3rd Edition, John Wiley & Sons, 2003

OUTCOMES:

On completion of the course, students will be able to

- Recall the basic laws of Electromagnetic theory
- Solve the static and time varying electric and magnetic fields for practical applications.
- Characterize the EM waves in free space and at different boundaries.
- Analyze the wave propagation in different mediums.
- Explain the basic concepts of Transmission lines and waveguides
- Illustrate the types of wave propagation

ECC2105	ELECTRONIC CIRCUITS LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To design the biasing circuits for FET and BJT.
- To obtain the characteristics of common emitter and common collector amplifiers.
- To design multistage amplifiers and oscillators.
- To use modern tools for PCB layouts of electronic circuits.
- To design, simulate and verify the performance of electronic circuits.

PRE-REQUISITES:

- Knowledge on basic concepts of electron Devices and its applications

LIST OF EXPERIMENTS:

1. Design of Biasing networks for BJT & FET and find the operating points & verification using SPICE / Cadence software.
2. Design & Determination of frequency response, input impedance and output impedance of CE amplifier.
3. Design & Determination of frequency response, input impedance and output impedance of CS amplifier.
4. Determination of frequency response, input impedance and output impedance of two stage RC Coupled Amplifier, Darlington amplifier.
5. Determination of CMRR of Differential amplifier.
6. Design and Analysis of Feedback Amplifiers
7. Design of Class C Single Tuned Amplifier
8. Determination of frequency response, input impedance and output impedance of Cascode amplifier
9. Design and Verification of Oscillators
10. Design and fabrication of PCB for basic circuits.

Total Hours –30

REFERENCES:

1. Paul Horowitz and Thomas C. Hayes, “Learning the Art of Electronics: A Hands-On Lab Course Book”, Cambridge university press, first edition, 2016.
2. S.V. Subrahmanyam , “Experiments in Electronics Paperback” New Central Book Agency Pvt Ltd, 2011.
3. Owen Bishop, “Electronics - Circuits and Systems”, Elsevier publication, 4th Edition, 2010.

4. John Keown “OrCAD PSpice and Circuit Analysis, Pearson Publication, 4th edition, 2000.

OUTCOMES:

On completion of the course, students will be able to

- Design the biasing circuit for BJT and FET circuits for given operating points and stability factors.
- Design RC coupled amplifier and Darlington amplifiers for better gain values.
- Design RC and LC type oscillators for different frequency.
- Design tuned amplifier for any given frequency.
- Design PCB layout for simple electronics circuits using modern software tools.

ECC2106	DIGITAL ELECTRONICS LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To design and implement the Combinational circuits.
- To verify the functionalities of Flip-flops.
- To design and implement sequential circuits.
- To simulate the Verilog programs using simulators.

PRE-REQUISITES:

- Basic knowledge on digital theory
- Familiarity with logic gates, digital electronic devices and its building blocks

LIST OF EXPERIMENTS:

1. Design and implementation of combinational circuits using logic gates.
2. Design and implementation of 4 bit binary Adder/ subtractor and BCD adder using IC7483.
3. Design and implementation of 2-Bit Magnitude Comparator using logic gates & 8 Bit magnitude Comparator using IC 7485.
4. Design and implementation of 16 bit odd/even parity checker generator using IC 74180.
5. Verification of state tables of R-S flip-flop, J-K flip-flop, T Flip-Flop, D Flip-Flop Using NAND and NOR gates.
6. Design and implementation of asynchronous and synchronous counters.
7. Design and Implementation of shift registers using Flip- flops.
8. Simulation of combinational and sequential circuits using Verilog HDL.
9. Mini project

Total Hours –30

REFERENCES:

1. M. Morris Mano ,Michael D. Ciletti “Digital Design With an Introduction to the Verilog HDL”,5th Edition, Pearson Education, 2013

2. Charles H. Roth, "Fundamentals of Logic Design", 7th Edition, Global Engineering: Tim Anderson, 2014.

3.Donald P. Leach and Albert Paul Malvino, "Digital Principles and Applications", 6th Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2009

4. R.P. Jain, "Modern Digital Electronics", Tata McGraw Hill, 4th Edition. New Delhi, 2010.

OUTCOMES:

On completion of the course, students will be able to

- Analyze and design digital logic circuits applying the knowledge of number systems, codes and Boolean algebra.
- Design simple combinational circuits containing logic gates, multiplexer, encoder and decoder
- Design simple sequential circuits containing latch circuit and flip-flop circuits.
- Identify, formulate and solve engineering problems in the area of digital logic circuit design to meet desired needs within realistic constraints.
- Use the techniques, skills and modern engineering tools such as logic works and Verilog HDL, necessary for engineering practice
- Function on multi-disciplinary teams through digital circuit experiments and projects

SEMESTER IV

ENC 2282	WRITTEN COMMUNICATION	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To help students identify content specific vocabulary and learn its usage.
- To expose them to reading for specific purposes, especially in professional contexts.
- To expose them to the process of different kinds of formal writing.
- To help them learn corporate correspondence for different purposes.
- To train them in preparing effective applications with résumé
- To make them write different types of reports.

MODULE I **4**

Introduction - process of writing – Fundamentals of academic and professional writing – Understanding short, real world notices, messages, etc.

MODULE II **4**

Reading industry related texts (ex. Manufacturing, textile, hospitality sector etc.) for specific information.

Writing Instructions and recommendations

MODULE III **6**

Understanding format and conventions of writing email, memo, fax, agenda and minutes of the meeting.

Writing email, memo, fax, agenda and minutes of the meeting for various purposes (industry specific)

MODULE IV **6**

Viewing letter of application and Résumé, letter calling for an interview, letter of inquiry and Promotional letter

Writing Functional résumé and letter of application using Edmodo,

MODULE V **6**

Viewing a Video and reading a case study (industry specific) – collaborative writing using Edmodo –reading and information transfer

Writing reports- Survey, feasibility and progress – exposure to discipline

specific reports

MODULE VI **4**

Writing Statement of purpose (Higher Education)-- Justifying and writing about one's preparedness for job (Statement of Purpose highlighting strengths and weaknesses) – Peer evaluation skills through Edmodo.

P – 30; Total Hours –30

REFERENCES:

1. Riordan,D (2013). *Technical Report Writing Today*. Cengage Learning, 10th edition. USA.
2. Oliu, W. E., Brusaw, C.T., & Alred, G.J.(2012). *Writing that Works: Communicating Effectively on the Job* . Bedford/St. Martin's. Eleventh Edition.
3. Garner, B.A. (2013). *HBR Guide to Better Business Writing (HBR Guide Series)*. Harvard Business Review Press. USA.
4. Sharma, R.C. & Krishna M. (2002). *Business Correspondence and Report Writing*. Tata MacGraw – Hill Publishing Company Limited, New Delhi.
5. Macknish, C. (2010). *Academic and Professional Writing for Teachers*. McGraw-Hill Education. USA.
6. Whitby, Norman (2014). *Business Benchmark: Pre-Intermediate to Intermediate.* Cambridge University Press, UK.

OUTCOMES:

On completion of the course, the students will have the ability to

- Identify content specific vocabulary and also use them in appropriate contexts.
- Demonstrate reading skills with reference to business related texts.
- Draft professional documents by using the three stages of writing.
- Create different types of documents for various corporate correspondences.
- Write effective letter of applications, résumé and statement of purpose.
- Write business related reports efficiently.

ECC2201 DIGITAL SIGNAL PROCESSING

L	T	P	C
3	1	0	4

OBJECTIVES:

- Implementation of discrete Fourier transform and its applications in digital Filter design.
- Familiarize on design of FIR and IIR Digital filters.
- To understand the concept of quantization noise and its effects in multi-rate signal processing.
- To introduce signal processing concepts in systems having more than one sampling frequency.
- To study the architecture and features of digital signal processor

PRE-REQUISITES:

- Knowledge on Signals and systems

MODULE I DISCRETE FOURIER TRANSFORM 8+3

Introduction to Discrete Fourier Transform, Direct computation of DFT and Inverse DFT, Properties of DFT, Radix-2FFT algorithms -Decimation in Time, Decimation in Frequency algorithms.

MODULE II DESIGN AND IMPLEMENTATION OF IIR FILTERS 8+3

Design of Low Pass Butterworth filters & Chebyshev filters- analog to analog transformation - Analog to digital transformation, Bilinear transformation - prewarping, Impulse invariant transformation.

MODULE III DESIGN AND IMPLEMENTATION OF FIR FILTERS 8+3

Amplitude and phase responses of FIR filters - symmetric and anti-symmetric impulse response, Frequency response of FIR filters, Linear phase filters - Windowing techniques for design of Linear phase FIR filters - Rectangular, Hamming, Hanning windows.

MODULE IV FINITE WORD LENGTH EFFECTS 8+3

Representation of numbers - Fixed point and binary floating point number representation - comparison, errors due to truncation and rounding- off, Quantization noise - derivation for quantization noise power at the input and output of a digital filter, Co-efficient quantization error -product quantization error, Round-off effects in digital filters, Limit cycle oscillation .

MODULE V MULTIRATE DIGITAL SIGNAL PROCESSING 8+3

Interpolation and Decimation, Decimation by an integer factor, Interpolation by an

integerfactor, Sampling rate conversion by a rational factor, Time and frequency domain descriptions - Quadrature Mirror Filter banks - Sub-band Coding.

MODULE VI DIGITAL SIGNAL PROCESSORS 5

Introduction to DSP processor - Harvard and Von Neumann architecture - Pipelining - Architecture of TMS320C5X and C54X, Overview of instruction set of TMS320C5X and C54X.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. John G Proakis, Dimtris G Manolakis, "Digital Signal Processing Principles, Algorithms and Application", 4th Edition, PHI, 2009.
2. B.Venkataramani, M. Bhaskar, "Digital Signal Processor Architecture, Programming and Application", 2nd Edition, TMH 2002.

REFERENCES:

1. Alan V Oppenheim, Ronald W Schafer, John R Back, "Discrete Time Signal Processing", 2nd Edition, PHI, 2000.
2. Avtar Singh, S.Srinivasan, "DSP Implementation using DSP microprocessor with Examples from TMS32C54XX", 3rdEdition, Thomson / Brooks Cole Publishers, 2003.
3. Johny.R.Johnson, "Introduction to Digital Signal Processing", 2nd Edition, Prentice Hall, 2002.
4. S.K.Mitra, "Digital Signal Processing- A Computer based approach", 4th Edition, Tata McGraw-Hill, New Delhi, 2011.

OUTCOMES:

On completion of the course, students will be able to

- Represent discrete-time signals in the frequency domain, using z-transform and discrete Fourier transform (DFT).
- Analyze the basic forms of FIR and IIR filters and, to design filters with desired frequency responses.
- Analyze the effect of finite word length in the DSP systems.
- Implement the multirate processing fundamentals using decimation and interpolation.
- Illustrate the basic architecture of digital signal processors.
- Apply digital signal processing concepts in audio, video signals etc.

ECC2202	LINEAR INTEGRATED CIRCUITS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To describe the characteristics and internal circuit of op-amps.
- To Characterize the differential amplifiers and current sources
- To design the various linear and non-linear applications of op-amps.
- To design and characterize the data converters and active filters.
- To explain and characterize the special purpose ICs like PLL, Timer IC, voltage regulators, switched capacitor filters.

PREREQUISITES:

- Comprehensive knowledge in Network Analysis and Synthesis
- Knowledge in Electronic circuits

MODULE I INTRODUCTION AND CIRCUIT CONFIGURATION OF LINEAR ICS **8**

OP-AMP fundamentals, differential amplifier, current mirror, active load, level shifter, output stage; ac and dc characteristics, basic building blocks of OP-AMP.

Feedback Amplifiers: General feedback structure, properties of negative feedback, basic feedback topologies, determination of loop-gain, stability problem.

MODULE II LINEAR APPLICATIONS OF OPERATIONAL AMPLIFIERS **8**

Linear circuits using operational amplifiers and their analysis: virtual ground, Inverting and non-inverting modes; adder, subtractor, difference amplifier; common mode rejection ratio (CMRR), Differentiator, Integrator, V to I converter and I to V converter, Instrumentation Amplifier, sine wave Oscillators, Log and Antilog amplifiers. Designing linear power supply using op amp.

MODULE III NON LINEAR APPLICATIONS OF OPERATIONAL AMPLIFIERS AND ANALOG MULTIPLIER **8**

Precision rectifier, Comparator, Application of comparator, Schmitt trigger, Multivibrators, Triangular wave generator. Analysis of four quadrant (Gilbert cell) and variable trans conductance multiplier, DC analysis of Gilbert multiplier cell, Application of Gilbert cell as complete analog multiplier, modulator and phase detector.

MODULE IV DAC and ADC 7

Analog switches, High speed Sample and Hold circuit. DAC techniques: Weighted Resistor, R-2R ladder, Inverted R-2R ladder, ADC techniques: Flash type, Counter type, Successive approximation, Single slope and Dual slope.DAC and ADC specifications - Linearity, accuracy, Monotonicity, Settling time and stability.

MODULE V TIMER IC AND PLL 8

555 timer IC, Applications: Astable and Monostable operation, Active filters, PLL and Closed loop analysis of PLL, Applications of PLL: Frequency translation, AM, FM and FSK modulators and demodulators.

MODULE VI SPECIAL PURPOSE ICS 6

IC Voltage regulators – General purpose ,variable regulator Switched capacitor filter- IC MF10, Frequency to Voltage and Voltage to Frequency converters, Audio Power amplifier, Video Amplifier, Isolation Amplifier, fiber optic IC- IC transducers.

Total Hours – 45

TEXT BOOKS:

1. D. Roy Choudhry, Shail Jain, "Linear Integrated Circuits", 2nd Edition, New Age International Pvt. Ltd., 2011.
2. Gray and Meyer, 'Analysis and Design of Analog Integrated Circuits', 4th Edition, Wiley International, 2009.
3. Sergio Franco, “Design with Operational Amplifiers and Analog Integrated Circuits”, TMH. 2007.

REFERENCES:

1. J.Michael Jacob, 'Applications and Design with Analog Integrated Circuits', 4th Edition, Prentice Hall of India, 1996.
2. Ramakant A. Gayakwad, 'OP-AMP and Linear IC's', 3rd Edition, Prentice Hall / Pearson Education
3. Millman.J. and Halkias.C.C. 'Integrated Electronics', 2ndEdiiton, McGraw-Hill, 1972.
4. William D.Stanely, 'Operational Amplifiers with Linear Integrated Circuits'.4th Edition, Pearson Education, 2004
5. Sedra & Smith, "Micro Electronic Circuits", 5th Edition, Oxford University Press, 2004.

OUTCOMES:

On completion of the course, students will be able to

1. Determine the difference between ideal and practical AC & DC characteristics of an Operational Amplifier.
2. Differentiate linear and non-linear applications of operational amplifiers
3. Generate waveforms using Op-Amp.
4. Identify the special purpose ICs
5. Apply IC 555 and PLL for different applications
6. Design and analyze a circuit using ICs, based on the requirement.

ECC2203 COMMUNICATION THEORY AND SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- Introduce various continuous wave modulation techniques.
- Differentiate all types of amplitude modulation systems based on transmission bandwidth, transmitted power and system complexity
- Apply the knowledge of vestigial side band modulation in television system.
- Compare amplitude modulation and angle modulation with respect to performance parameters.
- Analyze the noise performance of various analog receivers.
- Distinguish various pulse modulation and Multiplexing techniques.

PREREQUISITES:

- Fundamentals of Electronic circuit design and its function
- Knowledge on Signals and Systems and Random Process

MODULE I AMPLITUDE MODULATION 8

Overview of communication systems-electromagnetic spectrum-ranges and application areas. Need for modulation, Principles of amplitude modulation. Generation of AM wave: square law modulator, switching modulator. Detection of AM waves: square law detector, envelop detector. Generation of DSBSC waves: balanced modulator, ring modulator. Coherent detection of DSBSC modulated waves. Costas loop.

MODULE II SSB AND VSB MODULATION 8

Single side-band modulation - Phase discrimination method for generating an SSB modulated wave, Demodulation of SSB waves. Vestigial side band modulation - Generation of VSB modulated wave, Envelop detection of VSB wave plus carrier, Frequency translation, Frequency division multiplexing, Application: Radio broadcasting, AM radio.

MODULE III ANGLE MODULATION 8

Angle modulation - Frequency modulation, transmission bandwidth of FM signals, frequency spectrum, phase modulation, relationship between FM&PM, narrow band FM & wide band FM. Generation of FM waves: direct method, indirect method of FM generation. Detection of FM waves: Balanced frequency discriminator, Zero crossing

detectors, Phase locked loop, Fosterseely discriminator, ratio detector.

MODULE IV NOISE THEORY 7

Sources of noise - shot noise, thermal noise, white noise, Noise bandwidth, Noise temperature, Noise figure - Measurement of noise figure, Signal in presence of noise, Narrow band noise. Noise in continuous wave modulation-Noise in SSB and DSB - SC receiver, Noises in AM receiver threshold effect.

MODULE V PULSE MODULATION AND MULTIPLEXING TECHNIQUES 7

Sampling of Signals- Pulse modulation - Generation and detection of PAM, PWM and PPM. Multiplexing- TDM, FDM.

MODULE VI BROADCAST AND TELEPHONE SYSTEMS 7

AM and FM radio broadcast systems, Television systems and scanning principles, TV signal transmission and reception, Telephone systems.

Total Hours – 45

TEXT BOOKS:

1. Simon Haykin, "Communication System", 5th Edition, John Wiley & Sons, 2009.
2. A. Bruce Carlson, Paul B. Crilly,“Communication Systems” McGraw-Hill , 5th Edition, 2011
3. Taub & Schilling, Gautam Sahe, "Principles of Communication Systems", 3rd Edition, TMH, 2008.
4. Wayne Tomasi, "Electronic Communication Systems: Fundamentals Through Advanced", 6th Edition, Pearson Education, 2007.
5. R.R. Gulati “Modern Television Practice: Principles, Technology and Servicing” 2nd edition, New Age International Publications – 2007

REFERENCES:

1. Roddy and Coolen, "Communication Systems", 4th Edition, PHI learning, New Delhi, 2003.
2. George Kennedy and Bernard Davis, "Electronic Communication Systems", 4th Edition, Tata McGraw Hill, 2008.
3. K.N.Hari Bhat & Ganesh Rao, "Analog communications", 2nd Edition, Pearson Publication, 2008.
4. J.G. Proakis and M. Salehi, Communication Systems Engineering, 2nd Edition,

Prentice Hall, 2002.
5. A.M.Dhake “TV and Video Engineering” Tata Mcgraw Hill,2001

OUTCOMES:

On completion of the course the students will be able to

- Explain continuous wave modulation techniques.
- Differentiate and analyze the performance of AM, DSB-SC, SSB and VSB systems.
- Compute the performance parameter for noise analysis in various analog receivers
- Design different types of pulse modulation system and its multiplexing techniques.
- Apply suitable analog / pulse modulation techniques for signal transmission.
- Describe the television system and scanning principles.

ECC2204 MICROPROCESSORS & MICROCONTROLLERS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To illustrate the architecture of 8085 & 8086 microprocessors.
- To introduce the programming and interfacing techniques of 8086 microprocessor.
- To analyze the basic concepts and programming of 8051 microcontroller
- To develop the interfacing circuits for various applications of 8051 microcontroller
- To make use of ARM board for various applications

PREREQUISITES:

- Knowledge on Digital Electronics.

MODULE I ARCHITECTURE OF 8086 MICROPROCESSOR 8

Introduction to the architecture of 8085 Microprocessor, 8086 Microprocessor – Architecture - Register Organization - Memory Organization - Minimum Mode bus cycle - Maximum Mode bus cycle -Timing Diagram - Interrupts & Service Routine.

MODULE II PROGRAMMING OF 8086 6

Addressing modes - Instruction set – Data transfer instructions, Arithmetic Instructions, Logical instructions, String manipulation instructions and control transfer instructions - Assembly language Programming.

MODULE III INTERFACING WITH 8086 MICROPROCESSOR 9

Memory interfacing - Interfacing with peripheral ICs like 8251 - serial I/O, 8255-parallel I/O, 8254-programmable interval timer, 8279-Keyboard display controller, 8257-DMA, LEDs, LCDs, ADCs and DACs.

MODULE IV 8051 MICROCONTROLLER 8

Architecture of 8051 – Special Function Registers (SFRs) – I/O Ports and Memory organization – Instruction set – Addressing modes – Assembly language programming.

MODULE V INTERFACING WITH 8051 MICROCONTROLLER 8

Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing – ADC, DAC & Sensor Interfacing – External Memory

Interface - Stepper Motor interface.

MODULE VI INTRODUCTION TO ARM PROCESSOR 6

ARM architecture - ARM Organization and Implementation - ARM Instruction Set.

Total Hours – 45

TEXT BOOKS:

1. A.K. Ray and K.M.Burchandi, “Advanced Microprocessors and Peripherals (Third Edition)", McGraw Hill International Edition, 2012.
2. Mohammed Ali Mazidi and Janice Gillispie Mazidi, "The 8051 Microcontroller and Embedded Systems", 2nd Edition, Pearson Education Asia, New Delhi, 2003.
3. Steve Furber, “ARM System-on-Chip Architecture”, 2nd Edition, University of Manchester, Addison-Wesley Professional, 2001.

REFERENCES:

1. Yu-Cheng Liu, Glenn A.Gibson, “Microcomputer Systems: The 8086 / 8088 Family – Architecture, Programming and Design”, Second Edition, Prentice Hall of India, 2007.
2. Kenneth J Ayala, "The 8051 Microcontroller Architecture Programming and Application", 2nd Edition, Penram International Publishers (India), New Delhi, 1996.
3. Doughlas V.Hall, “Microprocessors and Interfacing, Programming and Hardware”, TMH, 2012.

OUTCOMES:

On completion of the course, students will be able to

- Illustrate the organization of registers and memory in microprocessors and microcontroller.
- Prioritize interrupts for executing the respective ISR.
- Identify the addressing mode and calculate the number of T-states required for the execution of an instruction
- Develop assembly language programs suitable for real time applications using microprocessors / microcontroller.
- Explain the different interfacing devices.
- Design and develop applications using ARM boards.

ECC2205	MICROPROCESSOR AND MICROCONTROLLER LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To introduce the concept of Assembly Language Programming (ALP).
- To develop skills in assembly language programming to interface 8086 with various modules.
- To familiarize students on programming and interfacing of 8051 Microcontroller.
- To introduce applications using ARM board.

PREREQUISITES:

- Knowledge on Digital Electronics.
- Comprehensive knowledge on the instruction set of 8086 Microprocessor & 8051 Microcontroller.

LIST OF EXPERIMENTS:

8086 Microprocessor basic programs

1. 16 bit Arithmetic operation
2. Sorting of an array

8086 Microprocessor interfacing programs

3. Stepper motor interface
4. Generate an interrupt using 8253 timer.
5. Program to display a string of characters using Keyboard display (8279).
6. Interfacing PPI (8255).

8051 Microcontroller basic and interfacing programs

7. 16 bit Arithmetic operation
8. Interfacing ADC
9. Interfacing DAC
10. Communication between 8051 kit and PC using USART (8251)
11. Interfacing Traffic Light Control
12. Study on ARM Processor

Total Hours – 30

REFERENCES:

1. Doughlas V.Hall, “Microprocessors and Interfacing, Programming and Hardware”, TMH, 2012.
2. Yu-Cheng Liu, Glenn A.Gibson, “Microcomputer Systems: The 8086 / 8088 Family – Architecture, Programming and Design”, Second Edition, Prentice Hall of India, 2007.

3. A.K. Ray and K.M.Burchandi, "Intel Microprocessors Architecture Programming and Interfacing", 2nd Edition, McGraw Hill International Edition, 2000.
4. William Hohl and Christopher Hinds “ARM Assembly Language: Fundamentals and Techniques”, Second Edition, CRC Press is an imprint of Taylor & Francis Group, 2015.

OUTCOMES:

On completion of the course, students will be able to

- Develop the assembly language program for the basic arithmetic and logical operations of 8086 Microprocessor and 8051 Microcontroller.
- Interface different peripheral devices with Microprocessor/Microcontroller.
- Analyze the errors during the execution of program.
- Develop applications using Microprocessor/Microcontroller based systems.
- Interface Microcontroller and PC.
- Design and develop programs for various applications using Microprocessor/ Microcontroller.

ECC2206	DIGITAL SIGNAL PROCESSING LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To implement Linear and Circular Convolution
- To implement FIR and IIR filters
- To study the architecture of DSP processor
- To demonstrate Finite word length effect

PREREQUISITES:

- Basic concepts of Signals and systems
- Fundamentals of various transforms.

LIST OF EXPERIMENTS USING SIMULATION TOOL

1. Frequency response of LTI system.
2. Linear convolution/Circular convolution
3. Discrete Fourier Transform& Fast Fourier Transform
4. Design of IIR filter using Impulse invariant and Bilinear transformation
5. Design of FIR filter using windows
6. Sampling and reconstruction of a signal
7. Sampling rate conversion-interpolation & decimation.

LIST OF EXPERIMENTS USING DSP PROCESSOR

8. Linear convolution using TMS320C54X
9. Circular convolution using TMS320C54X
10. Discrete Fourier Transform using TMS320C54X
11. Inverse Discrete Fourier Transform using TMS320C54X
12. Mini project

Total Hours – 30

REFERENCES:

1. S.K.Mitra, "Digital Signal Processing- A Computer based approach", 4th Edition Tata McGraw-Hill, New Delhi, 2013.
2. Nasser kehtarnavaz and Namjin Kim, “Digital Signal processing system-level design using LabVIEW”, Newnes- Elsevier,2005.
3. B.Venkataramani, M. Bhaskar, "Digital Signal Processor Architecture, Programming and Application", 2nd Edition, TMH 2002.

OUTCOMES:

On completion of the course, students will be able to

- Use DSP tools to analyze discrete time signals and systems
- Analyze the properties of discrete time signals and systems and identify its implication for practical systems.
- Evaluate and plot the frequency, magnitude and phase response of linear time-invariant systems using simulation tools.
- Evaluate the discrete Fourier transform (DFT) of a sequence, use the FFT to compute DFT and implement using DSP processor.
- Implement convolution using DSP processor.
- Design digital IIR and FIR filter.

ECC2207	LINEAR INTEGRATED CIRCUITS LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To understand the characteristics of operational amplifier
- To categorize the linear integrated circuits and available ICs with its basic functionalities
- To apply operational amplifiers in linear and nonlinear applications
- To acquire the basic knowledge of special function ICs like PLL, regulators
- To use Elvis board and SPICE, Netlist software for circuit design
- To become skilled with the functions of linear integrated circuits

PREREQUISITES:

- Basic knowledge on circuits and circuit theory
- Knowledge on dual power supply connections.

LIST OF EXPERIMENTS:

DESIGN AND TESTING OF

1. Inverting and Non-Inverting Amplifiers and Voltage follower – Application as Buffer/Isolator.
2. Adder, Subtractor, Difference amplifier, Integrator, Differentiator – Application of Analog computation.
3. Instrumentation Amplifier – Signal extraction from sensor and measurement of CMRR
4. Active Butterworth Filters – As distortion eliminators in Audio amplifiers
5. Multivibrators and Schmitt Trigger using operational amplifier – Function generator
6. Phase shift and Wien bridge oscillators using operational amplifier – Variable low frequency generator.
7. Design of Multivibrators using 555 timer – Clock Pulse generator.
8. PLL characteristics and its application as Frequency Multiplier.
9. DC power supply using LM317 and LM723.
10. Study of SMPS
11. Simulation using PSpice, Netlist of above experiments
12. Mini project using above experiments

Total Hours – 30

REFERENCES:

1. D. Roy Choudhry, Shail Jain, "Linear Integrated Circuits", 2nd Edition, New Age International Pvt. Ltd., 2011.
2. Gray and Meyer, 'Analysis and Design of Analog Integrated Circuits', 4th Edition, Wiley International, 2009.
3. William D.Stanely, 'Operational Amplifiers with Linear Integrated Circuits'.4th Edition, Pearson Education, 2004.
4. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", 3rd Edition, Tata McGraw-Hill, 2002.

OUTCOMES:

On completion of this course the student will be able to:

- Estimate the DC and AC Analysis of operational amplifiers.
- Design and implement circuits using Op amp to perform various mathematical operations.
- Design and demonstrate the sinusoidal and non-sinusoidal oscillators using Op-AMP
- Design filters using Opamp and perform experiment on frequency response
- Develop and analyze various multivibrator circuits using OP amp and 555 Timer IC
- Analyze the working of PLL and use PLL as frequency multiplier

SEMESTER V

MSB 3181	LEADERSHIP & CEO TRAINING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course aims at

- Bringing about positive transformation in students' attitude.
- Building unique leadership competencies that would ensure successful transition of students across all career stages.
- Sensitizing students to identify their strengths & weakness and training them to deal with it
- Assisting students in enhancing their expressive ability and inducing a high level of self confidence to manage both business and emotions
- Training students to become more adaptable and flexible to changing business environment

MODULE I INTRODUCTION TO LEADERSHIP 12

Leadership concept - meaning, definitions, importance of leadership, leadership traits. Leadership functions- general functions, listening, observing, managing and decision making. Components of leadership - leaders, followers and situation. Leadership theories – Trait theory, Skills theory, Style theory, Situational theory, Transformational theory, Transactional theory, Path Goal Theory and LMX. Assessing emotional intelligence and exploring the capabilities and inherent traits through psychometric tests - Multi factor leadership questionnaire and personal reflections

MODULE II LEADERSHIP STYLE AND COMMUNICATION 08

Leadership styles-visionary, Coaching, Affiliative, Democratic, Pacesetting Commanding, Transformational, Transactional. Autocratic, Participative, Laissez-Faire Leader versus Managers. Leadership communication - Rationale, tactic, assertive, formal, informal, communication in crisis- leadership and negotiations, Leadership Presentations-convincing and impressive style

MODULE III LEADERSHIP ROLES 08

Facets of leadership- Leader as an individual – personality and leadership, values, attitudes and ethics of a leader. **Leader as a relationship builder**-

empowering people to meet higher order needs, initiating organization wide motivational programs, involvement with all stakeholders- focusing on organization growth. **Leader as an inspirer**- motivation and leadership, recognizing and appreciating contributions, empowering others to lead **Leader as an innovator** –leader's role in shaping culture and values in an organization. **Leader as a Liaison- Leader as team player**

MODULE IV LEADERSHIP CHALLENGES AND STRATEGIES 09

Challenges in leadership: Perception of organization culture and values, interpreting the power dynamics in the organization, establishing work life balance. Bad leadership – Reasons and impact.-Case Study of Marissa Mayer-Yahoo.Inc Organizational transformation through efficient leaders-Case study of Apple Inc. Blue Ocean Leadership-Steps to Blue ocean Leadership-Four Pillars of Blue Ocean leadership-Blue Ocean leadership grid

MODULE V LEADERSHIP AND CEO TRAINING 08

Leader as a CEO: Traits of a successful CEO, Key responsibilities of a CEO, the path to be a CEO ,Training on Board Room Discussions, Meeting the CEO –Live sessions with industry CEO's. Requirements of Leadership: - Cognitive skills, Interpersonal skills, Business skills, Strategic skills. Role of Emotional Intelligence in taking up key-positions in the organization.

Teaching Pedagogy:

Nurturing – Based on the identified strengths and weaknesses, training will be given to enhance the strengths and overcome the weakness.

Assessment - Continuous evaluation will be effected through group discussions, oratory assignments and situational enactments. Pre-and post-training assessment through peer reviews and faculty feedback.

Sustained development – Training will be imparted for self-development and monitoring of leadership skills to ensure sustained applicability of the skills learnt.

L – 45; Total Hours – 45

REFERENCES:

1. Andrew J DuBrin. "Leadership: Research Findings, Practice, and Skills", 8th Edition, South-Western College Pub, 2015.
2. Yukl G , "Leadership in Organisations", 8th Edition, Pearson Education, 2013.
3. Richard L Daft , "Leadership", 5th Edition, South Western Cengage

Learning 2012.
4. Stephen P. Robbins and Timothy A. Judge. “Organizational Behaviour”, 15th Edition, New Delhi: Pearson, 2013.
5. Fred Luthans, “Organizational Behavior, An Evidence Based Approach”, 12th Edition, New Delhi: McGraw Hill Education, 2013.
6. Emotional Intelligence, Why it can matter no more than IQ by Daniel Goleman (include a book) Publisher: Bloomsbury Publishing India Private Limited; Latest edition (2017)
7. Primal Leadership: Unleashing the Power of Emotional Intelligence by Prof Daniel Goleman , Richard Boyatzis and McKee ,Harvard Business Review Press

Recommended Readings:

1. Jim Collins, (2001). “Good To Great: Why Some Companies Make the Leap...And Others Don't”, Random House Publishers India Pvt.Ltd, New Delhi
2. George, B. with Sims, P. True North: Discover Your Authentic Leadership, The Times Group Books; First edition (1 October 2015)
3. Kim, W. C., & Mauborgne, R. A. (2014). Blue ocean strategy, expanded edition: How to create uncontested market space and make the competition irrelevant. Harvard business review Press.
4. Leadership Wisdom by Robin Sharma Jaico Publishing House;

OUTCOMES:

The students will be able to

- Explore through self-introspection one’s own leadership style, their strength and weakness
- Gain self confidence to lead a team in the organization
- Realize the role of leadership in making or breaking of an organization
- Acquire the practice of self introspection and development of leadership competencies thorough continuous efforts
- Manage their own emotions as well as other resulting in successful relationship building with all stakeholders

ENC 3181	COMMUNICATION AND SOFT SKILLS - I CAREER CHOICE	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To create awareness of industrial trends and market demands.
- To encourage students to explore career opportunities in an industry and evaluate themselves in relation to industry preparedness

MODULE I **6**

Knowledge about specific industry-Discussion with industry experts --Self evaluating career prospects through survey questionnaire (based on his/her eligibility for taking up a job (industry preparedness)

MODULE II **6**

. Knowing case studies of industries(pertaining to students' choice of career)- Reading and discussing about job markets-goal setting, working on creativity.

MODULE III **4**

SWOC analysis and discussing outcomes--exploring mini projects or case studies of latest industries.

MODULE IV **6**

Writing statement of purpose pertaining to career choice---- Outcomes

MODULE V **8**

Project or case study presentations (Presentation in pairs) -mini project report or case study report.

Total Hours – 30

REFERENCES:

1. Brown,D.(2002). Career Choice and Development. Wiley,J. & Sons.USA
2. Lore,N.(1998). The Pathfinder: How to Choose or Change Your Career for a Lifetime of Satisfaction and Success. Simon & Schuster.USA.
3. Shell, G.R.(2013). Springboard Launching your Personal Search for Success.Portfolio.USA.

OUTCOMES:

After the completion of the course, students would be able to

- Speak about their career choice.
- Self evaluate their strengths and weaknesses and speak about it.

- Make effective presentations on case studies or relating to projects.
- Write the statement of purpose relating to their career choice.

ECC3101 DIGITAL COMMUNICATION

L	T	P	C
3	1	0	4

OBJECTIVES:

- To understand the building blocks of digital communication systems.
- To give an overview of the design of digital communication systems.
- To introduce the basic concepts of digital modulation of baseband and passband signals.
- To give an exposure to information theory, source coding and error control coding.
- To discuss about the spread spectrum modulation schemes.

PREREQUISITES:

- Basic knowledge on Probability and random process.
- Fundamentals of Analog Communication.

MODULE I SAMPLING AND QUANTIZATION PROCESS 12

Digital communication systems – Functional description, Channel classification, Mathematical Models of Communication Channel, Sampling theory, Sampling theorem- Impulse sampling , flat top sampling, Sampler implementation: Quantization – Uniform and Non uniform.

MODULE II WAVEFORM CODING TECHNIQUES AND BASEBAND SIGNALING 10

Pulse Code Modulation, Differential pulse code modulation, Delta modulation, Adaptive delta modulation, Line Codes & their properties - Matched filter – ISI, Signal Design for zero ISI and Ideal Nyquist's Pulse for distortionless baseband data transmission - Correlative coding - Eye pattern, Adaptive Equalization.

MODULE III BAND PASS SIGNALING 11

Geometric Representation of signals, Conversion of the continuous AWGN Channel into a Vector Channel, Optimum receivers using coherent detection - Generation, detection, PDF and BER of Coherent BPSK, BFSK, and QPSK - Principles of MSK and QAM - Non-Coherent Modulation Techniques –BFSK- Principle of DPSK.

MODULE IV INFORMATION THEORY 9

Entropy –Source coding theorem - Lossless data Compression Algorithms- Prefix coding, Huffman and Shannon-Fano codes. - Mutual information - Channel capacity -

Channel coding theorem.

MODULE V ERROR CONTROL CODING 9

Error control using forward error correction, Discrete memoryless channels, - Linear Block codes –Syndrome and properties- Hamming codes - Cyclic codes-Convolution codes - Viterbi Decoder - Trellis Coded Modulation.

MODULE VI SPREAD SPECTRUM TECHNIQUES 9

Spread Spectrum Codes - PN sequence - Auto correlation and Cross correlation properties - M Sequences - Direct Sequence Spread Spectrum - Code synchronization, Processing Gain - Jamming Resistance - CDMA - Frequency Hop Spread Spectrum.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Simon Haykin, “Digital Communication System”, John Wiley & Sons 2014.
2. John G. Proakis, "Digital Communication", 4th Edition, McGraw Hill Higher Education, 2000.
3.

REFERENCES:

- Leon W. Couch, "Modern Communication Systems: Principles and Applications", 2nd Edition, Prentice Hall.1995.
- Bernard Sklar, "Digital Communications: Fundamentals and Applications", 2nd Edition, Prentice Hall, 2001.
- B. P. Lathi, "Modern Digital and Analog Communication Systems", 3rd Edition, Oxford University Press,1998.
- Roger L. Peterson, David E. Borth and Rodger E. Ziemer, "Introduction to Spread Spectrum Communications", 1st Edition, Prentice Hall Inc, 1995.

OUTCOMES:

On Completion of the course, students wil be able to

- Explain the fundamental concepts of sampling and quantization.
- To describe the baseband and pass band digital communication.
- Choose different modulation techniques based on the application.
- Apply the suitable source coding and channel coding techniques.

- Develop secure communication using spread spectrum techniques.
- Design and evaluate a digital communication system on need basis.

List of Mini Project Samples (Project Based Learning):

1. Digital modulation and demodulation using MATLAB Simulation.
2. Implementation of duo binary encoding and modified duo binary encoding Using MATLAB
3. Analysis of AWGN channel by using Adaptive Equalizer.
4. Binary step size based LMS Algorithm developed by using MATLAB.
5. Implementation of MSK in Radio Communication Using MATLAB.
6. Analysis of Eb/N0 Vs BER for BPSK modulation scheme.
7. QPSK modulation and demodulation using MATLAB simulation.
8. Channel coding developed using Hamming code techniques by using MATLAB simulation.
9. Slow Frequency Hopping Spread Spectrum Implementation.
10. Direct sequence spread spectrum using MATLAB Simulation.

ECC3102	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Familiarize the student with the basic taxonomy and terminology of the computer networking region.
- To know about the concepts of data communication and networks.
- To discuss on ISO-OSI model and different protocols.
- To distinguish different protocols of network layer, transport layer and application layer.
- To provide students with contemporary knowledge in Cryptography and Security.

PREREQUISITES:

- Basic Knowledge in Computer Architecture

MODULE I DATA COMMUNICATIONS 7

Components and Categories - types of Connections - Topologies-Protocols and Standards - ISO / OSI model -Modems - RS232 Interfacing sequences

MODULE II DATA LINK LAYER 10

Error - detection and correction - Parity - LRC - CRC - Hamming code - Flow Control and Error control: stop and wait - go back N ARQ - selective repeat ARQ- sliding window techniques LAN: Ethernet IEEE 802.3, IEEE 802.4, IEEE 802.5 and IEEE 802.11.

MODULE III NETWORK LAYER 9

Packet Switching and Datagram approach - IP addressing methods - Sub netting - Routing - Distance Vector Routing - Link State Routing - Routers.

MODULE IV TRANSPORT LAYER 7

Duties of transport layer - Multiplexing - Demultiplexing - Sockets – User Datagram Protocol (UDP) - Transmission Control Protocol (TCP) – Congestion Control - Quality of services (QOS).

MODULE V APPLICATION LAYER 6

Domain Name Space (DNS)-SMTP, FTP, HTTP, WWW

MODULE VI CRYPTOGRAPHY&SYSTEM SECURITY 6

Basics of cryptography, classical encryption techniques, Data Encryption Standard and RSA algorithm, Role of firewalls and types of firewalls.

L – 45;Total Hours –45

TEXT BOOKS:

1. Behrouz A. Forouzan, "Data communication and Networking", Fourth Edition, Tata McGraw-Hill, 2011.
2. Larry L. Peterson & Bruce Davie, "Computer Networks': A system Approach", 5th Edition, Morgan Kaufmann Publishers, 2011.
3. William Stallings, Cryptography and network Security", 6th Edition, Pearson Education, March 2013

REFERENCES:

1. James.F. Kurose, Keith W.Ross, "Computer Networking: A Top-down ApproachFeaturing the Internet", SixthEdition, Pearson Education, 2012.
2. Andrew S. Tanenbaum,David J. Wetherall"Computer Networks", 5th Edition, Pearson Education, 2011.

OUTCOMES:

On completion of the course, students will be able to

- Explain data communication systems and its components.
- Enumerate the layers of OSI model ad TCP/IP.
- Implement the error detection and correction techniques in computer networks
- Understand and build the sub-netting and routing mechanisms.
- Compare the operation and features of application layer protocol.
- Have a basic knowledge of the use of cryptography &security issues

ECC3103	VLSI DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide rigorous foundation in MOS and CMOS digital circuits
- To introduce the fundamental principles of MOS and CMOS process technology and to examine the basic building blocks of large-scale digital integrated circuits.
- To introduce the concepts of modeling a digital system using Hardware Description Language.
- To offer a profound understanding of the design of complex digital VLSI circuits.

PREREQUISITES:

- Fundamentals and applications of Digital Electronics, Electronic Devices and Circuits

MODULE I MOS TRANSISTOR PRINCIPLES AND CMOS INVERTER 8

MOS(FET) Transistor Characteristic under Static and Dynamic Conditions, MOS Transistor Secondary Effects, Process Variations, Technology Scaling, CMOS Inverter - Static Characteristic, Dynamic Characteristic, Power, Energy, and Energy Delay parameters.

MODULE II COMBINATIONAL LOGIC CIRCUITS 7

Propagation Delays, Stick diagram, Layout diagrams, Examples of combinational logic design, Elmore’s constant, Dynamic Logic Gates, Pass Transistor Logic, Power Dissipation, Low Power Design principles.

MODULE III SEQUENTIAL LOGIC CIRCUITS 7

Static Latches and Registers, Dynamic Latches and Registers, Timing Issues, Pipelines, Pulse and sense amplifier based Registers, Nonbistable Sequential Circuits.

MODULE IV ARITHMETIC BUILDING BLOCKS AND MEMORY ARCHITECTURES 7

Data path circuits, Architectures for Adders, Accumulators, Multipliers, Barrel Shifters, Speed and Area Tradeoffs, Memory Architectures, and Memory control circuits.

MODULE V IMPLEMENTATION STRATEGIES 8

Full custom and Semi-custom design, Standard cell design and cell libraries, FPGA building block architectures, FPGA interconnect routing procedures.

MODULE VI DESIGN OF VLSI SYSTEMS 8

Basic concepts- identifiers- gate primitives, gate delays, operators, timing controls, procedural assignments conditional statements, Data flow and RTL, structural, gate level, switch level modeling, Design hierarchies, Behavioral and RTL modeling, Test benches, Structural gate level description with examples.

L – 45;Total Hours –45

TEXT BOOKS:

1. Introduction To VLSI Circuits And Systems, John P. Uyemura, John,2009, Wiley & Sons
2. Jan Rabaey, AnanthaChandrakasan, B Nikolic, “Digital Integrated Circuits: A Design Perspective”. Second Edition, Feb 2003, Prentice Hall of India
3. N.Weste, K. Eshraghian, “ Principles of CMOS VLSI Design”. Second Edition, 1993 Addision Wesley,
4. Verilog HDL, A guide to digital design and synthesis, Samir Palnitkar, 2010, PHI

REFERENCES:

1. CMOS Digital Integrated Circuits Analysis, Sung-Mo (Steve) Kang, 2011, TMH
2. Introduction to VLSI Systems: A Logic, Circuit, and System Perspective, Ming Lo Bin, 2011, CRC Press, ISBN 9781439868591
3. Principles Of CMOS VLSI Design, Neil H.E, Weste, 2010, Pearson
4. CMOS Logic Circuit Design, John P Uyemura, 2009, Springer
5. Verilog for Digital Design, Frank Vahid, Roman Lysecky, Wiely, 2007
6. Digital VLSI Design with Verilog, A Textbook from Silicon Valley Polytechnic Institute, Williams, John Michael, 2014 Springer
7. Digital Design and Verilog HDL fundamentals, Joseph Cavanagh, 2007, CRC Press, ISBN

OUTCOMES:

On completion of the course, students will be able to

- Explain data communication systems and its components.

- Enumerate the layers of OSI model ad TCP/IP.
- Implement the error detection and correction techniques in computer networks
- Understand and build the sub-netting and routing mechanisms.
- Compare the operation and features of application layer protocol.
- Have a basic knowledge of the use of cryptography &security issues.

ECC3104	VLSI LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To learn coding of combinational and sequential circuits using Verilog HDL
- To familiarize the simulation and synthesis tools for FPGAs.
- To estimate power and delay of logic circuits in FPGAs.

PREREQUISITES:

- Principles of Digital Electronics and its systems
- VLSI Design.

LIST OF EXPERIMENTS

Study of Simulation & Synthesis tools.
Design and simulation of basic logic gates.
Design, simulate and synthesis of adders and subtractors using HDL.
Design, simulate and synthesis of Multiplexers & demultiplexers using HDL.
Design, simulate and synthesis of Encoders & Decoders using HDL.
Design, simulation and synthesis of multipliers using HDL.
Design, simulation and synthesis of flip flops using HDL.
Design, simulation and synthesis of Shift registers and Counters using HDL.
Verification of on board LEDs and switches of FPGA using HDL codes.
Design of traffic light controller using HDL .
Design of Real time Clock (2 digits, 7 segment LED displays each for Hour, Minute and Sec) and verification in the FPGA board.
Simulation for CMOS Inverter Using Xilinx

P – 30; Total Hours –30

REFERENCES:

1. Digital Design: With an Introduction to the Verilog HDL, 5th Edition by M Morris Mano and Michael Ciletti, Pearson publications, 2013.
2. Verilog HDL: A Guide to Digital Design and Synthesis, Second EditionBy Samir Palnitkar, Prentice Hall PTR, 2003
3. Fundamentals of Digital Logic with Verilog Design, Third Edition, Stephen Brown, Mc, Graw Hill, 2014

OUTCOMES:

On completion of the course, students will be able to

- Write Verilog code for combinational circuits and sequential circuits
- Simulate the combinational circuits and sequential circuits using Xilinx ISE

- Synthesize the designed digital circuits using Spartan FPGA kits.
- Implement the designed circuits in FPGA and verify the operation physically
- Estimate the power and delay of the digital circuit from device utilization summary
- Develop a real time application using Xilinx ISE and FPGA kit

ECC3105	NETWORKS LAB	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To explain about basic network components and devices in a network
- To find out performance of different wired LAN protocols
- To analyze wireless LAN protocol
- To use different algorithms for finding out shortest path between any nodes
- To study and analyze cryptographic algorithm

PREREQUISITES:

- Knowledge of basics of network and its protocols
- Basics of C language.

LIST OF EXPERIMENTS

1. Demonstration of network devices and crimping of Ethernet cable.
2. Performance Study of ALOHA protocol for packet communication between nodes in a network.
3. Performance Study of CSMA protocol for data communication between nodes in a network.
4. Performance Study of CSMA – CD protocol for data communication between nodes in a network.
5. Performance Study of Token Bus access method in a bus network.
6. Performance Study of Token Ring access method in a ring network
7. Performance Study of Stop-and-Wait and Go-back N protocol for data transfer between two nodes in a network.
8. WLAN realization and throughput measurement
9. Simulation of shortest path between any two nodes using Distance Vector Routing Protocol and Link State Routing Protocol
10. Simulation of Cryptographic algorithm using C program.

P – 30; Total Hours –30

REFERENCES:

1. Behrouz A. Forouzan, "Data communication and Networking", Fourth Edition, Tata McGraw-Hill, 2011.
2. Larry L. Peterson & Bruce Davie, "Computer Networks': A system Approach", 5th Edition, Morgan Kaufmann Publishers, 2011.
3. William Stallings, Cryptography and network Security",6th Edition, Pearson

Education, March 2013.

OUTCOMES:

On completion of the course, students will be able to

- Understand fundamental underlying principles of computer networking devices
- Implement basic wired LAN protocol such as ALOHA in a network and find its performance
- Implement IEEE standard protocols for wired LAN such as IEEE 802.3,802.4 and 802.5 and find its performance
- Implement wireless LAN protocol in a network and find its performance
- Understand the algorithm for finding shortest path between any two nodes in a network.
- Acquire knowledge about cryptographic algorithm used for network security

ECC3106	COMMUNICATION SYSTEM LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To implement Amplitude modulation, frequency modulation and demodulation circuit
- To analyse the Spectral characteristics of AM and FM signal
- To implement the modulation techniques using NI-LABVIEW SOFTWARE
- To construct and analyse different converters and mixer circuits.
- To develop an application using various analog modulation techniques.

PREREQUISITES:

- Familiarity with Electronic components, devices and its associated systems
- Basics of Electronic circuit design
- Knowledge on basic circuit functions
- Fundamentals of analog modulation

LIST OF EXPERIMENTS

1. Design and test the performance of
2. Amplitude modulator and demodulator.
3. Frequency modulator and demodulator
4. Study of spectrum analyzer.
5. Spectral analysis of AM/FM.
6. Up converter
7. Down converter
8. Mixer circuit
9. IF Amplifier
10. Frequency Division Multiplexing and demultiplexing
11. Time Division Multiplexing and demultiplexing
12. Labview –AM,FM,Noise Analysis
13. Pulse Modulation Techniques(PAM,PWM,PPM)
14. Mini project

P – 30; Total Hours –30

REFERENCES:

1. Simon Haykin, "Communication System", 5th Edition, Wiley India Pvt Ltd, 2009.
2. Wayne Tomasi, "Electronic Communication Systems: Fundamentals Through Advanced", 6th Edition, Pearson Education, 2007.

3. J.G. Proakis and M. Salehi, Communication Systems Engineering, 5th Edition, Prentice Hall, 2014.

OUTCOMES:

On completion of the course the students will be able to

- Design and Implement the modulation techniques for the analysis of signal communication circuits.
- Analyze and design simple modulators & demodulators using diode, transistors and integrated circuits
- Identify, formulate and Perform spectral estimation in the area of communication engineering to meet desired needs within realistic constraints.
- Apply the techniques, skills and modern engineering tools such as NI-LABVIEW necessary for engineering practice.
- Analyze and design the multiplexer and demultiplexer circuits.
- Justify and incorporate the modulator and demodulator circuits for various applications.

SEMESTER VI

MSB 3182	**SOCIAL ENTREPRENEURSHIP**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

- To be able to understand the field of social entrepreneurship and Social problems
- To be able to describe and understand the traits of social entrepreneurs
- To recognize the social business opportunities
- To synthesize the resource mobilization ways for social entrepreneurship
- To understand the social entrepreneurship models
- To recognize the impact of social entrepreneurship on societies

MODULE I INTRODUCTION TO SOCIAL ENTREPRENEURSHIP 07

Introduction - Emergence and Development of Social Entrepreneurship. Social Problems in India: An Overview. Social Development: The Indian Scenario. Emergence of Social Entrepreneurs and Sustainable Solutions to Social Problem. Characteristics and Context of Social Entrepreneurship .The Role of Social Entrepreneurship in Societies & Economies.

MODULE II SOCIAL ENTREPRENEURSHIP: DRIVERS AND CHALLENGES 07

The Drivers of Social Entrepreneurship. Elements of the Social Entrepreneurial Personality. Challenges of financial constraints. Challenge to attract and cultivate talented workers. Challenge of evaluation of social entrepreneur impact. Challenge of scaling and its impact. Cases

MODULE III SOCIAL ENTREPRENEURSHIP: OPPORTUNITY RECOGNITION 07

Opportunity Recognition and Planning Process. Opportunities for Social Entrepreneurs. The Nature of Social Entrepreneurial Opportunities. Social Problems into Opportunities. Idea development and conceptualization of social problem. Cases

MODULE IV RESOURCE MOBILIZATION FOR SOCIAL VENTURE 08

Resources at Initial Stage. Social Network as a role of Social Capital. Team and Collective Efforts. Need and Determination of Important Resources. Resource of Knowledge, Skills and Abilities. overview of venture capital and angel investment.

Cases

MODULE V **BUSINESS MODELS AND BUSINESS PLAN FOR SOCIAL ENTERPRISES** **08**

Design Principles of Social Entrepreneurship Business Models , Evaluation of the Root Cause of a Societal Problem. Developing business plan for social ventures. Developing an investor presentation. Feasibility study and report. How to start a business - Procedures for registration of small scale industry

MODULE VI **THE IMPACT OF SOCIAL ENTREPRENEURSHIP ON SOCIETY** **08**

Static Impact of Social Entrepreneurship. Impact of Charitable NGOs vs. Social Entrepreneurship, Impact of For-Profit Companies vs. Social Entrepreneurship. Social entrepreneurship report preparation by students.

Case Study of Social Entrepreneurs.

L – 45; Total Hours – 45

REFERENCES:

1. “Social Entrepreneurship : New models of sustainable social change” . Alex Nicholls, Oxford University Press 2006
2. The Process of social value creation : A multiple case study on Social Entrepreneurship in India , Archana Singh Springer 2016
3. “Social Entrepreneurship and social business” Christine K Volkmann, Springer Gabler 2012
4. “Social Entrepreneurship” Manuel London ,Routlege, 2010

OUTCOMES:

The students can able to

- Conceptualize social entrepreneurship in terms of a theoretical framework between changing social values and institutions
- Think and communicate about social values
- Learn about practical models of social change to launch, lead, manage, and evaluate a social venture
- Analyze funding needs and sources for the social venture
- Experience the ideas can be critically and collaboratively examined prior to commitment.

ENC 3281	COMMUNICATION AND SOFT SKILLS - II	L	T	P	C
	CONFIDENCE BUILDING	0	0	2	1

OBJECTIVES:

- To develop professional skills like work ethics, analytical skills, presentation skills etc.
- To train them in problem solving skills and leadership skills pertaining to industries.
- To train them in team building skills.
- To train in setting up career goals

MODULE I **6**

Brief about Multinational companies- Analysing work ethics of multinational companies and small industries- discussing as pairs-Knowledge about etiquette (different types)

MODULE II **6**

Visit to an Industry and prepare reports --Critically reading of industry specific journal articles and write ups-- preparing reports.

MODULE III **4**

Analysing problem solving situations in industries (relating to application of core subject to specific jobs) and discussing about them- working on a sample case

MODULE IV **6**

Developing Leadership in team projects-- debating about various aspects of leadership: for example, responsibility and reliability-time management

MODULE V **8**

Team building skills-- group discussions pertaining to industries-- presenting career goals. -- preparing for interviews- interpersonal skills

Total Hours – 30

REFERENCES:

1. Covey,S.R. (2004). The 7Habits of Highly Effective People: Powerful Lessons in Personal Change. Free Press.UK
2. Fine, P.M.& Alice Olins. (2016).Step up: Confidence, Success and Your Stellar Career in 10 Minutes a Day. Vermilion.UK
3. Pai, A. (1993).How to Develop Self-Confidence. Amazon.com
4. Wentz,F.H.(2012). Soft skills training: A Workbook to Develop Skills for Employment. Amazon.com

OUTCOMES:

After completing the course students would be able to

- Exhibit critical reading skills through review of industry specific articles.

- Provide solutions to problem based situations.
- Exhibit leadership qualities by debating over industry specific issues.
- Participate in group discussions confidently.
- Present their career goals.

ECC3201	RF & MICROWAVE ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce various microwave sources, devices and components.
- To study the characteristics of microwave devices and components.
- To demonstrate the theory of wire antennas and aperture antennas.
- To familiarize with array antennas.
- To study about planar transmission lines and microwave integrated circuits

.

PREREQUISITES:

- Electromagnetic Fields & Electromagnetic Wave Propagation.

MODULE I MICROWAVE SOURCES 7

Microwave tubes-High frequency limitations- Principle of operation of Two cavity klystron, Multicavity Klystron, Reflex Klystron, TWT and Magnetron.

MODULE II MICROWAVE SOLID STATE DEVICES 8

Microwave junctions- Tee junctions- Magic Tee – Rat race-Corners- bends and twists-Directional couplers- Two hole directional couplers-Isolator-Circulator–S Matrix for microwave components

MODULE III MICROWAVE PASSIVE COMPONENTS 7

Microwave junctions- Tee junctions- Magic Tee – Rat race-Corners- bends and twists-Directional couplers- Two hole directional couplers-Isolator-Circulator–S Matrix for microwave components

MODULE IV FUNDAMENTALS OF ANTENNA 8

Vector Potential, Radiation from a infinitesimal alternating current element, Half-wave dipole antenna - power radiated, Mono-pole antenna. Antenna Parameters, radiation resistance, radiation intensity, radiation pattern, directivity, gain, effective height and effective aperture. Reciprocity theorem, Self and Mutual impedance

MODULE V ANTENNA ARRAYS& APERTURE ANTENNAS 8

Linear Arrays - Broadside and End-fire arrays, pattern multiplication, parasitic array elements, log-periodic and Yagi-Uda antenna. Loop antenna, Travelling wave antenna concepts. Horn Antennas and its types – Reflector antennas and its types.

MODULE VI STRIPLINES & MMICs 7

Monolithic Microwave Integrated Circuits: Introduction - Materials: Substrate Introduction to Microstrip Lines - Characteristic Impedance, Attenuation Losses – Parallel Strip Lines - Distributed Lines - Coplanar Strip Lines - Shielded Strip Lines. Materials, ConductorMaterials, Dielectric Materials, Resistive Materials - Monolithic Microwave Integrated- Circuit Growth - MMIC Fabrication Techniques.

Total Hours –45

TEXT BOOKS:

1. Samuel Y Liao,“Microwave Devices & Circuits”, Prentice Hall of India, 2006.
2. Robert.E.Collin-Foundations of Microwave Engg–McGraw Hill, 2002.
3. Constantine A. Ballanis , "Antenna Theory ", 2nd Edition, John Wiley & Sons, 2003.

REFERENCES:

1. D.M.Pozar, “Microwave Engineering”, John Wiley &sons,Inc., 2006.
2. John D Kraus, Ronald J Marhefka, Ahmad S Khan, "Antennas and Wave Propagation", 3rd Edition, Tata McGraw Hill, 2006.
3. R. S. Elliot, "Antenna Theory and Design", Revised edition, Wiley-IEEE Press., 2003.

OUTCOMES:

On completion of the course, students will be able to

- Select a microwave source, device and strip lines for a particular application.
- Determine the S-Matrix of various passive devices.
- Analyze the various microwave devices and components.
- Analyze the characteristics of different strip lines, antennas and antenna arrays.
- Solve the problems related to microwave devices.
- Design various types of antennas and micro strip line for a specific application.

ECC3202 EMBEDDED SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To expose the concepts of embedded systems
- To equip students with the software development skills necessary for practitioners in the embedded systems field.
- To learn entire software development lifecycle and examine the various issues involved in developing software for embedded systems.

PREREQUISITES:

- Knowledge in Microprocessor and Microcontrollers
- Basic Programming Skills in C language..
-

MODULE I EMBEDDED COMPUTING PLATFORM 8

Embedded computing – classification, characteristics and challenges –embedded system design process- overview of processors and hardware units in an embedded system- Embedded application-case study.

MODULE II EMBEDDED SOFTWARE DEVELOPMENT TOOLS 8

Host and target machines - Linkers / Locators for Embedded Software – Debugging techniques - Instruction set simulators Laboratory tools - Practical example – Source code.

MODULE III EMBEDDED C 7

Programming embedded systems in C- Introducing the 8051 microcontroller family-simulation and debugging in IDE-I/O port programming- Reading Switch- Adding structure to your code- meeting real-time constraints- Creating an embedded operating system- Serial interface.

MODULE IV REAL TIME OPERATING SYSTEMS (RTOS) 8

Overview of Operating Systems (OS) concepts – Real time systems –Types -Need for RTOS in Embedded Systems -Compare OS and RTOS- Multiple Tasks and Multiple Processes-Priority-Based Scheduling- Real time scheduling algorithm –Inter process Communication Mechanisms- Case study.

MODULE V PROGRAM DESIGN AND ANALYSIS 7

Components for Embedded Programs - Program design - Model of programs –

Assembly, Linking and Loading - Basic compilation techniques –program optimization –program level performance analysis-software performance optimization-program level energy and power analysis- Analysis and optimization of program size - Program validation and testing.

MODULE VI EMBEDDED NETWORKING 7

Embedded Networking: Introduction – Serial/Parallel Communication – Serial communication protocols - RS232 standard – Inter Integrated Circuits (I2C)-CAN Bus-Ethernet- Introduction to IoT.

Total Hours –45

TEXT BOOKS:

1. Marilyn Wolf, "Computers as components", Elsevier 2012
2. Qing Li and Carolyn Yao," Real-Time Concepts for Embedded Systems", CMP Books, 2003.
3. Michael J Pont, "Embedded C", Pearson Education Ltd, 2011.

REFERENCES:

1. David E.Simon, "An Embedded Software Primer", Pearson Education, 2003.
2. Rajkamal, "Embedded Systems Architecture, Programming and Design",1st Reprint, Tata McGraw-Hill, 2003.
3. Steve Heath, "Embedded System Design", 2nd Edition, Elsevier, 2004.
4. Frank Vahid and Tony Gwargie, "Embedded System Design", John Wiley & sons, 2002.

OUTCOMES:

On completion of the course, students will be able to

- Describe the software and hardware components in embedded system.
- Apply code optimization and debugging techniques for host & target based embedded system
- To discuss the application development using RTOS
- Illustrate the communication in distributed embedded system
- Design real time embedded application.
- Study the basics of 8051 microcontroller Architecture and programming the peripherals with C Language

ECC3203	RF AND MICROWAVE LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To study the characteristics of various microwave sources.
- To determine S - matrices of various passive microwave components.
- To find the gain and radiation pattern of various microwave antennas.
- To measure various microwave parameters using network analyzer.

PREREQUISITES:

- Electromagnetic Fields & Electromagnetic Wave Propagation.

LIST OF EXPERIMENTS:

1. Characteristics of Gunn diode Oscillator.
2. Characteristics of Reflex Klystron.
3. Microwave Power Measurement.
4. Characteristics of Directional Coupler and Magic Tee.
5. Determination of guide wavelength, frequency measurement.
6. VSWR measurements.
7. Determination of impedance of microwave components.
8. Radiation Patten of Horns, parabolic antenna.
9. Measurement of Dielectric constants of a solid.
10. Simulation of Microwave components using HFSS.
11. Characteristics of microwave components using Vector Network Analyser.

TOTAL HOURS-30

REFERENCES:

1. Annapurna Das and Sisir K Das, “Microwave Engineering”, TMH, 2nd ed., 2008.
2. M.L. Sisodia, " Basic Microwave Techniques and Laboratory Manual”, New Age international Publishers, 2011.
3. Samuel Y Liao,“Microwave Devices & Circuits”, Prentice Hall of India, 2006.

OUTCOMES:

On completion of the course the students will be able to

- Identify the antenna based on the characteristics of radiation pattern.
- Determine the s parameters of microwave devices.
- Design a microwave system, components or process to meet desired needs within realistic constraints

- Apply the theoretical principles underlying microwave devices and network.
- Use the techniques, skills and modern engineering tools such as network analyzer and HFSS, for solving problems in microwave systems

ECC3204	EMBEDDED SYSTEM DESIGN LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To learn the concepts of programming on software tools for Microcontrollers
- To develop a program, simulate and debug 8051/PIC and ARM Microcontrollers
- To program serial ports and displays device with Microcontrollers
- To program on chip peripherals of ARM Controllers.
- To familiarize a real time operating system.
- To know the concepts of IOT

PRE-REQUISITES:

- Micro-processor and Micro-controller architecture and its interfacing mechanism.
- Basics of C language.

LIST OF EXPERIMENTS:

1. Design with 8051/PIC Microcontrollers - I/O Programming, Timer programming - Assembly and C Programming.
2. Serial port programming with 8051/ PIC Microcontrollers – Assembly and Embedded C language.
3. Program 16X2 LCD and 4X4 keypad interface with 8051/ PIC Microcontrollers – Embedded C Programming.
4. I/O port programming and Serial port programming using ARM LPC2148.
5. Program for Analog to Digital conversion (with on chip ADC) of ARM LPC2148 microcontroller.
6. Program CAN bus of ARM LPC2378 microcontroller
7. Graphical LCD interfacing with ARM Cortex-M3 LPC1768 microcontroller
8. Multitasking implementation using RTX-tiny Real Time Operating Systems.
9. Study and implementation of Internet of Things for real time application.

Total Hours –30

REFERENCES:

1. Michael J Pont, “Embedded C”, Pearson Education, 2007.
2. Mohamammad Ali Mazidi & Mazidi, “8051 Microcontroller and Embedded Systems” , Pearson Education, 2006.

OUTCOMES:

On completion of the course, students will be able to

- Develop and debug the programs using Keil µvision IDE.
- Design projects for I/O ports, timers, serial ports using 8051/ PIC Microcontrollers.
- Demonstrate Keypad and LCD interfacing with microcontroller.
- Develop the application based on on- chip peripherals and CAN bus of ARM family Microcontroller
- Develop a real time embedded application using 8051and ARM Microcontrollers.
- Design IOT based application using Raspberry PI boards.

SEMESTER VII

		L	T	P	C
ECC4101	**INTRODUCTION TO WIRELESS COMMUNICTION**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To introduce the aspects, needs and standards of modern wireless communications.
- To elaborate techniques for wireless channel modeling, and their performance over digital modulation.
- To give overview on advanced wireless techniques like OFDM and Spread Spectrums.

PRE-REQUISITES:

- Basics of communication theory and system

MODULE I INTRODUCTION TO WIRELESS COMMUNICATION 8

Overview of Wireless Communication – History, Types of services, Requirement for the Services, Current wireless systems, Wireless Spectrum and Standards.

MODULE II RADIO WAVE PROPAGATION

Path Loss and Shadowing – Free space Path loss – Ray tracing models, Emphrical Path loss Models, shadow fading, combined loss, outage probability, coverage area

MODULE III STATISTICAL MULTIPATH CHANNEL MODELS

Impulse response of channel, Narrow-band fading model and wide-band fading model, Discrete-time model, Space-Time channel models, Capacity of wireless AWGN channels, Flat-fading channels, and Frequency-selective fading channels

MODULE IV DIGITAL MODULATION OVER WIRELESS CHANNELS

Signal Space analysis, Geometric representation of signals, AWGN Channels, SNR, Error Probability for BPSK, QPSK, MPSK, MPAM, MQAM, FSK and CPFSK, Doppler Spread, ISI, Equalization techniques.

MODULE V CODING FOR WIRELESS CHANNELS

Linear Block Codes, Cyclic codes, Probability of Error for Hard Decision Decoding, convolutional codes, Viterbi algorithm, Turbo Codes, Low Density Parity Check Codes

MODULE VI MULTICARRIER MODULATION AND SPREAD SPECTRUM

Multicarrier Modulation with Overlapping Subchannels, Discrete implementation of Multicarrier, OFDM, Direct Sequence Spread Spectrum, RAKE recievers, Frequency-Hopping Spread Spectrum techniques and CDMA.

Total Hours –45

TEXT BOOKS:

1. Andrea Goldsmith, "Wireless Communications", 1st Edition, Cambridge University Press, 2005
2. Andreas F. Molisch , "Wireless Communications", 2nd Edition, Wiley IEEE, 2011

REFERENCES:

1. Theodore S. Rappaport, "Wireless Communications : Principles and Practice" 2nd Edition, Pearson India, 2010.
2. Simon Haykin, Michael Moher, "Modern Wireless Communication", 1st Edition, Pearson India, 2011.
3. Kamilo Feher, "Wireless Digital Communications: Modulation and Spread Spectrum Applications", 1st Edition, PHI Learning, 2009.

OUTCOMES:

On completion of the course the students will be able to

- Recognize various wireless communication services and modulation techniques.
- Classify channel models and signal models.
- Interpret the effects AWGN channel in discrete communication.
- Apply suitable coding techniques for a given discrete channel.
- Analyze the performance of common modulation techniques and coding techniques.
- Evaluate the benefits of different Spread-spectrum techniques and OFDM

ECC4102 OPTICAL COMMUNICATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To apply the principle and techniques of fiber optical communication.
- To distinguish various optical fiber modes, configurations and various signal degradation factors associated with optical fiber.
- To integrate optical source, optical detectors, Network Topologies and their application in optical Communication system.

PREREQUISITES:

- Basic knowledge in analog communication and digital communication, fundamental knowledge in Maxwell's equation.

MODULE I INTRODUCTION TO OPTICAL FIBERS 7

Element of an Optical Fiber Transmission link - Ray Optics - Optical Fiber Modes and Configurations - Mode theory of Circular Wave guides - Overview of Modes - Linearly Polarized Modes – Single Mode and Multimode mode Fibers - Graded Index fiber structure.

MODULE II SIGNAL DEGRADATION IN OPTICAL FIBERS 8

Attenuation - Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Wave guides - Information Capacity determination - Group Delay - Material Dispersion, Wave guide Dispersion, Signal distortion in SM fibers - Polarization Mode dispersion, Intermodal dispersion, Pulse Broadening in GI fibers - Mode Coupling - Design Optimization of SM fibers.

MODULE III FIBER OPTICAL SOURCES 8

Direct and indirect Band gap materials - Light source materials - LED structures, Quantum efficiency and LED power, Modulation of a LED, Laser Diodes - Modes and Threshold condition - Rate equations - External Quantum efficiency, Resonant frequencies - Laser Diodes structures and radiation patterns.

MODULE IV FIBER OPTICAL RECEIVERS 7

PIN and APD diodes - Photo detector noise, SNR, Detector Response time, Avalanche Multiplication Noise - Comparison of Photo detectors – Fundamental Receiver Operation.

MODULE V DIGITAL TRANMISSION SYSTEM 7

Point-to-Point links - System considerations - Fiber Splicing and connectors - Link Power budget - Rise-time budget - Noise Effects on System Performance

MODULE VI OPTICAL NETWORKS 8

Introduction to optical networking components-Basic networks-Network Topologies, Performance of passive linear Buses, Performance of star Architectures- Operational Principles of WDM, Erbium-doped fiber, Solitons, Basic concepts of SONET/SDH- Optical CDMA- Measurements- optical power meter- optical time domain reflectometer (OTDR).

Total Hours –45

TEXT BOOKS:

1. Gerd Keiser, "Optical Fiber Communication", 3rd Edition, McGraw-Hill International, Singapore, 2000.
2. J. Gowar, "Optical Communication System", Prentice Hall of India, 2001.
3. J. Senior, "Optical Communication, Principles and Practice", Prentice Hall of India, 3rd Edition, 2008

REFERENCES :

1. D. C. Agrawal , "Fiber Optic Communication", S.Chand& Co Ltd., 2005.
2. Rajiv Ramaswami and Kumar Sivarajan, "Optical Networks: A practical perspective", 2nd Edition, Morgan Kaufmann, 2001.

OUTCOMES:

On completion of the course, students will be able to

- Describe the basic elements in optical communication system.
- Identify and analyze the characteristics of optical fibers.
- Quantify, and understand the significance of dispersion and attenuation in optical fiber communications.
- Classify the characteristics of Optical sources and detectors.
- Design a real time fiber optic system based on link power and rise time budget.
- Analyze the optical network based on network topologies and optical power measurements**.**

ECC4103	OPTICAL COMMUNICATION LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To apply the principle and techniques of fiber optical communication.
- To distinguish various optical fiber modes, configurations and various signal degradation factors associated with optical fiber.
- To integrate optical source, optical detectors, Network Topologies and their application in optical Communication system.

PRE-REQUISITES:

- Basic knowledge in analog communication and digital communication, fundamental knowledge in Maxwell's equation.

LIST OF EXPERIMENTS:

1. To measure the numerical aperture (NA) of the different optical fiber.
2. Measurement of Mode field diameter of optical fiber.
3. Analysis of various parameters for step index fiber and graded index fibers using MATLAB.
4. Measuring optical power attenuation in plastic optical fiber.
5. Measuring optical power bending loss and coupling loss in plastic optical fiber.
6. To check the VI characteristic of LED.
7. Characteristics of LASER Diode.
8. Characteristics of APD
9. Describe the operational characteristics and parameters of Photodiode used as photo detector in fiber optic system.
10. Analysis of fiber optic power budget using MATLAB.
11. Power budget analysis of LASER and LED.
12. Measurement of Link Characteristics using OTDR

Total Hours –30

REFERENCES:

1. D. C. Agrawal , "Fiber Optic Communication", S.Chand& Co Ltd., 2005.
2. Rajiv Ramaswami and Kumar Sivarajan, "Optical Networks: A practical perspective", 2nd Edition, Morgan Kaufmann, 2001.
3. J. Senior, "Optical Communication, Principles and Practice", Prentice Hall of India, 3rd Edition, 2008.
4. Gerd Keiser, "Optical Fiber Communication", 3rd Edition, McGraw-Hill

International, Singapore, 2000.

OUTCOMES:

On completion of the course, students will be able to

- Describe the basic elements in optical communication system.
- Identify and analyze the characteristics of optical fibers.
- Quantify, and understand the significance of dispersion and attenuation in optical fiber communications.
- Classify the characteristics of Optical sources and detectors.
- Design a real time fiber optic system based on link power and rise time budget.
- Analyze the optical network based on network topologies and optical power measurements.

ECC4104	WIRELESS COMMUNICATION LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To familiarize mathematical modeling of wireless communication systems and channels.
- To evaluate the performance of wireless communication systems using software tools.
- To implement Filters and Equalizer for wireless digital communication

PRE-REQUISITES:

- Basics of communication theory and system

LIST OF EXPERIMENTS:

1. Modelling Digital Baseband Communication with noise.
2. Implementation of Matched Filter using Simulation tools
3. Study of EYE-Pattern variation with SNR & Bandwidth
4. Spectral Analysis of BPSK, QPSK, 16-PSK, FSK and QAM.
5. Implementation of Digital Communication Receiver with Hard Decision Decoding BER vs SNR for BPSK, QPSK, FSK
6. Direct Sequence Spread Spectrum communication
7. Modeling of Fading wireless channels.
8. Implementation of Equalization techniques
9. Implementation of OFDM

Total Hours –30

REFERENCES:

1. Andrea Goldsmith, “Wireless Communications”, 1st Edition, Cambridge University Press, 2005
2. Andreas F. Molisch , “Wireless Communications”, 2nd Edition, Wiley IEEE, 2011
3. Apurba Das, “Digital Communication - Principles & System Modelling”, Springer, 2010
4. Agam Kumar Tyagi, “Matlab and Simulink for Engineers”, Oxford University Press, 2012

OUTCOMES:

On completion of the course, students will be able to

- Classify the modulation schemes based on the applications

- Model wireless communication Systems and channels
- Implement suitable filters and Equalizers based on the system.
- Analyze the BER performance of various modulation schemes under AWGN and ISI
- Evaluate the performance of different Spread Spectrum techniques.
- Summarize the benefits of OFDM

ECC4105	INTERNSHIP/INDUSTRY TRAINING/ MINI PROJECT	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To improve the professional competency and research aptitude of students

GUIDELINES:

1. This mini project will help the students to develop the work practice to apply the design skills for solving real life problems.
2. The project can be an experimental project on any of the topics in electronics and communication.
3. The project work is allotted individually on different topics.
4. The students shall be encouraged to do their project in the parent institute itself.
5. Department will constitute an Evaluation Committee to review the project periodically.

Total Hours –30

OUTCOMES:

At the end of the project the student will be able to

- Design and analyze an electronic system
- Fabricate an electronic system/device in their area of interest
- Improve their presentation skills
- Improve the documentation skills.

SEMESTER VIII

		L	T	P	C
ECC4201	**PROJECT WORK**	**0**	**0**	**24**	**12**

OBJECTIVES:

- To develop the work practice of students
- To apply theoretical and practical tools/techniques
- To solve real life problems related to industry and current research
- To improve the skills on prototype development
- To improve the skills towards report/documentation preparation

GUIDELINES:

Project work can be a design project/experimental project and/or computer simulation project on any of the topics of Electronics and communication Engineering. The project work is allotted individually or a group of students not more than 3 on different topics. The students shall be encouraged to do their project work in the parent institute itself. If found essential (Industry oriented Projects), they may be permitted to continue their project outside the parent institute.

Department will constitute an Evaluation Committee to review the project work. The Evaluation committee consists of internal guide and experts in the specified area of the project. Project work consists of thesis work, two reviews of the work and the submission of project report. First review would highlight the topic, objectives, methodology and expected results. Second review evaluates the progress of the work, draft of the project report and demo of the prototype model.

OUTCOMES:

At the end of the project the student will be able to

- Learn the tool required for the design, analysis of their preliminary work.
- Select the specific devices for different application along with justification.
- Apply the practical knowledge while solving real time problems
- Incorporate cost effective and efficient project models.
- Conclude the subject knowledge through proto type models.
- Prepare an appropriate documentation.

PROFESSIONAL ELECTIVES

ECCX01	DIGITAL SYSTEM DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To identify the principles involved in the design of asynchronous sequential circuits to match industry standards.
- To gain knowledge in the design of asynchronous sequential circuits, fault modelling and simulation.
- Students will gain knowledge in designing memory devices.
- Students will be able to design circuits using PLDs.
- The students will gain knowledge in system verilog programming.

MODULE I ASYNCHRONOUS SEQUENTIAL CIRCUIT DESIGN 7

Analysis of Asynchronous Sequential Circuit (ASC) – Flow Table Reduction – Races in ASC – State Assignment Problem and the Transition Table – Design of ASC – Static and Dynamic Hazards – Essential Hazards – Designing vending Machine Controller – Mixed Operating Mode Asynchronous Circuits

MODULE II STATE MACHINE CHARTS 6

SM Chart - derivation of SM Chart- SM chart for Binary Multiplier, Realization of SM Chart.

MODULE III NEW GENERATION PROGRAMMABLE LOGIC DEVICES 8

ROM- Internal ROM structure – Implementation of Boolean functions using ROM- Design of Sequential circuits using ROM, PROM – Realization State machine using PLD, PAL, PLA, Programmable Gate Arrays, Programmable Logic sequencer, Field Programmable Gate Array Families.

MODULE IV FAULT MODELING 7

Logical fault model, Fault detection & Redundancy in combinational, sequential circuits, Fault Equivalence and Fault location in Combinational & sequential Circuits. Single stuck fault model, Multiple stuck fault model.

MODULE V FAULT TESTING 8

Basic issues, Automatic test generator for single stuck fault in combinational circuits,D Algorithm, Path oriented Decision Making Algorithm, ATG systems, Test set

compaction

MODULE VI SYSTEM DESIGN USING VERILOG 9

Hardware Modelling with Verilog, Realization of combinational and sequential circuits using Verilog – Registers – counters – sequential machine – serial adder – Multiplier-Divider – Design of simple microprocessor, Synthesis of Finite State Machines.

Total Hours –45

TEXT BOOKS:

1. Donald G. Givone, “Digital principles and Design”, Tata McGraw Hill, 2002.
2. Stephen Brown and ZvonkVranesic, “Fundamentals of Digital Logic with Verilog Design”, Tata McGraw Hill, 2002.
3. Parag K Lala, “Digital System design using PLD”, BS Publications, 2003.
4. John M Yarbrough, “Digital Logic applications and Design”, Thomson Learning, 2001.

REFERENCES:

1. Nripendra N Biswas, “Logic Design Theory”, Prentice Hall of India, 2001.
2. Charles H. Roth Jr., “Fundamentals of Logic design”, Thomson Learning, 2004.
3. Digital Logic Design, IV edition, Brian Holdsworth, Clive Woods, Elesevier, 2008.
4. Michael D Ciletti, “Advanced Digital Design with the Verilog HDL”, PHI, 2008.

OUTCOMES:

- Analyze asynchronous sequential circuits and design simple asynchronous digital system for the given specifications.
- Make use of state machines and ASM charts for the given design requirements.
- Select and use appropriate PLDs to realize digital systems based on the requirements.
- Test the faults in the digital circuits using stuck at fault models.
- Generate test vectors using ATPG algorithms and analyze its performance.
- Apply digital system design principles and make projects based on the requirements using verilog HDL.

ECCX02 COMPUTER ARCHITECTURE

L	T	P	C
3	0	0	3

OBJECTIVES:

- To acquaint students with the basic hardware components and performance measure of computers
- To study the algorithms & implementation of arithmetic for Computer
- To understand the concepts of pipelining and the hierarchy of memory system
- To impart knowledge on Parallel Processors and networking

MODULE I COMPUTER ABSTRACTIONS AND TECHNOLOGY 9

Introduction - Eight Great Ideas in Computer Architecture - Below Your Program - Technologies for Building Processors and Memory – Performance - The Power Wall - Switch from Uniprocessors to Multiprocessors - Fallacies and Pitfalls

MODULE II LANGUAGE OF THE COMPUTER 9

Operations and Operands of computer hardware – Signed and Unsigned Numbers - Representing Instructions in the Computer – Instruction and instruction sequencing - Addressing modes - Stacks and queues - A translation hierarchy for C.

MODULE III ARITHMETIC ALGORITHMS FOR COMPUTERS 8

Algorithms : Addition and Subtraction – Multiplication – Division - Floating Point operations

MODULE IV PROCESSING UNIT AND PIPELINING CONCEPTS 7

Fundamental concepts - Hardwired control - Microprogrammed control- Nano Programming - Pipelining - Basic concepts - Data hazards - Instruction hazards - Superscalar operation

MODULE V EXPLOITING MEMORY HIERARCHY 7

Basic concepts - Semiconductor RAMs, ROMs ,Speed, size and cost - Associative memory - Cache memories - Virtual memory - Memory Management requirements - Secondary storage.

MODULE VI PARALLEL PROCESSORS FROM CLIENT TO CLOUD 5

Introduction - Categorization of parallel hardware - Introduction to Multiprocessor Network Topologies - Communicating to the Outside World: Cluster Networking.

Total Hours –45

TEXT BOOKS:

1. D A Patterson & J L Hennessy, Computer Organization and Design: The hardware/software interface, Morgan-Kaufmann (Fifth edition) 2013.
2. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, "Computer Organization" 5th Edition, McGraw Hill, 2002.
3. Morris Mano, "Computer System Architecture", 3rd Edition, PHI, 2001.

REFERENCES:

1. William Stallings, "Computer Organization & Architecture - Designing for Performance", 6th Edition, Pearson Education, 2003 reprint.
2. David A.Patterson and John L.Hennessy, "Computer Organization & Design, the hardware / software interface", 2nd Edition, Morgan Kaufmann, 2002 reprint.
3. John P.Hayes, "Computer Architecture & Organization", 3rd Edition, McGraw-Hill, 1998.

OUTCOMES:

On completion of the course the students will be able to

- Analyze and evaluate the performance of a system.
- Identify addressing modes and describe the language of a computer.
- Demonstrate how to add and multiply integers and floating-point numbers using two’s complement.
- Design and emulate a single cycle or pipelined CPU and handle different types of hazards.
- Explain the wide variety of memory technologies and learn partitioning of memory.
- Use different techniques to create and use parallelism.

ECCX03	CONTROL SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the modeling of control systems.
- To analyze the properties of control system in time domain & frequency domain.
- To design feedback controllers and compensators
- To analyze the stability of the control system.
- To introduce state variable representation of physical systems and study the effect of state feedback
- To introduce the modern tool such MATLAB for analyzing the system.

MODULE I CONTROL SYSTEM MODELING 8

Basic Elements of Control System – Open loop and Closed loop systems - Differential equation - Transfer function, Modeling of Electric systems, Translational and rotational mechanical systems - Block diagram reduction Techniques - Signal flow graph

MODULE II TIME RESPONSE ANALYSIS 8

Time response analysis - First Order Systems - Impulse and Step Response analysis of second order systems - Steady state errors – P, PI, PD and PID Compensation, Analysis using MATLAB

MODULE III FREQUENCY RESPONSE ANALYSIS 8

Frequency Response - Bode Plot, Polar Plot, Nyquist Plot - Frequency Domain specifications from the plots - Constant M and N Circles - Nichol‟s Chart - Use of Nichol‟s Chart in Control System Analysis

MODULE IV STABILITY ANALYSIS 7

Stability, Routh-Hurwitz Criterion, Root Locus Technique, Construction of Root Locus, Stability, Dominant Poles, Application of Root Locus Diagram - Nyquist Stability Criterion - Relative Stability, Analysis using MATLAB

MODULE V STATE VARIABLE ANALYSIS 7

State space representation of Continuous Time systems – State equations – Transfer function from State Variable Representation – Solutions of the state equations - Concepts of Controllability and Observability – State space representation for Discrete time systems. Sampled Data control systems – Sampling Theorem – Sampler & Hold

– Open loop & Closed loop sampled data systems

MODULE VI DESIGN OF COMPENSATORS 7

Series, Parallel, series-parallel Compensators - Lead, Lag, and Lead Lag Compensators, Analysis using MATLAB.

Total Hours –45

TEXT BOOKS:

1. Farid Golnaraghi, Benjamin C. Kuo," Automatic Control Systems", McGraw Hill Professional, Tenth Edition , 2017.
2. Katsuhiko Ogata," Modern Control Engineering" Prentice Hall, 5e, 2010.
3. J. Nagrath, M. Gopal Control Systems Engineering, Anshan, 5e, 2008.

REFERENCES:

1. William S. Levine, "The Control Handbook, Second Edition: Control System Fundamentals "CRC Press, 2010.
2. Jesus C. De Sosa, "Control Systems: Analysis and Realization ", iUniverse, 2010

OUTCOMES:

On completion of the course the students will be able to

- develop mathematical models of control components and systems
- design controllers for systems
- analyze the system in time and frequency domain
- use the Root Locus method, Routh Hurwitz array and Nyquist stability criterion to find stability of a system
- obtain and manipulate state space representation of systems
- use techniques and skills of system control using modern tool such as matlab

ECCX04	BIO MEDICAL ELECTRONICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the application of biomedical sensors.
- To analyze different instruments to measure bio signals like EEG, ECG, and EMG.
- To explain the working of different medical instruments, Therapeutic Instruments and their use in physiological measurements.

MODULE I SOURCES OF BIOELECTRIC POTENTIALS 8

Introduction to bio potentials-Resting & Action potentials, propagation of active potential, The Bioelectric potentials – ECG, EEG, EMG and Evoked responses

MODULE II TRANSDUCERS & ELECTRODES 8

Transducers & Transduction principles-Active transducers- Passive Transducers- Biochemical Transducers- Transducer for Biomedical Applications.

Electrode theory- Bio potential Electrodes – Microelectrodes- Body surface electrodes- Needle Electrodes- Reference electrodes- PH electrodes- Blood gas electrodes.

MODULE III MONITOR AND RECORDERS 5

Bio potential amplifiers, recorders, monitors, Galvanometric, potentiometric, ultra violet, electrostatic, ink jet recorder video monitors, color printers, Electro Physiological recorders

MODULE IV BIO SIGNAL MEASUREMENTS 8

Neuronal communication, EPSP & IPSP, Neuronal firing measurements, EEG-block diagram, various Rythms, EEG in diagnostics, EMG -principles and applications. ECG-principles and clinical applications.

MODULE V OPHTHALMOLOGY INSTRUMENTS 8

Electro retinogram, Electrooculogram, Opthalmoscope, Tonometer for eye pressure measurement.

MODULE VI THERAPEUTIC INSTRUMENTS 8

Diathermy, Defibrillator, cardiac pacemaker, stimulators, Laser applications in

machine, X-Rays production & use, Radiographic Diagnostic and Therapeutic, Film construction and processing, Interaction with body. Fundamentals of radiation therapy.

Total Hours –45

TEXT BOOKS:

1. Khandpur, R.S., "Handbook of Biomedical Instrumentation", Tata McGraw-Hill, New Delhi, 2014.
2. Willis J.Tompkins,"Biomedical digital signal processing", Prentice Hall of India, New Delhi, 2000
3. Leislie Cromwell, "Biomedical instrumentation and measurement", Prentice Hall of India, New Delhi, 2013.

REFERENCES:

1. W.F. Ganong / Review of Medical Physiology / 25th Asian Ed. / Medical Publishers, -2015
2. J. G. Webestered / Medical Insturmentation / Houghton Mifflin, Fourth edition,2010
3. A. M. Cook and J. G. Webester, eds / Therapeutic Medical Devices / PHI, 2009

OUTCOMES:

On completion of the course the students will be able to

- Characterize various sources of bio signals.
- Identify the transducers and electrodes used for brain, heart, muscles diagnosis.
- Discuss the various recorders in clinical applications.
- Analyze EEG,ECG & EMG signal.
- Describe the Ophthalmology Instruments for eye pressure measurements
- Apply modern therapeutic Instruments for diagnosis and treatments

ECCX05 IMAGE PROCESSING

L	T	P	C
2	0	2	3

OBJECTIVES:

- Describe basic principles of digital image processing and its performance parameters
- Design and implement algorithms that perform basic image processing
- Design and implement algorithms for advanced image analysis
- Use appropriate algorithm for different image processing applications

MODULE I DIGITAL IMAGE FUNDAMENTALS 5

Difference between Analog and Digital image, Components of Image Processing System, Elements of Visual Perception, Image Sampling & Quantization, Spatial and Gray Level Resolution, Basic Relationships between Pixels. Performance parameters-Measures and their significance- Mean, variance, PSNR, correlation. Fundamentals of color image processing: color models- RGB, CMY, HIS.

MODULE II IMAGE ENHANCEMENT 5

Image Enhancement techniques overview- Histogram of an image-Histogram equalization-Spatial and frequency domain-Low pass and High pass filters.

MODULE III IMAGE TRANSFORMS 5

Significance of image transforms – Classifications-2D DFT,DCT, Hadamard and Haar transform

MODULE IV IMAGE SEGMENTATION AND RESTORATION 6

Morphological Image Processing: Dilation, Erosion, Opening, Closing on Binary Images, Segmentation: Point, line edge detection, boundary and thresholding, Segmentation types, Restoration: Image Degradation Model, Unconstrained and constrained restoration

MODULE V IMAGE COMPRESSION 4

Need of image compression-Compression ratio-Compression types-Lossless and lossy compression techniques.

MODULE VI IMAGE PROCESSING APPLICATIONS 5

Applications using different Imaging modalities such as Satellite Imaging, Medical imaging etc. Applications in Biometrics and security.

Practicals :

1. Read, write and displaying images
2. Image sampling and quantization
3. Extraction of basic color components from an image
4. Histogram of a low contrast, high contrast and good contrast image
5. Histogram equalization
6. Image filtering using LPF and HPF
7. DFT of an image
8. Haar transform of an image
9. Dilation, Erosion, opening and closing of binary image
10. Point,line and edge detection of an image
11. Image compression using lossless technique and find its compression ratio
12. Image compression using lossy technique and find its compression ratio
13. Extracting Agricultural fields from satellite images
14. Enhancing X-ray images
15. Fingerprint recognition

L – 30; P– 30; Total Hours –60

TEXT BOOKS:

1. Gonzalez and Woods, "Digital Image Processing", 3rd Edition, Pearson Education, 2016.
2. Anil. K. Jain, "Fundamentals of Digital Image Processing"; 4th Edition, PHI, 2007
3. Gonzalez, Woods and Eddins, “Digital Image Processing using MATLAB”, Tata McGraw Hill Education,2nd edition,2017

REFERENCES:

1. Pratt William, "Digital Image Processing", John Wiley & Sons, 2007.
2. Jayaraman, S.Essakirajan and T.Veerakumar “Digital Image Processing”, Tata McGraw Hill Education,5th edition,2015
3. Arthur Weeks Jr., "Fundamentals of Digital Image Processing", PHI, 2006.

OUTCOMES:

On completion of the course the students will be able to

- Explain the fundamental concepts and performance parameters of digital image processing.
- Recognize & apply various image enhancement techniques.
- Apply various transforms for image processing

- Apply various techniques for image segmentation and restoration.
- Identify and use appropriate image compression techniques
- Apply suitable image processing techniques in different applications

ECCX06	ADVANCED MICROPROCESSORS AND MICROCONTROLLERS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study about Pentium Processor and its programming
- To learn about the functioning of PIC Microcontroller.
- To learn about the interfacing of PIC Microcontroller.
- To study the ARM RISC architecture and its programming.

MODULE I HIGH PERFORMANCE ARCHITECTURE – PENTIUM 8

CPU Architecture- Bus Operations – Pipelining – Branch predication – floating point unit- Pentium memory management.

MODULE II INTRODUCTION TO MULTICORE ARCHITECTURE 7

State of computing – Multiprocessor and Multicomputer – Multivector and SIMD Computer –Performance Metrics and Measures- Speedup Performance Laws

MODULE III PIC MICROCONTROLLER CPU 8

CPU Architecture - Instruction set - interrupts - Assembly language programming and introduction to C-Compilers.

MODULE IV PIC COMMUNICATION INTERFACE 7

Timers- I2C Interfacing - UART- A/D Converter -PWM and Introduction to C-Compilers.

MODULE V ARM ARCHITECTURE 7

Organization of CPU - Bus architecture -Memory management unit - ARM instruction sets - addressing modes - Programming the ARM processor

MODULE VI HIGH PERFORMANCE RISC ARCHITECTURE ARM 8

Exception handling – Interrupts – Interrupt handling schemes- Firmware and bootloader – Application of ARM Processor.

Total Hours –45

TEXT BOOKS:

1. James L.Antonakos ,” An Introduction to the Intel family of Microprocessors ‘’ Pearson Education 1999.
2. Kai Hwang, “Advanced Computer Architecture”, Tata McGraw-Hill Education,

2011.
3. James L. Antonakos , “ The Pentium Microprocessor ‘’ Pearson Education , 1997.
4. Steve Furber , ‘’ ARM System –On –Chip architecture “Addision Wesley , 2000.
5. Andrew N.Sloss, Dominic Symes and Chris Wright “ARM System Developer’s Guide: Designing and Optimizing System Software”, First edition, Morgan Kaufmann Publishers, 2004.

REFERENCES:

1. Gene .H.Miller.” Micro Computer Engineering,” Pearson Education, 2003.
2. John .B.Peatman, “Design with PIC Microcontroller, Prentice hall, 1997.
3. Valvano "Embedded Microcomputer Systems" Thomson Asia PVT LTD first reprint 2001.
4. Barry.B.Breg,” The Intel Microprocessors Architecture, Programming and Interfacing”, PHI, 2002.

OUTCOMES:

On completion of the course the students will be able to

- Categorize the CISC and identify the addressing modes for various instructions of advanced microprocessors
- Develop an algorithm and write programs for PENTIUM.
- Develop an algorithm and write programs for PIC.
- Interface peripheral devices with PIC microcontroller.
- Explain the architecture and programming of ARM processor.
- Design a ARM development board.

ECCX07	PCB DESIGN	L	T	P	C
		1	0	2	2

OBJECTIVES:

- To familiarize with basics of PCB components.
- To study about Pspice for circuit analyze
- To learn about schematic design.
- To evaluate Design rule check and prepare footprint.
- To design layout and generate art files.
- To Fabricate the PCB, assemble the components and test the PCB.

MODULE I BASICS OF PCB AND SCHEMATIC DESIGN 7

PCB components – SMD and through hole components, Circuit analysis – Pspice, Schematic design - Design rule check. Footprint design, Net list generation

1. Schematic circuit design
2. New symbol creation.
3. Pspice Simulation
4. Foot print creation
5. Design rule check and Net list generation

MODULE II PCB LAYOUT DESIGN AND MANUFACTURING PROCESS 6

Classification of PCB, Layer design, General layout - rules and parameters - PCB design rules for digital and analog circuits, Art file Generation.

1. Layout design constrains
2. Components placement
3. Board routing
4. Design rule check
5. Art file generation.

MODULE III PCB FABRICATION USING MILLING MACHINE AND ASSEMBLY 2

Fabrication and testing of five Volt power supply board, Fabrication and testing of half adder and full adder circuit, Fabrication and testing of Half wave rectifier circuit.

L – 15; P-30 ;Total Hours –45

TEXT BOOKS:

1. Walter C Bosshart , ‘’ Printed Circuit Boards, Design and Technology ” McGraw Hill.Inc., 2009
2. Khandpur R.S, ‘’ Printed Circuit Boards, Design, Fabrication and Assembly” McGraw Hill.Inc.,

REFERENCES:

1. Clyde F.Coombs,Jr., and Happy T.Holden,“Printed Circuits Handbook”Tata Mc.Graw Hill Education,seventh Edition.
2. Kraig Mitzner “Complete PCB Design Using OrCAD Capture and PCB Editor” Newnes, 2009
3. IPC 2221 standards
4. Pspice.com for component models and libraries

OUTCOMES:

On completion of the course the students will be able to

- Categorize the SMD components and PTH components with different packages
- Understand circuit design process and different machines used for designing.
- Design pads and footprint for new symbols.
- Design, place components and trouble shoot the errors.
- Etch the traces for final PCB and Produce art files for fabrication.
- Fabricate the board and test the circuit by assembling the components

ECCX08	DATA STRUCTURE AND ITS ALGORITHMS	L	T	P	C
		1	0	2	2

OBJECTIVES:

- To introduce the fundamental concepts of data structure.
- To understand the basic operations of stacks and queues for real time scenario.
- To comprehend the significance of sorting algorithms.
- To demonstrate the understanding of various searching algorithms.

MODULE I BASICS OF DATA STRUCTURES 5

Introduction to Data Structures-Data Structure Operations- Algorithm: complexity, Time- space tradeoff- Linked lists-Representation of linked lists in Memory- Traversing a linked list, Searching a linked list- insertion into linked list, Deletion from a linked list- Types of linked list: Singly Linked Lists – Doubly Linked Lists – Circular List

MODULE II STACK ,QUEUES & TREES 5

Introduction, Array Representation of Stack-Operations on Stack: Infix, prefix and postfix notations-Application of stack, Queue- Array Representation of Queue- Trees: Definitions and Concepts- Operations on Binary Trees, Representation of binary tree –Tree Traversal.

MODULE III GRAPHS: SEARCHING TECHNIQUES ELEMENTARY ALGORITHMS 5

Graphs: Matrix Representation of Graphs, Breadth First Search, Depth First Search, - Searching Techniques: Sequential Searching, Binary Searching, Search Trees, Sorting: Introduction, O notation, Exchange sort- Bubble sort, Quick sort- Elementary Algorithms: Characteristics of an Algorithm; Building Blocks of Algorithms- Outline of Algorithms

PRACTICALS :

1. Write a C program to implement the doubly linked list.
2. Write a C program to implement the Circular list.
3. Write a C program to implement the tower of Hanoi.
4. Write a C program to demonstrate the working of stack, of size N using Array. The program should check overflow and underflow also.

5. Write a C program to demonstrate the working of queue, of size N using Array. The program should check the queue status for empty and full.
6. Write a C program to convert the given expression from infix to postfix.
7. Write a C program to search for an element in an array using binary search.
8. Write a C program to sort a list of n elements using bubble sort.
9. Write a C program to sort a list of n elements using quick sort.

L – 15; P – 30; Total Hours –45

TEXT BOOKS:

1. Horowitz, Sahni, Anderson- Freed , “Fundamentals of Data Structures in C” , , 2nd edition, Universities Press,2008.
2. A.M.Tennenbaum, Y.Langsam and M.J.Augenstein , “Data Structures using C”, PHI, Pearson education 1991.
3.

REFERENCES:

1. Rajesh K. Shukla , “Data Structures Using C & C++”, Wiley- India,1st edition 2009.
2. Data Structures Using C, ISRD Group, Second Edition, Tata McGraw-Hill, First reprint 2007.
3. Balagurusamy, “Data Structure Using C” , McGraw Hill Education; First edition, July 2017
4. C & Data Structures, Prof. P.S. Deshpande, Prof. O.G. Kakde, Dreamtech press.

OUTCOMES:

On completion of the course the students will be able to

- Describe common applications for arrays.
- Compare between different data structures. Pick an appropriate data structure for a design situation.
- Apply linear and non-linear data structures like stacks, queues, linked list etc.
- Analyse, evaluate and choose appropriate abstract data types and algorithms to solve particular problems.
- Analyze and evaluate the efficiency of various sorting algorithms including exchange sort, bubble sort and quicksort.
- Formulate new solutions for programming problems or improve existing code using learned algorithms and data structures.

ECCX09	JAVA PROGRAMMING	L	T	P	C
		1	0	0	1

OBJECTIVES:

- To introduce the concept of OOPS
- To familiarize core Java concepts.
- To apply standard Java API's in programming
-

MODULE I INTRODUCTION TO JAVA 2

Introduction to Object Oriented Programming, Java Virtual Machine, Java Bytecode, Overview of Java API's.

MODULE II BASIC JAVA LANGUAGE 4

Keywords, literals, lexical tokens, data types, variables and arrays, operators, control statements

MODULE III CLASSES AND OBJECTS 5

Class fundamentals, constructors & methods, Object reference, access control and modifiers, inheritance and method overloading, package and interfaces, standard java library.

MODULE IV EXCEPTION HANDLING, MULTI THREADING & IO 4

Use of try, catch, finally, throw and throws keywords. User defined exceptions. Java Thread, thread life-cycle, priorities and thread synchronization. Standard java.io library.

Total Hours –15

TEXT BOOKS:

1. Herbert Schildt, "Java: The Complete Reference", 8th Edition, McGraw Hill Education, 2011.

REFERENCES:

1. Robert Sedgewick and Kevin Wayne, "Introduction to Programming in Java: An Interdisciplinary Approach", 1st Edition, Pearson India, 2014.
2. C Thomas Wu, "An Introduction to Object-Oriented Programming with Java", 4th Edition, McGraw Hill Education, 2010.
3. Cay S. Horstmann, "Core Java: Volume I: Fundamentals", 10th Edition, Pearson Education, 2016.

OUTCOMES:

On completion of the course the students will be able to

- Write, compile and execute simple Java program.
- Recognize data types, classes and objects in a Java program
- Interpret the functionalities of inheritance, overloading and overriding
- Construct Java programs that could handle exceptions.
- Decide on the appropriate standard library class for applications.
- Develop multi-threaded Java programs

ECCX10 MATLAB PROGRAMMING L T P C
1 0 0 1

OBJECTIVES:

- To practice the MATLAB environment and learn programming fundamentals
- To develop skill to write Programs using commands and functions
- To use MATLAB in engineering applications

MODULE I AN OVERVIEW OF MATLAB 7

MATLAB environment - Command Window- History- Workspace-Current Directory-Figure window- Edit window-Shortcuts-Help files-Data types-Constants and Variables- Character constants- operators- Assignment statements-Control Structures: For loops, While, If control structures, Switch, Break, Continue statements.

MODULE II OPERATIONS IN MATLAB 8

Input Output functions-Reading and Storing Data-Vectors and Matrices- Matrix Manipulations- Arithmetic operations on Matrices, Relational operations on Matrices, and Logical operations on Matrices- Polynomial Evaluation- Roots of Polynomial- Arithmetic operations on Polynomials- Graphics: 2D plots, Printing labels, Grid & Axes box, Text in plot, Bar and Pie chart- Applications of MATLAB in engineering.

Total Hours –15

TEXT BOOKS:

1. Bansal R.K, Goel A.K, Sharma M.K, “MATLAB and its Applications in Engineering”, Pearson Education, 2012
2. MATLAB for Electrical and Computer Engineering Students and Professionals, with Simulink, R. Priemer, SciTech Pub, 2013, ISBN: 978-1-61353-188-4.

REFERENCES:

1. Amos Gilat, “MATLAB-An Introduction with Applications”, Wiley India, 2009.
2. Stephen J Chapman, “Programming in MATLAB for Engineers”, Cengage Learning, 2011.

OUTCOMES:

On completion of the course the students will be able to

- Write simple program modules to implement algorithms
- Calculate solutions to engineering problems
- Test program output for accuracy using hand calculations and debugging techniques
- Synthesize multiple program modules into larger program packages

ECCX11 INTRODUCTION TO ASIC DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- The concept of semicustom and programmable ASIC types.
- The fundamentals of digital logic design and the physical features of each ASIC.
- ASIC logic design, partitioning, floor planning, placement, and routing.

MODULE I INTRODUCTION TO CMOS 6

CMOS transistors- process, CMOS current equation- CMOS inverter characteristics and Design rules.

MODULE II INTRODUCTION TO ASICs 7

ASIC introduction - advantages- Types of ASICs - Full Custom, Semi custom and programmable ASICs- ASIC Design flow.

MODULE III CMOS LOGIC DESIGN AND ASIC LIBRARY DESIGN 8

CMOS Combinational Logic Cell - Sequential logic cell - Data path logic cell - Transistors as Resistors - Transistor Parasitic Capacitance.

MODULE IV PROGRAMMABLE ASICs AND LOGIC CELLS 8

Anti fuse - static RAM - EPROM and EEPROM technology - PREP benchmarks - Actel ACT - Xilinx LCA -Altera FLEX - Altera MAX.

MODULE V PROGRAMMABLE ASIC INTERCONNECT 8

Actel ACT -Xilinx LCA - Xilinx EPLD - Altera MAX 5000 and 7000 – Altera MAX9000 - Altera FLEX.

MODULE VI PARTITIONING, FLOOR PLANNING, PLACEMENT & ROUTING 8

Partitioning methods - floor planning - placement - global routing - detailed routing.

Total Hours –45

TEXT BOOKS:

1. M.J.S .Smith, "Application Specific Integrated Circuits", Addison -Wesley Longman Inc., 2001.
2. Andrew Brown, "VLSI Circuits and Systems in Silicon", McGraw Hill, 1991
3. S.D. Brown, R.J. Francis, J. Rox, Z.G. Vranesic, "Field Programmable Gate

Arrays", Kluwer Academic Publishers, 1992.

REFERENCES:

1. Mohammed Ismail and Terri Fiez, "Analog VLSI Signal and Information Processing", McGraw Hill, 1994.
2. S. Y. Kung, H. J. White House, T. Kailath, "VLSI and Modern Signal Processing", Prentice Hall, 1985.
3. Jose E. France, Yannis Tsividis, "Design of Analog & Digital VLSI Circuits for Telecommunication and Signal Processing", Prentice Hall, 1994.

OUTCOMES:

On completion of the course the students will be able to

- Apply the appropriate layout rules while carrying transistor level circuit design.
- Interpret appropriate ASIC types based on application and requirements.
- Design data path circuits required for ASIC chip.
- Illustrate required types of programming technologies as well as logic cells based on applications.
- Choose type of interconnects required for the ASIC chip.
- Select appropriate algorithm to perform back end design such as partitioning, floor planning, placement & routing.

ECCX12 BIOMEDICAL SIGNAL PROCESSING L T P C
3 0 0 3

OBJECTIVES:

- To explain the methods of recording various bio-potentials.
- To introduce the processing techniques of biomedical signals and parameter detection
- To discuss recent techniques in bio medical signal processing
- To introduce modern industrial biomedical applications

PREREQUISITES:

- Basic knowledge about signals and systems
- Fundamentals of signal processing

MODULE I INTRODUCTION TO BIOMEDICAL SIGNALS 6

The origin of Bio-potentials-l -ECG, EEG, ENG,EMG, PCG, EOG- - Typical waveforms and signal characteristics.

MODULE II PROCESSING OF BIOMEDICAL SIGNAL 9

Processing of Random & Stochastic signals - spectral estimation - Properties and effects of noise in biomedical signals - Filtering of biomedical signals- Detection of biomedical signals in noise.

MODULE III ANALYSIS OF ECG 10

High-frequency noise in the ECG. Motion artifact in the ECG -.Power-line interference in ECG signals - Maternal interference in fetal ECG- ECG parameters estimation -Direct data compression techniques- Direct ECG data compression techniques- Transformation compression techniques-MATLAB Simulation of analyzing ECG.

MODULE IV ANALYSIS OF EEG 10

EEG rhythms & waveform - EEG applications-Epilepsy-sleep disorders-brain computer interface-Modeling EEG- linear, stochastic models - Non linear modeling of EEG - artifacts in EEG & their characteristics and processing - Model based spectral analysis - EEG segmentation - Joint Time-Frequency analysis - correlation analysis of EEG channels - coherence analysis of EEG channels.

MODULE V BIO-TELEMETRY 5

Telemetry principles- Frequency selection- Bio-telemetry- Radio-pill and Tele-stimulation-

MODULE VI BIOMEDICAL APPLICATIONS 5

Case Study HL7 Protocol- Patient Monitoring System - Nano medicine and application.

TOTAL HOURS 45

TEXT BOOKS

1. Rangaraj M. Rangayyan, “Bio medical signal analysis. A case study approach”, Wiley-IEEE Press June 2015
2. D.C.Reddy, "Biomedical Signal Processing: Principles and techniques", Tata McGraw Hill, New Delhi, 2005

REFERENCES

1. Khandpur, R.S., "Handbook of Biomedical Instrumentation", Tata McGraw-Hill, New Delhi, 2014.
2. Joseph J.Carr and John M.Brown, "Introduction to Biomedical equipment Technology", John Wiley and Sons, New York, 2001.
3. Leislie Cromwell, "Biomedical instrumentation and measurement", Prentice Hall of India, New Delhi, 2013.
4. Willis J.Tompkins,”Biomedical digital signal processing”, Prentice Hall of India, New Delhi, 2000

OUTCOMES:

On completion of the course, students will be able to

1. Describe the characteristics of various Bio medical signals.
2. Discuss the properties and effects of noise in biomedical signals
3. Design filters for biomedical signals .
4. Analyze the ECG signals and its compression techniques.
5. Analyze the EEG signals
6. Summarize the biotelemetry and modern technologies in hospital applications.

ECCX13	TELECOMMUNICATION SWITCHING NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Various Telecommunication systems and networks.
- Understand the concept in PSTN communication
- Understand the various switching and signalling techniques
- Analyze the concepts in network traffic and its engineering
- Identify the applications of telecom networks

MODULE I TELECOMMUNICATION CONCEPTS 7

Introductory concepts of Telecommunication, Quality of Service, Standardization in Telecommunications, Tele Transmission types,

MODULE II PUBLIC SWITCHING TELEPHONE NETWORK 8

Makeup of the PSTN, Design of Long-Distance Networks, Traffic Routing in a National Network, Transmission Factors in Long-Distance Telephony, Fiber Optic Communication Links, LAN- Types,

MODULE III SWITCHING TECHNIQUES 8

Introduction to Switching techniques-Message and Packet Switching-, Voice Telephony, operation of telephone subset, Subscriber Loop Design, Design of Local Area Wire-Pair Trunks (Junctions), VF Repeaters (Amplifiers), Long-Distance PCM Transmission, Digital Switching, Digital Loop Carrier

MODULE IV SIGNALLING 7

Signaling, Signaling Techniques, Concepts of Link by Link and End to End signaling, Effects of numbering on signaling

MODULE V TRAFFIC ENGINEERING 8

Network traffic and load parameters, Grade of service and blocking probability, Modeling of Switching system, Traffic and time characterization, Blocking Models and delay systems

MODULE VI TELECOM NETWORKS 7

Overview of communication Networks- Communication process and Layered Architecture and Standards, ISDN,ATM,SONET

Total Hours –45

TEXT BOOKS:

1. Fundamentals of Telecommunications, Roger L. Freeman, A Wiley-Interscience publication, fourth edition, JOHN WILEY & SONS, INC. New York
2. Communication Networks Fundamental Concepts And Key Architectures 2nd Edition, Alberto Leon-Garcia, Tata Mc Graw-Hill publishing company limited, New Delhi,2004 edition.
3. Telecommunication Switching Systems and Networks , Thiagarajan Viswanathan, Manav , Second edition,2015,PHI learning PVT Ltd.

REFERENCES:

1. Telecommunications Engineer's Reference Book,Edited By Fraidoon Mazda,Butterworth Heimann Limited,Part of Reed International Books.
2. Telecommunication Switching, Traffic And Networks, J.E.Flood, Pearson Education, Second Impression 2007.
3. Network Routing Algorithms, Protocols And Architechtures, Deepankar Medhi, Karthikeyan Ramasamy, Elseiver Publication 2007.

OUTCOMES:

On completion of the course the students will be able to

- Explain the telecommunication concept
- Differentiate PSTN from other networks.
- Describe the switching types
- Compute traffic in a telecom network
- Explain the signaling techniques
- Apply suitable network for suitable system.

ECCX14	ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide knowledge of Artificial Intelligence systems and its application
- To describe various knowledge representation techniques.
- To formulate machine learning problems corresponding to different applications

MODULE I ARTIFICIAL INTELLIGENCE AS REPRESENTATION AND SEARCH 8

History And Applications-The Predicate Calculus - Structures And Strategies For State Space Search - Heuristic Search -Stochastic Methods - Control And Implementation Of State Space Search

MODULE II CAPTURING INTELLIGENCE: THE AI CHALLENGE 8

Knowledge Representation - Strong Method Problem Solving -Reasoning In Uncertain Situations

MODULE III MACHINE LEARNING-SYMBOL-BASED,CONNECTIONIST 9

Introduction -A Framework for Symbol-based Learning -Version Space Search -The ID3 Decision Tree Induction Algorithm -Inductive Bias and Learn ability -Knowledge and Learning -Unsupervised Learning -Reinforcement Learning -Foundations for Connectionist Networks -Perceptron Learning –Back propagation Learning - Competitive Learning -Hebbian Coincidence Learning.

MODULE IV MACHINE LEARNING: GENETIC AND EMERGENT,PROBABILISTIC 9

Genetic and Emergent Models of Learning -The Genetic Algorithm -Classifier Systems and Genetic Programming -Artificial Life and Society-Based Learning - Stochastic and Dynamic Models of Learning -Hidden Markov Models -Dynamic Bayesian Networks and Learning -Stochastic Extensions to Reinforcement Learning

MODULE V ADVANCED TOPICS FOR AI PROBLEM SOLVING-AUTOMATED REASONING 5

Introduction to Weak Methods in Theorem Proving -The General Problem Solver and Difference Tables -Resolution Theorem Proving -PROLOG and Automated Reasoning - Further Issues in Automated Reasoning

MODULE VI ADVANCED TOPICS FOR AI PROBLEM SOLVING- UNDERSTANDING NATURAL LANGUAGE **6**

The Natural Language Understanding Problem -Deconstructing Language: An Analysis -Syntax -Transition Network Parsers and Semantics -Stochastic Tools for Language Understanding -Natural Language Applications

Total Hours –45

TEXT BOOKS:

1. George F Luger, Artificial Intelligence, Pearson Education, 6th edition, 2009.

REFERENCES:

1. Patrick Henry Winston, “Artificial Intelligence”, Addison Wesley, Third edition, 2000.
2. Engene Charniak and Drew Mc Dermott, “Introduction to Artificial intelligence”, Addison Wesley 2000.
3. Nils J. Nilsson, “Principles of Artificial Intelligence”, Narosa Publishing House, 2000

OUTCOMES:

On completion of the course the students will be able to

- Apply AI problem solving techniques, knowledge representation, and reasoning methods in Knowledge based systems
- Design, implement and evaluate a system / computer based system process, component or program to meet desired needs
- Use current techniques, skills and tools necessary for computing and engineering practice
- Analyze the computational trade-offs involved in applying different AI techniques and models.
- Formulate machine learning problems corresponding to different applications.
- Apply machine learning algorithms to solve problems of moderate complexity

ECCX15	WIRELESS NETWORKS & ITS APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To apply various wireless applications like WLAN and WAN.
- To discuss wireless internet and adhoc networks.
- To study about advanced wireless network, LTE, 4G
- To study about wireless IP architecture, Packet Data Protocol and LTE network architecture

MODULE I WIRELESS LAN 8

Introduction-WLAN technologies: Infrared, UHF narrowband, spread spectrum - IEEE802.11: System architecture, protocol architecture, physical layer, MAC layer, 802.11a/b/g/c/n – Hiper LAN1, HiperLAN2, WATM, BRAN - IEEE802.16-WIMAX: Physical layer, MAC, Spectrum allocation for WIMAX

MODULE II MOBILE NETWORK LAYER 7

Mobile IP: IP packet delivery, Agent discovery, tunneling and encapsulation, IPV6-Network layer in the internet- Mobile IP session initiation protocol – mobile adhoc network - Issues in adhoc networks - Routing Protocols, Wireless Sensor Networks – Architecture

MODULE III MOBILE TRANSPORT LAYER 7

TCP enhancements for wireless protocols – Traditional TCP: Congestion control, fast retransmit/fast recovery, Implications of mobility – Classical TCP improvements: Indirect TCP, Snooping TCP, Mobile TCP, Time out freezing, Selective retransmission, Transaction oriented TCP – TCP over 3G wireless networks.

MODULE IV WIRELESS WIDE AREA NETWORK 7

Overview of 2G & 2.5G Networks - UTMS Terrestrial Radio access network-UMTS Core network Architecture: 3G-MSC, 3G-SGSN, 3G-GGSN, SMS-GMSC/SMS-IWMSC, Firewall, DNS/DHCP-High Speed Packet Access (HSPA)

MODULE V 4G NETWORK 8

Introduction – 4G vision – 4G features and challenges – Applications of 4G – 4G Technologies: Multicarrier Modulation, Smart antenna techniques, OFDM-MIMO systems, Adaptive Modulation and coding with time slot scheduler, Cognitive Radio.

MODULE VI WIRELESS IP NETWORK ARCHITECTURE 8

3GPP Packet Data Networks - Network Architecture - Packet Data Protocol (PDP) Context -Configuring PDP Addresses on Mobile Stations - Accessing IP Networks through PS Domain – LTE network Architecture - Roaming Architecture- Protocol Architecture- Bearer Establishment Procedure -Inter-Working with other RATs.

Total Hours –45

TEXT BOOKS:

1. Jochen Schiller, ”Mobile Communications”, Second Edition, Pearson Education,2012.
2. Vijay Garg , “Wireless Communications and networking”, First Edition, Elsevier, 2007
3. Kaveh Pahlavan, Prashant Krishnamoorthy, "Principles of Wireless Networks,-A unified approach", PHI, New Delhi, 2009
4. C.Siva Ram Murthy, B S Manoj, "Ad hoc Wireless Networks, Architectures and Protocols", Pearson, 2004

REFERENCES:

1. Erik Dahlman, Stefan Parkvall, Johan Skold and Per Beming, “3G Evolution HSPA and LTE for Mobile Broadband”, Second Edition, Academic Press, 2008
2. Anurag Kumar, D.Manjunath, Joy kuri, “Wireless Networking”, First Edition, Elsevier 2011
3. Ayman ElNashar, Mohamed El-saidny, Mahmoud Sherif, “Design, Deployment and Performance of 4G-LTE Networks: A Practical Approach”, John Wiley & Sons, 2014.
4. Crosspoint Boulevard, “Wireless and Mobile All-IP Networks”, Wiley Publication, 2005.
5. Stefania Sesia, IssamToufik and Matthew Baker, “LTE – The UMTS Long Term Evolution From Theory to Practice”, John Wiley & Sons, Inc. Publication, Second Edition, 2011
6. Savo Glisic,” advanced wireless networks-technology and business models”, Third Edition, John Wiley & Sons, Ltd, 2016

OUTCOMES:

On completion of the course the students will be able to

- Describe working principle of wireless LAN network and protocol involved in physical layer and MAC layer.
- Explain the importance of various TCP Protocols

- Classify various wireless networks
- Illustrate the mechanism of Ad Hoc Networks and Sensor Networks
- Familiar with the latest 4G networks and LTE
- Understand about the wireless IP architecture and LTE network architecture.

ECCX16 MULTIMEDIA COMMUNICATION SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the components of Multimedia Communication.
- To describe the different compression techniques for text, image, audio and video signal.
- To familiarize real time applications of multimedia.

MODULE I MULTIMEDIA COMPONENTS 4

Introduction - Multimedia skills - Multimedia components and their characteristics - Text, sound, images, graphics, animation, video, hardware.

MODULE II TEXT COMPRESSION 9

Need for Compression, types, Huffman coding-Adaptive Huffman coding - arithmetic coding - Shannon-Fano coding - LZW algorithms

MODULE III IMAGE COMPRESSION 8

Analogue black and white picture signal. Colour picture and RGB signal, Y;Cr,Cb. Resolution of the picture. Structure of the picture signal information, luminescence and chromatic components .Transform coding - DCT – JPEG

MODULE IV AUDIO AND VIDEO COMPRESSION 9

A law and μ law companding - Basic sub-band coding - Application to speech coding - G.722.H.261 - H.263 - MPEG 1, 2, 4.

MODULE V REQUIREMENT AND PERFORMACE ISSUES 7

Network performance parameters for multimedia, characteristics of multimedia traffic sources, factors that affect network performance, multimedia traffic requirement for networks, Quality of Service.

MODULE VI MULTIMEDIA APPLICATIONS 8

Video conferencing, DVI technology-Packet Video. DVB-T and DVB-C. Digital television.TV monitor as Multimedia terminal. VOIP Technology.

L – 45; Total Hours –45

TEXT BOOKS:

1. K.R. Rao, Z S Bojkovic, D A Milovanovic, "Multimedia Communication

System", Standards, and Networks", Pearson Education, 2007.
2. Khalid Sayood, "Introduction to Data Compression", Morgan Kauffman Harcourt India, 2nd Edition, 2000.
3. Yun Q. Shi, Huifang Sun, "Image and video compression for Multimedia Engineering", CRC Press,1999.

REFERENCES:

1. Fred Halshall "Multimedia communication - applications, networks, protocols and standards", Pearson education, 2007.
2. R. Steimnetz, K. Nahrstedt, "Multimedia Computing, Communications and Applications", Pearson Education,2002.
3. Ranjan Parekh, "Principles of Multimedia", TMH 2006.
4. Marcus goncalves "Voice over IP Networks", McGraw Hill, 1998.

OUTCOMES:

On completion of the course the students will be able to

- Distinguish and describe the various components of multimedia communication.
- Describe various compression techniques and apply them for text compression.
- Explain various compression techniques and apply them for image compression.
- Describe various compression techniques and apply them for sound and video compression
- Analyze the performance issues of multimedia on networks.
- Apply multimedia in real time.

ECCX17	PRINCIPLES OF WIRELESS SENSOR NETWORK	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Principles of Wireless Sensor Network• To obtain a broad understanding of the technologies and applications for the emerging and exciting domain of wireless sensor networks.
- To know physical layer issues, medium Access control Protocols , network layer characteristics and protocols.
- A broad coverage of challenges related to the design and management of wireless sensor networks.

MODULE I INTRODUCTION 6

Introduction to wireless sensor networks - Challenges and Constraints - Application of sensor networks - Node architecture

MODULE II BASIC ARCHITECTURAL FRAMEWORK: PHYSICAL LAYER 8

Basic Components, Source Encoding, The Efficiency of a Source Encoder, Pulse Code Modulation and Delta Modulation, Channel Encoding, Types of Channels, Information Transmission over a Channel, Error Recognition and Correction, Modulation, Modulation Types, Quadratic Amplitude Modulation, Signal Propagation

MODULE III MEDIUM ACCESS LAYER 8

Overview, Wireless MAC Protocols, Characteristics of MAC Protocols in Sensor Networks, Contention-Free MAC Protocols, Contention-Based MAC Protocols, Hybrid MAC Protocols

MODULE IV NETWORK LAYER 8

Overview, Routing Metrics, Flooding and Gossiping, Data-Centric Routing, Proactive Routing, On-Demand Routing, Hierarchical Routing, Location-Based Routing, QoS-Based Routing Protocols

MODULE V NODE AND NETWORK MANAGEMENT 8

Local Power Management Aspects, Dynamic Power Management, Basics of Time Synchronization, Time Synchronization Protocols.

MODULE VI LOCALIZATION AND SECURITY 7

Ranging Techniques, Range-Based Localization, Range-Free Localization, Challenges of Security in Wireless Sensor Networks, Security Attacks in Sensor Networks

Total Hours –45

TEXT BOOKS:

1. Christian Poellabauer and Waltenegus Dargie, ,“FUNDAMENTALS OF WIRELESS SENSOR NETWORKS THEORY AND PRACTICE”, John Wiley & Sons Ltd. First edition 2010
2. Carlos de Morais Cordeiro , Dharma Prakash Agarwal, Ad hoc and Sensor Network : Theory and Applications , 2nd Edition, World Scientific Publishing Co.

REFERENCES:

1. Holger Karl and Andreas Willig, “Protocols and Architectures for Wireless Sensor Networks”, John Wiley and Sons, 2012.
2. G.Anastasi, Marco Conti, Mario Di Francesco and Andrea Passarella, “Energy Conservation in Wireless Sensor Networks: A Survey”, Adhoc Networks, Vol.7, No.3 May 2009, Elsevier Publications, pp.537-568. 4

OUTCOMES:

On completion of the course the students will be able to

- Understand the state of art techniques in wireless sensor networks.
- Learn the basics and challenges of wireless networking, the constraints of wireless sensor networks, the design of protocols to meet the challenges and constraints of a specific application and the development of a research project
- Be able to apply the concepts of wireless sensor networks (WSN) to various application areas.
- Get an overview of basic architectural framework.
- Able to analyze performance characteristics of WSN and manage WSN.
- To know methods in Localization tracking and security issues.

ECCX18 FUNDAMENTALS OF NANOTECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the basic concepts of nano technology
- To illustrate the importance of various synthesis method.
- To enrich the knowledge of students in various fabrication and characterization techniques.
- To introduce various nano devices

MODULE I INTRODUCTION **7**

Overview of nanotechnology, Historical background, Importance of Nanoscale, Bottom-up approaches, Top-down approaches, Functional approaches - Difference between bulk and nano materials - Size dependent properties

MODULE II SYNTHESIS OF NANOMATERIALS **7**

Fundamentals of film-Physical vapor deposition(PVD)-Chemical Vapor deposition(CVD)-Atomic layer deposition-solgel films

MODULE III FABRICATION OF NANOSTRUCTURES **8**

Lithography -Nanomanipulation and nanolithography-Soft lithography-Assembly of nanoparticles and nanowires-other methods for microfabrication

MODULE IV CHARACTERIZATION **8**

Structural characterization –X-ray diffraction, Small angle X-ray scattering ,Scanning electron microscopy, Transmission electron microscopy, Scanning probe microscopy-Chemical characterization – Optical spectroscopy, Electron spectroscopy, Ion spectroscopy-Physical properties of nanomaterials

MODULE V NANO DEVICES **7**

Issues of miniaturization - Digital information processing – Quantum Computing – Electronic devices – Spintronics – Storage class memory – Photonic devices – Thermal devices

MODULE VI APPLICATION OF NANOMATERIALS **8**

Molecular Electronics and Nanoelectronics - Nanobots-Biological applications of Nanoparticles-Catalysis by Gold Nanoparticles-Quantum devices -Nanomechanics-

Carbon nanotube emitters-Energy applications of nanomaterials-environmental applications of nano materials

Total Hours –45

TEXT BOOKS:

1. Guozhong Cao, “Nanostructures and Nano materials-Synthesis, Properties and Applications”, Imperial College Press (2011).
2. M.S. Ramachandra Rao, Shubra SinghH, “Nanoscience and Nanotechnology: Fundamentals to Frontiers”, Wiley, 2013.
3. Guozhong Cao,Ying Wang “Nanostructures and Nano materials”world scientific series in nanoscience and nanotechnology2 nd edition 2016

REFERENCES:

1. C.Dupas, P.Houdy, M.Lahmani, Nanoscience: “Nanotechnologies and Nanophysics”, Springer-Verlag Berlin Heidelberg, 2007.
2. Mick Wilson, Kamali Kannangara, Michells Simmons and Burkhard Raguse,“Nano Technology – Basic Science and Emerging Technologies”, 1st Edition,Overseas Press, New Delhi,2005

OUTCOMES:

On completion of the course the students will be able to

- Acquire the knowledge of various nano tec hniques
- Discuss about the synthesis of nano materials
- Describe various fabrication techniques of nano structures
- Compare different characterization techniques
- Explain about nano devices
- Apply the knowledge of different types of nano materials for various engineering applications

ECCX19 EMBEDDED SIGNAL PROCESSING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To study the architecture of embedded processor.
- To introduce the number formats and quantization in real time processing.
- To learn the memory systems and data transfer in Blackfin Processor.
- To introduce the concept of code optimization and power management.

MODULE I INTRODUCTION TO EMBEDDED PROCESSOR 4

Embedded Processor: Micro Signal Architecture -Real-Time Embedded Signal Processing

MODULE II BLACKFIN PROCESSOR 6

The Blackfi n Processor: An Architecture for Embedded Media Processing-Introduction to Micro Signal Architecture-Overview of the Blackfin Processor-Architecture: Hardware Processing Units and Register Files-Bus Architecture and Memory-Basic Peripherals

MODULE III REAL-TIME DSP FUNDAMENTALS AND IMPLEMENTATION CONSIDERATIONS 9

Number Formats Used in the Blackfin Processor-Fixed-Point Formats -Fixed-Point Extended Format -Fixed-Point Data Types -Emulation of Floating-Point Format -Block Floating-Point Format-Dynamic Range, Precision, and Quantization Errors - Incoming Analog Signal and Quantization -Dynamic Range, Signal-to-Quantization Noise Ratio, and Precision -Sources of Quantization Errors in Digital Systems-Overview of Real-Time Processing

MODULE IV MEMORY SYSTEM AND DATA TRANSFER 10

Overview of Signal Acquisition and Transfer to Memory-DMA Operations and Programming-Using Cache in the Blackfin Processor-Comparing and Choosing Between Cache and Memory DMA- Scratchpad Memory of Blackfin Processor

MODULE V CODE OPTIMIZATION AND POWER MANAGEMENT 10

Using Assembly Code for Efficient Programming - Using Hardware Loops - Using Dual MACs -Using Parallel Instructions -Special Addressing Modes: Separate Data Sections - Using Software Pipelining- Power Consumption and Management in the Blackfin Processor

MODULE VI DSP APPLICATIONS 6

Overview of Audio Compression -Audio Encoding -Audio Decoding- Digital Image Processing- Overview of Image Representation- Color Conversion- Image Enhancement

Total Hours –45

TEXT BOOKS:

1. Woon-Seng Gan,Sen M.Kuo," Embedded Signal Processing with the Micro Signal Architecture", Wiley-IEEE Press,January 2007.

REFERENCES:

2. Proakis and Manolokis, "Digital Signal Processing: Principles, Algorithms, and Applications, Pearson, July 13
3. S.K. Mitra ,"Digital Signal Processing", Mc-Graw Hill,. 3rd Edition, 2006.
4. Sinha, Priyabrata," Speech Processing in Embedded Systems", Springer 2010.
5. Phil Lapsley, Jeff Bier, Amit Shoham, Edward A. Lee, "DSP Processor Fundamentals: Architectures and Features", Wiley-IEEE Press, January 1997

OUTCOMES:

On completion of the course the students will be able to

- Describe the architecture of embedded processor.
- Differentiate the Number Formats Used in Blackfin processor.
- Analyze the Quantization Errors in Digital Systems
- Compare DMA Operations and Cache in Blackfin Processor
- Optimize the codes and Power Consumption in Blackfin Processor.
- Acquire knowledge about applications of DSP.

ECCX20	INTRODUCTION TO NETWORK SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the fundamentals of Cryptography
- To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.

To understand the various key distribution and management schemes.

- To understand how to deploy encryption techniques to secure data in transit across data networks

PREREQUISITES:

Fundamentals of networking concepts.

MODULE I INTRODUCTION TO NETWORKSECURITY 7

Security attacks (Interruption, Interception, Modification & fabrication), Security services (confidentiality, authentication, integrity, Non-repudiation, access control and availability) and mechanisms. A model for internetwork security, internet standards and RCFs, Buffer overflow & format string vulnerabilities, TCP session hijacking, ARP attacks, route table modification, UDP hijacking and mon-in-the-middle attacks

.

MODULE II CLASSICAL ENCRYPTION TECHNIQUES 9

Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Cipher, One TimePad. Block Ciphers and the data encryption standard: Traditional block Cipher structure, stream Ciphers and block Ciphers, Motivation for the feistel Cipher structure, the feistel Cipher, The data encryption standard, DES encryption, DES decryption, ADES example, results, the avalanche effect, the strength of DES.

MODULE III PUBLIC-KEY CRYPTOGRAPHY and RSA 8

Principles of public-key cryptosystems, Public key cryptosystems, Applications, for public-key cryptosystems, requirements for public-key cryptosystems. public-key cryptanalysis. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA. Other Public-Key Crypto systems: Diffie-hellman key exchange.

MODULE IV KEY MANAGEMENT AND DISTRIBUTION 8

Symmetric key distribution using Symmetric encryption, A key distribution scenario, Hierarchical key control, session key lifetime, a transparent key control scheme, Decentralized key control, controlling key usage, Symmetric key distribution using asymmetric encryption, simple secret key distribution scheme, distribution of public keys, public announcement of public keys, publicly available directory, public key authority, public keys certificates, X-509 certificates.

MODULE V EMAIL PRIVACY SECURITY 8

Pretty good privacy, notation, operational; description, S/MIME, RFC5322, Multipurpose internet mail extensions, S/MIME functionality, S/MIME messages, S/MIME certificate processing, enhanced security services, Domain keys identified mail, internet mail architecture, E-Mail threats.

MODULE VI IP SECURITY 5

IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management.

Total Hours –45

TEXT BOOKS:

1. William Stallings, 'Cryptography and Network Security', Pearson 6th edition. 2013
2. V k Pachghare, ' Cryptography and Information Security', PHE, 2013.
3. Ryan Russell, Dan Kaminsky, Rain Forest Puppy, Joe Grand, David Ahmad,Hal Flynn Ido Dubrawsky, Steve W.Manzuik and Ryan Permeh, Wiley Dremtech ,"Hack Proofing your Network" , syngress publishing,2002

REFERENCES:

1.Neal Krawetz ,'Introduction to Network Security', published by CENGAGE Learning, 2006
2. Charlie Kaufman, Radia Perlman and Mike Spenciner , "Network Security– Private Communication in a Public World" by, Pearson/PHI, 2002.

OUTCOMES:

On successful completion of this course, students will be able to:

1. Understand basic cryptographic algorithms, web authentication and security issues.
2. Analyze the vulnerabilities in any computing system and hence be able to design a security solution.

3. Identify the security issues in the network and resolve it.
4. Evaluate security mechanisms using rigorous approaches, including theoretical.
5. Describe about electronic mail security.
6. Understand the current legal issues towards information security.

ECCX21	INFORMATION CODING TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Fundamental concepts of information theory
- Data compaction, data compression, data transmission,
- Error detection and correction

MODULE I INFORMATION ENTROPY FUNDAMENTALS 7

Uncertainty, Information and Entropy – Source coding Theorem – Huffman coding – Shannon Fano coding – Discrete Memory less channels – channel capacity – channel coding Theorem – Channel capacity Theorem.

MODULE II DATA AND VOICE CODING 8

Linear Block codes – Syndrome Decoding – Minimum distance consideration – cyclic codes – Generator Polynomial – Parity check polynomial – Encoder for cyclic codes – calculation of syndrome – Convolution codes.

MODULE III ERROR CONTROL CODING 8

Principles – Text compression – Static Huffman Coding – Dynamic Huffman coding – Arithmetic coding – Image Compression – Graphics Interchange format – Tagged Image File Format – Digitized documents – Introduction to JPEG standards.

MODULE IV COMPRESSION TECHNIQUES 7

Principles – Text compression – Static Huffman Coding – Dynamic Huffman coding – Arithmetic coding – Image Compression – Graphics Interchange format – Tagged Image File Format – Digitized documents – Introduction to JPEG standards.

MODULE V AUDIO AND VIDEO CODING 7

Linear Predictive coding – code excited LPC – Perceptual coding, MPEG audio coders – Dolby audio coders – Video compression – Principles – Introduction to H.261 & MPEG Video standards.

MODULE VI CRYPTOGRAPHY: 8

Overview of encryption techniques - symmetric cryptography - Data Encryption Standard (DES) - International Data Encryption Algorithm (IDEA) - RC Ciphers -

Public-key algorithm - RSA algorithm - Pretty Good Privacy - One-way Hashing

Total Hours –45

TEXT BOOKS:

1. Simon Haykin, “Communication Systems”, John Wiley and Sons, 4th Edition, 2001.
2. Fred Halsall, “Multimedia Communications, Applications Networks Protocols and Standards”, Pearson Education, Asia 2002; Chapters: 3,4,5.

REFERENCES:

1. Mark Nelson, “Data Compression Book”, BPB Publication 1992.
2. Watkinson J, “Compression in Video and Audio”, Focal Press, London, 1995.

OUTCOMES:

- Understand encoding and decoding of digital data streams.
- know methods for the generation of these codes and their decoding techniques.
- Have a detailed knowledge of compression and decompression techniques.
- analyze concepts of multimedia communication
- Have a complete understanding of error–control coding.
- Understand the cryptographic techniques

ECCX22 PYTHON PROGRAMMING

L	T	P	C
1	0	0	1

OBJECTIVES:

- To fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
- Understand fundamentals of object-oriented programming in python, including defining classes, invoking methods, using class libraries, etc
- Have the ability to write a program to solve specified problems

MODULE I PYTHON CONCEPTS 5

Introduction to python, Installation, Python Interpreter, Interpreter and its environment, running a program, first python programme , Basic Operators, Data types- String ,List, tuple, set, Dictionary, Control statements – Decision making, loop, numbers ,Date and time.

MODULE II FUNCTIONS AND MODULES 5

Defining a Function- Calling a Function-Passing by Reference Versus Passing by Value -Function Arguments-The return Statement-scope of variables – global and local variables-Modules-import statements.

MODULE III FILES I/O ,EXCEPTIONS AND CLASSES & OBJECTS 5

Reading Keyboard Input-Opening and Closing Files-Reading and Writing Files-Renaming and Deleting Files -Directories in Python-file and Directory Related methods-Exception handling, creating Classes and Objects, accessing the attributes, class inheritance, Over riding, Over loading methods.

Total Hours - 15

TEXT BOOKS:

1. Mark Lutz , “Learning Python” , Fifth Edition, O,Reilly, 2013
2. Allen Downey, “Think Python”, second edition, Green Tea Press,2015

REFERENCES:

1. Jason Cannon, “Python Programming for Beginners” O,Reilly, 2012
2. David Beazley , Brain K Jones “Python CookBook” Third edition,2013
3. CHUN, WESLEY J ”Core Python Programming”, Pearson Education 2012
4. GUTTAG, JOHN V ”Introduction to Computation and Programming Using Python”, PHI Learning Private,2014

OUTCOMES:

On completion of the course the students will be able to

- Implement user defined python functions.
- Create programs using various collection data types
- Develop basic programs using fundamental structures
- Apply appropriate Python control flow structure
- Design classes and use them
- know how Python can be used for application development

ECCX23	DESIGN USING EDA TOOLS	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To introduce the basic functionality of CAE/CAD tools for integrated circuits CADENCE.
- To become familiar with the main structure and basic modules of the CAE/CAD tools.
- To investigate the main design flow for analog, analog-digital and digital integrated circuit
- To enable students to exercise appropriate design of digital and analog circuits.

LIST OF EXPERIMENTS

1. Study of Basic CMOS technology and design rules.
2. Analyze and compare advanced analog ICs based on CMOS techniques, such as different types of current sources, amplifiers, filters and comparators.
3. Analyze and compare simple digital circuits based on different CMOS techniques.
4. Designing complex analog/digital systems starting from simpler analog/digital circuits.

Total Hours –30

TEXT BOOKS:

1. A Computer-Aided Design and Synthesis Environment for Analog Integrated Circuits, Geert van der Plas, Georges Gielen Willy Sansen, Kluwert Academic Publishers, ISBN 0-7923-7697-8, 2002.
2. Electronic Design Automation for Integrated Circuits Handbook, Volume 1, EDA for IC System Design, Verification and Testing, Edited by Louis Scheffer, Luciano Lavagno and Grant Martin, Taylor & Francis, 2006, ISBN 0-8493-7923-7.
3. Electronic Design Automation for Integrated Circuits Handbook, Volume 2, EDA for IC Implementation, Circuits Design and Process Technology, Edited by Louis Scheffer, Luciano Lavagno and Grant Martin, Taylor & Francis, 2006, ISBN 0-8493-7924-5.

REFERENCES:

1. Erik Brunvand, “Digital VLSI Chip Design with Cadence and Synopsys CAD Tools“, Pearson Publications, 1st edition, 25th February 2009.
2. Dennis Fitzpatrick, “Analog Design and Simulation using OrCAD Capture and PSpice”, Newnes, 2nd edition, December 13, 2017.

OUTCOMES:

On completion of the course the students will be able to

- Demonstrate knowledge and understanding of fundamental concepts in CAD.
- Work on the simulation tool.
- Analyze any analog circuit using a simulation tool.
- Analyze any digital circuit using a simulation tool.
- Design a component or circuit for a specific application.
- Establish capability for CAD tool development and enhancement.

ECCX24	PREDICTIVE ANALYTICS	L	T	P	C
		1	0	0	1

OBJECTIVES:

- Design effective experiments and analyze the results
- Use resampling methods to make clear and bulletproof statistical arguments
- Analytics tools to analyze the problems through prediction, classification and discrete choices
- Explain and apply a set of unsupervised learning concepts and methods

PREREQUISITES:

- Knowledge on programming, calculus, statistics, mathematical models or linear algebra
- Statistical analysis, Descriptive statistics, Probability Distribution, Hypothesis testing, ANOVA

MODULE I PREDICTION EFFECT 8

Introduction to Analytics, Analytics in Decision Making, Digital Data Collection Predicts - Data Effect -data models and algorithms - data integration components- Trick to Predictive Analytics

MODULE II PREDICTIVE ANALYTICS AND MACHINE LEARNING **7**

Predictive Analytics tools, Prediction Takes Action; automation of driverless Cars- Change Motoring, Right Tool for Tough Times, Ethical issues, A Case for Early Adoption

Total Hours –15

TEXT BOOKS:

1. Conor Doherty, Steven Camiña, Kevin White & Gary Orenstein The Path to Predictive Analytics and Machine Learning, O'Reilly Media, Inc.,First edition, 2016
2. Eric Siegel, "Predictive Analytics", Wiley Publishers, First edition, 2016

REFERENCES:

1. Daniel T. Larose, Chantal D. Larose, "Data Mining and Predictive Analytics", MISL-WILEY publishers, 2nd edition, 2016
2. Dean Abbott, "Applied Predictive Analytics: Principles and Techniques for The Professional Data Analyst", MISL-WILEY publishers, First edition, 2014

OUTCOMES:

On completion of the course, students will be able to

- Apply the concepts, ideas and protocols to analyze derived datasets
- Use computational abilities, inferential thinking, and practical skills for tackling core data scientific challenges.
- Investigate the foundational concepts of data management and processing
- Perform statistical computing and dynamic visualization using modern programming tools.

ECCX25 IC TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES:

- To provide strong foundation in fundamentals of VLSI.
- To introduce the fundamental principles Integrated Circuit Fabrication.
- To familiarize with fabrication of Integrated circuits.
- To demonstrate design rules for layout and circuit characterization.

PREREQUISITE :

Knowledge on Digital Electronics, Electron Devices and Circuits

MODULE I INTRODUCTION TO CMOS CIRCUITS: 8

MOS Transistors and Switches , CMOS Logic --- Inverter, Combinational logic, NAND and NOR gates, Compound gates and Multiplexers, Memories ‘ Circuit and System Representation --- behavioral, structural and physical representations

MODULE II OPERATING PRINCIPLES OF MOS TRANSISTORS: 7

Introduction, NMOS and pMOS enhancement transistors , Threshold voltage and body effect ,MOS device design equations ,Basic DC equation ,Second order effects Complementary CMOS Inverter , DC characteristics ,Static load MOS inverters ,Differential inverter ,Transmission gate ‘Tri-state inverter , Bipolar devices

MODULE III FABRICATION OF CMOS INTEGRATED CIRCUITS 7

An overview of silicon semiconductor technology, Wafer processing ,Oxidation ,Epitaxy, deposition, ion-implantation and diffusion , Silicon gate process Basic CMOS Technology, Basic n–well CMOS process, P-well process,Twin-Tub process, Silicon-on-Insulator process

MODULE IV INTERCONNECTIONS AND CONTACTS, PACKAGING AND YIELD 7

Metal Interconnections and Contact Technology, Diffused Interconnections, Polysilicon Interconnections and Buried Contacts, Silicides and Multilayer-Contact Technology, Copper Interconnects and Damascene Processes, Wafer Thinning and Die Separation, Die Attachment, Wire Bonding, Packages, Yield.

MODULE V CMOS PROCESS ENHANCEMENTS AND LAYOUT DESIGN RULES 8

Circuit elements, Layer representations ,CMOS n-well rules, Latch-up, Technology-related CAD issues

MODULE VI CIRCUIT CHARACTERIZATION 8

Resistance estimation ,Capacitance, estimation, Switching, characteristics Analytic delay models ,Gate delay ,CMOS-gate transistor sizing ,Power transmission , Scaling of MOS transistor dimensions

TOTAL HOURS 45

TEXT BOOKS

1. J. Plummer, Michael D. Deal and Peter B. Griffin, “Silicon VLSI Technology, fundamentals, practice and modeling” Pearson Education, 2009.
2. Richard C. Jaeger , “Introduction to Microelectronic Fabrication”, Second Edition.

REFERENCES

1. J. P. Uyemura, Physical Design of CMOS Integrated Circuits Using L-Edit, PWS Publishers, Boston, 1995.
2. Neil H. E. Weste, David Money Harris, “CMOS VLSI Design A Circuits and Systems Perspective” 4th edition , Pearson Publication.
3. Jan M. Rabaey ,Anantha Chandrakasan,Borivoje Nikolic “Digital Integrated (ionnd Edit2)Circuits .

OUTCOMES:

On completion of the course, students will be able to

1. Understand the principles of CMOS transistors.
2. Learning lithography techniques and concepts of wafer exposure system, types of resists etc.
3. Understand concepts of thermal oxidation and Si/SiO2 interface and its quality measurements.
4. Learn concepts of IC Fabrication
5. Understand back-end technology to define contacts, interconnect, gates, source and drain, and measurements techniques to insure quality of designs.

ECCX26	SIMULATION OF RF CIRCUITS AND COMPONENTS	L	T	P	C
		0	0	2	1

OBJECTIVES:

To study the basic tools of microwave engineering and practice them.

LIST OF EXPERIMENTS

1. Simulation of Rectangular waveguide.
2. Simulation of circular waveguide
3. Simulation of wave guide Tee junction.
4. Simulation of microstripline
5. Simulation of strip line
6. Simulation of RF Low Pass & High Pass Filters
7. Simulation of RF amplifier
8. Simulation of RF Band pass and Band stop Filters
9. Simulation of coupled filters.
10. Simulation of Impedance matching networks

Total Hours –30

REFERENCES:

1. David. M.Pozar, "Microwave Engineering" 3rd Edition, John Wiley and Sons, 2005.
2. S.Y.Liao, "Microwave Amplifiers and Oscillators Design", Prentice Hall, New Jersey, 1999.

OUTCOMES:

On completion of the course the students will be able to

- Work on the simulation tool.
- Analyze any RF component or circuit using a simulation tool
- Design a component or circuit for a specific application.

ECCX27	RF TEST AND MEASUREMENT	L	T	P	C
		1	0	0	1

OBJECTIVES:

To study the RF & Microwave measurement techniques.

To learn the EMI/EMC testing methods of RF Components & Circuits.

MODULE I INTRODUCTION TO S MATRIX AND EMI. 5

High frequency parameters-Formulation of S parameters, properties of S parameters. Concepts of EMI and EMC and definitions - Sources of EMI.

MODULE II MICROWAVE MEASUREMENTS 5

Slotted line VSWR measurement, VSWR through return loss measurements, power measurement, impedance measurement insertion loss and attenuation measurements-measurement of scattering parameters- Measurement of dielectric constant of a solid using waveguide.

MODULE III EMI MEASUREMENTS 5

Open area test site measurements-Measurement precautions - Open –area test site-Anechoic Chamber-TEM Reverberating TEM-GTEM cell - Comparisons.

Total Hours –15

TEXT BOOKS:

1. D.M.Pozar, “Microwave Engineering”, John Wiley & sons,Inc., 2006.
2. Reinhold. Ludwig and Pavel Bretshko “RF Circuit Design”, Pearson Education, Inc.,2006

REFERENCES:

1. V.P.Kodali, "Engineering EMC Principles, Measurements and Technologies", IEEE Press, 1996.
2. C.R.Paul, "Introduction to Electromagnetic Compatibility", John Wiley and Sons,
3. Inc, 1992

OUTCOMES:

On completion of the course the students will be able to

1. Find unknown load impedance for any high frequency networks using smith chart.

2. Determine s parameters for any microwave circuits or components.
3. Relate the transmission matrix with S matrix.
4. Analyze the microwave networks using SFG
5. Analyze the microwave networks using S matrix.
6. Design impedance matching networks.

ECCX28 DSP ARCHITECTURE AND PROGRAMMING

L	T	P	C
3	0	0	3

OBJECTIVES:

1. To describe the architecture of programmable digital signal processor.
2. To implement basic DSP functions in processor TMS320C5XX
3. To apply TMS320C5XX for real time applications.
4.

MODULE I FUNDAMENTALS OF DSP PROCESSORS 7

Multiplier and Multiplier accumulator, Modified Bus Structures and Memory access in PDSPs, Multiple access memory, Multi-ported memory, VLIW architecture, Pipelining, Special Addressing modes in P-DSPs, on chip Peripherals.

MODULE II COMPUTATIONAL ACCURACY IN DSP IMPLEMENTATION 7

Number formats for signals and coefficients in DSP systems, Dynamic Range and Precision, Sources of error in DSP implementation, A/D Conversion errors, DSP Computational errors, D/A Conversion Errors.

MODULE III ARCHITECTURES OF DIGITAL SIGNAL PROCESSOR 9

Basic Architectural features, DSP computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Speed issues Features for External interfacing.

MODULE IV PROGRAMMABLE DIGITAL SIGNAL PROCESSORS 10

Commercial Digital signal-processing Devices, TMS320C54XX DSP: Data Addressing mode, Memory space, Program Control, Instructions and Programming, On-Chip peripherals, Interrupts, Pipeline Operation, Introduction to code composer studio.

MODULE V TMS320C6XDSPs 6

Introduction, features of TMS320C6X processor, internal architecture, functional units and its operations, addressing modes in C6x, memory architecture, peripherals

.

MODULE VI IMPLEMENTATION OF BASIC DSP ALGORITHMS 6

The Q-notation,FIR Filters, IIR Filters, interpolation Filters, Decimation filters, Adaptive Filters, 2-D signal processing, An FFT Algorithm for DFT Computation, Computation of signal spectrum.

Total Hours –45

TEXT BOOKS:

1. B. Venkataramani, M. Bhaskar "Digital Signal Processors: Architecture, Programming and Applications", Tata McGraw-Hill Education, 2002
2. Avtar Singh, S.Srinivasan ,"DSP Implementation using DSP microprocessor with Examples from TMS32C54XX" -Thomson 2004
3. Sen-Maw Kuo, Woon-SengGan,"Digital signal processors architectures, implementations, and applications", Pearson Prentice Hall, 2005
4.

REFERENCES:

1. Phil Lapsley, Jeff Bier, AmitShohan, Edward A Lee, "DSP Processor Fundamentals, Architectures & Features". S. Chand & Co, 2000
2. Jonathan Stein, "Digital signal processing" John Wiley 2005.
3. S.K. Mitra, "Digital Signal Processing", Tata McGraw-Hill Publication, 2001.
4. Alan V. Oppenheim,"Discrete-Time Signal Processing", Pearson Education India, 2006.

OUTCOMES:

On completion of the course the students will be able to

- Recognize the fundamentals of fixed and floating point architectures of various DSPs.
- Estimate DSP computational errors.
- Describe the architectural features of DSP processors
- Select appropriate DSP processors for signal processing applications.
- Make use of TMS3206X processors in real time applications.
- Implement various DSP algorithms.

ECCX29	DSP APPLICATIONS	L	T	P	C
		0	0	2	1

OBJECTIVES:

- Apply the concepts of DSP for real time applications
- To provide an understanding of how to design signal processing systems and process data in a software simulation.
- To introduce programming for real time DSP applications.

LIST OF EXPERIMENTS

AUDIO PROCESSING

1. Generation of Octave music
2. Real time Audio processing- Audio equalizer, Delayed audio playback,Audio reverberator, Concert hall simulation& Audio effects

IMAGE PROCESSING

3. Histogram equalization
4. Implementation of transforms on images
5. Edge detection of Images
6. Pseudo color image processing

DIGITAL SIGNAL GENERATION AND DETECTION

7. Dual-tone Multifrequency (DTMF) signals
8. ECG signal analysis.

Total Hours –30

REFERENCES:

1. Sen M. Kuo, Bob H. Lee, Wenshun Tian, “Real-Time Digital Signal Processing: Fundamentals, Implementations and Applications”, Third edition, Wiley publication, 2013.

OUTCOMES:

On completion of the course the students will be able to

- Use DSP tools to analyze the real time signals.
- Apply various transforms like DCT , FFT for real time signals
- Validate the concept of digital signal generation and detection through real time systems.

ECCX30	INTRODUCTION TO RECONFIGURABLE COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Basic concepts of Reconfigurable computing
- Various FPGA designs
- Modeling and programming various reconfigurable systems
- Mapping algorithms for reconfigurable architectures
- Design and development of Various Reconfigurable architectures.
- Applications development of reconfigurable systems

PRE-REQUISITES:

- Basics of VLSI Design
- Fundamental knowledge of FPGA architecture

MODULE I RECONFIGURABLE COMPUTING HARDWARE 8

Device Architecture- The Computational Fabric- Array and Interconnect-Extending Logic Configuration-Reconfigurable Processing Fabric Architectures- -RPF Integration into Traditional Computing Systems-Reconfigurable Computing Systems - Configuration Architectures

MODULE II FPGA DESIGN 8

FPGA Physical Design Tools -Technology mapping - Placement & routing - Register transfer (RT)/Logic Synthesis - Controller/Data path synthesis - Logic minimization .

MODULE III MAPPING DESIGNS TO RECONFIGURABLE PLATFORMS 8

Technology Mapping- Structural Mapping Algorithms- Integrated Mapping Algorithms Mapping Algorithms for Heterogeneous Resources- FPGA Placement- Placement Problem Clustering- Partition-based Placement-Analytic Placement- Datapath Composition Fundamentals.

MODULE IV RETIMING AND FAST COMPILATION 7

Retiming: Concepts, Algorithm, and Restrictions- Re-pipelining and C-slow Retiming Implementations of Retiming- Retiming on Fixed-frequency FPGAs-C-slowing as Multithreading.

MODULE V CASE STUDIES OF FPGA APPLICATIONS 7

SPIHT Image Compression- Automatic Target Recognition Systems- Multi- FPGA Systems: Logic Emulation.

MODULE VI APPLICATION DEVELOPMENT 7

Implementing Applications with FPGAs- Strengths and Weaknesses of FPGAs- Application Characteristics and Performance- General Implementation Strategies for FPGA-based Systems- Implementing Arithmetic in FPGAs-Instance-specific Design- Partial Evaluation Distributed Arithmetic- FPGA Implementation of CORDIC Processors- Hardware/Software Partitioning.

Total Hours –45

TEXT BOOKS:

1.Scott Hauck and Andr´e DeHon, "Reconfigurable Computing :The Theory And Practice of FPGA-Based mputation". Morgan Kaufmann Publishers, 2008.

REFERENCES:

1. M.Gokhale and P.Graham, "Reconfigurable Computing: Accelerating Computation with Field Programmable Gate Arrays", Springer Publications, 2005.
2. C.Bobda," Introduction to Reconfigurable Computing: Architectures, Algorithms and Applications", Springer Publications, 2007.

OUTCOMES:

On completion of the course, students will be able to

- Analyze various reconfigurable architectures.
- Apply various methodologies to reconfigure FPGA.
- Implement fast compilation techniques in architecture design.
- Develop modules and applications using high level languages and tools.
- Design and build an SOPC for a specific application
- Design FPGA and programming reconfigurable systems

ECCX31 PROGRAMMING IN EMBEDDED SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the design of embedded computing systems with its hardware and software architectures
- To describe entire software development lifecycle and examine the various issues involved in developing software for embedded systems.
- To analyze the I/O programming and Embedded C coding techniques
- To equip students with the software development skills necessary for Practitioners in the field of embedded systems.

PRE-REQUISITES:

Embedded System Concepts and C Language

MODULE I DATA REPRESENTATION IN EMBEDDED SYSTEMS 6

Introduction to embedded system-Fixed-Precision binary numbers-Binary representation of integers-Binary representation of Real numbers-integer data types-mixed data types-manipulating bits in memory, I/O ports- Accessing memory mapped I/O Devices-Structures

MODULE II C PROGRAMMING CONCEPTS 8

Programming Style - Declarations and Expressions - Arrays, Qualifiers and Reading Numbers - Decision and Control Statements - Programming Process - More Control Statements - Variable Scope and Functions - C Preprocessor - Advanced Types - Simple Pointers - Debugging and Optimization.

MODULE III EMBEDDED C 9

Programming Embedded System In C-Introducing 8051 Microcontroller-Keil Software-Reading Switches- Adding Structure To C Code- Meeting Real Time Constraints-Creating An Embedded Operating System-Multistate Systems And Function Sequences- Serial Interface.

MODULE IV INPUT/OUTPUT PROGRAMMING 6

Mixing c and assembly-I/O Instructions, Synchronization, Transfer Rate & Latency, Polled Waiting Loops, Interrupt – Driven I/O, Direct memory access.

MODULE V MEMORY MANAGEMENT 7

Scheduling-Objects In C-Automatic Allocation-Static Allocation-Object Creation, Initialization, Destruction-Dynamic Allocation-Automatic Allocation With Variable Size-Recursive Function –Shared Memory.

MODULE VI PYTHON PROGRAMMING 9

Basics of PYTHON Programming Syntax and Style – Python Objects– Dictionaries – comparison with C programming on Conditionals and Loops – Files – Input and Output – Errors and Exceptions – Functions – Modules – Classes and OOP – Execution Environment.

Total Hours –45

TEXT BOOKS:

1. Michael J Pont, “Embedded C”, Pearson Education, 2007.
2. Daniel W. Lewis, "Fundamentals of embedded software where C and assembly meet", Pearson Education
3. Allen Downey, “Think Python”, second edition, Green Tea Press,2015

REFERENCES:

1. Mohamammad Ali Mazidi & Mazidi, “8051 Microcontroller and Embedded Systems” , Pearson Education,2006
2. Jason Cannon, “Python Programming for Beginners” O,Reilly, 2012
3. Steve Oualline, ‘Practical C Programming 3rd Edition’, O’Reilly Media, Inc, 2006.

OUTCOMES:

On completion of the course, students will be able to

- Write, compile and debug programs in C language.
- Develop program using embedded C
- Analyze the Real-time constraints in embedded systems
- Describe memory management in embedded systems
- Program using python language
- Design projects using embedded C and python language

ECCX32	MULTI-CORE ARCHITECTURE AND PARALLEL PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study multicore architecture and their design issues.
- To Program distributed and shared memory architecture.
- To know various types of multicore architecture and application.

MODULE I INTRODUCTION TO MULTI-CORE ARCHITECTURE 8

Motivation for concurrency in software-Parallel computing Platforms-Parallel computing in Microprocessors-Differentiating Multi-core architectures fromm Hyper-threading technology-Multithreading on Single-Core versus Multi-core platforms-understanding performance-Amdahl's law-Gustafson's law-Homogeneous multi-core-Heterogeneous multi-core

MODULE II PARALLEL HARDWARE 7

The basics of caching- Cache mappings- Virtual memory- Instruction-level parallelism- Hardware multithreading- SIMD systems- MIMD systems - Interconnection networks- Cache coherence- Shared-memory versus distributed-memory

MODULE III PARALLEL SOFTWARE 7

Coordinating the processes/threads- Programming hybrid systems-Input and Output- Scalability- Parallel Program Design

MODULE IV DISTRIBUTED-MEMORY PROGRAMMING WITH MPI 8

Getting Started- Compilation and execution- MPI programs- Communicators- SPMD programs- Communication- Message matching- The Trapezoidal Rule in MPI- Dealing with I/O- Collective Communication- MPI Derived Datatypes- Performance Evaluation of MPI Programs

MODULE V SHARED-MEMORY PROGRAMMING WITH OPENMP 8

Compiling and running OpenMP programs- The Trapezoidal Rule- The Reduction Clause- The parallel for Directive- Loops in OpenMP- Scheduling Loops- Producer-Consumer Synchronization - Caches, Cache Coherence, and False Sharing- Thread-Safety

MODULE VI CASE STUDIES 7

Intel Core Duo, Intel i7, AMD Dual Core Opteron, SUN UltraSPARC Multicore, Freescale Embedded Multicore,IBM cell.

L – 45; Total Hours -45

TEXT BOOKS:

1. Peter S. Pacheco, "An Introduction to Parallel Programming", Elsevier,2011
2. Shameem Akhtar and Jason Roberts, “Multi-core Programming”, 2nd Edition, Intel Press, 2006.
3. David E. Culler, Jaswinder Pal Singh, “Parallel computing architecture: A hardware/software 71 approach”, Morgan Kaufmann /Elsevier Publishers, 1999.

REFERENCES:

1. Kai Hwang and Zhi Wei Xu, “Scalable Parallel Computing”, Tata McGraw Hill, New Delhi, 2003.
2. Kai Hwang, “Advanced Computer Architecture”, Tata McGraw-Hill Education, 2003
3. Richard Y. Kain, “Advanced Computer Architecture a Systems Design Approach”, Prentice Hall,2011

OUTCOMES:

On completion of the course the students will be able to

- Know need of multicore architecture
- Compare various multicore processor architectures
- Analyze the architecture of Vector, SIMD and GPU architecture
- Develop parallel programming using MPI for DSM
- Develop programme for shared memory architecture using OpenMP
- Discuss the existing multicore architecture

ECCX33	ROBOTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the various parts of robots and fields of robotics.
- To study the various kinematics and inverse kinematics of robots.
- To study the Euler, Lagrangian formulation of Robot dynamics.
- To study the trajectory planning for robot.
- To study the control of robots for some specific applications.

MODULE I BASIC CONCEPTS 9

Definition and origin of robotics – different types of robotics – various generations of robots – degrees of freedom – Asimov"s laws of robotics – dynamic stabilization of robots.

MODULE II POWER SOURCES AND SENSORS 9

Hydraulic, pneumatic and electric drives – determination of HP of motor and gearing ratio – variable speed arrangements – path determination – micro machines in robotics – machine vision – ranging – laser – acoustic – magnetic, fiber optic and tactile sensors

MODULE III MANIPULATORS, ACTUATORS AND GRIPPERS 9

Construction of manipulators – manipulator dynamics and force control – electronic and pneumatic manipulator control circuits – end effectors – U various types of grippers – design considerations.

MODULE IV KINEMATICS AND PATH PLANNING 6

Solution of inverse kinematics problem – multiple solution jacobian work envelop – hill Climbing Techniques

MODULE V ROBOT PROGRAMMING 4

Robot Programming: Robot Langauges – Classification of Robot language – Computer Control and Robot Software

MODULE VI CASE STUDIES 8

Mutiple robots – machine interface – Application of robots - robots in manufacturing and non- manufacturing applications – robot cell design – selection of robot.

Total Hours – 45

TEXT BOOKS:

1. Mikell P. Weiss G.M., Nagel R.N., Odraj N.G., “Industrial Robotics”, Mc Graw-Hill Singapore, 1996.
2. Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers, Chennai, 1998.
3. M.P.Groover, M.Weiss, R.N. Nagal, N.G.Odrey, “Industrial Robotics – technology, Programming and Applications” Tata McGraw-Hill Education, 2008.

REFERENCES:

1. Deb. S.R.,“Robotics Technology and flexible Automation”, John Wiley, USA 1992.
2. Klafter R.D., Chimielewski T.A., Negin M., “Robotic Engineering – An integrated approach”, Prentice Hall of India, New Delhi, 1994.
3. Mc Kerrow P.J. “Introduction to Robotics”, Addison Wesley, USA, 1991.
4. Issac Asimov “Robot”, Ballantine Books, New York, 1986.
5. Barry Leatham – Jones, “Elements of industrial Robotics” PITMAN Publishing, 1987.
6. Mikell P.Groover, Mitchell Weiss, Roger N.Nagel Nicholas G.Odrey, “Industrial Robotics Technology, Programming and Applications “, McGraw Hill Book Company 1986.
7. Fu K.S. Gonzaleaz R.C. and Lee C.S.G., “Robotics Control Sensing, Vision and Intelligence” McGraw Hill International Editions, 1987.

OUTCOMES:

On completion of the course the students will be able to

- Explain the basic concepts of working of robot
- Analyze the function of sensors in the robot
- Write program to use a robot for a typical application
- Use Robots in different applications

ECCX34	VLSI SIGNAL PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn different algorithms used for DSP processors and fundamentals of pipelining and parallel processing on FIR filters.
- To study the concepts of retiming, unfolding, transforms and rank order filters.
- To understand different fast convolution algorithms and pipelining/parallel processing techniques for IIR filters.
- To study different bit level architectures and their complexities.
- To study the general architectures of programmable Digital signal processors.

MODULE I INTRODUCTION TO DSP SYSTEMS 5

Typical DSP algorithms: Convolution, correlation, Digital filters, Adaptive filters, Discrete cosine transform Decimators and Expanders, wavelets and filter banks, DSP application demands and scaled CMOS technologies, Representation of DSP Algorithms

MODULE II PIPELINING AND PARALLEL PROCESSING 9

Data flow graph representations, loop bound and iteration bound, Algorithms for computing iteration bound: Longest path Matrix algorithm, Iteration bound for multirated data flow graphs Pipelining and parallel processing - Pipelining of FIR digital filters, parallel processing, pipelining and parallel processing for low power.

MODULE III RETIMING, ALGORITHMIC STRENGTH REDUCTION 9

Definitions and properties of retiming, an algorithm for unfolding, properties of unfolding, Applications of unfolding: sample period reduction , parallel processing

MODULE IV FAST CONVOLUTION AND ALGORITHMIC STRENGTH REDUCTION IN FILTERS AND TRANSFORMS 9

Cook Toom algorithm, modified Cook-Took algorithm, parallel FIR filter, 2-parallel fast FIR filter, DCT algorithm architecture transformation, parallel architectures for rank-order filters, odd- even merge- sort architecture, parallel rank-order filters.

MODULE V BIT LEVEL ARITHEMATIC ARCHITECTURES 9

Parallel multipliers with sign extension, parallel carry-ripple array multipliers, parallel carry save multiplier, bit Baugh-Wooley multipliers, parallel multipliers with modified

booth recoding, Bit serial multipliers, Bit serial filter design and implementation multipliers using Horner's rule, bit-serial FIR filter.

MODULE VI PROGRAMMABLE DIGITAL SIGNAL PROCESSORS 4

Introduction, evolution of programmable DSP, important features of DSP processors, DSP processors for mobile and wireless communication, processors for multimedia signal processing.

Total Hours –45

TEXT BOOKS:

1. Keshab K.Parhi, "VLSI Digital Signal Processing systems, Design and implementation", Wiley, Inter Science, 1999.
2. Mohammed Ismail and Terri Fiez, "Analog VLSI Signal and Information Processing ", McGraw-Hill, 1994.

REFERENCES:

1. S.Y. Kung, H.J.White House,T.Kailath,"VLSI and Modern Signal Processing ", Prentice Hall,1985.

OUTCOMES:

On completion of the course the students will be able to

- Understand various algorithms that can be designed and applied on application specific VLSI architecture.
- Have knowledge on fast convolution algorithms and high speed multipliers.
- Gain minimum knowledge to find solution for any research queries on DSP processors.
- Apply the advantages retiming, unfolding and folding on pipelined and parallel processed architectures.
- Have the ability to develop advanced DSP filters and processors.
- Be able to develop optimized DSP designs by employing the advantages of VLSI concepts.

ECCX35	ELECTROMAGNETIC INTERFERENCE & COMPATIBILITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To apply, identify and understand the basic knowledge of science in EMI & EMC in different environments.
- To select and apply appropriate coupling principles for EMI.
- To formulate and analyze different EMI measurements
- To understand the concepts of EMI control mechanisms which meets the specific needs with appropriate techniques.
- To select, apply and differentiate appropriate standards for EMI/EMC.
- To design, analyze and understand the process of creating EMC PCBs

MODULE I EMI ENVIRONMENT 8

Concepts of EMI and EMC and definitions - Sources of EMI - Celestial Electromagnetic noise - Lightning discharge-Electrostatic Discharge-Electromagnetic Pulse - Electromagnetic emissions - Noise from relays and Switches - Nonlinearities in Circuits

MODULE II EMI COUPLING PRINCIPLES 8

Capacitive coupling - Inductive coupling- Common impedance ground coupling- Ground loop coupling-Transients in power supply lines- Radiation coupling, Conduction coupling- Common - mode and Differential mode interferences- Conducted EM noise on power supply lines.

MODULE III EMI MEASUREMENTS 7

Open area test site measurements-Measurement precautions - Open -area test site-Anechoic Chamber-TEM Reverberating TEM-GTEM cell – Comparisons

MODULE IV EMI CONTROL TECHNIQUES 7

EMC Technology- Grounding-Shielding-Electrical Bonding-Power line filter-CM filter - DM filter- EMI suppression Cables- EMC Connectors -Isolation transformer.

MODULE V EMI / EMC STANDARDS 8

Introduction- Standards for EMI/EMC- MIL-STD-461/462-IEEE/ANSI standard-CISPR/IEC standard- FCC regulations-British standards-VDE standards-Euro norms-Performance standards-some comparisons.

MODULE VI EMC DESIGN OF PCBs 7

PCB Traces Cross Talk, Impedance Control, Power Distribution Decoupling, Zoning, Motherboard Designs and Propagation Delay Performance Models.

Total Hours – 45

REFERENCES:

1. V.P.Kodali, "Engineering EMC Principles, Measurements and Technologies", IEEE Press, 1996.
2. Henry W.Ott, "Noise Reduction Techniques in Electronic Systems", John Wiley and Sons, New York,1988.
3. C.R.Paul, "Introduction to Electromagnetic Compatibility", John Wiley and Sons, Inc, 1992
4. Bernhard Keiser, "Principles of Electromagnetic Compatibility", 3rd Edition, Artech house, 1986.

OUTCOMES:

On completion of the course the students will be able to

- Outline the basic knowledge of science in EMI & EMC in different environments.
- Distinguish coupling principles for EMI.
- Measure different EMI parameters
- Apply EMI control mechanisms for specific needs with appropriate techniques.
- Compare and discuss different standards for EMI/EMC.
- Design and analyze the process of creating EMC PCBs

ECCX36 INTRODUCTION TO INTERNET OF THINGS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To Provide an overview of concepts, main trends and the paradigm of Internet of Things.
- Develop skills to relate the IoT technologies for practical IoT applications.
- Develop the ability to use Internet of Things related protocols and connectivity methods.
- Provide the knowledge of data management business processes and analytics of IoT.

PRE-REQUISITES:

- Prerequisite: Fundamentals of computer network, wireless sensor network, communication & internet technology, web technology, information security.

MODULE I INTRODUCTION – CONCEPTS BEHIND THE INTERNET OF THINGS 6

The IoT paradigm - Smart objects - Bits and atoms - Goal orientation - Convergence of technologies - Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization - Overview of IoT architecture.

MODULE II IOT APPLICATIONS FOR VALUE CREATION 5

Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT - Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT - Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, eHealth.

MODULE III OVERVIEW OF IOT CONNECTIVITY METHODS AND TECHNOLOGIES 9

Wireless 101 - RF 101 - ZigBee - RFID - Hardware, SoC, sensors, device drivers, IoT standards - Cloud computing for IoT - Bluetooth, Bluetooth Low Energy - IEEE 802.15.4, IEEE 802.15.4e, 802.11ah - Relay Access Point (AP) - Grouping of stations - Target Wake Time (TWT) - Real-time systems and embedded software -

Cloud computing and storage - Augmented Reality.

MODULE IV PROTOCOLS 8

NFC, RFID, Zigbee - MIPI, M-PHY, UniPro, SPMI, SPI, M-PCIe - Wired vs. Wireless communication -GSM, CDMA, LTE, GPRS, 3G, LTE,small cells, SATCOM - Sensors and sensor networks - Wired connectivity - IPv4/IPv6 - Ethernet/GigE.

MODULE V EVALUATION OF THE INTERNET OF THINGS 8

Platforms - Mobile integration - Deployment - Data Visualization - Convergence with Social Networks - Value chain and Business models - User centric cloud based services - Analytical Hierarchy Process for technology selection - End-to-end security - Integration with IT systems, Cost/benefit constraints End-to-end compatibility, Application Architecture - Lifecycle solution management, Real-time response and delay.

MODULE VI INTERNET OF THINGS PRIVACY, SECURITY AND GOVERNANCE 9

Introduction, Overview of Governance - Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach - Data Aggregation for the IoT in Smart Cities, Security.

TOTAL HOURS 45

TEXT BOOKS

1. Dr. Ovidiu Vermesan, Dr. Peter Friess, Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, River Publishers, 2013.

REFERENCES

1. Cuno P fister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978-1-4493- 9357-1
2. Vijay Madisetti and Arshdeep Bahga, “Internet of Things (A Hands-on-Approach)”, 1 st Edition, VPT, 2014
3. Samuel Greengard, “The Internet of Things”, MIT Press, 2015.
4. Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1 st Edition, Apress Publications, 2013

OUTCOMES:

On completion of the course, students will be able to

1. Explain and interpret the concepts of IoT.
2. Understand the steps involved in IoT design Methodology for different applications.
3. Identify the hardware and connecting methods of IoT Technologies.
4. Explore the features of various protocols used for IoT.
5. Experiment with the software & hardware IoT Technologies.
6. Evaluate the performance of an IoT based prototype.

ECCX37	RF SYSTEM DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the characteristics of RF basic components and RF transistors.
- To design and analyze all types of RF filters,amplifiers,oscillators.
- To understand and design the various impedance matching using smith chart.

PREREQUISITES

- Basics of Resonant Circuits, Biasing of transistor, Amplifier design.

MODULE I INTRODUCTION TO RF COMPONENTS 7

Wire – Resistor – Inductor – Capacitor – Torids – Toroidal Inductor Design.

MODULE II RESONANT CIRCUITS 8

Resonance – Loaded Q – Insertion Loss -Impedance transformations – Coupling of Resonant circuits

MODULE III MODERN FILTER DESIGN 8

Filter types – Normalization and Low pass prototype- Frequency & Impedance Scaling – High Pass Filter design - Dual networks – Band Pass Filter design – Band Rejection filter Design – effects of finite Q.

MODULE IV IMPEDANCE MATCHING 8

Background – L Network design – Complex Loads – three element matching – Wideband matching Networks – Smith chart – Impedance Matching using smith chart.

MODULE V TRANSISTOR AT RADIO FREQUENCIES 8

Transistor equivalent circuit – Y parameters – S parameters – transistor biasing – Design Using Y parameters – Design using S parameters

MODULE VI RF AMPLIFIER & OSCILLATORS 6

RF Power amplifier characteristics – Transistor Biasing - Power amplifier Design – Matching to Coaxial feed lines – Broadband Amplifiers – Oscillators.

Total Hours –45

TEXT BOOKS:

1. Chris Bowick, “Rf Circuit Design”, Newnes Ltd.,1982.
2. Reinhold Ludwig and Powel Bretchko, "RF Circuit Design - Theory and Applications", 1st Edition, Pearson Education Asia, 2001.
3. David.M.Pozar, "Microwave Engineering" 3rd Edition, John Wiley and Sons, 2005.

REFERENCES:

1. Mathew M. Radmanesh, "Radio Frequency & Microwave Electronics", 2nd Edition, Pearson Education Asia, 2002.
2. S.Y.Liao, "Microwave Amplifiers and Oscillators Design", Prentice Hall, New Jersey, 1999.
3. G.Gonzalez, "Microwave Transistors and Amplifiers: Analysis and Design", Prentice Hall, New Jersey 1999.

OUTCOMES:

On completion of the course, students will be able to

- Understand the basic RF components Characteristics and resonant circuits.
- Design different types of filters for various applications.
- Identify impedance matching for various RF circuits using smith chart.
- Analyze the S parameter value for any RF transistors.
- Design RF power amplifiers and oscillators with proper transistor biasing
- Implement the design of RF components and circuits for various applications.

ECCX38	INTRODUCTION TO SATELLITE COMMUNICATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To define satellite orbits and to understand about satellite communication
- To illustrate geostationary orbit and to formulate uplink and down link equations
- To explain the basic concepts of earth and space segments
- To introduce the principles and mechanism involved in satellite systems
- To illustrate the facts and ideas of different satellite services and its applications

MODULE I ORBITAL MECHANICS AND LAUNCHER 8

Orbital Mechanics – Look angle determination –Orbital perturbations – Orbit determination- launches and launch vehicles – Orbital effects in communication systems

MODULE II THE SPACE AND EARTH SEGMENT 8

Space segment: Satellite subsystems – Attitude and orbit control systems – Telemetry, Tracking, Command and Monitoring – Power systems – Communication Subsystems. Earth segment: Receive only Home TV Systems- Master antenna TV systems – community antenna TV systems - Transmit-Receive Earth stations.

MODULE III SATELLITE ANTENNAS CHARACTERISTICS 7

Satellite antennas– Antenna foot prints- horn antenna- Parabolic Antenna – Multibeam Antenna – Phased array antenna –Frequency reuse in multibeam and Phased array antenna

MODULE IV THE SPACE LINK AND INTERFERENCE 7

EIRP- transmission loss- the link power budget equation –system noise –CNR-the uplink- the downlink – Effects of rain – Combined uplink and down link – Intermodulation noise- Intersateliite links- Interference between satellites – Energy dispersal – Coordination

MODULE V SATELLITE DIGITAL AUDIO RADIO SERVICE AND VSAT NETWORKS FOR INTERACTIVE APPLICATION 7

Satellite radio broad cast Concept- World space- Sirius satellite radio- XM satellite

Radio – Interactive data networks- VSAT star networks – VSAT in business TV

MODULE VI FIXED TELEPHONY SATELLITE NETWORKS AND MOBILE SATELLITE SERVICE **8**

Role of satellite in telephone services – Demand assignment SCPC Network Architecture – Preassigned point to point link – Application of FTS- Foundation of Mobile Satellite services – GEO MSS system – Handheld terminals – Non- GEO MSS systems – Intelligent MSS services- Multiple access in MSS – Digital speech compression – Ground Segment Architecture in MSS- Subscriber access and connectivity – Network security

Total Hours –45

TEXT BOOKS:

1. Timothy Pratt, Charles Bostian, Jeremy Allmuti, "Satellite Communications", John Wiley &Sons (Asia) Pvt. Ltd. 2004.
2. Dennis Roddy, "Satellite Communications", 4th Edition, McGraw-Hill Publication, 2006.

REFERENCES:

1. Satellite Communications Network Design and Analysis, Kenneth Y. Jo, Artech House, 2011- Artificial satellites in telecommunication
2. The Satellite Communication Applications Handbook, 2nd edition Bruce R. Elbert , Artech House, 2004 - Technology & Engineering
3. Introduction to Satellite Communication, Bruce R. Elbert , 3rd edition Artech House, 2008 - Technology & Engineering
4. Wilbur L. Pritchard, Henri G.Suyder, Hond Robert A.Nelson, "Satellite Communication Systems Engineering", 2nd Edition, Pearson Education Ltd., 2003.
5. M.Richharia,"Satellite Communication Systems (Design Principles)", 2nd Edition, Macmillan Press Ltd, 2003.

OUTCOMES:

On completion of the course the students will be able to

- Identify satellite orbits and launching mechanisms
- Describe the space segment and earth segment
- Identify different antennas used in satellite communication
- Design uplink and downlink of a satellite systems
- Describe satellite service like FSS, DBS, MSS, VSS etc.…

ECCX39	MICROWAVE & MILLIMETER WAVE SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To train different microwave and millimeter wave transceivers architectures and illustrate their operation principle.
- To provide the design consideration of microwave and millimeter waves systems.
- To introduce the design consideration for antennas in the millimeter wave range.

MODULE I PASSIVE MICROWAVE COMPONENTS 8

Lumped & Distributed elements, Two-port networks, S-parameters, impedance matching, Microwave Filters - Butterworth and Chebyshev Response, Transmission Line Filter.

MODULE II ACTIVE MICROWAVE DEVICES

Diodes, Microwave Transistors, Microwave FET, Power Amplifier Design – stability, Oscillator and Resonators Design.

MODULE III CHARACTERISTICS OF MILLIMETER WAVE

Millimeter Wave Characteristics, Channel Performance at 60 GHz, Gigabit Wireless Communications, Development of Millimeter Wave Standards, Coexistence with Wireless Backhaul. Review of modulations for millimeter wave, Orthogonal Frequency Division Multiplexing.

MODULE IV MILLIMETER WAVE TRANSCEIVERS

Millimeter Wave Link Budget, Transceiver Architecture, Transceiver Without Mixer, Receiver Without Local Oscillator, Millimeter Wave Calibration, Silicon-based transceivers.

MODULE V MILLIMETER WAVE ANTENNAS

Path Loss and Antenna Directivity, Antenna Beamwidth, Maximum Possible Gain-to-Q, Polarization, Beam Steering and Beam Forming, Millimeter Wave Design Consideration.

MODULE VI MIMO

Spatial Diversity of Antenna Arrays, Multiple Antennas, Multiple Transceivers, Noise

Coupling in a MIMO System. Potential Benefits for Millimeter Wave Systems, Spatial and Temporal Diversity, Spatial and Frequency Diversity.

Total Hours – 45

TEXT BOOKS:

1. Kao-Cheng Huang, Zhaocheng Wang, "Millimeter Wave Communication Systems", 1st Edition, Wiley - IEEE, 2011.
2. George D. Vendelin ,ANTHONY M. Pavio, Ulrich L. Rohde, “Microwave Circuit Design Using Linear and Nonlinear Techniques”, 2nd Edition, Wiley Interscience, 2005.

REFERENCES:

1. D. Liu, U. Pfeiffer, J. Grzyb, B. Gaucher, “Advanced Millimeter-wave Technologies: Antennas, Packaging and Circuits”, John Wiley & Sons, 2009.
2. D. Liu, U. Pfeiffer, J. Grzyb, B. Gaucher, “Advanced Millimeter-wave Technologies:Antennas, Packaging and Circuits”, John Wiley & Sons, 2009.
3. J. Wells, “Multi-Gigabit Microwave and Millimeter-Wave Wireless Communications”, Artech House, 2010.

OUTCOMES:

On completion of the course students will be able to

1. Identify the active and passive microwave components
2. Describe the characteristics of millimeter waves
3. Apply the spatial and frequency diversity principles in designing MIMO systems.
4. Evaluate the channel performance at frequencies above 40 GHz.
5. Analyze the design of millimeter wave transceivers and antennas.
6. Design antennas for specific microwave and millimeter wave applications.

ECCX40	RADAR AND NAVIGATIONAL AIDS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the Principle of Radar and derive range equation of RADAR.
- To learn the different types of Radars and its applications.
- To illustrate the Doppler principle in radars and to know about the facts in the detection and tracking.
- To analyze the usage of antennas and its propagation as related to radars and the transceivers.
- To know about the principles of navigation and landing aids.

MODULE I INTRODUCTION TO RADAR 9

Basic Radar –The simple form of the Radar Equation- Radar Block Diagram-Radar Frequencies –Applications of Radar – The Origins of Radar.

MODULE II THE RADAR EQUATION 9

Introduction- Detection of Signals in Noise- Receiver Noise and the Signal-to-Noise Ratio-Probability Density Functions- Probabilities of Detection and False Alarm-Integration of Radar Pulses- Radar Cross Section of Targets- Radar cross Section Fluctuations-Transmitter Power-Pulse Repetition Frequency-Antenna Parameters-System losses – Other Radar Equation Considerations.

MODULE III TARGET ECHO INFORMATION EXTRACTION 5

Detection – Detection in Noise – Signal Integration and Target Fluctuation – M of N Detection – Threshold Setting Concept (CFAR) – Ranging – Target Velocity – Range and Velocity with CW – Radar Height Finding

MODULE IV MTI AND PULSE DOPPLER RADAR 9

Introduction to Doppler and MTI Radar - Delay –Line Cancelers - Staggered Pulse Repetition Frequencies –Doppler Filter Banks - Digital MTI Processing - Moving Target Detector - Limitations to MTI Performance - MTI from a Moving Platform (AMIT) - Pulse Doppler Radar– Other Doppler Radar Topics- Tracking with Radar – Monopulse Tracking –Conical Scan and Sequential Lobing - Limitations to Tracking Accuracy - Low-Angle Tracking - Tracking in Range - Other Tracking Radar Topics - Comparison of Trackers - Automatic Tracking with Surveillance Radar (ADT).

MODULE V FUNDAMENTALS OF NAVIGATION 9

Introduction to Navigation - Aural Null Direction Finder - Commutated Aerial Direction Finder - Range and Accuracy of Direction Finders, Radio Ranges - The LF/ MF Four course Radio Range - VHF Omni Directional Range(VOR) - VOR Receiving Equipment - Range and Accuracy of VOR – Recent Developments. Hyperbolic Systems of Navigation (Loran and Decca) - Loran-A - Loran-A Equipment - Range and precision of Standard Loran - Loran-C - The Decca Navigation System - Decca Receivers - Range and Accuracy of Decca - The Omega System.

MODULE VI APPLICATIONS OF RADAR 4

DME - TACAN - Microwave Landing System(MLS) - Global Positioning System (GPS)

Total Hours –45

TEXT BOOKS:

1. Merrill I. Skolnik ," Introduction to Radar Systems", Tata McGraw-Hill, 3rd Edition, 2003.
2. Byron Edde, “Radar Principles, Technology, Applications”, Pearson Education India,2009.

REFERENCES:

1. Peyton Z. Peebles, "Radar Principles", Johnwiley, 2004
2. J.C Toomay, "Principles of Radar", 2nd Edition –PHI, 2004

OUTCOMES:

On completion of the course the students will be able to

- Define and describe the basic principle and operation of Radar.
- Describe the working of RADAR and the techniques of detection.
- Apply Doppler principle to radars
- Compare and Analyze different types of Radar and its applications.
- Distinguish the types of antennas and propagation related to radars.
- Illustrate the principle and mechanism involved in the navigational aids

ECCX41	ADVANCED ANTENNA DESIGN	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To provide an in-depth understanding of modern antenna concepts
- Understanding of practical antenna design for various applications
- To discuss various types of antennas including the planar printed antennas
- To introduce the concept of smart antennas

MODULE I FUNDAMENTAL CONCEPTS 5

Physical concept of radiation, Radiation pattern, near- and far-field regions, reciprocity, directivity and gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation, radiation integrals and auxiliary potential functions.

MODULE II MICROSTRIP ANTENNAS 6

Basic characteristics of microstrip antennas, feeding methods, methods of analysis, design of rectangular and circular patch antennas.

MODULE III ANTENNA ARRAYS 6

Analysis of uniformly spaced arrays with uniform and non-uniform excitation amplitudes, extension to planar arrays.

MODULE IV ADVANCED ANTENNA CONCEPTS & APPLICATIONS 7

Reconfigurable Antennas – Millimeter Wave Antennas – Concepts of Metamaterial Antennas - Antennas for medical applications - Antennas for MIMO / Full-Duplex Systems - Antennas for mobile communications

MODULE V BASIC CONCEPTS OF SMART ANTENNAS 6

Concept and benefits of smart antennas, Fixed weight beamforming basics, Adaptive beamforming

MODULE VI ANTENNA MEASUREMENTS 5

Antenna ranges - Radiation patterns - Gain measurements - Directivity - Polarization measurements - Scale model measurements

Practicals:

1. Simulation of Rectangular Microstrip Antennas.
2. Simulation of Circular Microstrip Antennas.
3. Simulation of 2 Element Antenna Array
4. Simulation of Planar Array
5. Simulation of Reconfigurable Antenna
6. Simulation of Millimeter wave Antenna
7. Simulation of Metamaterial Antenna
8. Simulation of MIMO Antenna
9. Simulation of Smart antenna
10. Antenna Measurements.

L – 30; T – 30; Total Hours –60

TEXT BOOKS:

1. C.A.Balanis,"Antenna Theory and Design", 3rd Ed., John Wiley & Sons., 2005
2. W. L.Stutzman, and G.A. Thiele,"Antenna Theory and Design", 2nd Ed., John Wiley & Sons., 1998
3. R.S.Elliot,"Antenna Theory and Design", Revised edition, Wiley-IEEE Press., 2003

REFERENCES:

1. Ved Vyas Dwivedi, “Microstrip Patch Antenna Using Metamaterial”, Lambert Academic Publishing, 2012
2. Lamont V. Blake, Maurice W. Long, "Antennas: Fundamentals, Design, Measurement", 3rd SciTech Pub., 2009.
3. Jaco du Preez, Saurabh Sinha, "Millimeter-Wave Antennas: Configurations and Applications", Springer, 2016
4. John D Kraus, Ronald J Marhefka, Ahmad S Khan, "Antennas and Wave Propagation", 3rd Edition, Tata McGraw Hill, 2006
5. Frank Gross, "Smart Antennas for Wireless Communications: With MATLAB", 2nd edition, Tata McGraw Hill, 2005

OUTCOMES:

On completion of the course the students will be able to

- Understand the fundamental concepts of antennas.
- Analysis and design parameters pertaining to microstrip patch antennas
- Design antenna arrays and analyze mutual coupling among antennas

- Have an understanding of advanced antenna concepts such as millimeter-wave antennas, reconfigurable antennas, and metamaterial based antennas
- Formulate and execute a research plan to design advanced antenna types including simulations and measured results.
- Understand the concepts of smart antennas.

ECCX42	INTRODUCTION TO ERROR CONTROL CODING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide an introduction to traditional and modern coding theory.
- To introduce the recent advancements in codes
- To develop a new code based on an application

MODULE I Linear Block codes **8**

Introduction to Error control coding, Linear Block codes-Generator matrix-Parity check Matrix-Properties of Linear Block codes-syndrome and Error Detection-Decoding of Linear block codes-Distance properties of Linear Block codes.-Examples –Repetition codes, SPC, Reed Muller codes.

MODULE II CYCLIC CODES **7**

Fields-Polynomial ring-Construction of finite fields-Deducing finite field structure-subfields –cyclic codes –BCH codes-Reed Solomon codes-Decoding of BCH and Reed Solomon codes

MODULE III CONVOLUTIONAL CODES **7**

Introduction to convolutional codes-Encoding-state diagram-trellis diagram-classification-realisation-Distance properties-Decoding of convolutional codes-Viterbi algorithm-BCJR algorithm

MODULE IV TURBO CODES **8**

Turbo codes-Intoduction-encoding-Decoding of Turbo codes-Distance Properties of Turbo codes-Convergence of Turbo codes-HARQ schemes in Turbo codes

MODULE V LDPC CODES **7**

Low Density Parity Check Codes-Intoduction-Encoding –Decoding of LDPC codes-Belief Propagation Algorithm on BSC and AWGN channel

MODULE VI APPLICATIONS OF ECC **8**

Error Detecting codes in ISBN numbers, European article number(EAN)-Compact Discs-Satellite Communications-Deep Space Communications-modems-Wireless Communications

Total Hours –45

TEXT BOOKS:

1. Shu Lin and Daniel Costello, “Error Control Coding”, Pearson, II edition, 2004

REFERENCES:

1. RudigerUrbanke and Thomas Richardson “Modern coding theory”, Cambridge 2008
2. F. J. MacWilliams and N. J. A. Sloane, “The theory of error-correcting codes”, North-Holland publishers, 1983.
3. Richard Blahut “Algebraic codes for data transmission” Cambridge, 2003
4. Thierry Lestable, Moshe Ran, “Error Control Coding for B3G/4G Wireless Systems”, John Wiley & Sons ltd, 2011.
5. DhouhaKbaier Ben Ismail, Catherine Douillard and Sylvie Kerouédan, “A survey of three-dimensional turbo codes and recent performance enhancements” Journal on Wireless Communications and Networking 2013, Vol. 2013:115

OUTCOMES:

On completion of the course the students will be able to

- Describe the modern coding techniques and basics of coding algebra.
- Combine the effect of HARQ schemes with Error Correcting Codes
- Employ the concept of convolutional codes in constructing a turbo coder
- Analyze the performance of Turbo codes and LDPC.
- Develop a new design of channel coding.
- Recommend a channel coder based on the application.

ECCX43 SATELLITE IMAGE PROCESSING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To study about the satellite systems and display systems
- To describe about the procedure of satellite data acquisition.
- To analyze about enhancing the satellite images
- To know about the methods to extract information from satellite images
- To analyze the satellite images using different techniques
- To interpret satellite images

MODULE I SATELLITE SYSTEMS AND DATA 7

acquisition - storage - orbits – Data formats –Data products – Image processing system – factors to be considered- Image display systems – Image sampling and quantization - Basic relationship between pixels.

MODULE II SENSOR AND DATA MODEL 8

Sensor model – pixel characters - Image formation – Histogram -Types- Uni-variate & multi-variate image statistics – spatial statistics – Image registration and ortho rectification - Geometric and radiometric correction - noise models.

MODULE III IMAGE ENHANCEMENTS 8

Spectral signatures – Image characteristics, feature space scatterogram- point, local and regional operation – contrast, spatial feature and multi image manipulation techniques - Fourier transform - principle component analysis - Optimal Rotation Transformation – Scale-space transform, wavelet transform. multi-image fusion

.

MODULE IV INFORMATION EXTRACTION 7

Training sits - Supervised, Unsupervised and Hybrid classifiers - Baye's Theorem – parametric Classification - -Decision tree – other Non - parametric classifiers - sub-pixel and super-pixel classification – Hyper-spectral image analysis – Accuracy assessment.

MODULE V IMAGE ANALYSIS 8

Pattern recognition - boundary detection and representation - textural and contextual analysis - decision concepts: Fuzzy sets - evidential reasoning - Expert system - Artificial Neural Network – Case studies

MODULE VI VISUAL IMAGE INTERPRETATION 7

Introduction –Fundamentals - Visual Image interpretation equipment Land use/Lan cover Mapping – Geological and soil mapping – wet land mapping- Application : Agriculture , forestry, rangeland, water resource , urban ,regional and archeological

Total Hours –45

TEXT BOOKS:

1. John R. Jensen, Introductory Digital Image Processing: A Remote Sensing Perspective, 4th Edition, 2015.
2. Robert Shcowebgerdt, Remote sensing models & methods for image processing,3 rd edition, 2004. 3. John A.Richards, Springer – Verlag, Remate Sensing Digital Image Analysis 1999.

REFERENCES:

1. Digital Image Processing (3rd Edition) Rafael C. Gonzalez, Richard E. Woods Prentice Hall, 2007.
2. W.G.Rees - Physical Principles of Remote Sensing, Cambridge University Press, 2nd edition, 2001.
3. Remote Sensing and Image Interpretation 6th Edition, by Thomas Lillesand , ,Kiefer .Ralph W Jonathan Chipman 2008
4. Image Processing and GIS for Remote Sensing: Techniques and Applications, Jian Guo Liu, Philippa J. Mason, John Wiley & Sons, 2016

OUTCOMES:

On completion of this course, the student shall be able to

- Get familiarized about various satellite systems and data systems
- Understand the image formation and information
- Apply the image enhancement and image processing techniques.
- Interpret satellite images and can analyses the image using models
- Derive the information from various images
- Interpret the satellite image visually

ECCX44	SOFTWARE DEFINED RADIO	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand Modern Radio Communication System
- To understand GNU Radio
- To understand how SDR platform provides easy access to wireless network system
- To understand how unlike simulation in Communication Projects, SDR allows easy access to both PHY and MAC layer
- To understand the concept of Cognitive Radio and Spectrum sharing

PREREQUISITES:

- Basics of Analog and digital communication
- Basics of wireless communication

MODULE I SOFTWARE DEFINED RADIO FUNDAMENTALS 8

Introduction to SDR, Principles of SDR , Basic Principle and difference in Analog radio and SDR , SDR characteristics, required hardware specifications, Software/Hardware platform, GNU radio - GNU Radio Architecture, Hardware Block of GNU, GNU software , MATLAB in SDR , Radio Frequency Implementation issues, Purpose of RF front End, Dynamic Range ,RF receiver Front End topologies, Flexibility of RF chain with software radio, Duplexer ,Diplexer ,RF filter ,LNA ,Image reject filters , IF filters , RF Mixers Local Oscillator , AGC, Transmitter Architecture and their issues, Sampling theorem in ADC, Noise and distortion in RF chain, Pre-distortion

MODULE II SDR ARCHITECTURE 7

Architecture of SDR-Open Architecture, Software Communication Architecture, Transmitter Receiver Homodyne/heterodyne architecture, RF front End, ADC, DAC, DAC/ADC Noise Budget, ADC and DAC Distortion, Role of FPGA/CPU/GPU in SDR, Applications of FPGA in SDR, Design Principles using FPGA, Trade –offs in using DSP, FPGA and ASIC, Power Management Issues in DSP,ASIC,FPGA

MODULE III MULTI RATE SIGNAL PROCESSING 8

Sample timing algorithms, Frequency offset estimation and correction, Channel Estimation, Basics of Multi Rate, Multi Rate DSP, Multi Rate Algorithm, DSP techniques in SDR, OFDM in SDR

MODULE IV SMART/MIMO ANTENNAS USING SOFTWARE RADIO 7

Smart Antenna Architecture, Vector Channel Modeling , Benefits of Smart Antenna Phased Antenna Array Theory, Adaptive Arrays, DOA Arrays, Applying Software Radio Principles to Antenna Systems, Beam forming for systems-Multiple Fixed Beam Antenna Array, Fully Adaptive Array , Relative Benefits and Trade-offs OF Switched Beam and Adaptive Array, Smart Antenna Algorithms , Hardware Implementation of Smart Antennas, MIMO -frequency, time, sample Synchronization, Space time block coding-Space Time Filtering, Space Time Trellis Coding .

MODULE V COGNITIVE RADIO 8

Cognitive Radio Architecture, Dynamic Access Spectrum, Spectrum Efficiency, Spectrum Efficiency gain in SDR and CR ,Spectrum Usage, SDR as a platform for CR, OFDM as PHY layer ,OFDM Modulator, OFDM Demodulator, OFDM Bandwidth, Benefits of OFDM in CR, Spectrum Sensing in CR, CR

MODULE VI APPLICATIONS OF SDR 7

Application of SDR in Advance Communication System-Case Study, Challenges and Issues, Implementation, Parameter Estimation –Environment, Location, other factors, Vertical Handoff, Network Interoperability.

Total Hours –45

TEXT BOOKS:

1. Jeffrey.H.Reed ,Software Radio : A Modern Approach to Radio Engineering , Pearson , LPE
2. Markus Dillinger , KambizMadani ,Nancy Alonistioti, Software Defined Radio : Architectures , Systems and Functions ,Wiley.
3. Tony .J. Rouphael , RF and DSP for SDR, Elsevier Newness Press ,2008

REFERENCES:

1. Dr.TajStruman ,Evaluation of SDR –Main Document
2. SDR –Handbook , 8th Edition , PENTEK 5. Bruce a. Fette , Cognitive Radio Technology, Newness, Elsevier.

OUTCOMES:

After successfully completing the course students will be able to

- Compare SDR with traditional Hardware Radio (HDR)
- Implement modern wireless system based on OFDM, MIMO & Smart Antenna
- Build experiment with real wireless waveform and applications.

- Analyze the Multi Rate Signal Processing
- Accessing both Physical and MAC layers.
- Parameter estimation of SDR

ECCX45	GNU RADIO REALIZATION THROUGH PYTHON AND C++	L	T	P	C
		1	0	2	2

OBJECTIVES:

- Student will learn with about open source software with respect to digital communication in
- The course is combined with USRP/RTL SDR to enable the use of off the self-component for analysis of the RF signal, which are readily available at much lower cost than the standard testing rig
- Various system requirement for a good RF receiver

MODULE I GNU RADIO & RTL SDR 5+10

USRP/RTL hardware schematics(A/D convertor, OCXO, TCXO, PPM, USB interface) -Sampling and bandwidth, SNR, Low Noise Amplifier, Down conversion -Gnu radio Companion(GRC) modules, source modules, sink modules, plotting of frequency response

PRACTICAL :

Sin wave generation using GRC

frequency plot using GRC

MODULE II GNU RADIO PYTHON & C++ 5+10

GRC Blocks, (gr-theano, gr-)- Modification of the python code generated by GRC - Out of order (OOT) modules creation - How to add Python blocks with gr_modtool - create a module for QPSK mapping, create GRC binding for block

PRACTICAL :

Creation of AM receiver using GRC flow graph

Modify the python code for water fall frequency plot

Add the module to gr_modtool

Creation of QPSK block and add it to gr_modtool

MODULE III GNU RADIO INTERFACING WITH HARDWARE 5+10

gr-uhd-Interfacing with USRP- gr-osmosdr-interfacing with RTL-SDR, decimation, interpolation, wifi 802.11 (Phy and mac) layer, study and analysis using gr-ieee802-11

PRACTICAL :

1) Implementation of the OFDM receiver based on Wifi physical layer specification
2) Implementation of the 802.11 MAC layer packetization of the received MAC data (802.11) using gr-foo for analysis using wireshark

L – 15; P – 30; Total Hours – 45

TEXT BOOKS:

1. David clark & Paul clark , “Field Expedient SDR: Introduction to Software Defined Radio”
2. Carl Laufer , “The Hobbyist's Guide to the RTL-SDR: Really Cheap Software Defined Radio”.
3. Mathew S. Gast , “802.11 wireless Networks : The definitive guide”

REFERENCES:

1. Simon Haykin and Michael Moher, ”An Introduction to Analog and Digital Communications”, JOHN WILEY & SONS, INC, .2006.

OUTCOMES:

- Student will learn how to build modules in gnu radio
- Use off the self-components to analyse different radio technology
- Will learn the system design aspect for SDR

ECCX46	IMPLEMENTATION OF GSM (2G), 3G STACK	L	T	P	C
		1	0	2	2

OBJECTIVES:

- To have practical exposure on GSM stack implementation.
- GSM base station is a complex entity which had high cost and cannot be used for funding.
- Open BTS being open source and open hardware presents a simplified view of the base station

PREREQUISITES:

- Digital communication, Networking, wire shark

MODULE I INTRODUCTION TO GSM 5+10

GSM Architecture (HLR, VLR, Equipment identity register, Outgoing call, incoming call, BTS-L1(PHY), BTS-L2(MAC))- PSTN - VoIP (SIP) -Wireshark packet analysis

Practical :

Wireshark installation

Filtering of packet (udp & TCP)

MODULE II OPEN BTS & USRP 5+10

USRP (dynamic range of the a/d convertor, bandwidth, fpga, UDP packet to the host from usrp, ocxo) - GSM BTS (PHY, MAC) module discussion with respect to specification - Sip authentication & registration per session (Register, invite, message) USRP B2xx internals (a/d convertor, fpga)

Practical :

Open BTS installation (clone, compiling, tool chain installation)

Mobile registration on the network

MODULE III CALL ESTABLISHMENT AND PACKET ANALYSIS 5+10

Registration of the mobile (message sequence) packet capture and analysis, (Paging request, System information)- SMS message sequence study(A-I/F DTAP, A-I/F RP, SMS TPDU)- Voice call message sequence(CCH, CI, LAI, BCCH) - 2G - Edge mode - UMTS data mode registration, packet capture and analysis

Practical :

capture and analysis of the packet for SMS

capture and analysis of the packet for voice
mobile registration rejection analysis

L – 15; P – 30; Total Hours – 45

TEXT BOOKS:

1. Michael Iedema,"Getting Started with OpenBTS: Build Open Source Mobile Networks"
2. Martin Sauter ,"From GSM to LTE: An Introduction to Mobile Networks and Mobile",
3. Russell Bryant, Leif Madsen and Jim Van Meggelen" Asterisk: The Definitive Guide: The Future of Telephony Is Now",

REFERENCES:

1. GSM - Architecture, Protocols and Services, 3rd Edition, Jörg Eberspächer, Hans-Joerg Vögel, Christian Bettstetter, Christian Hartmann Radio Access Networks for UMTS: Principles and Practice, Chris Johnson

OUTCOMES:

On completion of the course the students will be able to

- Student will have the basic understanding of control path & data path of the GSM stack.
- System capacity to handling multiple users

ECCX47	IoT FOR INDUSTRIAL APPLICATIONS	L	T	P	C
		1	0	2	2

OBJECTIVES:

- To Understand the Architectural Overview of IoT
- To Understand the IoT Reference Architecture and Real World Design Constraints
- To Understand the various IoT Protocols
- To learn the concepts of big data analytics

PREREQUISITES:

- Basics of wireless communication
- Basics of embedded system

MODULE I IOT OVERVIEW 8

IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management.

Practical

- Sensor Interfacing
- Server configuration
- Node-Node Communication

MODULE II BIG DATA PLATFORMS FOR THE INTERNET OF THINGS 7

Big Data Platforms for the Internet of Things: network protocol- data dissemination – current state of art- Improving Data and Service Interoperability with Structure, Compliance, Conformance and Context Awareness: interoperability problem in the IoT context- Big Data Management Systems for the Exploitation of Pervasive Environments - Big Data challenges and requirements coming from different Smart City applications.

Practical

- Data Management in cloud

- Web Design
- Application design

L-15 , P-30 Total Hours –45

TEXT BOOKS:

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.
2. Stackowiak, R., Licht, A., Mantha, V., Nagode, L.," Big Data and The Internet of Things Enterprise Information Architecture for A New Age", Apress, 2015.

REFERENCES:

1. Peter Waher, "Learning Internet of Things", PACKT publishing, BIRMINGHAM – MUMBAI
2. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156 5 e-ISBN 978-3-642-19157-2, Springer.
3. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6:The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications
4. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-onApproach)",1st Edition, VPT, 2014.
5. Dr. John Bates , "Thingalytics - Smart Big Data Analytics for the Internet of Things", john Bates, 2015.Outcomes

OUTCOMES:

After successfully completing the course students will be able to

- Effective usage of IoT deployment for different sectors.
- Developing and modifying code for various sensor based applications using wireless sensor modules and working with variety of modules like environmental and security module.
- Exploring the features of predictive data analytics for IoT applications.
- Modular hands on training will enable participants to conduct IoT related activities in academic environment and initiate new projects in Industrial sectors.
- Participants will be encouraged to orient themselves to specific focused areas of their interest with hands on training.

ECCX48	TELEVISION ENGINEERING	L	T	P	C
		1	0	2	2

OBJECTIVES:

- To Identify different components and section in TV receiver
- To gain sufficient knowledge regarding different modules present in the TV transmitter and receiver and their design considerations
- To get adequate knowledge regarding signal injection and signal tracing in TV system.
- To measure Voltage and waveform signals
- Organization of RF and VIDIF sections.
- Familiarization of TV set with specification and operation.

MODULE I ELEMENTS OF TV SYSTEM, TV SIGNAL TRANSMISSION AND PROPAGATION: 5+10

TV transmitter and receiver, TV signal propagation, TV broadcast channels, TV transmission antennas, Receiver antennas. Monochromatic picture tube, electrostatic focusing, beam deflection, picture tube characteristics and specifications, , TV standards: American 525 line B&W TV system, NTSC color system, 625-line monochrome system.

1. Study and Identification of various elements in TV Transmitter and Receiver.
2. Signal generation and Tracking in TV system.
3. Familiarization with specification, operation and use of TV set equipment.
4. Test TV antenna and booster.
5. Study and use of various video cameras and its controls.

MODULE II COLOR TV: 5+10

Color picture tubes, Interleaving process, Three Color theory, Chrominance Signal, composite color signal, comparison of NTSC, PAL and SECAM Systems. Color television display tubes (Delta gun, PIL, Trinitron). Color signal transmission.

1. Study of composite video signal.
2. Color pattern generators.
3. Troubleshoot VCRs for simple faults.

MODULE III SYNCHRONOUS SEPARATION, AFC AND DEFLECTION OSCILLATORS: 5+10

Synchronous separation, separation of frame and line synchronous pulses, AFC,

single ended AFC circuit. Deflection oscillators, TV cameras.

1. Tuning of RF, VIDIF and SIF sections.
2. Various video cameras and its controls.

L-15 , P-30 Total Hours –45

TEXT BOOKS:

1. Modern television practice-Principles, Technology and service-R.R. Gulati, New Age International publication, 2005.
2. Monochrome and color TV-R.R Gulati, New Age International publication, 2005.

REFERENCES:

1. Color Television Theory and practice-S.P.Bali, TMH, 2007.
2. Television and Video engineering-A.M. Dhake, 2nd Edition, Tata McGraw Hill, 2006
3. Basic television and video systems-B.Grob and C.E.Herndon, McGraw Hill, 1999.

OUTCOMES:

After completion of this course the student will be able to

- Key out various elements and sections in TV receiver.
- Get complete knowledge regarding the working principles involved in both Monochrome and Color Television.
- Get adequate knowledge regarding different modules and their design considerations.
- Get familiarized with principles involved in the modern televisions system.
- Troubleshoot VCRs, TV antenna and booster.
- Use of various video cameras and its controls.

ECCX49	MOBILE NETWORKS	L	T	P	C
		1	0	0	1

OBJECTIVES:

- To study the basics of Mobile networks and its generation.
- To understand the concepts of advanced network concepts.
- To study the basics of Mobile networks and its generation.

MODULE I INTRODUCTION TO MOBILE NETWORKS 7

Introduction to mobile networks - IEEE technologies - Cellular networks – Generation of networks - Relevant features of LTE - HetNet in LTE Advanced – Small cell concepts - Transition of LTE advanced towards 5G - cloud RAN - Femtocell technology –The backhaul network

MODULE II WPAN,WLAN, WMAN, WRAN AND IOT 8

WPAN and WiGig – WLAN and Wifi – WMAN and Wimax – WiMAX and Wifi integration - IEEE 802.22 – interconnection between IEEE standards – Sensor Networks –RFID – Near field communication – IOT in the home – FOG networking – connection of things – LoRa

Total Hours –15

TEXT BOOKS:

1. Khaldoun Al Agha, Guy Pujolle, Tara Ali-Yahiya, “Mobile and Wireless Networks”, Volume 2, Advanced Networks set, published by ISTE Ltd. and John Wiley & Sons Inc.

REFERENCES:

1. Joh R. Vacca, “Wireless Broadband Networks Handbook 3G, LMDS and Wireless Internet” Tata McGraw-Hill, 2001
2. D.P. Agrawal and Qing-An zeng, “Introduction to Wireless and Mobile Systems” Thomson Learning, 2003. [Unit I, Chapter 13.1 to 13.7.7, Unit 2 13.7.8 to 13.9

OUTCOMES:

On completion of the course the students will be able to

- To explain the types and functional principles of cellular networks.
- To describe the features, interconnections and applications of various IEEE standards.

ECCX50	OPTICAL NETWORKS	L	T	P	C
		1	0	0	1

OBJECTIVES:

- Acquire knowledge of optical components and networks.
- Gain knowledge on architecture and standards of optical networks.

MODULE I OPTICAL COMPONENTS & CHARACTERISTICS 7

Light propagation in optical fibers-Loss & Bandwidth, System limitations Optical Components- Couplers, Isolators & Circulators, Multiplexers & Filters Optical Amplifiers, Switches Wavelength Converters. Introduction to Optical Networks; Advantages of optical network, WDM optical networks ,Challenges of optical WDM network, Metropolitan-Area Networks, Layered Architecture; Broadcast and Select Networks- Topologies for Broadcast Networks, Media Access Control Protocols, Wavelength Routing Architecture.

MODULE II WAVELENGTH ROUTING NETWORKS AND OPTICAL ACCESS NETWORKS 8

The Optical layer, Node Designs, Optical layer cost tradeoff, Routing and Wavelength Assignment algorithms, Virtual Topology design, Architectural variations, Introduction to access network, PON, EPON and WDN EPON: overview, principal of operation, architecture; dynamic wavelength allocation, STARGATE: overview, need, architecture, operation and application, gigabit Ethernet, radio over fiber network.

Total Hours –15

TEXT BOOKS:

1. Rajiv Ramaswamy, Kumar N. Sivaranjan and Galen H. Sasaki, "Optical Networks – A practical perspective", 3rd edition, Elsevier, 2010.
2. C.Siva Ram Moorthy and Mohan Gurusamy, “WDM Optical Networks: Concept, Design and Algorithms”, PHI, 1st Edition, 2002.
3. P.E.Green. jr., "Fiber Optical Networks", Prentice Hall, New Jersy, 1993.

REFERENCES:

1. John M. Senior, “Optical Fiber Communications –Principles and Practice”, Pearson Education, 2009.
2. Biswanath Mukherjee, “Optical Communication Networks”, McGraw-Hill, 1997.

OUTCOMES:

On completion of the course the students will be able to

- Define the fundamental concepts of optical networks and characteristics.
- Select appropriate and relevant optical network protocols
- Identify various access networks that can be used for real scenario.
- Compare the operation and features of optical network.
- Understand and build the WDM routing mechanisms.
- Choose different networking techniques based on the application.

ECCX51	ADAPTIVE SIGNAL PROCESSING	L	T	P	C
		1	0	0	1

OBJECTIVES:

- To understand the adaptive signal processing algorithms for extracting relevant information from noisy signals.
- explain the mean square algorithms
- identify the Weiner least-squares solution

MODULE I INTRODUCTION TO ADAPTIVE FILTERING 8

Introduction To Stochastic Processes, Linear Adaptive Filter Structure, Real And Complex Forms Of Adaptive Filter, Non-Linear Adaptive Filter, Adaptation Approaches: Wiener Filter Theory Method Of Least Squares. Mean-Square Error Criterion, Linear Optimum Filtering Statement, Principle Of Orthogonality, Wiener-Hopf Equation, Error Performance Surface.

MODULE II KALMAN & LINEAR ADAPTIVE FILTERING 7

Introduction to Kalman filters- Variance Of Kalman Filtering, Extended Kalman Filtering Method Of Steepest Descent, Stability Of Steepest Descent, Least Mean Square Algorithm, Adaptive Prediction, Adaptive Equalization, Robustness Of LMS Algorithm, Block Adaptive Filter, Fast LMS Algorithm, Unconstrained Frequency-Domain Adaptive Filtering, Methods Of Least Squares

Total Hours –15

TEXT BOOKS:

1. Simon Haykin,"Adaptive Filter Theory", Prentice Hall International", 3rd Ed., 2002.
2. Bernard Widrow and Samuel Stearns,"Adaptive Signal Processing", Pearson Education, 2nd Ed., 1995.

REFERENCES:

1. Ali H. Sayed,"Fundamentals of Adaptive Filtering", Wiley, 1st Ed., 2003.
2. Farhang-Boroujeny B.,"Adaptive Filters Theory and Applications", John Wiley & Sons, 1st Ed.,1998.
3. Mohamed Ibnkahla(Edited),"Adaptive Signal Processing in Wireless Communications", CRC Press, Taylor & Francis Group, 1st Ed., 2009.

OUTCOMES:

On completion of the course the students will be able to

- Design and apply optimal minimum mean square estimators and in particular linear estimators. To understand and compute their expected performance and verify it.
- Design, implement and apply Wiener filters (FIR, non-causal, causal) and evaluate their performance.
- Identify applications in which it would be possible to use the different adaptive filtering approaches.
- Design, implement and apply LMS, RLS, and Kalman filters to given applications.
- Analyze the accuracy and determine advantages and disadvantages of each method.
- Use the theoretical understanding to do troubleshooting.

ECCX52	STUDY ON NETWORK SIMULATORS	L	T	P	C
		1	0	0	1

OBJECTIVES:

- To analyze different network simulators used for WSN applications
- To analyze the network simulator ns-2
- To analyze the network simulator opnet

MODULE I NS-2 **7**

General ns-2 simulator characteristics and requirements, Network topology and simulation scenario, AODV protocol,Installation of NS-2, ns2 simulation output.

MODULE II OPNET **8**

General Opnet simulator characteristics and requirements, Network topology and simulation scenario, Installation of opnet , Visualization and Statistics

Total Hours –15

TEXT BOOKS:

1. Teerawat Issariyakul,Ekram Hossain ,"Introduction to Network Simulator NS2", Second Edition,Springer.

REFERENCES:

1. Adarshpal S. Sethi, Vasil Y. Hnatyshin,"The Practical OPNET User Guide for Computer Network Simulation", Chapman and Hall/CRC

OUTCOMES:

On completion of the course the students will be able to

- Work with network simulator ns-2
- Have knowledge on various simulator characteristics.
- Gain knowledge to find simulator for any networking research.
- Apply the network characteristics to the simulator
- Work with network simulator opnet

ECCX53	MIMO OFDM TECHNOLOGY	L	T	P	C
		1	0	0	1

OBJECTIVES:

- Acquire knowledge of OFDM technology.
- Gain knowledge on MIMO communication.

MODULE I Orthogonal Frequency Division Multiplexing 7

Basic principles of orthogonality, Single vs multi carrier systems, OFDM block diagram and ITS explanation, OFDM signal mathematical representation, Selection parameters for modulation, Pulse shaping in 05 20% OFDM signal and spectral efficiency, Windowing in OFDM signal and spectral efficiency, Synchronization in OFDM, Pilot insertion in OFDM transmission and channel estimation, Amplitude limitations in OFDM, FFT points selection constraints in OFDM, CDMA vs OFDM, Hybrid OFDM, Other variants of OFDM

MODULE II MIMO SYSTEMS 8

Introduction, Space diversity and systems based on space diversity, Smart antenna system and MIMO, MIMO-Based system architecture, MIMO exploits multipath, Space-time processing, Antenna considerations for MIMO, MIMO channel modeling, channel measurement and channel capacity, Cyclic delay diversity (CDD), Space-time coding, Advantages and applications of MIMO in present context, MIMO applications in 3G wireless systems, MIMO-OFDM.

Total Hours –15

TEXT BOOKS:

1. Wireless Communication By Upena Dalal, Oxford University Press

REFERENCES:

1. Wireless Communications and Networking By Vijay K. Garg, Morgan Kaufmann Publications

OUTCOMES:

On completion of the course the students will be able to

- Describe the concepts of MIMO OFDM Wireless communication systems.
- Determine the capacity and bit error rate of MIMO OFDM system for a given power delay profile of the MIMO channel.
- Explain the fundamental concept of Software defined Radio and current 3-G

and 4-G system

- Compare the operation SISO,SIMO,MISO and MIMO channels.
- Estimate and correct the timing and frequency offset in the signal received in the MIMO OFDM receivers.
- Analyze the performance of MIMO OFDM physical channel in WiMax/LTE wireless standards.

ECCX54	MEDICAL IMAGE PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the fundamentals of medical image processing techniques.
- To explain the sources of medical image sources.
- To develop computational methods
- To apply algorithms for analyze and quantify biomedical data
- To realize the methods of image registration and visualization

MODULE I IMAGE FUNDAMENTALS AND PRE-PROCESSING 7

Image perception, MTF of the visual system, Image fidelity criteria, Image model, Image sampling and quantization – two dimensional sampling theory, Image quantization, Optimum mean square quantizer, Image transforms – 2D-DFT and other transforms. Image enhancement – point operation, Histogram modeling, spatial operations, Transform operations,

MODULE II BASICS OF MEDICAL IMAGE SOURCES 8

Radiology- The electromagnetic spectrum-Computed Tomography-Magnetic Resonance Tomography –ultrasound-nuclear medicine and molecular imaging-other imaging techniques-radiation protection and dosimetry

MODULE III MEDICAL IMAGE REPRESENTATION 8

Pixels and voxels – algebraic image operations - gray scale and color representation-depth-color and look up tables - image file formats- DICOM- other formats- Analyze 7.5, NifTI and Interfile, Image quality and the signal to noise ratio- MATLAB based simple operations.

MODULE IV MEDICAL IMAGE ANALYSIS AND CLASSIFICATION 8

Image segmentation- pixel based, edge based, region based segmentation. Image representation and analysis, Feature extraction and representation, Statistical, Shape, Texture, feature and image classification – Statistical, Rule based, Neural Network approaches

MODULE V IMAGE REGISTRATIONS AND VISUALIZATION 8

Rigid body visualization, Principal axis registration, Interactive principal axis registration, Feature based registration, Elastic deformation based registration, Image

visualization – 2D display methods, 3D display methods, virtual reality based interactive visualization.

MODULE VI NEURAL NETWORKS FOR IMAGE PROCEssing 6

Neural Network based Image Processing-Statistical approach for texture analysis-Segmentation in color and B/W images-Expert system based Image Processing-Multispectral classification techniques

Total Hours –45

TEXT BOOKS:

1. John L. Semmlow, Benjamin Griffel ,"Biosignal and Medical Image Processing", Third Edition2014 by CRC Press
2. G. R. Sinha," "Medical Image Processing: Concepts and Applications", 2014
3. Wolfgang Birkfellner, "Applied Medical Image Processing – A Basic course", CRC Press, 2011.
4. Atam P.Dhawan, „Medical Image Analysis", Wiley Interscience Publication, NJ, USA 2003.
5. R.C.Gonzalez and R.E.Woods, „Digital Image Processing", Second Edition, Pearson Education, 2002.
6. Anil. K. Jain, „Fundamentals of Digital Image Processing", Pearson education, Indian Reprint 2003.

REFERENCES:

1. Alfred Horowitz, „MRI Physics for Radiologists – A Visual Approach", Second edition Springer Verlag Network, 1991.
2. Kavyan Najarian and Robert Splerstor," Biomedical signals and Image processing",CRC – Taylor and Francis,New York,2006
3. John L.Semmlow,"Biosignal and Biomedical Image Processing Matlab Based applications" Marcel Dekker Inc.,New York,2004
4. Jerry L.Prince and Jnathan M.Links," Medical Imaging Signals and Systems"-Pearson Education Inc. 2006.

OUTCOMES:

At the end of the course ,Students will be able to

Analyze Morphology, Segmentation techniques and implement these in images.

- Explain medical image acquisition and reconstruction methods.
- Apply the classical methods for spectral analysis to medical images
- Apply digital processing techniques to analyze medical images for texture

analysis and segmentation and classifications.

- Enables quantitative analysis and visualization of medical images of numerous modalities such as PET, MRI, CT, or microscopy

ECCX55 COMPUTER VISION AND ITS APPLICATIONS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To review image processing techniques for computer vision
- To understand shape and region analysis
- To understand three-dimensional image analysis techniques
- To understand motion analysis
- To study some applications of computer vision algorithms

MODULE I IMAGE PROCESSING FOUNDATIONS 7

Review of image processing techniques – classical filtering operations – thresholding techniques – edge detection techniques – corner and interest point detection – mathematical morphology – texture analysis

MODULE II SHAPES AND REGIONS 8

Binary shape analysis – connectedness – object labeling and counting – size filtering – distance, functions – skeletons and thinning – deformable shape analysis – boundary tracking procedures – active contours – shape models and shape recognition – centroidal profiles – handling occlusion – boundary length measures – boundary descriptors – chain codes – Fourier descriptors – region descriptors – moments

MODULE III HOUGH TRANSFORM 9

Line detection – Hough Transform (HT) for line detection – foot-of-normal method – line localization –line fitting – RANSAC for straight line detection – HT based circular object detection – accurate center location – speed problem – ellipse detection – Case study: Human Iris location – hole detection – generalized Hough Transform – spatial matched filtering – GHT for ellipse detection – object location – GHT for feature collation

MODULE IV IMAGE COMPRESSION 7

Image Coding Fundamentals, Image Compression Model, types of image redundancies, fidelity criteria, Lossless Compression - variable length, bit plane, Lossless Predictive, Lossy Compression- Lossy Predictive, JPEG, MPEG, fractal image compression

MODULE V 3D VISION AND MOTION 7

Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape from texture – shape from focus – active range finding – surface representations – point-based representation – volumetric representations – 3D object recognition – 3D reconstruction – introduction to motion – triangulation – bundle adjustment – translational alignment – parametric motion – spline based motion – optical flow – layered motion

MODULE VI APPLICATIONS 7

Application: Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models of faces Application: Surveillance – foreground-background separation – particle filters – Chamfer matching, tracking, and occlusion – combining views from multiple cameras – human gait analysis Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians

Total Hours –45

TEXT BOOKS:

1. Gonzalez and Woods, "Digital Image Processing", 3rd Edition, Pearson Education, 2016.
2. Mark Nixon and Alberto S. Aquado, “Feature Extraction & Image Processing for Computer Vision”, Third Edition, Academic Press, 2012.
3. E. R. Davies, “Computer & Machine Vision”, Fourth Edition, Academic Press, 2012.

REFERENCES:

1. D. L. Baggio et al., “Mastering OpenCV with Practical Computer Vision Projects”, Packt Publishing, 2012.
2. Jan Erik Solem, “Programming Computer Vision with Python: Tools and algorithms for analyzingimages”, O'Reilly Media, 2012.

OUTCOMES:

On completion of the course the students will be able to

- To implement fundamental image processing techniques required for computer vision To perform shape analysis
- To implement boundary tracking techniques
- To apply chain codes, other region descriptors
- To understand and implement suitable compression technique for images

- To apply 3D vision techniques
- To develop applications using computer vision techniques

ECCX56 SIGNAL DETECTION AND ESTIMATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- Mathematical background of detection and estimation theory
- Some common and practical detection and estimation techniques

PREREQUISITES:

- Signals and Systems
- Probability theory and random processes

MODULE I REVIEW OF RANDOM VARIABLES AND STATISTICAL DECISION THEORY **9**

Review of Gaussian variables and processes; problem formulation and objective of signal detection and signal parameter estimation in discrete time domain, Bayesian, minimax, and Neyman-Pearson decision rules, likelihood ratio, receiver operating characteristics, composite hypothesis testing, locally optimum tests, detector comparison techniques, asymptotic relative efficiency.

MODULE II DETECTION OF DETERMINISTIC SIGNALS **7**

Matched filter detector and its performance; generalized matched filter; detection of sinusoid with unknown amplitude, phase, frequency and arrival time, linear model.

MODULE III DETECTION OF RANDOM SIGNALS **8**

Estimator-correlator, linear model, general Gaussian detection, detection of Gaussian random signal with unknown parameters, weak signal detection.

MODULE IV NON PARAMETRIC DETECTION **6**

Detection in the absence of complete statistical description of observations, sign detector, Wilcoxon detector, detectors based on quantized observations, robustness of detectors.

MODULE V ESTIMATION OF SIGNAL PARAMETERS **9**

Minimum variance unbiased estimation, Fisher information matrix, Cramer-Rao bound, Sufficient statistics, minimum statistics, complete statistics; linear models; best linear unbiased estimation; maximum likelihood estimation, invariance principle; estimation efficiency; Bayesian Estimation: philosophy, nuisance parameters, risk functions, minimum mean square error estimation, maximum a

posteriori estimation..

MODULE VI SIGNAL ESTIMATION IN DISCRETE-TIME 6

Linear Bayesian estimation, Weiner filtering, dynamical signal model, discrete Kalman filtering.

TOTAL HOURS 45

TEXT BOOKS

1. H. L. Van Trees, "Detection, Estimation and Modulation Theory: Part I, II, and III", John Wiley, NY, 1968.
2. H. V. Poor, "An Introduction to Signal Detection and Estimation", Springer, 2/e, 1998.

REFERENCES

1. M. Hays, "Statistical Digital Signal Processing and Modelling", John Willey and Sons, 1996.
2. Steven.M.Kay, "Fundamentals of Statistical Signal Processing:" Volume I Estimation Theory, Prentice Hall, USA, 1998.
3. Steven.M.Kay, "Fundamentals of Statistical Signal Processing:" Volume I Detection Theory, Prentice Hall, USA, 1998

OUTCOMES:

On completion of the course, students will be able to

1. Acquire basics of statistical decision theory used for signal detection and estimation.
2. Examine the detection of deterministic signals using statistical models.
3. Examine the detection of random signals using statistical models
4. Comprehend the elements and structure of nonparametric detection
5. Examine the performance of signal parameters using optimal estimators.
6. Analyze signal estimation in discrete-time domain using filters.

ECCX57 VIDEO PROCESSING TECHNIQUES L T P C
2 0 0 2

OBJECTIVES:

- Understand representation of digital images and video in the spatial (pixel) and frequency domains.
- Analyze video enhancement and compression standards
- To implement image and video processing algorithms using MATLAB or another programming language

MODULE I VIDEO ACQUISITION AND REPRESENTATION 10

Principles of color video processing, Spatial Temporal Sampling — Interpolation — video formats, Motion Estimation

MODULE II VIDEO ENHANCEMENT 10

Video Filtering: Motion Compensation – Noise Filtering – Enhancement and Restoration – Video Stabilization and Super Resolution

MODULE III VIDEO COMPRESSION STANDARDS 10

MPEG1, MPEG2, MPEG3 and MPEG4

Total Hours –30

TEXT BOOKS:

1. Handbook of Image and Video processing – Al Bovik (Alan C Bovik), Academic Press, Second Edition, 2005.
2. Digital Image Sequence Processing, Compression, and Analysis – Todd R. Reed, CRC Press, 2004

REFERENCES:

1. Practical Image and Video Processing using MATLAB, Dr.Oge Marques, John Wiley&Sons,2013
2. IEEE Transactions of Circuits and Systems for Video Technology.

OUTCOMES:

On completion of the course the students will be able to

- Explain the fundamental concepts of digital video processing.
- Recognize & apply various image enhancement techniques
- Identify and use appropriate image compression techniques

ECCX58 DIGITAL VLSI TESTING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce different techniques for detection of faults in digital circuits.
- To develop a Generation of test vectors for combinational and sequential circuits
- To establish Self-testing methods

MODULE I BASICS OF TESTING 7

Introduction to Testing - Role of testing - VLSI Realisation process- VLSI Technology Trends Affecting Testing-Types of Testing -ATE -AC and DC parameters testing and yield.

MODULE II FAULT MODELLING AND SIMULATION 8

Functional Versus Structural Testing-Faults in digital circuits - Modelling of faults-Fault detection - Fault location - Fault dominance - Logic Simulation - Types of simulation

MODULE III TESTING OF COMBINATIONAL CIRCUITS 8

Combinational logic circuits -test generation, Testable combinational logic circuit design

MODULE IV TESTING OF SEQUENTIAL CIRCUITS 8

Test generation for sequential circuits - design of testable sequential circuits.

MODULE V DESIGN FOR TESTABILITY 7

Design for Testability - Ad-hoc design - scan based design.

MODULE VI SELF TESTING 7

Built-In Self Test - Test pattern generation for BIST - Circular BIST - BIST Architectures

Total Hours –45

TEXT BOOKS:

1. M.L. Bushnell and V.D. Agrawal, "Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits", Kluwer Academic Publishers, 2002.
2. A.L. Crouch, "Design Test for Digital ICs and Embedded Core Systems", Prentice Hall International, 2002.

REFERENCES:

1. Phillip E. Allen, Douglas R. Holberg. CMOS Analog Circuit Design, Oxford University Press, Second Edition, 2002.
2. M. Abramovici, M.A. Breuer, and A.D. Friedman. Digital Systems Testing and Testable Design. Wiley-IEEE Press, 1994.

OUTCOMES:

On completion of the course the students will be able to

- To comprehend the standard procedures and principles to test digital VLSI circuits
- Apply the testing principles to test digital circuits logically using stuck at faults models.
- Analyze and compare the performance of the fault models used to perform testing of digital circuits.
- To apply the design for test (DFT) principles for designing digital systems.
- To generate test vectors using ATPG algorithms for combinational and sequential circuits
- To function in teams involving the testing of digital VLSI systems

ECCX59	FIN FET TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the necessary of scaling of MOS transistor.
- To introduce the concepts of nanoscale MOS transistor concepts and their performance characteristics.
- To study the various nano scaled MOS transistors.

MODULE I INTRODUCTION TO NOVEL MOSFETS 9

from Single Gate to Multigate, MOSFET scaling and Moore's law, Short-Channel Effects, Gate Geometry and Electrostatic Integrity, History and Multigate MOSFET Physics

MODULE II MULTIGATE MOSFET TECHNOLOGY 9

Introduction, Active Area: Fins, Gate Stack, Source/Drain Resistance and Capacitance, Mobility and Strain Engineering, Contacts to the Fins

MODULE III PHYSICS OF THE MULTIGATE MOS SYSTEM 9

Device electrostatics, Double gate MOS system, Two-dimensional confinement

MODULE IV MOBILITY IN MULTIGATE MOSFETS 9

Introduction, Double-Gate MOSFETs and FinFETs, Silicon multiple-gate nanowires

MODULE V MULTI-GATE MOSFET CIRCUIT DESIGN 9

Introduction, Digital Circuit Design, Analog Circuit Design, SOC Design and Technology Aspects

MODULE VI RADIATION EFFECTS IN ADVANCED SINGLE AND MULTIGATE MOSFETS 7

Total ionizing Dose effects-Advanced multi-gate devices-Single-event effects-Scaling effects.

Total Hours –45

TEXT BOOKS:

1. FinFETs and Other Multigate Transistors. J. P. Colinge, Springer Publications
2. Nanoelectronic Circuit Design – Niraj K. Jha and Deming Chen, Springer Publications.

REFERENCES:

1. Mark Lundstrom Jing Guo, Nanoscale Transistors: Device Physics, Modeling and Simulation, Springer, 2006.
2. M S Lundstorm, Fundamentals of Carrier Transport, 2nd Ed., Cambridge University Press, Cambridge UK, 2000

OUTCOMES:

On completion of the course the students will be able to

- Realize limitations of MOSFET technology.
- Apply the merits of FinFET technology.
- Analyze FinFET physics and modeling.
- Determine FinFET circuit design approaches.
- Analyze various issues with FinFET device
- Explore research opportunities in FinFET technology

ECCX60 REAL TIME EMBEDDED SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the concepts of embedded systems
- To learn about the data management system for real time
- To introduce the fundamentals of real time communication
- To familiarize different algorithms and techniques used for real time systems

MODULE I INTRODUCTION TO EMBEDDED SYSTEMS 7

Introduction - Embedded Systems – Skills Required for an Embedded System Designer - Issues in Real Time Computing – Structure of a Real Time System – Task classes – Performance Measures for Real Time Systems – Estimating Program Run Times.

MODULE II TASK ASSIGNMENT AND SCHEDULING 8

Introduction - Classical uniprocessor scheduling algorithms – Uniprocessor scheduling of IRIS tasks tasks – Task assignment – Mode changes and Fault Tolerant Scheduling.

MODULE III PROGRAMMING TOOLS 8

Introduction – Desired language characteristics – Data typing – Control structures – Facilitating Hierarchical Decomposition, Packages, Run time (Exception) Error handling – Overloading and Generics – Multitasking – Low level programming – Programming Environments – Run – time support.

MODULE IV REAL TIME DATABASES 7

Basic Definition- Real time vs General Purpose Databases- Main Memory Databases - Transaction priorities - Transaction Aborts - Concurrency control issues - Disk Scheduling Algorithms -Databases for Hard Real Time Systems.

MODULE V COMMUNICATION PROTOCOLS 7

Network Topology - contention based Protocol, Token Based Protocol, Stop-and-Go multihop Protocol, Polled Bus Protocol , Hierarchical Round Robin Protocol, Deadline-Based Protocols

MODULE VI EVALUATION TECHNIQUES 8

Reliability Evaluation Techniques – Obtaining parameter values - Reliability models

for Hardware Redundancy – Software error models. Clock Synchronization – Clock, A Non fault – Tolerant Synchronization Algorithm – Impact of faults – Fault Tolerant Synchronization in Hardware – Fault Tolerant Synchronization in software.

Total Hours –45

TEXT BOOKS:

1. C.M. Krishna, Kang G. Shin, “Real – Time Systems”, McGraw – Hill International Editions, 1997.
2. Rajib Mall, ”Real-time systems: theory and practice”, Pearson Education, 2009
3. Peter D.Lawrence, “Real Time Micro Computer System Design – An Introduction”, McGraw Hill, 1987.
4. Stuart Bennett, “Real Time Computer Control – An Introduction”, Prentice Hall of India, 1998.
5.

REFERENCES:

1. S.T. Allworth and R.N.Zobel, “Introduction to real time software design”, Macmillan, 2nd Edition, 1987.
2. R.J.A Buhur, D.L Bailey, “An Introduction to Real – Time Systems”, Prentice – Hall International, 1999.
3. Philip.A.Laplante, “Real Time System Design and Analysis”, Prentice Hall of India, 3rd Edition, April 2004
4. Sriram V Iyer, PankajGupta, “Embedded Real Time Systems Programming”, Tata Mc Graw Hill 2004.

OUTCOMES:

On completion of the course the students will be able to

- Describe the concepts of Embedded Systems
- Illustrate task assignment and scheduling.
- Discuss about error handling and multitasking.
- Understand real time data bases and transaction.
- Describe deadline based protocols and fault tolerance techniques.
- Discuss about the reliability evaluation techniques and tolerant synchronization algorithms.

ECCX61 INTRODUCTION TO RTOS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To explain the aspects of the Operating systems and Real-time Operating Systems
- To analyze the unique issues in the design and analysis of computer systems for real-time applications.
- To describe Resource management, time-constrained communication, scheduling and imprecise computations, real-time kernels and case studies on RTOS

MODULE I OVERVIEW OF OPERATING SYSTEM 7

Computer-System Organization-Operating-System Structure -Operating-System Operations - Process Management - Memory Management -Storage Management - Protection and Security - Kernel Data Structures - Computing Environments - Open-Source Operating Systems-Operating system structures-System Calls-Operating-System Design and Implementation-Operating-System Structure -Operating-System Debugging - Operating-System Generation - System Boot

MODULE II REAL TIME OPERATING SYSTEMS 8

Brief History of OS, Defining RTOS, The Scheduler, Objects, Services, Characteristics of RTOS, Task, Tasks States and Scheduling, Task Operations, Structure, Synchronization, Communication and Concurrency, Semaphores, Defining Message Queue, States, Content, Storage, Operations and Use.

MODULE III KERNEL OBJECTS AND RTOS SERVICES 7

Pipes, Event Registers, Signals, Other Building Blocks, Component Configuration, Basic I/O Concepts, I/O Subsystem

MODULE IV Exceptions , Interrupts and Memory Management 8

Exceptions, Interrupts, Applications, Processing of Exceptions and Spurious Interrupts, Real Time Clocks, Programmable Timers, Timer Interrupt Service Routines (ISR), Soft Timers, Dynamic memory allocation.

MODULE V MICROC/OS-II 8

MicroC/OS-II -Introduction – Features and Goals of µC/OS – II – Requirements of

µC/OS – II - Support Devices for µC/OS – II – File Structure in µC/OS – II - Task Management Functions – Creating a Task - Time Management Functions – OS Delay Functions - Implementation of Scheduling and rescheduling.

MODULE VI APPLICATION OF RTOS 7

Comparison RT Linux, Vx Works, QNX and Basic Concepts of Android OS-RTOS for Image Processing – RTOS for fault Tolerant Applications – RTOS for Control Systems.

Total Hours –45

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, " Operating system concepts", 9th edition, John Wiley and Sons Inc.,2012
2. Qing Li, Elsevier , "Real Time Concepts for Embedded Systems", 2011
3. 3Jean J. Labrosse, "MicroC/OS – II The Real Time Kernel", CMP Books, 2002.
4. Karim Yaghmour, " Embedded Android: Porting, Extending, and Customizing", O'Reilly March 2013.

REFERENCES:

1. Embedded Systems- Architecture, Programming and Design by Rajkamal, 2007, TMH
2. David. E. Simon, "An Embedded Software Primer", Pearson Education, 2001.

OUTCOMES:

On completion of the course the students will be able to

- Describe various task assignment and scheduling methods of operating system and real time operating system.
- Solve the task synchronization problem using synchronization techniques.
- Describe the application of real time OS – Micro- C OS-2.
- Analyze the use of synchronization techniques in real-time systems.
- Illustrate exceptions, timer and memory management in OS.
- Justify the type of real time operating system needed for particular application.

ECCX62	MECHATRONICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Identify the different components for mechatronics system design.
- To gain sufficient knowledge regarding PIC Microcontroller and its interfacing concept.
- To study the applications of electronics, electrical and mechanical systems for the control of mechanical and electronic systems.
- To impart knowledge on the role of sensors, transducers, control, and machine intelligence in mechanical- electronics engineering.
- To gain knowledge on the concepts and techniques involved in PLC systems which are widely used in mechatronics.
- To develop the mechatronics systems for real time applications.

MODULE I FUNDAMENTALS 8

Introduction to Mechatronics systems – elements – design process – Types of Design: Traditional and Mechatronics design - Integrated product design - Advanced approaches in Mechatronics - Industrial design and ergonomics, safety.

MODULE II PIC MICROCONTROLLER 7

Architecture of PIC 18 – Pin Description – Memory organization: Program memory – Data Memory – I/O Ports – Timers / Counters – Capture / Compare /PWM mode – External Hardware Interrupts – USART – ADC.

MODULE III PIC 18 EMBEDDED C PROGRAMMING 7

I/O ports: Register configuration–programming – Timers: modes–programming – Counters – ADC: configuration registers–programming – External Hardware Interrupts: types–programming.

MODULE IV PROGRAMMABLE LOGIC CONTROLLERS SYSTEMS 8

Introduction –– PLC Architecture, specifications and operation – PLC hardware components, Analog & digital I/O modules , CPU & memory module – Programming devices – PLC ladder diagram, Converting simple relay ladder diagram in to PLC relay ladder diagram. PLC programming Simple instructions – Manually operated switches – Mechanically operated a Proximity switches - Latching relays.

MODULE V SYSTEM INTERFACING: 7

Introduction – Elements of data acquisition and system – Overview of I/O process - Installation of I/O card and software – serial interface standards (RS232/422/485) – General Purpose Interface Bus (IEEE 488) - GUI card – Ethernet switch - Man Machine Interfaces. Sensor interfacing – LED interfacing – LCD interfacing – Motor interfacing – High power devices using relays.

MODULE VI CASE STUDY ON MECHATRONICS SYSTEMS: 8

Disk Drive – Transducer calibration system - Strain gauge weighing system - Controlling temperature of a hot / cold reservoir using PID – pH Control system. virtual instrumentation, Electronics engine management system - Control of pick and place robot – Automatic washing machine - Artificial Intelligence in Mechatronics: Neural network and Fuzzy logic system.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Devdas Shetty and Richard A. Kolk, — Mechatronics System Design‖, Thomson Learning/ Vikas Publishing House, New Delhi, 2011.
2. Mazidi, Muhammad Ali, Mckinlay, Rolin D., and Causey Danny, —PIC Microcontroller and Embedded Systems using Assembly and C for PIC 18‖, Pearson Education Asia, 2015.
3. Bolton,W, “Mechatronics”, Pearson education, second edition, fifth Indian Reprint, 2003.

REFERENCES:

1. Bradley D. Dawson, Burd N.C. and Loader A.J., —Mechatronics: Electronics in Products and Processes‖, Chapman and Hall, London, 1994.
2. Valvano Jonathan W., —Embedded Microcomputer Systems: Real Time Interfacing‖, 3rd Edition, Thomson Asia, Singapore, 2011.
3. Peatman John B., —Design with PIC Microcontrollers‖, Pearson Education, New Delhi, 2009.
4. Sanjay Gupta and Joseph John, "Virtual Instrumentation and LabVIEW", Tata McGraw Hill Publications, Co., 2005.
5. Gary Dunning, ‘Introduction to Programmable Logic Controllers‘’ Thomson Learning, 2001.

OUTCOMES:

On completion of the course the students will be able to

- Identify the components for mechatronics system design.
- Apply the data acquisition system, display systems, recorders, alarms measurement of voltage, current, frequency, temperature, displacement and pressure and its applications in process control industries.
- Interpret architecture and interfacing concepts of PIC18 microcontroller.
- Select the suitable PLC interface for mechatronics system.
- Develop the physical system based on mechatronics design process.
- Build the mechatronics systems for real time applications.

Physics Elective Courses
(To be offered in II Semester)

PHCX 01	FUNDAMENTALS OF ENGINEERING MATERIALS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To help students to acquire the properties and applications of conducting and semiconducting materials.
- To familiarize students with basic ideas about the properties of dielectric and magnetic materials and their applications.
- To familiarize students with basic knowledge of nanomaterials and its electrical, electronic, mechanical and magnetic properties.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I CONDUCTING AND SEMICONDUCTING MATERIALS 7

Conductors: properties, Fermi distribution function, Fermi energy in metals- density of states- conducting polymers-properties-applications, semiconductors: intrinsic and extrinsic semiconductors-carrier concentration, conductivity and energy band gap, semiconducting polymers- properties- applications.

MODULE II DIELECTRIC MATERIALS 8

Polarization- dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – Internal field - Clausius Mosotti relation - dielectric loss – dielectric breakdown – applications of dielectric materials (capacitors and transformers) – Pyroelectricity, Piezoelectricity, ferroelectricity and applications in Ferroelectric Random Access Memory (FeRAM) - multiferroic materials and its applications.

MODULE III MAGNETIC MATERIALS 7

Origin of magnetism-magnetic moment, susceptibility, permeability – Bohr magneton – Dia, Para and Ferro magnetism –Spontaneous magnetization- Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites and its application - Giant Magneto-resistance effect (GMR) - Magnetic resonance imaging(MRI).

MODULE IV NANOMATERIALS 8

Properties of nanomaterials – size effect on thermal, electrical, electronic, mechanical, optical and magnetic properties – quantum confinement – classification of nanomaterials –

quantum well, quantum wire, quantum dot - nanoporous materials - carbon nanotubes, graphene - nanocomposites – applications of nano materials.

PRACTICALS

1. Determination of energy band gap of a semiconductor.
2. Determination of resistivity of metals by four point probe method.
3. Determination of dielectric constant of dielectric material.
4. Determination of time constant of a capacitor using RC circuit.
5. Determination of paramagnetic susceptibility of given liquid.
6. Determination of hysteresis loss in a transformer using BH curve.
7. Analysis of size effect on the absorption spectrum of nanomaterials.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. William D. Callister, “Material Science and Engineering”, Wiley Publications, 2006.
2. Raghavan, V., “Materials Science and Engineering”, 5th edition, Printice Hall of India Pvt Ltd. New Delhi, 2004.
3. Wahab. M.A, “Solid State Physics: Structure and Properties of Materials”, Narosa Publishing House Pvt. Ltd., New Delhi , 2nd Edition, 2010.
4. Pillai, S.O., “Solid State Physics”, New Age International, New Delhi, 2005.
5. Charles P. Poole and Frank J. Owens, ”Introduction to nanotechnology”, Wiley (India), 2009.
6. Pradeep. T., “Textbook of Nanoscience and Nanotechnology”, McGraw Hill Education (India) Private Limited, New York, 2012.

OUTCOMES:

On completion of this course, the student will be able to

- apply the concepts of conducting and semiconducting materials for solid state devices.
- comprehend the significance of properties of dielectric magnetic materials and derive these properties from synthesized materials.
- differentiate between the properties of the nanomaterials compared to bulk materials.
- complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 02	HEAT AND THERMODYNAMICS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To familiarize students with basic concepts of heat.
- To help students acquire the fundamentals of heat conduction and radiation.
- To enable students acquaint with the basics of thermodynamic concepts.
- To make students understand the fundamentals of heat based experiments.

MODULE I CONCEPTS OF HEAT **10**

Definition of temperature, thermal and thermodynamic equilibrium - relationship between temperature and kinetic energy - definition of solid, liquid, gas - Introduction to phase transitions, critical and triple points- definition of heat capacity, mechanical equivalent of heat -Joule's calorimeter- latent heat- microscopic model of ideal gas - equation of state, internal energy, equipartition theorem- equation of state for non-ideal gases.

MODULE II CONDUCTION AND RADIATION **10**

Thermal conductivity – rectilinear flow of heat – thermal conductivity of a good conductor – Forbe’s method – thermal conductivity of a bad conductor – Lee’s disc method – conduction of heat through compound media - radiation – Planck’s law of blackbody radiation – Wien’s law – Stefan’s law – Newton’s law of cooling from Stefan’s law – Solar constant – Pyrometry.

MODULE III FUNDAMENTALS OF THERMODYNAMICS **10**

Thermodynamic equilibrium – zeroth law of thermodynamics – first law of thermodynamics – Reversible and irreversible processes – second law of thermodynamics - Heat engine – Carnot’s engine – Carnot’s theorem – Internal combustion engines – petrol and diesel engines (qualitative) – Entropy and available energy – temperature – entropy diagram for Carnot’s cycle - Third Law of thermodynamics (qualitative).

PRACTICALS

1. Determination of mechanical equivalent of heat by Joule’s calorimeter.
2. Relation between temperature of a body and time by plotting a cooling curve-Newton’s law of cooling.

3. Determination of specific heat capacity of liquid by cooling.
4. Determination of thermal conductivity of a good conductor-Forbe's method
5. Determination of thermal conductivity of a bad conductor-Lee's disc method

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Mathur. D.S, “Heat & Thermodynamics”, S.Chand & Co., 2009.
2. Brijlal & Subramaniam, “Heat and Thermodynamics”, S.Chand & Co, Delhi, 2010.
3. Gupta. A.B and Roy. H, “Thermal Physics”, Books and Allied Ltd., 2002.
4. Sharma. J.K and Sarkar. K.K, “Thermodynamics and statistical Physics”, Himalaya Publishing House, 1988.

OUTCOMES:

On completion of this course, the student will be able to

- understand the concepts of heat and its properties.
- comprehend the ideas governing the conduction and radiation processes.
- apply the knowledge of laws of thermodynamics in thermodynamic systems.
- perform heat based experiments and determine its various properties.

PHCX 03 INTRODUCTION TO NANOSCIENCE AND TECHNOLOGY

L	T	P	C
2	0	2	3

OBJECTIVES:

- To acquire basic knowledge about the nanomaterials and applications.
- To learn about the synthesis and imaging techniques of nanomaterials.
- To gain the basic concepts of fabrication techniques.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I NANOMATERIALS AND APPLICATIONS **10**

Properties of nanomaterials – size effect on thermal, electrical, electronic, mechanical, optical and magnetic properties – quantum confinement – classification of nanomaterials – quantum well, quantum wire, quantum dot - nanoporous materials - zeolite, mesoporous materials, carbon nanotubes, grapheme - nanocomposites - applications (qualitative): Molecular electronics-nanoelectronics – nanophotonics - single electron transistor-drug delivery.

MODULE II SYNTHESIS AND IMAGING TECHNIQUES **12**

Top-down and bottom up approaches – mechanical alloying and mechanical ball milling - sol-gel approach - hydrothermal method - precipitation method - spray pyrolysis - spin coating-self assembled monolayer (SAM) - Chemical vapour deposition method – Physical vapour deposition method: laser ablation method, sputtering method.

Optical microscopy – Phase contrast and interference microscopy – confocal microscopy - high resolution Scanning electron microscope (HRSEM) - high resolution Transmission electron microscope (HRTEM) - Atomic force microscope - Scanning Tunnelling microscope (STM).

MODULE III NANOFABRICATION **8**

Photolithgraphy - electron beam lithography - X-ray and Ion beam lithography - nanoimprint lithography - soft lithograpy - nanoelectromechnical systems (NEMS) - nanoindentation principles.

PRACTICALS

1. Synthesis of nanomaterials by sol-gel method.

2. Synthesis of nanomaterials by hydrothermal method.
3. Synthesis of nanomaterials by solid state reaction method.
4. Synthesis of nanomaterials by chemical bath deposition method.
5. Synthesis of nanomaterials by co-precipitation method.
6. Synthesis of nano thin films by spray pyrolysis method.
7. Synthesis of nano thin films by pulsed laser deposition (PLD) method.
8. Analysis of size effect on the absorption spectrum of nanomaterials.
9. SEM characterization of nanomaterials.
10. AFM characterization of nano thin films.
11. Phase confirmation by XRD.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Charles P.Poole and Frank J. Owens, ”Introduction to nanotechnology”, Wiley (India), 2009.
2. Cao. G., “Nanostructures & Nanomaterials: Synthesis, Properties & Applications”, Imperial College Press, 2004.
3. Gaddand. W., Brenner. D., Lysherski. S. and Infrate. G.J., “Handbook of NanoScience Engineering and Technology”, CRC Press, 2002.
4. Pradeep. T., “Textbook of Nanoscience and Nanotechnology”, McGraw Hill Education (India) Private Limited, New York, 2012.
5. Chris Mack, “Fundamental Principles of Optical Lithography: The Science of Microfabrication”, John Wiley & Sons, 2008.
6. Bandyopadhyay A.K., “Nano Materials”, New Age International Publishers, New Delhi, 2008.

OUTCOMES:

At the end of the course, the students will be able to

- understand the importance and basic concepts of the nanomaterials.
- comprehend the imaging techniques for nanomaterials.
- illustrate the various nanofabrication techniques.
- complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 04	LASERS AND THEIR APPLICATIONS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To recognize the fundamentals of laser and its characteristics.
- To comprehend and compare the different laser systems.
- To apply lasers in metrology and material processing.
- To understand the working of laser instrumentation.
- To correlate the experimental results for applications.

MODULE I LASER THEORY **8**

Spontaneous and stimulated emission - Population inversion – Einstein's A & B coefficients - Threshold condition – super-radiance Laser – Three level and four level laser systems -conditions for CW and pulsed laser action. Q-Switching - experimental methods - cavity dumping - Mode locking - experimental methods - Spatial and Temporal coherence.

MODULE II DIFFERENT LASER SYSTEMS **8**

Laser systems – General description - Laser structure - excitation mechanism - Different laser systems- He-Ne laser, Carbon-dioxide laser - Excimer laser – Free electron laser- Alexandrite laser - Ti-Sapphire laser – Semiconductor diode laser - Diode pumped solid state laser - Pulsed-CW dye laser- Fibre laser.

MODULE III METROLOGICAL AND MATERIAL PROCESSING APPLICATIONS **8**

CW and Pulsed laser beam characteristics and its measurements - Beam focusing effects - spot size - Power and Energy density Measurements - Distance measurement - Interferometric techniques - LIDARS - different experimental arrangements - Pollution monitoring by remote sensing - Laser gyroscope - Laser welding, drilling, machining and cutting - Laser surface treatment - Laser vapour deposition – Biophotonic applications.

MODULE IV LASER INSTRUMENTATION **7**

Laser for measurement of length, current and voltage – Laser Doppler Velocimetry - Holography and speckle in displacement and deformation measurements - Laser for communication with fiber optics as channel.

PRACTICALS

1. Tuning of Dye Laser using DFDL Arrangement
2. Determination of Brewster Angle using He-Ne laser
3. Study of transversely Pumped Dye Lasers
4. Study of longitudinally Pumped Dye Lasers
5. Determination of power and wavelength using Distributed Feedback Dye Laser (DFDL)
6. Determination of fibre optic losses using semiconductor laser.
7. Bandgap determination of a semiconductor diode.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. William T. Silfvast, “Laser Fundamentals”, Cambridge University Press, 2009.
2. Ghatak. A. & Thyagarajan. K. “Optical Electronics”, Cambridge University, 1994.
3. Laud.B.B., “Laser and Non-Linear Optics”, Second Edition, New Age International (p) Limited Publishers, 2011.
4. Nambiar. K.R., “Lasers Principle, Types and Applications”, New Age International (p) Ltd, 2004.
5. Wilson. J. & Hawkes. J.F.B., “Opto Electronics - An Introduction”, Prentice Hall, 1992.
6. William M.Steen, ”Laser Material Processing”, Springer-Verlag, Berlin, Third Edn., 2005.

OUTCOMES:

At the end of the course, the students will be able

- To complement the knowledge acquired in the theory class.
- To work with dye lasers for tunability of laser wavelength.
- To measure the loss of information involved in fibre optic communication.
- To correlate the results for application.

PHCX 05	MATERIALS SCIENCE	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To gain basic knowledge in conducting and semiconducting materials and their properties.
- To provide basic understanding of properties and applications of dielectric materials.
- To impart knowledge on magnetic and optical materials and their properties & applications.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I CONDUCTING AND SEMICONDUCTING MATERIALS 10

Quantum free electron theory of metals and its importance - Energy distribution of electrons in metals - Fermi distribution function - Density of energy states and carrier concentration in metals - Fermi energy – Classification of solids into conductors, semiconductors and insulators on the basis of Band theory – Introduction to Elemental and Compound semiconductors - Carrier concentration derivation for Intrinsic semiconductors - Density of electrons in conduction band & Density of holes in valence band- intrinsic carrier concentration - Fermi energy & Variation of Fermi energy level with temperature - Mobility and electrical conductivity - Band gap determination.

MODULE II DIELECTRIC MATERIALS 7

Introduction to dielectric materials & basic definitions – Electronic, Ionic, Orientation & Space charge polarizations - Total polarization – Frequency and temperature dependence of polarization - Internal field in a dielectric material - Deduction of Clausius - Mosotti's relation - dielectric loss & loss tangent – Different types of dielectric breakdown – Applications of dielectric materials : Capacitors and Transformers.

MODULE III MAGNETIC MATERIALS 6

Introduction to magnetic materials & origin of magnetic moment - Different types of

magnetic materials and their properties - Ferromagnetism & Domain theory of ferromagnetism - Hysteresis, Soft and Hard magnetic materials - Antiferromagnetic materials - Ferrites and its applications – Applications of magnetic materials : Data storage.

MODULE IV OPTICAL MATERIALS 7

Optical properties of semiconductors - Direct and Indirect bandgap semiconductors – Traps, recombination centre, color center and exciton – Luminescence : Fluorescence and Phosphorescence - Liquid crystal display : twisted nematic crystal display – Applications of Optical materials - Optical Sources : light emitting diode and laser diode - Photo detectors : PIN photodiode and Avalanche Photodiode - Pyroelectric devices - Electro optic effect : Kerr effect and Faraday effect.

PRACTICALS

1. Resistivity measurement of a semiconductor using four point probe method.
2. Determination of band gap of a semiconductor diode.
3. Determination of Hall coefficient of a given semiconductor material.
4. Determination of dielectric constant of a given non-polar liquid.
5. Determination of magnetic susceptibility of a given paramagnetic liquid using Quincke's method.
6. Determination of energy loss of a given transformer core using hysteresis method.
7. To study the I-V characteristics of a photodiode.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Palanisamy P.K., ''Physics II'', Material Science for ECE, Scitech Publications (India) Pvt. Ltd., 2006.
2. Kasap. S.O., ''Principles of Electronic materials and devices'', McGraw Hill Publishers, 3rd Edition, 2007.
3. Arumugam. M, "Physics II'', Material Science for ECE, Anuradha Publishers, 5th Edition, 2005.
4. Sze. S.M., ''Semiconductor Devices – Physics and Technology'', John Wiley, 2nd Edition. 2002.
5. Raghavan. V, ''Materials Science and Engineering'', Prentice Hall of India, 5th Edition, 2004.

OUTCOMES:

On the completion of this course, the students will be able to

- Gain knowledge about fundamentals of conducting and semiconducting materials.
- Understand concepts and applications of Dielectric and Magnetic materials.
- Familiarize Optical materials and their applications in Engineering and Medical fields.
- Complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 06	NON-DESTRUCTIVE TESTING	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To study the process and applications of ultrasonic inspection method.
- To understand the basic concepts of radiographic inspection method.
- To acquire the knowledge about the various surface Non-Destructive Testing (NDT) techniques.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I ULTRASONIC INSPECTION METHOD **10**

Ultrasonic Testing - Principle of operations - types of sound waves - types of Transducers - transmission and pulse-echo method - straight beam and angle beam, instrumentation - calibration methods - ultrasonic testing technique- data representation, A Scan, B-scan, C-scan. Phased Array Ultrasound, Time of Flight. Diffraction - thickness determination - advantages, disadvantages and applications.

MODULE II RADIOGRAPHIC INSPECTION METHOD **10**

Radiographic testing – Principle - Interaction of X-ray with matter - X-ray radiography - method of generation-industrial radiography inspection techniques – Equipment - Exposure charts - Types of films – Fluoroscopy - Xero-Radiography – Limitations - Gamma radiography - Equipment, radiation sources - method of generation - film processing - interpretations of radiography - safety in industrial radiography.

MODULE III SURFACE NDT TECHNIQUES **10**

Liquid Penetrant Testing – Principles, Characteristics and types of liquid penetrants – developers - advantages and disadvantages of various methods - Inspection Procedure and Interpretation of results. Applications of Liquid Penetrant testing.

Magnetic Particle Testing - Principle-magnetizing technique - procedure –equipment - Interpretation and evaluation of test indications - applications and limitations - demagnetization.

PRACTICALS

1. Inspection of welds using solvent removable visible dye penetrant.
2. Inspection of welds using solvent removable fluorescent dye penetrant.
3. Inspection on non magnetic materials by eddy current method.

4. Inspection on magnetic materials by eddy current method.
5. Inspection of welds by Eddy current Testing.
6. Inspection of welds by Magnetic Particle Testing - Dry method.
7. Inspection of welds by Magnetic Particle Testing - Wet method.
8. Ultrasonic flaw detector - Inspection of defects.
9. Demonstration of Radiographic inspection.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Baldev Raj., Jayakumar T.,Thavasimuthu., “Practical Non-Destructive Testing”, Narosa Publishing House, 2009.
2. Ravi Prakash., “Non-Destructive Testing Techniques”, 1st revised edition, New Age International Publishers, 2010.
3. ASM Metals Handbook of Non-Destructive Evaluation and Quality Control, American Society of Metals, Metals Park, Ohio, USA, Volume-17, 2000.
4. Paul E Mix,”Introduction to Non-destructive testing: a training guide”, Wiley, 2nd Edition New Jersey, 2005.
5. Charles J., Hellier, “Handbook of Nondestructive evaluation”, McGraw Hill, New York, 2001.

OUTCOMES:

Upon completion of this course, the students will be able to

- illustrate the ultrasonic inspection methods of NDT.
- understand the basic concept of radiographic inspection method.
- test the surfaces by the various surface NDT techniques.
- complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 07	PROPERTIES OF MATTER AND ACOUSTICS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To understand principles and properties of elasticity.
- To understand the basic concepts and application of viscosity.
- To analysis acoustic of building.
- To know about photoelasticity and its applications.

MODULE I ELASTICITY **8**

Stress and strain - Hooke's Law of elasticity - Elastic moduli - Stress-Strain Diagram - Poisson's Ratio - Relation between elastic constants - Work done in stretching and twisting a wire - Twisting couple on a cylinder- Expression for bending moment - Cantilever–Expression for depression - Uniform bending and Non-uniform bending of beams (theory & experiment) - I form Girders (qualitative treatment) and applications.

MODULE II VISCOSITY **8**

Viscosity- Newton’s formula for viscous flow - Streamline and turbulent motion - Reynolds number - Poiseuille's formula - Determination of coefficient of viscosity- factors affecting viscosity - capillary flow method - Stoke's formula- viscosity of highly viscous liquids – Stoke’s method - Lubricants and its applications –viscosity measurements - Viscometer - Variation of Viscosity with Temperature.

MODULE III ACOUSTICS OF BUILDING **7**

Basic requirement for the acoustically good halls - Reverberation and time of reverberation – Sabine’s formula for reverberation time - Absorption coefficient and its measurement -Transmission of sound and transmission loss - Factors affecting the architectural acoustics and their remedy-sound absorbing materials - vibration and noise control systems for buildings.

MODULE IV PHOTOELASTICITY **7**

Polarization - double refraction - Theory of Plane, Circularly and Elliptically polarized light - Quarter wave plate and half wave plate - photo elasticity - Theory of photo-elasticity - Stress optic relations - model materials - analysis techniques - Photo elastic bench - Three dimensional photo elasticity - Digital photo elasticity - Photo elastic coatings.

PRACTICALS

1. Determination of viscosity of liquid by Poiseuille's method.
2. Determination of viscosity of liquid by Stoke's method.
3. Analysis of stress by photo elastic method.
4. Verification of Hooke's law by spring method.
5. Determination of Young's modulus of the cantilever beam.
6. Determination of rigidity modulus by static torsion method.
7. Visit to acoustically good auditorium and identifying the sound absorbing materials in the auditorium.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Mathur D.S., "Elements of Properties of Matter", S.Chand & Co, Delhi, 2009.
2. Gaur R.K., Gupta S.L.,"Engineering Physics", Dhanpat Rai Publishers, 2010.
3. Brijlal and Subramaniam.," Properties of Matter", Eurasia Publishing Co, New Delhi, 2002.
4. Smith C.J.," General Properties of Matter", Orient & Longman,1960.
5. Kenneth G. Budinski and Michel K., Budinski, "Engineering Materials Properties and Selection", Pearson, Singapore, 2002.

OUTCOMES:

Upon completion of this course, the students will be able to

- understand the basic concepts of the elasticity of materials.
- comprehend the concepts of viscosity of liquid and measurement.
- demonstrate the acoustical aspects of building and its importance in construction.
- apply the fundamental concept of photo elasticity for the stress analysis of the object.

PHCX 08	PROPERTIES OF MATTER AND NONDESTRUCTIVE TESTING	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To impart knowledge about the principles and properties of elasticity.
- To learn the laws governing the dynamic of rigid bodies.
- To acquire the knowledge of the various techniques of Non-Destructive Testing (NDT) of materials.
- To understand the principle and basic concept of low temperature applications.

MODULE I ELASTICITY **8**

Stress and strain - Hooke's Law of elasticity - Elastic moduli - Stress-Strain Diagram - Poisson's Ratio - Relation between elastic constants - Work done in stretching and twisting a wire - Twisting couple on a cylinder- Expression for bending moment- Cantilever–Expression for depression - Uniform Bending and Non-uniform bending of beams (theory & experiment) - I form Girders (qualitative treatment) and applications.

MODULE II DYNAMICS OF RIGID BODIES **8**

Rigid bodies - angular acceleration - Torque on a particle - angular momentum - law of conservation of angular momentum - moment of inertia and its significance - Theorem of parallel and perpendicular axis - moment of inertia of a thin uniform bar - moment of inertia of a rectangular lamina - moment of inertia of uniform circular disc - Moment of inertia of hollow and solid cylinders – flywheel
(qualitative) - kinetic energy of rotating body – Routh rule.

MODULE III NDT TECHNIQUES **6**

Ultrasonic Testing- types of Transducers-transmission and pulse-echo method- Radiographic testing- Principle-Interaction of X-ray with matter-X-ray radiography-method of generation-industrial radiography inspection techniques- Liquid Penetrant Testing**-** Inspection Procedure and Interpretation of results.

MODULE IV LOW TEMPERATURE PHYSICS **8**

Definition of Refrigeration and Air-Conditioning - Types of Refrigeration Systems-Applications- Comfort Air Conditioning, Industrial Refrigeration, Food processing

and food chain - Cryogenic treatment - Low temperature properties of engineering materials: Mechanical properties, Thermal properties, Electrical properties.

PRACTICALS

1. Verification of Hooke's law by spring method.
2. Determination of Young's modulus of the beam by bending method.
3. Inspection of welds using solvent removable visible dye penetrant.
   Inspection of welds using solvent removable fluorescence dye penetrant.
5. Inspection of welds by Magnetic Particle Testing.
6. Determination of moment of inertia of the disc by torsion pendulum method.
7. Determination of moment of inertia of the disc by static torsion method.
8. Demonstration of working of flywheel.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Mathur D.S.,"Elements of Properties of Matter", S.Chand & Co, Delhi, 2009.
2. Brijlal & Subramaniam," Properties of Matter", Eurasia Publishing Co, Delhi, 2002.
3. Gaur R.K., Gupta S.L., "Engineering Physics" Dhanpat Rai Publishers, 2010.
4. Baldev Raj.,Jayakumar T., Thavasimuthu M.,"Practical Non-Destructive testing", Narosa Publishing House, 2009.
5. Brijlal & Subrahmanyam., "Heat and Thermodynamics" S.Chand & Company Ltd, 2002.
6. Paul E Mix.," Introduction to Non-destructive testing: a training guide", Wiley, 2nd Edition, New Jersey, 2005.
7. Charles J., Hellier.," Handbook of Nondestructive evaluation", McGraw Hill, New York, 2001.

OUTCOMES:

Upon completion of this course, the students will be able to

- understand the basic of concept of elasticity of materials.
- comprehend the basic concepts of motion of rigid bodies and its applications.
- demonstrate the various NDT techniques and its importance.
- know the low temperature systems and its applications.

PHCX 09	SEMICONDUCTOR PHYSICS AND OPTOELECTRONICS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To understand the Physics of Semiconductor devices.
- To make the students learn the fundamentals of Photoluminous - semiconductors, Optoelectronic devices, Optical modulators/detectors.
- To make them understand the technology behind latest Display devices like LCD, Plasma and LED Panels.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I PHYSICS OF SEMICONDUCTORS **8**

Elemental and compound semiconductors – Drift and diffusion current - Intrinsic semiconductors – Carrier concentration (derivation) – Fermi energy – Variation of Fermi energy level with temperature – Mobility and electrical conductivity – Band gap determination – Extrinsic semiconductors – Carrier concentration in n-type and p-type semiconductor (derivation) – Variation of Fermi level with temperature and impurity concentration – Variation of Electrical conductivity with temperature – Hall effect – Experiment and applications of Hall effect.

MODULE II OPTOELECTRONIC DEVICES **7**

Light Emitting Diodes (LED) – power and efficiency - double hetero LED - LED structure - LED characteristics - White LED – Applications. Liquid crystal displays – Dynamic scattering and Twisted nematic display, Semiconductor Lasers, Homojunction and Heterojunction laser diodes - Optical processes in semiconductor lasers.

MODULE III OPTICAL MODULATORS **7**

Modulation of light – birefringence –Modulation Techniques - Electro optic effect – Electro optic materials –Types of Electro optic Modulators : Kerr and Pockel modulators –- Magneto optic effect - Magneto optic Modulators – Acousto Optic modulators.

MODULE IV OPTICAL DETECTORS **8**

Photo detectors - photodiodes - phototransistors - noise characteristics - PIN diode – Avalanche Photodiode (APD) characteristics - APD design of detector arrays – Charged Couple Device - Solar cells - Materials and design considerations, Thin film

solar cells, amorphous silicon solar cells.

PRACTICALS

1. Resistivity measurement of a semiconductor using four point probe method.
2. Determination of band gap of a semiconductor diode.
3. Determination of Hall coefficient of a given semiconductor material.
4. Determination of the wavelength of a given laser source using diffraction grating.
5. Determination of Planck's constant using LED.
6. To study the I-V characteristics of photodiode and phototransistor.
7. To study the characteristics of a solar cell.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Arumugam. M, "Physics II", Anuradha Publishers, 5th Edition, 2005.
2. Sze. S.M., "Semiconductor Devices – Physics and Technology", 2nd edn. John Wiley, 2002.
3. Wilson & J.F.B. Hawkes, "Optoelectronics – An Introduction", Prentice Hall, India, 1996.
4. Bhattacharya, "Semiconductor optoelectronic devices", Second Edn, Pearson Education, 2002.
5. Safa O. Kasap, "Optoelectronics & Photonics:Principles & Practices", Second Edn, Pearson Education,2013.
6. Palanisamy P.K., "Semiconductor physics and optoelectronics" Scitech Publications, 2003.

OUTCOMES:

On completion of this course, the student will be able to

- understand the principles of Physics behind semiconductor devices.
- choose the correct semiconductors for electronic devices and display.
- differentiate the working principle of LED and Diode Laser.
- apply the knowledge of modulation of light for different types of optical modulators.
- select suitable photodetectors for different types of applications.
- complement the knowledge acquired in the theory class and correlate the results for applications.

Chemistry Elective Courses
(To be offered II Semester)

CHCX01	ANALYTICAL INSTRUMENTATION	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make the student conversant with

- principles, instrumentation and applications of different electroanalytical techniques
- different chromatographic techniques
- principles, instrumentation and applications of various types of absorption and emission spectroscopy
- different thermal analytical methods and their applications

MODULE I ELECTROANALYTICAL TECHNIQUES **7**

Principle and applications: conductometric titrations – potentiometrIc titrations, ion-selective electrodes and pH-metry – coulometry – voltammetry - polarography, amperometric titrations.

MODULE II CHROMATOGRAPHY **8**

Basic concepts of chromatography – paper chromatography – column chromatography – thin layer chromatography – gas chromatography – high performance liquid chromatography – gel permeation chromatography.

MODULE III SPECTROSCOPY **8**

Absorption spectroscopy (principle, instrumentation and applications): Colorimetric analysis – UV-Visible spectroscopy – FTIR spectroscopy - Emission Spectroscopy (principle, instrumentation and applications): fluorescence, phosphorescence and chemiluminescence – Atomic absorption spectroscopy – flame emission spectroscopy.

MODULE IV THERMAL ANALYSIS **7**

Principle, instrumentation and applications: Thermo gravimetric analysis – Differential thermal analysis – Differential scanning calorimetry

PRACTICALS

1. Conductometric titrations: acid-base and precipitation titrations

2. Potentiometric titrations
3. Determination of pH of the unknown solution
4. Estimation of alkali metals using flame emission spectroscopy
5. Estimation of metal ions of coloured solutions using colorimetric analysis
6. Separation of compounds using gas chromatography
7. Separation of compounds using high performance liquid chromatography
8. Analysis of the given sample and interpretation of the data using IR, UV-Visible spectroscopy
9. Demonstration of TGA/DTA and DSC and interpretation of data.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Skoog D.A., West D.M., Holler F.J. and Crouch S.R., Fundamentals of Analytical Chemistry, 8th Edition, Thomson Brooks/Cole Publication., Singapore, 2004.
2. Willard H.H., Merritt L.L., Dean J.A. and Settle F.A., Instrumental Methods of Analysis, 7th Edition, CBS Publication, New Delhi Reprint, 2004.
3. A.I. Vogel, Vogel's Textbook of Practical Organic Chemistry, 5th Edition, Prentice Hall, London, 2008.
4. Christian G.D., Analytical Chemistry, 6th Edition, John Wiley, Singapore, 2003.
5. Fifield F.W. and Kealey D., Principles and Practice of Analytical Chemistry, 5th Edition, Blackwell Publication, London, 2000.
6. Settle F. (Editor), Handbook of Instrumental Techniques for Analytical Chemistry, Pearson Education, Singapore, 2004.

OUTCOMES:

The student will be able to

- state the principle and applications of various electro-analytical techniques
- identify the right separation method for a given sample using different chromatographic techniques
- explain the principle, instrumentation & applications of various spectroscopic methods and also to interpret the data
- elaborate the principle, instrumentation and applications of various thermal analytical techniques and interpret the data.

CHCX02	CORROSION AND ITS CONTROL	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students should be conversant with the

- Basic concepts, principles and factors affecting corrosion
- Types and mechanism of corrosion
- Control measures of corrosion by material selection, proper design and by applying organic coatings
- Control of corrosion by applying inorganic coating

MODULE I BASIC CONCEPTS OF CORROSION 8

Corrosion – causes and impacts of corrosion – mechanism of corrosion: Dry corrosion- oxidation corrosion - corrosion by other gases – Pilling-Bedworth rule- Corrosion by hydrogen: hydrogen blistering, hydrogen embritttlement, decarburization and hydrogen attack – corrosion of silver and copper by sulphur compounds – liquid metal corrosion (embritttlement or cracking) – Wet corrosion : hydrogen evolution – presence and absence of oxygen and absorption of oxygen – difference between dry and wet corrosion-factors influencing corrosion-polarization-passivity-emf series and galvanic series- corrosion current -rate of corrosion.

MODULE II FORMS OF CORROSION 7

Forms of corrosion-conditions for electrochemical corrosion –galvanic corrosion – differential aeration corrosion: pitting, water line, wire fencing, crevice and filiform corrosion – stress corrosion – Intergranular corrosion- erosion corrosion – soil corrosion – microbiological corrosion- fretting corrosion- corrosion in composites.

MODULE III CORROSION CONTROL AND ORGANIC COATINGS 8

Corrosion control – selection of materials and designing- cathodic protection – sacrificial anode and impressed current cathodic protection – corrosion inhibitors: anodic, cathodic and vapour phase inhibitors.

Organic protective coatings – paints: constituents – functions – varnishes : types-constituents – functions – lacquers : constituents – functions –enamels-constituents – functions – special paints : fire retardant, water repellant, heat resistant, temperature indicating and luminous paints.

MODULE IV INORGANIC COATINGS 7

Treatment of metal surface-inorganic coatings- classification- metallic coatings : anodic and cathodic coatings-hot dipping : galvanizing and tinning- electroplating—electroless plating – cementation (diffusion) : sherardizing, calorizing and chromizing – metal cladding-metal spraying – non metallic coatings (chemical conversion coatings) : phosphate, chromate, oxide coatings and anodizing – comparison of anodic and cathodic protection.

PRACTICALS

1. Determination and comparison of rate of corrosion of metals in the presence of acid, base and neutral medium by weight loss method.
2. Determination of rate of corrosion of iron in the presence of various acids by weight loss method.
3. Determination of rate of corrosion of iron in the presence and absence of anodic Inhibitor by weight loss method.
4. Determination of rate of corrosion of iron in the presence and absence of cathodic Inhibitor by weight loss method.
5. Electroplating of base metal with copper.
6. Electrolessplating of base metal with copper
7. Chemical conversion coatings such as chromate and phosphate coatings.
8. Demonstration on the study of rate of corrosion by using cyclic voltametry.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. P.C Jain & Monica Jain, Engineering Chemistry Dhanpatrai Publishing Company (P) Ltd., New Delhi (2013).
2. S S Umare & S S Dara, A text Book of Engineering Chemistry, S. Chand& Company Ltd, New Delhi, 2014.
3. M.G. Fontana and N.G. Green, Corrosion Engineering, McGraw Hill Book Company, NewYork, 1984.
4. S. Banerjee, A.K. Tyagi, Functional Materials- Preparation, Processing and Applications, ELSEVIER Publications, London ; Waltham, MA : 2011

OUTCOMES:

Students will be able to

- explain the mechanism, compare and enumerate the factors affecting

corrosion

- describe and identify the place and types for a given situation.
- choose and elaborate the suitable organic coating method for a given real time situation.
- apply a suitable metallic coating for a given situation

CHCX03	ELECTRICAL MATERIALS AND BATTERIES	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students should be conversant with

- preparation, properties and applications of plastics used in electrical and electronic applications
- properties and uses of electrical engineering materials
- classification and description of different types of batteries.
- classification and types of fuel cells

MODULE I POLYMERS FOR ELECTRICAL AND ELECTRONIC APPLICATIONS **8**

Preparation, properties and applications **:** polyethylene, polypropylene, EPDM, Nylon-6,6, PVC, PTFE, polycarbonates, ABS, phenol formaldehyde, urea formaldehyde, epoxy resins – polymer blends and alloys.

MODULE II ELECTRICAL ENGINEERING MATERIALS **7**

Conductors: Silver, Copper, Gold, Aluminum – Semiconductors: Germanium, Silicon, Gallium Arsenic – Insulating Materials: Rubbers, Mica, Plastics, Ceramics, Insulating papers – Magnetic Materials: ferromagnetic materials, paramagnetic materials, diamagnetic materials, antiferromagnetic materials, ferrites

MODULE III BATTERIES **7**

Electrochemical and electrolytic cell – batteries: types (primary, secondary and flow cell) – primary batteries: dry cells, alkaline batteries – secondary batteries: nickel-cadmium cell – lead acid storage cell, lithium battery: primary and secondary type – solar cell – dye sensitized solar cell.

MODULE IV FUEL CELLS **8**

Difference between batteries and fuel cells - chemistry of fuel cells - types of fuel cell (based on temperature and electrolyte) – principle, characteristic features, advantages, disadvantages and applications of polymer electrolyte membrane or proton exchange membrane fuel cell (PEMFC), direct methanol fuel cell (DMFC), alkaline fuel cell (AFC), phosphoric acid fuel cell (PAFC), molten carbonate fuel cell (MCFC) and solid oxide

fuel cells (SOFC).

PRACTICALS

1. Free radical polymerization of styrene.
2. Free radical polymerization of PMMA.
3. Preparation of phenol-formaldehyde.
4. Preparation of urea-formaldehyde.
5. Synthesis of epoxy resin.
6. Demonstration of mechanical properties of insulating materials using UTM
7. Demonstration of electrical properties of insulating materials
8. Construction of batteries using natural resources
9. Measurement of EMF for different batteries.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Jain P.C. and Renuka Jain, Engineering Chemistry, Dhanpat Rai Publication Co. (P) Ltd., New Delhi, 2013.
2. Michael L. Berins, Plastics Engineering Hand Book, 5th Edition, Chapman and Hall, New York, 1991.
3. H.F. Mark and N. Gaylord, Encyclopedia of Polymer Science and Technology, Vol. 1 to XIV Interscience, 2nd Ed. 1988.
4. Gowarikar V.R., Viswanathan N.V and Jayadev Sreedhar, Polymer Science, Wiley Eastern Limited, Madras, 1981.
5. R.K. Rajput,A Textbook of Electrical Engineering Materials, Firewall Media, 2004
6. Vladimir S. Bagotsky, Fuel Cells: Problems and Solutions, 2nd Edition, John Wiley and Sons, 2012.
7. B. Viswanathan and M. Aulice Scibioh, Fuel Cells: Principles and Applications, Taylor and Francis Group, 2007.

OUTCOMES:

The student will be able to

- summarise the preparation, properties and applications of plastics used in electrical and electronic applications
- enumerate the properties and uses of electrical engineering materials
- illustrate various types of batteries with the aid of a diagram
- classify the fuel cells and elaborate the different types of fuel cells.

CHCX04	ENGINEERING MATERIALS	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students should be conversant with

- properties and uses of different types of refractories and abrasives
- adhesives, cements and lime, setting of cements and their chemical behaviors.
- types, properties and uses of lubricants.
- various types of composite materials.

MODULE I REFRACTORIES AND ABRASIVES **8**

Introduction refractory: -classification - based on chemical nature- characteristic and selection of good refractory - general manufacture of refractory- preparation properties and uses of: silica refractory - magnesite refractory - zirconia refractory, properties of refractories: refractoriness - refractoriness under load - thermal spalling - porosity and dimensional stability, Cermets - super refractory.

Abrasives : introduction - Moh's scale - natural abrasives: diamond – corundum – emery - garnet and quartz, synthetic abrasives: preparation properties and uses: carborundum (silicon carbide)– alundum - boron (norbide) carbide

MODULE II ADHESIVES AND BINDING MATERIALS **7**

Introduction - classification of adhesives –advantage –limitation of adhesive bonding – development of adhesive- factors influencing adhesive action: chemical and physical, application techniques of adhesive – Lime: classification – manufacture - setting and hardening, Gypsum: -Manufacture and properties and uses - Cement : chemical composition- Manufacture – setting and hardening – concrete – weathering of cement and concrete and its prevention- special cements: high alumina cement - sorel cement - white portland cement – water proof cement.

MODULE III LUBRICANTS **7**

Introduction –functions of lubricant- mechanism of lubrication - classification of lubricant – liquid lubricant: vegetable and animal oils – mineral oils, semisolid: grease(calcium, lithium, aluminium) – petroleum jelly, solid lubricant: graphite - molybdenum disulphide, Properties of lubricant: viscosity - viscosity index - flash point and fire point - cloud point and pour point – oiliness - aniline point - carbon residue.

MODULE IV COMPOSITE MATERIALS 7

Introduction – advantageous characteristics of composites, applications of composites, main constituent of composites, types and applications of composites: RCC fibre-reinforced plastics (glass , carbon and aramid) - particulate composite - metal matrix composite - layered composites - failures in fibre-reinforced composites, ceramic matrix composites (CMC) – properties and applications.

PRACTICALS

1. Preparation of refractory bricks
2. Preparation of abrasive papers/cloth
3. Preparation of simple adhesives
4. Estimation of alkalinity in cements
5. Determination of cloud point and pour point
6. Determination of flash point and fire point
7. Preparation of fibre-reinforced composite

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. P.C Jain & Monica Jain, Engineering Chemistry Dhanpatrai Publishing Company (P) Ltd., New Delhi (2013).
2. B.Sivasnakar, “Engineering Chemistry”, Tata McGrow-Hill Publication Limited, New Delhi, second reprint 2008.
3. Engineering Chemistry, Wiley India Editorial Team, Willey India Publisher, New Delhi, 2011.
4. S S Umare & S S Dara, A text Book of Engineering Chemistry, S. Chand& Company Ltd, New Delhi, 2014.

OUTCOMES:

The student will be able to

- classify and describe the manufacture the refractories and enumerate the properties and uses of abrasive materials.
- elaborate the manufacture, properties and uses of various adhesives and binding materials.
- classify lubricants and describe the properties and uses of them
- enumerate the properties and uses of various composite materials.

CHCX05	FUELS AND COMBUSTION	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make the students conversant with the

- three types of fuels available and the different processes involved in it.
- analysis of fuel characteristics and manufacture of fuels
- calculations involved in calorific values and minimum air requirement for complete combustion.
- classification, functions, mechanism and properties of lubricants.

MODULE I SOLID FUELS **7**

Characteristics of good fuel. Solid fuel – Wood, Coal – Ranking of coal – selection of coal. Analysis of coal – Proximate analysis. Pulverized coal – Metallurgical coke – Carbonization of coal – types. Manufacture of metallurgical coke – Beehive oven and Otto Hoffman's by-product oven methods.

MODULE II LIQUID AND GASEOUS FUELS **8**

Liquid fuel: Petroleum: Refining of petroleum, Liquid fuels derived from petroleum – Cracking: Thermal (Liquid and Vapour phase) – Catalytic (fixed bed and moving bed cracking – Synthetic petrol: Fischer-Tropsch method– Knocking in petrol and diesel engine: octane number and antiknocking – cetane number and improvement of cetane number – biodiesel (trans-esterification) – Gaseous fuels: Compressed natural gas (CNG) – LPG – oil gas – producer gas – water (blue) gas – biogas.

MODULE III COMBUSTION **8**

Calorific value: Gross and net caloric value – Bomb Calorimeter, Gas calorimeter - Definition of combustion – calculation of minimum requirement of air (problems) – theoretical calculation of calorific values (Dulong's formula), Gross and net calorific values ((problems) – Analysis of flue gas: Orsat's gas analysis method, explosive range, Ignition temperature. Introduction to air pollution from IC (Internal combustion) engines, photochemical smog, primary and secondary pollutants.

MODULE IV LUBRICANTS **7**

Friction and wear – lubricants: definition, functions and mechanism of lubrication

(thick film and thin film) –classification: liquid lubricants: animal and vegetable origin, mineral oil, blended oils, lubricating emulsions and silicones – properties of lubricating oils: viscosity and viscosity index; Flash and fire-point, Cloud and pour point, oiliness, emulsification number, volatility, carbon residue, aniline point – semisolid lubricant: greases and waxes – solid lubricant: graphite and molybdenum disulphide –nanolubricants.

PRACTICALS

1. Testing of fuels - proximate analysis (moisture, volatile matter, ash content and fixed carbon present in coal, coke, charcoal etc)
2. Ash content and carbon residue test
3. Biodiesel synthesis by trans-esterification method (from coconut, groundnut, mustard oil, palm oil)
4. Determination of calorific value of a solid fuel using Bomb calorimeter (coal, charcoal, coke etc)
5. Determination of calorific value of a liquid fuel using Bomb calorimeter (petrol, diesel, biodiesel etc)
6. Determination of cloud point and pour point of a lubricant
7. Determination of flash and fire point of diesel.
8. Aniline Point of diesel
9. Viscosity Index of lubricants and Fuels by Viscometer
10. Flue gas analysis by Orsat's gas analysis method – Demonstration
11. Working of internal combustion engine – Demonstration

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai and Sons, New Delhi, 2001.
2. Engineering Chemistry, Wiley India Editorial Team, Willey India Publisher, New Delhi, 2011.
3. John Griswold, Fuels Combustion and Furnaces, Mc-Graw Hill Book Company Inc. University of Michigan, 1946.
4. J.B. Heywood, Internal Combustion Engine Fundamentals, McGraw Hill International Editions, 1989.
5. Bahl B.S., Tuli and Arun Bahl, Essentials of Physical Chemistry, S. Chand and Company Ltd., New Delhi, 2004.

OUTCOMES:

The students will be able to

- compare and contrast the solid, liquid and gaseous fuels and also describe the processes involved in liquid and gaseous fuels.
- analyse the fuel properties such as moisture, votalite matter, ash content, calorific value etc
- calculate minimum air required for complete combustion and calorific values of fuels.
- categorize different lubricants into three types, explain the preparation and determine their properties.

CHCX06	FUNDAMENTALS OF PHYSICAL CHEMISTRY	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students will be conversant with the

- various thermodynamic terms and relate the laws of thermodynamics in chemical processes
- molecularity and order of reaction and derive the rate constant for different order of reactions
- basics of adsorption of different materials and propose mechanisms and surface area measurement
- conditions for equilibrium and learn different components at equilibrium

MODULE I BASIC THERMODYNAMICS **8**

Introduction - Thermodynamic terms - Thermodynamic equilibrium and processes - 1st law of thermodynamics: internal energy, enthalpy, heat capacity, isothermal and adiabatic expansion, Joule-Thomson effect - Zeroth law of thermodynamics: absolute temperature - 2nd law of thermodynamics: - spontaneous and cyclic process, Entropy in isothermal, isobaric and isochoric processes, work and free energy function, Maxwell's relation - 3rd law of thermodynamics

MODULE II CHEMICAL KINETICS **8**

Rate of chemical reaction - order and molecularity of a reaction - Rate constant - kinetics of opposing, parallel and consecutive and chain reactions - isotope effects - effect of temperature on reaction rate - collision theory - absolute reaction rate theory - kinetics in enzyme catalysis

MODULE III SURFACE SCIENCE AND CATALYSIS **8**

Adsorption - adsorption isotherms - uni and bimolecular adsorption reactions - parahydrogen conversion - factors affecting adsorption – Langmuir adsorption isotherm - Hinshelwood mechanism and *Eley-Rideal* mechanism with example - adsorption of gases on solids and surface area measurement by BET method - Terms in catalysis - homogeneous and heterogeneous and enzyme catalysis with example

MODULE IV PHASE RULE 6

Terms involved - Conditions for equilibrium - application of phase rule to water, lead-silver system, freezing mixtures, thermal analysis: cooling curves.

PRACTICALS

1. Determination of the heat capacity of benzoic acid, internal energy of combustion of camphor using Bomb calorimeter. Calculation of enthalpy of combustion and formation for camphor.
2. Determination of adsorption isotherm of (i) acetic acid on charcoal (ii) oxalic acid on charcoal.
3. *Kineticsoffirst and second order reactions.*
4. Phase rule experiments with organic compounds: (i) naphthalene and p-dichloro benzene (ii) naphthalene and diphenyl (iii) m-dinitrobenzenzene and p-nitro toluene.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Rajaram J. and Kuriacose J.C., Chemical Thermodynamics: Classical, Statistical and Irreversible, Pearson Education, India, 2013.
2. Samuel Glasstone, Thermodynamics for Chemists, Read Books, United Kingdom, 2007.
3. James E. House, Principles of Chemical Kinetics, 2nd Edition, Academic Press, United States of America, 2007.
4. Keith J. Laidler, Chemical Kinetics, Pearson Education, India, 1987.
5. Douglas M. Ruthven, Principles of Adsorption and Adsorption Processes, John Wiley & Sons, 1984.
6. Puri B.R., Sharma L.R. and Pathania M.S., Principles of Physical Chemistry, 47th Edition, Vishal Publishing Co. India, 2016.

OUTCOMES:

The student will be able to

- calculate entropy, enthalpy and free energy change for different chemical processes
- calculate the rate constant for any chemical and biochemical processes
- differentiate the adsorption processes and calculate the surface area and predict the suitability of catalysts for different chemical processes

- predict the equilibrium conditions for water, alloys, freezing mixtures and draw the thermal curves for phase transition

CHCX07	GREEN TECHNOLOGY	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make students conversant with the

- basic principles of green chemistry and green technology.
- wastes that causes hazards to human health
- chemicals that harms our environment
- need for green processes in various industries

MODULE I GREEN CHEMISTRY PROTOCOL **7**

Need – Significance – 12 Principles with examples – R4 model – Life cycle analysis – sustainable and cleaner production - Green Technology: definition, examples: CFC free refrigerants, green building, energy, 3D printers, nanotechnology – Awards for Green chemistry – organization promoting green chemistry.

MODULE II WASTE & WASTE MINIMISATION **8**

Source of wastes: domestic, industrial, medical, nuclear, e-waste; problems; prevention – economy of waste disposal – Waste minimization techniques: general waste treatment and recycling – alternate waste water treatment technologies: hybrid process – Green computing: goals, green cloud, green ICT - Pollution statistics from various industries (Industrial case studies).

MODULE III GREEN SYNTHESIS **7**

Introduction - Solvent free reactions - green reagents, green solvents in synthesis - microwave and ultrasound assisted reactions – supercritical fluid extraction – green oxidation and photochemical reactions – catalyst and biocatalysts.

MODULE IV GREEN INDUSTRIAL PROCESSES **8**

Polymer industry: biodegradable polymer - textile industry: greener approaches of dyeing, waste disposal – ecofriendly agrochemicals: biofertilizers, biopesticides – Pharmaceutical industry: atom economy, reduction of toxicity, use of biocatalyst, zero waste disposal – Leather industry: greener process in tanning, crusting, surface coating – ecofriendly batteries & fuel cells.

PRACTICALS

1. Synthesis of an ionic liquids (Ex: imidazolium) and testing the solubility of organic

chemicals.

2. Green bromination of stilbene (using pyridine hydrobromide).
3. Green synthesis: Photocatalytic reactions, solvent-free organic reaction – Aldol; green oxidation, green reduction.
4. Microwave assisted chemical reaction. (synthesis of aspirin, pinacol-pinacolone reaction, etc).
5. Comparison of conventional reaction with microwave assisted reactions (atom economy, solvent, etc) [Ex: aldehyde and ketones with hydrazines to give hydrazones].
6. Diels-Alder reaction in eucalyptus oil (green process).

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai and Sons, New Delhi. 2001.
2. V. K. Ahluwalia, Green Chemistry: Environmentally Benign Reactions, Ane Books India, New Delhi, 2006.
3. Paul Anastas, John C.Warner, John Warner Joint; Green Chemistry: Theory & Practice New Ed Edition; Oxford University press, USA, 2000.
4. Rashmi Sanghi, M. M. Srivastava, Green chemistry, Narosa publishers, New Delhi, 2003.

OUTCOMES:

The students will be able to

- outline the principles and implications of green chemistry.
- comprehend the potential risks of waste generated and analyse the threats to human and environment.
- integrate information into design of molecules to avoid/eliminate toxic solvents & reagents or reduce toxic products.
- identify various alternate greener technologies for various industries.

CHCX08	ORGANIC CHEMISTRY OF BIOMOLECULES	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make students conversant with the

- basic concepts in organic chemistry
- types and structure of carbohydrates and lipids
- formation of different structures of proteins from amino acid
- structure of nucleic acids

MODULE I BASIC CONCEPTS IN ORGANIC CHEMISTRY 8

Classification and IUPAC nomenclature of organic compounds – stereochemistry – optical, stereo and geometrical isomerism – types of reagents: electrophiles and nucleophiles – types of reactions: addition, substitution, elimination and rearrangement reactions.

MODULE II CARBOHYDRATES, LIPIDS AND VITAMINS 7

Structure and functions of carbohydrates: mono, di, oligo and polysaccharides – lipids: phospholipids, glycolipids, sphingolipids – cholesterol – steroids – Structure, functions and deficiency disorders of fat soluble vitamins: A, D, E & K - Water soluble vitamins B & C: Thiamine, riboflavin, pantothenic acid, niacin, pyridoxine, biotin, cobalamine, folic acid and ascorbic acid.

MODULE III AMINO ACIDS, PEPTIDES AND PROTEINS 7

Aminoacids: classification, properties - peptides – polypeptides – proteins: primary, secondary, tertiary and quaternary structure – glycoproteins – lipoproteins – Enzymes: classification and functions

MODULE IV NUCLEIC ACIDS 8

Nucleic acids – importance - structure of purines and pyrimidines – nucleotides – polynucleotides - RNA – types & structure - DNA – phosphodiester bonds – chemical, helical structure and functions – DNA replication – gene modification.

PRACTICALS

1. Qualitative tests to identify carbohydrates.

2. Quantitative estimation of carbohydrates.
3. Separation of sugars – TLC and/or paper chromatography.
4. Quantitative estimation of lipids.
5. Separation of amino acids – TLC and/or paper chromatography.
6. Quantitative estimation of proteins by Lowry's method.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. V. K. Ahluwalia, Organic Reaction Mechanism, Narosa Publishers, New Delhi, 2002.
2. Johnson Arthur T., Biology for Engineers, CRC Press, Finland, 2011.
3. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai and Sons, New Delhi. 2001.
4. David L. Nelson, Michael M. Cox, Lehninger Principles of biochemistry, Macmillan press, London, 2010

OUTCOMES:

The students will be able to

- classify organic compounds and explain the mechanism of various organic reactions.
- draw the structures and enumerate the functions of carbohydrate, lipids and vitamins.
- correlate the relationship among amino acids, peptides and proteins.
- recognize the role of nucleic acid in the formation of RNA & DNA and differentiate DNA & RNA using their structure and function.

CHCX09	POLYMER SCIENCE AND TECHNOLOGY	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make the student conversant with the

- basic concepts of polymers, classification, types of polymerization and molecular weight & its distribution
- preparation, properties and applications of thermoplastics and introduction to biodegradable polymers
- properties and applications of thermosets, elastomers and FRP
- different types of moulding techniques

MODULE I BASIC CONCEPTS OF POLYMERS **8**

Definitions: monomer, polymer, functionality, degree of polymerization – classification of polymers: source, structure, application, thermal processing behavior (thermoplastics and thermosets), composition and structure (addition and condensation), mechanism (chain growth and step-wise growth) – copolymer: types – Definition –nomenclature of polymers – tacticity – types of polymerization : free radical, cationic and anionic polymerization (concepts only) – average molecular weight of polymer: number, weight – molecular weight distribution (problems)

MODULE II THERMOPLASTICS AND BIODEGRADABLE POLYMERS **8**

Preparation, properties and applications : LDPE, HDPE, polypropylene, PVC, PTFE, PET, polyamides (Nylon-6 and Nylon 6,6) and polycarbonates – polymer blends and alloys – basics of biodegradable polymers.

MODULE III THERMOSET RESINS, ELASTOMERS AND FRP **7**

Thermoset resins : phenolic resins, amino resins (urea and melamine formaldehyde), epoxy resins, unsaturated polyesters – polyurethanes – elastomers : vulcanization of natural rubber, diene based elastomers –fibre reinforced plastics: glass, aramid and carbon.

MODULE IV MOULDING TECHNIQUES **7**

Moulding constituents**:** functions – moulding techniques**:** compression, injection, extrusion (single screw), blow moulding, thermoforming, (mechanical and vacuum forming), lamination.

PRACTICALS

1. Determination of molecular weight and degree of polymerization using Oswald’s

viscometer.

2. Free radical polymerization of styrene.
3. Free radical polymerization of PMMA.
4. Preparation of phenol-formaldehyde.
5. Preparation of urea-formaldehyde.
6. Synthesis of epoxy resin.
7. Synthesis of unsaturated polyester.
8. Preparation of FRP laminates.
9. Demonstration of injection moulding, compression moulding and blow moulding.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Billmeyer F.N., Text Book of Polymer Science, 3rd Edition, John Wiley and Sons, New York, 1994.
2. George Odian, Principles of Polymerisation, 3rd Edition, McGraw Hill Book Company, New York, 1991.
3. Michael L. Berins, Plastics Engineering Hand Book, 5th Edition, Chapman and Hall, New York, 1991.
4. Jacqueline I., Kroschwitz, Concise Encyclopedia of Polymer Science and Engineering, John Wiley and Sons, New York, 1998.
5. Encyclopedia of Polymer Science and Technology, Vol. 1 to XIV, H.F. Mark and N. Gaylord, Interscience, 2nd Ed. 1988.
6. Gowarikar V.R., Viswanathan N.V and Jayadev Sreedhar, Polymer Science, Wiley Eastern Limited, Madras, 1981.

OUTCOMES:

The student will be able to

- classify various polymers, name the polymers and types of polymerization reactions, calculate molecular weight of polymers,
- summarise preparation, properties and applications of thermoplastics and give examples of biodegradable polymers
- elaborate the properties and applications of thermosets, elastomers and FRP
- select the appropriate moulding technique for a given polymer, based on the application

Maths Elective Courses

(to be offered in IV

Semester)

MACX 01	**DISCRETE MATHEMATICS AND GRAPH THEORY**	**L** **3**	**T** **1**	**P** **0**	**C** **4**

OBJECTIVES:

The aims of this course are to

- introduce Logical and Mathematical ability to deal with abstraction.
- familiarize the basic mathematical ideas and terminologies used in computer science.
- translate real life situations into diagrammatic representations.

MODULE I PROPOSITIONAL CALCULUS 8

Propositions – Logical connectives – Compound propositions – Conditional and biconditional propositions – Truth tables – Tautologies and contradictions – Contrapositive – Logical equivalences and implications – DeMorgan's Laws – Normal forms – Principal conjunctive and disjunctive normal forms – Rules of inference – Arguments – Validity of arguments.

MODULE II PREDICATE CALCULUS 7+3

Predicates – Statement function – Variables – Free and bound variables – Quantifiers – Universe of discourse – Logical equivalences and implications for quantified statements – Theory of inference – The rules of universal specification and generalization – Validity of arguments.

MODULE III FUNCTIONS 7+3

Functions – Classification of functions –– Composition of functions – Inverse functions – Binary and n–ary operations – Characteristic function of a set – Hashing functions – Recursive functions – Permutation functions.

MODULE IV ALGEBRAIC SYSTEMS 8+2

Groups, Cyclic Groups, Subgroups, Cosets, Lagrange's theorem, Normal subgroups – Codes and group codes – Basic notions of error correlation – Error recovery in group codes.

MODULE V GRAPH THEORY 7+3

Graphs – incidence and degree – subgraphs – isomorphism – complement of a graph – operations on graphs

MODULE VI PATH AND CIRCUIT 8+2

Walks, trails and paths – Eulerian graphs – Konigsburg bridge problem - Hamiltonian graphs

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1 Trembly J.P and Manohar R, “Discrete Mathematical Structures with Applications to Computer Science”, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, 30th Reprint 2011.

2 Kenneth H.Rosen, “Discrete Mathematics and its Applications:, 7th Edition, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, Special Indian Edition, 2011.

REFERENCES:

1 Ralph.P.Grimaldi, “Discrete and Combinatorial Mathematics: An Introduction”, 4th Edition, Pearson Education Asia, Delhi, 2007.

2 Thomas Koshy, “Discrete Mathematics with Applications”, Elsevier Publications, 2006.

3 C.L.Liu, D.P.Mohapatra, “Elements of Discrete Mathematics”, 4th Edition, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, 2012.

OUTCOMES:

At the end of the course, student will be able to

- use the concepts of propositional calculus.
- use the concepts of predicate calculus.
- identify types of functions and their importance.
- decode and encode the messages using group theory concepts.
- apply the basic concepts of graph theory.
- represent some real life situations into diagrammatic representation.

MACX 02	PROBABLITY AND STATISTICS	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aims of this course are to impart the

- knowledge of the theory of probability and random variables
- techniques to carry out probability calculations and identifying probability distributions
- application of statistical inference in practical data analysis

MODULE I BASICS OF PROBABILITY AND STATISTICS 8+2

Sample space, events- axioms of probability and interpretation – Addition, multiplication rules – conditional probability, Independent events - Total probability – Baye's theorem - Descriptive Statistics.

MODULE II ONE DIMENSIONAL RANDOM VARIABLE AND PROBABILITY DISTRIBUTION FUNCTIONS 7+3

Discrete random variable –continuous random variable – Expectation - probability distribution - Moment generating function – Binomial, Poisson, Geometric, Uniform (continuous), Exponential and Normal distributions.

MODULE III TWO DIMENSIONAL RANDOM VARIABLES 8+2

Joint, marginal, conditional probability distributions –covariance, correlation - transformation of random variables.

MODULE IV SAMPLING AND ESTIMATION 7+3

Sampling distributions – basic knowledge on Random , simple random , stratified and cluster samplings – Test of Hypotheses - concepts- Point estimation and Interval estimation.

MODULE V THEORY OF INFERENCE 8+2

Large sample tests – test for single and difference on proportions, single mean, difference of means, difference of variances – confidence intervals. Small sample tests – Student's t test, F test and Chi square test on theory of goodness of fit and analyses of independence of attributes.

MODULE VI DESIGN OF EXPERIMENTS 7+3

Analysis of variance – one way classification – two way classification – Completely

Randomised Block Designs – Randomised Block Design – Latin square designs - Interpretations - case studies.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. T.Veerarajan, “Probability and Statistics”, Tata McGraw-Hill Education, 2008.
2. Miller, I., Miller, M.,Freund, J. E., “Mathematical statistics”, 7th Edition, Prentice Hall International, 1999.
3. S.P.Gupta, “Applied Statistics”, Sultan Chand & Sons

REFERENCES:

1. S.M.Ross, “Introduction to Probability and Statistics for Engineers and Scientists” Fifth Edition, Elesvier.
2. S.C.Gupta and V.K.Kapoor, “Fundamentals of Mathematical Statistics” First edition, Sultan Chand and Sons.
3. Arora and Arora, “Comphrensive Statistical Methods”, S. Chand, 2007

OUTCOMES:

On completion of the course, students will be able to

- do basic problems on probability and descriptive statistics.
- derive the probability mass / density function of a random variable.
- calculate probabilities and derive the marginal and conditional distributions of bivariate random variables.
- calculate point and interval estimates.
- apply some large sample tests and small sample tests.
- carry out the data collection representation analysis and implications and the importance of inferences.

MACX 03	RANDOM PROCESSES	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aims of the course are to

- acquire the knowledge of the theory of probability and random variables
- study discrete and continuous probability distributions.
- demonstrate the techniques of two dimensional random variables and its distributions.
- introduce the random process, stationarity, Markov process and the study of correlation function and spectral analysis.

MODULE I Basics of Probability 7+3

Sample space, events- axioms of probability and interpretation – Addition, multiplication rules – conditional probability, Independent events - Total probability – Baye's theorem - Tchebychev's inequality.

MODULE II One dimensional Random variable and Probability Distribution functions 7+3

Discrete random variable –continuous random variable – Expectation - probability distribution - Moment generating function – Binomial, Poisson, Geometric, Uniform (continuous), Exponential and Normal distributions.

MODULE III Two dimensional random variables 7+3

Joint, marginal, conditional probability distributions - covariance, correlation and regression lines - transformation of random variables.

MODULE IV RANDOM PROCESSES 8+2

Classification of Random process - Stationary process - WSS and SSS processes - Poisson process – Markov Chain and transition probabilities.

MODULE V CORRELATION FUNCTIONS 8+2

Autocorrelation function and its properties - Cross Correlation function and its properties - Linear system with random inputs – Ergodicity.

MODULE VI SPECTRAL DENSITY 8+2

Power spectral Density Function - Properties - System in the form of convolution - Unit Impulse Response of the System – Weiner-Khinchine Theorem - Cross Power

Density Spectrum.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Veerarajan T., “Probability, Statistics and Random Processes”, Tata McGraw Hill,3rd edition, 2008.
2. Papoulis, “Probability, Random Variables and Stochastic Processes”, 4th Edition, Tata McGraw Hill Company, 2002.
3. S.M.Ross, “Introduction to Probability and Statistics for Engineers and Scientists” Fifth Edition, Elesvier

REFERENCES:

1. Scott L. Miller,Donald G. Childers, Probability and Random Processes, Academic Press,2009.
2. Trivedi K S, “ Probability and Statistics with reliability, Queueing and Computer Science Applications”,Prentice Hall of India,New Delhi,2nd revised edition, 2002

OUTCOMES:

On completion of the course, students will be able to

- do basic problems on probability.
- derive the probability mass / density function of a random variable.
- calculate probabilities and derive the marginal and conditional distributions of bivariate random variables.
- identify and study the different random processes.
- compute correlation functions and related identities.
- compute power spectral density functions and apply Weiner-Khinchine formula.

MACX 04	APPLIED NUMERICAL METHODS	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aims of the course are to

- introduce basic computational methods for analyzing problems that arise in engineering and physical sciences.
- acquire knowledge about approximation theory and convergence analysis associated with numerical computation.

MODULE I NUMERICAL SOLUTIONS OF EQUATIONS 7+3

Bisection method - Regula Falsi method – Secant method - Fixed point iteration method - Newton's Raphson method –Gauss Elimination method - Gauss-Jordon method – Gauss Jacobi method - Gauss-Seidel method.

MODULE II INTERPOLATION 8+2

Finite difference operators – Gregory Newton's forward and backward interpolations – Cubic spline interpolation - Lagrange interpolation - Newton's divided difference formula.

MODULE III NUMERICAL DIFFERENTIATION AND INTEGRATION 8+2

Numerical differentiation using Newton's forward and backward formulae – Numerical integration : Trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Gaussian Two Point and Three Point Quadrature formulae – Double integrals using Trapezoidal and Simpson's 1/3 rule.

MODULE IV INITIAL VALUE PROBLEMS FOR FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS 7+3

Numerical solutions by Taylor's Series method, Euler's method, Modified Euler's Method - Runge – Kutta Method of fourth order – Milne's and Adam's Bashforth Predictor and Corrector methods

MODULE V INITIAL AND BOUNDARY VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 8+2

Numerical solutions by Taylor's Series method - Runge – Kutta Method of fourth order of second order ODE. Finite difference methods.

MODULE VI BOUNDARY VALUE PROBLEMS FOR PARTIAL 7+3

DIFFERENTIAL EQUATIONS

Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace equation.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Grewal, B.S., “Numerical methods in Engineering and Science”, 7th edition, Khanna
   Publishers, 2007.
2. C.F.Gerald, P.O.Wheatley, “Applied Numerical Analysis” ,Pearson Education, New Delhi, 2002.

REFERENCES:

1. Chapra S.C, Canale R.P. “Numerical Methods for Engineers”, 5th Ed., McGraw Hill, 2006.
2. M.K.Jain, S.R.K.Iyengar, R.K.Jain, “Numerical methods for Scientific and Engineering Computation”, New Age International Publishers, New Delhi, 2003

OUTCOMES:

At the end of this course, students will be able to

- solve algebraic, transcendental and system of equations.
- apply interpolation techniques.
- carry out numerical differentiation and integration using different methods.
- solve first order ODE using single and multi step methods.
- solve second order ODE, initial and boundary value problems.
- solve the boundary value problems in PDE.

Maths Elective Courses
(To be offered in VI Semester)

MACX 05	MATHEMATICAL PROGRAMMING	L	T	P	C
		2	0	0	2

OBJECTIVES:

The aims of the course are to

- acquire knowledge and training in optimization techniques.
- obtain knowledge about optimization in utilization of resources.
- understand and apply operations research techniques to industrial operations.

MODULE I LINEAR PROGRAMMING PROBLEM 10

Linear programming – formulation of the problem - graphical interpretation of optimality - Simplex method – to obtain basic feasible solution – types of linear programming solution – complications and their resolution.

MODULE II ADVANCED LINEAR PROGRAMMING PROBLEMS 8

Artificial variable - Big M method – Two phase method – alternative optimal solution – unbounded solution - Duality – primal dual relationships.

MODULE III TRANSPORTATION PROBLEM 7

Transportation problems – Initial basic feasible solutions, MODI method, Unbalanced transportation problem, Degeneracy in transportation models,.

MODULE IV ASSIGNMENT PROBLEM 5

Assignment problem – Minimization and Maximization type of problems by Hungarian method.

Total Hours –30

TEXT BOOKS:

1. Hamdy A Taha, “Operations Research - An introduction”, 8th edition, Phil Pearson, 2007.
2. Winston.W.L., “Operations Research”, 4th edition, Thompson-Brooks/Cole, 2003.

REFERENCES:

1. Wayne.L. Winston, “Operations Research Applications and Algorithms”,

4th edition, Thomson learning, 2007.

2. Frederick. S. Hiller and Gerald J Lieberman, “Operations Research Concepts and Cases”, 8th edition (SIE), Tata McGraw – Hill Pub. Co. Ltd., New Delhi, 2006.
3. A. Ravindran, D. T. Phillips and J. J. Solberg, "Operations Research: Principles and Practice", 2nd edition, John Wiley & Sons, New York, 1992.
4. Robertazzi. T.G., “Computer networks and systems-Queuing theory and performance evaluation”, 3rd edition, Springer, 2002.

OUTCOMES:

At the end of the course, students will be able to

- formulate industrial problems as mathematical programming problems.
- solve linear programming problems by different methods.
- solve transportation problems by different methods.
- solve assignment problems by Hungarian method.

MACX 06	STATISTICAL METHODS FOR DATA ANALYSIS	L	T	P	C
		2	0	0	2

OBJECTIVES:

The aim of the course is to

- introduce statistical quality control tools.

MODULE I TESTS OF HYPOTHESES AND STATISTICAL INFERENCES 8

Small sample tests – Student's ' t ' test for single mean , difference of means, paired t test – F test for difference of variances – Chi square test on theory of goodness of fit and analyses of independence of attributes.

MODULE II DESIGN OF EXPERIMENTS 7

Analysis of variance – one way classification – two way classification – Completely Randomised Block Designs – Randomised Block Design – Latin square designs - Statistical analysis -Interpretations - case studies.

MODULE III STATISTICAL QUALITY CONTROL-I 8

Quality improvement and statistics –Statistical quality control- statistical process control – control charts – design of control charts –analysis of patterns on control charts - X bar chart, R chart and S chart.

MODULE IV STATISTICAL QUALITY CONTROL-II 7

Process and product control – attribute charts – P, np and C charts – control charts performance.

Total Hours –30

TEXT BOOKS:

1. Douglas C.Montgomery, George C. Runger "Applied Statistics and probability for Engineers" V Edition – John Wiley & Sons Inc.
2. Miller, I., Miller, M., Freund, J. E. "Mathematical statistics" 7th Edition. Prentice Hall International, 1999.

REFERENCES:

1. Dekking, F.M., Kraaikamp, C., Lopuhaä, H.P., Meester, L.E. "A Modern Introduction to Probability and Statistics" Springer, 2nd Edition.
2. Chin Long chiang "Statistical Methods of Analysis "World Scientific Books,

2003.
3. S.C.Gupta and V.K. Kapoor, “Mathematical Statistics” , Sultan Chand publications.
4. Veerarajan “Fundamentals of Mathematical Statistics” I Edition, Yes Dee Publishing Pvt. Ltd., 2017.

OUTCOMES:

On completion of the course, students will be able to

- develop and test hypothesis for different statistical tests
- design an experiment and case study the experiment with different data.
- analyze the industrial data using quality control design tools statistically.
- analyze the industrial data using process and product control tools statistically.

MACX 07	NUMERICAL METHODS FOR INTEGRATION AND DIFFERENTIAL EQUATIONS	L	T	P	C
		2	0	0	2

OBJECTIVES:

- This course aims to solve numerically integral and differential equations.

MODULE I NUMERICAL INTEGRATION 8

Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Two Point and Three point Gaussian quadrature formulae.

MODULE II NUMERICAL DOUBLE INTEGRATION 6

Double integrals using trapezoidal and Simpson's 1/3 rules

MODULE III NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS 8

Milne's Predictor and Corrector Method – Adam's Predictor-Corrector Method - Finite difference methods for two – point Boundary Value problems for Ordinary Differential Equations.

MODULE IV BOUNDARY VALUE PROBLEMS FOR PARTIAL DIFFERENTIAL EQUATIONS 8

Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace and Poisson equations

Total Hours –30

TEXT BOOKS:

1. M.K.Jain, S.R.K.Iyengar, R.K.Jain, "Numerical methods for Scientific and Engineering Computation", New Age International Publishers, New Delhi, 2003.
2. Grewal, B.S., "Numerical methods in Engineering and Science" 7th edition, Khanna Publishers, 2007

REFERENCES:

1. C.F.Gerald, P.O.Wheatley, "Applied Numerical Analysis" Pearson Education, New Delhi 2002.
2. P.Dechaumphai, N. Wansophark, "Numerical Methods in Engineering", Narosa Publications, 2012.

OUTCOMES:

At the end of the course students will be able to

- solve the integration by numerical methods.
- solve the double integration by numerical methods
- find numerical solution of ordinary differential equations in engineering problems.
- find numerical solution of partial differential equations in engineering problems.

MACX 08 MATHEMATICAL MODELLING

L	T	P	C
3	0	0	3

OBJECTIVES:

The aims of the course are to

- provide basic idea of formation and use of Mathematical models for different purposes.
- determine the extent to which models are able to replicate real-world phenomena under different conditions

MODULE I PRINCIPLES OF MATHEMATICAL MODELING 7

Mathematics as a modelling language - Classification of models - Building, studying, testing and using models - Black and white box models – Difference equations

MODULE II PHENOMENOLOGICAL MODELS 7

Linear, Multiple linear and nonlinear regression - Neural networks - Fuzzy model - Stability and higher dimensional systems

MODULE III MECHANISTIC MODELS –I 8

Setting up ODE models – Initial and Boundary value problems - Numerical solutions - Fitting ODE to data - Applications

L	T	P	C
2	0	0	2

MODULE IV MECHANISTIC MODELS –II 8

Linear and nonlinear equations - Elliptic, parabolic and hyperbolic equations - Closed form solutions - Finite difference and finite element methods

Total Hours –30

TEXT BOOKS:

1. G . Ledder , “Calculus, modelling , probability and dynamic systems”, Springer 2013
2. Kei Velten, “Mathematical modelling and simulation”, J. Wiley and sons,2009

REFERENCES:

1. Michael D Alder, “An introduction to Mathematical modelling”, Heaven for Books.com
2. Alfio Quarteroni, “Mathematical models in science and engineering”, Notices of AMS
3. J.N. Kapur, “Mathematical models in Biology and Medicine”, Affiliated East-

West Press Private Limited, New Delhi, 1992.

OUTCOMES:

On completion of the course, the students will be able to

- identify the relationship between real world and mathematical models
- Classify the data and choose the appropriate model
- Distinguish between linear and nonlinear models
- identify the relationship between empirical and mechanistic models

MACX 09 **GRAPH THEORY** **L T P C**
3 0 0 3

OBJECTIVES:

The aims of this course are to

- represent the real life situations diagrammatically.
- appraise different methods to find solutions to graph theory problems.

MODULE I INTRODUCTION TO GRAPH THEORY 8

Graphs - finite and infinite graphs - Incident and degree-isolated vertex, pendent vertex and null vertex.

MODULE II PATH AND CIRCUIT 8

Isomorphism – sub graphs-walks, paths and circuits – connected and disconnected graphs- Euler graphs – operation on a graph.

MODULE III TREES AND FUNDAMENTAL CIRCUITS 7

Trees- some properties of trees- pendent vertices in a tree – rooted binary tree-spanning trees-fundamental circuits.

MODULE IV CUT SETS AND CUT VERTICES

Cut sets – some properties of cut sets- fundamental circuits and cut sets-network flows.

Total Hours –30

TEXT BOOKS:

1. NARSINGH DEO, Graph theory with applications to Engineering and Computer Science, Prentice Hall INC, New Delhi,
2. J.A. Pondy and U.S.R. Murthy, North Holland, Oxford, New York Graph theory with applications

REFERENCES:

1. Trembly J.P and Manohar R, “Discrete Mathematical Structures with Applications to Computer Science”, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, 30th Reprint 2011
2. Kenneth H.Rosen, “Discrete Mathematics and its Applications”, 7th Edition, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, Special Indian Edition, 2011

3. Md. Saidur Rahman, “Basic graph theory”, Springer, 2017

OUTCOMES:

At the end of the course, students will be able to

- demonstrate the basic concepts of Graph theory.
- explore connected and disconnected graphs.
- identify the real life problems with trees and circuits.
- bring out the cut set properties and network flows properties.

Humanities Elective I

(To be offered in III Semester)

		L	T	P	C
SSCXO1	**FUNDAMENTALS OF ECONOMICS**	**2**	**0**	**0**	**2**

OBJECTIVES:

- To identify and present the basic concepts of demand, supply and equilibrium.
- To explain and discuss the types and concepts of national income and inflation.
- To illustrate the fundamental concepts of money, banking and public finance.
- To apprise the students about Indian economy and the role of engineers in economic development.

MODULE I DEMAND AND SUPPLY ANALYSIS 8

Classification of economy – open and closed economy, Demand - Types of demand - Determinants of demand – Law of Demand - Demand elasticity - Supply - Determinants of Supply – Law of Supply - Supply elasticity - Pricing strategies.

MODULE II NATIONAL INCOME AND INFLATION 7

Concepts of National income and measurement – Importance and difficulties of estimating National Income in India - Aggregate demand and aggregate supply, Macroeconomic equilibrium – meaning of inflation- types - causes and preventive measures

MODULE III MONEY, BANKING AND PUBLIC FINANCE 9

Money – Meaning, types, functions, importance - Commercial Banks - Central Bank - Monetary policy – meaning, objectives, Methods of Credit Control By RBI, Government Budget – Government revenue and Expenditures – Fiscal policy - Its objectives, instruments and limitations - Deficit Financing - The Fiscal Responsibility and Budget Management Act, 2003 (FRBMA) .

MODULE IV INDIAN ECONOMY AND THE ROLE OF ENGINEERS 6

Economic reforms – Liberalization, Privatization and Globalization - challenges and opportunities, Engineers – Engineers' contributions to the economic growth.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Dutt and Sundharam (2013), *Indian Economy*, S. Chand & Company Pvt. Ltd, New Delhi.
2. Hussain, Moon Moon (2015), *Economics for Engineers*, Himalaya Publishing House, New Delhi.

REFERENCES:

1. Cleaver Tony (2004), "*Economics: The Basics*", Routledge, London.
2. Mell Andrew and Walker Oliver (2014), "*The Rough Guide to Economics*", Rough Guide Ltd.

OUTCOMES:

On successful completion of this course,

- Students will have had exposure to the basic concepts of demand, supply and various pricing strategies.
- Students will have understood the macroeconomic concepts of national income and inflation.
- Students will be able to apply the knowledge of money, banking and public finance in their real life situations.
- Students will have an overview of the economic reforms introduced in Indian economy.

SSCXO2	PRINCIPLES OF SOCIOLOGY.	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To acquaint the students with Concepts and perspectives of Sociology
- To explain the reflection of society in Individuals and vice versa
- To describe the hierarchical arrangement of individuals and groups in society
- To explicate the dimensions, forms and factors of Social change.
- To examine the context, impact and agencies of Globalization

MODULE I THE FOUNDATIONAL CANON 8

Sociology-Definition, scope and importance; Major theoretical perspectives- Functionalism, Conflict Theorising and Interactionism; Elements of social formation- Society, Community, Groups and Association; Associative Social Process- Co-operation, Accommodation and Assimilation; Dissociative Social Process- Competition and Conflict.

MODULE II INDIVIDUAL AND SOCIETY 7

Culture-definition, characteristics, functions, types, cultural lag and civilization, Socialization – definition, process, stages, agencies and anticipatory socialization; Social Control- definition, characteristics, importance, types & agencies.

MODULE III SOCIAL INEQUALITY AND STRATIFICATION 7

Concepts- inequality, hierarchy, differentiation, Social Exclusion, and Social Stratification. Forms of Social Stratification- Caste, Class and Estate. Gender and Social Stratification- sex and gender, patriarchy, factors perpetuating gender stratification; Globalization and gender inequality

MODULE IV SOCIAL CHANGE AND GLOBALIZATION 8

Social Change-definition, nature, direction; Forms- evolution, development, progress and transformation; Factors of social change- demography, economy, technology, polity and culture. Globalization- definition, characteristics, historical and social context and Impact, agencies of globalization- IGOs, INGOs, Nation-State, MNEs and Media

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Giddens A. 1989. “Sociology” Cambridge: Polity Press.
2. Heald Haralambos, R.M(2014) . ‘‘Sociology Themes and Perspectives”, Oxford, New Delhi-92
3. Bhushan Vidya and D.R. Sachdeva (2012). ‘‘Fundamental of Sociology”, Pearson, Delhi.

REFERENCES:

1. Das Gupta, Samir and Paulomi Saha (2012), ‘‘An Introduction to Sociology”, Pearson, Delhi
2. Bottomore, T.B. 1972. *Sociology- A Guide to Literature and Problems*, New Delhi,

OUTCOMES:

On successful completion of this course,

- Students will have exposure to the fundamentals tenets of Sociology.
- Students will be trained to understand social reality with sociological perspective.
- Students will be oriented to constructively analyze human interactions, social relationship and social issues
- Students will gain exposure to the dynamics of human society with special reference to the contemporary trends of globalization.

SSCXO3	SOCIOLOGY OF INDIAN SOCIETY.	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To present a portrayal of the components of the Indian Social structure
- To describe the nature and contemporary structure of Indian social Institutions.
- To examine the causality and magnitude of social problem facing the contemporary India.
- To elucidate the processes forms and impact of change and development in Indian society

MODULE I INDIAN SOCIAL STRUCTURE 7

Unity and Diversity; Concepts of unity and diversity- racial, religious, ethnic and linguistic composition of India. Types of communities-rural, urban and tribal; Social backwardness- OBC, SC and ST; Indian minorities- religious, ethnic, linguistic and LGBT

MODULE II INDIAN SOCIAL INSTITUTIONS 7

Family- definition, types, characteristics, functions of family; Joint Family- definition features, utility, changes; Marriage- definition, characteristics, marriage as sacrament or contract. Caste- definition, principles, contemporary changes, dominant caste, caste -class interface.

MODULE III SOCIAL PROBLEMS IN INDIA 8

Social Problem-definition, nature, social disorganization; Population explosion-causes, effects, relationship with development; Child Labour- causes, magnitude and consequences; Unemployment-nature , types, causes and effects; Gender issues-social status of women, violence against women and women in work place; Contemporary issues- communalism, terrorism and corruption.

MODULE IV SOCIAL CHANGE AND DEVELOPMENT IN INDIA 8

Socio-cultural Change- Sanskritization, Westernization, Secularization, Modernization; Processes of Social change- Industrialization, Urbanization, Globalization; Development- definition, elements, role of government, industry and corporate sector. Technology and change- invention and innovation, impact of technology on social institutions, technology and development.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Sharma,K.L.2008. *Indian Social Structure and Change*. Jaipur: Rawat Publications,.
2. Shah, A.M. 1998. *The Family in India: Critical Essays*. New Delhi: Orient Longman,
3. Ahuja Ram. 1999. *Social problems in India*, Rawat Publication: New Delhi.
4. Ahuja Ram. 2014. *Society in India,*, Rawat Publication: New Delhi.

REFERENCES:

1. Jayapalan, N.(2001), **"**Indian Society and Social Institutions" Atlantic Publishers & Distri,
2. Atal, yogesh (2006), "Changing Indian Society" Rawat Publications, Jaipur

OUTCOMES:

On successful completion of this course,

- Students will gain an in-depth understanding of the social structure and social institutions that constitute society in India.
- Students will be sensitized to the various categories ,Inequalities and their challenges
- Students will be exposed to the social problems encountered in contemporary India.
- Students will gain knowledge about the various forms and trends of the social change.
- Students will become aware about the challenges in the path of progress of Indian society and realize relevance of their role in bringing about development

Humanities Elective II

(To be offered in IV Semester)

SSCXO4	**ECONOMICS OF SUSTAINABLE DEVELOPMENT**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**2**

OBJECTIVES:

- To have an increased awareness on the concept and components of sustainable development.
- To develop the ability to demonstrate the need of sustainable development and international responses to environmental challenges.
- To have an insight into global environmental issues and sustainable globalization.
- To establish a clear understanding of the policy instruments of sustainable development.

MODULE I CONCEPT OF SUSTAINABLE DEVELOPMENT 7

Evolution of the Concept – Rio Summit and sustainable development - various definitions of sustainable development - Components of sustainable development: Social, environmental and economic components.

MODULE II NEED FOR SUSTAINABLE DEVELOPMENT 8

Need for sustainability – Global environmental challenges: population growth, resource depletion, pollution, energy use, climate change, pollution, growing water scarcity, other urban problems, loss of biodiversity, hazardous wastes disposal.International responses to environmental challenges - Global policy such as Kyoto Protocol, Montreal Protocol, Basel Convention.

MODULE III GLOBALIZATION AND ENVIRONMENT SUSTAINABILITY 8

Impact of Globalization on sustainable development, Co - existence of globalization and Environment sustainability, Globalization and Global Governance.Green economy - Renewable energy, sustainable transport, sustainable construction, land and water management, waste management.

MODULE IV POLICIES FOR ACHIEVING SUSTAINABLE DEVELOPMENT 7

Principles of environmental policy for achieving sustainable development:

precautionary principle and polluter pays principle – Business Charter for Sustainable Development.Policy instruments for sustainable development: direct regulation – market based pollution control instruments such as pollution tax, subsidy, pollution permits.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Anderson, David A (2010), "*Environmental Economics and Natural Resource Management*", Routledge, 3rd edition.
2. Karpagam M (1999), "*Environmental Economics: A Textbook*", Sterling Publishers Pvt. Ltd, New Delhi.

REFERENCES:

1. Karpagam M and Jaikumar Geetha (2010), "*Green Management Theory and Applications*", Ane Books Pvt. Ltd, New Delhi.
2. Sengupta Ramprasad (2004), "*Ecology and Economics: An Approach to Sustainable Development*", Oxford University Press, New Delhi.

OUTCOMES:

On successful completion of this course,

- The students will have understood the concepts and components of sustainable development.
- The students will have a holistic overview on the challenges of sustainable development and International responses to environmental challenges.
- The students will have gained knowledge on the global environment issues and demonstrate responsible globalization through global governance.
- The students will have developed awareness of the ethical, economic, social and political dimensions that influence sustainable development.

SSCXO5 INDUSTRIAL SOCIOLOGY

L	T	P	C
2	0	0	2

OBJECTIVES:

- To introduce sociological approaches and perspectives to understand the social relationship in manufacturing industries and corporate sector.
- To explain the structure and functions of industrial organizations.
- To elucidate the dynamics of organizational behavior, leadership and communication.
- To inculcate professional ethics and values to equip students to work in organizational settings.

MODULE I INTRODUCTION 8

Industrial Sociology- definition, scope and importance; Theoretical approaches- scientific management, human relations approach, theory of bureaucracy, Fordism and post-fordism; Production system- concept and characteristics of factory system, automation and rationalization; Industrial conflict- strike , lockout and trade unions.

MODULE II INDUSTRIAL ORGANIZATION 7

Formal organization- definition, features, utility; Informal organization- definition, characteristics, types and relevance; Structure of industrial organization- features and functions of line organization, characteristics and roles of staff organization, distinction;

Industrial hierarchy-white collar, blue collar, supervisors and managers.

MODULE III DYNAMICS OF INDUSTRIAL RELATIONS 8

Group dynamics- Definition, Group behaviour model, Group decision making process, group cohesiveness; Leadership- definitions, style and effective supervision; Communication- concepts, types, model barriers; Job satisfaction- nature, employee compensation and job satisfaction.

MODULE IV PROFESSIONAL ETHICS AND VALUES 7

Concepts- values- morals, and ethics, Integrity, work ethics , service learning - Civic Virtue - caring - Sharing - Honesty - Courage - Valuing Time - Co-operation - commitment - empathy - Self-Confidence - Environmental Ethics, Cyber issues - computer ethics, cyber crimes, plagiarism Ethical living-concept of harmony in life.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Narender Singh, Industrial Sociology, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2012.
2. Gisbert Pascal, Fundamentals of Industrial Sociology, Tata Mc. Graw Hill Publishing Co., New Delhi, 1972
3. Schneider Engeno. V, Industrial Sociology 2nd Edition, Mc. Graw Hill Publishing Co., New Delhi, 1979.

REFERENCES:

1. Robbins, Stephen, Organizational Behaviour , Prentice Hall of India PVT ltd new Delhi, 1985
2. Devis Keith , Human Behaviour at work place, Mc. Graw Hill Publishing Co., New Delhi,1984

OUTCOMES:

On successful completion of this course,

- Students will have acclimatized with sociological perspectives for dealing with social relationships in production and service organizations.
- Students will be familiar with structure of authority, roles and responsibility in organizational settings.
- Students will imbibe leadership, communication and behavioral acumen to govern organization
- Students will be sensitized to standards of desirable behavior to engage in industrial and corporate sector.

SSCXO6 LAW FOR ENGINEERS

L	T	P	C
2	0	0	2

OBJECTIVES:

- To understand the Constitution and Governance of our country.
- To apprise the students of human rights - local and international and redressal mechanism.
- To have an insight into the industrial, corporate and labour laws of our country.
- To establish a clear understanding about the importance of intellectual property related laws.

MODULE I INDIAN CONSTITUTION AND GOVERNANCE 8

Constitution – salient features, Preamble, Citizenship, Fundamental rights, Fundamental duties, Directive principles, Union executive, Legislature – Union – State and union territories – Election Commission – Election for parliament and state legislature, Judiciary- basic functioning of the Supreme Court and High Courts, Right to information Act 2005 – evolution – concept – practice.

MODULE II HUMAN RIGHTS 7

Human rights – meaning and significance, Covenant on civil and political rights, Covenant on Economic, Social and Cultural rights, UN mechanism and agencies, The Protection of Human Rights Act, 1993 – watch on human rights and enforcement.

MODULE III INDUSTRIAL, CORPORATE AND LABOUR LAWS 8

Corporate laws – meaning and scope, Companies Act 1956 – Indian Contract Act 1872 - Principles of Arbitration - Industrial Employment (Standing Orders) Act 1946 - Industrial Disputes Act 1947 - Workmen's Compensation Act 1923 - The Factories Act, 1948.

MODULE IV LAWS RELATED TO IPR 7

IPR – meaning and scope, International organization – WIPO – TRIPS, Major Indian IPR Acts – Copyright laws, Patent and Design Act, Trademarks Act, Trade Secret Act, Geographical Indicator.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. M.P. Jain (2005) *Indian Constitutional Law*, Wadhwa & Co.

2. H. D, Agarwal (2008), *International Law and Human Rights,* Central Law Publications,
3. Rao, Meena (2006), *Fundamental Concepts in Law of Contract*, 3rd edn., Professional offset.
4. Ramappa (2010), *Intellectual Property Rights Law in India*, Asia Law House.
5. Singh, Avtar (2007), *Company Law*, Eastern Book Co.
6. R.F, Rustamji (1967)*, Introduction to the Law of Industrial Disputes*, Asia Publishing House.

REFERENCES:

1. Acts: Right to Information Act, Industrial Employees (standing order) Act, Factories Act, Workmen Compensate Act.

OUTCOMES:

On successful completion of this course,

- Students will `be able to apply the basic concepts of Indian Constitution, Governance and power in their real life situation.
- Students will have gained knowledge in human rights, cultural, social and political rights.
- Students will have synthesized knowledge about industrial, corporate and labour laws of our country.
- Students will have an overview of IPRs and laws related to Intellectual Property Rights.

General Elective Courses
Group I courses
(To be offered in V Semester)

		L	T	P	C
GECX101	**DISASTER MANAGEMENT**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To give an exposure to various environmental hazards and disasters: and various concepts and principles to manage disaster.
- To give exposure to various environmental policies & programs in India for disaster management

MODULE I ENVIRONMENTAL HAZARDS 7

Environmental hazards, Environmental Disasters and Environmental stress-Meaning and concepts. Vulnerability and disaster preparedness.

MODULE II NATURAL DISASTERS 7

Natural hazards and Disasters - Volcanic Eruption, Earthquakes, Tsunamis, Landslides, Cyclones, Lightning, Hailstorms, Floods, Droughts, Cold waves, Heat waves and Fire.

MODULE III MAN-MADE DISASTERS 7

Man induced hazards & Disasters - Soil Erosion, Chemical hazards, Population Explosion

MODULE IV DISASTER MANAGEMENT 8

Emerging approaches in Disaster Management- Preparing hazard zonation maps, Predictability / forecasting & warning, Preparing disaster preparedness plan, Land use zoning, Communication. Disaster resistant house construction, Population reduction in vulnerable areas, Awareness - Rescue training for search & operation at national & regional level - Immediate relief, Assessment surveys, Political, Administrative, Social, Economic, Environmental Aspects.

MODULE V NATURAL DISASTER REDUCTION & MANAGEMENT 8

Provision of Immediate relief measures to disaster affected people, Prediction of Hazards & Disasters, Measures of adjustment to natural hazards

MODULE VI ENVIRONMENTAL POLICIES & PROGRAMMES IN INDIA **8**

Regional survey of Land Subsidence, Coastal Disaster, Cyclonic Disaster & Disaster in Hills with particular reference to India. Ecological planning for sustainability & sustainable development in India, Sustainable rural development: A Remedy to Disasters, Role of Panchayats in Disaster mitigations, Environmental policies & programmes in India- Institutions & National Centers for Natural Disaster reduction, Environmental Legislations in India, Awareness, Conservation Movement, Education & training.

L – 45; Total Hours –45

REFERENCES:

1. Satender, “Disaster Management in Hills”, Concept Publishing Co., New Delhi, 2003.
2. Singh, R.B. (Ed.), “Environmental Geography”, Heritage Publishers, New Delhi,1990.
3. Savinder Singh, “Environmental Geography”, Prayag Pustak Bhawan,1997.
4. Kates, B.I. and White, G.F., “The Environment as Hazards”, Oxford University Press, New York, 1978.
5. Gupta, H.K., (Ed), “Disaster Management”, University Press, India, 2003.
6. Singh, R.B.,“Space Technology for Disaster Mitigation in India (INCED)”, University of Tokyo, 1994.
7. Bhandani, R.K., “An overview on Natural & Manmade Disaster & their Reduction”, IIPA Publication, CSIR, New Delhi, 1994.
8. Gupta, M.C., “Manuals on Natural Disaster management in India”, National Centre for Disaster Management, IIPA Publication, New Delhi, 2001.

OUTCOMES:

At the end of the course, the students will

- achieve sufficient knowledge on the disaster prevention strategy, early warning system, disaster preparedness, response and human resource development.
- be familiar with the National Policy on Disaster Management.

GECX102	TOTAL QUALITY MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the various principles, practices of TQM to achieve quality.
- To get acquainted with the various statistical tools and approaches for quality control and continuous improvement.
- To get aware of the importance of ISO and Quality Systems.

MODULE I INTRODUCTION 8

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

MODULE II TQM PRINCIPLES 7

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits.

MODULE III TQM IMPROVEMENT PROCESS 8

Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

MODULE IV STATISTICAL PROCESS CONTROL (SPC) 8

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

MODULE V TQM TOOLS 7

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

MODULE VI QUALITY SYSTEMS 7

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System– Elements, Implementation of Quality System, Documentation, Quality Auditing, TS 16949, ISO 14000 – Concept, Requirements and Benefits

L – 45; Total Hours –45

TEXT BOOKS:

1. Dale H.Besterfiled, et al., “Total Quality Management”, Pearson Education, Inc. 2003.

REFERENCES:

1. James R.Evans & William M.Lidsay, “The Management and Control of Quality”, 5th Edition, South-Western (Thomson Learning), 2002.
2. Feigenbaum.A.V., “Total Quality Management”, McGraw-Hill, 1991.
3. Oakland.J.S., “Total Quality Management”, Butterworth Hcinemann Ltd., Oxford, 1989.
4. Narayana V. and Sreenivasan. N.S., “Quality Management – Concepts and Tasks”, New Age International, 1996.
5. Zeiri, “Total Quality Management for Engineers”, Wood Head Publishers, 1991.

OUTCOMES:

The student should be able to

- apply the various statistical tools and approaches for Quality control.
- achieve continuous process improvement through TQM.

GECX103	ENERGY STUDIES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the growing demand, supply of energy on global and national levels and the need for renewable energy promotion.
- To understand the basic need for energy conservation and waste heat recovery.
- To learn the important aspects of energy audit and management.
- To get acquainted with the global environmental issues and carbon credits.

MODULE I GLOBAL AND NATIONAL ENERGY SCENARIO 7

Role of energy in economic development, various energy resources - overall energy demand and availability- Energy consumption in various sectors and its changing pattern - Exponential increase in energy consumption and projected future demands. Need for renewable energy.

MODULE II SOLAR ENERGY 8

Solar Radiation – Measurements of Solar Radiation - Flat Plate and Concentrating Collectors – Solar direct Thermal Applications – Solar thermal Power Generation - Fundamentals of Solar Photo Voltaic Conversion – Solar Cells – Solar PV Power Generation – Solar PV Applications.

MODULE III OTHER RENEWABLE ENERGY SOURCES 8

Power from wind – wind turbine working and types, solar thermal power plants – low medium and high power generation, power from wave , tidal, geothermal sources, OTEC system. MHD power plants – working, types, merits and demerits. Energy from biomass.

MODULE IV COGENERATION, WASTE HEAT RECOVERY AND COMBINED CYCLE PLANTS 8

Cogeneration principles- topping and bottoming cycles, role in process industries. Energy from wastes- waste heat recovery- heat recovery from industrial processes. Heat exchange systems – recuperative and regenerative heat exchangers – commercially available waste heat recovery devices. Combined cycle plants – concept, need and

advantages, different combinations and practical scope.

MODULE V ENERGY CONSERVATION AND MANAGEMENT 7

Need for energy conservation – use of energy efficient equipment. Energy conservation opportunities - in educational institutions, residential, transport, municipal, industrial and commercial sectors – concept of green building. Energy audit in industries – need, principle and advantages. Case studies.

MODULE VI GLOBAL ENERGY ISSUES AND CARBON CREDITS 7

Energy crisis, fossil consumption and its impact on environmental climate change. Energy treaties – Montreal and Kyoto protocols - Transition from carbon rich and nuclear to carbon free technologies, carbon foot print – credits – clean development mechanism.

L – 45; Total Hours –45

TEXT BOOKS:

1. S.S. Rao and B.B. Parulekar, “Energy Technology”, 3rd Edition, Khanna Publishers, New Delhi, 2011.
2. O. Callaghn. P.W., “Design and Management for Energy Conservation”, Pergamon Press, Oxford, 1981.

REFERENCES:

1. G.D. Rai, “Non Conventional Energy Sources”, Khanna Publishers, New Delhi, 2011.
2. Archie, W Culp. “Principles of Energy Conservation”, McGraw Hill, 1991.
3. D Patrick and S W Fardo, “Energy Management and Conservation”, PHI,1990
4. P. O’Callaghan: “Energy Management”, McGraw - Hill Book Company, 1993.
5. Kenney, W. F., “Energy Conservation in Process Industries”, Academic Press, 1983.

OUTCOMES:

The student should be able to

- Realize the global and national energy status and need to switch over to renewable energy technology.
- Energy audit and suggest methodologies for energy savings.
- Utilize the available resources in an optimal way.
- Concern about the global environmental issues & promote carbon credits.

GECX104 **ROBOTICS** **L T P C**
3 0 0 3

OBJECTIVES:

To learn about the robots, various components, of Robots, programming and their applications.

MODULE I **8**

Definition- Need - Application, Types of robots – Classifications – Configuration, work volume, control loops, controls and intelligence- basic parts - functions – specifications. of robot, degrees of freedoms, end effectors – types, selection

MODULE II ROBOT DRIVES AND CONTROL **8**

Controlling the Robot motion – Position and velocity sensing devices – Design of drive systems – Hydraulic and Pneumatic drives – Linear and rotary actuators and control valves – Electro hydraulic servo valves, electric drives – Motors – Designing of end effectors – Vacuum, magnetic and air operated grippers.

MODULE III ROBOT SENSORS **8**

Transducers and Sensors – Tactile sensor – Proximity and range sensors – Sensing joint forces – Robotic vision system – Image Representation - Image Grabbing –Image processing and analysis – Edge Enhancement – Contrast Stretching – Band Rationing - Image segmentation – Pattern recognition – Training of vision system.

MODULE IV ROBOT PROGRAMMING & AI TECHNIQUES **7**

Types of Programming – Teach pendant programming – Basic concepts in AI techniques – Concept of knowledge representations – Expert system and its components.

MODULE V ROBOTIC WORK CELLS AND APPLICATIONS OF ROBOTS **7**

Robotic cell layouts – Inter locks – Humanoid robots – Micro robots – Application of robots in surgery, Manufacturing industries, space and underwater.

MODULE VI ROBOT KINEMATICS AND DYNAMICS **7**

Forward and inverse Kinematic equations, Denvit – Hartenbers representations Fundamental problems with D-H representation, differential motion and velocity
of frames - Dynamic equations for sing, double and multiple DOF robots – static force analysis of robots.

L – 45; Total Hours –45

REFERENCES:

1. Yoram Koren," Robotics for Engineers", Mc Graw-Hill, 1987.
2. Kozyrey, Yu, "Industrial Robots", MIR Publishers Moscow, 1985.
3. Richard. D, Klafter, Thomas, A, Chmielewski, Michael Negin, "Robotics Engineering – An Integrated Approach", Prentice-Hall of India Pvt. Ltd., 1984.
4. Deb, S.R. "Robotics Technology and Flexible Automation", Tata Mc Graw-Hill, 1994.
5. Mikell, P. Groover, Mitchell Weis, Roger, N. Nagel, Nicholas G. Odrey, "Industrial Robotics Technology, Programming and Applications", Mc Graw- Hill, Int. 1986.
6. Timothy Jordanides et al,"Expert Systems and Robotics", Springer – Verlag, New York, May 1991.

OUTCOMES:

Students would be able to

- Understand about the robots, its various components.
- Design Robots for industrial applications.
- Do programming for robots and apply them in real time applications.

GECX105	TRANSPORT MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the transport fleet and their related activities for minimizing operational cost.
- To understand the need of maintenance and its importance.
- To understand the functions and applications of various types of transport system.

MODULE I INTRODUCTION 7

Personnel management; objectives and functions of personnel management, psychology, sociology and their relevance to organization, personality problems. Selection process: job description, employment tests, interviewing, introduction to training objectives, advantages, methods of training, training procedure, psychological tests.

MODULE II ORGANISATION AND MANAGEMENT 7

Forms of Ownership – principle of Transport Management – Staff administration – Recruitment and Training – welfare – health and safety. Basic principles of supervising. Organizing time and people. Driver and mechanic hiring - Driver checklist - Lists for driver and mechanic - Trip leasing - Vehicle operation and types of operations.

MODULE III TRANSPORT SYSTEMS 9

Introduction to various transport systems. Advantages of motor transport. Principal function of administrative, traffic, secretarial and engineering divisions. chain of responsibility, forms of ownership by state, municipality, public body and private undertakings.

MODULE IV SCHEDULING AND FARE STRUCTURE 8

Principal features of operating costs for transport vehicles with examples of estimating the costs. Fare structure and method of drawing up of a fare table. Various types of fare collecting methods. Basic factors of bus scheduling. Problems on bus scheduling.

MODULE V MOTOR VEHICLE ACT 7

Traffic signs, fitness certificate, registration requirements, permit insurance, constructional regulations, description of vehicle-tankers, tippers, delivery vans, recovery vans, Power wagons and fire fighting vehicles. Spread over, running time, test for competence to drive.

MODULE VI MAINTENANCE 7

Preventive maintenance system in transport industry, tyre maintenance procedures. Causes for uneven tyre wear; remedies, maintenance procedure for better fuel economy, Design of bus depot layout.

L – 45; Total Hours –45

TEXT BOOKS:

1. John Duke, "Fleet Management", McGraw-Hill Co, USA, 1984.
2. Kitchin.L.D., "Bus Operation", III edition, Illiffee and Sons Co., London, 1992

REFERENCES:

1. Government Motor Vehicle Act, Publication on latest act to be used as on date.

OUTCOMES:

Upon completion of the course, students will

- Know about different aspects related to transport system and management.
- Features of scheduling, fixing the fares
- Know about the motor vehicle act and maintenance aspects of transport.

GECX106	CONTROL SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the system modeling and to derive their transfer function.
- To provide adequate knowledge of time response of systems and steady state error analysis.
- To accord basic knowledge in obtaining the open loop and closed–loop frequency responses of Control systems.

MODULE I BASIC CONCEPTS AND SYSTEM REPRESENTATION 8

Control System - Basic elements in control systems – Open and closed loop systems – Electrical analogy of mechanical and thermal systems – Transfer function – Block diagram reduction techniques – Signal flow graphs.

MODULE II TIME RESPONSE ANALYSIS AND DESIGN 8

Time response – Time domain specifications – Types of test input – First and Second order system - Type I and Type II System – Response - Error coefficients – Generalized error series – Steady state error – P, PI, PID modes of feedback control.

MODULE III FREQUENCY RESPONSE ANALYSIS AND DESIGN 7

Performance specifications - correlation to time domain specifications - bode plots and polar plots – gain and phase margin – constant M and N circles and Nichols chart – all pass and non-minimum phase systems.

MODULE IV STABILITY 8

Characteristics equation – Location of roots in s plane for stability – Routh Hurwitz criterion – Root locus construction – Effect of pole, zero addition – Gain margin and phase margin – Nyquist stability criterion.

MODULE V COMPENSATOR DESIGN 8

Performance criteria – Lag, lead and lag-lead networks – Compensator design using bode plots and root locus technique.

MODULE VI CONTROL SYSTEM COMPONENTS AND APPLICATION OF CONTROL SYSTEMS 6

Synchros – AC servomotors - DC Servo motors - Stepper motors - AC

Tacho generator - DC Tacho generator - Typical applications of control system in industry.

L – 45; Total Hours –45

REFERENCES:

1. K. Ogata, “Modern Control Engineering”, 4th Edition, Pearson Education, New Delhi, 2003.
2. I.J. Nagrath & M. Gopal, “Control Systems Engineering”, New Age International Publishers, 2003.
3. C.J.Chesmond, “Basic Control System Technology”, Viva student edition, 1998.
4. I.J.Nagarath and M.Gopal, “Control System Engineering”, Wiley Eastern Ltd., Reprint, 1995.
5. R.C.Dorf and R.H.Bishop, “Modern Control Systems”, Addison-Wesley (MATLAB Reference), 1995.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Proper understanding of basics of Control Systems.
- Ability and skill to carry-out time domain and frequency domain analysis.
- Capable of determining stability of the system using Routh Hurwitz criterion, Root locus and Nyquist criterion.
- Ability to design lag, lead and lag lead compensator networks.

GECX107 INTRODUCTION TO VLSI DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- Basic concepts of HDL.
- Verilog language and its syntax constructs.
- Programmable Logic Devices and FPGAs
- MOS devices theory
- CMOS based combinational and sequential circuits

PREREQUISITES:

Fundamentals of Electronics

Basics knowledge in Digital Electronics.

MODULE I REVIEW OF BASIC DIGITAL SYSTEMS 7

Boolean algebra, Building blocks of combinational logic design-Adders, multiplexer, encoder, decoder, comparator, Latches & flip-flops, counters, shift registers.

MODULE II LOGIC DESIGN USING VERILOG HDL 8

Overview of Digital Design with Verilog HDL, Levels of Design Description, Concurrency, Hierarchical Modeling Concepts, Modules and Ports, Component instantiation Data flow and RTL, structural, gate level, switch level modeling and Behavioral Modeling.

MODULE III LANGUAGE CONSTRUCTS OF VERILOG HDL 7

Identifiers- gate primitives, gate delays, operators, timing controls, procedural assignments, conditional statements Variable types, arrays and tables, Tasks and functions, Test bench.

MODULE IV BUILDING BLOCKS OF DIGITAL VLSI SYSTEMS 8

HDL Design -Data Path Operations-Addition/Subtraction, Parity Generators, Comparators, Zero/One Detectors, Binary Counters, ALUs, Multiplication, Shifters, Memory Elements. Programmable logic elements and AND-OR arrays, FPGAs programming methods.

MODULE V TRANSISTOR THEORY 7

Introduction to MOS Transistors-NMOS & PMOS Characteristics, Current Equations, Complementary CMOS Inverter-DC Characteristics, Static Load MOS Inverters.

MODULE VI BASICS OF DIGITAL CMOS DESIGN 8

NMOS & PMOS Logic Gate, CMOS Logic Gate, Basic layout design of simple gate-stick diagram, CMOS Logic Structures-full adder, multiplexers.

Total Hours –45

TEXT BOOKS:

1. M.Morris Mano "Digital Design", 3rd Edition, Prentice Hall of India Pvt. Ltd New Delhi, 2003

REFERENCES:

1. Michael D. Ciletti“Advanced Digital Design with the Verilog HDL" (2nd Edition) Hardcover – January 31, 2010
2. J.Bhasker: Verilog HDL primer, BS publication, 2001.
3. J. P. Uyemura, "Introduction to VLSI Circuits and System", Wiley, 2002
4. Neil Weste and K. Eshragian, “Principles of CMOS VLSI Design: A System Perspective,” 2nd edition, Pearson Education (Asia) Pvt.Ltd., 2000
5. Douglas A Pucknell& Kamran Eshragian , “Basic VLSI Design” PHI 3rd Edition (original edition – 1994)

OUTCOMES:

At the end of the course the students will be able to

- Create basic Register Transfer Level (RTL) models for combinational circuits & Sequential circuits using Verilog HDL.
- Create basic behavioral models for combinational circuits & Sequential circuits using Verilog HDL.
- Describe the usage of Programmable Logic Devices and FPGAs.
- Describe MOS devices theory and inverter circuit DC characteristics
- Design the basic digital building blocks using MOS circuit.
- Apply VLSI design concepts based on the requirements to conduct experiments or projects

GECX108	PLANT ENGINEERING	L	T	P	C
		3	0	0	4

OBJECTIVES:

- To provide in depth knowledge on Plant Engineering
- To introduce detail engineering and P&ID
- To learn about the support to Instrumentation from other disciplines
- To study about the Installation and commissioning

MODULE I INTRODUCTION OF PLANTS 7

General Project Cycle – Feed – Sales - Plant Description, Component / Areas of Plant, Plant Layout, Plant Interfaces, Plant Location

MODULE II ELEMENTS OF PLANT 8

Main Elements of a Plant, Process Flow Scheme (PFD – Process Flow Diagram) P&ID's, Plant Legend Finalization.

MODULE III DETAIL ENGINEERING 10

P& ID Development with PFD's, Major Discipline Involvement & Inter discipline Interaction, Major Instrumentation & Control Systems - Development Phase – Instrument List , I/O Count, Specification Sheets, Instrument Installation (Hook ups) , Control Philosophy – Detail Engineering.

MODULE IV SUPPORT FROM OTHER DISCIPLINE 8

Other Discipline Supports to Instrumentation – Plot Plan, Piping / Equipment Plan, Electrical Area Classification, Fire Hazardous Classification Telecommunication Systems - Control Network architecture.

MODULE V INSTALLATION AND COMMISSIONING 7

Plant Construction - Key Drawings for Construction Support Construction Activities, System Testing, Startup / Commissioning, Production.

MODULE VI CASE STUDIES 5

Case studies of Water Treatment Plant - Paper Industry – Power Plant etc

L – 45; Total Hours –45

REFERENCES:

1. Duncan C Richardson, Plant Equipment and Maintenance Engineering Handbook, McGraw-Hill Education: New York, Chicago, San Francisco, Athens, London, Madrid, Mexico City, Milan, New Delhi, Singapore, Sydney, Toronto, 2014 McGraw-Hill Education
2. Gabriel Salvendy, Handbook of Industrial Engineering – Technology and operations Management, John Wiley & Sons, 2001.
3. Robert C Rosaler , Standard Handbook of Plant Engineering, Mc Graw Hill third Edition, 2004
4. R. Keith Mobley, Plant Engineer's Handbook, Technology and Engineering, 2001.

OUTCOMES:

At the end of the course, the student will be able to

- Review and correct P&IDs
- Do installation and commissioning of new plants
- Apply plant engineering in design and maintenance of water treatment plant / power plant etc

GECX109	NETWORK SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

The students should be able to

- Discuss the basic concepts of computer security, model and attacks
- Examine the major types of threats and the associated attacks
- Identify the encryption techniques in real time applications
- Understand the special requirements for wireless security and how authentication is implemented in wireless systems
- Understand the functions of Network Security Device Firewall and its types
- Interpret the various network intrusion such as computer viruses, network worms etc

MODULE I INTRODUCTION 6

Computer Security Concepts - The OSI Security Architecture - Security Attacks - Security Services - Security Mechanisms - A Model for Network Security - Standards – classical encryption techniques.

MODULE II SYMMETRIC ENCRYPTION AND MESSAGE CONFIDENTIALITY 7

Symmetric Encryption Principles - Symmetric Block Encryption Algorithms - Random and Pseudorandom Numbers - Stream Ciphers and RC4 - Cipher Block Modes of Operation

MODULE III PUBLIC KEY CRYPTOGRAPHY AND MESSAGE AUTHENTICATION 8

Approaches to Message Authentication - Secure Hash Functions - Message Authentication Codes - Public-Key Cryptography Principles - Public-Key Cryptography Algorithms - Digital Signatures

MODULE IV KEY DISTRIBUTION ,USER AUTHENTICATION AND TRANSPORT-LEVEL SECURITY 8

Symmetric Key Distribution Using Symmetric Encryption - Kerberos - Key Distribution Using Asymmetric Encryption - X.509 Certificates - Public-Key Infrastructure -Federated Identity Management - Web Security Considerations -

Secure Socket Layer and Transport Layer Security - Transport Layer Security

MODULE V WIRELESS NETWORK SECURITY, ELECTRONIC MAIL SECURITY AND IP SECURITY **8**

IEEE 802.11 Wireless LAN Overview -IEEE 802.11i Wireless LAN Security - Wireless Application Protocol Overview - Wireless Transport Layer Security - WAP End-to-End Security - Pretty Good Privacy - S/MIME – Domain Keys Identified Mail- IP Security Overview -IP Security Policy - Encapsulating Security Payload - Combining Security Associations - Internet Key Exchange - Cryptographic Suites

MODULE VI SYSTEM SECURITY **8**

Intruders -Intrusion Detection -Password Management - Types of Malicious Software - Viruses Virus Countermeasures – Worms - Distributed Denial of Service Attacks- The Need for Firewalls - Firewall Characteristics - Types of Firewalls - Firewall Basing - Firewall Location and Configurations

L – 45; Total Hours –45

REFERENCES:

1. William Stallings,"Network security Essentials:Applications and standards", Prentice Hall, Fifth Edition , ISBN-13: 978-0134527338, 2013
2. William Stallings, "Cryptography and Network Security: Principles and Practice", Pearson, ISBN-13:978-0-273-79335-9,2013
3. Behrouz Forouzan, Debdeep Mukhopadhyay,Cryptography and network security (sie) 2nd edition, ISBN-13: 978-0070702080, 2016
4. Wikipedia, "Network Security and Management" , https://en.wikipedia.org/wiki/Book:Network Security and Management, 2014.
5. Nitesh Dhanjani, Justin Clarke, "Network Security Tools", O'Reilly Media, ISBN-13: 9780596007942, 2005.

OUTCOMES:

Students who complete this course will be able to

- Recognize the computer security concepts, architecture attacks and model
- Distinguish the symmetric and asymmetric encryption techniques
- Apply the cryptographic algorithms in different applications
- Express the network security designs using available secure solutions

such as PGP,SSL, IPSec, etc.

- Describe the firewalls principles and different types of firewalls applied in organization
- Identify abnormalities within the network caused by worms, viruses and Network related security treats**.**

GECX110	KNOWLEDGE MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course

- Focuses on positioning knowledge as a valuable commodity, embedded in products and in the tacit knowledge of highly mobile individual employees.
- Presents KM as a deliberate and systematic approach to cultivating and sharing an organization's knowledge base.
- Brings out the paradigm in terms of information technology and intellectual capital.

MODULE I KNOWLEDGE MANAGEMENT 6

KM Myths – KM Life Cycle – Understanding Knowledge – Knowledge, intelligence – Experience – Common Sense – Cognition and KM – Types of Knowledge – History of Knowledge Management - From Physical assets to Knowledge Assets – Expert knowledge – Human Thinking and Learning.

MODULE II KNOWLEDGE MANAGEMENT SYSTEMS AND MODELS 9

Challenges in Building KM Systems – Conventional Vs KM System Life Cycle (KMSLS) – Knowledge Creation and Knowledge Architecture – KM cycle - Different variants of KM cycle - KM models - Implications and practical implementations.

MODULE III CAPTURING KNOWLEDGE AND SHARING 9

Tacit knowledge capture - Explicit knowledge codification – Knowledge taxonomies - Knowledge sharing - Communities - Obstacles to knowledge capture and sharing.

MODULE IV KNOWLEDGE MANAGEMENT TOOLS 9

KM System tools – Neural Network – Association Rules – Classification Trees – Data Mining and Business Intelligence – Knowledge capture and creation tools - Content creation tools - Data mining and knowledge discovery – Content management tools - Knowledge sharing and dissemination tools – Group ware

and Collaboration tools - Intelligent filtering tools.

MODULE V KNOWLEDGE APPLICATION 6

KM at individual level - Knowledge workers - Task analysis and modeling - Knowledge application at group and organizational levels – Knowledge repositories - Knowledge reuse -Case study: e-learning.

MODULE VI VALUE OF KNOWLEDGE MANAGEMENT 6

KM return on investment and metrics - Benchmarking method – Balanced scorecard method - House of quality method - Results based assessment method - Measuring success - Future challenges for KM.

L – 45; Total Hours –45

TEXT BOOKS:

1. Elias M. Awad, Hassan M. Ghaziri, “Knowledge Management”, Prentice Hall, 2nd Edition, 2010.
2. Jay Liebowitz, “Handbooks on Knowledge Management”, 2nd Edition, 2012.
3. Irma Becerra-Fernandez, Rajiv Sabherwal, ”Knowledge Management: Systems and Processes”, 2010.

OUTCOMES:

Students who complete this course will be able to

- Describe the fundamental concepts in the study of knowledge and its creation, acquisition, representation, dissemination, use and re-use, and management.
- Explains the core concepts, methods, techniques, and tools for computer support of knowledge management.
- Critically evaluate current trends in knowledge management and apply it for e-learning

GECX111	CYBER SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basics of Cyber Security Standards and Policies.
- To know the legal, ethical and professional issues in Cyber security.
- To understand Cyber Frauds and Abuse and its Security Measures.
- To know the technological aspects of Cyber Security.

MODULE I FUNDAMENTALS OF CYBER SECURITY 7

Security problem in computing – Cryptography Basics – History of Encryption – Modern Methods – Legitimate versus Fraudulent Encryption methods – Encryption used in Internet.

MODULE II CYBERCRIME AND CYBEROFFENSES 8

Cybercrime and Information Security – Cybercriminals – Classifications of Cybercrimes – Email Spoofing – Spamming – Cyber defamation – Internet Time Theft – Forgery – Web jacking – Hacking – Online Frauds – Software Piracy – Mail Bombs – Password Sniffing – Cyberoffenses – Categories – Planning the attacks – Cyberstalking – Cybercafe and Cybercrimes – Botnets.

MODULE III CYBERCRIME: MOBILE AND WIRELESS DEVICES 8

Proliferation of Mobile and Wireless Devices – Trends in Mobility – Credit card frauds in Mobile and Wireless Computing – Security Challenges – Authentication Service Security – Attacks on Mobile Phones.

MODULE IV TOOLS AND METHODS USED IN CYBERCRIME 8

Proxy Servers and Anonymizers – Phishing – Password Cracking – Keyloggers and Spywares – Virus and Worms – Trojan Horses and Backdoors – Steganography – DoS and DDoS Attacks.

MODULE V SECURITY POLICIES 7

Introduction - Defining User Policies – Passwords – Internet Use – Email Usage – Installing/ Uninstalling Software – Instant Messaging – Defining System Administrative Policies – Defining Access Control Developmental Policies Standards, Guidelines and Procedures – Basics of assessing a system

MODULE VI COMPUTER FORENSICS 7

General Guidelines – Finding Evidence on the PC - Finding Evidence in System Logs – Windows Logs – Linux Logs – Getting Back Deleted Files – Operating System Utilities – The Windows Registry.

L – 45; Total Hours –45

TEXT BOOKS:

1. Nina Godbole, Sunit Belapure, “Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Wiley, 2011.

2. Chuck Easttom, “Computer Security Fundamentals”, 2nd Edition, Pearson Education, 2012.

REFERENCES:

1. Charles B. Pfleeger, Shari Lawrence Pfleeger, “Security in Computing”, 3rd Edition, Pearson Education, 2003.
2. William Stallings, “Cryptography and Network Security – Principles and Practices”, 3rd Edition, Pearson Education, 2003.
3. Atul Kahate, “Cryptography and Network Security”, Tata McGraw Hill, 2000.

OUTCOMES:

Upon completion of this course, students will be able to

- Explain the general security issues.
- Discuss various cybercrimes and offenses.
- Outline the occurrence of Cybercrime in mobile and wireless environment.
- Use relevant tools and methods in cybercrime
- Apply security policies in cyber forensics.
- Outline the strategies adopted in computer forensics.

GECX112 GENETIC ENGINEERING L T P C
4 0 0 4

OBJECTIVES:

The course aims to provide an advanced understanding of the core principles and topics of Cell and Organism reproduction and the Principles of heredity and their experimental basis, and to enable students to be able to apply these principles in assessment of pedigrees to identify genotypes and predict the mating outcomes.

MODULE I GENETICS AND ORGANISM 10

Genetics and human affairs, Genetics and Biology, Genes and Environment, Techniques of genetic analysis, The chromosome theory of heredity, Sex chromosomes, Sex linkage, The parallel behaviour of autosomal genes and chromosomes.

MODULE II MENDELISM AND LINKAGE 12

Mendel's laws of inheritance, Interaction of genes, Variations on dominance, Multiple alleles, Lethal alleles, Several genes affecting the same character, Penetrance and expressivity, Linkage- Basic eukaryotic chromosome mapping, The discovery of linkage, Recombination linkage symbolism, Linkage of genes on X chromosomes, Linkage maps, Examples of linkage maps.

MODULE III FINE STRUCTURE OF GENES 10

The concept of promoter, Coding sequence, Terminator, Induction of gene for expression. The concept of extranuclear genome in higher plants and animals, Overview of mitochondrial genome, Chloroplast genome.

MODULE IV RECOMBINATION IN BACTERIA AND VIRUSES 10

Conjugation recombination and mapping the E.coli chromosomes, Transformation, Transduction, Chromosome mapping. Population genetics: Darwin's revolution, Variation and its modulation, The effect of sexual reproduction on variation, The sources of variation, Selection quantitative genetics

MODULE V PRINCIPLES OF PLANT BREEDING 9

Objectives, Selfing and crossing techniques, Male sterility,Incompatability, Hybrid vigour.

MODULE VI HUMAN GENOME PROJECT 9

Genetic diseases in humans, Genetics and society

L – 45; T – 15; Total Hours –60

REFERENCES:

1. In Introduction to genetic analysis, Griffiths, Miller, Suzuki, Lewontin and Gelbart, Freeman and Company.
2. Genetics, A.V.S.S. Sambamurty, Narosa Publishing House.
3. Concepts of Genetics, Klug & Cummings, Prientice Hall.
4. Molecular Cloning, Moniatisetal, Cold Spring Harbor Laboratory.

OUTCOMES:

At the end of the course students will be able to

- Describe the structure, function and replication of DNA as the genetic material
- Describe gene structure, expression and regulation
- Describe the chromosomal basis of inheritance and how alterations in chromosome number or structure may arise during mitosis and meiosis

GECX113	FUNDAMENTALS OF PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The students would gain knowledge on

- Technicalities attached to Project Management and Significance of Quality Consideration
- Project management methodologies – tools and techniques, supplemented with examples from case studies
- The importance of Efficient HR team and role of Communication in executing Projects.
- Managing Risks in Project Management

MODULE I INTRODUCTION TO PROJECT MANAGEMENT 9

Introduction to Project and Project Management-Project Management as a Career-Project Management Skill Sets-Project Scope Management: Project Charter, Scope Creep, Scope Validation, Scope Change Control-Type of Organization: Organization Structure-Influence of Organization Structure on Project, Project Stakeholders and Organizational Productivity.

MODULE II PROJECT MANAGEMENT PROCESS, TOOLS AND TECHNIQUES 8

Project life cycle-Initiation, Planning, Execution, Monitoring and Closing Phase; - Link between project management process, process groups and knowledge areas; Project management tools and techniques- Project Stakeholders description and mapping - Stakeholder Management Process

MODULE III PROJECT QUALITY, COST AND SCHEDULE MANAGEMENT 10

Triple constraints of project-quality, cost and schedule-Quality Planning, Quality Assurance and Quality Control, Process Control, Cost of Quality, Seven Tools of Quality Control- Cost Management: Cost Estimating Methods, Estimating Completion Cost, Earned Value Management, Budgeting, Life-Cycle Cost analysis- Project Time Management: Duration Estimation Method, FS/FF/SS/ SF Relations, Lead/Lag, Arrow Diagram Method and Precedence Diagram Method for Scheduling-Resource Allocation

MODULE IV PROJECT HR MANAGEMENT 5

Organizational Goals- (MBO/MBE/MBP)-Responsibility Assignment Matrix (RAM)-Types of Powers- Manage or Lead-Conflict management Techniques-Performance Evaluation Process-Motivation Theories and its Application for execution of Projects-Leadership Styles-Project Team Building-Project Staffing Constraints/Policies

MODULE V COMMUNICATION MANAGEMENT 5

Communication Management: Understanding Body languages of Project Personnel-Effective Communications- Interpersonal Skills for project Managers-PMIS-Communicating with the Customer-Communicating with Management- Formal vs. Informal Communications-Written, Verbal and Non-Verbal Communications.

MODULE VI PROJECT PROCUREMENT & RISK MANAGEMENT 8

Introduction to Project Procure Management: Soliciting RFQ/RFP-Contract Proposals-Contract Negotiation-Contract Closure-Risk Management: Defining risks-Risk management process-Risk identification-Qualitative and Quantitative Risk-Probability and Decision trees-Risk Response strategies / methods-Expected monetary value-Risk vs. life cycle phases

L – 45; Total Hours –45

REFERENCES:

1. Jack. R. Meredith, Samuel. J. Mantel & Scott. M. Shafer, Project Management in Practice, Fifth Edition, Bangalore: Wiley, 2015
2. Bob Hughes, Mike Cotterrel “Software Project Management”, Tata McGraw-Hill, 2009

OUTCOMES:

- Learners will be able to identify the Key Knowledge Areas and apply PM process in hypothetical project assignments given as continuous assessment.
- They would be able to suitably recognize tools and techniques required for various phases included in a project.
- They would also be able to manage scope, time, cost and other major components that would help them to execute the project efficiently.

GECX114	OPERATIONS RESEARCH	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To acquire knowledge and training in optimization techniques.
- To get knowledge about optimization in utilization of resources.
- To understand and apply operations research techniques to industrial operations

MODULE I LINEAR PROGRAMMING PROBLEM 8

Linear programming – formulation of the problem - graphical interpretation of optimality - Simplex method – to obtain basic feasible solution – types of linear programming solution – complications and their resolution.

MODULE II ARTIFICIAL VARIABLE AND TWO PHASE METHOD, DUALITY 6

Artificial variable - Big M method – Two phase method – alternative optimal solution – unbounded solution - Duality – primal dual relationships - rules of constructing the dual from primal.

MODULE III TRANSPORTATION PROBLEM & ASSIGNMENT PROBLE 8

Transportation problems – Initial basic feasible solutions, MODI method, Unbalance in transportation, Degeneracy in transportation models, Assignment problem – Minimization and Maximization type of problems by Hungarian method.

MODULE IV NETWORK AND SEQUENCING PROBLEMS 8

PERT and CPM – Network diagram – Fulkerson's rule - CPM Probability of achieving completion date – Crash time – Cost analysis. Sequencing N jobs through 2 machines and 3 machines.

MODULE V QUEUING THEORY & SIMULATION 7

Poisson arrivals and exponential service times – characteristics of Queuing models – single channel – Introduction to multi channel models – Random number generation – Monte Carlo Simulation.

MODULE VI INVENTORY CONTROL, REPLACEMENT MODELS AND GAME THEORY 8

Types of inventory- Inventory cost - EOQ - Deterministic inventory problems – Introduction to probabilistic models & system level inventory control - Replacement models – Replacement of items that deteriorate with time – value of money changing with time – not changing with time – Individual and group replacement policy - Game theory – simple games.

L – 45; Total Hours –45

TEXT BOOKS:

3. Hamdy ATaha, “Operations Research an introduction”, 8th edition, Phil Pearson, 2007.
4. Winston.W.L., “Operations Research”, 4th edition, Thompson-Brooks/Cole, 2003.

REFERENCES:

1. Wayne.L. Winston, “Operations Research applications and algorithms”, 4th edition, Thomson learning, 2007.
2. Frederick. S. Hiller and Gerald.J.Lieberman, “Operations Research concepts and cases”, 8th edition (SIE), Tata McGraw – Hill Pub. Co. Ltd., New Delhi, 2006.
3. A. Ravindran, D. T. Phillips and J. J. Solberg, "Operations Research:Principles and Practice", 2nd edition, John Wiley & Sons, New York, 1992.
4. Robertazzi. T.G., “Computer networks and systems-Queuing theory and performance evaluation”, 3rd edition, Springer, 2002.

OUTCOMES:

At the end of the course students will be able to

- solve linear programming problems
- solve transportation and assignment problems.
- solve network and sequencing problems.
- apply the operations research techniques to solve industrial problems.

GECX115	NANO TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the basic concepts of Nanoscience relevant to the field of engineering.
- To provide an exposure about the importance of various synthesis method.
- To enrich the knowledge of students in various characterisation techniques.

MODULE I INTRODUCTION & CLASSIFICATION OF NANOMATERIALS 9

Definition - Origin of nanotechnology - Difference between bulk and nanomaterials- Top-down and bottom-up processes - Size dependent properties (magnetic, electronic,transport and optical), Classification based on dimensional property - 0D, 1D, 2D and 3D nanostructures – Kubo gap.

MODULE II TYPES OF NANOMATERIALS 9

Metal oxides and metal nano particles - Ceramic nano particles - Semi conducting quantum dots - Core-shell quantum dots - Nanocomposites - Micellar nanoparticles.

MODULE III PRODUCTION OF NANOPARTICLES 7

Sol-gel, hydrothermal, solvothermal, Plasma Arcing, Electro deposition, RF sputtering, Pulsed laser deposition, Chemical vapour, deposition.

MODULE IV CARBON BASED NANOMATERIALS 6

Carbon nanotubes: Single wall nanotubes (SWNT), Multiwall nanotubes (MWNT) - structures-carbon nanofibre, Fullerenes-Application of carbon nanotubes and Fullerenes.

MODULE V NANOPHOTONICS 7

Light and nanotechnology, Interaction of light and nanotechnology, Nanoholes and photons, nanoparticles and nanostructures; Nanostructured polymers, Photonic Crystals, Solar cells.

MODULE VI CHARACTERISATION TECHNIQUES 7

Basic principles of scanning Electron Microscopy (SEM), Atomic force microscopy (AFM), Scanning tunneling microscopy (STM), Scanning probe

microscopy (SPM) and Transmission electron microscopy (TEM), Particle size analyzer, Luminescence techniques.

L – 45; Total Hours –45

TEXT BOOKS:

1. Hari Singh Nalwa, “Handbook of Nanostructured Materials and Nanotechnology”, Academic Press, 2000.
2. Guozhong Cao, “Nanostructures and Nano materials-Synthesis, Properties and Applications”, Imperial College Press (2011).
3. Zhong Lin Wang, “Handbook of Nanophase and Nanomaterials (Vol 1 and II)”, Springer, 2002.
4. Mick Wilson, Kamali Kannangara, Geoff smith, “Nanotechnology: Basic Science and Emerging Technologies”, Overseas press, 2005.

REFERENCES:

1. A. Nabok, “Organic and Inorganic Nanostructures”, Artech House, 2005.
2. C.Dupas, P.Houdy, M.Lahmani, Nanoscience: “Nanotechnologies and Nanophysics”, Springer-Verlag Berlin Heidelberg, 2007.
3. Mick Wilson, Kamali Kannangara, Michells Simmons and Burkhard Raguse, “Nano Technology – Basic Science and Emerging Technologies”, 1st Edition, Overseas Press, New Delhi,2005.
4. M.S. Ramachandra Rao, Shubra SinghH, “Nanoscience and Nanotechnology: Fundamentals to Frontiers”, Wiley, 2013.

OUTCOMES:

At the end of this course, the students will be able to:

- Apply the knowledge of different types of nanomaterials for various engineering applications.
- Acquire the knowledge of various methods of production of nanomaterials.
- Familiarize with various characterization techniques.

GECX116	VEHICLE MAINTENANCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To know about the various methods of maintaining procedure, vehicle insurance and basic problems in a vehicle.
- The student able to impart knowledge in maintaining of engine components and subsystems.
- The student able to impart knowledge in maintaining of transmission, driveline, steering, suspension, braking and wheels.
- The student able to impart **carefully maintaining their vehicle and can increase driving safety.**

MODULE I MAINTENANCE, WORKSHOP PRACTICES, SAFETY AND TOOLS **7**

Maintenance – Need, importance, primary and secondary functions, policies - classification of maintenance work - vehicle insurance - basic problem diagnosis. Automotive service procedures – workshop operations – workshop manual - vehicle identification. Safety – Personnel, machines and equipment, vehicles, fire safety - First aid. Basic tools – special service tools – measuring instruments – condition checking of seals, gaskets and sealants. Scheduled maintenance services – service intervals - Towing and recovering.

MODULE II ENGINE AND ENGINE SUBSYSTEM MAINTENANCE **8**

General Engine service- Dismantling of Engine components- Engine repair- working on the underside, front, top, ancillaries- Service of basic engine parts, cooling and lubricating system, fuel system, Intake and Exhaust system, electrical system - Electronic fuel injection and engine management service - fault diagnosis- servicing emission controls.

MODULE III TRANSMISSION AND DRIVELINE MAINTENANCE **8**

Clutch- general checks, adjustment and service- Dismantling, identifying, checking and reassembling transmission, transaxle- road testing- Removing and replacing propeller shaft, servicing of cross and yoke joint and constant velocity joints- Rear axle service points- removing axle shaft and bearings- servicing differential assemblies- fault diagnosis.

MODULE IV STEERING AND SUSPENSION MAINTENANCE 7

Maintenance and Service of Mc person strut, coil spring, leaf spring, shock absorbers. Dismantling and assembly procedures. Inspection, Maintenance and Service of steering linkage, steering column, Rack and pinion steering, Recirculating ball steering service- Worm type steering, and power steering system.

MODULE V BRAKE AND WHEEL MAINTENANCE 7

Inspection, Maintenance and Service of Hydraulic brake, Drum brake, Disc brake, parking brake. Bleeding of brakes. Wheel alignment and balance, removing and fitting of tyres, tyre wear and tyre rotation.

MODULE VI AUTO ELECTRICAL AND AIR CONDITIOING MAINTENANCE 8

Maintenance of batteries, starting system, charging system and body electrical -Fault diagnosis using Scan tools. Maintenance of air conditioning parts like compressor, condenser, expansion valve, evaporator - Replacement of hoses- Leak detection- AC Charging- Fault diagnosis Vehicle body repair like panel beating, tinkering, soldering, polishing, painting.

L – 45; Total Hours –45

TEXT BOOKS:

1. Ed May, "Automotive Mechanics Volume One" , Mc Graw Hill Publications, 2003
2. Ed May, "Automotive Mechanics Volume Two" , Mc Graw Hill Publications, 2003
3. Vehicle Service Manuals of reputed manufacturers
4. Vehicle maintenance and garage practice by Jigar A.Doshi Dhru U.Panchal,Jayesh P.Maniar. 2014
5. A Practical Approach to Motor Vehicle Engineering and Maintenance 3rd Edition by Allan Bonnick.

REFERENCES:

1. Bosch Automotive Handbook, Sixth Edition, 2004.
2. Advanced Automotive Fault Diagnosis by Tom Denton 2011.
3. Nissan Patrol Automotive Repair Manual: 1998-2014 by Haynes Manuals Inc.
4. Automobile electrical manual a comprehensive guide by Haynes manual car repair.

OUTCOMES:

On completion of the course student should be able to

- Prepare maintenance schedules and procedures with appropriate tools.
- Demonstrate the procedure and methods to repair and calibrate the engine.
- **Analyze the causes and remedies for fault in transmission and drive line systems.**
- **Analyze the causes and remedies of steering and suspension systems.**
- **Analyze the causes and remedies of brake system.**
- **Demonstrate the procedure for wheel alignment and wheel balanced.**

GECX117	FUNDAMENTALS OF DIGITAL IMAGE PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Describe and explain basic principles of digital image processing
- Design and implement algorithms that perform basic image processing
- Design and implement algorithms for advanced image analysis
- Assess the performance of image processing algorithms and systems

PRE-REQUISITES:

- Basic knowledge of transforms in Mathematics

MODULE I DIGITAL IMAGE FUNDAMENTALS 8

Elements of Image Processing System, Fundamentals steps in Digital Image Processing, Image Sampling & Quantization, Spatial and Gray Level Resolution.

MODULE II COLOR IMAGE PROCESSING 8

Fundamental of color image processing, color models- RGB, CMY, HIS, Pseudo color image processing

MODULE III IMAGE ENHANCEMENT 7

Basic gray level Transformations, Histogram Processing, Spatial Filtering

MODULE IV IMAGE TRANSFORMS 7

2D-DFT, DCT, Haar Transform, Fundamentals of 2D-wavelet transform, sub-band coding

MODULE V IMAGE SEGMENTATION AND RESTORATION 8

Point, line and edge detection methods ,Image Segmentation and its types, Restoration: Noise model, Inverse filter and Wiener filter.

MODULE VI IMAGE COMPRESSION 7

Fundamentals of redundancies, Basic Compression Methods: Huffman coding, Arithmetic coding, JPEG and MPEG Compression standards.

TOTAL HOURS 45

TEXT BOOKS

1. Gonzalez and Woods, "Digital Image Processing", 3rd Edition, Pearson Education, 2016.
2. Anil. K. Jain, "Fundamentals of Digital Image Processing"; 4th Edition, PHI, 2007

REFERENCES

1. Pratt William, "Digital Image Processing", John Wiley & Sons, 2007.
2. Arthur Weeks Jr., "Fundamentals of Digital Image Processing", PHI, 2006.

OUTCOMES:

On completion of the course, students will be able to

- Explain the fundamental concepts of digital image processing.
- Discuss about color image processing
- Recognize & apply various image enhancement techniques.
- Apply various transforms for image processing.
- Apply various techniques for image segmentation and restoration.
- Identify and use appropriate image compression techniques

Group II courses
(To be offered in VII Semester)

GECX201	GREEN DESIGN AND SUSTAINABILITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart knowledge to face challenges, the technology poses for water, energy, and climate change by implementing sustainable design.

MODULE I CONCEPTS OF SUSTAINABLE DEVELOPMENT 7

Objectives of Sustainable Development - Need for sustainable development-Environment and development linkages - Globalisation and environment-Population, poverty and pollution- global, regional and local environment issues-Green house gases and climate change.

MODULE II SUSTAINABLE DEVELOPMENT OF SOCIO ECONOMIC SYSTEMS 8

Demographic dynamics of sustainability- Policies for socio economic development- Sustainable Development through trade- Economic growth- Action Plan for implementing sustainable development- Sustainable Energy and Agriculture.

MODULE III FRAME WORK FOR ACHIEVING SUSTAINBAILITY 7

Sustainability indicators- Hurdles to sustainability- Business and Industry – Science and Technology for Sustainable Development- Performance indicators of sustainability and assessment mechanism- Constraints and barriers of Sustainable Development.

MODULE IV GREEN BUILDINGS 8

Introduction to Green Building- Energy- Water- Materials and Resources - Sustainable Sites and Land Use - Indoor Environmental Quality- Life Cycle Assessment- Energy, water and materials efficiency.

MODULE V ENERGY CONSERVATION AND EFFICIENCY 7

Energy savings- Energy Audit- Requirements- Benefits of Energy conservation-Energy conservation measures for buildings- Energy wastage- impact to the environment.

MODULE VI GREEN BUILDINGS DESIGN 8

Elements of Green Buildings Design- Foundation, Electrical, Plumbing, flooring, Decking, roofing, insulation, wall coverings, windows, siding, doors and finishing, LEED certification for Green Buildings, Green Buildings for sustainability.

L – 45; Total Hours –45

TEXT BOOKS:

1. Kirby, J., Okeefe, P., and Timber lake, “Sustainable Development”, Earthscan Publication, London, 1995.

REFERENCES:

1. Charles Kibert, J., “Sustainable Construction: Green Building Design and Delivery”, 2nd Edition, John Wiley and sons, 2007.

OUTCOMES:

At the end of the course, the students will be able to

- Explain the relationship between sustainability and emergence of green building practices.
- Address the economic, environmental, and social concerns.

GECX202	APPROPRIATE TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart students knowledge about the basics and applications of various appropriate technologies in the field of civil engineering.

MODULE I BASICS CONCEPTS 7

Back ground, Tools, Choices and Implications, Appropriate Technology Movement (an overview) - Basic design process, basic financial analysis-discounted cash flow, and energy fundamentals.

MODULE II APPROPRIATE TECHNOLOGY WITH REFERENCE TO BUILDING DESIGN 7

Appropriate Building Materials, Appropriate Energy Saving Techniques, Water Conservation (Indoor), Rain Water Harvesting.

MODULE III WATER, HEALTH AND SANITATION MANAGEMENT 7

Water Storage: Designing Dams and Pipelines, Appropriate Selection for Sanitation Technique, Sewerage, Communal Health and Waste Water Recycling.

MODULE IV WASTE MANAGEMENT 8

Types of Waste - Sources - Collections and On-Site Processing -Transferring Stations - Disposal Systems - Recycling.

MODULE V ENERGY EFFICIENT TECHNIQUES 8

Green building concepts-renewable energy sources- Solar – Steam and wind-Biofuels - Biogas – Electricity.

MODULE VI TECHNOLOGY POLICY 8

Government Policies- Energy Policy-Appropriate technology Development Centre-its function and responsibilities-Building policies-Case Studies.

L – 45; Total Hours –45

TEXT BOOKS:

1. Barrett Hazeltine and Christopher Bull, “Appropriate Technology: Tools Choices and Implications”, Academic Press, Orlando, USA, 1998.
2. Ken Darrow and Mike Saxenian, “Appropriate Technology Source Book : A Guide to Practical Books for Village and Small Community Technology”, Stanford, 1986.

REFERENCES:

1. Richard Heeks, “Technology and Developing Countries: Practical Applications Theoretical Issues”, 1995.
2. John Pickford, “The Worth of Water : Technical Briefs on Health, Water and Sanitation”, Intermediate Technology Publications, 1998.

OUTCOMES:

- At the end of the course, the students will be able to use suitable technologies for various conditions for sustainable development.

GECX203 ENGINEERING SYSTEM MODELLING AND SIMULATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn the concepts, techniques, tools for modeling and simulation systems and environments through the use of computers.
- To study the various aspects of discrete dynamic, stochastic systems modeling and conducting experiments with those models on a computer.

MODULE I INTRODUCTION 6

Systems – Modelling – types – systems components – Steps in model building- Simulation Algorithms and Heuristics; Simulation Languages.

MODULE II RANDOM NUMBERS / VARIATES 7

Random numbers – methods of generation – random variates for standard distributions like uniform, exponential, Poisson, binomial, normal etc. – Testing of Random variates – Monte Carlo Simulation.

MODULE III MODELLING PROCESS 7

Primitive Models : Establishing relationships via physical laws; Establishing relationships via curve fitting; Parameters estimation problems; Elementary state transition models.

MODULE IV DESIGN OF SIMULATION EXPERIMENTS 9

Steps on Design of Simulation Experiments – Development of models using of Highlevel language for systems like Queuing, Inventory, Replacement, Production etc., – Model validation and verification, Output analysis.

MODULE V SIMULATION LANGUAGES 10

Need for simulation Languages – Comparisons & Selection of Languages – GPSSARENA- EXTEND – Study of any one of the languages.

MODULE VI CASE STUDIES USING SIMULATION LANGUAGES 6

Case Study using simulation languages

L – 45; Total Hours –45

REFERENCES:

1. Law, A.M., & W.D. Kelton, “Simulation Modelling and Analysis”, McGraw

Hill, Singapore, 2000.
2. Harrel, C.R., et. al., “System Improvement Using Simulation”, 3rd Edition, JMI Consulting Group and ProModel Corporation, 1995.
3. Harrel, C.R. & T. Kerim, “Simulation Made Easy, A Manager’s Guide”, IIE Press, 1995.
4. Geoffrey Gordon, “Systems Simulation”, Prentice Hall, 2002.
5. David Kelton, Rondall P Sadowski, David T Sturrock, “Simulation with Arena”, Mc Graw Hill, 2004.

OUTCOMES:

The student should be able to

- Model and simulate systems and environments through the use of computers.
- Conduct experiments with discrete dynamic, stochastic system models on a computer.

GECX204 VALUE ANALYSIS AND ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To get acquainted with value analysis and engineering tool for productivity improvement.
- To understand and analyze the theory and methodology of Value Engineering.

MODULE I VALUE ENGINEERING BASICS 8

Origin of Value Engineering, Meaning of value, Definition of Value Engineering and Value analysis, Difference between Value analysis and Value Engineering, Types of Value, function - Basic and Secondary functions, concept of cost and worth, creativity In Value Engineering.

MODULE II VALUE ENGINEERING JOB PLAN AND PROCESS 6

Seven phases of job plan, FAST Diagram as Value Engineering Tool, Behavioural and organizational aspects of Value Engineering, Ten principles of Value analysis, Benefits of Value Engineering.

MODULE III ORIENTATION AND INFORMATION PHASES 8

Launching Value Engineering project work - Objectives and Targets - VE Project work: a time-bound programme - Projects and Teams - Time Schedule - Co-ordination - Consultant. Technical data - Marketing related information - Competition profile - Cost data - Materials Management related information - Quality related information - Manufacturing data.

MODULE IV FUNCTION ANALYSIS AND CREATIVE PHASES 9

Objectives - Function definition - Classification of functions - Higher level functions – Function – Cost – Function – Worth - Value Gap - Value index - How to carry out Function Analysis? – Fast Diagraming - Cost Modelling.

Creativity - How to improve creativity of an individual? – How to promote creativity in the organisation? - Obstacles to Creativity - Mental road blocks - Creativity killer phrases. Positive thinking - Ideas stimulators - Creativity techniques - Brainstorming.

MODULE V EVALUATION, INVESTIGATION AND RECOMMENDATION 6

Paired comparison and Evaluation Matrix techniques - Criteria for selection of

VE solutions. Design – Materials – Quality – Marketing – Manufacturing - Preview session. The report - presentation.

MODULE VI IMPLEMENTATION PHASE AND CASE STUDIES 8

Design department - Materials department - Production Planning & Control - Quality Control – Manufacturing – Marketing - Need for co-ordinated teams - The Action Plan. Value Engineering case studies.

L – 45; Total Hours –45

TEXT BOOKS:

1. Mudge, Arthur E. “Value Engineering- A systematic approach”, McGraw Hill, New York, 2000.
2. Kumar S, Singh R K and Jha J K (Ed), “Value Engineering”, Narosa Publishing House, 2005.

REFERENCES:

1. Park RJ, “Value Engineering: A Plan for Invention”, St.Lucie Press, New York, 1999.
2. Lawrence, D.M., “Techniques of Value Analysis and Engineering”, McGraw Hill 1988.
3. George, E.D., “Engineering Design: a Material and Processing Approach”, McGraw Hill, 1991.
4. Heller, D.E., “Value Management, Value Engineering and Cost Reduction”, Addison Wesley, 1988.

OUTCOMES:

- The student will be able to realize the value of products, processes and implement value analysis to achieve productivity improvement.

GECX205 INDUSTRIAL SAFETY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the various safety measures to be taken in different industrial environments.

MODULE I SAFETY MANAGEMENT **7**

Evolution of modern safety concept- Safety policy - Safety Organization - line and staff functions for safety- Safety Committee- budgeting for safety. safety education and training.

MODULE II SAFETY IN MANUFACTURING **7**

Safety in metal working-Machine guarding -Safety in welding and gas cutting - Safety in cold forming and hot working of metals -Safety in finishing, inspection and testing -Regulation.

MODULE III SAFETY IN CONSTRUCTION **8**

General safety consideration in Excavation, foundation and utilities – Cordoning – Demolition – Dismantling –Clearing debris – Types of foundations – Open footings.

Safety in Erection and closing operation - Safety in typical civil structures – Dams-bridges-water Tanks-Retaining walls-Critical factors for failure-Regular Inspection and monitoring.

MODULE IV ELECTRICAL SAFETY **8**

Electrical Hazards – Energy leakage – Clearance and insulation – Excess energy – Current surges – Electrical causes of fire and explosion – National electrical Safety code.

Selection of Environment, Protection and Interlock – Discharge rods and earthing device – Safety in the use of portable tools - Preventive maintenance.

MODULE V SAFETY IN MATERIAL HANDLING **8**

General safety consideration in material handling devices - Ropes, Chains, Sling, Hoops, Clamps, Arresting gears – Prime movers.

Ergonomic consideration in material handling, design, installation, operation and

maintenance of Conveying equipments, hoisting, traveling and slewing mechanisms.

Storage and Retrieval of common goods of shapes and sizes in a general store of a big industry.

MODULE VI SAFETY EDUCATION AND TRAINING 7

Importance of training-identification of training needs-training methods – programme, seminars, conferences, competitions – method of promoting safe practice - motivation – communication - role of government agencies and private consulting agencies in safety training – creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign – Domestic Safety and Training.

L – 45; Total Hours –45

REFERENCES:

1. Krishnan N.V, “Safety Management in Industry”, Jaico Publishing House, Bombay, 1997.
2. Blake R.B., “Industrial Safety”, Prentice Hall, Inc., New Jersey, 1973.
3. Fulman J.B., “Construction Safety, Security, and Loss Prevention”, John Wiley and Sons, 1979.
4. Fordham Cooper W., “Electrical Safety Engineering”, Butterworths, London, 1986.
5. Alexandrov M.P., “Material Handling Equipment”, Mir Publishers, Moscow, 1981.

OUTCOMES:

Students would be able to

- Acquire knowledge on various safety Hazards.
- Carry out safety measures for different industrial environments.

GECX206 ADVANCED OPTIMIZATION TECHNIQUES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the various advanced optimization tools.
- To provide an understanding to deal with ill identified and fuzzy problems.

MODULE I INTRODUCTION **7**

Review of conventional optimization techniques - limitations - limitation of exhaustive search - need for artificial intelligence - bio mimicking methods

MODULE II HEURISTICS METHODS **8**

Introduction – Advanced methods of algorithm design: Greedy method, Backtracking method, Divide and Conquer method – Dynamic programming – Heuristics exploration algorithms – Greedy search - Local search – Hill climbing – Tabu search – Gradient search – Beam search – Simulated Annealing.

MODULE III GENETIC ALGORITHM **7**

Introduction - Basics of GA – Population – Reproduction – Cross over – Mutation -genetic algorithms in search, optimization and machine learning-practical genetic algorithms.

MODULE IV ANT COLONY OPTIMIZATION **8**

Introduction: Ant Colony Optimization – Meta-heuristic Optimization – History – The ACO Meta-heuristic – ACO Algorithms: Main ACO – Ant system – Ant colony system – Max-Min Ant system – Applications: Routing in telecommunication networks – Travelling salesmen – Graph Coloring – Advantages & Disadvantages

MODULE V FUZZY LOGIC AND ANN **8**

Fuzzy logic, knowledge representation and inference mechanism – Fuzzy and expert control – standard Takagi-Sugeno mathematical characterizations – Design example – Biological foundations to intelligent systems: Artificial neural networks, Back-propagation networks, Radial basis function networks, and recurrent networks.

MODULE VI IMPLEMENTATIONS & APPLICATIONS 7

Reduction of size of an optimization problem – multilevel optimization – parallel processing – multi objective optimization – Job shop scheduling – Vehicle scheduling – Line balancing – Sensor integration.

L – 45; Total Hours –45

REFERENCES:

1. Singiresu S. Rao, “Engineering optimization – Theory and practices”, John Wiley and Sons, 1996.
2. Ravindran – Phillips –Solberg, “Operations Research – Principles and Practice, John Wiley and Sons, 1987.
3. Fredrick S.Hillier and G.J.Liberman, “Introduction to Operations Research”, McGraw Hill Inc. 1995.
4. Kalymanoy Deb, “Optimization for Engineering Design”, PHI, 2003
5. Christos H. Papadimitriou, Kenneth Steiglitz, Combinatorial Optimization, PHI 2006

OUTCOMES:

At the end of the course student will be able to

1. Formulate a real life situation as an optimization the problem.
2. Identify the appropriate solution methodology and provide a solution

GECX207	MATLAB SIMULINK	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Teach students how to mathematically model engineering systems
- Teach students how to use computer tools to solve the resulting mathematical models. The computer tool used is MATLAB and the focus will be on developing and solving models of problems encountered in engineering fields

MODULE I INTRODUCTION MATLAB DATA PRESENTATION 7

Vectors, Matrices -Vector/Matrix Operations & Manipulation- Functions vs scripts- Making clear and compelling plots-Solving systems of linear equations numerically and symbolically- Least squares regression -Curve fitting.

MODULE II MATLAB PLOT FUNCTION 7

Introduction- Plot Function – Animation- 3D Plots-Customizing Plots – Plot Applications- Saving &Painting Plots.

MODULE III ROOT FINDING AND COMPUTER REPRESENTATION OF NUMBERS 7

Linearization and solving non-linear systems of equations- The Newton-Rapson method- Integers and rational numbers in different bases- Floating point numbers- Round off and errors in basic arithmetic-Significant digits when reporting results

MODULE IV ORDINARY DIFFERENTIAL EQUATIONS 8

Numerical integration and solving 1^{st} order, ordinary differential equations (Euler's method and Runge-Kutta)- Use of ODE function in MATLAB

MODULE V NON-LINEAR DIFFERENTIAL EQUATIONS 8

Converting 2^{nd} order and higher ODEs to systems of 1^{st} order ODEs- Solving systems of ODEs via Euler's method and Runge-Kutta)- Solving single and systems of non-linear differential equations by linearization-Use of the function ODE in MATLAB to solve differential equations

MODULE VI INTRODUCTION OF SIMULINK 8

Simulink & its relations to MATLAB – Modeling a Electrical Circuit- Modeling a fourth order differential equations- Modeling the solution of three equations with three unknowns- Representing a model as a subsystem-Simulink demos.

L – 45; Total Hours –45

REFERENCES:

1. Griffiths D V and Smith I M, Numerical Methods for Engineers, Blackwell, 1991.
2. Laurene Fausett, Applied Numerical Analysis Using MATLAB, Pearson 2008.
3. Moin P, Fundamentals of Engineering Numerical Analysis, Cambridge University Press, 2001.
4. Wilson HB, Turcotte LH, Advanced mathematics and mechanics applications using MATLAB. CRC Press, 1997
5. Ke Chen, Peter Giblin and Alan Irving , Mathematical Exploration with MATLAB, Cambridge University Press, 1999.

OUTCOMES:

At the end of this unit students will be able to:

1. Use Matlab as a convenient tool for solving a broad range of practical problems in engineering from simple models to real examples.
2. Write programs using first principles without automatic use of built-in ones.
3. Write programs for solving linear and nonlinear systems, including those arising from boundary value problems and integral equations, and for root-finding and interpolation, including piecewise approximations.
4. Be fluent in exploring Matlab's capabilities, such as using matrices as the fundamental data-storage unit, array manipulation, control flow, script and function m-files, function handles, graphical output.
5. Make use of Maltab visual capabilities for all engineering applications.
6. An ability to identify, formulate, and solve engineering problems. This will be accomplished by using MATLAB to simulate the solution to various problems in engineering fields

GECX208	EMBEDDED SYSTEMS AND ITS APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide a detailed overview of embedded system.
- To equip students with the software development skills necessary for practitioners in the embedded systems field.
- To understand entire software development lifecycle and examine the various issues involved in developing software for embedded systems.

MODULE I EMBEDDED SYSTEMS OVERVIEW 8

Introduction –Embedded Systems vs. General computing systems- Fundamental Components of embedded systems- Characteristics- Challenges-Examples-Embedded System design process.

MODULE II EMBEDDED COMPUTING PLATFORM 8

Overview of Processors and hardware units in an embedded system-CPU buses – Memory devices –Memory types- I/O devices – Designing with computing platforms-Consumer electronics architecture-Design example: Alarm clock.

MODULE III REAL TIME EMBEDDED SYSTEMS 8

Programming embedded systems in assembly and C – Real time systems – Hard and Soft real time systems- Need for RTOS in Embedded Systems- Multiple tasks and processes –Context switching-Scheduling policies- Interprocess communication and synchronization.

MODULE IV EMBEDDED SOFTWARE DEVELOPMENT PROCESS and TOOLS 8

Development process of an embedded system-software modules and tools for implementation of an embedded system- Integrated development environment- Host and target machines-cross compiler-cross assembler-Choosing right platform.

MODULE V PROGRAM MODELING IN EMBEDDED SYSTEMS 8

Program Models – Data Flow Graph model-control DFG model-Synchronous DFG model- Finite state machines- UML modeling – UML Diagrams.

MODULE VI EMBEDDED SYSTEMS APPLICATION 5

Application specific embedded system – case study: digital camera hardware and software architecture, embedded systems in automobile, embedded system for a smart card.

Total Hours –45

TEXT BOOKS:

1. Marilyn Wolf , "Computers as components", Elsevier 2012.
2. Shibu. K.V, “Introduction to Embedded Systems”, Tata Mcgraw Hill,2009.
3. Rajkamal, "Embedded Systems Architecture, Programming and Design",1st Reprint,Tata McGraw-Hill, 2003
4. Frank Vahid and Tony Gwargie, "Embedded System Design", John Wiley & sons, 2002.

REFERENCES:

1. Sriram V Iyer and PankajGupta ,”Embedded Realtime Systems Programming ”Tata McGraw-Hill,2008
2. Qing Li and Carolyn Yao," Real-Time Concepts for Embedded Systems", CMPBooks, 2003
3. David E.Simon, "An Embedded Software Primer", Pearson Education, 2003

OUTCOMES:

On completion of this course, the students will be able to

- Identify the suitable processor and peripherals in embedded applications
- Develop embedded programs in assembly and c
- Choose the right platform for designing an embedded system
- Explore different scheduling mechanism in rtos
- Design the program model for embedded applications.
- Analyze different domain specific applications in embedded systems.

GECX209 USABILITY ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

The objective of this course is

- To understand the emerging concept of usability, requirements gathering and analysis.
- To learn about human computer interaction with the help of interfaces that has high usability.

MODULE I INTRODUCTION 6

Cost Savings – Usability Now – Usability Slogans – Discount Usability Engineering – Usability – Definition – Example – Trade-offs – Categories – Interaction Design – Understanding & Conceptualizing Interaction – Cognitive Aspects.

MODULE II USER INTERFACES 8

Generation of User Interfaces – Batch Systems, Line Oriented Interfaces, Full Screen Interfaces, Graphical User Interfaces, Next Generation Interfaces, Long Term Trends – Usability Engineering Life Cycle – Interfaces – Data Gathering – Data Analysis Interpretation and Presentation.

MODULE III INTERACTION DESIGN 8

Process of Interaction Design - Establishing Requirements – Design,Prototyping and Construction - Evaluation and Framework.

MODULE IV USABILITY TESTING 8

Usability Heuristics – Simple and Natural Dialogue, Users' Language, Memory Load, Consistency, Feedback, Clearly Marked Exits, Shortcuts, Error Messages, Prevent Errors, Documentation, Heuristic Evaluation – Usability Testing - Test Goals and Test Plans, Getting Test Users, Choosing Experimenters, Ethical Aspects, Test Tasks, Stages of a Test, Performance Measurement, Thinking Aloud, Usability Laboratories.

MODULE V USABILITY ASSESSMENT METHODS 8

Observation, Questionnaires and Interviews, Focus Groups, Logging Actual Use, User Feedback, Usability Methods – Interface Standards - National, International and Vendor Standards, Producing Usable In-House Standards.

MODULE VI USER INTERFACES 7

International Graphical Interfaces, International Usability Engineering, Guidelines for Internationalization, Resource Separation, Multilocale Interfaces – Future Developments – Case Study.

L – 45; Total Hours –45

TEXT BOOKS:

1. Yvonne Rogers, Helen Sharp, Jenny Preece, “Interaction Design: Beyond Human - Computer Interaction”, John Wiley & Sons, 3rd Edition, 2011 (Module I, II, III).
2. Jakob Nielsen, “Usability Engineering”, Morgan Kaufmann Academic Press, 1994. (Module I – VI).

REFERENCES:

1. Ben Shneiderman, Plaisant, Cohen, Jacobs, “Designing the User Interface: Strategies for Effective Human Interaction”, Pearson Education, 5th Edition, 2010.
2. Laura M. Leventhal, Julie A. Barnes, “Usability Engineering: Process, Products, and Examples”, Pearson/Prentice Hall, 2008

OUTCOMES:

Students who complete this course will be able to

- build effective, flexible and robust user interfaces.
- translate system requirements into appropriate human/computer interaction sequences.
- choose mode, media and device for the application requirements.

GECX210	SUPPLY CHAIN MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the various decision phases in a supply chain
- To be aware of the Supply Chain and its drivers
- To design Supply Chain Network
- To build a aggregate plan in supply chain
- To understand Sourcing Decisions in Supply Chain
- To comprehend the influence of Information technology in Supply Chain

MODULE I INTRODUCTION TO SUPPLY CHAIN 7

Understanding Supply Chain - Decision phases - Supply chain performance - Competitive and supply chain strategies - Achieving strategic fit - Expanding strategic scope

MODULE II SUPPLY CHAIN DRIVERS AND DESIGN 7

Drivers of supply chain performance – Designing distribution network - Network Design in the Supply Chain - Network design in Uncertain Environment

MODULE III AGGREGATE PLANNING AND MANAGING SUPPLY, DEMAND AND INVENTORY 8

Aggregate Planning in a Supply chain: role - Managing Supply - Managing Demand in Supply Chain – Cycle and Safety inventory in supply chain – Level of product availability.

MODULE IV MANAGING INVENTORY IN SUPPLY CHAIN 8

Managing Economies of Scale in a Supply Chain : Cycle Inventory- Managing uncertainty in a Supply Chain Safety Inventory- Determining optimal level of Product Availability

MODULE V SOURCING AND TRANSPORTATION 8

Sourcing decision in supply chain - Third and Fourth – Party Logistics providers - Supplier scoring and assessment - Transportation in a Supply Chain – Risk and Trade-offs in transportation design.

MODULE VI INFORMATION TECHNOLOGY IN A SUPPLY CHAIN 7

Information technology in a supply chain – CRM, ISCM, SRM in supply chain -

Over view of recent trends in Supply Chain: e-SRM, e-LRM, e-SCM.

L – 45; Total Hours –45

REFERENCES:

1. Sunil Chopra and Peter Meindl, “Supply Chain Management-Strategy Planning and Operation”, Pearson Education, 5th Indian Reprint, 2013.
2. Jananth Shah “Supply Chain Management – Text and Cases“ Pearson Education, 2008.
3. Altekar Rahul V, “Supply Chain Management-Concept and Cases”, Prentice Hall India, 2005.
4. Monczka et al., “Purchasing and Supply Chain Management”, Thomson Learning, 2nd Edition, 2nd Reprint, 2002.

OUTCOMES:

- After taking up the course the student will be able to brighten his prospects of taking up a career on supply chain management.
- The student decision making capability specific to supply chain issues in an industry is improved.
- The student can plan a well defined execution of supply chain strategy in companies.
- The student will be able to design a optimal distribution network as per the demands of the industry.
- The student can also determine the most favorable transportation plan for a company.
- The student will also be able to bring in company from paper environment to paperless environment.

GECX211	SYSTEMS ANALYSIS AND DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To describe the phases of the systems development life cycle
- To teach the automated tools for system development
- To develop and evaluate system requirements.
- To explain the organizational issues in system implementation
- To teach the usability testing and electronic data interchange
- To elucidate the importance of System analysis and design in electronic commerce.

MODULE I FUNDAMENTALS OF SYSTEM DEVELOPMENT 8

System Concept – Characteristics – Elements of System – Types of System – Modern Approach to System Analysis and Design – System Development Life Cycle – Approaches to Improving Development – Tools for System Development – Succeeding as a System Analyst – Skills – Managing the Project.

MODULE II AUTOMATED TOOLS FOR SYSTEMS DEVELOPMENT 7

What is requirements determination? Fact finding techniques, Tools for documenting procedure and decision-CASE Tools-Need for CASE tools-Reverse engineering and reengineering- phases of the software life cycle-Ranking projects-Value Chain Analysis- Corporate Strategic Planning vs. Information Systems Planning.

MODULE III SYSTEM ANALYSIS 8

Determining System Requirements – Traditional Methods - Modern Methods – Radical Methods – Structuring System Requirements – Process Modeling – Data Flow Diagramming – Logic Modeling – Conceptual Data Modeling – E-R Modeling.

MODULE IV SYSTEM DESIGN 8

System Implementation – Software Application Testing – Installation – Documentation – Training and Support – Organizational Issues in Systems Implementation – Maintaining Information System – Conducting System

Maintenance.

MODULE V USABILITY AND MEASURING USER SATISFACTION **7**

Usability Testing-User satisfaction test- A tool for analyzing user satisfaction – Unified Modeling Language(UML)- Case study: System Design: Application in Human Resource-Financial Applications

MODULE VI SAD IN E-COMMERCE **7**

Systems analysis and design in the era of electronic commerce: B2B, B2C and C2C e-commerce -advantages and disadvantages of e-commerce. E-commerce system architecture – physical networks, logical network, World Wide Web, web-services - HTML, XML - case studies-El electronic data interchange: EDI standards - virtual private networks - XML and EDI

L – 45; Total Hours –45

REFERENCES:

1. Jeffrey A. Hoffer, Joey F. George, Joseph S. Valacich, “Modern Systems Analysis and Design”,Fifth Edition, Prentice Hall,March 2007.

2.Ned Kock, “Systems Analysis & Design Fundamentals” Sage South Asia, May 2008.

3. Joseph S. Valacich, Jeffrey A. Hoffer, Joey F. George, “Essentials Of System Analysis And Design” Prentice Hall , August 2005.

4. Rumbaugh et al, “Succeeding with Booch and Rambaugh Methods”, Addisson Wesley, second Edition, 1998.

5.Larman, C.,” Applying UML and Patterns. An introduction to Object-Oriented Analysis and Design”. Prentice-Hall PTR, 2002.

OUTCOMES:

- List the characteristics of the system and specify the approaches in the development of the system.
- Summarize the phases of the software life cycle
- Differentiate Corporate Strategic Planning and Information Systems Planning.
- Illustrate the system requirements through various modeling diagrams.
- Use tools and techniques for process and data modeling.
- Solve realistic systems analysis problems and perform user satisfaction test.

GECX212	ADVANCED MATERIALS	L	T	P	C
		3	0	0	3

OBJECTIVES:

To make the student conversant with

- Dielectric materials
- Magnetic materials
- Energy materials
- Nano materials
- Semi conductors
- Smart materials

MODULE I **8**

Dielectric Materials- Polarization and Mechanism-Internal or local field-Clausius-Mossotti relation- Dielectric loss- Temperature and Frequency effect- Measurement of Dielectric constant and loss using Scherring bridge- electric break down- ferro, piezo, pyroelectric materials and its application.

MODULE II **8**

Magnetic Materials- Terminology and classification of magnetic materials (Dia, Para, Ferro & Ferri) – Magnetic moments due to electrospin – Domain theory of Hysteresis – Heisenberg theory of Exchange Interaction (without derivation)- Structure and properties of Ferrites- Properties of Soft and Hard Magnetic Materials- Application: floppy disk, CD ROM, Magneto optical recording.

MODULE III **8**

Energy Materials (Nuclear) - Introduction to nuclear materials- Materials for nuclear fuel in fission and fusion reactors, Fissile and fertile materials- Control & Construction Materials for Nuclear reactors, Moderators, Heat Exchangers- Radiation proof materials- Brief discussion of safety and radioactive waste disposal.

MODULE IV **7**

Nano Materials- The nanosize range- classification of nanomaterials- processing of nanomaterials-properties of nanomaterials- mechanical, electrical, magnetic properties- other properties- carbon based nanomaterials- other nanomaterials and its application.

MODULE V **7**

Semiconductors- The energy gap in solids-Extrinsic Semiconductors- Intrinsic Semiconductors- Hall Effect in semiconductors- Application of Hall Effect- Basic ideas of compound semiconductors -Semiconductor materials- Fabrication of Integrated Circuits- Some semiconductor Devices

MODULE VI **7**

Smart materials- aerospace materials Ni and Co based super alloys, Special steels, Titanium alloys, Intermetallics, ceramics and their composites, New High strength material, Properties of Materials, Materials in Medical Applications, Stainless steel alloys,Cobalt based alloys, titanium based alloys, polymers

L – 45; Total Hours –45

REFERENCES:

1. Materials science and Engineering: A first course by V. RAGHAVAN, 6th ed., Eastern Economy edition,Prentice Hall of India,2015
2. Materials science and Engineering: An Introduction by William D. Callister Jr., 7th ed. John Wiley & Sons Inc. 2007
3. Material science by Dr.M.Arumugam, Anurasha agencies ,third revised edition ,2002

OUTCOMES:

Students will be able to know

- significance of dielectric materials
- types and applications of magnetic materials
- applications of nuclear materials for energy harvesting
- applications of nano materials
- significance of semi conductor devices
- applications of smart materials

GECX213	NATIONAL SERVICE SCHEME	L	T	P	C
		2	0	0	2

OBJECTIVES:

Primary Objective: Personality development through community service.
To achieve the above objective, the following should be adhered:

1. To provide an understanding about the aims, structure and programmes and activities of National Service scheme in terms of Nation Building
2. To develop certain basic skills for personality development through community development.
3. Understand the community in which they work and their relation
4. Identify the needs and problems of the community and involve them in problem-solving and
5. Practice national integration and social harmony.

MODULE I INTRODUCTION TO NSS 8

Orientation and structure of NSS,-Aims and Objectives of National Service Scheme- The history of NSS- Symbol and meaning- NSS hierarchy from national to college level – Role and responsibilities of various NSS functionaries

MODULE II PERSONALITY AND COMMUNITY DEVELOPMENT SKILLS 8

Importance of youth Leadership, Traits of Good Leadership and Personality Development. Role of youth in creating awareness through NSS Programmes on Health & Hygiene; Environmental Conservation and Enrichment for Sustainable Development; Sanitation and Swachh Bharat.

MODULE III UNDERSTANDING YOUTH 7

Definition and Profiles of youth categories, Youth Issues, Challenges and Opportunities for Youth, Youth as agent of social change & Community Mobilization .Role of Youth in Nation Building. National Youth Policy.

MODULE IV SOCIAL HARMONY AND NATIONAL INTEGRATION 7

National Integration, Various obstacles in the way of National Integration; such as caste, religion, language and provisional problems etc. Role of youth in Peace building and conflict resolution- Globalization and its Economic Social Political and

Cultural impacts.

L – 30; Total Hours –30

TEXT BOOKS:

1. National Service Scheme – A Youth Volunteers Programme for Under Graduate students as per UGC guidelines J.D.S.Panwar et al. Astral International. New Delhi.
2. National Service Scheme Revised Manual, 2006.Govt. of India. Ministry of Youth Affairs & Sports. New Delhi.
3. Social Problems in India, *Ram Ahuja.*

REFERENCES:

1. National Youth Policy-2014. Ministry of Youth Affairs & Sports. .Govt. of India

OUTCOMES:

On successful completion of this course-

- Students will have exposure to the the aims, structure and programmes and activities of National Service scheme in terms of Nation Building
- Students will be trained to skills for personality development through community development.
- Students will gain knowledge about national integration and social harmony.
- Students will be exposed to the role of youths in Nation building Students will gain

GECX214	AUTOMOTIVE POLLUTION AND CONTROL	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To have a fair knowledge in automotive pollution control.
- To understand the concept of formation and control techniques of pollutants like UBHC, CO, NOx, particulate matter and smoke for both SI and CI engine will be taught to the students.
- To know about the instruments for measurement of pollutants
- To get introduced about emission standards

MODULE I EMISSION FROM AUTOMOBILES 8

Sources of Air Pollution. Various emissions from Automobiles — Formation — Effects of ollutants on environment and human beings. Emission control techniques – Modification of fuel, after treatment devices. Emission standards. Automotive waste management, old vehicle disposal, recycling, tyre recycling

MODULE II SI ENGINE EMISSIONS AND CONTROL 9

Emission formation in SI Engines- Carbon monoxide & Carbon di oxide - Unburned hydrocarbon, NOx, Smoke —Effects of design and operating variables on emission formation – controlling of pollutants - Catalytic converters, Charcoal Canister, Positive Crank case ventilation system, Secondary air injection, thermal reactor

MODULE III CI ENGINE EMISSION AND CONTROL 8

Formation of White, Blue, and Black Smokes, NOx, soot, Effect of Operating variables on Emission formation — Fumigation, Split injection, Catalytic Coating, EGR, Particulate Traps, SCR, Fuel additives — Cetane number Effect.

MODULE IV NOISE POLLUTION FROM AUTOMOBILES 8

Sources of Noise — Engine Noise, Transmission Noise, vehicle structural Noise, aerodynamics noise, Exhaust Noise. Noise reduction in Automobiles — Encapsulation technique for noise reduction —Silencer Design.

MODULE V TEST PROCEDURES 6

Constant Volume Sampling I and 3 (CVSI &CVS3) Systems- Sampling Procedures — Chassis dynamometers - Seven mode and thirteen mode cycles for Emission Sampling.

MODULE VI EMISSION MEASUREMENTS 6

Emission analysers —NDIR, FID, Chemiluminesecent, Smoke meters, Dilution Tunnel, SHED Test, Sound level meters.

L – 45; Total Hours –45

TEXT BOOKS:

1. V.Ganesan, 'Internal combustion Engines', Tata McGraw Hill Book Co, Eighth Reprint, 2005.
2. Crouse and Anglin, 'Automotive Emission Control', McGraw Hill company., Newyork 1993.

REFERENCES:

1. G.P.Springer ad D.J.Patterson, Engine Emissions, Pollutant formation, Plenum Press, New York. 1986.
2. D.J.Patterson and N.A.Henin, 'Emission from Combustion Engine and their control', Anna Arbor Science Publication,1985.
3. L.Lberanek, 'Noise Reduction', Mcgrawhill Company., Newyork1993.
4. C.Duerson, 'Noise Abatment', Butterworths ltd., London1990.
5. A.Alexander, J.P.Barde, C.lomure and F.J. Langdan, 'Road traffic noise', Applied science publisher ltd., London,1987.

OUTCOMES:

On completion of the course student should be able to

- Identify the sources of emission from vehicles.
- Analyse the causes and effects of emissions.
- Analyse causes and effects of noise pollution
- Bring out solutions for control of emissions.
- Demonstrate the test procedures and emission norms.
- Select suitable instruments for measurement of emissions.

GECX215	MOTOR VEHICLE ACT, INSURANCE & POLICY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn about basic act and regulation followed for road vehicle
- To learn about systematic steps involved to get licence and registration of motor vehicle
- To learn arbour various types of motor vehicle polices and insurances

MODULE I BASIC RULES FOR ROAD VEHICLE 8

Display and Use of Number Plates- Attachment of number plates- Number plates in horizontal position- Removal of number plates on transfer- Hours prescribed for lighted lamps- Mounting of lamps and reflectors- Multiple beam headlamps- Daytime running lamps- Auxiliary driving lamps- Parking lamps- Brakes- Stopping distances- Emergency or parking brakes- Horn- Muffler- Mirrors- Inspection of motor vehicles- Standards of safety and repair

MODULE II LICENSING OF DRIVERS OF MOTOR VEHICLES 8

Necessity of driving licence- Age limit in connection with driving of motor vehicle-Responsibility of owners of motor vehicles-Restriction on the holding of driving licence-Grant of learner's licence-Grant of driving licence-Addition to driving licence- Renewal of driving licence-Revocation of driving licence on grounds of disease or disability-Driving licence to drive motor vehicle belonging to the central government- power of court to disqualify- suspension of driving licence in certain cases- suspension or cancellation of driving licence on convection- Endorsement.

MODULE III REGISTRATION OF MOTOR VEHICLE 7

Necessity for registration – Registration Where and how to be made- Special provision for registration of motor vehicle of diplomatic officers-Temporary registration- Production of vehicle at the time of registration- Refusal of registration- renewal of certificate of registration- effectiveness in India of registration- Change of residence or place of business-transfer of ownership-Suspension of registration – cancellation of registration suspended under section 53- certificate of fitness of transport vehicle-cancellation of registration.

MODULE IV INSURANCE OF MOTOR VEHICLE 8

Necessity for insurance against third party – Requirements of policies and limits of liability- - Duty of insurers to satisfy judgements and awards against person insured in respect of third party risks-Duty to give information as to insurance-Settlement between insurers and insured persons- transfer of certificate of insurance-production of certain certificates, licences and permit in certain cases-Special provisions as to compensation in case of hit and run motor accident – Types of motor polices

MODULE V CONTROL OF TRANSPORT VEHICLES 7

Power to State Government to control road transport- Transport authorities-General provision as to applications for permits- Application for stage carriage permit- Procedure of Regional Transport Authority in considering application for stage carriage permit- Scheme for renting of motor cabs- Application for private service vehicle permit- Procedure in applying for and granting permits- Duration and renewal of permits- Transfer of permit- Replacement of vehicles-Temporary permits

MODULE VI OFFENCES AND PUNISHMENT 7

Driving without holding an effective driving licence- Driving by an under-aged person (Minor driving vehicle)- Holding of a driving licence permitting it to be used by other person.- Driving a vehicle at an excessive speed- Driving or permitting to drive a vehicle carrying excess load- Driving dangerously / its Abetment Driving an uninsured vehicle

Rider and pillion rider failing to wear protective head gear (Helmet) -Violation of Mandatory Signs -.e-challan and spot challan

L – 45; Total Hours –45

TEXT BOOKS:

1. The motor vehicle act 1988, Universal law publishing co.cpvt ltd. Newdelhi 2011
2. A Commentary On The Motor Vehicles Act, 1988 by SUKHDEV AGGARWAL The Bright Law House, New Delhi

REFERENCES:

1. The Motor Vehicles Act, 1988 Along with Latest Case Law, Notifications

& Table of Offences and Punishments Asia Law House; 15th edition (2014)

2. Assessment of Compensation in Accidents under Motor Vehicles Act by Karkara Delhi Law House (2013)

OUTCOMES:

On completion of the course students should be able to

- Explain the analysis of rules and regulations for road vehicles
- Analyze the procedure for getting driving license for vehicles at national and international level
- Analyze the procedure for registration of vehicles.
- Analyze the procedure for Insurance of vehicles and claims.
- Analyze the procedure for obtaining Government Permits and renewal
- Analyze the consequences of not following the rules and regulations

GECX216	PRINCIPLES OF COMMUNICATION SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

To introduce the analog and digital modulation techniques.
To elaborate the working of communication receivers in the presence of noise.
To give an overview of various communication systems.

MODULE I LINEAR MODULATION 8

Baseband signals, Amplitude Modulation – Modulation Index, Power Transmitted, Double Side Band and Single Side Band AM, AM Modulators and AM Receivers, AM Radio systems, Frequency Division Multiplexing.

MODULE II ANGLE MODULATION 8

Frequency Modulation and Phase Modulation, Frequency deviation and modulation index, Bandwidth of FM, FM Modulators and FM receivers, FM Radio and FM Stereo Systems

MODULE III SAMPLING AND PULSE MODULATION 7

Sampling, Nyquist's Sampling Theorem, Pulse Modulations - PAM, PPM and PWM, Time Division Multiplexing, Bandwidth of TDM systems.

MODULE IV DIGITAL COMMUNICATION 7

Digital baseband data, Digital Modulations – ASK, FSK, PSK and QPSK. Digital Communication Transmitters and Receivers.

MODULE V NOISE 8

Sources of Noise, Thermal Noise, shot noise, White noise, Narrow band Noise, Effect of noise in communication, SNR, Receiver Noise Temperature and Noise Equivalent Bandwidth.

MODULE VI COMMUNICATION SYSTEMS & NETWORK 7

FM Radio Systems, Cellular Mobile network, Satellite Communications, Optical Fiber Communication.

L – 45; T – 0; Total Hours – 45

TEXT BOOKS:

1. A. Bruce Carlson, Paul B. Crilly, "Communication Systems", 5th Edition,

McGraw Hill Int., 2011.
2. B.P. Lathi, Zhi Ding, Hari M. Gupta, “Modern Digital and Analog Communication Systems”, 4th Edition, Oxford University Press, 2017.

REFERENCES:

5. Herbert Taub, Donald L. Schilling, Goutam Saha, “Principles of Communication Systems” 4th Edition, McGraw Hill Int. 2013.
6. Simon Haykin, “An Introduction To Analog And Digital Communications”, 1st Edition, Wiley India, 2010.
7. Simon Haykin , “Communications Systems” 4th Edition, Wiley India, 2006.
8. Hwei P. Hsu, “Analog and Digital Communications” 3rd Edition,

OUTCOMES:

On completion of the course students will be able to

3. Identify various communication systems and the corresponding modulation schemes.
4. Predict the characteristics of various analog and digital modulation schemes.
5. Interpret the effect of noise and bandwidth in a communication systems
6. Apply the Nyquist criteria for a given baseband signals.
7. Evaluate the performance of communication receivers.
8. Demonstrate the applications of common communication systems.

GECX217	LEAN MANAGEMENT	L	T	P	C
		3	1	0	4

OBJECTIVES:

The objective of the Course to make the student know about

- the basics of lean production management,
- how Lean principles are applied to the Construction industry to improve the operation management and product development.

MODULE I **8**

lean production? – Introduction, background, and lean thinking. Importance of philosophy, strategy, culture, alignment, focus and systems view. Discussion of Toyota Production System.

MODULE II **8**

Manufacturing systems – an overview of manufacturing strategies. Job shops, batch flow, and flexible manufacturing systems Flow production and lean production systems

MODULE III **7**

Value stream mapping in process design and product development Waste reduction - lead time reduction

Process cycle time and value-added vs. non-value added activities Optimum lot sizing

MODULE IV **8**

Lean production processes, approaches and techniques.—Importance of focusing upon flow. Tools -. Workplace organization – 5S. - Stability. - Just-In-Time – One piece flow – Pull. - . Cellular systems. - . Quick change and set-up reduction methods. f. Total productive maintenance. -. Poka-Yoke – mistake proofing, quality improvement. Standards. - . Leveling. - . Visual management. Just-in-time techniques – SMED and Takt Times - Standard work processes and line balancing Poka-yoke and pull systems material handling reduction and facilities planning

MODULE V **8**

Managing change in the lean organization Human resource management and the lean enterprise Employee involvement – Teams – Training – Supporting and encouraging involvement – Involving people in the change process -- communication -- Importance of culture. Startup of lean processes and examples of applications.

Sustaining improvement and change, auditing, follow-up actions.

7

MODULE VI

The lean enterprise and supply chain management Costs and risks of lean initiatives - Measuring lean initiatives

L – 45; Total Hours –45

TEXT BOOKS:

1. The Toyota Way Fieldbook, Jeffrey Liker and David Meier, McGraw-Hill, 2006. Lean Production Simplified, Pascal Dennis, Productivity Press, 2007.
2. Womack, James P., and Daniel T. Jones. Lean Thinking. New York, NY: Simon and Schuster, 2003. ISBN: 0743249275.
3. Murman, Earll. Lean Enterprise Value. New York, NY: Palgrave Macmillan, 2002. ISBN: 0333976975.

REFERENCES:

1. Readings at http://www.leanconstruction.org/readings.htm
2. Hopp, W. J., and Spearman, M. L. (2011). Factory Physics, Third Edition, Waveland Press, Long Grove, Il. 720 pp.

OUTCOMES:

The student will be able to

- Describe the manufacturing approaches employed and the background and philosophy of lean production.
- Illustrate the concept of waste reduction
- Apply evaluation techniques that can be used in preparation for and use in learn production activities.
- Select the tools that can be used implementing lean production in production operations.
- Discuss the importance of workplace organization, pull production, cellular arrangement and employee involvement, need for employee creativity
- Describe about the Methods for promoting success in implementing lean transformations

GECX218 GEOSPATIAL MODELING & ANALYSIS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To equip the students with fundamental representation and analysis of geospatial phenomena and provides foundations in methods and algorithms used in GIS analysis.
- To focus is on terrain modeling, geomorphometry, watershed analysis and introductory GIS-based modeling of landscape processes (water, sediment). The course includes analysis from lidar data, coastal change assessment and 3D visualization.

MODULE I INTRODUCTION TO GEOSPATIAL DATA 7

Mapping natural phenomena –Concept of continuous fields and discrete sampling – Units, projections, coordinate transformation – Georeferencing, geospatial formats, conversions, geospatial data abstraction library – Raster and vector representation, raster and vector conversions and resampling.

MODULE II DATA DISPLAY AND VISUALIZATION 7

Display of continuous and discrete data, use of color, shading, symbols, to extract the spatial pattern and relationships – 3D visualization: multiple surfaces and volumes, 3D vector objects – visualization for data analysis (lighting, scaling, transparency, cutting planes, animations) – view/create maps/post your data on-line (Google Earth/Maps, GPS visualizer)

MODULE III GEOSPATIAL ANALYSIS 7

Foundations for analysis of continuous and discrete phenomena – neighborhood operations and buffers – analysis and modeling with map algebra – cost surfaces and least cost path – spatial interpolation and approximation (gridding)

MODULE IV TERRAIN MODELING AND ANALYSIS 9

terrain and bathymetry mapping – mathematical and digital representations (point clouds, contour, raster, TIN) – DEM and DSM, working with multiple return lidar data – spatial interpolation of elevation data and topographic analysis, line of sight, view shed analysis – solar irradiation, photovoltaic energy potential, time series of elevation data, analysis of coastal change.

MODULE V FLOW TRACING, WATERSHED ANALYSIS AND LANDFORMS 8

Methods for flow routing and flow accumulation – Extraction of stream networks – Extraction of watershed boundaries and building watershed hierarchies – feature extraction, types of landforms.

MODULE VI MODELING OF GEOSPATIAL PROCESSES 7

Model formulation, input data processing – introduction to GIS-based hydrologic, erosion and environmental modeling – Geocomputational methods, including agent-based modeling, artificial neural networks and evolutionary computing.

L – 45; T – 0; Total Hours –45

TEXT BOOKS:

1. Hassan A, Karimi (2017), *Geospatial Data Science Techniques and Applications*, CRS Press & Co.
2. Sudipto Banerjee, Bradley P, Carlin, Alan E. Gelfand (2014), *Hierarchical Modeling and Analysis for Spatial Data*, CRS Press & Co.

REFERENCES:

1. Maguire, D., M. Batty, and M. Goodchild. 2015. GIS, Spatial analysis, and modeling. ESRI Press (G70.212 .G584 2005)
2. Zeiler, M. 2010. Modeling Our World: The ESRI Guide to Geodatabase Design. Second Ed. ESRI Press, Redlands, California

OUTCOMES:

On successful completion of this course,

- Students will be able to apply the basic concepts of Conceptualize models as representations of real life systems with inputs, outputs, and processes.
- Students will have gained knowledge in spatial tools to make simulations and predictions of real life phenomena.
- Students will have synthesized knowledge about Apply, integrate, and develop models with geospatial data through a GIS.
- Students will have an overview of Evaluate models in terms of accuracy, sensitivity, and uncertainty.
- Students will have Use of a system-based approach for problem solving, with an emphasis on sustainability.

B.S. Abdur Rahman Crescent Institute of Science & Technology

Deemed to be University u/s 3 of the UGC Act, 1956

REGULATIONS 2017

CURRICULUM AND SYLLABI

B.TECH.

COMPUTER SCIENCE AND ENGINEERING

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

VISION AND MISSION

VISION

The vision of the Department of Computer Science and engineering is to impart quality education, inculcate professionalism and enhance the problem solving skills of the students in the domain of Computer Science and Engineering with a focus to make them industry ready, involve in possible areas of research, to pursue and have continual professional growth.

MISSION

- To equip the students with strong fundamental concepts, analytical capability, programming and problem solving skills.
- To create an academic environment conducive for higher learning through faculty training, self learning, sound academic practices and research endeavors.
- To provide opportunities in order to promote organizational and leadership skills in students through various co-curricular and extra – curricular activities
- To make the students industry ready and to enhance their employability through training and internships.
- To improve department industry collaboration through interaction including participation in professional society activities, guest lecturers and industrial visit.

PROGRAMME EDUCATIONAL OBJECTIVES

- To introduce the fundamentals of science and engineering concepts essential for a computer engineer
- To inculcate the knowledge of mathematical foundations and algorithmic principles for effective problem solving
- To provide knowledge in computer science, modeling & design of computer based systems
- To impart knowledge to analyze, design, test and implement software required for various applications
- To hone personality skills, trigger social commitment and inculcate societal responsibilities.

PROGRAMME OUTCOMES

PO1: Analyse and build models applying the knowledge of mathematics, statistics, electronic, electrical and computer science discipline and solve the problem.

PO2: Identify the sources of information for data collection, design and conduct the experiments and interpret the result.

PO3: Think out-of-the box and solve the real time problems using their creativity in designing human friendly software systems.

PO4: Comprehend computer engineering concepts of the new research developments and apply them to develop relevant software and hardware products.

PO5: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: Apply the computing knowledge to solve the socially relevant problems.

PO7: Understand the impact of engineering solutions in global, economic, environmental, societal context and apply it in exploring the new developments, research trends and involve them in research.

PO8: Develop professional integrity by understanding and appreciating professional, legal, ethical, cyber security and related issues and act with responsibility.

PO9: Communicate, collaborate and work as a team by involving in the group projects of multi-disciplinary nature.

PO10: To prepare documents as per the standards and present effectively to improve software documentation skills.

PO11: Apply the hardware and software project management techniques to estimate the time and human resources required to complete computer engineering projects.
PO12: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes

PSO1: Understand, analyze and develop essential proficiency in the areas related to algorithms, system software, multimedia, web design, big data analytics, networking and apply the knowledge to solve practical problems.
PSO2: Apply standard practices and strategies in hardware and software project development using open-ended programming environments for successful career and entrepreneurship.

B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE AND TECHNOLOGY

B.TECH. COMPUTER SCIENCE ENGINEERING

CURRICULUM & SYLLABUS, REGULATIONS 2017

SEMESTER I

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	BS	MAC 1181	Differential Calculus and Geometry	3	1	0	4	
2.	HS	ENC 1181/ ISC 1181/ LNC 1181/ LNC 1182 / LNC 1183	English / Arabic / Mandarin / German / Japanese	3	0	0	3	
3.	BS	PHC 1181	Physics	3	0	2	4	
4.	BS	CHC 1181	Chemistry	3	0	2	4	
5.	ESF	GEC 1101	Engineering Graphics	2	0	2	3	
6.	ESF	GEC 1102	Engineering Design	2	0	0	2	
7.	ESF	GEC 1103	Basic Engineering Practices Laboratory	0	0	2	1	
8.	ESF	GEC 1104	Computer Programming I	1	0	2	2	**23**

SEMESTER II

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	BS	MAC 1281	Advanced Calculus	3	1	0	4
2.	BS	-	Physics Elective	2	0	2	3
3.	BS	-	Chemistry Elective	2	0	2	3
4.	ESF	GEC 1211	Basic Engineering Mechanics	3	1	0	4
5.	BS	GEC 1212	Environmental Studies	2	0	0	2
6.	ESF	GEC 1213	Computer Programming II	1	0	2	2

7.	EC	CSC 1211	Digital System	3	0	2	4	
8.	EC	CSC 1212	Python Programming	2	0	0	2	**24**

SEMESTER III

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	BS	MAC 2181	Partial Differential Equations and Transforms	3	1	0	4	
2.	HS	-	Humanities Elective I	2	0	0	2	
3.	HS	ENC 2181	Oral Communication	0	0	2	1	
4.	EC	CSC 2101	Data Structures	3	1	0	4	
5.	EC	CSC 2102	Computer Networks	3	0	2	4	
6.	EC	CSC 2103	Software Engineering	3	0	0	3	
7.	EC	CSC 2104	Object Oriented Programming	3	0	0	3	
8.	EC	CSC 2105	Data structures Lab	0	0	2	1	
9.	EC	CSC 2106	Object Oriented Programming Lab	0	0	2	1	**23**

SEMESTER IV

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	BS	-	Mathematics Elective I	3	1	0	4
2.	HS	-	Humanities Elective II	2	0	0	2
3.	HS	ENC 2282	Written Communication	0	0	2	1
4.	EC	CSC 2211	Computer architecture and microprocessor	3	0	0	3
5.	EC	CSC 2212	Analysis of Algorithms	3	1	0	4
6.	EC	CSC 2213	Network Security and Cryptography	3	0	0	3
7.	EC	CSC 2214	Database Management Systems	2	0	0	2
8.	EC	CSC 2215	DBMS Lab	0	0	2	1

9.	EC	CSC 2216	Security Lab	0	0	2	1	
10.	PE		Programme Elective ##1				3*	**24**

SEMESTER V

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	MS	MSC 3181 MSC 3182	Leadership and CEO Training/ Social Entrepreneurship	3	0	0	3	
2.	GE	-	General Elective I	3	0	0	3	
3.	HS	ENC3181	Communication & soft skill – I Career Choice	0	0	2	1	
4.	EC	CSC 3101	Operating Systems	3	0	0	3	
5.	EC	CSC 3102	Web Development using JAVA	3	0	0	3	
6.	EC	CSC 3103	Artificial Intelligence and Machine Learning	3	0	0	3	
7.	EC	CSC 3104	Web Development Lab	0	0	2	1	
8.	PE		Programme Elective ##2				6**	**23**

SEMESTER VI

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	EF	MSC 3181 MSC 3182	Leadership and CEO Training/ Social Entrepreneurship	3	0	0	3
2.	BS	-	Mathematics Elective II	2	0	0	2
3.	HS	ENC3281	Communication and soft skill – II Confidence Building	0	0	2	1
4.	EC	CSC 3211	Big Data Analytics	3	0	0	3
5.	EC	CSC 3212	Distributed Computing	3	0	0	3
6.	EC	CSC 3213	Graph Theory and Application	3	1	0	4
7.	EC	CSC 3214	Big Data Analytics Tools Lab	0	0	2	1
8.	EC	CSC 3215	Mobile Application Development Lab	0	0	2	1

9.	PE	-	Programme Elective ##3	6**	**24**

SEMESTER VII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	GE	-	General Elective II	3	0	0	3	
2.	EC	CSC 4101	Software project management	3	0	0	3	
3.	EC	CSC 4102	Compiler Design	3	0	0	3	
4.	EC	CSC 4103	Cloud Computing	3	0	2	4	
5.	EC	CSC 4104	Compiler Lab	0	0	2	1	
6.	EC	CSC 4105	Internship	0	0	0	1*	
7.	PE	-	Programme Elective ##4				9**	**24**

SEMESTER VIII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	EC	CSC 4211	Project Work	0	0	24	12	**12**

Total credits – 177

* Industrial training will be undertaken during Third year summer vacation for 15 days. The credit will be awarded in the 7th Semester.

ELECTIVE LIST

SEMESTER IV

Programme Elective ##1 (3 Credits*)

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	CSC X201	Multimedia and Animation	3	0	0	3
2.	PE	CSC X202	VFX	2	0	0	2
3.	PE	CSC X203	Digital Transmission	3	0	0	3
4.	PE	CSC X204	Information Technology in Organization	3	0	0	3
5.	PE	CSC X205	Innovation and New product development	3	0	0	3
6.	PE	CSC X206	Fundamentals of Computer Forensics	2	0	0	2
7.	PE	CSC X207	Open Source Technologies	2	0	2	3
8.	PE	CSC X208	User Interface Design	2	0	0	2
9.	PE	CSC X209	Stress Management	1	0	0	1
10.	PE	CSC X210	Information Ethics	1	0	0	1

SEMESTER V

Programme Elective ##2 (3+3 Credits*)

Elective 1 (3 Credits*)

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	CSC X101	2D Character Animation	2	0	0	2
2.	PE	CSC X102	Image processing	2	0	2	3
3.	PE	CSC X103	Multimedia Application Development	2	0	0	2
4.	PE	CSC X104	3D Animation	2	0	2	3
5.	PE	CSC X105	Advanced Computer Graphics	2	0	2	3

6.	PE	CSC X106	Multimedia Design program	2	0	2	3
7.	PE	CSC X107	Network Modeling	3	0	0	3
8.	PE	CSC X108	Cellular and Wireless Networks	3	0	0	3
9.	PE	CSC X109	Network Management	2	0	0	2
10.	PE	CSC X110	Network Simulators	1	0	0	1
11.	PE	CSC X111	Agile practices	1	0	0	1
12.	PE	CSC X112	Software testing	2	0	0	2
13.	PE	CSC X113	Software Requirements and Modeling	2	0	0	2
14.	PE	CSC X114	Theory of Computation	3	0	0	3
15.	PE	CSC X115	Internet of Things	2	0	0	2
16.	PE	CSC X116	Cognitive Science	2	0	0	2
17.	PE	CSC X117	Virtualization Techniques	3	0	0	3

Elective 2 (3 Credits*)

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	CSC X122	Foundation on Robotics	2	0	0	2
2.	PE	CSC X123	Sound Editing and processing	2	0	2	3
3.	PE	CSC X124	Computer Vision	3	0	0	3
4.	PE	CSC X125	Mobile Multimedia Systems	2	0	0	2
5.	PE	CSC X126	Scripting Languages	2	0	2	3
6.	PE	CSC X127	Online video production	1	0	0	1
7.	PE	CSC X128	Multimedia security	2	0	0	2
8.	PE	CSC X129	Multimedia Communication and Networking	3	0	0	3
9.	PE	CSC X130	Gaming Technology	3	0	2	3

10.	PE	CSC X131	Routing Protocols	3	0	0	3
11.	PE	CSC X132	Queuing Theory	3	0	0	3
12.	PE	CSC X133	Network Trouble shooting tools	1	0	0	1
13.	PE	CSC X134	Design of Computer Network services	3	0	0	3
14.	PE	CSC X135	Software architecture for the internet of things	1	0	0	1
15.	PE	CSC X136	Software metrics	2	0	0	2
16.	PE	CSC X137	Multicore Architecture	2	1	0	3
17.	PE	CSC X138	Statistics and analytics using R programming	2	0	2	3
18.	PE	CSC X139	C# & .NET	2	0	0	2

SEMESTER VI

Programme Elective ##3(3+3)

Elective 1 (3 Credits*)

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	CSC X214	Information Retrieval	2	0	2	3
2.	PE	CSC X215	Software Risk Management	1	0	0	1
3.	PE	CSC X216	Social Media Security	2	0	0	2
4.	PE	CSC X217	Web Security	2	0	0	2
5.	PE	CSC X218	Software design and architecture	1	0	0	1
6.	PE	CSC X219	Software Configuration Management	2	0	0	2
7.	PE	CSC X220	Human Computer Interaction	2	0	0	2
8.	PE	CSC X221	Green Computing	3	0	0	3
9.	PE	CSC X222	XML and Web services	2	0	0	2
10.	PE	CSC X223	Business Process Management	3	0	0	3

11.	PE	CSC X224	Advanced Machine Learning	3	0	0	3

Elective 2 (3 Credits*)

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	CSC X228	Information Visualization	2	1	0	3
2.	PE	CSC X229	Cyber Forensics	3	0	0	3
3.	PE	CSC X230	Smart Devices Security	1	0	0	1
4.	PE	CSC X231	Biometric Security	3	0	0	3
5.	PE	CSC X232	Database Security	3	0	0	3
6.	PE	CSC X233	Software Quality Assurance	3	0	0	3
7.	PE	CSC X234	Customer Relationship Management	1	0	0	1
8.	PE	CSC X235	Service Oriented Architecture	2	0	0	2
9.	PE	CSC X236	Genetic Algorithm	3	0	0	3
10.	PE	CSC X237	Enterprise Resource Planning	2	1	0	3
11.	PE	CSC X238	API Design	2	0	0	2

SEMESTER VII

Programme Elective ##4 (3+3+3)

Elective 1 (3 Credits*)

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	CSC X143	Deep Learning	2	0	2	3
2.	PE	CSC X144	Intrusion Detection and Prevention	3	0	0	3
3.	PE	CSC X145	Security Law and Compliance	2	0	0	2
4.	PE	CSC X146	Software Design patterns	1	0	0	1
5.	PE	CSC X147	Writing skills for engineering leaders	1	0	0	1

6.	PE	CSC X148	Software Reliability	2	0	0	2
7.	PE	CSC X149	AAIP – Animation with Portfolio Development	2	0	2	3
8.	PE	CSC X150	Advanced SAS: Macros & SQL	2	0	0	2
9.	PE	CSC X151	Advanced Programming in Data Science with Python	3	0	0	3

Elective 2 (3 Credits*)

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	CSC X155	Security Issues in Cloud Computing	3	0	0	3
2.	PE	CSC X156	Security Evaluation and Assessment Methodology	3	0	0	3
3.	PE	CSC X157	Software process and product quality	1	0	0	1
4.	PE	CSC X158	System Integration	2	0	0	2
5.	PE	CSC X159	IBM Websphere	2	0	2	3
6.	PE	CSC X160	AVIP - Broadcast	1	0	0	1
7.	PE	CSC X161	Full Stack mobile application development I (Front end)	2	0	2	3
8.	PE	CSC X162	Advanced Game Design	2	0	0	2

Elective 3 (3 Credits)

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	CSC X166	Web Application Security	2	0	0	2
2.	PE	CSC X167	Cyber Laws and Ethics	2	0	0	2
3.	PE	CSC X168	Secure Interconnecting systems	3	0	0	3
4.	PE	CSC X169	Software Maintenance	2	0	0	2
5.	PE	CSC X170	Personal Software Process	1	0	0	1
6.	PE	CSC X171	Web analytics and Social media mining	3	0	0	3

7.	PE	CSC X172	Ruby	1	0	0	1
8.	PE	CSC X173	Full Stack mobile application development II (Back end)	2	0	2	3
9.	PE	CSC X174	5G Wireless communication Techniques	3	0	0	3

*** - Student has to take either 3 Credit or 2+1 Credits**

**** - Sum of the credits of the electives**

Physics Elective Courses

(To be offered in II Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	PHCX 01	Fundamentals of Engineering Materials	2	0	2	3
2.	PHCX 02	Heat and Thermodynamics	2	0	2	3
3.	PHCX 03	Introduction to Nanoscience and Technology	2	0	2	3
4.	PHCX 04	Lasers and their applications	2	0	2	3
5.	PHCX 05	Materials Science	2	0	2	3
6.	PHCX 06	Non-Destructive Testing	2	0	2	3
7.	PHCX 07	Properties of Matter and Acoustics	2	0	2	3
8.	PHCX 08	Properties of Matter and Nondestructive Testing	2	0	2	3
9.	PHCX 09	Semiconductor Physics and Optoelectronics	2	0	2	3

Chemistry Elective Courses

(To be offered in II Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	CHCX01	Analytical Instrumentation	2	0	2	3
2.	CHCX02	Corrosion and its Control	2	0	2	3
3.	CHCX03	Electrical Materials and Batteries	2	0	2	3
4.	CHCX04	Engineering Materials	2	0	2	3
5.	CHCX05	Fuels and Combustion	2	0	2	3
6.	CHCX06	Fundamentals of Physical Chemistry	2	0	2	3
7.	CHCX07	Green Technology	2	0	2	3
8.	CHCX08	Organic Chemistry of Biomolecules	2	0	2	3
9.	CHCX09	Polymer Science and Technology	2	0	2	3

Maths Elective Courses

(To be offered in IV Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	MACX 01	Discrete Mathematics And Graph Theory	3	1	0	4
2.	MACX 02	Probability And Statistics	3	1	0	4
3.	MACX 03	Random Processes	3	1	0	4
4.	MACX 04	Applied Numerical Methods	3	1	0	4

Maths Elective Courses

(To be offered in VI Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	MACX 05	Mathematical Programming	2	0	0	2
2.	MACX 06	Statistical Methods for Data Analysis	2	0	0	2
3.	MACX 07	Numerical Methods for Integral and Differential Equations	2	0	0	2
4.	MACX 08	Mathematical Modelling	2	0	0	2
5.	MACX 09	Graph Theory	2	0	0	2

Humanities Elective I

(To be offered in III Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	SSCX01	Fundamentals of Economics	2	0	0	2
2.	SSCX02	Principles of Sociology	2	0	0	2
3.	SSCX03	Sociology of Indian Society	2	0	0	2

Humanities Elective II

(To be offered in IV Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	SSCX04	Economics of Sustainable Development	2	0	0	2
2.	SSCX05	Industrial Sociology	2	0	0	2
3.	SSCX06	Law for Engineers	2	0	0	2

General Elective

Group I Courses

(To be offered in V semester)

Sl. No.	Course Code	Course Title	Offering Department
1.	GECX101	Disaster Management	Civil
2.	GECX102	Total Quality Management	Mechanical
3.	GECX103	Energy Studies	Mechanical
4.	GECX104	Robotics	Mechanical
5.	GECX105	Transport Management	Automobile
6.	GECX106	Control Systems	EEE
7.	GECX107	Introduction to VLSI Design	ECE
8.	GECX108	Plant Engineering	EIE
9.	GECX109	Network Security	CSE
10.	GECX110	Knowledge management	CSE
11.	GECX111	Cyber security	IT
12.	GECX112	Genetic Engineering	LS
13.	GECX113	Fundamentals of Project Management	CBS
14.	GECX114	Operations Research	Mathematics
15.	GECX115	Nano Technology	Physics / Chemistry
16.	GECX116	Vehicle Maintenance	Automobile
17.	GECX117	Fundamentals of Digital Image Processing	ECE

Group II Courses

(To be offered in VII semester)

Sl. No.	Course Code	Course Title	Offering Department
1.	GECX201	Green Design and Sustainability	Civil
2.	GECX202	Appropriate Technology	Civil / Mechanical
3.	GECX203	Engineering System Modelling and Simulation	Mechanical
4.	GECX204	Value Analysis and Engineering	Mechanical
5.	GECX205	Industrial Safety	Mechanical
6.	GECX206	Advanced Optimization Techniques	Mechanical
7.	GECX207	Mat Lab Simulation	EEE
8.	GECX208	Embedded Systemsand its Applications	ECE
9.	GECX209	Usability Engineering	CSE
10.	GECX210	Supply Chain Management	CBS
11.	GECX211	System Analysis and Design	CA
12.	GECX212	Advanced Materials	Physics & Chemistry
13.	GECX213	National Service Scheme	School of Humanities
14.	GECX214	Automotive Pollution and Control	Automobile
15.	GECX215	Motor Vehicle Act, Insurance and Policy	Automobile
16.	GECX216	Principles of Communication Systems	ECE
17.	GECX217	Lean Management	Civil
18.	GECX218	Spatial Data Modeling & Analysis	Civil

SEMESTER I

MAC 1181	DIFFERENTIAL CALCULUS AND GEOMETRY	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aims of this course are to

- introduce eigen values and eigenvectors of matrix algebra.
- make the student knowledgeable in the area of Three Dimensional Analytical Geometry.
- demonstrate the application of Differential Calculus.
- familiarize the student with the functions of several variables.
- develop the use of ODE solvable techniques necessary for engineering applications.
- motivate the students with some basic engineering application problems in ODE.

MODULE I **MATRICES** **8+2**

Characteristic Equation- Eigenvalues and Eigenvectors of a real matrix –Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton Theorem (without proof) – Orthogonal matrices – orthogonal transformations of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation.

MODULE II **THREE DIMENSIONAL ANALYTICAL GEOMETRY** **7+3**

Direction cosines and ratios – angle between two lines – equations of a plane – equations of a straight line, coplanar lines - shortest distance between skew lines - sphere – tangent plane – plane section of a sphere – orthogonal spheres.

MODULE III **DIFFERENTIAL GEOMETRY** **7+3**

Curvature – Cartesian and polar coordinates – centre and radius of curvature – circle of curvature – involutes and evolutes – envelopes.

MODULE IV **DIFFERENTIAL CALCULUS OF SEVERAL VARIABLES** **8+2**

Functions of two variables – partial derivatives – total differential – Implicit Functions – Jacobian - Taylor’s series expansion – Optima of two variables – Lagrange’s multiplier method.

MODULE V **ORDINARY DIFFERENTIAL EQUATIONS** **8+2**

Linear equations of second order with constant and variable coefficients – Simultaneous first order linear equations with constant coefficients – homogeneous equations of Euler's type – method of undetermined coefficients, method of variation of parameters

MODULE VI **APPLICATIONS OF ORDINARY DIFFERENTIAL EQUATIONS** **7+3**

Solution of Ordinary Differential Equation Related to Electric Circuits – Bending of Beams- Motion of a Particle in a resisting medium – Simple harmonic motion.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Ramana, B.V, "Higher Engineering Mathematics" Tata McGraw Hill Publishing Co. New Delhi, 2006.
2. Grewal B.S., "Higher Engineering Mathematics" (43rd edition), Khanna Publishers, New Delhi, 2012.
3. John W. Cell "Engineering Problems Illustrating Mathematics" Mc Graw Hill Publishing Co., New York 1943.

REFERENCES:

1. Veerarajan.T., "Engineering Mathematics" (5th edition) Tata Mc Graw Hill Publishing Co. New Delhi, 2012
2. Kreyszig, E., "Advanced Engineering Mathematics", 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
3. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th edition, Cengage Learning, 2011.
4. Dennis G. Zill, Warren S. Wright, "Advanced Engineering Mathematics", 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
5. Alan Jeffrey, "Advanced Engineering Mathematics", Academic Press, USA, 2002.
6. Venkataraman, M.K., "Engineering Mathematics", Volume I, 2nd edition, National Publishing Co., Chennai, 2003.
7. James Stewart ".Calculus" (7th edition),Brooks/Cole cengage learning,UK

OUTCOMES:

After completing the course, student will be able to

- Understand the matrix techniques and compute eigen values and eigenvectors of a given matrix.
- Do the problems based on three dimensional analytic geometry.
- Apply differential calculus in engineering problems.
- Differentiate more than one variable and their applications.
- Solve the differential equations with constant coefficient and variable coefficient.
- Form and solve differential equations.

ENC 1181	ENGLISH	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To train students to use appropriate vocabulary in academic and technical contexts.
- To facilitate students to speak effectively while exchanging ideas and making presentations.
- To develop students' listening skill for comprehending and analyzing information.
- To develop their reading skill through sub skills like skimming , scanning and critical reading of a text.
- To sharpen their academic writing skills.
- To expose them to the correct usage of language and help them to apply that knowledge appropriately.

MODULE I **8**

L: Listening for general information

S : Self Introduction, Introducing one another.

R: Predicting the content

W: Paragraph Writing

Language Focus: Affixes, Simple Present tense , Connective & Prepositions.

MODULE II **8**

L: Listening for specific information (from dialogues)

S:Exchanging opinion.

R: Skimming technical Passages

W: Argumentative Writing (using the concept of Flipped Learning), Letter to the Editor.

Language Focus: Idioms, use of Modals, Simple Past tense & use of "Wh" and question tags.

MODULE III **7**

L: Learning the ways of describing images and presenting specific information (focusing on note making)

S: Making Presentations using visuals.

R : Scanning short texts for gist of information

W: Letter of Invitation, Expository Writing

Language Focus: Homophones, Homographs, Simple Future & Collocations.

MODULE IV **7**

L: Understanding prepared presentation techniques through videos

S: Short Presentations.

R: Reading for coherence and cohesion

W: Letter seeking permission for Industrial Visit

Language Focus: S-V agreement, Euphemism

MODULE V **8**

L : Understanding Non- Verbal Communications while listening to narration of incidents.

S: Narrating an expereince

R: Inferential Reading

W: Process Description – Transcoding a Flow chart.

Language Focus: Interchange of Active & passive voice, Impersonal Passive voice.

MODULE VI **7**

L: Learning Story telling techniques (stories & visuals) through audio files

S: Discussion in groups

R: Reading for critical appreciation

W: Developing an idea, Slogan writing, Interpreting a Bar Chart.

Language Focus: If clause and phrasal verbs.

TOTAL HOURS :45

REFERENCES:

1. Carol Rosenblun perry(2011). The Fine Art of Technical Writing. Create Space Independent Publishing Platform, New Delhi.
2. Dutt, P.K. Rajeevan. G and Prakash , C.L.N. (2007) A course in Communication Skills. Cambridge Univesity Press, India.
3. Kala, Abdul & Arun Tiwari (2004). Wings of Fire: An Autobiography (Simplified and A bridged by Mukul Chowdhri). Hyderabad Univeristy Press.
4. Sen, Leena. (2004) Communication Skills. Prentice Hall, New Delhi.

5. Matt Firth, Chris Sowton et.al. (2012). Academic English: An Integrated Skills Course for EAP. Cambridge University Press, Cambridge.

OUTCOMES:

After completion of the course, students will have the ability to

- Demonstrate their range of vocabulary in academic and technical contexts
- Exchange ideas and make presentations
- Comprehend and respond appropriately to listening tasks.
- Read a text efficiently and process information.
- Create and draft different kinds of academic documents
- Communicate effectively using grammatically correct expressions.

ISC1181	ARABIC	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To read and write in Arabic language.
- To learn vocabulary of different fields
- To develop situational communication skills.

MODULE I PREPARATORY ARABIC **7**

Introducing Arabic Alphabets.
Listening and Reading.
Audio & Video aided listening, Tajweed listening,
Writing Arabic Alphabets (connected & unconnected).
Introducing words.
Reading simple sentences.
Learning names of the things in and around the class room.
Exercises.

MODULE II FUNCTIONAL ARABIC **7**

Listening Arabic texts, stories and action verbs
Communicating Simple sentences.
Jumla' Ismiyya and Jumla' Fi'liyya
Situational Conversation:
Greetings, Introduction.
Classroom, College, Picnic.
Dining and Kitchen.
Reading skills.
Exercises

MODULE III FUNCTIONAL ARABIC **8**

Implication of effective listening.
Audio aids.
Writing Simple sentences.
Communicating ordinal and cardinal numbers.
Situational communication:

Playground, library.
Forms of plural – Sample sentences.
Introduction to tenses.
Exercises.

MODULE IV FUNCTIONAL ARABIC 8

Communication:
Family, travel
Market, Prayer hall
Writing skills:
Note making.
Sequencing of sentences.
Developing answers from the questions.
Exercises.

MODULE V TECHNICAL ARABIC 8

Importance of technical communication.
Reading and writing skills.
Audio & Video aided listening.
Introduction to Arabic terms related to administration.
Situation communication:
Air travel, Office administration, passport, visa.
Exercises

MODULE VI TECHNICAL ARABIC 7

Situation communication:
Contractual work, machineries and equipments..
Computer, internet browsing.
Banking,
Exercises.

TOTAL HOURS :45

TEXT BOOKS:

1. Arabic for professionals and employees, Kilakarai Bukhari Aalim Arabic College, Chennai, India, 2013.

REFERENCES:

1. Arabic Reader for Non Arabs (Ummul Qura University, Makkah), Kilakarai Bukhari Aalim Arabic College, 2005.

OUTCOMES:

On successful completion of the course, the student will be able to:

- Write correct sentences in Arabic.
- Communicate in Arabic at primary level in working situations in the fields of engineering and administration.

LNC1181	MANDARIN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To improve the proficiency of students in Mandarin language.
- To develop their knowledge of vocabulary.
- To train them in using appropriate grammatical forms during communications.
- To empower them for successful communication in social and academic contexts.
- To make them appreciate the language usage in real life situations.

MODULE I **8**

· General Introduction to Chinese • Pinyin and Tones • Introduction to the Writing System: basic strokes and stroke order · Numbers 1-100, song · Days of the Week · Months of the Year

MODULE II **8**

· Chinese names and related culture · Chinese family structures and values · Greetings · Introducing Yourself · Family members · Occupations

MODULE III **7**

· Languages and Nationalities · Daily Routine · Chinese breakfast · Negative Sentences and Interrogative Sentences · Asking for Personal Information · The Verb *shi* and Basic Sentence Structures

MODULE IV **7**

· Answering an Affirmative-negative Question · Food and drinks · Transportation · Likes and dislikes · Adverbs *bu*, *jiu* and *dou* · Verb-absent Sentences

MODULE V **8**

·*Jisui* and *duoda* Questions · S+V+O Construction · Routines and Daily Activities ·*Haishi* Questions · Modal Verbs · Hobbies and Habits

MODULE VI **7**

· Making Suggestions with *haoma* ·Colors · Clothing · Body parts · Talking about Likes and

Dislikes · Measurement Words in Chinese

TOTAL HOURS :45

TEXT BOOKS:

1.Ma, Yanmin, and Li, Xinying. *Easy Steps to Chinese, Vol*. *1 Textbook*. Beijing: Beijing Language and Culture University Press, 2006. Print.

2. Ma, Yanmin, and Li, Xinying. *Easy Steps to Chinese, Vol. 1 Workbook*. Beijing: Beijing Language and Culture University Press, 2006. Print.

OUTCOMES:

On completion of the course, students will be able to

- Exhibit proficiency in Chinese Language.
- Use vocabulary in appropriate contexts.
- Use appropriate grammatical forms effectively.
- Use the language in social and academic contexts.
- Appreciate the use of language forms.

LNC1182	GERMAN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To improve the proficiency of students in German language.
- To create awareness of using vocabulary among students.
- To expose them to correct grammatical forms of the language.
- To empower them for successful communication in social and academic contexts.

MODULE I **8**

Introduction to German alphabets, phonetics and pronunciation- Introducing themselves and others using simple sentences and answer to some basic personal questions-: Introduction to different types of articles and verbs, Nouns

MODULE II **8**

Understanding and responding to everyday queries like instruction, questions, - number & gender, pronouns, present and past tense.

MODULE III **7**

Short telephone messages, requests etc., if spoken slowly and clearly-- Detailed overview of articles, adjectives with/without articles, Prepositions

MODULE IV **7**

Ask and giving directions using simple prepositions- Ability to fill basic information on forms while registering for courses / classes.

MODULE V **8**

Ability to extract and understand relevant information in a public announcement, broadcast, newspaper, radio etc-- dative & accusative

MODULE VI **7**

Ability to describe about people, work, immediate environment, education and other topics related to personal needs in a concise manner-- Understanding of matters that are familiar and are encountered regularly like instances at school, work, at public places, places of leisure etc.

TOTAL HOURS :45

TEXT BOOKS:

1. Course book : Tangram aktuell 1 – Lektion 1–4 (Kursbuch + Arbeitsbuch mit Audio-CD zum Arbeitsbuch), Rosa-Maria Dallapiazza, Eduard von Jan, Til Schönherr, Hueber Publisher, ISBN 978-3-19-001801-7

2. Practice book: Tangram aktuell 1 – Lektion 1–4 (Kursbuch + Arbeitsbuch mit Audio-CD zum Arbeitsbuch), Rosa-Maria Dallapiazza, Eduard von Jan, Til Schönherr, Hueber Publisher, ISBN 978-3-19-001801-7.

REFERENCES:

1. NETZWERK A1 TEXTBOOK, Deutsch als Fremdsprache,Stefanie Dengler,Paul Rusch, Helen Schmitz, Tanja Sieber, Langenscheidt and Klett, ISBN : 9788183076968

2. STUDIO D A1 (SET OF 3 BOOKS + CD), Hermann Funk. Cornelsen, ISBN: 9788183073509

3. Willkommen! Beginner's course. Paul Coggle, Heiner Schenke. 2nd edition. (chapter 1 - 6) ISBN: 9781444165159 –

4. Willkommen! Beginner's course. Paul Coggle, Heiner Schenke. ISBN: 978-1-444-16518-0

5. An Introduction to the German Language and Culture for Communication, Updated Edition Lovik, Thomas A., J. Douglas Guy & Monika Chavez. Vorsprung -. New York, Houghton Mifflin Company, 1997/2002. ISBN 0-618-14249-5.

OUTCOMES:

On completion of the course, students will be able to

- Show their proficiency in German Language.
- Use appropriate vocabulary in real life contexts.
- Use appropriate grammatical forms while communicating with people.
- Effectively use the language in social and academic contexts.

LNC1183	JAPANESE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To train students to use appropriate vocabulary in academic and technical contexts.
- To facilitate students to speak effectively while exchanging ideas and making presentations.
- To develop their reading skill through sub skills like skimming, scanning and critical reading of a text.
- To sharpen their academic writing skills.
- To expose them to the correct usage of language and help them to apply that knowledge appropriately.

MODULE I **7**

Introduction of the Japanese writing system, i.e. *Hiragana*, *Katakana* and *Kanji*, word-building, writing foreign names and loan words in Katakana.

MODULE II **8**

Oral practice of pronunciation and intonation of Japanese sounds, Japanese greetings, self introduction, identifying things, time of the day, calendar; counting using Japanese numerical classifiers; describing things;

MODULE III **7**

Making comparisons; talking of daily activities, kinship terms used for address and reference, seasons, giving and receiving, shopping; making requests, talking of one's likes and dislikes.

MODULE IV **8**

Extensive practice of basic patterns at the lower intermediate level through drills and exercises.

MODULE V **7**

Comprehension of passages in simple Japanese and writing of composition in Japanese applying lower intermediate grammatical patterns.

MODULE VI **8**

Diverse texts based on Japanese culture, customs, history, food habits, and science etc, for the development of communicative competence of students; skimming, scanning of texts with emphasis on advanced sentence patterns, grammatical structures and idiomatic phrases, reading and writing of approximately

TOTAL HOURS :45

REFERENCES:

1. Nihongo I, Kokusaigakuyukai, and other supplementary material
2. Exersice book 1of Nihongo 1, and other supplementary material
3. Nippon, the Land and its People & Encyclopedia of Contemporary Japanese
4. Japani: Japanese Conversation for Improving Spoken Proficiency, By P.A. George, Inoue Yoriko and Itsuko Nandi, Books Plus.
5. Chukyu Nihongo, Tokyo Gaikokugo Daigaku; Nihongo II, Kokusaigakuyukai, and other supplementary material.

OUTCOMES:

After completion of the course, students will have the ability to

- Demonstrate their range of vocabulary in academic and technical contexts
- Exchange ideas and make presentations
- Comprehend and respond appropriately to listening tasks.
- Read a text efficiently and process information.
- Create and draft different kinds of academic documents
- Communicate effectively using grammatically correct expressions.

PHC 1181	PHYSICS	L	T	P	C
		3	0	2	4

OBJECTIVES:

To make students conversant with the

- basic concepts of crystal physics and its structures
- production and applications of ultrasonic waves
- study of thermal conductivities of good and bad conductors
- phenomenon of wave optics and its applications
- principle of fibre optic communication and its applications to sensors
- wave mechanics principle and its applications in electron microscopy
- green energy physics and its environmental impacts to society

MODULE I CRYSTAL PHYSICS **8**

Crystalline and amorphous solids – Unit Cell – Seven Crystal Systems – Bravais Lattice – Miller Indices – Interplanar Spacing – Characteristics of Unit Cell - Calculation of Number of atoms per unit cell, Atomic Radius, Coordination Number and Packing Factor for SC, BCC, FCC and HCP and Diamond structures –Defects in crystals-Point defects –Edge and screw dislocations and their significance - Surface Defects.

MODULE II ULTRASONICS AND THERMAL PHYSICS **8**

Introduction to Ultrasonics - Properties - Production methods - Magnetostriction Oscillator method- Piezoelectric Oscillator method – Detection of Ultrasonics – Thermal method – Piezoelectric method – Kundt's tube method – Applications of Ultrasonics – Acoustic Grating – SONAR – Depth of sea – Velocity of blood flow, Ultrasonic Flaw detector (qualitative).

Transmission of heat – Conduction, Convection and Radiation – Thermal Conductivity of good Conductor – Forbe's method- Thermal Conductivity of bad Conductor – Lee's Disc method.

MODULE III APPLIED OPTICS **8**

Interference – Air Wedge – Michelson's Interferometer – Determination of wavelength of light and thickness of thin transparent sheet.

Introduction to Laser – Characteristics of Laser – Spontaneous and Stimulated Emissions – Einstein's Coefficients - Population inversion – Pumping Mechanism – Laser Action – Types of Laser: He-Ne laser, CO2 laser and Nd:YAG laser - Applications : Laser Materials Processing .

MODULE IV FIBRE OPTICS 7

Optical fibre – Principle and propagation of light in optical fibre – Numerical aperture and acceptance angle – Types of optical fibres – Attenuation – Absorption, Scattering losses, Bending losses and Dispersion in Optical fibres – Fiber Connectors and Couplers - Applications – Fibre optic communication system (block diagram only)- Fibre optic sensors - displacement and pressure sensors (qualitative) - Medical endoscope.

MODULE V QUANTUM MECHANICS 7

Black body radiation – Planck's theory of radiation – Deduction of Wien's displacement law and Rayleigh – Jean's law from Planck's theory –Dual nature of matter – de Broglie's wavelength- Physical significance of wave function – Schrodinger wave equation – Time independent and time dependent wave equation – Particle in one dimensional box – Harmonic oscillator(qualitative).

MODULE VI RENEWABLE ENERGY SOURCES 7

Present Energy sources and sustainability - Solar energy - Solar photovoltaics - Solar cells – Bioenergy - Biomass – production of liquid fuels from biomass – Wind energy – Wind turbines – energy and power from wind turbines - Geothermal energy - Ocean energy: Wave energy – Wave energy conversion devices – Tidal energy – Tidal power basics – power generation –Tidal energy potential – Environmental benefits and impacts of renewable energy sources

PRACTICALS

1. Determination of Velocity of Ultrasonic waves in a given liquid using Ultrasonic Interferometer.
2. Determination of wavelength of ultrasonic waves using Kundt's tube method.
3. Determination of thickness of a thin wire using Air Wedge method.
4. Determination of wavelength of light using spectrometer diffraction grating.
5. Determination of angle of divergence of a laser beam using He-Ne laser.
6. Determination of particle size of lycopodium powder using semiconductor laser.
7. Determination of wavelength of laser light using semiconductor laser diffraction.
8. Determination of Acceptance angle and Numerical Aperture using fiber optic cable.
9. Determination of thermal conductivity of a good conductor by Forbe's method.
10. Determination of thermal conductivity of a bad conductor by Lee's disc method.
11. Determination of solar cell characteristics.

L – 45; P – 30; TOTAL HOURS – 75

REFERENCES :

1. Gaur R.K. and Gupta S.L., “Engineering Physics’’, 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2013.
2. Palanisamy P.K., Physics for Engineers, Vol1 & Vol2, 2nd Edition, Scitech Publications, 2003.
3. Serway R.A. and Jewett, J.W. “Physics for Scientists and Engineers with Modern Physics”. Brooks/cole Publishing Co., 2010.
4. Tipler P.A. and Mosca, G.P., “Physics for Scientists and Engineers with Modern Physics”, W.H. Freeman, 2007.
5. Markert J.T., Ohanian. H. and Ohanian, M. “Physics for Engineers and Scientists”. W.W. Norton & Co. 2007.
6. Godfrey Boyle, “Renewable Energy: Power for sustainable future”, 2nd edition, Oxford University Press, UK, 2009.

OUTCOMES:

At the end of the course, students will be able to

- understand the different types of crystal structures
- apply the concept of ultrasonic principle in engineering and medical field
- calculate thermal conductivities of good and bad conductors
- differentiate the various laser systems and its applications in engineering and medical field
- apply the principle of fibre optics for communication and sensor applications
- formulate wave mechanics principle for applications in electron microscopy
- Correlate the different renewable energy sources for societal needs.
- To complement the knowledge acquired in the theory class.
- To correlate the experimental results for application.

CHC1181	CHEMISTRY	L	T	P	C
		3	0	2	4

OBJECTIVES:

The students should be conversant with

- the basic problems like hardness, alkalinity, dissolved oxygen associated with the water used for domestic and industrial purpose and treatment process involved.
- the synthesis, properties and applications of nanomaterials.
- the importance of renewable energy sources like solar, wind, biogas, biomass, geothermal, ocean and their limitations.
- the basic analytical techniques like UV-Visible, FT-IR, NMR, AAS, AES, Circular Dichroism and XRD etc.
- photochemistry concepts related to physical processes and chemical reactions induced by photon absorption and their applications.
- basic principles of electrochemistry, cell construction and evaluation and to understand general methodologies for construction & design of electrochemical cell

MODULE I WATER TECHNOLOGY 9

Impurities present in water, hardness : types of hardness, demerits of hard water in boilers, estimation of hardness by EDTA method (problems) – alkalinity : estimation of alkalinity (problems) – dissolved oxygen: estimation of dissolved oxygen – conditioning methods : external treatment method: – lime soda and zeolite process (principle only), Ion exchange process – Internal treatment : colloidal, carbonate, phosphate and calgon methods – drinking water: standards (BIS), treatment of domestic water {screening, sedimentation, coagulation, filtration, disinfection }– desalination: electrodialysis, reverse osmosis.

MODULE II NANOCHEMISTRY 6

Introduction – distinction between molecules, bulk materials and nanoparticles – classification based on dimension with examples – synthesis (top-down and bottom-up approach} : sol-gel, thermolysis (hydrothermal and solvothermal), electrodeposition, chemical vapour deposition, laser ablation – properties and applications (electronic, magnetic and catalytic) – risk factors and future perspectives.

MODULE III ENERGY SOURCES 8

Energy: past, today, and future – a brief history of energy consumption – present energy scenario of conventional and renewable energy sources – renewable energy : needs of renewable energy, advantages and limitations of renewable energy – solar energy: basics, solar energy in the past , photovoltaic, advantages and disadvantages – bioenergy: conversion, bio degradation, biogas generation, biomass gasifier, factors affecting biogas generation, advantages and disadvantages – geothermal energy: geothermal resources (hot dry rock and magma resources, natural and artificial), advantages and disadvantages – wind energy: wind resources, wind turbines, advantages and disadvantages – ocean energy: wave energy, wave energy conversion devices, ocean thermal energy, advantages and disadvantages.

MODULE IV PHOTOCHEMISTRY 7

Introduction: absorption and emission, chromophores, auxochromes – laws of photochemistry : Grotthus-Draper law, Stark Einstein law – quantum yield (problems) –photo physical processes : fluorescence and phosphorescence - Jablonski diagram (electronic states and transitions) – quenching, annihilation – photosensitization: principle and applications – chemiluminescence, bioluminescence.

MODULE V ANALYTICAL TECHNIQUES 7

Spectroscopy: electromagnetic radiation and spectrum – types of transitions – types of spectra (atomic and molecular with their chemical usefulness) – Beer-Lamberts law (problems) – principles, instrumentation and applications of: Colourimetry – UV-Vis spectrophotometer – atomic absorption spectroscopy – atomic emission spectroscopy – principles and applications of: IR, NMR, mass and X-ray diffraction analysis.

MODULE VI ELECTROCHEMISTRY 8

Electrochemistry - types of electrodes (principle and working) : gas (SHE), metal/metal ion electrode, metal-metal insoluble salt (calomel electrode), ion-selective (glass electrode and fluoride ion selective electrode) – Electrolytic and galvanic cells, construction of cell, EMF measurement and applications (problems), standard cell (Weston-cadmium), reversible and irreversible cell, concentration cell. Determination of fluoride ion using fluoride ion selective electrode – Chemically modified electrodes (CMEs) : concept, approaches and applications.

PRACTICALS

1. Estimation of hardness in given water sample.
2. Estimation of the alkalinity of the given water sample.
3. Estimation of strong acid by conductometry.
4. Estimation of Fe^{2+} present in the given sample by potentiometry.
5. Verification of Beer-Lamberts law and estimation of Cu^{2+} present in unknown sample.
6. Estimation of sodium and potassium present in the given sample by flame photometry.
7. Determination of molecular weight and degree of polymerisation of a polymer by viscosity method.
8. Synthesis of thermosetting polymer.

L – 45; P – 30; TOTAL HOURS – 75

REFERENCES:

1. S. Vairam, P. Kalyani and Suba Ramesh, “Engineering Chemistry”, Wiley India Ltd., New Delhi, 2011.
2. G.A. Ozin and A.C. Arsenault, “Nanochemistry: A Chemical Approach to Nanomaterials”, RSC Publishing, Thomas Graham House, Cambridge, 2005.
3. P.C Jain & Monica Jain, Engineering Chemistry Dhanpatrai Publishing Company (P) Ltd., New Delhi (2013).
4. S S Umare & S S Dara, A text Book of Engineering Chemistry, S. Chand& Company Ltd, New Delhi, 2014.
5. G.D.Rai, “Non conventional energy sources,” Khanna Publishers, New Delhi, 2011.
6. John Twidell and Tony Weir, “Renewable Energy Resources, Taylor & Francis Ltd, London, United Kingdom, 2005
7. Principles of molecular photochemistry: An introduction, Nicholas J. Turro, V.Ramamurthy and Juan C. Scaiano, University Science Books, Sausalito, CA, 2009.

OUTCOMES:

The students will be able to

- solve problems related to hardness, alkalinity, dissolved oxygen associated with the water and describe the treatment processes.
- classify nanomaterials and apply the nanochemistry approach to synthesize the

nanomaterials.

- explain the principle and enumerate the advantages and disadvantages of various renewable energy sources.
- state the principle and illustrate the instrumentation of various analytical techniques.
- apply the concepts of photochemistry to elaborate various photo-physical and photochemical reactions.
- construct a electrochemical cell and describe the various types of electrodes and determine the fluoride content.

GEC 1101	ENGINEERING GRAPHICS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To introduce the students of all engineering programs, the basic concepts of engineering drawing, which is the basic communication medium for all engineers
- To provide practical exposure on important aspects like drawing analytic curves, orthographic projections, section of solids, development of surfaces, isometric projection, perspective projection and free hand drawing.
- To introduce computerized drafting.

MODULE I BASICS AND ENGINEERING CURVES **10**

Drawing instruments, dimensioning, BIS conventions, types of lines, simple geometric constructions.

Conic sections: ellipse, parabola, hyperbola.

Special curves: cycloid, epicycloid, hypocycloid and involutes.

MODULE II ORTHOGRAPHIC PROJECTION **8**

Orthographic projection – first angle, second angle, third angle and fourth angle projections –setup - assumptions, principle. Free hand sketching of orthographic views of simple machine parts as per first angle projection. Orthographic projection of points in all quadrants. Some commands and demonstration of drafting packages.

MODULE III PROJECTION OF STRAIGHT LINES AND PLANES **10**

Projection of straight lines in first quadrant – true length and true inclinations – Rotating line and trapezoidal methods –traces of straight line.

Projection of plane lamina in first quadrant and its traces

MODULE IV PROJECTION OF SOLIDS **10**

Projection of solids in first quadrant: Axis inclined to one reference plane only- prism, pyramid, cone, cylinder – change of position and auxiliary projection methods.

MODULE V SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES **12**

Section of solids: prism, pyramid, cone, cylinder, and sphere – sectional view – true shape of section Solids in simple position and cutting plane inclined to one reference

plane only.

Development of surface of truncated solids: prism, pyramid, cone cylinder – frustum of cone, pyramid and simple sheet metal parts.

MODULE VI PICTORIAL PROJECTIONS 10

Isometric projection: Isometric scale – isometric axes- iso sheet - Isometric projection and view of prism, pyramid, cylinder, cone, frustums, truncated solids and simple products

Perspective projection: station point – vanishing point – Perspective projection and views of prism, pyramid, cylinder and frustums by Visual ray method.

L – 30; P – 30; TOTAL HOURS – 60

TEXT BOOKS:

1. N.D. Bhatt, 'Engineering Drawing' Charotar Publishing house, 53rd Edtion, (2014)

REFERENCES:

1. K.V. Natarajan, 'A text book of Engineering Graphics', Dhanalakshmi publishers, Chennai. (2009)
2. Venugopal. K, and V. Prabhu Raja, Engineering Graphics, New Age International (P) Ltd., Publication, Chennai. (2011)

OUTCOMES:

- Students should be able to read the specifications and standards of technical drawing and able to draw conic sections and special curves.
- Students should be able to understand the insight of orthographic projection and to draw the various views of orthographic projection of a point and various components.
- Students should be able to draw the orthographic views of straight lines and plane figures.
- Students should be able to draw the orthographic views of simple solids.
- Students should be able to draw the sections of solids and development of solid surfaces.
- Students should be able to draw the isometric and perspective projection of simple solids and components.

GEC 1102	ENGINEERING DESIGN	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To understand the role of design in Engineering
- To understand the basic design concepts
- To understand the role of innovation in design

MODULE I DESIGN AS A CENTRAL ACTIVITY IN ENGINEERING 08

Product design – products and processes – product design methodology Design of systems; Software design

MODULE II NEED ANALYSIS AND CONCEPT DEVELOPMENT 07

Voice of customers – product specification - need analysis Bench marking Product architecture – concept generation and evaluation;

MODULE III CASE STUDIES IN ENGINEERING DESIGN 08

Product design – process design; system design; software design -Ergonomics – usability

MODULE IV INNOVATION AND DESIGN 07

Role of innovation in Engineering – incremental changes and systemic changes; scientific approach to driving innovation – case studies.

TOTAL HOURS – 30

REFERENCES:

1. Clive L. Dym and David C. Brown,“Engineering Design: Representation and Reasoning”, 2nd Edition, Cambridge University Press, New Delhi, 2011.
2. Daniel G. Dorner, G. E. Gorman and Philip J. Calvert, “Information Needs Analysis: Principles and practice in information organizations”, Published by Faced Publishing, London. 2015.
3. Cliff Matthews, “Case Studies in Engineering Design”, John Wiley & Sons Pvt. Ltd, New York, 1998.
4. Bengt-Arne Vedin, “The Design-Inspired Innovation Workbook”, World Scientific, 2011.
5. Navi Radjou, Jaideep Prabhu and Simone Ahuja, “Jugaad Innovation”, Published

by Random House India, 2012.

OUTCOMES:

The students will be able to

- Apply the basic knowledge of design in engineering products / process / service.
- Analyse the problems and give innovative solutions.
- Correlate the basic knowledge of design in the real world problems.
- Apply innovative approaches to engineering design.

GEC1103	BASIC ENGINEERING PRACTICES LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To provide a practical exposure to basic engineering practices like carpentry, fitting, plumbing, welding and making of simple electrical and electronic circuits
- To have an understanding on the use of various tools, instruments and methods
- To enable the students to appreciate the practical difficulties and safety issues

CIVIL ENGINEERING PRACTICE

1. Study of plumbing in general household and industrial systems
2. Making a small window frame with Lap and Mortise & Tenon Joints
3. Introduction to power tools

MECHANICAL ENGINEERING PRACTICE

1. Fabrication of a small Table frame with Butt, Lap and Fillet Joints
2. Machining of a simple component like a table weight using lathe
3. Mold preparation for simple component

ELECTRICAL ENGINEERING PRACTICE

1. Comparison of incandescent, Fluorescent, CFL and LED lamps.
2. Study of Protection Circuits (small relay, fuse, MCB, HRC, MCCB, ECCB).
3. Familiarization of households Electrical Gadgets (Iron Box, Wet Grinder).
4. Understanding of Domestic and Industrial wiring.
5. Earthing and its significance.
6. Troubleshooting in Electrical Circuits.
7. Study of inverter fed UPS/Emergency lamp

ELECTRONICS ENGINEERING PRACTICE

1. Identifications symbolic representation of active and passive electronic components
2. Soldering and tracing of electronic circuits and checking its continuity
3. Assembling of A.C. to D.C, D.C to A.C. Circuits in bread Board and Mini project.

TOTAL HOURS – 30

OUTCOMES:

Upon the completion of the course, students should be able to

- Appreciate the practical skills needed even in making of simple objects, assemblies and circuits
- Attend minor defects especially in items used in day to day life
- Aware of the safety aspects involved in using tools and instruments

GEC 1104	COMPUTER PROGRAMMING I	L	T	P	C
		1	0	2	2

OBJECTIVES:

- To identify the hardware and software components of the computer.
- To know the basic concept of operating system and get knowledge about different operating systems.
- To learn various database concepts and operations
- To develop efficient algorithms for solving a problem.
- To implement the algorithms in C language.
- To use arrays in solving problems.

MODULE I COMPUTER FUNDAMENTALS **7**

Introduction -. Number System - Planning the computer program - Computer Software - Basic operating system concepts - Database Operations

MODULE II PROGRAMMING IN C **8**

Introduction to C Programming Language – Operators - Control statements -Iterative statements - Arrays.

LIST OF EXPERIMENTS:

1. Computer organization –Hardware in a typical computer Identification – Booting- error messages and what it means
2. Types of Operating systems – Windows and Linux
3. Structure of a basic program - Hello world program – Debugging it
4. Data types: Type conversions
5. Input / Output: Formatted functions – Unformatted functions – Library functions
6. Properties of operators – Priority of operators – Arithmetic relational logical and bitwise operators
7. If – if else- nested if else- goto- switch case – nested switch case – for loops – nested for loops – while loop – do-while loop – break and continue statement
8. Arrays – Operation with arrays
9. Sorting and searching.

L – 15; P – 30; TOTAL HOURS – 45

REFERENCES:

1. Ashok N Kamthane, “Computer Programming”, Pearson Education, 2nd Edition, ISBN 13: 9788131704370, 2012
2. Paul J. Deitel, Deitel & Associates, “C How to Program”, Pearson Education, 7th Edition, ISBN-13: 978-0132990448, 2012

OUTCOMES:

Students who complete this course will be able to

- Recognize Modular design, logic flow, data abstraction
- Analyze the working of the programming constructs, functions, and I/O.
- Write down programs for sorting and searching algorithms
- Write down programs developing cycle for different applications
- Debug the programs and solve some practical problems in programming
- Develop programs using arrays.

SEMESTER II

MAC 1281	ADVANCED CALCULUS	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aims of this course are to

- train the students in solving problems using multiple integration.
- provide knowledge in using special functions to find out the area and volume of a region.
- acquire knowledge in tangent and normal vectors.
- gain knowledge in finding the areas of a curve and surface using vector integration.
- learn about the analytic functions and their properties along with bilinear transformation.
- know complex integration using Cauchy's theorems.

MODULE I MULTIPLE INTEGRATION AND ITS APPLICATIONS 8+2

Multiple integrals– Cartesian and Polar coordinates – change of order of integration – Multiple integral to compute area and volume.

MODULE II TRANSFORMATION OF COORDINATES AND SPECIAL FUNCTIONS 7+3

Change of variables between Cartesian, polar, cylindrical and spherical coordinates - Beta and Gamma functions – Properties and applications.

MODULE III VECTOR DIFFERENTIATION 7+3

Operations on vectors – Scalar Product, Vector Product, Projection of Vectors - Angle between two vectors - Gradient, divergence and curl

MODULE IV VECTOR INTEGRATION 8+2

Line, surface and volume integrals – Green's Theorem, Gauss Divergence Theorem and Stokes Theorem (statement only) – verification and evaluation of integrals.

MODULE V

ANALYTIC FUNCTION 8+2

Analytic function - Necessary and Sufficient condition (statement only) – Cauchy-Riemann equations in polar coordinates - properties of analytic function – determination of analytic function – conformal mapping (w = z+a, az and 1/z) and bilinear transformation.

MODULE VI COMPLEX INTEGRATION **7+3**

Statement and application of Cauchy's integral theorem – Cauchy's integral formula – Taylor's series and Laurent's series expansion – singularities - classification – residues - Cauchy's residue theorem – contour integration – Unit circle and semi circular contours (excluding poles on the real axis).

L – 45; T – 15; TOTAL HOURS – 60

TEXT BOOKS:

1. Veerarajan.T., "Engineering Mathematics "(5th edition) Tata Mc Graw Hill Publishing Co. New Delhi, 2012
2. Grewal B.S., "Higher Engineering Mathematics" (43rd edition), Khanna Publishers, New Delhi, 2012.
3. John W. Cell "Engineering Problems Illustrating Mathematics" Mc Graw Hill Publishing Co., New York 1943

REFERENCES:

1. Kreyszig, E., "Advanced Engineering Mathematics", 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
2. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th edition, Cengage Learning, 2011.
3. Dennis G. Zill, Warren S. Wright, "Advanced Engineering Mathematics", 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
4. Alan Jeffrey, "Advanced Engineering Mathematics", Academic Press, USA, 2002.
5. Ramana, B.V., "Higher Engineering Mathematics" Tata Mc Graw Hill Publishing Co. New Delhi, 2006.
6. Venkataraman, M.K., "Engineering Mathematics", Volume 2, 2nd edition, National Publishing Co., Chennai, 2003.
7. James Stewart ".Calculus" (7th edition),Brooks/Cole cengage learning,UK.

OUTCOMES:

After completing the course, student will be able to

- compute the area and volume using multiple integrals.

- apply special functions to solve integration problems.
- apply differentiation in scalar and vector fields.
- find area and volume of a region using vector integration.
- verify analyticity, conformity and bilinearity of complex functions.
- evaluate complex integrals.

GEC 1211	BASIC ENGINEERING MECHANICS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To impart knowledge about the basic laws of statics and dynamics and their applications in problem solving
- To acquaint both with scalar and vector approaches for representing forces and moments acting on particles and rigid bodies and their equilibrium
- To give on exposure on inertial properties of surfaces and solids
- To provide an understanding on the concept of work energy principle, friction, kinematics of motion and their relationship

MODULE I VECTOR APPROACH TO MECHANICS **07**

Introduction - Units and Dimensions- Vectors – Vectorial representation of forces and moments –Vector Algebra and its Physical relevance in Mechanics - Laws of Mechanics – Parallelogram and triangular Law of forces -Lame's theorem, Coplanar Forces – Resolution and Composition of forces- Equilibrium of a particle.

MODULE II EQUILIBRIUM OF PARTICLE **06**

Forces in space - Equilibrium of a particle in space - Equivalent systems of forces – Principle of transmissibility – Single equivalent force

MODULE III EQUILIBRIUM OF RIGID BODY **06**

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis –Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem - Equilibrium of Rigid bodies in two dimensions -Examples

MODULE IV PROPERTIES OF SURFACES **08**

Determination of Areas – First moment of area and the Centroid of sections – Rectangle, circle, triangle from integration – T section, I section, Angle section, Hollow section by using standard formula – second and product moments of plane area – Physical relevance - Rectangle, triangle, circle from integration - T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia- Mass moment of Area

MODULE V FRICTION **08**

Introduction to friction- types of friction- Laws of Coloumb friction- Frictional force – simple

contact friction – Rolling resistance –ladder friction

MODULE VI LAWS OF MOTION 10

Review of laws of motion – Newton's law – Work Energy Equation of particles– Impulse and Momentum – Impact of elastic bodies.

L – 45; T – 15; TOTAL HOURS – 60

REFERENCES:

1. Beer, F.P and Johnston Jr. E.R, "Vector Mechanics for Engineers, Dynamics & Statics", Third SI Metric Edition, Tata McGraw-Hill International Edition, 2001.
2. Hibbeller, R.C., Engineering Mechanics, Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., 2000.
3. Irving H. Shames, Engineering Mechanics – Statics and Dynamics, IV Edition Pearson Education Asia Pvt. Ltd., 2003.

OUTCOMES:

On completion of this course students should be able

- Analyse and resolve forces, moments and solve problems using various principles and laws of Mechanics
- Apply the concept of equilibrium to particles and solve problems
- Apply the concept of equilibrium to rigid bodies and solve problems
- Analyse and determine the properties of surfaces
- Analyse and evaluate the fractional forces between the bodies
- Apply the laws of motion in solving dynamics problems

GEC 1212	ENVIRONMENTAL STUDIES	L	T	P	C
		2	0	0	2

OBJECTIVES:

The student will be conversant with the

- various natural resources, availability, utilisation and its current scenario
- different ecosystems, energy transfer, values, threats and conservation of biodiversity
- levels of different pollutants and its impact and the causes and effects of natural disasters
- impacts of human population, impact assessment, human rights and environmental acts and sustainable development

MODULE I NATURAL RESOURCES **8**

Land resources: land degradation, soil erosion and desertification - Forest resources: use and over-exploitation, deforestation - Water resources: use and over-utilisation of surface and ground water, conflicts over water (inter-state and international), dams (benefits and problems), water conservation (rainwater harvesting and watershed management) - Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources, mining - Food resources: world food problems, changes in land use by agriculture and overgrazing, modern agriculture and its effects, fertilizer and pesticide problems, water logging and salinity - Energy resources: increasing energy needs, renewable and non-renewable, use of alternate energy sources.

MODULE II ECOSYSTEM AND BIODIVERSITY **8**

Ecosystem- energy flow in the ecosystem - food chains, food webs and ecological pyramids - characteristics, structure and function of (a) Terrestrial ecosystems (forest, grassland, desert) and (b) Aquatic fresh water ecosystems (pond, lake, river) (c) Aquatic salt water ecosystems (ocean, estuary) - ecological succession.

Biodiversity - genetic, species and ecosystem diversity – hot-spots of biodiversity – biogeographic classification of India - endangered, endemic, extinct and invasive species of India - red data book - values of biodiversity: consumptive, productive, social, ethical, aesthetic and option values - threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts - conservation of biodiversity: in-situ and ex-situ conservation of biodiversity

MODULE III ENVIRONMENTAL POLLUTION AND NATURAL DISASTER **8**

Definition, cause, effects and control measures of (a) air pollution (b) water pollution (c) soil pollution (d) marine pollution (e) noise pollution (f) thermal pollution (g) nuclear hazards - ill-effects of fireworks and upkeep of clean environment - solid waste management: types (urban, industrial, biomedical and electronic wastes), collection, processing and disposal (incineration, composting and land-fill) - natural disaster and management: flood, cyclone, drought, landslide, avalanche, volcanic eruptions, earthquake and tsunami.

MODULE IV HUMAN POPULATION, HEALTH AND SOCIAL ISSUES **6**

Population and population growth, population variation among nations, population explosion, family welfare programme.

Human health: air-borne, water borne diseases, infectious diseases, risks due to chemicals in food and environment.

Sustainable development - environmental legislation and laws: water act, air act, wildlife protection act, forest conservation act, environment protection act - environmental impact assessment, steps in EIA - human rights - women and child welfare.

Case studies related to current situation

TOTAL HOURS – 30

TEXT BOOKS:

1. Erach Bharucha, Textbook for Environmental Studies For Undergraduate Courses of all Branches of Higher Education for University Grants Commission, Orient Blackswan Pvt Ltd, Hyderabad, India, 2013.
2. Benny Joseph, Environmental Studies, Tata McGraw-Hill Education, India, 2009.
3. Ravikrishnan A, Environmental Science and Engineering, Sri Krishna Publications, Tamil Nadu, India, 2015.
4. Raman Sivakumar, Introduction to Environmental Science and Engineering, McGraw Hill Education, India, 2009.
5. Venugopala Rao P, Principles of Environmental Science and Engineering, Prentice Hall India Learning Private Limited; India, 2006.
6. Anubha Kaushik and Kaushik C.P., Environmental Science and Engineering,

New Age International Pvt Ltd., New Delhi, India, 2009.

REFERENCES:

1. Masters G.M., Introduction to Environmental Engineering and Science, Prentice Hall, New Delhi, 1997.
2. Henry J.G. and Heike G.W., Environmental Science and Engineering, Prentice Hall International Inc., New Jersy, 1996.
3. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co. Boston, USA, 2016.

OUTCOMES:

The student will be able to

- predict the scenario of various natural resources and suggest remedies to curb the exploitation of these resources.
- identify food chain and web and its role in various ecosystems, assess the impacts on biodiversity and provide solutions to conserve it.
- analyse the impacts of pollutants in the environment and propose suitable method to alleviate the pollutants and the natural disasters.
- assess on the impact of human population and the health related issues and the ethics to be followed for sustainable life.

GEC 1213	COMPUTER PROGRAMMING II	L	T	P	C
		1	0	2	2

OBJECTIVES:

- To provide knowledge about the benefits of Object Oriented Programming over Procedure oriented programming.
- To learn various File operations
- To expose fundamental concepts of object-oriented programming in classes, invoking methods and functions.
- To prepare students to get full use of code reusability using object oriented programming.
- To implement the basic concepts of object oriented programming using C++concepts.
- To focus on solving problems based on analyzing, designing and implementing programs in C and C++.

MODULE I PROGRAMMING IN C 7

Functions - Storage Classes - Structures and Unions – Pointers -Self Referential Structures and Linked Lists - File Processing.

MODULE II PROGRAMMING IN C++ 8

Programming in C++ - Overview of OOP in C – Inheritance - Polymorphism - Type Casting – Exceptions.

LIST OF EXPERIMENTS:

1. Functions
2. One dimensional arrays, Pointers
3. Recursion
4. Multi dimensional arrays, Linked lists.
5. Operating on Files.
6. Simple C++ program with Control statements.
7. Getting input from user console.
8. Classes, Object and Constructors.
9. Method overloading.
10. Inheritance

L – 15; P – 30; TOTAL HOURS – 45

REFERENCES:

1. Bjarne Stroustrup," The C++ Programming Language", Addison Wesley, 4th edition, ISBN-13: 978-0321563842, 2013.
2. Brian W. Kernighan and Dennis M. Ritchie, " The C Programming Language", Prentice Hall, ISBN 0-13-110362-8, 2015.
3. Bjarne Stroustrup, " Programming: Principles and Practice Using C++ ", Addison Wesley, 2nd edition, ISBN-13: 978-0321992789, 2014.
4. Brian W. Kernighan and Dennis M. Ritchie, " The C Programming Language (Ansi C Version)", Prentice Hall India Learning Private Limited, 2nd edition, ISBN-13: 978-8120305960, 1990.

OUTCOMES:

Students who complete this course will be able to

- Develop efficient algorithms for solving problems
- Handle files in C
- Use simple data structures like arrays and linked lists in solving problems.
- Write simple programs using concepts of object oriented programming.
- Implement algorithms in C++ Language.
- Demonstrate the Object Oriented Programming concepts applied in networking, web development and Database applications.

CSC1211	DIGITAL SYSTEM	L	T	P	C
		3	0	2	4

OBJECTIVES:

- Expose Boolean algebra, Boolean functions and realization of functions with basic gates.
- To design combinational and sequential circuits.
- To implement the K-map method for logical operation.
- To use the concepts of state and state transition for analysis and design of sequential circuits.
- Use the functionality of flip-flops for analysis and design of sequential circuits
- To learn Hardware Design language programming for Digital Systems.

MODULE I BOOLEAN ALGEBRA AND LOGIC GATES 07

Review of Binary Number Systems - Binary Arithmetic - Binary Codes - Boolean Algebra and Theorems -.Boolean functions- Canonical and Standard forms - Logic operations-Digital Logic Gates.

MODULE II GATE-LEVEL MINIMIZATION 08

The K-Map method-Two variable-Three variable-Four Variable -Product of sums simplification - Don't care conditions- NAND and NOR implementation - - Other two level implementation – Exclusive OR function - Hardware Description Language .

MODULE III COMBINATIONAL LOGIC 08

Combinational circuits - Analysis and Design procedures -Adder, Subtractor, - Decimal adder – Binary Multiplier - Magnitude Comparators -Encoder -Decoder -, Multiplexer - Demultiplexer - HDL models of combinational circuits.

MODULE IV SYNCHRONOUS SEQUENTIAL LOGIC 08

Sequential Circuits - Latches and Flip Flops - Analysis of clocked sequential

circuits- - Synthesizable HDL models of Sequential circuits – State Table ,State Reduction Diagram and State Assignment – Design Procedure.

MODULE V REGISTERS, COUNTERS, MEMORIES 06

Registers-Shift Registers -Ripple Counters - Synchronous Counters-Other Counters-HDL for Registers and Counters – Memory - Programmable Logic Array-Programmable Array Logic- Sequential Programmable Devices.

MODULE VI DESIGN AT THE REGISTER TRANSFER LEVEL 08

Introduction-Register Transfer Level Notation-Register transfer level in HDL-ASMs-Sequential Binary multiplier-Control Logic-HDL description of Binary Multiplier-Design with Multiplexers.

L – 45; P – 30; TOTAL HOURS – 75

REFERENCES:

1. M. Morris Mano and Michael D.Ciletti, "Digital Design with an introduction to the Verilog HDL", Pearson Education, Fifth Edition, ISBN-13: 978-0-13-277420-8, 2012.
2. Charles H.Roth, Jr., Kinney," Fundamentals of Logic Design", Brooks Publications, Seventh Edition,. ISBN-13 :978 -1-133-62848-4,2013
3. Donald D.Givone, "Digital Principles and Design", Tata McGraw-Hill, Third Edition, ISBN 0072525037, 2003.

OUTCOMES :

Students who complete this course will be able to

- Define different number systems, binary addition and subtraction, 2's complement representation and its operations
- Demonstrate the use of Karnaugh map and perform an algorithmic reduction of logic functions.
- Define the following combinational circuits: buses, encoders/decoders, (de)multiplexers, exclusive-ORs, comparators, arithmetic-logic units; and to build simple applications
- Evaluate the concepts of state and state transition for analysis and design

of sequential circuits.

- Design and develop simple projects Using flip flops after state machine analysis.
- Expose the basics of Hardware Design language to design digital circuits.

CSC1212	PYTHON PROGRAMMING	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To Learn simple data types, and expressions.
- To learn the control structures of Python programming.
- To know the scope of the variables used in functions.
- To Write large programs in Python, with modules.
- To learn objects, classes, and other object-oriented features
- To study the different types of inheritance concepts.

MODULE I INTRODUCTION TO PYTHON 10

Basic Elements of Python – Object, Expression and Numeric Types – Variables and Assignments – Data types - Input statements – Input Statements – Branching Programs – Looping Programs.

MODULE II FUNCTIONS AND STRUCTURES 10

Functions and Scoping – Function Definitions – Keyword Arguments and Default values – Scoping – Specifications – Recursion –Global Variables – Modules – Tuples – Lists – Dictionaries.

MODULE III CLASSES AND OBJECTS 10

Abstract Data Types – Classes – Inheritance – Multiple level of Inheritance – Substitution Principles – Encapsulation and Information Hiding.

TOTAL HOURS – 30

REFERENCES:

1. John V. Guttag, “Introduction to Computation and Programming Using Python: With Application to Understanding Data”, 2nd Edition, MIT Press, ISBN: 978-0262529624, 2016.
2. Bill Lubanovic, “Introducing Python: Modern Computing in Simple Package”, O'Reilly Media, 1st Edition, ISBN: 9781449359362, 2014.
3. Pratik Desai ,“Python Programming for Arduino”,1st edition, Packt publishing,

ISBN:9781783285938, 2015.

OUTCOMES:

Students who complete this course will be able to

- Identify the elements of python and the different types of data.
- write loops and decision statements in Python.
- explore Python code structure, including the use of functions.
- Implement lists, tuples, and dictionaries in Python programs
- design object oriented programs with Python classes.
- Use class inheritance in Python for reusability.

SEMESTER III

MAC 2181	**PARTIAL DIFFERENTIAL EQUATIONS AND TRANSFORMS**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

OBJECTIVES:

The aims of this course are to

- Familiarize in solving partial differential equation of first, second and higher orders.
- Introduce basics and engineering applications of Fourier series, Laplace Transform, Fourier Transform and Z- Transform.

MODULE I PARTIAL DIFFERENTIAL EQUATIONS 8 + 2

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solution of standard types of first order partial differential equations – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients.

MODULE II FOURIER SERIES 8+2

Fourier Series and Dirichlet's conditions - General Fourier series - Half range Fourier series - Parseval's identity - Harmonic Analysis.

MODULE III FOURIER TRANSFORMS 7+3

Fourier integral theorem (without proof) - Fourier transform pair - Fourier Inverse Transform – Properties - Convolution theorem - Parseval's identity.

MODULE IV APPLICATIONS OF FOURIER SERIES AND FOURIER TRANSFORMS 7+3

Applications of Fourier series and Fourier Transform to solution of PDEs having constant coefficients with special reference to Heat & Wave equations, Discrete & point Spectrum and Single pulse.

MODULE V LAPLACE TRANSFORM 8+2

Introduction to Laplace transform - Existence of Laplace Transform - Properties of Laplace Transforms - Initial & Final Value Theorems - Inverse Laplace Transform - Convolution Theorem – Circuits to signal square wave: Integral equations with unrepeated complex factors – Damped forced vibrations: repeated complex factors – Resonance - Solution of differential equations

MODULE VI Z – TRANSFORM 7+3

Introduction and Definition of Z-transform - Properties of Z- Transform - Convolution Theorem of Z-Transform - Inverse Z–transform - Convolution Theorem of Inverse Z-Transform - Formation of difference equations - Solving Difference Equations using Z-Transform.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Kreyszig .E., “Advanced Engineering Mathematics“, 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
2. Grewal B.S., “Higher Engineering Mathematics”, 42nd edition, Khanna Publishers, New Delhi, 2012.
3. Ramana, B.V, “Higher Engineering Mathematics” Tata Mc Graw Hill Publishing Co. New Delhi, 2006.

REFERENCES:

1. Veerarajan.T., “Engineering Mathematics“, 5th edition, Tata Mc Graw Hill Publishing Co. New Delhi, 2012.
2. Peter V. O'Neil, “Advanced Engineering Mathematics**”**, 7th edition, Cengage Learning, 2011.
3. Dennis G. Zill, Warren S. Wright, “Advanced Engineering Mathematics”, 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
4. Alan Jeffrey, “Advanced Engineering Mathematics”, Academic Press, USA, 2002.

OUTCOMES:

After completing the course, student will be able to

- solve the partial differential equations.
- derive a Fourier series of a given periodic function by evaluating Fourier coefficients.
- apply integral expressions for the forward and inverse Fourier transform to a range of non-periodic waveforms.
- solve wave equation and heat flow equation.
- solve ordinary differential equations using Laplace transform.
- solve difference equation using Z-transform.

ENC 2181 **ORAL COMMUNICATION** **L T P C**

0 0 2 1

OBJECTIVES:

- To expose students to a range of professional contexts through podcasts for learning appropriate expressions.
- To train them in making poster presentations.
- To enable them to make effective business presentations.
- To help them learn persuasive and negotiation skills.
- To train them to debate on issues of current relevance
- To train them to participate in group discussions on current affairs

MODULE I **4**

Orientation to the Importance of Oral Communication -– Verbal and non-verbal communication -Paralinguistic features.

One-minute presentations (using Audacity/Voicethread) – Just a minute (JAM) on random topics

MODULE II **4**

Negotiating and persuading through effective arguments – to arrive at a conclusion (pair-work)

Understanding Negotiation, persuasion and marketing skills through Podcasts

Listening to short conversations and monologues for understanding real life conversations

MODULE III **4**

Making Poster presentations on current issues

Understanding nuances of making effective presentations (TED Videos)

MODULE IV **6**

Deliberation on social and scientific issues – Debates (focus on rebuttal skills and deconstructing arguments)

Viewing videos on debates (NDTV Discussions)

MODULE V **6**

Discussing social issues or current affairs in groups

Viewing group discussions and listening for specific information

MODULE VI **6**

Making full length presentation (through Voicethread) with the focus on one's career plans and prospects (discipline specific)

Listening to interviews for understanding speakers' perception (on industry related issues)

P – 30; Total Hours –30

REFERENCES:

1. Hancock, Mark (2012). *English Pronunciation in Use*. Cambridge University Press, UK.
2. Anderson, Kenneth & et.al (2007). *Study Speaking: A Course in Spoken English for Academic Purposes* (Second Edition). Cambridge University Press, UK.
3. Hurlock, B.Elizabeth (2011). *Personality Development*. Tata McGraw Hill, New York.
4. Dhanavel,S.P (2015). *English and Soft Skills*. Orient Blackswan, Chennai.
5. Whitby, Norman (2014). *Business Benchmark: Pre-Intermediate to Intermediate.* Cambridge University Press, UK.

OUTCOMES:

On completion of the course, students will be able to

- Listen to business conversations and do related tasks.
- Deliver effective poster presentations.
- Make effective business presentations.
- Use persuasive and negotiating skills for justifying arguments.
- Participate effectively in debates.
- Speak English intelligibly, fluently and accurately in group discussions.

CSC 2101 **DATA STRUCTURES** **L T P C**
3 1 0 4

OBJECTIVES :

- To assess how the choice of data structures impacts the performance of programs
- To design and implementation of various basic and advanced data structures
- To expose the different types of searching and sorting algorithms.
- To employ the different data structures to find the solutions for specific problems.
- To improve the logical ability
- To develop application using data structures.

MODULE I OVERVIEW , ARRAYS, RECORDS AND POINTERS 08

Introduction – Basic Terminology- Data Structures – Algorithms – Linear Arrays – Representation of linear arrays in Memory – Traversing linear arrays – Insertion and deletion – Sorting – Searching – Multidimensional arrays – Pointers – Records

MODULE II LINKED LIST 08

Linked list – Representation of linked list in Memory – Traversing a Linked List – Searching a Linked List – Memory allocation – Insertion into a Linked list – Deletion from a Linked List – Header Linked Lists – Two- ways Lists

MODULE III STACKS, QUEUES AND RECURSION 07

Stacks – Array Representation of Stacks-Linked Representation of Stacks – Arithmetic Expressions – Quick sort , an application of stacks – Recursion – Towers of Hanoi – Implementation of Recursive procedures by Stacks – Queues – Linked representation of Queues – Dequeues – Priority Queues

MODULE IV TREES 08

Binary Trees – Representing Binary Trees in Memory – Traversing Binary Trees – Traversal algorithm using Stacks – Header nodes ; Threads – Binary Search Trees searching and inserting in Binary Search Trees –Deleting in a Binary Search Trees - AVL Search Trees – Insertion in an AVL Search Trees – Deletion in an AVL Search Trees – m-way search trees – B trees – Heap; Heap sort – Path Length; Huffman’s Algorithms – General Trees

MODULE V GRAPHS AND THEIR APPLICATIONS 07

Graph Theory Terminology – Sequential Representation of Graphs – Warshall's Algorithm –Linked Representation of a Graph – Operations on a Graph – Traversing a Graph – Posets ; Topological Sorting

MODULE VI SORTING AND SEARCHING 07

Sorting – Insertion Sort – Selection Sort – Merging – Merge Sort – Radix Sort – Searching and Data modification – Hashing

L-45 ;T-15;TOTAL HOURS-60

REFERENCES :

1. Seymour Lipschutz, "Data Structures", McGraw Hill Education, Revised First edition, ISBN-10: 1259029964, ISBN-13: 978-1259029967, 2014
2. Narasimha Karumanchi ,"Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles" ,CareerMonk Publications, Fifth Edition, ISBN-10: 819324527X, ISBN-13: 978-8193245279, 2016.
3. Reema Thareja, "Data Structures Using C", Oxford Publisher, Second Edition, ISBN-10: 0198099304, ISBN-13: 978-0198099307 , 2014
4. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Pearson Education; Second edition, ISBN-10: 9332535841,ISBN-13: 978-9332535848, 2014.

OUTCOMES:

Students who complete this course will be able to

- Examine a given problem and recommend suitable data structure.
- Implement operations on arrays, linked lists, stacks and queues.
- Design, implement, test, and debug programs using a variety of data structures including binary and general tree structures, search trees, heaps, graphs, and B-trees.
- Compare between different data structures and pick an appropriate data structure for a design situation.
- Employ Algorithm for solving problems like sorting, searching, insertion and deletion of data.
- Apply concepts learned in various domains like DBMS, compiler construction etc.

CSC 2102 COMPUTER NETWORKS

L	T	P	C
3	0	2	4

OBJECTIVES :

- To study the networked system organization and architecture, current practices and recent trends
- To lay the foundation on emerging network and data communication technologies and their potential impact
- To provide knowledge on socket programming using TCP and UDP.
- To explore the modern network architectures from a design and performance perspective.
- To understand and design the mobile and wireless network protocols.
- To identify various network parameters to increase QoS for multimedia networks.

MODULE I INTRODUCTION TO COMPUTER NETWORKS **07**

Need for Networking - Service Description -Connectionless and Connection-oriented Services - Circuit and Packet Switching - Physical Media - Wireless Links and Characteristics - Queuing Delay and Packet Loss - Internet Protocol stack - OSI Reference Model - Service Models.

MODULE II APPLICATION LAYER **07**

Principles of Network Applications - The Web and HTTP - FTP - Electronic Mail - SMTP - DNS - Peer-to-Peer Applications.

MODULE III TRANSPORT LAYER **08**

Transport Layer Services - Multiplexing and Demultiplexing - UDP – Principles of Reliable Data Transfer - Connection-oriented Transport: TCP – Principles of Congestion Control - TCP congestion control mechanism – Socket Programming with TCP and UDP - Implementation of transport layer protocols using open source network simulators.

MODULE IV NETWORK LAYER AND LINK LAYER **09**

Forwarding and Routing - Network Service Models - Virtual Circuit and Datagram Networks - Router - Internet Protocol (IP) - Routing algorithms - Implementation of network layer protocols using open source network simulators - Layer Services - Error Detection and Correction Techniques - Multiple Access Protocols - Switched Local Area

Networks - Link Virtualization - Data Center Networking.

MODULE V WIRELESS AND MOBILE NETWORKS 07

Wireless Links and Network Characteristics - WiFi: 802.11 Wireless LAN - Cellular Internet Access - Mobility Management: Principles - Mobile IP - Wireless and Mobility: Impact on Higher-Layer Protocols - Implementation of mobile routing protocols using open source network simulators.

MODULE VI MULTIMEDIA NETWORKING 07

Multimedia Networking Applications - Voice-over-IP - Protocols for Real-Time Interactive Applications - Network Support for Multimedia.

L – 45;P-30;TOTAL HOURS-75

REFERENCES :

1. James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", 7th Edition, Pearson Education, ISBN:9780133594140,2017.
2. Larry Peterson and Bruce S Davis “Computer Networks: A System Approach” Elsevier, 5th Edition, ISBN: 978-0123850591, 2012.
3. Douglas E Comer, “Internetworking with TCP/IP, Principles, Protocols, and Architecture” 6th Edition, PHI, ISBN: 9780136085300, 2014.
4. Behrouz A. Forouzan, “Data Communications and Networking”, McGraw-Hill Education, 5th Edition , illustrated, ISBN : 9780073376226, 2012.

OUTCOMES:

Students who complete this course will be able to

- Compare and contrast the OSI reference model and TCP/IP model.
- Examine the various application layer protocols and propose the solutions based on the need.
- Review the protocols, network interfaces, and performance issues in local area networks and wide area networks.
- Identify different congestion control techniques and critique upon them.
- Design and implement the routing and transport protocols for Wireless and Mobile networks.
- Analyze and interpret the effect of QoS Parameters in the multimedia networks.

CSC 2103 SOFTWARE ENGINEERING L T P C

3 0 0 3

OBJECTIVES :

- To introduce the process involved in developing software.
- To guide the importance of requirements gathering.
- To represent the requirements collected using the various design models
- To provide knowledge in developing a software in a systematic method with quality.
- To explore the various testing methodologies.
- To understand how to improve performance of a software product.

MODULE I SOFTWARE PROCESS 07

Nature of Software – Software Engineering - Software Process – Models – Generic Process Model – Process Assessment - Prescriptive Process Model – Specialized Process Models – Unified Process – Personal and Team Process Models – Process Technology – Product and Process – Agile Model.

MODULE II REQUIREMENTS GATHERING 08

Requirements Engineering – Understanding Requirements – Requirements Modeling – Scenarios, Information and Analysis Classes, Flow, Behavior, Patterns and Web Apps.

MODULE III DESIGN 09

Introduction – Design Process – Design Concepts – Design Model – Software Architecture –Component Based Development: Introduction – User Interface Design – Pattern Based Design – WebApp Design.

MODULE IV QUALITY MANAGEMENT 07

Software Quality – Achieving Software Quality – Review Techniques – SQA Goals and Metrics – Software Reliability.

MODULE V SOFTWARE TESTING 07

Software Testing – Strategic Approach – Issues – Test Strategies – Validation Testing – System Testing – Debugging – Testing Fundamentals: Path Testing, White Box and Black Box, Control Structure – Testing Applications.

MODULE VI MAINTENANCE 07

Software Maintenance – Supportability – Reengineering – Software Reengineering – Reverse Engineering – Restructuring – Forward Engineering – Risk Management.

L – 45;TOTAL HOURS-45

REFERENCES :

1. Roger S. Pressman, “Software Engineering – A Practitioners Approach”, Mc Graw Hill, Eighth Edition, ISBN -13: 9789339212087, 2014.
2. Ian Sommerville, “Software Engineering”, Addison-Wesley, 9th Edition, ISBN-13: 978-0137035151, 2010.
3. Jibitesh Mishra, Ashok Mohanty, “Software Engineering”, Pearson Education, ISBN 978-81-317-5869-4, 2012.

OUTCOMES :

Students who complete this course will be able to

- Choose the appropriate process model for the software application to be developed.
- Collect requirements based on the type of the application and its need.
- Design frameworks for the application to be developed.
- Ensure that the software satisfies the quality standards.
- Apply the appropriate testing strategies to the developed products.
- Modify and improve the deployed product based on user needs and performance results.

CSC 2104 OBJECT ORIENTED PROGRAMMING L T P C

3 0 0 3

OBJECTIVES :

- To learn the concepts of object-oriented programming.
- To acquire knowledge and skills in OO design and program development.
- To explain the concepts of inheritance and polymorphism.
- To learn the syntax, features of, and how to utilize the Standard Template Library
- To study the concepts of Packages, Interfaces, Threading and Swing
- To expose the students to apply certain concepts in Network Programming.

MODULE I INTRODUCTION 07

Object oriented programming concepts –abstraction and encapsulation – inheritance – abstract classes – polymorphism- benefits of OOP– Introduction to C++ – Structure of C++ – access specifiers – function and data members –tokens, expressions and control Structures- data types-storage classes.

MODULE II INHERITANCE 08

Introduction – defining derived classes – single inheritance –multilevel inheritance-multiple inheritance-hierarchical inheritance hybrid inheritance – virtual base classes – abstract classes – constructors in derived classes.

MODULE III POLYMORPHISM AND I/O OPERATIONS 08

Pointers-this pointer-virtual functions –pure virtual function – virtual constructors and destructors– C++ stream classes – Unformatted I/O operations – formatted I/O operations – file stream operations-opening and closing a file –file modes – abstract class – error handling during file operations

MODULE IV TEMPLATES AND EXCEPTION HANDLING 08

Class templates – function templates – overloading of template functions – non-type template arguments – basics of exception handling – mechanism – throwing and catching mechanism – rethrowing an exception – exceptions in constructors and destructors - standard template library -components of STL–containers – algorithms – iterators - application of container classes.

MODULE V INTRODUCTION TO JAVA 07

Java: an Introduction, Life cycle of a Java program, Java virtual machine, Programming in

Java - Declaring Variables - Packages and Interfaces - Exception Handling. Java I/O streaming - Filter and pipe streams - Byte Code interpretation - Threading -Swing.

MODULE VI NETWORK PROGRAMMING IN JAVA 07

Sockets - Secure sockets - Custom sockets - UDP datagrams – Multicast sockets -URL classes - Reading Data from the server - Writing data - Configuring the connection- Reading the header- Java Messaging services.

L – 45; TOTAL HOURS-45

REFERENCES :

1. E.Balagurusamy,”Object Oriented Programming with C++”,6th Edition, Tata McGraw Hill Education,ISBN:9781259029936, 2013.
2. Matt Weisfeld," Object-Oriented Thought Process", 4th Edition, Pearson Education, ISBN: 9780321861276, 2013.
3. Hortsmann & Cornell, "Core Java Advance Features VOL II", 9th Edition, Pearson Education,ISBN: 9780137081608, 2013.

OUTCOMES :

Students who complete this course will be able to

- Experience in basic concepts of object oriented programming.
- Know practical knowledge in OO design concepts.
- Develop the template and exception handling programs,
- Write simple example programs using concepts of the standard template library.
- Demonstrate the OOP concepts applied in networking and web development.
- To implement OOP in various applications.

CSC 2105 **DATA STRUCTURES LAB** **L T P C**

0 0 2 1

OBJECTIVES :

- To make familiar with the data structure concepts.
- To design real time problems and find the way to implement the solution.
- To implement the Stack and Queue ADT.
- To traverse the tree and graph data structures.
- To implement searching and sorting techniques.
- To demonstrate the shortest path algorithm.

SOFTWARE REQUIRED : C/C++/JAVA

Design problems and implement solutions for the following concepts:

1. Basic data structure concepts
2. Linked list
3. Stack ADT and Queue ADT
4. Priority Queue
5. Sorting and Searching
6. Tree traversal
7. Tree Structure - Binary tree, AVL tree
8. Graph traversal
9. Huffman Algorithm
10. Shortest path algorithm

P-15; TOTAL HOURS-15

OUTCOMES :

Students who complete this course will be able to

- Identify the data structure to provide a solution for the given problem.
- use object oriented concepts to solve the complex problems.
- apply Stack and Queue ADT.
- develop and implement the algorithm for the application.
- analyze the problem and identify the appropriate solution for it.
- implement linear and non-linear data structure concepts through programming.

CSC 2106 OBJECT ORIENTED PROGRAMMING LAB

L	T	P	C
0	0	2	1

OBJECTIVES :

- To make familiar with the object oriented concepts.
- To design real time problems and find the way to implement the solution.
- To implement and understand the object oriented concepts and application developments using C++.
- To strengthen their problem solving ability by applying the characteristics of an object-oriented approach.
- To implement File handling and Exception handling.
- To introduce object oriented concepts in C++ and Java.

SOFTWARE REQUIRED : C++/JAVA

Design problems and implement solutions for the following concepts:

1. Classes and Objects
2. Friend function and Inline function
3. Constructor and Destructor
4. Function Overloading and Operator Overloading
5. Inheritance
6. Virtual Function and Dynamic binding
7. File handling and Exception handling
8. Simple Java programs
9. Inheritance using java programs
10. Event handling using java programs
11. Networking using java programs

P-15;TOTAL HOURS-15

OUTCOMES :

Students who complete this course will be able to

- Explain what constitutes an object-oriented approach to programming and identify potential benefits of object-oriented programming over other approaches.
- Use object oriented concepts to solve the complex problems.
- Identify the exception for the specific problem.
- Apply an object-oriented approach to developing applications of varying complexities.

- Analysis the application problem and identify the efficient solution for it.
- Implement networking concepts through programming.

SEMESTER IV

ENC 2282	WRITTEN COMMUNICATION	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To help students identify content specific vocabulary and learn its usage.
- To expose them to reading for specific purposes, especially in professional contexts.
- To expose them to the process of different kinds of formal writing.
- To help them learn corporate correspondence for different purposes.
- To train them in preparing effective applications with résumé
- To make them write different types of reports.

MODULE I **4**

Introduction - process of writing – Fundamentals of academic and professional writing – Understanding short, real world notices, messages, etc.

MODULE II **4**

Reading industry related texts (ex. Manufacturing, textile, hospitality sector etc.) for specific information.

Writing Instructions and recommendations

MODULE III **6**

Understanding format and conventions of writing email, memo, fax, agenda and minutes of the meeting.

Writing email, memo, fax, agenda and minutes of the meeting for various purposes (industry specific)

MODULE IV **6**

Viewing letter of application and Résumé, letter calling for an interview, letter of inquiry and Promotional letter

Writing Functional résumé and letter of application using Edmodo,

MODULE V **6**

Viewing a Video and reading a case study (industry specific) – collaborative writing using Edmodo –reading and information transfer

Writing reports- Survey, feasibility and progress – exposure to discipline specific reports

MODULE VI **4**

Writing Statement of purpose (Higher Education)-- Justifying and writing about one's preparedness for job (Statement of Purpose highlighting strengths and weaknesses) – Peer evaluation skills through Edmodo.

P – 30; Total Hours –30

REFERENCES:

1. Riordan,D (2013). *Technical Report Writing Today*. Cengage Learning, 10th edition. USA.
2. Oliu, W. E., Brusaw, C.T., & Alred, G.J.(2012). *Writing that Works: Communicating Effectively on the Job* . Bedford/St. Martin's. Eleventh Edition.
3. Garner, B.A. (2013). *HBR Guide to Better Business Writing (HBR Guide Series)*. Harvard Business Review Press. USA.
4. Sharma, R.C. & Krishna M. (2002). *Business Correspondence and Report Writing*. Tata MacGraw – Hill Publishing Company Limited, New Delhi.
5. Macknish, C. (2010). *Academic and Professional Writing for Teachers*. McGraw-Hill Education. USA.
6. Whitby, Norman (2014). *Business Benchmark: Pre-Intermediate to Intermediate.* Cambridge University Press, UK.

OUTCOMES:

On completion of the course, the students will have the ability to

- Identify content specific vocabulary and also use them in appropriate contexts.
- Demonstrate reading skills with reference to business related texts.
- Draft professional documents by using the three stages of writing.
- Create different types of documents for various corporate correspondences.
- Write effective letter of applications, résumé and statement of purpose.
- Write business related reports efficiently.

CSC 2211 COMPUTER ARCHITECTURE AND MICRO PROCESSOR

L	T	P	C
3	0	0	3

OBJECTIVES :

- To conceptualize the basics of organizational and architectural issues of a digital computer
- To develop an in-depth understanding of the operation of Central processing unit and ILP.
- Impart the knowledge about Control unit and the ideas about parallel organization.
- Provide the essentials of the processors and Develop assembly level programs using 8085.
- To understand fundamental architecture of 16 bit and 32 bit microprocessors.
- To offer a necessary ideas on microcontroller.

MODULE I BASIC STRUCTURE OF COMPUTERS **07**

Basics – Computer evolution and performance – Computer functions and interconnections –Cache memory – internal memory– external memory – I/O.

MODULE II CENTRAL PROCESSING UNIT **08**

Computer arithmetic – Instruction sets: characteristics and functions – addressing modes and formats – processor structure and functions – Reduced instruction set computers – Instruction level parallelism and superscalar processors.

MODULE III CONTROL UNIT & PARALLEL ORGANIZATION. **07**

Control unit operations – Micro programmed control – Parallel processing – Multi core computers.

MODULE IV 8085 ARCHITECTURE **08**

Microprocessor based systems hardware and interfacing – Programming 8085 – Interfacing peripherals and applications.

MODULE V 8086 ARCHITECTURE **07**

Basics of 8086 – Instruction set of 8086 – assembler directives –Interrupt systems –

classification – interrupts of 8086 – PIC (8259).

MODULE VI MICROCONTROLLER 08

Microprocessors and Microcontrollers - The 8051 micro controller- Moving Data – Logical operations – arithmetic operations – jump and call opcodes - applications.

L – 45; TOTAL HOURS-45

REFERENCES :

1. William Stallings, "Computer Organization and Architecture - Designing for Performance", 10th Edition, Pearson Education, ISBN-13: 978013410613, 2015.
2. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, "Computer organization", 5th Edition, McGraw Hill, ISBN 13:9781259005275, 2002.
3. John Kennessy and David Patterson, “Computer Architecture”, 5th edition, ISBN: 9780123838728, 2011.
4. Ramesh Goankar, “Microprocessor architecture, programming and applications with 8085”, 6th edition, Penram International Publishing, ISBN: 978-8187972884, 2013.
5. Mathur Sunil, “Microprocessor 8086: Architecture, Programming and Interfacing”, PHI, ISBN: 9788120340879, 2012.
6. Kenneth J Ayala,” The 8051 micro controller”, 3rd edition, Cengage Learning, ISBN: 9781401861582, 2010.

OUTCOMES :

Students who complete this course will be able to

- Clarify the essentials of the working of the computing units and trace the operation.
- Demonstrate the working of central processing unit.
- Illustrate the computer architectures and design issues and tradeoffs.
- Bring out the design of microprocessors / microcontrollers-based systems.
- Write an assembly language code to program a microprocessor system.
- Elucidate the microcontroller basics and showcase its applications.

CSC 2212 ANALYSIS OF ALGORITHMS

L	T	P	C
3	1	0	4

OBJECTIVES :

- To learn the asymptotic performance of algorithms.
- To synthesize efficient algorithms in common engineering design situations.
- To familiar with good principles of algorithm design.
- To understand different algorithmic design strategies.
- To know the limitations of Algorithm Power.
- To define the classes P and NP and explain the significance of NP-completeness.

MODULE I FUNDAMENTALS OF ANALYSIS OF ALGORITHM 08

Algorithm - Fundamentals of Algorithmic Problem Solving – Important Problem Types - Fundamental Data Structures – Analysis Framework –Asymptotic Notations and Basic Efficiency Classes –Mathematical Analysis of Recursive and Non-Recursive Algorithms- Empirical Analysis of Algorithm-Algorithm Visualization.

MODULE II BRUTE FORCE AND DECREASE AND CONQUER 08

Selection Sort and Bubble Sort – Sequential Search and Brute Force String matching – Closest pair and Convex Hull Problems by Brute Force – Exhaustive Search – Depth First Search and Breadth First Search – Insertion Sort – Topological Sorting – Algorithms for Generating Combinatorial Objects – Decrease by a Constant Factor Algorithms – Variable Size Decrease Algorithms.

MODULE III DIVIDE AND CONQUER AND TRANSFORM AND CONQUER 08

Merge Sort – Quick Sort - Binary Tree Traversals and Related Properties – Multiplication of Large Integers and Strassen's Matrix Multiplication – The Closest Pair and Convex Hull Problems by Divide and Conquer – Presorting – Gaussian Elimination – Balanced Search Trees – Heaps and Heap Sort – Horner's Rule and Binary Exponentiation – Problem Reduction.

MODULE IV DYNAMIC PROGRAMMING AND COMPUTATIONAL COMPLEXITY 07

Sorting by Counting – Input Enhancement in String Matching – Hashing – B-Trees – Knapsack Problems and Memory Functions – Optimal Binary Search Trees – Warshall's and Floyd's Algorithm.

MODULE V GREEDY TECHNIQUE AND ITERATIVE IMPROVEMENT **07**

Prim's Algorithm – Kruskal's Algorithm – Dijkstra's Algorithm – Huffman Trees and Codes – The Simplex Method – The Maximum Flow Problem – Maximum Matching in Bipartite Graphs.

MODULE VI COPING WITH THE LIMITATIONS OF ALGORITHM POWER **07**

Lower Bound Arguments – Decision Trees – P,NP and NP Complete Problems – Challenges of Numerical Algorithms – Backtracking – Branch and Bound – Approximation Algorithms for NP Hard Problems – Algorithms for Solving Non Linear Equations.

L-45 ; T-15; TOTAL HOURS-60

REFERENCES :

1. Anany Levitin,"The Design and Analysis of Algorithms",Pearson Education Limited,Third Edition,ISBN 10:0-273-76411-X,ISBN 13:978-0-273-76411-3, 2012.
2. Rajesh K.Shukla,"Analysis and Design of Algorithms",Wiley India Private Limited,ISBN : 978–81-265-5477-5,ISBN:978-81-265-8214-3, 2015.
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein," Introduction to Algorithms", MIT Press,Third Edition, ISBN: 978-0-262-03384-8,ISBN: 978-0-262-53305-8, 2009.
4. Sahni Horowitz,"Fundamentals of Computer Algorithms,University Press, ISBN-10:8173716129,ISBN-13:978-8173716126, 2008.

OUTCOMES:

Students who complete this course will be able to

- Analyze best case, average case and worst-case running times of algorithms using asymptotic analysis.
- Apply design principles and concepts to algorithm design.
- Identify and analyze criteria and specifications appropriate to new problems, and choose the appropriate algorithmic design technique for their solution.
- Have the mathematical foundation in analysis of algorithms.
- Develop new data structures by augmenting existing data structures and design algorithms that employ data structures.
- Design algorithms using the Divide-and-Conquer, Dynamic Programming strategy and recite algorithms that employ this strategy.

CSC 2213 NETWORK SECURITY AND CRYPTOGRAPHY

L	T	P	C
3	0	0	3

OBJECTIVES :

- Provide deeper understanding into cryptography, its application to network security, threats/vulnerabilities to networks and countermeasures.
- Cram the various approaches to Encryption techniques, strengths of Traffic Confidentiality, Message Authentication Codes.
- Acquainted with Digital Signature Standard and provide solutions for their issues.
- Familiar with cryptographic techniques for secure (confidential) communication of two parties over an insecure (public) channel
- Introduce the remote User Authentication Principle, symmetric and asymmetric encryption
- Focuses on the practical applications that have been implemented and are in use to provide email and web security.

MODULE I INTRODUCTION TO COMPUTER AND NETWORK SECURITY **07**

Computer and Network Security concepts – The OSI Security Architecture – Security attacks – Security Services – Security Mechanisms – Fundamental Security Design Principles – Attack surfaces and Attack Trees – Introduction to Number Theory – Divisibility and the Division Algorithm – The Euclidean Algorithm – Modular Arithmetic Prime Numbers – Femat's and Euler's Theorem – The Chinese Remainder Therom

MODULE II SYMMETRIC CIPHERS **07**

Classical Encryption Techniques – Symmetric Cipher Model – Substitution Techniques – Transposition Techniques – Rotor Machines – Steganography – Block Ciphers and Data Encryption Standard – Traditional Block Cipher Structure – The Data Encryption Standard – DES Example – Strength of DES – Block Cipher Design Principles- Advanced Encryption Standard – Block Cipher Operation – Multiple Encryption and Triple DES – Electronic Code book – Cipher Block Chaining Mode – Cipher Feedback Mode 0 Output Feedback Mode – Counter Mode

MODULE III ASYMMETRIC CIPHERS **07**

Public- Key Cryptography and RSA – Principles of Public Key Cryptosystem – RSA Algorithm – Diffie-Hellma Key Exchange – Elliptic Curve Arithmetic – Elliptic Curve

Cryptography – Pseudo Random Generation

MODULE IV CRYPTOGRAPHIC DATA INTEGRITY ALGORITHMS 08

Cryptographic Hash Functions – Applications of Cryptographic Hash functions – Simple Hash Functions – Requirements and Security – Hash Functions Based on Cipher Block Chaining – Secure Hash Algorithm (SHA) – Message Authentication Codes – Message Authentication Requirements – Message Authentication Functions – Security of MACs-HMAC – MACs Based on Block Ciphers : DAA and CMAC – Digital Signatures – Elgamal, Schnorr , NIST, Elliptic, RSA-PSS Digital Signature.

MODULE V MUTUAL TRUST 07

Key Management and distribution – Symmetric Key Distribution using Symmetric Distribution – Public Key infrastructure – User authentication – Remote User Authentication Principle – Kerberos – Remote User Authentication using symmetric and Asymmetric Encryption

MODULE VI NETWORK AND INTERNET SECURITY 09

Network Access Control and Cloud Security – Transport Kevel Security – Wireless Network Security – Electronic Mail Security - IP Security

L-45 ; TOTAL HOURS-45

REFERENCES :

1. Williams Stallings, “Cryptography and Network Security: Principles and Practice “,Pearson Education, 7th Edition, ISBN: 10:1-292-15858-1, 2016.
2. Manuel Mogollon, “Cryptography and Security Services: Mechanisms and Applications “, Cybertech Publishing, 1st Edition, ISBN-13: 978-1599048376, 2008.
3. Mike Speciner, Radia Perlman ,“Network Security: Private Communications in a Public World”, , Pearson Education, 2nd Edition, ISBN: 0-13-046019-2, 2002.
4. Christof Paar; Bart Preneel; Jan Pelzl,”,Understanding Cryptography : a Textbook for Students and Practitioners”, Springer, e-ISBN: 978-3-642-04101-3, 2014

OUTCOMES :

Students who complete this course will be able to

- Impart knowledge on Encryption techniques, Design Principles and Modes of

Operation.

- Design a security solution for a given application
- Devise the Key Management techniques and Number Theory.
- Create an understanding of Authentication functions the manner in which Message Authentication Codes and Hash Functions works.
- Examine the issues and structure of Authentication Service and Electronic Mail Security
- Provide familiarity in Intrusion detection and Firewall Design Principles.

CSC 2214 DATABASE MANAGEMENT SYSTEMS

L	T	P	C
2	0	0	2

OBJECTIVES :

- To identify the role of a database management system in an organization.
- To learn the fundamentals of data models and to conceptualize and depict a database system using ER diagram.
- To study SQL and relational database design.
- To learn the internal storage structures and schema.
- To study the relational algebra operations.
- To learn the ACID properties in transaction management.

MODULE I INTRODUCTION **08**

Introduction - An example - Characteristics of Database approach – Roles of database users - Advantages of using DBMS approach - Database applications - Data models, schemas and instances - Three-schema architecture and data independence - Database languages and interfaces - The database system environment - Centralized and client-server architectures - Classification of Database Management systems.

MODULE II RELATIONAL MODEL AND RELATIONAL ALGEBRA **10**

Relational Model: Relational Model Constraints and Relational Database Schemas - Update Operations, Transactions and dealing with constraint violations - Basic Retrieval queries in SQL - Insert, Delete and Update statements in SQL - Additional features of SQL - More Complex SQL Retrieval Queries - Unary Relational Operations: SELECT and PROJECT - Relational Algebra Operations from Set Theory - Binary Relational Operations: JOIN and DIVISION.

MODULE III ER MODEL AND TRANSACTION MANAGEMENT **12**

Entity Types, Entity Sets, Attributes and Keys - Relationship types, Relationship Sets, Roles and Structural Constraints - Weak Entity Types - Refining the ER Design -ER Diagrams, Naming Conventions and Design Issues – Transaction Management - ACID Properties – Transaction Schedules.

L – 30; TOTAL HOURS-30

REFERENCES :

1. Elmasri and Navathe, "Fundamentals of Database Systems", 7th Edition, Addison-Wesley, ISBN: 978-0133970777,2015.

2. Silberschatz, Korth and Sudharshan, "Data Base System Concepts", 6th Edition, Mc-GrawHill, ISBN: 978-0073523323, 2010.
3. Raghu Ramakrishnan and Johannes Gehrke,"Database Management Systems", 3rd Edition, McGraw-Hill,ISBN: 978-9339213114, 2014.
4. C.J. Date, A. Kannan, S. Swamynathan, "An Introduction to Database Systems", 8th Edition, Pearson Education, ISBN: 978-8131762660, , 2012 .

OUTCOMES :

Students who complete this course will be able to

- Describe fundamental elements of a relational database management system.
- Transform an information model into a relational database schema.
- Demonstrate any database applications using ER diagrams.
- Use the Data base model based on the application.
- Write complex queries to solve the real world problems.
- Compare the various transaction schedules.

CSC 2215	DBMS LAB	L	T	P	C
		0	0	2	1

OBJECTIVES :

- To learn the concepts of Database Management systems.
- To create, update and query with the data in the databases.
- To make a detailed study on the applications of DBMS.
- To access and manipulate data using PL/SQL blocks.
- To familiarize advanced SQL queries.
- To learn JDBC/ODBC connectivity.

LIST OF EPERIMENTS:

SQL:

1. Creating, altering and dropping tables with integrity constraints using DDL commands.
2. Retrieving and modifying data from a database using DQL and DML Statements.
3. Retrieving data from database using IN, BETWEEN, LIKE, ORDER BY, GROUP BY and HAVING clause.
4. Use of scalar and aggregate functions.
5. Retrieving data from a database using Join operations(Inner and Outer Joins).
6. Using sub queries or complex queries for retrieving data.

PL/SQL:

7. Simple PL/SQL Programs.
8. Use of implicit & explicit cursors in data handling.
9. Use of stored procedures & functions in data manipulation.
10. Use of trigger in data manipulation.

APPLICATION DEVELOPMENT (JDBC/ODBC connectivity)

a) Inventory Control System.

b) Material Requirement Processing.

c) Hospital Management System.

d) Railway Reservation System.

e) Blood Donors Information Management System.

f) Web Based User Identification System.

g) Timetable Management System.

h) Hotel Management System

SOFTWARES:

- Front end: VB/VC ++/JAVA or Equivalent
- Back end: Oracle / SQL / MySQL/ PostGress / DB2 or Equivalent.

TOTAL HOURS-15

OUTCOMES :

Students who complete this course will be able to

- Design and implement a database schema for a given problem-domain.
- Populate and query a database using SQL DML/DDL commands.
- Apply the normalization techniquesto a database.
- Create simple applications using Java and Oracle using JDBC connectivity.
- Create and maintain tables using PL/SQL.
- Build applications using VB and Oracle.

CSC 2216	SECURITY LAB	L	T	P	C
		0	0	2	1

OBJECTIVES :

- To study and implement simple security algorithm
- To understand the concept of public key encryption, its implementation and real time applications
- To know the symmetric algorithms, and its real time applications
- To identify the various applications of cryptography and security issues practically
- To analyze the different security parameters by installing the security tool kits
- To familiar with S/MIME for e-mail communication

SOFTWARE REQUIRED : C/C++/JAVA

1. Implement the Substitution and Transposition Techniques
2. Implement DES
3. Implement RSA and Diffie Hellman Algorithm
4. Implement MD5 and SHA
5. Implement Digital Signature Standard
6. Install JCRYPT tool (or any other equivalent). Demonstrate Symmetric and Asymmetric cryptographic algorithm, hash and digital signatures
7. Demonstrate Intrusion Detection System (IDS) using any tool using SNORT (or any other equivalent)
8. Demonstrate secure data storage, secure data transmission and create Digital Signatures GnuPG(or any other equivalent)
9. Configure SSH (Secure Shell) and send/receive a file on this connection to verify the correctness of this system using the configured parameters.
10. Install Rootkits and study the variety of options
11. Generate password hashes with OpenSSL.
12. Configuring S/MIME for e-mail communication
13. Using IPTABLES on Linux and setting the filtering rules
14. Understanding the buffer overflow and format string attacks
15. Setup a Honey pot and monitor the honey pot on network using KF Sensor (or any other equivalent)
16. Configure a firewall to block the following for 5 minutes and verify the correctness of this system using the configured parameters: (a) Two

neighborhood IP addresses on your LAN (b) All ICMP requests (c) All TCP SYN Packets

TOTAL HOURS-15

OUTCOMES :

Students who complete this course will be able to

- Implement Symmetric and asymmetric algorithms
- Install the different security toolkits and analyze various parameters
- Demonstrate Intrusion Detection System and Digital signatures using tool kits
- Generate password hashes with security toolkits
- Monitor flow of information in the network and look for vulnerability
- Configure the firewall to block the system and verify the correctness of the system

SEMESTER V

MSB 3181	**LEADERSHIP & CEO TRAINING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

The course aims at

- Bringing about positive transformation in students' attitude.
- Building unique leadership competencies that would ensure successful transition of students across all career stages.
- Sensitizing students to identify their strengths & weakness and training them to deal with it
- Assisting students in enhancing their expressive ability and inducing a high level of self confidence to manage both business and emotions
- Training students to become more adaptable and flexible to changing business environment

MODULE I INTRODUCTION TO LEADERSHIP 12

Leadership concept - meaning, definitions, importance of leadership, leadership traits. Leadership functions- general functions, listening, observing, managing and decision making. Components of leadership - leaders, followers and situation. Leadership theories – Trait theory, Skills theory, Style theory, Situational theory, Transformational theory, Transactional theory, Path Goal Theory and LMX. Assessing emotional intelligence and exploring the capabilities and inherent traits through psychometric tests - Multi factor leadership questionnaire and personal reflections

MODULE II LEADERSHIP STYLE AND COMMUNICATION 08

Leadership styles-visionary, Coaching, Affiliative, Democratic, Pacesetting Commanding, Transformational, Transactional. Autocratic, Participative, Laissez-Faire Leader versus Managers. Leadership communication - Rationale, tactic, assertive, formal, informal, communication in crisis- leadership and negotiations, Leadership Presentations-convincing and impressive style

MODULE III LEADERSHIP ROLES 08

Facets of leadership- Leader as an individual – personality and leadership, values, attitudes and ethics of a leader. **Leader as a relationship builder**- empowering people to meet higher order needs, initiating organization wide

motivational programs, involvement with all stakeholders- focusing on organization growth. **Leader as an inspirer**- motivation and leadership, recognizing and appreciating contributions, empowering others to lead **Leader as an innovator** –leader's role in shaping culture and values in an organization. **Leader as a Liaison- Leader as team player**

MODULE IV LEADERSHIP CHALLENGES AND STRATEGIES 09

Challenges in leadership: Perception of organization culture and values, interpreting the power dynamics in the organization, establishing work life balance. Bad leadership – Reasons and impact.-Case Study of Marissa Mayer-Yahoo.Inc Organizational transformation through efficient leaders-Case study of Apple Inc. Blue Ocean Leadership-Steps to Blue ocean Leadership-Four Pillars of Blue Ocean leadership-Blue Ocean leadership grid

MODULE V LEADERSHIP AND CEO TRAINING 08

Leader as a CEO: Traits of a successful CEO, Key responsibilities of a CEO, the path to be a CEO ,Training on Board Room Discussions, Meeting the CEO –Live sessions with industry CEO's. Requirements of Leadership: - Cognitive skills, Interpersonal skills, Business skills, Strategic skills. Role of Emotional Intelligence in taking up key-positions in the organization.

Teaching Pedagogy:

Nurturing – Based on the identified strengths and weaknesses, training will be given to enhance the strengths and overcome the weakness.

Assessment - Continuous evaluation will be effected through group discussions, oratory assignments and situational enactments. Pre-and post-training assessment through peer reviews and faculty feedback.

Sustained development – Training will be imparted for self-development and monitoring of leadership skills to ensure sustained applicability of the skills learnt.

L – 45; Total Hours – 45

REFERENCES:

1. Andrew J DuBrin. "Leadership: Research Findings, Practice, and Skills", 8th Edition, South-Western College Pub, 2015.
2. Yukl G , "Leadership in Organisations", 8th Edition, Pearson Education, 2013.
3. Richard L Daft , "Leadership", 5th Edition, South Western Cengage Learning 2012.

4. Stephen P. Robbins and Timothy A. Judge. “Organizational Behaviour”, 15th Edition, New Delhi: Pearson, 2013.
5. Fred Luthans, “Organizational Behavior, An Evidence Based Approach”, 12th Edition, New Delhi: McGraw Hill Education, 2013.
6. Emotional Intelligence, Why it can matter no more than IQ by Daniel Goleman (include a book) Publisher: Bloomsbury Publishing India Private Limited; Latest edition (2017)
7. Primal Leadership: Unleashing the Power of Emotional Intelligence by Prof Daniel Goleman , Richard Boyatzis and McKee ,Harvard Business Review Press

Recommended Readings:

1. Jim Collins, (2001). “Good To Great: Why Some Companies Make the Leap...And Others Don't”, Random House Publishers India Pvt.Ltd, New Delhi
2. George, B. with Sims, P. True North: Discover Your Authentic Leadership, The Times Group Books; First edition (1 October 2015)
3. Kim, W. C., & Mauborgne, R. A. (2014). Blue ocean strategy, expanded edition: How to create uncontested market space and make the competition irrelevant. Harvard business review Press.
4. Leadership Wisdom by Robin Sharma Jaico Publishing House;

OUTCOMES:

The students will be able to

- Explore through self-introspection one’s own leadership style, their strength and weakness
- Gain self confidence to lead a team in the organization
- Realize the role of leadership in making or breaking of an organization
- Acquire the practice of self introspection and development of leadership competencies thorough continuous efforts
- Manage their own emotions as well as other resulting in successful relationship building with all stakeholders

MSB 3182 SOCIAL ENTREPRENEURSHIP L T P C
3 0 0 3

OBJECTIVES:

- To be able to understand the field of social entrepreneurship and Social problems
- To be able to describe and understand the traits of social entrepreneurs
- To recognize the social business opportunities
- To synthesize the resource mobilization ways for social entrepreneurship
- To understand the social entrepreneurship models
- To recognize the impact of social entrepreneurship on societies

MODULE I INTRODUCTION TO SOCIAL ENTREPRENEURSHIP 07

Introduction - Emergence and Development of Social Entrepreneurship. Social Problems in India: An Overview. Social Development: The Indian Scenario. Emergence of Social Entrepreneurs and Sustainable Solutions to Social Problem. Characteristics and Context of Social Entrepreneurship .The Role of Social Entrepreneurship in Societies & Economies.

MODULE II SOCIAL ENTREPRENEURSHIP: DRIVERS AND CHALLENGES 07

The Drivers of Social Entrepreneurship. Elements of the Social Entrepreneurial Personality. Challenges of financial constraints. Challenge to attract and cultivate talented workers. Challenge of evaluation of social entrepreneur impact. Challenge of scaling and its impact. Cases

MODULE III SOCIAL ENTREPRENEURSHIP: OPPORTUNITY RECOGNITION 07

Opportunity Recognition and Planning Process. Opportunities for Social Entrepreneurs. The Nature of Social Entrepreneurial Opportunities. Social Problems into Opportunities. Idea development and conceptualization of social problem. Cases

MODULE IV RESOURCE MOBILIZATION FOR SOCIAL VENTURE 08

Resources at Initial Stage. Social Network as a role of Social Capital. Team and Collective Efforts. Need and Determination of Important Resources. Resource of Knowledge, Skills and Abilities. overview of venture capital and angel investment. Cases

MODULE V BUSINESS MODELS AND BUSINESS PLAN FOR SOCIAL ENTERPRISES **08**

Design Principles of Social Entrepreneurship Business Models , Evaluation of the Root Cause of a Societal Problem. Developing business plan for social ventures. Developing an investor presentation. Feasibility study and report. How to start a business - Procedures for registration of small scale industry

MODULE VI THE IMPACT OF SOCIAL ENTREPRENEURSHIP ON SOCIETY **08**

Static Impact of Social Entrepreneurship. Impact of Charitable NGOs vs. Social Entrepreneurship, Impact of For-Profit Companies vs. Social Entrepreneurship. Social entrepreneurship report preparation by students.

Case Study of Social Entrepreneurs

L – 45; Total Hours – 45

REFERENCES:

1. “Social Entrepreneurship : New models of sustainable social change” . Alex Nicholls, Oxford University Press 2006
2. The Process of social value creation : A multiple case study on Social Entrepreneurship in India , Archana Singh Springer 2016
3. “Social Entrepreneurship and social business” Christine K Volkmann, Springer Gabler 2012
4. “Social Entrepreneurship” Manuel London ,Routlege, 2010

OUTCOMES:

The students can able to

- Conceptualize social entrepreneurship in terms of a theoretical framework between changing social values and institutions
- Think and communicate about social values
- Learn about practical models of social change to launch, lead, manage, and evaluate a social venture
- Analyze funding needs and sources for the social venture
- Experience the ideas can be critically and collaboratively examined prior to commitment.

ENC 3181	COMMUNICATION AND SOFT SKILLS - I CAREER CHOICE	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To create awareness of industrial trends and market demands.
- To encourage students to explore career opportunities in an industry and evaluate themselves in relation to industry preparedness

MODULE I **6**

Knowledge about specific industry-Discussion with industry experts --Self evaluating career prospects through survey questionnaire (based on his/her eligibility for taking up a job (industry preparedness)

MODULE II **6**

. Knowing case studies of industries(pertaining to students' choice of career)- Reading and discussing about job markets-goal setting, working on creativity.

MODULE III **4**

SWOC analysis and discussing outcomes--exploring mini projects or case studies of latest industries.

MODULE IV **6**

Writing statement of purpose pertaining to career choice---- Outcomes

MODULE V **8**

Project or case study presentations (Presentation in pairs) -mini project report or case study report.

Total Hours – 30

REFERENCES:

1. Brown,D.(2002). Career Choice and Development. Wiley,J. & Sons.USA
2. Lore,N.(1998). The Pathfinder: How to Choose or Change Your Career for a Lifetime of Satisfaction and Success. Simon & Schuster.USA.
3. *Shell, G.R.(2013).* Springboard Launching your Personal Search for Success.Portfolio.USA.

OUTCOMES:

After the completion of the course, students would be able to

- Speak about their career choice.

- Self evaluate their strengths and weaknesses and speak about it.
- Make effective presentations on case studies or relating to projects.
- Write the statement of purpose relating to their career choice.

CSC 3101 OPERATING SYSTEMS L T P C

3 0 0 3

OBJECTIVES :

- To know the objectives, functions and architecture of operating systems.
- To understand process management concepts.
- To study the functions of process concurrency and synchronization .
- To provide knowledge about how the memory management is done with the help of operating systems.
- To learn the techniques for managing the I/O devices.
- To illustrate techniques for managing the files.

MODULE I OVERVIEW OF OPERATING SYSTEMS 08

Operating Systems Objectives and Functions - Evolution of the Operating systems - Operating System Structures.

MODULE II PROCESS MANAGEMENT & SCHEDULING 08

Process Life cycle - Process control - Threads - Multi Threads - Scheduling criteria - Types of scheduling - Scheduling Algorithms.

MODULE III PROCESS SYNCHRONIZATION 07

Concurrent process - Principles of Concurrency - IPC - Semaphores – Deadlock - Deadlock Prevention, Avoidance, Detection and recovery.

MODULE IV MEMORY MANAGEMENT 07

Introduction - Partitions - Paging - Segmentation - Segmentation and paging - Need for virtual memory management - Demand Paging - Page fault and page replacement policies.

MODULE V I/O MANAGEMENT 07

Organization of I/O functions - Evolution of I/O Functions - Logical Structure of I/O functions - I/O Buffering and Blocking

MODULE VI DISK SCHEDULING 08

Disk I/O - Disk Scheduling algorithms - File Management: Principles - File management Techniques - File directories - File System Architecture - File allocation.

TOTAL HOURS-45

REFERENCES :

1. Abraham Silberschatz, Peter B galvin , Greg Gagne, "Operating System Concepts", 9th Edition, John Wiley & Sons Inc, 2013, ISBN:978-1-118- 06333-0.
2. Deitel H M, "Operating Systems", 3rd Edition, Pearson education India, New Delhi, 2007,ISBN : 978-0-536-21215-3.
3. Dhamdhere D M, "Operating Systems", 1st reprint, Tata McGraw Hill, New Delhi, 2006, ISBN 978–0–07–295769–3.

OUTCOMES :

Students who complete this course will be able to

- State the functioning of operating systems
- Compare the performance of various process scheduling algorithms.
- Analyze the implementation of processes and problems related to process synchronization.
- Find how to manage the resources like memory, I/O devices and files.
- Compare the functioning of various operating systems.
- Compare the functioning of various scheduling algorithms.

CSC 3102 WEB DEVELOPMENT USING JAVA L T P C
3 0 0 3

OBJECTIVES :

- To understand the importance of the web as a medium of communication.
- To learn the language of the web: XHTML and CSS.
- To become familiar with graphic design principles that relate to web design.
- To know the principles of creating an effective web page.
- To develop skills in analyzing the usability of a web site.
- To become familiar with popular search engine.

MODULE I INTRODUCTION 08

Declaring Variables - Programming in Java - Operator and control structures- Functions - Packages and Interfaces - Exception Handling. Java I/O streaming - Filter and pipe streams - Byte Code interpretation - Threading -Swing - Internet and web Trends.

MODULE II XHTML & CSS 07

XHTML Introduction- Body and Text basics- List basics – Text Formatting-Hyperlink-CSS Overview- Configuring Color with embedded style sheet - Configuring Text-Centering XHTML elements with CSS.

MODULE III WEB DESIGN 08

Website Organization & Navigation – Design Principles- Web Page Design – Page layout Design Techniques – Text Design – Graphics Design.

MODULE IV WEBSITE DEVELOPMENT 08

Server side programming - Servlets - Java Server Pages - JDBC - Development Process- Domain name overview – Web Hosting – Choosing Virtual Host.

MODULE V WEB MULTIMEDIA & INTERACTIVITY 07

Helper Applications – Multimedia file types – Using Sound on a Web Page – Using Video on Web Page – podcasting overview – Adobe flash in web page- Java in web page.

MODULE VI WEB PROMOTION 07

Search Engine Overview – Popular Search Engine – Components of Search Engine – Designing pages for Web promotion – Social Media Organization – Case Study: Car

loan, Interior Design.

TOTAL HOURS-45

REFERENCES :

1. Herbert Schildt,"JAVA: The Complete Reference", McGraw Hill Education Pvt Ltd, 9th Edition, ISBN: 9780071808569, 2014.
2. Terry Felke, Morris,"Web Development and Design Foundations with HTML5", Pearson Publication, Eighth Edition, ISBN: 9780134323589, 2016.
3. Sandeep Kumar Patel,"Developing Responsive Web Applications with AJAX and jQuery", Packt publishing, 1st edition, ISBN: 978-1-78328-637-9, 2014.
4. AchyutGodbole, AtulKahate, "Web Technologies: TCP/IP, Web/Java Programming, and Cloud Computing", McGraw Hill Education Pvt Ltd, Third edition, ISBN: 978129062681, 2013.
5. Alex Belotserkovskiy, Stephen Kaufman, Nikhil Sachdeva, "Building Web Services with Microsoft Azure", Packt publishing, first edition, ISBN: 978-1-78439-8, 2015.
6. Jennifer T. Campbell, "Web Design: Introductory", Shelly Cashman Series, 5th Edition, ISBN: 978-1285170626, 2017.

OUTCOMES :

- Students who complete this course will be able to
- Use fundamental skills to maintain web server services required to host a website.
- Design and develop basic web pages using XHTML and CSS.
- Select and apply markup languages for processing, identifying, and presenting of information in web pages.
- Apply scripting languages and web services to transfer data and add interactive components to web pages.
- Create and manipulate web media objects using editing software.
- Design websites using appropriate security principles, focusing specifically on the vulnerabilities inherent in common web implementations.

CSC 3103 ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

L	T	P	C
3	0	0	3

OBJECTIVES :

- To introduce the fundamentals of artificial intelligence.
- To focus on knowledge representation and reasoning techniques.
- To equip the student on machine learning problems and applications.
- To provide understanding on the machine learning architecture for big data.
- To gather knowledge on the installation of various machine learning tools.
- To have a deeper knowledge on the types of learning based on tools.

MODULE I PRODUCTION SYSTEMS AND AI 8

Production systems, specialized production systems, types of production systems, search strategies for AI production systems, backtracking strategies, graph search strategies, uninformed graph search, heuristic graph search, related algorithms, and measures of performance.

MODULE II DECOMPOSABLE PRODUCTION SYSTEMS 8

AND/OR graphs, AO* a heuristic procedure for AND/OR graphs, relationship between decomposable and commutative systems, searching game trees, predicate calculus in AI, resolution, use of predicate calculus in AI, resolution refutation systems, control strategies for resolution methods, simplification strategies, extracting answers from resolution refutations.

MODULE III RULE BASED DEDUCTION SYSTEMS 8

A forward deduction systems, backward deduction systems, resolving within AND/OR graphs, computation deduction and program synthesis, control knowledge for rule based deduction systems, basic plan generating systems, robot problem solving, forward production systems, representation of plans, backward production systems, STRIPS, using deduction systems to generate robot plans.

MODULE IV MACHINE LEARNING OVERVIEW 8

Introduction to machine learning – machine learning applications – supervised learning – learning class with example – learning multiple classes – model selection and generalization – Dimensions of supervised machine learning algorithm.

MODULE V MACHINE LEARNING MODELS 8

Statistical learning framework model – unsupervised learning – PAC learning – a more general learning model – uniform convergence for learnability – non uniform learnability – structural risk minimization – run time of learning.

MODULE VI ADVANCED LEARNING MODELS 5

Online learning – realizable and unrealizable case – clustering – generative models – Feature selection and generation – feature selection – feature manipulation and normalization – feature learning.

L - 45; TOTAL HOURS-45

REFERENCES :

1. Nils J. Nilsson, “Principles of Artificial Intelligence”, 1 st Edition, Morgan Kauffman publishers, ISBN: 1483295869 2014.
2. Ethem Alpaydin, “Introduction to Machine Learning”, MIT Press, ISBN 9780262028189, 2014.
3. Shai Shalev - Shwartz, Shai Ben-David, “Understanding Machine Learning: From Theory to Algorithms”, Cambridge University Press, ISBN 9781107057135, 2014.

OUTCOMES :

Students who complete this course will be able to

- Identify the production systems and the search strategies.
- Acquire knowledge on the representation and reasoning techniques.
- Have an exposure on machine learning problems and applications.
- Examine the learning applications for machine learning
- Examine the installation of machine learning tools and its packages.
- Address the types of learning based on machine learning tools.

CSC 3104 **WEB DEVELOPMENT LAB** **L T P C**

0 0 2 1

OBJECTIVES :

- To develop a web application using java technologies.
- To discover the language of the web: XHTML and CSS.
- To become familiar with graphic design principles that relate to web design.
- To know the principles of creating an effective web page.
- To expand skills in analyzing the usability of a web site.
- To become familiar with web application and development careers.

SOFTWARE REQUIRED :

Basic tools : Java JDK 1.6 and above ,AJAX ,MySQL ,Dream Weaver, Apache Server

LIST OF EXPERIMENTS:

1. Applications form for B.E/B.TECH Admission using Java.
2. Study of Layout Controls.
3. Color Palette Applications.
4. Webpage Design using Image Mapping.
5. Webpage Design Using Style sheet.
6. Designing and Validating Bio-Data using HTML Script.
7. JDBC Connectivity.
8. Invoking HTML forms by Servlets.
9. Servlet with JDBC Connectivity.
10. Employee Payroll System using Java Servlet

TOTAL HOURS-15

OUTCOMES :

Students who complete this course will be able to

- Define modern protocols and systems used on the Web such as HTML.
- Apply client-server internet approaches to web design and implementation.
- Design and implement interactive web sites.
- Apply scripting languages and web services to transfer data and add interactive components to web pages
- Justify and explain particular internet application concepts, relevant alternatives and decision recommendations, including design considerations for internet security.

- Conceptualize and plan an internet-based business that applies appropriate business models and web technologies.

SEMESTER VI

ENC 3281	**COMMUNICATION AND SOFT SKILLS - II**	**L**	**T**	**P**	**C**
	CONFIDENCE BUILDING	**0**	**0**	**2**	**1**

OBJECTIVES:

- To develop professional skills like work ethics, analytical skills, presentation skills etc.
- To train them in problem solving skills and leadership skills pertaining to industries.
- To train them in team building skills.
- To train in setting up career goals

MODULE I **6**

Brief about Multinational companies- Analysing work ethics of multinational companies and small industries- discussing as pairs-Knowledge about etiquette (different types)

MODULE II **6**

Visit to an Industry and prepare reports --Critically reading of industry specific journal articles and write ups-- preparing reports.

MODULE III **4**

Analysing problem solving situations in industries (relating to application of core subject to specific jobs) and discussing about them- working on a sample case

MODULE IV **6**

Developing Leadership in team projects-- debating about various aspects of leadership: for example, responsibility and reliability-time management

MODULE V **8**

Team building skills-- group discussions pertaining to industries-- presenting career goals. -- preparing for interviews- interpersonal skills

Total Hours – 30

REFERENCES:

1. Covey,S.R. (2004). The 7Habits of Highly Effective People: Powerful Lessons in Personal Change. Free Press.UK
2. Fine, P.M.& Alice Olins. (2016).Step up: Confidence, Success and Your Stellar Career in 10 Minutes a Day. Vermilion.UK
3. Pai, A. (1993).How to Develop Self-Confidence. Amazon.com
4. Wentz,F.H.(2012). Soft skills training: A Workbook to Develop Skills for Employment. Amazon.com

OUTCOMES:

After completing the course students would be able to

- Exhibit critical reading skills through review of industry specific articles.
- Provide solutions to problem based situations.
- Exhibit leadership qualities by debating over industry specific issues.
- Participate in group discussions confidently.
- Present their career goals.

CSC 3211 BIG DATA ANALYTICS L T P C

3 0 0 3

OBJECTIVES :

- To provide the basics of data science and Hadoop architecture.
- To construct streaming framework and execute programs with MapReduce.
- To provide the basics of design patterns and learn the basics of Spark programming.
- To formulate queries and evaluate using Hive and HBase.
- To ingest data and work on Sqoop.
- To expose higher level APIs and apply machine learning techniques in Big data .

MODULE I OPERATING SYSTEM FOR BIG DATA 08

Data products – Hadoop for data products – Hadoop eco system – Big data workflows – Hadoop architecture – Hadoop cluster – HDFS – Working with distributed file System – MapReduce – Hadoop Installation.

MODULE II PYTHON AND HADOOP STREAMING 07

Hadoop streaming – computing on CSV data with streaming – executing streaming jobs – MapReduce with Python – simple tasks on MapReduce – counting bigrams – Advanced MapReduce – Combiners – Partitioners – Job Chaining

MODULE III COMPUTING WITH SPARK AND DESIGN PATTERNS 08

Spark Basics – Spark Stack – Resilient Distributed Data Sets – working with Resilient Distributed Data Sets – Interactive Spark – Writing Spark applications. Computing with keys – Compound keys – Keyspace patterns – Pairs Vs Stripes – Design patterns – Summarization – Indexing – Filtering – Fitting and validating models.

MODULE IV DATA MINING FOR LARGE DATA SETS 07

Data Mining basics - Structured data queries with Hive – Hive Command line Interface – Hive query language – simple problem solving - data analysis with Hive – HBase – Real time data Analytics with Hive.

MODULE V DATA IMPORT AND QUERYING 05

Importing relational data with Sqoop – MySQL to HDFS – MySQL to Hive – MySQL to HBase – Ingesting streaming data with Flume.

MODULE VI HIGHER LEVEL APIs AND MACHINE LEARNING 10

Pig – Pig Latin – Data Types – Relational operators – User defined functions – Spark's higher level APIs – Spark SQL – Spark SQL – Data Frames. Machine learning with Spark – Collaborative filtering – Classification – Clustering – Machine learning life cycle.

; TOTAL HOURS- 45

REFERENCES :

1. Benjamin Bengfort , Jenny Kim, "Data Analytics with Hadoop", O'Reilly Media, Inc., First edition, ISBN: 9781491913734, 2016.
2. Isaac D. Cody, "Data Analytics and Python Programming: Beginners Guide to Learn Data Analytics, Predictive Analytics and Data Science With Python Programming, CreateSpace Independent Publishing Platform, First edition, ISBN-13: 9781541334571, 2016.
3. Sam R. Alapati, "Expert Hadoop Administration: Managing, Tuning, and Securing Spark, YARN, and HDFS", Addison Wesley Publishers, First edition, ISBN-13: 9780134597195, 2016.

OUTCOMES :

Students who complete this course will be able to

- Relate to data science and state the working of Hadoop architecture
- Design and implement simple streaming framework and work on MapReduce based problem solving.
- Choose a real time problem, design the analytic logic and solve using Spark.
- Construct queries and evaluate using Hive and HBase.
- Apply various techniques of data ingestion and perform analytics on them.
- Be able to solve data analytics case studies applying machine learning techniques.

CSC 3212 DISTRIBUTED COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES :

- To identify the fundamental principles to design basic distributed systems.
- To describe about the various distributed computing paradigms for Client-Server communication based on the application.
- To analyze the key issues related to communication across a distributed infrastructure and across multiple heterogeneous resources.
- Illustrate the principles of naming and coordinating distributed systems and evaluate the effectiveness and shortcomings of this solution.
- To interpret how various identify and apply design principles when consistency and replication is addressed in architecture.
- To recognize and analyze the failure detection algorithms for fault tolerance and how recovery from failure can be carried out.

MODULE I DISTRIBUTED COMPUTING ARCHITECTURE 08

Design goals-Types of distributed system-Architecture styles-Middleware organization-System architecture.

MODULE II PROCESSES 08

Threads-Virtualization-Clients-Servers-design issues-object servers-Code migration-Migration in heterogeneous systems.

MODULE III COMMUNICATIONS 08

Layered protocols-Types of communication-Remote procedure call-Message oriented communication-Multicast communication.

MODULE IV NAMING AND CO-ORDINATION 07

Flat naming-Structured Naming-Attribute-based naming-Clock synchronization-Logical clocks-Mutual Exclusion-Election Algorithms-Distributed event matching-Gossip based coordination.

MODULE V CONSISTENCY AND REPLICATION 07

Introduction-Data-Centric consistency models- Client-Centric consistency models-Replica management-Consistency protocols-Caching and replication in web.

MODULE VI FAULT TOLERANCE AND SECURITY 07

Failure Models-Process resilience-Reliable client-server communication-Reliable group communication-Distributed commit-Recovery-Security threats-Cryptography-Secure channel-Access control-Secure Naming-Security Management.

TOTAL HOURS-45

REFERENCES :

1. Andrew S Tanenbaum, Maartenvan Steen, "Distributed Systems – Principles and Paradigms", 2nd Edition, Pearson Education,ISBN=1543057381, 2017.
2. Pradeep K. Sinha, "Distributed Operating Systems - Concepts, Systems and Applications", 3rd Edition, Prentice Hall India, New Delhi, ISBN=8120313801,2008
3. George Coulouris, Jean Dollimore and Tim Kindberg, "Distributed Systems Concepts and Design", 3rd Edition, Pearson Education, ISBN=0321263545,2009
4. A.D. Kshemkalyani, M. Singhal, "Distributed Computing: Principles, Algorithms and Systems", Paperback Edition, Cambridge University Press, ISBN=1139470310, 2011.

OUTCOMES :

Students who complete this course will be able to

- Recognize the design principles underlying the functioning of distributed systems.
- Design a distributed system and migrate process when required.
- Apply various communication algorithms and techniques to distributed system environment.
- Build distributed system environment using various naming strategies and coordination techniques based on application.
- Improve the performance and reliability of distributed programs analyzing various security factors.
- Describe and distinguish synchronization and concurrency control for a parallel or distributed computing system.

CSC 3213 GRAPH THEORY AND APPLICATION L T P C

3 1 0 4

OBJECTIVES :

- To introduce the students to graphs and their properties.
- To introduce graph applications as models of networks
- To improve the ability to use recursive definitions and solve recurrence relations.
- To deal with non-polynomial time graph problems.
- To impart knowledge on applying graph algorithms in the domain of Computer Science.
- To apply concept of graph theory to represent and use in communication networks.

MODULE I INTRODUCTION TO GRAPHS 08

Fundamentals of Graph Theory - Families of Graphs and Digraphs - History of Graph Theory – Graph Representation

MODULE II GRAPH THEORY 07

Graph Isomorphism - Recursively Constructed Graphs - Structural Graph Theory - Directed Graphs - Basic Digraph Models and Properties - Directed Acyclic Graphs – Tournaments.

MODULE III CONNECTIVITY AND REVERSIBILITY 08

Connectivity: Properties and Structure - Eulerian Graphs - Chinese Postman Problems - Hamiltonian Graphs - Traveling Salesman Problems - High Connectivity – Bounded Connectivity.

MODULE IV COLORINGS 08

Graph Coloring - Independence and Cliques - Factors and Factorization - Applications to Timetabling - Graphs in Computer Science – Searching - Dynamic Graph Algorithms - Algorithms on Recursively Constructed Graphs - Fuzzy Graphs.

MODULE V GRAPHS IN COMPUTER SCIENCE 08

Searching - Dynamic Graph Algorithms - Dynamic Problems on Undirected Graphs - Dynamic Problems on Directed Graphs - Drawings of Graphs - Types of Graphs and Drawings - Combinatorics of Some Geometric Graphs - Properties of Drawings and Bounds - Complexity of Graph Drawing Problems.

MODULE VI NETWORKS AND FLOWS 06

Maximum Flows - The Basic Maximum Flow Problem - Minimum Cuts and Duality - Max-Flow Min-Cut Theorem - Algorithms for Maximum Flow - Variants and Extensions of Maximum Flow - Minimum Cost Flows - The Basic Model and Definitions - Residual Networks - Optimality Conditions - The Dual Problem - Algorithms for Minimum Cost Flow - Extensions to Minimum Cost Flow - Matchings and Assignments.

L – 45; T-15; TOTAL HOURS-60

REFERENCES :

1. "Handbook of Graph Theory", Ping Zhang, Jay Yellen, Jonathan L. Gross, Chapman and Hall/CRC, 2nd Edition, ISBN: 9781439880197, 2015.
2. "Advanced Graph Theory and Combinatorics, Michel, John Wiley & Sons, ISBN: 9781848216167, 2016.
3. "Algorithmic Graph Theory and Perfect Graphs", Martin Charles Golumbic, North Holland, 2nd Edition, ISBN: 9780444515308, 2004.

OUTCOMES :

Students who complete this course will be able to

- Formulate problems in terms of graphs.
- Solve graph theoretic problems and apply algorithms taught in the course.
- Use generating functions to solve a variety of combinatorial problems.
- Identify the biconnected components in a graph or a circuit.
- Apply principles and concepts of graph theory in practical situations
- Apply concepts of graph theory in Computer networks.

CSC 3214	BIG DATA ANALYTICS TOOLS LAB	L	T	P	C
		0	0	2	1

OBJECTIVES :

- To provide the basic understanding of Hadoop eco system
- To create a Hadoop working environment
- To execute simple programs in Hadoop.
- To write Python programs for solving problems by MapReduce.
- To give basics of Spark programming principles.
- To establish database connectivity and perform analytics on the imported data.

LIST OF EXERCISES:

1. Hadoop Installation.
2. Simple program execution on Hadoop.
3. Python basic programming.
4. MapReduce problem using Python.
5. Simple programs using Spark.
6. Database connectivity and query evaluation using HBase and Hive.
7. Case studies on data analytics using real world Data with suitable Big data open source tools and presentation with effective visualization of analytics.

P-15;TOTAL HOURS-15

OUTCOMES :

Students who complete this course will be able to

- Establish the Hadoop working environment.
- Test working of simple programs on Hadoop.
- Develop programs in Python for performing data analytics.
- Analyze and MapReduce a given problem and solve it in Hadoop.
- Design and develop programs in Spark.
- Carry out data analytics on big data collected from real time scenarios.

CSC 3215	MOBILE APPLICATION DEVELOPMENT LAB	L	T	P	C
		0	0	2	1

OBJECTIVES :

- To expose the various mobile development environments.
- To study the user interface design in mobile applications.
- To inculcate the graphical design for mobile application.
- To restate the concept of multi threading in mobile environment.
- To provide insight about Client-Server communication in mobile environment.
- To be acquainted with database connectivity in the mobile application.

SOFTWARE REQUIRED : J2ME/Android Studio/iOS/Windows phone/Equivalent Mobile Application Development tools with Emulators and Debuggers

1. To implement User Interface features
2. To develop Layout designs and Action Listeners in mobile devices
3. To create a simple calculator application
4. To implement graphical design in mobile applications
5. To connect applications to databases in the device
6. To access RSS Feeds from web
7. To develop mobile application that implements Multi threading
8. To establish Client-Server communication
9. An application development-Mini Project

P-15;TOTAL HOURS-15

OUTCOMES :

Students who complete this course will be able to

- Develop mobile application using any mobile application development tool.
- Design good graphical interface for any mobile application.
- Apply action listeners for the buttons in the mobile application.
- Implements database connectivity to the mobile application.
- Devise a mobile application that uses the concept of multithreading.
- Create a mobile application that supports web access.

SEMESTER VII

		L	T	P	C
CSC 4101	**SOFTWARE PROJECT MANAGEMENT**	**3**	**0**	**0**	**3**

OBJECTIVES :

- Learn the basic of software project management and the project planning.
- Evaluate and assess the projects and to find the cost of the project using cost benefit evaluation techniques.
- To highlight different techniques for software cost estimation and activity planning.
- It also help identify the risks involved in the project and the appropriate strategies for minimizing potential risks.
- Conduct project planning activities that accurately forecast project costs, timelines, and quality. Implement processes for successful resource, communication and change management.
- Manage the selection and initiation of individual projects and of portfolios of projects in the enterprise.

MODULE I INTRODUCTION 08

Software projects versus other types of project - Contract management and technical project management- Plans, methods and methodologies -categorizing software projects -Stakeholders - The business case - Requirement specification - Management control - Step Wise project planning.

MODULE II PROJECT EVALUATION 07

Strategic assessment - Technical assessment - Cost–benefit analysis - Cash flow forecasting - Cost–benefit evaluation techniques - Risk evaluation.

MODULE III SOFTWARE PROJECT APPROACH 07

Choosing technologies - Technical plan contents list - The waterfall model - The V-process model - The spiral model - Software prototyping - Incremental delivery - Dynamic Systems Development Method - Extreme programming..

MODULE IV EFFORT ESTIMATION AND ACTIVITY PLANNING 08

Problems with over- and under-estimates -Software effort estimation techniques - Albrecht function point analysis - A procedural code-oriented approach - COCOMO: a

parametric model - The objectives of activity planning -Project schedules and activities - Network planning models - The forward pass - The backward pass - Identifying the critical path and activities.

MODULE V RISK MANAGEMENT AND MONITORING 08

Introduction - The nature of risk - Types of risk - Managing risk - Hazard identification - Hazard analysis - Risk planning and control- Evaluating risks to the schedule- Creating the framework - Collecting the data - Visualizing progress - Cost monitoring - Earned value - Prioritizing monitoring -Getting the project back to target - Change control- Types of contract - Stages in contract placement - Typical terms of a contract - Contract management – Acceptance.

MODULE VI ORGANIZING TEAMS AND SOFTWARE QUALITY 07

Understanding behavior- Organizational behavior-- Selecting the right person for the job - Instruction in the best methods -The Oldham–Hackman job characteristics model - Decision making - Leadership -Organizational structures - software quality in project planning -Practical software quality measures- Product versus process quality - Quality plans.

L – 45; TOTAL HOURS-45

REFERENCES :

1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata McGraw Hill, New Delhi,. ISBN= 9780077122799,2012
2. Robert K.Wysocki “Effective Software Project Management” –Wiley Publication. ISBN=1118089243,2011
3. Walker Royce: “Software Project Management”- Addison-Wesley, 1998. ISBN=0321734025,1998
4. Gopalaswamy Ramesh, “Managing Global Software Projects” – McGraw Hill Education (India),. ISBN=1259007111,2013

OUTCOMES :

Students who complete this course will be able to

- Practice Project Management principles while developing a software.
- Demonstrate effective project execution and control techniques that result in successful projects.
- Conduct project closure activities and obtain formal project acceptance.
- Demonstrate a strong working knowledge of ethics and professional

responsibility.

- Demonstrate effective organizational leadership and change skills for managing projects, project teams, and stakeholders.
- Critical-thinking and analytical decision-making capabilities to investigate complex business problems to propose project-based solutions

CSC 4102 **COMPILER DESIGN** **L T P C**

3 0 0 3

OBJECTIVES :

- To outline the history and algorithms for compiler construction.
- To introduce high-level programming language implementation.
- To provide fundamental principles of compiler design.
- To have an in-depth knowledge of inner process of compiler.
- To understand the workings of and add to a language processor for each of the modern paradigms.
- To give knowledge on writing programs using compiler construction tools.

MODULE I INTRODUCTION 07

Introduction – A simple traditional modular compiler/interpreter – Structure of compiler – Compiler architecture – Properties of good compiler- History of Compiler Construction – Grammar- Closure algorithm.

MODULE II LEXICAL ANALYSIS 08

Reading the program text – Regular expressions and regular descriptions – Creating lexical analysis by hand and by automatically – Transition table compression – Error handing in lexical analyzers – Lexical identification of tokens – Macro processing and file inclusion.

MODULE III SYNTAX ANALYSIS 09

Two classes of parsing methods – Error detection and error recovery – Creating top down parser manually and automatically – LL(1) parsing – Creating bottom up parser automatically – SLR (1) parsing – LR(1) parsing – LALR (1) parsing – Recovering grammars from legacy code.

MODULE IV SEMANTIC ANALYSIS AND INTERMEDIATE CODE 06

Types and types checking – Storage management – Syntax directed translation – Intermediate code - Assemblers, Dissemblers, Linkers and Loaders.

MODULE V CODE GENERATION 08

Optimization techniques – Local Optimization and Basic blocks – Control and data flow - Code generation – Target machines – Register allocation – Stack management –

Automatic Code generation construction.

MODULE VI COMPILER CONSTRUCTION TOOLS 07

Implementation issues – Cross compilation – Implementation languages – Compiler construction tools – Structure – Simple programs.

TOTAL HOURS-45

REFERENCES :

1. Des Watson, “A Practical Approach to Compiler Construction”, Springer, 2nd Edition, ISBN: 3319527894, 9783319527895, 2017
2. Dick Grune, Kees van Reeuwijk, Henri E. Bal, Ceriel J.H. Jacobs, Koen Langendoen, "Modern Compiler design", Springer Science & Business Media, 2012, 2nd Edition, ISBN : 1461446996, 9781461446996,2012.

OUTCOMES :

Students who complete this course will be able to

- Describe the fundamental steps for designing a compiler.
- Generate tokens for any programming syntax.
- Construct syntax tree and parse the input.
- Implement a translator for a programming language.
- Optimize the code using the techniques provided.
- Use compiler construction tools such as LEX/FLEX and YACC/BISON.

CSC 4103 **CLOUD COMPUTING** **L T P C**
3 0 2 4

OBJECTIVES :

- To lay the foundation on various types of cloud services, technologies and service providers.
- To comprehend the technical capabilities and business benefits of virtualization and cloud computing.
- To study the design challenges of cloud infrastructure.
- To have a knowledge on different programming models and cloud software.
- To elaborate on energy efficient, privacy and security issues in cloud environments.
- To study the fundamental concepts of cloud storage and demonstrate their use in storage systems.

MODULE I CLOUD FUNDAMENTALS 07

Scalable Computing Service over The Internet - Technologies for Network based Computing - System Models for Distributed and Cloud Computing - Introduction to Cloud Computing – Essential Characteristics - Benefits and challenges of cloud computing- Cloud Delivery Models - Deployment models -cloud computing vendors.

MODULE II VIRTUALIZATION 07

Implementation Levels of Virtualization - Virtualization Structures - Virtualization of CPU, Memory and I/O Devices - Virtual Clusters and Resource Management - Virtualization for Datacenter Automation.

MODULE III CLOUD INFRASTRUCTURE 08

Architectural Design of Compute and Storage Clouds – Layered Cloud Architecture Development – Design Challenges - Inter Cloud Resource Management – Resource Provisioning and Platform Deployment – Implementation of resource scheduling algorithm using cloud simulation tool kits

MODULE IV PROGRAMMING MODEL 08

MapReduce programming model - MapReduce and extensions – Relational operations – Parallel Efficiency of Map Reduce- Cloud File Systems - MongoDB - Hadoop - Cloud platforms in Industry – Google App Engine - Cloud Software Environments –Eucalyptus

MODULE V ENERGY EFFICIENT CLOUD COMPUTING 08

Energy efficiency in clouds – Green Computing - Energy efficient cloud computing

architecture – energy aware virtual machine placement in data centers -Energy aware dynamic resource allocation – case studies – Implementation of energy aware scheduling algorithm using open source cloud simulation tool kit.

MODULE VI CLOUD SECURITY AND APPLICATIONS 07

Cloud security fundamentals- Privacy and Security in cloud - Security Architecture – cloud applications – scientific applications – Healthcare – Geosciences – Social networking - media applications - Multiplayer online gaming.

L – 45; P – 30; TOTAL HOURS-75

REFERENCES :

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, — “Distributed and Cloud Computing, From Parallel Processing to the Internet of Things”, Morgan Kaufmann Publishers, ISBN : 9780123858801, 2012.
2. Rajkumar Buyya, Christian Vecchiola, S.ThamaraiSelvi, “Mastering Cloud Computing”, McGraw-Hill Education Private Ltd., ISBN : 9781259029950, 2013
3. Thomas Erl, Zaigham Mahmood, Ricardo Puttini, “Cloud Computing: Concepts, Technology & Architecture”, 1st Edition, Prentice Hall/ Pearson PTR, 2013.
4. Michael J. Kavis “Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)” 1st Edition, wiley, ISBN:9781118617618, 2014.

OUTCOMES :

Students who complete this course will be able to

- Demonstrate the different taxonomy of parallel and distributed computing.
- Articulate the main concepts, key technologies, strengths and limitations of Virtualization and Cloud computing
- Compare and contrast the delivery and deployment models of cloud computing
- Analyze the core issues of cloud computing such as energy efficiency, security, privacy and interoperability
- Recognize the cloud file systems and their applications in industry.
- Identify problems, explain, analyze, and evaluate various cloud computing solutions.

CSC 4104 **COMPILER LAB** **L T P C**
0 0 2 1

OBJECTIVES :

- To expose the working of various phases of compiler.
- To introduce various compiler construction tools.
- To illustrate tools to design lexical analyzer and produce a parser for a given grammar.
- To implement various methods for converting three address code to assembly level program.
- To introduce concept of code optimization of three address code for different programming statements.
- To generate assembly code for the input program.

SOFTWARE REQUIRED :

Basic tools :C/C++/JAVA, LEX/FLEX, YACC/BISON
Compiler construction tools based on the selection of projects.

LIST OF EXERCISES:

1. Design a lexical analyzer for a given High Level Language. Ignore redundant space, tabs and new lines.
2. Study of compiler construction tools.
3. Implement a lexical analyzer.
4. Design and implement Top-Down parsing techniques and Bottom up parsing techniques.
5. Implement a scientific calculator.
6. Generate abstract syntax tree and intermediate code for the given language.
7. Implement code optimization phase of the compiler.

TOTAL HOURS-15

OUTCOMES :

Students who complete this course will be able to

- Illustrate the working of compiler.
- Design lexical analyzer and generate tokens.
- Parse the string for the given grammar.
- Develop and implement the mathematical operations.
- Construct syntax tree and intermediate code.
- Implement various phases of complier through construction tools.

ELECTIVE LIST

SEMESTER IV

Programme Elective ##1

CSC X201 MULTIMEDIA AND ANIMATION

L	T	P	C
3	0	0	3

OBJECTIVES :

- To introduce the various components of Multimedia.
- To expose the principles of animation and design for developing multimedia applications.
- To adapt professional workflows into the design process of animation industry.
- To effectively create and develop animated content for multimedia projects.
- To develop multimedia content for Hand held devices.
- To develop interactive and animated multimedia content.

MODULE I MULTIMEDIA 09

Introduction-Uses of Multimedia-Nyquist's Sampling Theorem-Visual Display Systems-Text-Type of Text- Font, Compression, File formats-Image-Data Representation-Acquisition—Image Processing-Grayscale and Color Processing-Image output on Monitors- Image output on Printers.

MODULE II GRAPHICS 08

Components of Graphic System-Transformations-Line and Circle Drawing Algorithm-Filling and Clipping Algorithms-2d modeling-3D Graphics-Transformations-3D Modeling-Quad Tree

MODULE III VIDEO BASICS FUNDAMENTALS 07

Animation Principles - Techniques - File Formats - Analog Video -Digital Video-Codecs - Format Converters - Shooting and Editing Videos

MODULE IV MULTIMEDIA REQUIREMENTS 07

Stages of Making Multimedia -Intangibles - Multimedia Hardware Requirements-Multimedia Software Requirements - Authoring Systems - Acquiring Content- Internet and Multimedia.

MODULE V MULTIMEDIA SKILLS 07

Multimedia Skills - Planning - Costing - Designing - Producing - Talent Acquisition - Delivery Mechanism.

MODULE VI MULTIMEDIA PROCESS AND TOOLS 07

Designing for World Wide Web- Designing for Handheld Devices- Macromedia Flash Introduction -Understanding the Interface - Drawing and Color Tools.

L – 45; TOTAL HOURS-45

REFERENCES :

1. Ranjan Parekh",”Principles of Multimedia”, Tata McGraw Hill, 2nd Edition, ISBN: 9780070588332, 2013.
2. Tay Vaughan, "Multimedia: Making It Work”, Tata McGraw Hill, 8th Edition, ISBN: 9780071748469, 2010 .
3. James Gonzalez, "Macromedia Flash Professional 8 Hands-On Training", Peachpit Press,2nd Edition, ISBN: 9780321293886, 2006.

OUTCOMES :

Students who complete this course will be able to

- Identify the basic components, basic hardware and software requirements for multimedia development and playback.
- Apply animation principles in Multimedia application development..
- Identify and describe the function of the general skill sets in the multimedia industry..
- Apply animated contents in any Multimedia projects.
- Design Multimedia content for handheld devices.
- Design and create animation using computerized animation tools.

CSC X202 **VFX** **L T P C**
2 0 0 2

OBJECTIVES :

- To develop a technical understanding of 3D Modeling, Deformations, and Texturing.
- To explore and utilize Procedural and Bitmapped Shades
- To implement modeling, Deformations and Textures as applied to Lighting & Animation requirements.
- To acquire skills in pipe line motion
- To demonstrate skills in pipe line pixel isolation
- To develop student's aesthetic, intellectual &technological abilities through programs that integrates theory & practical

MODULE I VFX FUNDAMENTALS 10

Introduction-The foundation of raster for VFX - The foundation of motion for VFX- The foundation of audio for VFX- The foundation of 2D vector for VFX- The foundation of 3D vector for VFX

MODULE II VFX SOFTWARES 10

Fusion vs. Fusion Studio: Two Versions -Fusion Studio: Flow, Stereo 30, Nodes, and Plug-ins- Flow Node Editor: VFX Compositing Tool-The Fusion Bin: using Predefined VFX and Tools

MODULE III VFX PIPELINE COMPOSITION AND MOTION CONTROL 10

Adding Imagery: Drag and Drop with File Manager-The Color Correction Tool: Lighten Shadow Levels-Saving a VFX Project Pipeline- Spline Editor: Control Time using Curves-Navigate the Spline Editor: Independent Zooming -Coloring the Spline Editor: Customize Spline Color

TOTAL HOURS-30

REFERENCES :

1. Wallace Jackson,"VFX Fundamentals: Visual Special Effects Using Fusion 8.0", Apress publications, 1st Edition, ISBN-10: 1484221303, ISBN-13: 978-1484221303,2016.
2. Susan Zwerman , Jeffrey A. Okun ,"The VES Handbook of Visual Effects: Industry

Standard VFX Practices and Procedures Paperback – Import", Focal Press publication; 2 edition, ISBN-10: 0240825187, ISBN-13: 978-0240825182, 2014.

3. Ian Failes ," Masters of FX Paperback – Import", Ilex Press publications, ISBN-10: 1781572674, ISBN-13: 978-1781572672,2015.

OUTCOMES :

Students who complete this course will be able to

- Demonstrate creativity, critical thinking and innovation when identifying and solving problems in diverse contexts within the discipline.
- Apply a body of theoretical and practical knowledge and specific skills in media and communication, in which to base your professional practice or future study.
- Examine and discuss the evolution of digital compositing and digital visual effects.
- Critically analyze and discuss the implications of emerging technologies in the visual effects design process.
- Design and develop a range of creative visual effects solutions to design problems.
- Interpret the influence of visual effects in the creation of innovative digital media.

CSC X203 DIGITAL TRANSMISSION L T P C

3 0 0 3

OBJECTIVES :

- To introduce the fundamental components of digital transmission system.
- To provide knowledge about performance objectives the established for digital transmission system.
- To prepare mathematical background for communication signal analysis.
- To expose the working of different digital systems.
- To explore the importance of synchronization in digital transmission.
- To study the performance of digital communication systems.

MODULE I BASIC TERMINOLOGIES 07

Principles of System Design – Analog to Digital Conversion Techniques – Pulse Code Modulation – Time Division Multiplexing.

MODULE II BASEBAND TRANSMISSION 08

Baseband Transmission – Binary Coding – Power Spectral Density – Error Performance – Pulse Shaping and Inter Symbol Interference – Multilevel Baseband Transmission – Partial Response coding – Eye Patterns – Equalization – Data Scrambling Techniques Modulation Techniques.

MODULE III DIGITAL TRANSMISSION 09

Digital Modulation Techniques – ASK- FSK – BPSK – Comparison – M-ary FSK – M-ary PSK – Quadrature Amplitude Modulation – Offset QPSK – Minimum Shift Keying – Quadrature Partial Response – Digital Transmission – Telephone Networks – FDM – Transmission Parameters – Conditioning – Voice Band Modems- Wideband Modems – Transmultiplexers – Hybrid Transmission Systems.

MODULE IV DIGITAL SYSTEMS 07

Digital Cable Systems – Introduction – Characteristics – Regenerative Repeaters – Clock Recovery and Jitter – Crosstalk – Error Performance – Repeater Spacing – Implementation – Digital Radio Systems – Line of Path Propagation – Multipath Fading – Frequency Allocation – Interference Effects – Digital Radio Design – Radio Link Calculation.

MODULE V NETWORK TIMING AND SYNCHRONIZATION 07

Time Standards – Frequency Sources – Clocks – Synchronization Techniques –

Dissemination Systems: Time, Frequency – Synchronization Schemes – Transmission System – Testing Techniques.

MODULE VI MONITORING AND CONTROL 07

Performance Monitoring – Fault Isolation – Monitoring and Control System – Future of Digital Transmission – New Digital Services – Technology – Transmission in Local Areas – ISDN.

TOTAL HOURS-45

REFERENCES :

1. David R.Smith, “Digital Transmission Systems”, Springer, 4th Edition, ISBN 978–1–4757-1187-5, 2013.
2. Simon S. Haykin, “Digital Communication Systems”, Wiley Publications, ISBN 978-0-471-64735-5, 2013.

OUTCOMES :

Students who complete this course will be able to

- Analyze the different components and their respective roles in communication systems.
- Design a digital system employing the common transmission technologies
- Apply the performance objectives on the designed digital systems.
- Compare and contrast the different technologies applied to digital transmission systems.
- Advice upon choosing appropriate testing strategies employed in signal transmission.
- Identify the practical issues that impact reliable communication in real world scenarios.

CSC X204 INFORMATION TECHNOLOGY IN ORGANIZATION

L	T	P	C
3	0	0	3

OBJECTIVES :

- To describe the role of digital technology in the organizational context.
- To depict the management and flow of data through the digital networks.
- To expose the approachability and management of consumers in organizations.
- To be acquainted with the basics of support systems and enterprise systems in organizations.
- To familiarize the techniques involved in operational and strategic information systems.
- To examine the impacts of Information Technology on individuals, organization and society.

MODULE I DIGITAL TECHNOLOGY 07

Technology transformation-Business process management-Competitive advantage and SWOT analysis-Entrepreneurship technology trends-IT expertise-Data governance strategy-Enterprise IT architecture-Information and decision support systems-Data center and cloud computing-Cloud services delivery models.

MODULE II DATA MANAGEMENT AND DIGITAL NETWORKS 08

Database Management Systems-Big data and Analytics-Data and Text mining-Business Intelligence-Data Networks and API-Wireless and Mobile Infrastructure-Messaging and collaboration Technology-Sustainability and the triple bottom line.

MODULE III REACHING & MANAGING CONSUMERS 09

Search Technology-Organic search and search engine optimization-paid search strategies and metrics-Semantic web and search-recommendation engines-Social media strategies and communities-Social communities and engagement-Social monitoring, metrics and analytics-Social media failures-Retail, mobile and E-commerce.

MODULE IV SUPPORT SYSTEMS AND STRATEGIC ENTERPRISE SYSTEMS 07

Business challenges-Manufacturing, production and transportation management systems-Sales and marketing systems-Accounting and finance systems-Human resource systems and ethics-Enterprise systems-Enterprise social platforms-Enterprise resource planning

systems-Supply chain management systems-Customer relationship management system.

MODULE V **OPERATIONAL AND STRATEGIC INFORMATION SYSTEMS** **07**

Data visualization-Enterprise data mashups-Digital dashboards-Geographic information systems-IT strategies-IT business alignment-Balanced scorecard method-cloud and vendor strategies-project Management and SDLC.

MODULE VI **IMPLEMENTING AND MANAGING IT** **07**

Information Technology for strategic advantage-Information Technology economy-acquiring IT applications and infrastructure-Managing information resources and security-impacts of Information Technology on individuals, organization and society.

L – 45;TOTAL HOURS-45

REFERENCES :

1. Turban, Volonino, Wood,"Information Technology for management", 10th edition, John Wiley and sons Inc., ISBN: 978-1-118-96126-1, 2016.
2. Turban, Leidnar, McLean and Weatherbe, "Information Technology for Management", 5th edition, John Wiley and sons Inc., ISBN: 0-471-705225, 2012.
3. James A O'Brien, George M Marakas, Ramesh Behl, "Management Information Systems", tenth edition, McGraw Hill Education, ISBN 13: 9780073376813, 2013
.

OUTCOMES :

Students who complete this course will be able to

- Analyze the various digital technologies and sort out the appropriate one that suits for the IT organization.
- Implement the different techniques in data management and transmits data through digital networks.
- Examine the impact of the internet for enabling companies to become smarter and closer to the consumer.
- Realize the value of enterprise systems in providing a seamless flow of information within the organization.
- Differentiate between operational systems for transaction processing and Information Support Systems for decision-making, and their impact on setting IT priorities and the IT organization.
- Apply information technology in business environments, with consideration of the cultural context of the organizations.

CSC X205 INNOVATION AND NEW PRODUCT DEVELOPMENT L T P C

3 0 0 3

OBJECTIVES :

- To recognize the importance of innovation in organizational context.
- To identify the changing views of innovation over time and innovation management in organization.
- To explore the significance of discontinuous products.
- To restate the new product development process and strategic features of new product development.
- To appreciate strategic thinking and planning abilities throughout the early product design stage.
- To state various techniques for new product planning and market research.

MODULE I INTRODUCTION TO INNOVATION MANAGEMENT 07

The importance of innovation - the study of innovation- the need to view innovation in an organizational context-Entrepreneurship-Design-Innovation and invention-Different types of innovations - Technology and science -Popular views of innovation- Models of innovation-Innovation as a management process-Case study: European Innovation Scoreboard.

MODULE II MANAGING INNOVATION WITHIN FIRMS 07

Theories about organizations and innovation- The dilemma of innovation management-Managing uncertainty- Organizational characteristics that facilitate the innovation process-Industrial firms are different: a classification- Organizational structures and innovation-Individual's role in the innovation process-IT systems and their impact on innovation-Establishment and propagation of an innovative environment- Case study: Gore-Tex® and W.L. Gore & Associates: An innovative company and a contemporary culture .

MODULE III INNOVATION AND OPERATIONS MANAGEMENT 07

Operations management- The nature of design and innovation in the context of operations- Process design and innovation- Innovation in the management of the operations process- Design of the organization and its suppliers- Operations and technology- Case study: Novels- new products and Harry Potter.

MODULE IV MANAGING INTELLECTUAL PROPERTY 09

Intellectual property- An introduction to patents- Exclusions from patents-The patenting of

life-Human genetic patenting-The configuration of a patent-Patent harmonization- famous patent cases-Patents in practice-Expiry of a patent and patent extensions- The use of patents in innovation management- Trademarks- Brand names-Using brands to protect intellectual property- Duration of registration- infringement and passing off-Registered designs-Copyright-Remedy against infringement- Cast study: Pricing- patents and profits in the pharmaceutical industry.

MODULE V **TECHNOLOGY TRANSFER & NEW PRODUCT DEVELOPMENT** **08**

Introduction to technology transfer-Models of technology transfer-limitations and barriers to technology transfer-Internal organizational factors and inward technology transfer-Developing a receptive environment for technology transfer-Identifying external technology: the importance of scanning and networking-Managing the inward transfer of technology- Product and brand strategy- New product development- Packaging and product development.

MODULE VI **MARKET RESEARCH & NPD TEAM MANAGEMENT** **07**

Market research and new product development-The purpose of new product testing-Testing techniques-Influence of market research-Discontinuous new products-Market research and discontinuous new products-hindrance of market research-Technology-intensive products-convention and winning new markets-ignoring customers-balance between new technology and market research-The challenge for senior management-Managing the new product development team -Practical Steps to help Innovation and New Product Development.

TOTAL HOURS-45

REFERENCES :

1. Paul Trott," Innovation Management and New Product Development", 5th edition, Pearson Education, ISBN-13: 9780273736561, 2012.
2. Crawford C.M.and Di Benedetto C.A.," New Products Management",11th edition, McGraw Hill Education, ISBN-13: 9780078029042, 2015.
3. Joe Tidd- John Bessant- "Managing Innovation: Integrating Technological-Market and Organizational Change", 4th edition, John Wiley & Sons Inc, ISBN 13: 9781118360637, 2013.

OUTCOMES :

Students who complete this course will be able to

1. Realize the generation of product concepts that satisfy the needs of customers.

2. Explore and analyze market needs and appreciate their direct relationship with new products.
3. Discover new product opportunities based on the market research.
4. Evaluate the financial, environmental, social and cultural considerations with regard to design decisions.
5. Analyze the performance of the product based on the requirement.
6. Evaluate the business value and impact of the design product in business class

CSC X206 FUNDAMENTALS OF COMPUTER FORENSICS

L	T	P	C
2	0	0	2

OBJECTIVES :

- To inculcate the fundamentals of digital forensics from the viewpoint of courtroom legalities.
- To establish forensics concepts on networks and internet.
- To create digital forensics investigator role.
- To elaborate upon the evidence gathering over the internet.
- To gain the knowledge on digital investigations.
- To search the current techniques for forensic examinations.

MODULE I INTRODUCTION **10**

Foundations of digital Forensics-Language of Computer Crime Investigation- Digital Evidence in the courtroom-Cybercrime law - Benefits of Professional Forensics Methodology – Types of computer forensics technology.

MODULE II DIGITAL CRIME **10**

Conducting Digital investigations-Handling a Digital Crime Scene-Investigative reconstruction with Digital Evidence-Modus Operandi motive and technology - Computer Intrusions .

MODULE III FORENSICS AND NETWORKS **10**

Network basics for Digital Investigators-Applying Forensic science to Networks- Digital Evidence on the internet, Mobile device forensics, cloud forensics.

TOTAL HOURS-30

REFERENCES :

1. Eoghan Casey, “Digital Evidence and Computer Crime: Forensic Science, Computers and the Internet“, Published by Elsevier, 3rd Edition, ISBN: 9780123742681, 2011.
2. Keith John Jones, Richard Bejtlich, Curtis W. Rose, “Real Digital Forensics: Computer Security and Incident Response”, Addison Wesley Professional, 5th edition, ISBN: 9780321240699, 2008.
3. Terrence V. Lillard, Clint P. Garrison, “Digital Forensics for Network, Internet, and

Cloud Computing: A Forensic evidence Guide for Moving Targets and Data", Elsevier, 1st Edition, ISBN: 9781597495370, 2010.

4. John Sammons, "The Basics of Digital Forensics, The Primer for Getting Started in Digital Forensics", 2nd Edition, Elsevier, ISBN: 9780128016350, 2014.

OUTCOMES :

Students who complete this course will be able to

- Recognize the role of digital forensics in the real world.
- Identify and extract digital evidence from varied networking layers.
- Apply forensics techniques for analyzing computer systems and networks.
- Assess digital evidence and practice forensic investigation.
- Describe the legalities, penalties, and punishment associated with cyber.
- Identify the current techniques and tools for forensic examinations.

CSC X207 OPEN SOURCE TECHNOLOGIES L T P C

2 0 2 3

OBJECTIVES :

- Expose to context and operation of free open source software
- Illustrate the principles of GNU/Linux and distributions
- Explain why Open source technologies are the need of the hour
- Become aware of open source licenses and the processes of adoption and use
- Learn scripting, programming languages like Python and Perl
- Gain knowledge in the concept of open source data base

MODULE I INTRODUCTION 08

The concept of software freedom – Modifications – consequences of the freedom of software – Free software before free software – The beginning : BSD,GNU –Free software licences – Free software and public administrations

MODULE II GNU LINUX 07

GNU/Linux – Introduction – Installation and File System hierarchy - General Overview – Kernel Mode and User Mode – Process – Advanced Concepts – Scheduling – Personalities – Cloning – Signals – Development with Linux .

MODULE III PROGRAMMING LANGUAGUE - PYTHON 08

Introduction to Python – Syntax and Style – Python Objects – Numbers – Sequences – Strings – Lists and Tuples – Dictionaries – Conditionals and Loops – Files – Input and Output – Errors and Exceptions – Functions – Modules – Classes and OOP – Execution Environment .

MODULE IV DATABASE - POSTGRESQL 08

KeyFeatures of PostgreSQL - Environment Setup - Syntax - Data Types - Working with Databases - Basic operators , Expressions , Queries - Case Study

MODULE V PHP 07

Introduction to PHP – Programming in Web Environment – Variables – Constants – Data Type – Operators – Statements – Functions – Arrays – OOP – String Manipulation and Regular Expression – File Handling and Data Storage – PHP and SQL Database – PHP and LDAP – PHP Connectivity – Sending and Receiving E–mails – Debugging and Error Handling – Security – Templates .

MODULE VI PERL 07

Perl Backgrounder – Perl Overview – Perl Parsing Rules – Variables and Data – Statements and Control Structures – Subroutines, Packages and Modules – Working with Files – Data Manipulation.

L-30 ; P-30; TOTAL HOURS-60

REFERENCES :

1. Richard Petersen, “Linux: The Complete Reference”,, Sixth Edition 6th Edition, ISBN-13: 978-0071492478,ISBN-10: 007149247X,2016.
2. Sandeep Koranne, “Handbook of Open Source Tools”, Springer, ISBN-13: 978-1441977182, ISBN-10: 144197718X, 2011.
3. KY Cheung, “Scientific Database and Programming Examples Using PHP, MySQL, XML, MATLAB, Python, Perl Hardcover”, Xlibris Corporation, Import, 27 Sep 2011

OUTCOMES :

Students who complete this course will be able to

- Ability to install, configure and programming in Linux
- Explain about the open source communities Development Model
- Install and run open source operating systems
- Develop applications in Python and Perl
- Write own MySQL programs and sort the query results
- Develop web applications using open source software

CSC X208 USER INTERFACE DESIGN L T P C
2 0 0 2

OBJECTIVES :

- To expose the relation between interaction design and users expectations.
- To employ a set of usability engineering methods to refine a designed user-interface.
- To learn about human computer interaction with the help of interfaces that has high usability.
- To address a user-interface using suitable evaluation methodology.
- To demonstrates interaction design process.
- To acquire the concepts of usability, design principles, guidelines, heuristics and other fundamentals of Human-Computer Interaction.

MODULE I INERACTION DESIGN 10

Introduction, Good and Poor design, Interaction design, User experience, Process of Interaction design, Interaction design and User experience. Understanding the problem space and conceptualizing interaction, Interaction types.

MODULE II DEVELOPMENT PROCESS 10

Managing design process – organizational design to support usability – Four pillars of design – development methodologies – Ethnographical observation – Participatory design – scenario development. Develop System Menus and Navigation menus-Select the proper kinds of windows-Select the proper device based controls.

MODULE III INTERACTION DESIGN 10

Process of Interaction Design - Establishing Requirements – Design, Prototyping and Construction - Evaluation and Framework. Usability Heuristics – Simple and Natural Dialogue, Users' Language, Memory Load, Consistency, Feedback, Clearly Marked Exits, Shortcuts, Error Messages, Prevent Errors, Documentation, Heuristic Evaluation.

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TOTAL HOURS-30

REFERENCES :

1. Preece,Sharp & Rogers," Interaction Design: Beyond Human - Computer Interaction", John Wiley & Sons, 4th Edition,ISBN:9781119020752, 2015.
2. Yvonne Rogers, Helen Sharp, Jenny Preece, "Interaction Design: Beyond

Human - Computer Interaction", John Wiley & Sons, 3rd Edition,ISBN 9788131732557, 2011

3. Ben Shneiderman, Plaisant, Cohen, Jacobs, "Designing the User Interface: Strategies for Effective Human Interaction", Pearson Education, 5th Edition, 2010.
4. Bill Scott and Theresa Neil, "designing Web Interfaces", O'Reilly, USA,ISBN: 9780596516253, 2009.
5. Wilbert O.Galitz, "The essential guide to User Interface Design", 3rd Edition, Wiley Publishers,. ISBN: 408-297-2445, 2009.

OUTCOMES :

Students who complete this course will be able to

- Demonstrate knowledge about some interaction design patterns and their applicability.
- Select and execute an appropriate interaction design pattern for a particular user interface situation.
- Use several of the important concepts for interface design (i.e. color and typography) in their designs
- Analyze users' needs, usability goals and user experience goals of a small-to-medium-sized software application.
- Develop and construct suitable user interface for a given scenario.
- Implement basic user interface prototypes based on the design process

CSC X209 STRESS MANAGEMENT L T P C

1 0 0 1

OBJECTIVES :

- To bring awareness on the existence of stress in day-today activities.
- To differentiate between obstacles and opportunities.
- To understand the process of confidence building.
- To discriminate the work life activities and instill work life balance.
- To analyze the causes of occupational stress.
- To enumerate the strategies for stress management at work place.

MODULE I STRESS AND TAMING STRESS 07

Stress to success, The 50% rule, Obstacles to opportunities, Strategies to reduce workload.

MODULE II SOLUTIONS FOR STRESS MANAGEMENT 08

Building confidence, Elimination of Anxiety, Self criticism to self confidence, Anger to a cool head, stop other people stressing you, Work life balance,

TOTAL HOURS- 15

REFERENCES :

1. Sharon Melnick, “Success Under Stress: Powerful Tools for Staying Calm, Confident, and Productive When the Pressures On”, Amacom Publishers, ISBN-13: 978-0814432129, 2013.
2. D M Pestonjee, “Stress and Work: Perspectives on Understanding and Managing Stress”, SAGE Response publisher, First edition, ISBN-13: 978-8132110880, 2013.

OUTCOMES :

Students who complete this course will be able to

- Analyze and identify the stress issues in everyday activities.
- Recognize obstacles and opportunities and suggest strategies to utilize the opportunities.
- Create confidence building action plan.
- Assess work life activities and recommend strategies to inculcate work life balance.
- Enumerate the causes of occupational stress and prescribe plans to overcome them.
- Devise simple procedures and plans to minimize stress at work place.

CSC X210 INFORMATION ETHICS L T P C

1 0 0 1

OBJECTIVES :

- To expose the issues of morality and technology at the Internet age.
- To give an idea on the development of computer ethics.
- To provide an overview ethics for the IT professional.
- To highlight the importance of computer crimes.
- To understand information security policy management.
- To aware the crime prevention, detection and response in internet.

MODULE I OVERVIEW OF ETHICS 08

Definition of Ethics, Importance of ethics ,the difference between Morals, Ethics and Laws – Ethics in the business world, fostering good business ethics Importance, Improving corporate ethics, Creating an ethical work environment, Ethical considerations in decision making – Ethics in information technology - IT professionals – IT users.

MODULE II COMPUTER AND INTERNET CRIME 07

IT security incidents: A major concern, Types of exploits, Types of perpetrators, Federal laws for prosecuting computer attacks – Implementing trustworthy computing, Risk assessment, Establishing a security policy, Educating employees and contract workers, Prevention, Detection and Response.

L-15; TOTAL HOURS-15

REFERENCES :

1. George W. Reynolds - “Ethics in Information Technology”, Fifth and Edition, Cengage Learning, ISBN: 1285197151, 2015.
2. Toni Samek and Lynette Shultz – “Information Ethics Globalization and Citizenship “McFarland & Company, ISBN: 9781476667720, 2017.

OUTCOMES :

Students who complete this course will be able to

- Identify the issues of morality and technology at the Internet age.
- Acquire the idea on the development of computer ethics.
- Illustrate the knowledge about the ethics of IT professional.
- Evaluate the security issues over internet.
- Identify security policy concerns in information management.
- Recognize the crime prevention, detection and response.

SEMESTER V

Programme Elective ##2

Elective 1

		L	T	P	C
CSC X101	**2D CHARACTER ANIMATION**	**2**	**0**	**0**	**2**

OBJECTIVES :

- To design a 2D character and create it through the tool.
- To develop characters inspired by humans, birds, fish, snakes and four legged animals.
- To provide each stage of the animation production process in an engaging visual style.
- To create and edit 2D animations using professional suite.
- To give knowledge on tools and basic functions to develop a character.
- To implement the animation using the adobe profession tool.

MODULE I CONSTRUCTION OF CHARACTER 10

Introduction to animation – Principles of animation - Matter and animation of inanimate objects –Inanimate objects - Construction of a simple character – Creating a character using Adobe illustrator.

MODULE II ANIMATION 10

Timing for animation -Animation of human walks and runs-Animation of animal walks and run- Animation and acting- Creating animation using Adobe Photoshop.

MODULE III APPLICATIONS AND OUTCOMES 10

Draw and cell animation – 3D stop motion animation – Animation for children – Digital animation – Creating comic book using adobe illustrator-Creating basic animation in Flash professionals.

TOTAL HOURS-30

REFERENCES :

1. Steve Roberts, "Character Animation Fundamentals: Developing skills for 2D and 3D character animation", Taylor & Francis publication, 2nd Edition, ISBN No: 9781136129490, 2012.
2. Debra Keller," Creating 2D Animation with the Adobe Creative Suite", Cengage Learning, 1st Edition, ISBN No: 9781133693482, 2013.

3. Paul Wells, Samantha Moore ," The Fundamentals of Animation", Bloomsbury Publishing, 2nd Edition, ISBN No: 9781474241786, 2017.

OUTCOMES :

Students who complete this course will be able to

- construct 2D character using step by step procedure.
- develop characters personality with chapter on acting, voice-synching and facial expressions.
- devise on timing on animation.
- use the animation tips, tricks and techniques for unique projects.
- compile a diverse portfolio of high-quality animations to showcase artistic talent and technical skill.
- expertise on creating animation of characters for different plays.

CSC X102 IMAGE PROCESSING L T P C

2 0 2 3

OBJECTIVES :

- To provide the basic foundation of image processing.
- To give knowledge on image formation and preprocessing.
- To function on feature extraction through different approaches.
- To explain the basic steps of segmentation process.
- To represent the image and processing on binary images.
- To implement the image processing techniques using tools.

MODULE I FOUNDATION 07

Components of Image processing system – Image Representation – Neighborhood operations – Multi scale Representation.

MODULE II IMAGE FORMATION AND PREPROCESSING 08

Quantitative Visualization – Image formation – Digitization, Sampling and Quantization.

MODULE III FEATURE EXTRACTION 08

Averaging – Box filter – Binomial filter - Edges – General properties of Edge filters – Gradient Based Edge Detection - Simple Neighborhood – Motion – Texture.

MODULE IV IMAGE SEGMENTATION AND MODELING 07

Segmentation – Pixel based, Edge based, Region based, Model based segmentations - Regularization and modeling – Unifying local analysis and global knowledge – Diffusion models – Network models – Inverse filtering.

MODULE V IMAGE ANALYSIS 08

Processing binary images- Correlation, Classification, Identification and Matching - Tomography- Methods for object measurement.

MODULE VI PROGRAMMING 07

Applications – Handling image files – Establishing image processing tools – Correcting and enhancing images - Programming with Open CV - Simple examples.

L – 30; P – 30; TOTAL HOURS-60

REFERENCES :

1. Bernd Jahne, ”Digital image processing”, Springer Science and Business Media,

5th Edition, ISBN: 978366204781, 2013.

2. John C Russ,"Image processing handbook", CRC Press, 7th Edition, ISBN: 9781498740289, 2016.
3. Gloria Bueno García et.al, "Learning Image Processing with OpenCV", Packt Publishing, 1st Edition, ISBN: 9781783287666, 2015.

OUTCOMES :

Students who complete this course will be able to

- Explain the basis of image processing techniques.
- Build image through methods and preprocess it.
- Extract the features of region of interest through filters.
- Segment the image using various segmentation techniques.
- Analyze the image and represent it through measurements.
- Represent image using Open CV.

CSC X103 MULTIMEDIA APPLICATION DEVELOPMENT

L	T	P	C
2	0	0	2

OBJECTIVES :

- To summarize the fundamental concepts of multimedia.
- To learn the various paradigms in multimedia system.
- To identify the theoretical thoughts and practical knowledge of the multimedia development process.
- To incorporate and manipulate the multimedia building blocks.
- To expose on the different views of audio and video in multimedia applications.
- Use Action Script 3.0 to develop interactive applications in multimedia.

MODULE I INTRODUCTION TO MULITMEDIA **10**

Where to use Multimedia – Delivering Multimedia – Text in multimedia – Hypermedia and Hypertext – Image – Digital sound – Analog and digital video – Digital video containers.

MODULE II INTERNET AND MULTIMEDIA **10**

Internetworking - MIME Types - Multimedia on the web - Web servers and browsers - Web Page Makers and Site Builders - Plug-ins - Image, Sound, Video for the Web

MODULE III APPLICATION DEVELOPMENT **10**

Object oriented Features- Authoring an action script class - 2.0 Subclass - OOP Application Frame work, Components with ActionScript, MovieClip Subclasses.

L – 30; TOTAL HOURS-30

REFERENCES :

1. Tay Vaughan, "Multimedia Making It Work ", 8rd Edition, MC Graw Hill, 2011. ISBN: 978-0-07-174850-6
2. Nigel Chapman and Jenny Chapman, “Digital Multimedia”, 3rd Edition, Wiley Dreamtech, 2009. ISBN: 978-0-470-51216-6
3. Colin Moock, Essential ActionScript 3.0, 1st Edition, SPD O’Reilly, 2007. ISBN: 978-0-596-52694-8

OUTCOMES :

Students who complete this course will be able to

- Identify the components for building the multimedia blocks
- To effective use and produce the multimedia elements.

- Classify the function of the multimedia skill in the software industry.
- Choose an appropriate multimedia development mechanism for particular applications.
- Write a basic programs using Action Script language.
- Developing the application structure for the given real time scenario

CSC X104 **3D ANIMATION** **L T P C**
2 0 2 3

OBJECTIVES :

- To introduce the fundamentals of 3D animations.
- To focus on the digital imaging and visualization techniques.
- To equip the student on the usage of 3D scanners and storage solutions.
- To provide understanding on the creation of stereoscopic 3D animations.
- To gather knowledge on the 3D programming based on WebGL and javascript.
- To learn the developing of a simple 3D application and 3D environment.

MODULE I 3D ANIMATION OVERVIEW 8

Exploring 3D animation, history of 3D animation, understanding the production pipeline's components, working in 3D animation preproduction, production, postproduction, usage of production tools.

MODULE II DIGITAL IMAGING AND VIDEO 8

Understanding digital imaging, understanding digital video, exploring animation, story, pre visualization, using principles of fine art and traditional animation, building a good story, using pre visualization techniques.

MODULE III MODELLING AND ANIMATION 8

Modeling and texturing, rigging and animation, creating visual effects, lighting, rendering, working with graphics tablets, using 3D scanners, setting up render farms, finding data storage solutions, choosing software.

MODULE IV INDUSTRY TRENDS 5

Using motion capture, creating stereoscopic 3D, integrating point cloud data, providing real time capabilities.

MODULE V PROGRAMMING 3D APPLICATIONS 8

3D graphics basics, WebGL; real time 3D rendering, example, javascript 3D engine, 3D animations using frames, Advanced page effects, using 3D transforms.

MODULE VI APPLICATION DEVELOPMENT TECHNIQUES 8

3D content pipeline, 3D engines and frameworks, webGL framework, vizi framework,

developing a simple 3D application, developing, previewing, integrating, developing 3D environment.

L - 30; P – 30; TOTAL HOURS-60

REFERENCES :

1. Andy Beane , “3D Animation Essentials”, John Wiley & Sons, ISBN 1118239059, 2012.
2. Tony Parisi, “Programming 3D Applications with HTML5 and WebGL: 3D Animation and Visualization for Web Pages”, O'Reilly Media, Inc, ISBN 1449363954, 2014.

OUTCOMES :

Students who complete this course will be able to

- Determine the production tools suitable for applications
- Possess knowledge on the digital imaging and visualization techniques.
- Identify the storage solutions for animations
- Develop stereoscopic 3D animations
- Comprehend 3D programming levels based on WebGL and javascript..
- Implement the programming fundamentals of 3D application creation

CSC X105 ADVANCED COMPUTER GRAPHICS L T P C
2 0 2 3

OBJECTIVES :

- To use specific tools and software to produce a graphic product based on the principle of creative art.
- To make a graphic product based on the principle of creative art.
- To create graphic material using tools and software in line with the industrial norm.
- To introduce scene graphs in representing transformation hierarchies in articulated models.
- To processes of vertex blending, vertex skinning and keyframing in skeleton animation module.
- To explore forward and inverse kinematics solutions for animating a joint chain.

MODULE I 2D & 3D CONCEPTS 8

Two dimensional Geometric transformation - Two dimensional viewing -Line, Polygon, Curve and Text clipping algorithms- Three dimensional object representation-Polygons, Curved lines, Quadric Surfaces.

MODULE II COLOR MODELS 7

Color Models - RGB, YIQ, CMY, HSV - Animations - Conversation between HSV and RGB Models-HLS Color Model-Color Selection and Applications.

MODULE III RENDERING 7

Introduction to Shading models - Flat and Smooth shading - Adding texture to faces - Adding shadows of objects - Building a camera in a program - Creating shaded objects - Rendering texture - Drawing Shadows.

MODULE IV SCENE GRAPHS 8

Basic structure- Transformation hierarchy - Relative Transformations – Bounding Volume Hierarchy – Sample Implementation: Group node, Object Node, Camera Node.

MODULE V SKELETAL ANIMATION 7

Articulated Character Models – Vertex Blending – Skeleton and Skin – Vertex Skinning – Transformation Blending.

MODULE VI KINEMATICS 8

Robot Manipulators – Forward Kinematics – Linear and Angular Velocity – Inverse Kinematics- Circular alignment Algorithm-Mesh Representation - Spatial Partitioning.

L - 30; P – 30; TOTAL HOURS-60

REFERENCES :

1. Ramakrishnan mukundhan “Advanced Methods in Computer Graphics with examples in in OpenGL”,Springer Education, ISBN: 9781447123392,2012.
2. Donald Hearn, Pauline Baker, "Computer Graphics with OPENGL - C Version", Pearson Education, 4th Edition, 2010.
3. James D. Foley, Andries Van Dam, Steven K. Feiner, John F. Hughes, "Computer Graphics- Principles and practice", Pearson Education, 2nd Edition, ISBN: 0201848406, 2007.

OUTCOMES :

Students who complete this course will be able to

- Use surface and object modeling techniques to build 3D models.
- Learn the principles and commonly used paradigms and techniques of computer
- Develop a facility with the relevant mathematics of computer graphics
- Be able to write basic graphics application programs including animation .
- Identify the performance characteristics of advanced computer graphics pipeline.
- Be able to design programs to display graphic images to given specifications

CSC X106	MULTIMEDIA DESIGN PROGRAM	L	T	P	C
		2	0	2	3

OBJECTIVES :

- To recognize the basics of event based programming using Adobe Flash Work with the timeline
- To comprehend the standards of Flex by which applications can be deployed consistently on all major browsers, desktops, and devices with necessary skills to design rich forms that apply the use of data binding and validation.
- To gain knowledge on both client and server side scripting with Tween Animations
- To identify with the Adobe Integrated Runtime Create 3D Effects
- To build interactive software as part of a development team (including artists, animators, designers, producers and/or other programmers).
- To apply programming techniques essential to the construction of multimedia systems.

MODULE I UNDERSTAND THE FLASH WORKSPACE **07**

Open a Document and Playa Flash Movie- Create and Save a Flash Movie - Work with the timeline - Distribute a Flash Movie Application

MODULE II DRAWING OBJECTS IN ADOBE FLASH **08**

Use the Flash Drawing and Alignment Tools- Select Objects and Apply Colors -Work with Drawn Objects - Abik with Text and Text Objects - Work with layers and Objects

MODULE III WORKING WITH SYMBOLS AND INTERACTIVITY **09**

Create Symbols and Instances- Work with libraries - Create Buttons - Assign Actions to Frames and Buttons -Import Graphics

MODULE IV CREATING ANIMATIONS **07**

Create Motion Tween Animations- Create Classic tween animation - Create Frame-by-Frame Animations -Create Shape tween Animations - Create Movie- Animate Text

MODULE V CREATING SPECIAL EFFECTS **07**

Create A Mask Effect - Add Sound - Add Video - Create an Animated navigation Bar - Create Character Animations Using Inverse Kinematics - Create 3D Effects -Use the Deco Tool

MODULE VI PREPARING AND PUBLISHING APPLICATIONS **07**

Publish Movies Using Different formats – Reduce file Size to Optimize a Movie - Create a Preload& - Publish AIR Applications -Create and Publish Applications for Mobile Devices

L – 30 ;P-30;TOTAL HOURS-60

REFERENCES :

1. James Shuman,"Adobe Flash CS6 (Revealed)",Course Technology Ptr (Sd), ISBN : 978-1133693215,2012
2. Joseph Labrecque,"Learning Adobe Edge Animate", Packt Publishing,1st edition, ISBN: 1849692424, 2012
3. William Sanders,"Learning PHP Design Patterns", Shroff/O'Reilly; First edition, ISBN-10: 935110060X, ISBN-13: 978-9351100607, 2013.
4. Vic Costello,"Multimedia Foundations" Focal Press ,1st edition, ISBN-10: 0240813944, ISBN-13: 978-0240813943,2012

OUTCOMES :

Students who complete this course will be able to

- Evaluate and apply classes from a multimedia application programmer interface (API) or framework to aid the development of multimedia systems.
- Evaluate and apply appropriate methods for the storage, delivery and display of multimedia data.
- Develop object oriented programs to manipulate media objects.
- Apply programming techniques essential to the construction of multimedia systems.
- Implement effective design, production and testing techniques (including appropriate project engineering and management) through all phases of game development as relevant to programmers/engineers
- Communicate effectively (through the use of written material and visual presentations) to both technical and non-technical game developers.

CSC X107 **NETWORK MODELING** **L T P C**

3 0 0 3

OBJECTIVES :

- To empathize the basic concepts of lower and higher layer wireless modeling.
- To discuss about graphical models for different routing protocols.
- To expose user behavior in P2P systems and analyze the security aspects of network data in the Internet.
- To provide an overview on different network simulators for wireless network.
- To gain knowledge on different open source network simulators.
- To examine the performance of the network using simulation tools.

MODULE I **LOWER LAYER WIRELESS MODELING** **09**

Physical Layer Modeling - Link Layer Modeling - Channel Modeling - Selected System Models - Wireless Networking Use Cases - Modeling Mobility - Modeling Handover from the Access Networks' Perspective.

MODULE II **HIGHER LAYER WIRELESS MODELING -I** **07**

Modeling the Network Layer and Routing Protocols - Modeling Transport Layer Protocols - Modeling Application Traffic.

MODULE III **HIGHER LAYER WIRELESS MODELING -II** **06**

Modeling the Internet Delay Space and its application in Large Scale P2P Simulations - . Modeling User Behavior in P2P Systems - Modeling Security Aspects of Network - Modeling the Network Topology.

MODULE IV **COMPUTER NETWORK PERFORMANCE MODELING AND SIMULATION** **08**

Performance Modeling – Performance metrics in computer network simulation – Discrete event Simulation – Validation and Verification – Network Simulators – Case study on different Network Simulators.

MODULE V **MODELING APPROACHES OF COMPUTER NETWORKS AND SYSTEMS** **08**

On the self-similarity of traffic generated by network traffic simulators – Hurst Parameters – Analysis – Performance evaluation and Petri nets – Markov Chain models and applications.

MODULE VI **SIMULATION METHODOLOGIES IN COMPUTER NETWORKS AND SYSTEMS** **07**

A model- driven method for the design time performance analysis of Service-oriented Software systems – Model driven architecture and Method – Current and future trends in Open Source network simulators for wireless systems.

L – 45; TOTAL HOURS-45

REFERENCES :

1. Klaus Wehrle, Mesut Gunes, James Gross, “Modeling and Tools for Network Simulation”, Springer-Verlag Berlin Heidelberg, ISBN: 978-3-642-12331-3, 2016.
2. Mohammad S. Obaidat , Faouzi Zarai , Petros Nicopolitidis, “Modeling and Simulation of Computer Networks and Systems: Methodologies and Applications, Morgan Kaufmann; 1st edition , ISBN-13: 978-0128008874, 2015.
3. Mohsen Guizani and Ammar Rayes, “Network Modeling and Simulation: A Practical Perspective”, Wiley-Interscience; 1 edition, ISBN-13: 978-0470035870, 2010.
4. Jack L. Burbank , William Kasch , Jon Ward , “An Introduction to Network Modeling and Simulation for the Practicing Engineer”, 1st Edition,Wiley-IEEE Press; 1 edition, ISBN-13: 978-0470467268, 2011.

OUTCOMES :

Students who complete this course will be able to

- Categorize the suitable network models for different network layer characteristics.
- Design different graph models and examine challenges in designing it.
- Create network model for P2P systems and analyze its security using network simulators.
- Relate the QoS of the network using the inference and prediction analysis.
- Explore the existing modeling approaches of computer networks and systems.
- Analyze the need of Open Source network simulators for wireless systems.

CSC X108 CELLULAR AND WIRELESS NETWORKS L T P C
3 0 0 3

OBJECTIVES :

- To learn about the challenges and opportunities with respect to cellular networks.
- To provide a knowledge on capacity and coverage analysis of relay node.
- To explain the concepts for improving the performance of cellular networks.
- To describe the evolution of wireless networks standards such as IEEE 802.16, blue tooth and 3G.
- To expose the students to have a knowledge on UMTS.
- To illustrate the wireless standards such as CDMA 2000 & WiMax.

MODULE I CELLULAR NETWORKS CHALLENGES AND OPPORTUNITIES 07

Introduction – LTE – A – Cooperative relaying – Concept of Relay Node - Relay classification – Relay Node – RN enhance cellular Network – RN mode operation in LTE-A – RN planning in cellular network – Moving Relay .

MODULE II CAPACITY AND COVERAGE ANALYSIS FOR MULTI HOP RELAY 07

Introduction – Channel interference – Network capacity without RN – Handover process analysis - Network capacity with RN – Optimum RN location – Optimum number of relays – Pseudo code of RN deployment – Frequency reuse for multi hop relay – Enhance relay link capacity – System modeling – Balance transmission power for MR.

MODULE III PERFORMANCE ENHANCEMENT OF COVERAGE AREA AND CAPACITY 07

Mitigating interference between RNs – Relay link enhancement – UL and DL performance analysis.

MODULE IV INTRODUCTION TO WIRELESS NETWORKS 08

Evolution of mobile communications – fundamentals – mobile data – WiFi – Bluetooth – Cable systems – Wireless migration options – Harmonization process – Overview of 3G networks.

MODULE V UNIVERSAL MOBILE TELECOMMUNICATION SERVICES (UMTS) 08

Introduction – UMTS basics – WCDMA air interface – UTRAN architecture – Establishment of UMTS Speech Call – UMTS packet data – High Speed Packet data –

Handover – HSPA connection establishment.

MODULE VI CDMA 2000 and WiMax 08

Radio and network components – Network structure – Packet Data transport process flow – Radio network – WiMax standards – Generic WiMax Architecture – Core Network – Radio Network – Wimax spectrum – Modulation – Channel Structure – Applications.

L – 45; TOTAL HOURS-45

REFERENCES :

1. Clint Smith, Daniel Collins, “Wireless Networks”, McGrawHill Education, 3rd edition, ISBN-10: 9339218159, ISBN-13: 978-9339218157, 2014.
2. Abid Yahya , “LTE-A Cellular Networks: Multi-hop Relay for Coverage, Capacity and Performance Enhancement”, Springer, ISBN : 3319433040, 2016.
3. Sassan Ahmadi, “LTE-Advanced – A practical systems approach to understanding the 3GPP LTE Releases 10 and 11 radio access technologies”, Elsevier, ISBN 10: 0124051626 ISBN 13: 9780124051621, 2014.

OUTCOMES :

Students who complete this course will be able to

- Specify the opportunities and challenges with cellular networks.
- Analyze the capacity and coverage problem with multi hop relay
- Assess the performance enhancement of coverage area and capacity.
- Acquire knowledge on wireless communication standards like WiFi, Bluetooth and 3G networks.
- Illustrate the working principles of wireless UTMS.
- Have exposure to CDMA 2000 and WiMax architecture.

CSC X109 NETWORK MANAGEMENT

L	T	P	C
2	0	0	2

OBJECTIVES :

- To acquire knowledge on networking and networking technologies.
- To explore difference between SNMP V1,V2 and V3.
- To study about remote monitoring and its application.
- To discuss the basic terminologies and application of telecommunication management system.
- To expose the application of network management
- To examine the importance of broadband Networks.

MODULE I BASIC TERMINOLOGIES 07

Network Management Goals, organization and Functions, Network Management Architecture and organization, Network Management Perspective, NMS platform, Current Status and future of Network Management.

MODULE II SIMPLE NETWROK MANAGEMENT PROTOCOL V1,V2,V3 12

SNMP V1 Network Management, Basic Foundation Standards, Models and languages, Organization and information Models, Communication and functional Models.

SNMP V2 - Changes , System Architecture, Structure of Management Information, MIB, Protocol, Compatibility. SNMP V3 – Key Features, Architecture, Application, MIB, Security.

MODULE III REMOTE MONITORING 05

RMON SBI MIB, RMON1, RMON2, ATM ROM, Case Study.

MODULE IV TELECOMMUNICATION MANAGEMENT 05

TMN conceptual Model, Standards, Architecture, Management Service Architecture, integrated View, Implementation

MODULE V NETWORK MANAGEMENT APPLICATION 08

Network Management Application –Configuration Management, Fault Management, Performance Management, Event Correlation techniques, Security Management.

MODULE VI BROADBAND NETWORKS MANAGEMENT 08

ATM Technology, ATM Network Management, Wireless Access Network, Basic

Principles, Fixed Broadband Wireless access networks, Mobile Wireless Networks, Satellite Networks, Broadband Home Networks.

L – 30; TOTAL HOURS-30

REFERENCES :

1. Mani Subramanian “Network Management : Principles and Practice Pearson Edition “2nd edition, ISBN : 978-8131734049, 2010.
2. Adrian Farrel ,”Network Management –Know it all”, Morgan Kaufmann Publishers, 1st Edition ISBN : 9780080923420, 2008.

OUTCOMES :

Students who complete this course will be able to

- Acquire the knowledge about the basic terminologies of network management.
- Illustrate the standards and models of SNMP V1.,V2 & V3.
- Analyze the challenges faced by remote monitoring and suggest suitable solutions.
- Recommend telecommunication management network standards for real time scenarios.
- Evaluate the various applications of network management system.
- Compare and contrast the different broadband network strategies.

CSC X110 NETWORK SIMULATORS

L	T	P	C
1	0	0	1

OBJECTIVES :

- To illustrate the need for network simulators.
- To study the network simulator tools for analyzing the performance of computer networks.
- To test the performance of any one of the wired, wireless network routing protocol using the network simulator.

MODULE I NS3 and OMNET++5.1 09

Downloading – Installing - Building – Testing – Tweaking: using Logging Module, Command Line Arguments, Tracing System – Building Topologies – Tracing – Data Collection.

MODULE II NETWORK PERFORMANCE ANALYSIS 06

Case Study : Analyze the performance of wired or wireless network routing protocol in terms of QoS parameters.

L-15;TOTAL HOURS- 15

REFERENCES :

1. https://omnetpp.org/, https://www.nsnam.org
2. Thomas Bonald, Mathieu Feuillet, “Network Performance Analysis”, John Wiley & Sons, ISBN :1118602854, 9781118602850, 2013.
3. Matthew N.O. Sadiku, Sarhan M. Musa, “ Performance Analysis of Computer Networks”, Springer Science & Business Media, ISBN : 3319016466, 9783319016467, 2013.

OUTCOMES :

Students who complete this course will be able to

- Do modifications in the existing routing protocol depending upon the requirement.
- Illustrate the performance of wired and wireless networks.
- Implement and analyze the performance of network routing protocols.

CSC X111 **AGILE PRACTICES** **L T P C**
1 0 0 1

OBJECTIVES :

- To critically think in adapting a software engineering methodology.
- To understand the practices and philosophies of agile methods.
- To enable the students to plan and complete projects and understand stakeholders.
- To adapt to agile practices and approaches.
- To be conversant with Agile project management and its best practices.
- To explore tools for agile project management.

MODULE I AGILE METHODOLOGY AND PRACTICES 07

Agile Development – Agile Manifesto – Phases- Planning- Scaling-Roles –Agile Communications and tools. Impact of different business environments on Agile – Different Agile approaches- Scrum-Extreme Programming-Lean- Kanban

MODULE II AGILE PRACTICES 08

Agile Software Development Practices -Code refactoring - Continuous integration Pair Programming Test-driven development Extreme programming (XP) - Agile Quality Management Practices- Key differences in agile quality management practices

L-15; TOTAL HOURS- 15

REFERENCES :

1. Charles G.Cobb,"The Project Manager's Guide to Mastering Agile: Principles and Practices for an Adaptive Approach", Wiley, ISBN: 978-1-118-99104-6.,2015.
2. Scott W.Ambler ,Matthew Holitza, "Agile for Dummies", John Wiley & Sons, ISBN: 978-1-118-30506-5,2012
3. Clyde Bank Business "Agile Project Management: Quick Start Guide - The Simplified Beginners Guide To Agile Project Management ", Clyde Bank Media LLC, ASIN: B00NF8H2FK, 2014.
4. Manifesto for Agile Software Development, http://www.agilemanifesto.org

OUTCOMES :

Students who complete this course will be able to

- Compare agile software development to traditional software development

models.

- Identify the benefits and pitfalls of transition to agile.
- Describe agile software development methodologies and approaches.
- Apply critical thinking in evaluating the options and tradeoffs implicit in selecting an appropriate software engineering methodology, with a focus on agile methods.
- Apply agile practices and principles to software development.
- Construct tailored agile processes that best fit the technical and market demands of a modern software project.

CSC X112 **SOFTWARE TESTING** **L T P C**

2 0 0 2

OBJECTIVES :

- To learn the testers role in a Software Development Organization.
- To find defects created by the programmer while developing the software.
- To portray the recent trends in the field of Software testing.
- To explore the different levels and types of testing.
- To have a thorough overview about the test design strategy and review plans.
- To throw light on the importance of test automation.

MODULE I TESTING 10

Test Principles – Testing Team – Skills of Tester – Types of Testing – Evaluating Test Cases – Reducing Test Case – Effective Testing – Economics – Structural Testing – Integration Testing – Functional Testing.

MODULE II DEBUGGING 10

Bugs, Faults, Failures – Verification and Validation - Defect Management - Types of Defects – Cost of fixing Defects – Handling Defects – Risks – Traceability Matrix – Test Management – Cloud Testing.

MODULE III TEST AUTOMATION 10

Automation Testing – Activities – Frameworks – Automation Tools – Types – Scripting Language – Testing Specialized Systems.

L – 30;TOTAL HOURS-30

REFERENCES :

1. Anirban BASU, “Software Quality Assurance, Testing And Metrics”, Pearson Hall India, ISBN: 978-81-203-5068-7, 2015.
2. Sandeep Desai , Abhishek Srivastava, “Software Testing : A Practical Approach”, Second Edition, Pearson Hall India, ISBN: 978-81-203-5226-1, 2015.
3. William E. Perry, " Effective Methods for Software Testing", Wiley Publications, Third Edition, ISBN 978-0-7645-9837-1, 2007

OUTCOMES :

Students who complete this course will be able to

- Apply the appropriate testing technique for the developed software.
- Choose various testing design strategies needed for the software application.
- Perform different types of testing given an application.
- List the type of defects in a software application.
- Utilize various software testing tools and automation techniques.
- Test software in a structured and organized way.

CSC X113 SOFTWARE REQUIREMENTS AND MODELLING

L	T	P	C
2	0	0	2

OBJECTIVES :

- To introduce the concepts and the role of requirements engineering in software engineering.
- To introduce the different requirements elicitation techniques
- To describe the processes of requirements elicitation and analysis techniques.
- To consider the rationale in defining requirements and preparing requirements analysis documents.
- To provide an insight in to the current techniques, notations, methods, processes and tools used in requirements engineering.
- To provide comprehensive knowledge about the different tools for requirements management.

MODULE I SOFTWARE REQUIREMNTS 10

Essential Software Requirement – Requirements from Customers Perspective – Good Practices – Business Analyst.

MODULE II REQUIREMENTS DEVELOPMENT 10

Establishing Business Requirement – Requirements Elicitation – Understanding User Requirements – Documenting Requirements – Writing Excellent Requirements – Validating Requirements – Requirement Reuse.

MODULE III FOR REQUIREMENT MANAGEMENT 10

Requirements Management Practices – Change Control – Links in Requirements Chain –Tools for Requirements Engineering - Improving Requirement Processes – Risk Management.

L – 30;TOTAL HOURS-30

REFERENCES :

1. Karl Wegers & Joy Beatty," Software Requirements", 3rd Edition, Microsoft Press, ISBN-978-0735679665, 2013.
2. Swapna Kishore & Rajesh Naik, "Software Requirements and Estimation", Tata McGrawHill, ISBN-978-007-040312-3,2008.
3. Ian Sommerville and P Sawyer, "Requirements Engineering a Good Practice Guide", 1st Edition, Wiley India, ISBN: 978-0-471-97444-4,1997.
4. Leffingwell, D.Widrig, D, "Managing Software Requirements A Use Case

Approach", 2nd Edition, Pearson Education, ISBN: 9780201615937, 2000.

OUTCOMES :

Students who complete this course will be able to

- Analyze the various requirements elicitation methods and select the appropriate one.
- Identify the requirements of a project and document requirements.
- Reuse the requirements for effective utilization of time and cost.
- Explore requirement analysis methods and traceability of requirements
- Demonstrate the notational paradigms that can be applied to requirements.
- Apply methods and tools for requirements management from the development of project

CSC X114 THEORY OF COMPUTATION L T P C

3 0 0 3

OBJECTIVES :

- Identify the type of problems that can be solved using computation
- Describe the models through which computation can be expressed.
- Enhance students' ability to conduct mathematical proofs for computation.
- Demonstrate the key notions, such as algorithm, computability, decidability, and complexity through problem solving.
- Describe the challenges of theoretical computer science and its contribution to other sciences.
- Exemplify the features of a turing machine and identify its suitability for the given task.

MODULE I INTRODUCTION 07

Why study Automata Theory- Introduction to Formal Proof - Additional Forms of Proof Inductive Proofs- The Central Concepts of Automata Theory

MODULE II REGULAR EXPRESSIONS 09

An Informal Picture of Finite Automata- Deterministic Finite Automata-Nondeterministic Finite Automata- Finite Automata With Epsilon Transitions-Equivalence and Minimization of Automata.

MODULE III REGULAR EXPRESSIONS 08

Regular Expressions- Finite Automata and Regular Expressions-Pumping Lemma of regular languages- Properties of regular languages.

MODULE IV CONTEXT-FREE GRAMMARS AND LANGUAGES 08

Context-Free Grammars- Parse Trees- Ambiguity in Grammars and Languages- Normal Forms of Context Free Grammars- Pumping Lemma of Context Free Languages.

MODULE V PUSH DOWN AUTOMATA 07

Definition of the Pushdown Automaton - The Languages of a PDA Equivalence of PDA's and CFG's- Deterministic Pushdown Automata

MODULE VI TURING MACHINES 06

The Turing Machine- Programming Techniques for Turing Machines- Extensions to the Basic Turing Machine- Turing Machines and Computers.

L – 45;TOTAL HOURS-45

REFERENCES :

1. John Hopcroft, Rajeev Motwani & Jeffry Ullman "Introduction to Automata Theory, Languages & Computation", 3rd Edition, Pearson Education, 2012, ISBN : 978-0201029888.
2. John C Martin, "Introduction to Languages and Automata Theory", 3rd Reprint Edition, Tata McGraw-Hill, 2008. ISBN: 978-1118014783.
3. Michael Sipser, "Introduction to the Theory of Computation", 3rd Edition, PWS Publishing Company, 2013. ISBN: 978-1133187790.

OUTCOMES :

Students who complete this course will be able to

- Apply mathematical proof to real time computation problem.
- Solve simple problems in RE's, DFA's, NFA's, Turing machines and Grammars.
- Prove/disprove the basic results of the Theory of Computation.
- Describe the Grammars of Context Free Languages.
- Analyze the core concepts relating to the theory of computation and computational models including (but not limited to) decidability and intractability.
- Knowledge of recent technologies to enable them to face the world.

CSC X115 **INTERNET OF THINGS** **L T P C**
2 0 0 2

OBJECTIVES :

- Comprehend the design concepts and principles of IoT
- Understand the role of electronics and embedded computing in IoT
- Interpret the limitations and opportunities of wireless and mobile networks for Internet of Things
- Attain exposure to varied software and hardware platforms for realization of IoT
- Determine applications of IoT in various fields
- Analyze trade-offs in interconnected wireless embedded sensor networks or IoT

MODULE I IoT FUNDAMENTALS AND APPLICATIONS 10

Definitions – IoT communications Model – Device to Device communications- Device to Cloud communications – Device to Gateway Model – Back-End Data Sharing Model- Issues in ToT - Technological Aspects - Design Principles of Connected Devices – IPv6 concepts – IPV6 packet – IPV6 addressing- Addressing and Protocols relevant to IoT – Applications - Smart Cities and Environments – Smart Metering – Applications in Security – Healthcare – Retail – Industrial Control –Smart Farming and Agriculture.

MODULE II IoT PROTOTYPING CONCEPTS AND PHYSICAL DESIGN 10

Prototyping and Production – Open Source vs Closed Source – Electronics and Embedded Computing Fundamentals : Sensors - Actuators - Microcontrollers – System on Chips – Platform considerations- Physical Design - Sketch- Iterate-Explore – Non-Digital Methods- Laser Cutting – 3D Printing – CNC Milling – Repurposing and Recycling.

MODULE III IoT TECHNOLOGY PLATFORMS AND SOFTWARE DESIGN PRINCIPLES 10

Raspberry Pi – Raspbian - Arduino – Case Studies: Healthcare, Smart Cities, Analytics- IoT Connectivity Considerations – IoT and Cloud Access - REST – MQTT – CoAP – XMPP IOT.

TOTAL HOURS-30

REFERENCES :

1. Adrian McEwen and Hakim Cassimally , “Designing the Internet of Things”,

Wiley, ISBN-13: 978-1118430620, 2013.
2. Cuno Pfister, "Getting Started with the Internet of Things",1st Edition, Shroff, ISBN-13: 978-1449393571,O'REILLY, 2011.
3. Donlad Norris, "The Internet of Things: Do-It-Yourself at Home Projects for Arduino, Raspberry Pi and BeagleBone Black", McGraw-Hill Education - Europe, ISBN10 0071835202, 2015

OUTCOMES :

Students who complete this course will be able to

- Describe the IoT concepts and design principles in detail.
- Analyze the different devices, components, antenna and standards are available in IoT.
- Explore the design of simple IoT devices for different application domains
- Compare and choose appropriate software and hardware platform for realization of IoT devices
- Apply the IoT concepts in real time applications using the IoT devices
- Identify the security issues faced by IoT in various areas.

CSC X116 **COGNITIVE SCIENCE** **L T P C**

2 0 0 2

OBJECTIVES :

- Introduce the domain of cognitive science
- Present the different methods of representation of thought
- Outline mind as an information processor
- Categorize the models of attention
- Expose case studies in mind representation
- Relate language with cognitive science

MODULE I MIND AND PHILOSOPHY 09

Definition – Representation types – Computation – Tri-level hypothesis – Classical and connectionist views of computation – Various Approaches to Cognitive science - Reasoning - Philosophy – Mind body problem – Knowledge acquisition problem

MODULE II VISION AND ATTENTION 09

Mind as an Information Processor -Modularity of Mind - Theories of Vision and Pattern Recognition - Feature Detection Theory - Theories of Attention - Models of Attention

MODULE III MIND, LANGUAGE AND COGNITION SCIENCE 12

The Network Perspective - Semantic Networks: Meaning in the Web - Overall Evaluation of the Network Approach - The Linguistic Approach: The Importance of Language - Nature of Language - Language Use in Primates - Language Acquisition - Philosophy and Linguistics: The Linguistic - Neuroscience and Linguistics - Artificial Intelligence and Linguistics.

L – 30;TOTAL HOURS-30

REFERENCES :

1. Jay Friedenberg and Gordon Silverman, “Cognitive Science: An Introduction to the study of the Mind”, Sage Publishers, Third Edition - ISBN-13: 978-1483347417, October 2015.
2. Bernard J. Baars and Nicole M. Gage, Cognition, Brain, And Consciousness Introduction to Cognitive Neuroscience, Second Edition, Elsevier Publication, 2010, ISBN :978-0-12-375070-9.

OUTCOMES :

Students who complete this course will be able to

- Define cognitive science and relate its various disciplines
- Illustrate thinking as a computational problem
- Model the way mind works as an information processor
- Demonstrate the theories and models of attention
- Illustrate the way in which knowledge is represented
- Showcase the evolution of language in humans and describe how artificial intelligence approaches can work

CSC X117 VIRTUALIZATION TECHNIQUES

L	T	P	C
3	0	0	3

OBJECTIVES :

- To lay down the foundation of virtualization and its importance.
- To learn the essentials required to build virtualization.
- To provide an overview of the taxonomy of virtualization.
- To identify security implications in virtualization
- To expose the students to create and manage the virtual machine.
- To comprehend the technical capabilities and business benefits of virtualization.

MODULE I OVERVIEW OF VIRTUALIZATION 08

Describing Virtualization - Moore's Law - Importance of Virtualization –Types - Current Trends - Virtualization and Cloud Computing - Virtualization Software Operation - Virtualizing Servers - Virtualizing Desktops - Virtualizing Applications - Hypervisor - Type 1 Hypervisors - Type 2 Hypervisors - Role of a Hypervisor - Resource Allocation - Current Hypervisors - VMware ESX - Microsoft Hyper V

MODULE II INTRODUCTION TO VIRTUAL MACHINES 07

Virtual Machine - Examining CPUs in a Virtual Machine - Examining Memory in a Virtual Machine - Examining Network Resources in a Virtual Machine - Examining Storage in a Virtual Machine - Working with Virtual Machines - Virtual Machine Clones - Templates - Snapshots - Containers.

MODULE III VIRTUAL MACHINE CREATION 07

Performing P2V Conversions - Investigating the Physical-to-Virtual Process - Hot and Cold Cloning - Loading the Environment - VMware Workstation Player - Loading VirtualBox - Building a new Virtual Machine.

MODULE IV MANAGING CPU AND MEMORY FOR VIRTUAL MACHINE 07

CPU Virtualization - Configuring VM CPU Options - Tuning Practices for VM CPUs - Choosing Multiple CPUs - Hyper-Threading - Memory Virtualization - Configuring VM Memory Options - Tuning Practices for VM Memory - Calculating Memory Overhead - Memory Optimizations.

MODULE V MANAGING STORAGE AND NETWORKING FOR A VIRTUAL MACHINE **08**

Storage Virtualization – Configuring VM Storage Options - Tuning Practices for VM Storage - Network Virtualization - Configuring VM Network Options - Tuning Practices for Virtual Networks - Deploying Applications in a Virtual Environment

MODULE VI VIRTUALIZATION SECURITY **08**

Fundamentals of Virtualization Security - Securing Hypervisors - Designing Virtual Networks for Security - Architecture Considerations.

L – 45;TOTAL HOURS-45

REFERENCES :

1. Matthew Portnoy, “Virtualization Essentials”, Wiley, Second edition, ISBN : 9788126564668, 2016
2. Daniel Kusnetzky, "Virtualization: A Manager's Guide", O'Reilly Media, Illustrated, 9781449306458 2012.
3. Tom White, “Hadoop: The Definitive Guide Storage and Analysis at Internet Scale” O'Reilly Media Press, ISBN : 9781449311520, 2012.
4. Dave Shackleford, “ Virtualization security- Protecting Virtualized Environments”, Sybex Publishers, First Edition, ISBN : 978118288122, 2012.

OUTCOMES :

Students who complete this course will be able to

- Review virtualization concepts and their role in elastic computing.
- Articulate the main concepts, key technologies, strengths, and limitations of Virtualization.
- Analyze different types of virtualization with performance metrics.
- Describe the architecture and taxonomy of virtualization.
- Analyze the constraints and techniques in setting up virtualization through its enabling technologies.
- Design virtualization infrastructure solutions and give recommendations based on the need.

Elective 2

CSC X122	FOUNDATION ON ROBOTICS	L	T	P	C
		2	0	0	2

OBJECTIVES :

- To have an exposure on the basics of robotics concept.
- To gain knowledge about industrial robotics and classification.
- To study the protocols and functions related to robotics.
- To enhance students' understanding of operational capabilities and specifications.
- To learn the robot programming methods and its applications.
- To know the mechanisms of sensors and actuators.

MODULE I FUNDAMENTALS OF ROBOTICS 10

Overview of robotics, industrial robot, classification, Degree of freedom , degree of motion, robot components, joints and symbols, robot configuration, economic and social issues.

MODULE II ROBOT PROGRAMMING AND MODULAR COMPONENTS 10

Robot programming methods, advantages and disadvantages of robot, specifications, operational capabilities level, modular robot components.

MODULE III ROBOT SENSORS AND ACTUATORS 10

Internal and external sensors, static and dynamic performance characteristics, types of actuators, examples.

L-30;TOTAL HOURS-30

REFERENCES :

1. Appu k.kutta, "Robotics", I. K. International Pvt Ltd, ISBN: 9788189866389, 2010.
2. Tsuneo Yoshikawa, "Foundations of Robotics: Analysis and Control", MIT Press, 2nd edition, ISBN: 0262240289, 2013.

OUTCOMES :

Students who complete this course will be able to

- Address the degrees of freedom for objects
- Describe the requirements and mechanisms for types of robotics.

- Determine robot programming methods for various applications.
- Examine the mechanisms of sensors and actuators with examples.
- Have deeper knowledge on operational capabilities and specifications.
- Comprehend different protocol architectures and functions used in robotics.

CSC X123 SOUND EDITING AND PROCESSING L T P C

2 0 2 3

OBJECTIVES :

- To gain knowledge about existing supporting technologies for sound and editing
- To learn about various speech and audio technologies
- To identify the basic concepts of digital audio and speech
- To gain knowledge about speech analysis and classification
- To gain of the scientific principles relevant to the generation and propagation of musical sound, including the functioning of musical instruments
- To recognize audio signal processing and Parameterization

MODULE I INTRODUCTION TO SOUND AND SPEECH 07

Basic audio-processing-Normalization-Continuous audio processing-Visualization-Sound generation-The human voice-characteristics of speech –types of speech

MODULE II BASIC AUDIO PROCESSING 08

Sound in MATLAB-Normalization-Continuous audio processing- Segmentation-Analysis window sizing-Visualization- Sound generation

MODULE III THE HUMAN VOICE 09

Speech production-Characteristics of speech-Types of speech-Speech understanding

MODULE IV THE HUMAN AUDITORY SYSTEM 07

Physical processes -Perception -Amplitude and frequency models

MODULE V PSYCHOACOUSTICS 07

Psychoacoustic processing-Auditory scene analysis -Psychoacoustic modeling - Hermansky-style model-MFCC model-Masking effect of speech

MODULE VI SPEECH COMMUNICATIONS 07

Quantization - Parameterization -Pitch models - Analysis-by-synthesis-Perceptual weighting

L – 30; P-30;TOTAL HOURS-60

REFERENCES :

1. Ian Vince McLoughlin “Speech and Audio Processing: A MATLAB-based

Approach ", Cambridge University Press, ISBN: 1107085462, 2016.
2. David Miles Huber , Robert E. Runstein"Modern Recording Techniques (Audio Engineering Society Presents) , Focal Press; 8 edition, ISBN-10: 0240821572, ISBN-13: 978-0240821573, 2013
3. Michael Talbot-Smith "Sound Engineering Explained", Focal Press; 2 edition, ISBN: 0240516672, 2012

OUTCOMES :

Students who complete this course will be able to

- Apply the basics of audio theory and musical acoustics to real world recording situations
- Proficiently operate and interpret specifications of audio recording and live sound equipment.
- Produce audio recordings by using digital audio workstations (Avid Pro Tools, Cockos, Reaper, etc.
- Run sound at live events. Show proficiency in music production techniques for genres such as Classical, Jazz and Rock
- Demonstrate basic video recording and editing skills to facilitate additional opportunities in the broader digital media field. Read and perform music at an intermediate level
- Write and speak effectively about music.

CSC X124 **COMPUTER VISION** **L T P C**

3 0 0 3

OBJECTIVES :

- Describes the foundation of image mating, composting and editing
- Understand the camera parameters and calibration
- Grasp the principles of match moving and motion capture
- Develop the practical skills necessary to build computer vision applications.
- Provides knowledge on three dimensional data acquisition
- Showcase the different Methods of three dimensional Computer Vision

MODULE I INTRODUCTION AND IMAGE MATTING 08

Introduction – Computer Vision for Visual Effects – Matting Terminology – Blue-Screen, Green-Screen and Difference Matting – Bayesian Matting – Closed-Form Matting – Markov Random Fields for Matting – Random-Walk Methods – Poisson Matting – Hard-Segmentation-Based Matting – Video Matting – Matting Extensions

MODULE II IMAGE COMPOSITION AND EDITING ,FEATURES AND MATCHING 08

Compositing Hard-Edged Pieces – Poisson Image Editing – Graph-Cut Compositing – Image Inpainting –Image Retargeting and Recompositing - Video Recompositing, Inpainting, and Retargeting - Feature Detectors – Feature Descriptors – Evaluating Detectors and Descriptors – Color Detectors and Descriptors – Artificial Markers

MODULE III MATCHMOVING AND MOTION CAPTURE 08

Feature Tracking for Matchmoving – Camera Parameters and Image Formation – Single Camera Calibration- Extension of Matchmoving - Environment – Marker Acquisition and Cleanup – Forward Kinematics and Pose Parameterization – Inverse Kinematics – Motion Editing – Facial Motion Capture – Markless Motion Capture

MODULE IV THREE-DIMENSIONAL DATA ACQUISITION 07

Light Detection and Ranging (LiDAR) – Structured Light Scanning – Multi-View Stereo – Registering 3D Datasets

MODULE V METHODS OF 3D COMPUTER VISION 07

Triangulation-Based Approaches to Three Dimensional Scene Reconstruction – Three

Dimensional Pose Estimation and Segmentation Methods

MODULE VI INTENSITY BASED AND POLARISATION BASED APPROACHES TO 3D SCENE RECONSTRUCTION **07**

Intensity based and polarisation based approaches to 3d scene reconstruction - Shape from Shadow – Shape from Shading – Photometric Stereo – Shape from Polarisation – Point Spread Function Based Approaches to 3D Scene Reconstruction – The Point Spread Function – Reconstruction of Depth from Defocus –Reconstruction of Depth from Focus

L-45;TOTAL HOURS-45

REFERENCES :

1. Richard J Radke, “Computer Vision for Visual effects”, First Edition, Cambridge University Press, ISBN:978-0-521-76687-6, 2013.
2. Christian Wohler, “3D Computer Vision”, Second Edition, Springer – ISBN:9781-4471-4149-5 , 2013.
3. Mark Nixon and Alberto S. Aquado, “Feature Extraction & Image Processing for Computer Vision”, Third Edition, Academic Press, ISBN: 978-0-123-96549-3, 2012.
4. R. Szeliski, “Computer Vision: Algorithms and Applications”, Springer, ISBN: 978-1-84882-934-3, 2011.
5. Ethem Alpaydin, “Introduction to Machine Learning”, 3rd Edition, MIT Press, ISBN: 978-0-262-02818-9, 2014.
6. Amar Mitiche, J.K. Aggarwal,”Computer Vision Analysis of Image Motion by Variational Methods”, ISBN: 978-3-319-00711-3, 2013.
7. Christian Woohler,”3D Computer Vision: Efficient Methods and Applications”, Second Edition, Springer, ISBN: 978-1-4471-4150-1, 2013.

OUTCOMES :

Students who complete this course will be able to

- Familiar theoretical aspects of computing with images;
- Differentiate the mage, video Retargeting and Recompositing
- Analyze the camera parameters and form the image
- Gaining exposure to three dimensional data acquisition
- Construct 3D stereo and video images.
- Apply the 3D models in different applications

CSC X125	MOBILE MULTIMEDIA SYSTEMS	L	T	P	C
		2	0	0	2

OBJECTIVES :

- To summarize the basic concept of multimedia system
- To learn the various paradigms in mobile cellular networks.
- To identify the security issues in multimedia system
- To incorporate the user needs in cellular system
- To expose the structure of the mobile networks using multiple input and output system.
- To enable the principles and trade-offs involved in the design of mobile networks.

MODULE I INTRODUCTION TO MOBILE MULITMEDIA **10**

Where to use Mobile Multimedia – Multimedia over wireless Mobile data networks – Quality of Service issues – Speech and Video Coding.

MODULE II MOBILE CELLULAR SYSTEM **10**

Narrowband cellular systems – Wideband systems: CDMA, OFDM, Multiuser capacity and opportunistic communication – MIMO I - MIMO II MIMO III and MIMO IV: multiuser communication.

MODULE III MOBILE SECURITY AND SERVICES **10**

Security and privacy issues – Trust for mobile computing applications – Design challenges for Multimedia networks – QoS and QoE of cellular networks.

TOTAL HOURS-30

REFERENCES :

1. Gaur Karmakar, and Laurence S Dooley, “Mobile Multimedia Communications: Concepts, Applications, and Challenges”, IGI Global, 2008, ISBN: 9781591407683.
2. Yan Zhang, Shiwen Mao, Laurence T. Yang, and Thomas M Chen, “Broadband Mobile Multimedia: Techniques and Applications”, CRC Press, 2008. ISBN: 978-1-4200-5184-1
3. David Tse and Pramod Viswanath, “Fundamentals of Wireless Communication”, Cambridge University Press, 2010 ISBN:978-0-521-84527-4

OUTCOMES :

Students who complete this course will be able to

- Identify the Mobile networks with QoS services
- To effective use and produce the mobile networks.
- Classify the function of the various cellular systems.
- To implement and analyses the different networks and compare their performances.
- Enriched with the knowledge of recent day techniques to enable them in the real world.
- Developing the application structure of mobile system for the given real time scenario

CSC X127	ONLINE VIDEO PRODUCTION	L	T	P	C
		1	0	0	1

OBJECTIVES :

- To introduce the fundamentals of video production.
- To focus on the production methods and techniques.
- To equip the student on script writing and camera features.
- To provide understanding on the audio and lighting for video.
- To know about television graphics and video recording.
- To have a deeper knowledge on the online video distribution.

MODULE I VIDEO PRODUCTION BASICS **07**

Video production overview, Production crew, organizing the production, production process, production methods, empirical approach, planned approach, stages of production, production techniques - Outline script, basic script formats, suggestions on script writing, directing, camera features, controlling and using the camera.

MODULE II DISTRIBUTING THE PRODUCTION **08**

Shooting instructional productions, Audio for video, lighting for video, background - Television graphics, recording the video, editing, distributing hard copies of production, online distribution, live online distribution, internet protocol television, 3G/4G transmission.

L-15;TOTAL HOURS-15

REFERENCES :

1. Jim Owens, “Video Production Handbook”, Taylor & Francis, ISBN 1315530554, 2017.
2. Pierre A. Kandorfer, “Digital Video Production Handbook”, Xlibris Corporation, ISBN 1450003575, 2009.

OUTCOMES :

Students who complete this course will be able to

- Determine the production process
- Identify the production methods and techniques for applications

- Have an exposure on script writing and camera features.
- Address the audio and lighting features for video.
- Describe about television graphics and video recording.
- Address the features of online video distribution.

CSC X128 MULTIMEDIA SECURITY L T P C

2 0 0 2

OBJECTIVES :

- To develop a basic understanding on the digital rights management systems.
- To identify possible countermeasures against threats and vulnerabilities in a given security scenario.
- Learn the requirements and mechanisms for identification and authentication.
- Know the mechanisms for securing the information using biometrics.
- To compare and contrast the underlying security mechanisms needed to implement security countermeasures.
- Have a deeper knowledge on embedded concepts of multimedia security.

MODULE I FUNDAMENTALS OF MULTIMEDIA SECURITY 10

Overview of Digital rights management systems, Putting Digital rights management in context, multimedia encryption, multimedia authentication, key management for multimedia authentication and distribution.

MODULE II MULTIMEDIA SECURITY APPLICATIONS 10

An overview of Digital watermarking, Biometrics in Digital rights management, Steganalysis, passive blind image forensics, security in digital cinema.

MODULE III EMBEDDED MULTIMEDIA SECURITY 10

Video coding, embedded systems and reconfigurable architectures and encryption basics.

L-30;TOTAL HOURS-30

REFERENCES :

1. Wenjun Zeng, Heather Yu, Ching-Yung Lin, “Multimedia Security Technologies for Digital Rights Management”, Academic Press, 2nd edition, ISBN: 9780123894768, 2011.
2. Amit Pande, Joseph Zambreno,” Embedded Multimedia Security Systems: Algorithms and Architectures”, Springer Science & Business Media, 2nd edition, ISBN:1447144597, 2012.

OUTCOMES :

Students who complete this course will be able to

- Identify the various threats and vulnerabilities

- Get familiarized on the concept of multimedia security and its issues
- Describe the requirements and mechanisms for identification and authentication.
- Determine appropriate mechanisms for protecting information
- Examine the issues related to video coding techniques.
- Have a deeper knowledge on embedded multimedia security.

CSC X129 MULTIMEDIA COMMUNICATION AND NETWORKING

L	T	P	C
3	0	0	3

OBJECTIVES :

- To summarize the principles and standards of multimedia
- Expound on the multimedia internet protocols.
- To identify the multimedia communication across the networks.
- To learn the various paradigms of compression techniques
- To expose on the basic idea and structure of switching networks
- Exemplify the features of a multimedia system and identify its suitability for the given task

MODULE I INTRODUCTION 06

Introduction- Multimedia networks - Multimedia applications- Applications and networking terminology – components of multimedia – file format of multimedia system

MODULE II MULTIMEDIA COMPRESSION TECHNIQUES 08

Quantization –Non-Linear Quantization- Differential encoding –Linear Prediction coding – Differential pulse code modulation – Lossless Compression – Runlength coding – Huffman Coding – Lossy Compression – Direct cosine transform – Wavelet transform

MODULE III COMPRESSION STANDARDS 09

JPEG Standards – Models – JPEG LS standard – JBIG – MPEG – MPEG 1 –MPEG 2 – MPEG 7 – MPEG 21

MODULE IV INTERNET SERVICES 08

IP datagrams -Fragmentation and reassembly-IP addresses- ARP and RARP - Routing algorithms – ICMP- QoS Services-IPv4- IPv6 - Transport protocols -UDP- RTP and RTCP

MODULE V BROADBAND ATM NETWORKS 07

Cell format - switching principles – Switch and Protocol architecture - entertainment networks and high speed modems- Cable TV networks-Satellite television networks-Terrestrial television networks

MODULE VI COMMUNICATIONS ACROSS NETWORKS 07

Packet Audio and Video in the network environment - Video transport across generic networks - transport across ATM networks – Multimedia across IP networks – Multimedia across DSLs – Internet access Networks – Multimedia across wireless mobile networks.

L – 45; TOTAL HOURS- 45

REFERENCES :

1. Kumar Krishna, Multimedia Communication, Pearson Education India, 2010. ISBN: 978-81-317-3238-0
2. Fred Halsall, Multimedia Communications: Applications, Networks, Protocols, and Standards, Pearson Education, Fourth Edition, 2009 ISBN: 978-81-317-0994-8
3. C. T. Bhunia, Multimedia and Multimedia Communication, New Age International, 2009. ISBN: 81-2242-660-3

OUTCOMES :

Students who complete this course will be able to

- State of art techniques in multimedia communication
- Master using the appropriate compression technique for the given scenario
- Compare and contrast the various transport protocols
- Identify and solve problems in the fields of communication and networks.
- Design the communication and networking systems to meet desired specification
- Knowledge of recent technologies to enable them to face the world.

CSC X130	GAMING TECHNOLOGY	L	T	P	C
		3	0	2	3

OBJECTIVES :

- To recognize principles of Game design and Game Engine design
- To know Good knowledge of implementing games in various platform
- To Making use of artificial intelligence in gaming
- To realize different types of animation
- To provide the foundation knowledge of gaming technology in computing
- To provide programming training in gaming technology , multimedia system design and implementations

MODULE I FUNDAMENTAL OF GAME TECHNOLOGY **07**

Games and Video Games -Conventional Games Versus Video Games-Games for Entertainment-Serious Games

MODULE II DESIGNING AND DEVELOPING GAMES **08**

An Approach to the Task-Key Components of Video Games-The Structure of a Video Game-Stages of the Design Process-Game Design Team Roles-Game Design Documents-The Anatomy of a Game Designer

MODULE III UNDERSTANDING YOUR PLAYER **09**

Vanden Berghe's Five Domains of Play-Demographic Categories-Gamer Dedication-The Dangers of Binary Thinking

MODULE IV UNDERSTANDING YOUR MACHINE **07**

Home Game Consoles-Personal Computers-Portable Devices-Other Devices

MODULE V MAKING MONEY FROM YOUR GAME **07**

Direct Payment Models-Indirect Payment Models-World Markets-Game Concepts-Getting an Idea-From Idea to Game Concept

MODULE VI GAME WORLDS **07**

Introduction-The Purposes of a Game World-The Dimensions of a Game World-Realism.

L – 45; P-15; TOTAL HOURS-60

REFERENCES :

1. Ernest Adams and Andrew Rollings,"Fundamentals of Game Design", Pearson Education 3 edition, ISBN-10: 9332540241,ISBN-13: 978-9332540248,2015
2. James M. Van Verth, Lars M. Bishop "Essential Mathematics for Games and Interactive Applications, A K Peters/CRC Press; 3 edition, ISBN-10: 1482250926, ISBN-13: 978-1482250923, 2015
3. Justin Plowman "3D Game Design with Unreal Engine, Packt Publishing Limited, ISBN-10: 1785881469, ISBN-13: 978-1785881466,,2016

OUTCOMES :

Students who complete this course will be able to

- Identify, choose, and implement appropriate algorithmic, programming, and mathematical techniques
- Develop software components for various aspects of computer games, such as character control, scene management, artificial intelligence, graphics and animation, etc.
- Create prototype games or game fragments by integrating original software components with existing professional tools, such as game engines, middleware, and common application programming interfaces.
- Develop and maintain software in a team environment using collaborative tools and technologies reflective of industry practices, including source control, build management, deployment, bug tracking, etc.
- Evaluate and select appropriate hardware and software platforms for a particular game strategy
- Design, create, and present a technical design document for a computer game or game component

CSC X131 **ROUTING PROTOCOLS** **L T P C**

3 0 0 3

OBJECTIVES :

- To learn the basics of network routing protocol.
- To compare the difference between distance vector routing and link state routing.
- To discuss importance of Quality of Service(QoS) and traffic engineering in routing.
- To study the operations of gateway routing algorithms.
- To gain knowledge on ATM and Cellular wireless networks.
- To illustrate the design issues involved in various Mobile Ad Hoc and Sensor network routing algorithm.

MODULE I NETWORK ROUTING BASICS 07

Introduction to Networks - Network Architecture and Standards - Glimpse at the Network Layer - Addressing in TCP/IP Networks - Overview of Routing - Delivery, Forwarding, Routing, and Switching - Routing Taxonomy - Host Mobility and Routing - Introduction to basic Routing Algorithms - Routing Strategies - Non Adaptive Algorithms - Adaptive Algorithms - Flooding - Static Shortest Path Routing Algorithms - Dynamic Shortest Path Routing Algorithms - Stochastic Routing Algorithms.

MODULE II FUNDAMENTAL ROUTING PROTOCOLS 08

Routing Protocols - Distance Vector Routing - Working of the Protocol - Convergence of Distance Vector Table - Issues in Distance Vector Routing - Improvements in Distance Vector Routing - Advantages and Disadvantages - Link State Routing - Working of the Protocol - Routing Tables - Path Vector Routing - Working of the Protocol - Unicast, Multicast, and Broadcast Routing .

MODULE III QUALITY OF SERVICE AND TRAFFIC ENGINEERING 07

Introduction - QoS Measures - Differentiated and Integrated Services - QoS Routing Algorithms - QoS Unicast Routing Protocols - QoS Multicast Routing Protocols - QoS Best Effort Routing - Routing and MPLS Traffic Engineering - MPLS Fundamentals - Traffic Engineering Routing Algorithms - Minimum Interference Routing Algorithm - Profile Based Routing Algorithm - Dynamic Online Routing Algorithm - Wang et al.’s Algorithm - Random Races Algorithm.

MODULE IV INTERNET ROUTING 08

Interior Gateway Protocols - Distance Vector Protocols - Routing Information Protocol -

Interior Gateway Routing Protocol - Link State Protocols - Open Shortest Path First Protocol - Intermediate System to Intermediate System Protocol - Exterior Gateway Protocol - Hosts vs Gateways - Gateway to Gateway Protocol - Autonomous System - Characteristics of EGP - Evolution of EGP Standards - EGP Terminology and Topology - EGP Operation Model - Border Gateway Protocol.

MODULE V ATM AND CELLULAR WIRELESS NETWORKS 06

Introduction - ATM Frames - ATM Connection - ATM Architecture - Service Categories - PNNI Routing - PNNI Interface - PNNI Hierarchy - Building the Network Topology - Peer Group Leader - Advertizing Topology - Setting up Connection - Routing in Cellular Wireless Networks - Introduction - Basics of Cellular Wireless Networks - Resource Allocation - Routing in GSM Networks - Challenges in Mobile Computing.

MODULE VI MOBILE AD HOC NETWORKS AND SENSOR NETWORKS 09

Routing in Wireless Ad Hoc Networks - Basics - Issues with Existing Protocols – Table Driven (Proactive), On Demand (Reactive), Hybrid, Hierarchical, Geographic, Power Aware Routing Protocols - Routing in Wireless Sensor Networks - Basics -- Hardware Architecture of Sensor Node - Network Topology - Design Factors - Classification of Routing Protocol - Routing Challenges in Wireless Sensor Networks - Flat Routing Protocols - Hierarchical Routing Protocols - Location Based Routing Protocols - Multipath Routing Protocols - Query Based Routing Protocols - Negotiation Based Routing Protocols - QoS Routing Protocols – 6LowPAN.

L – 45; TOTAL HOURS-45

REFERENCES :

1. Sudip Misra, Sumit Goswami, “Network Routing: Fundamentals, Applications, and Emerging Technologies”, Wiley publication, ISBN: 978-0-470-75006-3, 2017.
2. Deepankar Medhi, Kartikeyan Ramasam , "Network Routing - Algorithms, Protocols, Architecture - 2nd Edition ", Morgan Kauffman Series Publication, ISBN: 9780128008294, 2017.
3. Mounir Frikha , “Ad Hoc Networks: Routing, Qos and Optimization”, Wiley-ISTE, ISBN: 978-1-84821-227-5, 2011.
4. Subir Kumar Sarkar, T G Basavaraju and C Puttamadappa, "Ad Hoc Mobile Wireless Networks - Principles, Protocols and Applications", 2nd Edition, Auerbach publications, 2008.

OUTCOMES :

Students who complete this course will be able to

- Acquire knowledge on fundamentals of network routing protocol.
- Analyze the working of distance vector routing and link state routing protocol.
- Inspect the QoS and traffic engineering parameters in different routing algorithms.
- Compare the characteristics of Internet routing protocols.
- Explore the network topology of ATM and Cellular wireless networks.
- Relate the issues in existing routing protocol and mobile routing protocols.

CSC X132 **QUEUING THEORY** **L T P C**

3 0 0 3

OBJECTIVES :

- To develop the modeling and mathematical skills for network design.
- Analytically determine computer systems and communication network performance.
- To read and understand the current performance analysis and queuing theory literature upon completion of the course.
- Elaborate strengths and weaknesses of Queuing Models.
- Impart knowledge of Queuing models and its applications to enable them to apply them for solving real world problems.
- To expose the students for modeling practical, present and future telecommunications traffic and networking applications.

MODULE I INTRODUCTION 07

Basic System Elements - Problems in a Queuing System - Probability Distributions as Models - Identification of Models - Distribution Selection - Basic Concepts in Stochastic Processes.

MODULE II MARKOVIAN QUEUING SYSTEMS 07

A General Birth and Death Queuing Model - The Queue M/M/1 - The Queue M/M/s - The Finite Queue M/M/s/K - The Infinite Server Queue M/M/∞ - Finite Source Queues - Other Models - Imbedded Markov Chains - The Queue M/G/1 - The Queue G/M/1 - Extended Markov and Renewal Models.

MODULE III QUEUING NETWORKS 07

The Markovian Node Network - Queues with Blocking - Open Jackson Networks - Closed Jackson Networks - Cyclic Queues - Matrix-Analytic Queuing Models - Phase Type Distributions - Markovian Arrival Process - Analysis of Queuing Models Using MAM – The Queue G/G/1 and Approximations - Bounds for Mean Waiting Time - Little's Law $L = \lambda W$ – Approximations.

MODULE IV STATISTICAL INFERENCE 08

Birth and Death Process Models - Imbedded Markov Chain Models for M/G/1 and G/M/1 - The Queue G/G/ 1.

MODULE V METHODS OF ESTIMATION 08

Tests of Hypotheses - Control of Traffic Intensity in M/G/1 and G/M/1 - Decision Problems in Queuing Theory - Performance Measures - Design Problems in Decision-Making - Control Problems in Decision-Making.

MODULE VI COMPUTER AND COMMUNICATION SYSTEMS 08

Modeling Computer Systems - Modeling Communication Systems - Modeling and Analysis using Computational Tools - Simulating Queuing Systems - Using MATLAB - Other Tools for Simulating and Analyzing.

L – 45;TOTAL HOURS-45

REFERENCES :

1. “An Introduction to queuing theory modeling and analysis in applications”, Bhat, U. Narayan, 2015, ISBN: 978-0-8176-8420-4.
2. “Fundamentals of Queueing Theory”, Donald Gross, John F. Shortle, James M. Thompson, Carl M. Harris, 2008,4th Edition, ISBN: 978-0-471-79127-0.
3. Queueing Theory for Telecommunications, AttahiruSule Alfa, Springer US, 2010, 978-1-4419-7313-9.

OUTCOMES :

Students who complete this course will be able to

- Define and explain basic concepts in descriptive statistics and probability theory.
- Solve some standard problems that include Queuing systems.
- Define and explain basic concepts in the theory Markov processes, M/M/m, M/M/m/K and M/M/m/K/C queuing systems.
- Derive and apply main formulas for some properties (such as stationary probabilities, average waiting and system time, expected number of customers in the queue, etc.) of M/M/m, M/M/m/K and M/M/m/K/C queuing systems.
- To estimate the traffic intensity, blocked traffic and the utilization of some queueing systems.
- Analyze and solve problems using computer aid (Maple, Matlab or Mathematica).

CSC X133 NETWORK TROUBLESHOOTING TOOLS

L	T	P	C
1	0	0	1

OBJECTIVES :

- Give an in-depth training on Wireshark and TCP/IP communications analysis.
- Use Wireshark to identify the most common causes of performance problems in TCP/IP communications.
- Develop a thorough understanding of how to use Wireshark efficiently to spot the primary sources of network performance problems
- To be able to provide effective packet analysis.

MODULE I NETWORK ANALYSIS 06

Introduction to Network Analysis and Wireshark - Capture Methods and Capture Filters - Customize for Efficiency: Global Preferences Configuration – Quick Navigation and Colouring Techniques - Network and Application Issues with Time Values and Summaries - Creation and Interpretation of Basic Trace File Statistics - Traffic Analysis Using Display Filters.

MODULE II TRAFFIC ANALYSIS 09

TCP/IP Communications and Resolutions Overview - DNS Traffic Analysis - ARP Traffic Analysis - IPv4 Traffic Analysis - ICMP Traffic Analysis - UDP Traffic Analysis - TCP Protocol Analysis - Graph Traffic Characteristics Analysis - HTTP Traffic Analysis - TLS-Encrypted Traffic (HTTPS) Analysis.

Lab Exercises:

- Capture Traffic to/from the Hardware Address
- Create a Troubleshooting Profile & Set Basic Preferences for Your Troubleshooting Profile
- Find, Mark, Save, and Colorize Packets, Detect and Colorize High Latency Indications
- Find the Top Talkers and Protocols/Applications on a Network
- Create and Use an IO Graph to Spot Performance Issues
- Locate a Text String in a Trace File
- Create a Coloring Rule to Detect DNS Error Responses and Suspicious DNS Responses
- Analyze a Network Problem Indicated by ARP

- Filter on a Range of IPv4 Addresses
- Detect Suspicious Traffic with a New ICMP Coloring Rule
- Analyze UDP-Based Multicast Streams and Queuing Delays
- Use an IO Graph to Locate TCP Performance Issues
- Determine the Cause of Slow File Downloads
- Use TCP Graphs to Detect the Cause of Performance Problems
- Create a Filter Expression Button to Detect HTTP Error Responses
- Export an HTTP Object
- Decrypt HTTPS Communications

L-15;TOTAL HOURS-15

REFERENCES :

1. Anish Nath, " Packet Analysis with Wireshark",Packt Publishing, 1st Edition, 2015.
2. Laura Chappell , "Wireshark Network Analysis: the Official Wireshark Certified Network Analyst™ Study Guide", 2nd Edition, Protocol Analysis Institute, Inc, dba Chappell University, 1-893939-94-4, 2015.
3. https://www.wireshark.org/docs/

OUTCOMES :

Students who complete this course will be able to

- Troubleshoot and optimize TCP/IP networks
- Analyze the network traffic with Wireshark
- Detect Suspicious Traffic in the network
- Detect and report the causes of performance problems

CSC X134 DESIGN OF COMPUTER NETWORK SERVICES

L	T	P	C
3	0	0	3

OBJECTIVES :

- To expose multimedia services with real-time and non real-time components delivered over the Internet.
- To gain knowledge about various QoS and QoE measures for audio and video streams.
- To illustrate the protocols for SIP and IMS for setting up multimedia services.
- To study the various architectures and protocols to provide QoS guarantees in the IP network.
- To identify the parameters influencing the control functions.
- To provide an overview on the various models for capacity planning.

MODULE I BASICS OF NETWORK SERVICES 06

Network services basics - Process-Services: Definition, Characteristics and Frameworks-IT infrastructure Library-Process Modeling - Process design patterns - Example using BPMN

MODULE II QUALITY OF SERVICE & QUALITY OF EXPERIENCE 08

QoS measures- Subjective evaluation of voice and video quality- Objective evaluation of audio and video quality - Session initiation protocol(SIP) - Format of a SIP message- SIP response messages - SIP methods-Session description protocol - Examples of SIP messages - Locating SIP servers

MODULE III IP MULTIMEDIA SUBSYSTEM 09

IMS entities and functionalities - User identification - Setting up a session in IMS -Service provision - Setting up an emergency IMS session - SIP compression - Networking Services over IMS - Multimedia Service Continuity-VPN

MODULE IV QOS ARCHITECTURES IN THE TRANSPORT NETWORK 06

Connection-oriented networks - MPLS architecture - DiffServ architecture - MPLS support for DiffServ - Label distribution protocol - Resource reservation protocol- The resource reservation protocol-traffic engineering (RSVP-TE)

MODULE V CONTROL FUNCTIONS 09

Traffic characterization - Congestion control - QoS and Bandwidth requirements - The resource and admission control functions - MPLs virtual private networks - VPN models - pseudowires – Ethernet pseudowires –Virtual private LANservice.

MODULE VI CAPACITY PLANNING 07

Measuring the response time of Solr - Performance modeling - Some basic concepts of Queuing models - Simulation Project.

L – 45;TOTAL HOURS-45

REFERENCES :

1. Harry Perros, Networking Services QoS, Signaling, Processes, Createspace Independent Publications, ISBN: 1495437485, 978-1-49-543748-9, 2014.
2. Peterson, Larry L., and Bruce S. Davie, Computer networks: a systems approach, Elsevier, ISBN:978-0-12-374013-7, 2012.
3. Jin, Cheng, Jamin Sugih, Danny Raz, and Yuval Shavitt, Building scalable network services: theory and practice, Springer Science & Business Media, ISBN: 978-1-44-198897-3, 2011.

OUTCOMES :

Students who complete this course will be able to

- Identify the attributes that impact the network services.
- Assess the QoS and QoE measures of audio and video streams.
- Summarize the functionalities of IP multimedia subsystem.
- Compare the different Qos architecture along with their protocols.
- Analyze the control functions with the underlying transport network and assess Qos of a multimedia session.
- Design capacity planning models for real time scenarios.

CSC X135 SOFTWARE ARCHITECTURE FOR THE INTERNET OF THINGS

L	T	P	C
1	0	0	1

OBJECTIVES :

- To contexts of software architecture: technical, project, business, and professional.
- To use various architecture styles for Internet of things devices.
- To provide architecture competence: what this means both for individuals and organizations.
- To emphasize on architecturally significant requirements, and how to determine them.
- To describe essential technical knowledge, building blocks, processes, design principles, implementation, and marketing for Internet of things projects.
- To provide readers with knowledge in planning, designing, and implementing IoT projects.

MODULE I SOFTWARE ARCHITECTURE 07

Software Architecture – Many context of architecture – Quality attributes – Three architecture in life cycle – Designing architecture.

MODULE II INTERNET OF THINGS ARCHITECTURE 08

Architecture and Business - Introduction to Internet of things – Architectural approaches- Business Architecture – Technology architecture – Software architecture for Internet of Things- Security and governance- Applications.

L-15;TOTAL HOURS- 15

REFERENCES :

1. Len Bass, Paul Clements, Rick Kazman," Software Architecture in Practice", Addison-Wesley, 3rd Edition, ISBN: 9780132942782, 2012.
2. Rajkumar Buyya, Amir Vahid Dastjerdi," Internet of Things: Principles and Paradigms", Elsevier, 1st Edition, ISBN: 9780128093474, 2016.
3. Hwaiyu Geng," Internet of Things and Data Analytics Handbook, John Wiley & Sons, 1st Edition, ISBN: 9781119173649,2017.

OUTCOMES :

Students who complete this course will be able to

- Design architecture for the IoT devices based on the application.

- Develop various styles of pattern of software architecture based on application.
- Achieve system quality that can be applied to subsequent systems.
- Captures the state-of-the-art research in Internet of Things, its applications, architectures, and technologies.
- Think on new innovations and interactions between people and things that will enhance the quality of life and utilization of scarce resources.
- Test the devices and enhance the architecture to provide high security models.

CSC X136 **SOFTWARE METRICS** **L T P C**
2 0 0 2

OBJECTIVES :

- To learn the software metrics and measurement.
- To emphasize the use of product and quality metrics.
- To explain quality assurance and various tools used in quality management
- To learn in detail about various quality assurance models
- To learn the audit and assessment procedures to achieve quality
- To expose the students to apply certain probability, statistical and operational research concepts

MODULE I INTRODUCTION TO SOFTWARE METRICS 10

Fundamentals of measurement-Scope of software metrics-Measurement theory-Software measurement validation software metrics data collection – Analysis methods.

MODULE II PRODUCT AND QUALITY METRICS 10

Measurement of internet product attributes-size and structure-external product attributes-measurement of quality- Software quality metrics-product quality-process quality- metrics for software maintenance.

MODULE III FUNDAMENTALS OF SOFTWARE QUALITY ASSURANCE 10

SQA basics-Software quality in business context – Planning for software quality assurance – Product quality and process quality – Software process models -Total Quality Management- 7 QC Tools and Modern Tools.

L-30;TOTAL HOURS- 30

REFERENCES :

1. S.A.Kelkar,”Software quality and Testing”, PHI Learing, Pvt, Ltd.,1st Edition,ISBN: 9788120346284, 2012.
2. Norman E-Fentor and Share Lawrence Pflieger,“Software Metrics”,International Thomson Computer Press,2nd Edition,ISBN: 9781850322757, 1997.
3. Watts S Humphrey, “Managing the Software Process”, Pearson Education Inc,2nd Edition,ISBN: 978-0201180954,2008.

OUTCOMES :

Students who complete this course will be able to

- Gain knowledge on how to choose which metrics to collect and use them to make predictions.
- Explain the product and quality metrics.
- Detect, classify, prevent and remove defects.
- Choose appropriate quality assurance models and develop quality.
- Conduct formal inspections, record and evaluate results of inspections.
- Acquire skills in handling the quality management.

CSC X137 MULTICORE ARCHITECTURE L T P C

2 1 0 3

OBJECTIVES :

- To introduce the fundamentals of parallel Programming.
- To introduce the basic concepts of IoT
- To introduce the importance of the underlying architecture
- To explore the basic approach of synchronization
- To explain the emerging transactional approach to concurrency
- To expose the concept of parallel Programming

MODULE I INTRODUCTION 06

Definitions – Technological Aspects - Design Principles of Connected Devices - Fundamentals of IPv6 – Addressing and Protocols relevant to IoT - Smart Cities and Environments – Smart Metering –

MODULE II APPLICATION 06

Applications in Security – Healthcare – Retail – Industrial Control –Smart Farming and Agriculture

MODULE III FOUNDATIONS OF SHARED MEMORY 08

Register construction – Atomic snapshots – Power of Primitive Synchronization Operations – Universality of Concensus – Spin Lock and Contention

MODULE IV SYNCHRONIZATION 08

Monitors and Blocking Synchronization – Role of Locking – Concurrent Queues – ABA Problem – Concurrent Stacks and Elimination.

MODULE V CONCURRENT DATA STRUCTURES 08

Counting, Sorting and distributed coordination – Concurrent hashing and Natural Parallelism – Multiprocessor Scheduling and Parallelism - Barriers – Transactional Memory.

MODULE VI PARALLEL PROGRAM DEVELOPMENT 09

Two n-Body Solvers – Tree Search – Pthreads – OpenMP – MPI.

L – 30; T-15;TOTAL HOURS-45

REFERENCES :

1. Maurice Herlihy, Nir Shavit, The Art of Multiprocessor Programming, Morganaufmann, 1st Edition, 2012, ISBN: 978-0-12-370591-4.
2. Peter Pacheco, An Introduction to Parallel Programming, Morgan Kaufmann,1st Edition, 2011, eBook ISBN: 978-0-080-92144-0.

OUTCOMES :

Students who complete this course will be able to

- Write effective multiprocessor programs.
- Identify the protocols relevant to IoT application
- Compare and contrast various parallel algorithms using shared memory
- Apply barriers, all of which are useful for structure concurrent applications
- Demonstrate synchronization and parallelism
- Able to analyze the results for various multiprocessor scheduling.

CSC X138 **STATISTICS AND ANALYTICS USING R PROGRAMMING**

L	T	P	C
2	0	2	3

OBJECTIVES :

- To teach basic of R programming.
- To express the sample data visually using charts, graphs and plots.
- To diagnose the research problem and set the objectives.
- To emphasise the need for confidence intervals and estimation of error rates.
- To evolve the statistical inference and summarize the inferences.
- To develop regression models and evaluate the findings
-

MODULE I BASIC CONCEPTS 08

Introduction to R, Variables and the Case Format, Central Tendency and Variability, Descriptive Statistics, Data acquisition and inspection, PDFs and CDFs, Using the Normal Model.

MODULE II CHARTS, GRAPHS, AND PLOTS 08

Bar Charts, Histograms, Segmented Bar Charts, Box Plots, Comparative Box Plots, Pie and Waffle Charts, Pareto Charts. QQ Plots and Tests for Normality, Scatterplots, Contingency Tables

MODULE III FOUNDATIONS FOR RESEARCH 08

Randomness and Sampling Strategies, Experiments vs. Observational Studies, R's 12 Steps, The Art of Developing Research Questions, Power Analysis to Determine Sample Size, Sampling Distributions and The Central Limit Theorem, P-Values, Confidence Intervals and Controversy.

MODULE IV CONFIDENCE INTERVALS AND STANDARD ERROR 07

One Mean, Two Means, Paired Means, One Proportion, Two Proportions, One Variance, Two Variances, Regression Slope and Intercept.

MODULE V STATISTICAL INFERENCE 07

One Sample t-test, Two Sample t-test (Equal Variance), Two Sample t-test (Unequal Variance), Paired t-test, One Proportion z-test & Binomial Test, Two Proportion z-test, Chi-square Test of Independence, Chi-square Test for One

Variance, F Test for Homogeneity of (Two) Variances, One-way Analysis of Variance (ANOVA)

MODULE VI REGRESSION AND INFERENCES ON REGRESSION 07

Simple Linear Regression, Multiple Regression, Hypothesis Tests of Regression Coefficients, Real time case study and inference presentation.

L – 30; P – 30 TOTAL HOURS-60

REFERENCES :

1. Nicole M. Radziwill, “Statistics (The Easier Way) with R: an Informal Text on Applied Statistics”, Lapis Lucera Publishers, ISBN-13: 978-0692339428, 2015.
2. John M. Quick, “Statistical Analysis with R – Beginner’s Guide”, Packt Publishing, ISBN: 9781849512084, 2010.
3. Richard Cotton, “Learning R”, O'Reilly Publications, First edition, ISBN-13: 978-9351102861, 2013.

OUTCOMES :

Students who complete this course will be able to

- Acquire the basics of R programming and apply it for statistical problem solving
- Study the given samples set and express using visual tools like charts, graphs and plots.
- Formulate the research problem and set the objectives
- Distinguish between the confidence error intervals and estimate the error rate.
- Apply Statistical inferences and propose actions based on the findings.
- Analyse a given real time scenario, apply regression and interpret the results.

CSC X139 **C# .NET** **L T P C**

2 0 0 2

OBJECTIVES :

- To learn the .NET Architecture
- To explain the strings, collections and exceptions.
- To learn the object oriented concepts and the application
- To acquire the knowledge of windows applications.
- To describe the Server side programming with ADO.NET data Access.
- To explain the Simple Object Access Protocol (SOAP) and ASP.NET Web Services.

MODULE I INTRODUCTION TO C# 10

.NET Architecture - Core C# -Objective and Types – Arrays - Operators and Casts – Strings – Collections - Errors and Exception.

MODULE II OBJECT ORIENTED ASPECTS OF C# 10

Classes - Objects-Inheritance - Polymorphism-Interfaces – Operator Overloading – Delegates – Events- Building Windows Applications - Accessing Data with ADO.NET

MODULE III .NET FRAMEWORK 10

Understanding Server Object Types - Specifying a server with an Interface - Building a server, Building the Client - Using Single Call -Threads - Develop ASP.NET Web Services - Web Services (SOAP).

L-30;TOTAL HOURS- 30

REFERENCES :

1. Christian Nagel,Bill Evjen,Jay Glynn,"Professional C# 2012 and .NET 4.5",2nd Edition,ISBN:978-1-118-31442-5,2013.
2. E.Balagurusamy , "Programming in C#", Pearson Education, 7th Edition, ISBN: 978813170205, 2002.
3. J. Liberty, "Prgramming in C#", O'Reilly", 2nd Edition, ISBN: 0-596-00309-9, 2002.

OUTCOMES :

Students who complete this course will be able to

- Develop and deploy the concepts of object oriented programming.
- Utilize the .NET framework to build distributed enterprise applications.
- Develop the experiment with the deployment of windows applications.

- Develop the ASP.NET Web Services and threads.
- Develop network applications using Web Services (SOAP).
- Build the client and server side programming using single call.

SEMESTER VI

Programme Elective ##3

Elective 1

CSC X214	**INFORMATION RETRIEVAL**	**L**	**T**	**P**	**C**
		2	**0**	**2**	**3**

OBJECTIVES :

- To recall the basics of information retrieval with pertinence to modeling, query operations and indexing.
- To introduce the IR principles to locate relevant information on large collections of data.
- To evaluate the performance of an information retrieval system.
- To acquire knowledge and experience of the XML programming language.
- To describe the various applications of information retrieval giving emphasis to multimedia IR, web search.
- To expose the document text mining techniques.

MODULE I INTRODUCTION 07

Basic Concepts – Practical Issues - Retrieval Process – Architecture - Boolean Retrieval – Retrieval Evaluation – Open Source IR Systems–History of Web Search – Web Characteristics– The impact of the web on IR —IR Versus Web Search–Components of a Search engine.

MODULE II MODELING 07

Taxonomy and Characterization of IR Models – Boolean Model – Vector Model - Term Weighting – Scoring and Ranking –Language Models – Set Theoretic Models - Probabilistic Models – Algebraic Models – Structured Text Retrieval Models – Models for Browsing.

MODULE III INDEXING 07

Static and Dynamic Inverted Indices – Index Construction and Index Compression. Searching - Sequential Searching and Pattern Matching. Query Operations -Query Languages – Query Processing - Relevance Feedback and Query Expansion - Automatic Local and Global Analysis – Measuring Effectiveness and Efficiency.

MODULE IV CLASSIFICATION AND CLUSTERING 09

Text Classification and Naïve Bayes – Vector Space Classification – Support vector

machines and Machine learning on documents. Flat Clustering – Hierarchical Clustering – Matrix decompositions and latent semantic indexing – Fusion and Meta learning.

MODULE V SEARCHING THE WEB 08

Searching the Web –Structure of the Web –IR and web search – Static and Dynamic Ranking – Web Crawling and Indexing – Link Analysis - XML Retrieval Multimedia IR: Models and Languages – Indexing and Searching Parallel and Distributed IR – Digital Libraries

MODULE VI DOCUMENT TEXT MINING 07

Information filtering - organization and relevance feedback – Text Mining -Text classification and clustering – Categorization algorithms: naive Bayes; decision trees; and nearest neighbor – Clustering algorithms: agglomerative clustering; k-means; expectation maximization (EM).

L – 30; P-30;TOTAL HOURS-60

REFERENCES :

1. Ricardo Baeza – Yates, Berthier Ribeiro – Neto, “Modern Information Retrieval: The concepts and Technology behind Search” (ACM Press Books), Second Edition, ISBN 10: 0321416910, 2011.
2. Stuart Russell-Peter Norvig, "Artificial Intelligence - A Modern Approach", 3rd Edition, Pearson Education, ISBN-10: 0-13-604259-7, 2009.
3. Bruce Croft, Donald Metzler and Trevor Strohman, Search Engines: Information Retrieval in Practice, 1st Edition Addison Wesley, ISBN-10: 0136072240, 2009.

OUTCOMES :

Students who complete this course will be able to

- Apply the basic concepts and techniques of Information Retrieval in various related fields.
- Form the ontology for different domains and generate the equivalent representations.
- Use different information retrieval techniques in various application areas
- Implement retrieval systems for web search tasks.
- Develop skills in problem solving using systematic approaches.
- Apply document text mining techniques and analysis.

CSC X215 SOFTWARE RISK MANAGEMENT L T P C

1 0 0 1

OBJECTIVES :

- To give an insight into the various risk levels in software development
- To provide a concise view on the risk plan
- To highlight the techniques in identifying risks.
- To realize the need for managing and tracing risks.
- To gain expertise in discovering risk and usage of risk assessment tools
- To highlight risk mitigation strategies.

MODULE I RISK MANAGEMENT PROCESS 07

Introduction to software risk management-objectives and goals-assessment-cost-developing a software risk management strategy-Risk management paradigm-cultural considerations

MODULE II RISK ASSESSMENT, MITIGATION AND MONITORING 08

Discovering risks-Methods-classification of risks-risk taxonomy-reviews-Risk assessment approaches-tools and techniques- risk planning-risk mitigation strategies- formulating and implementing risk management plans-risk database-managing and tracing risk.

L-15; TOTAL HOURS-15

REFERENCES :

1. John McManus, “Risk Management in Software Development Projects”, Route Ledge, ISBN: 1136367918, 9781136367915 ,2012
2. Tom DeMarco, Tim Lister, Waltzing with Bears: Managing Risk on Software Projects, Addison-Wesley, ISBN 0133492230, 9780133492231., 2013.
3. Hall, Elaine M.” Managing Risk: Methods for Software Systems Development”, Addison Wesley, ISBN 0201255928, 2001.

OUTCOMES :

Students who complete this course will be able to

- Identify risks associated with a project.
- Categorize risks and Develop basic risk management skills.
- Develop a comprehensive risk management plan for a project.
- Qualitatively and quantitatively analyze risks and assess risks.
- Apply risk mitigation strategies.
- Evaluate risk management tools and explore them.

CSC X216 **SOCIAL MEDIA SECURITY** **L T P C**
2 0 0 2

OBJECTIVES :

- To understand how to apply the principles of security in social media.
- To understand the vulnerabilities and threats in Social Media.
- To learn about the policies and procedures in Social Media Security.
- To identify and mitigate social media security risks.
- To learn the importance of security in social media.
- To overcome the privacy issues in social media.

MODULE I **UNDERSTANDING THE INFLUENCE OF SOCIAL MEDIA GLOBALLY** **09**

Overview of Social Media - Understanding Social Media's Impact on Global Security – Social Media Analytics- collecting and Managing Social Media Data

MODULE II **SECURITY ISSUES IN SOCIAL MEDIA** **10**

Risks of Social Media – Cyber Crime – Fake Accounts – Passwords – Content Security –Malware and Viruses

MODULE III **POLICIES AND PRIVACY** **11**

Laws and Regulations- forensics –Blocking users – Location Awareness

L-30;TOTAL HOURS-30

REFERENCES :

1. Ravi gupta & Hugh Brooks, "Using Social Media for Global Security",John Wiley Publishers, ISBN: 9781118442319,2013.
2. Michael Cross, "Social Media Security", Elsevier Publishers, ISBN: 9781597499866, 2014.
3. Yaniv Altshuler, Yuval Elovici, "Security and Privacy in Social Networks", Springer Publishers, ISBN: 9781461441380, 2013.

OUTCOMES :

Students who complete this course will be able to

- Evaluate the importance of security issues in social media.
- Analyze and provide security solutions.

- Overcome the vulnerabilities and threats in social media.
- Acquire knowledge about security issues and services available.
- Identify and respond to significant legal and ethical issues related to social media including laws and voluntary agreements covering protection of individual information protection.
- Identify privacy and data integrity issues associated with social media to identify both personal and institutional data privacy threats and maintain both personal and institutional data integrity.

CSC X217 **WEB SECURITY** **L T P C**
2 0 0 2

OBJECTIVES :

- To learn about the security concepts, security professional roles, and security resources in the context of systems and security development life cycle.
- To acquire the knowledge of threat and risk analysis.
- To explain the business need for web security threats and secure software development.
- To learn about the information of secure socket layer and transport layer security.
- To expose the students to apply the use of firewall and packet filtering firewall in physical design.
- To explain the concepts and techniques for establishing system security.

MODULE I SECURITY WORLD 10

History of Web Security-Black and White Hat-Security Elements-Asset Classification-Threat & Risk Analysis-Security of Browser-Cross-Site Scripting Attack – Introduction-Advanced XSS Attack-Platform.

MODULE II WEB SECURITY 10

Web Security Considerations- Web security threats- Web traffic security approaches-Secure Socket Layer and Transport Layer Security- Overview- HTTPS- Connection initiation- Connection closure- Basic Concept of Secure Electronic Transactions- SSL versus SET- D Secure Protocol.

MODULE III SYSTEM SECURITY 10

Intrusion- Classification of Intruders- Intrusion Detection techniques- Password Management- Malicious software- Virus Countermeasures- Need of firewall- Firewall characteristics- Types of Firewall- Packet filtering firewall- Application proxy firewall-Circuit level proxy firewall.

L-30;TOTAL HOURS- 30

REFERENCES :

1. Hanqing Wu and Liz Zaho,”Web Security”,1st Edition,CRC Press,ISBN: 9781466592612,2015.
2. Eric Malwald, “Fundamentals of Network Security “, 4th edition., Pearson

Education, ISBN: 978-0072230932,2010.

3. William Stallings,"Cryptography and Network security", 4th edition., Pearson Education, ISBN: 10: 0131873164,2008.

OUTCOMES :

Students who complete this course will be able to

- Describe importance of web security and attack.
- Explain Basic concept of web traffic security approaches.
- Identify the concept of secure socket layer.
- Demonstrate use of malicious software.
- Apply Application level security on web browser.
- Apply various parameters of antivirus and firewall security on network.

CSC X218 SOFTWARE DESIGN AND ARCHITECTURE

L	T	P	C
1	0	0	1

OBJECTIVES :

- To provide a concise overview of the basics and characteristics of software architecture.
- To provide an understanding of software development with an emphasis on architecture and design.
- To highlight the architectural patterns and models.
- To understand the principles of software quality concepts and quality attributes.
- To outline the various architectural styles and design strategies.
- To acquire knowledge on documentation of software architecture

MODULE I SOFTWARE ARCHITECTURE AND QUALITY ATTRIBUTES 07

Software Architecture- Importance – Contexts of software architecture – Quality attributes – Availability – Interoperability – Modifiability – Performance – Usability – other Quality attributes

MODULE II DESIGN AND MODELLING 08

Architectural tactics and patterns – Frameworks - Quality attribute modeling and analysis – Architecture in Agile Projects .Architectural Styles – Designing an Architecture – Design Strategy – Attribute Driven Design Methods – Documenting Software Architecture.

L-15;TOTAL HOURS- 15

REFERENCES :

1. Len Bass, Paul Clements, Rick Kazman,"Software Architecture in Practice", Addison-Wesley, 3rd Edition, ISBN – 97801321815736, 2015.
2. Paul Clements, Felix Bachmann, Len Bass, David Garlan, James Ivers, Reed Little, Robert Nord, Judith Stafford "Documenting Software Architectures: Views and Beyond ", 2nd edition, Pearson Education, ISBN: 0132488590, 9780132488594, 2011.
3. Taylor, R., Medvidovic, N., Dashofy, E., "Software Architecture: Foundations, Theory, and Practice", Wiley. ISBN: 9780470167748, 2010.

OUTCOMES :

Students who complete this course will be able to

- Identify and assess the quality attributes of a system at the architectural level.
- Select patterns and architectures for applications of various domains.
- Develop software that meets specific quality constraints by understanding the impact of architecture, design and implementation.
- Recognize major software architectural styles, design patterns, and frameworks.
- Apply the knowledge of various architectural tactics and styles in given scenario.
- Illustrate the skills to document software architectures.

CSC X219 SOFTWARE CONFIGURATION MANAGEMENT L T P C
2 0 0 2

OBJECTIVES :

- To learn the importance of integrity and control of system components throughout SDLC.
- To develop code in parallel with other developers.
- To analyze where the change happened in the history of a component development.
- To learn an environment focused on producing quality products.
- To have a knowledge on deciding when to use manual processes.
- To use current tools effectively.

MODULE I INTRODUCTION 10

Introduction – Pitfalls in SDLC – Importance of SCM – Basic concepts – Configuration Identification.

MODULE II CONFIGURATION CONTROL 10

Configuration control – Defect Classification – Defect controls – Status Accounting – Verification and Audits – CMM.

MODULE III SCM TOOLS 10

Introduction – SCM Tools Evolution – Advantages – Functions – Tools Selection – Documentation Management- SCM Implementation – Phases of SCM Implementation – SCM and Cloud Computing – Code Repositories – Operations on SCM system.

L – 30;TOTAL HOURS-30

REFERENCES :

1. Alexis Leon, "Software Configuration Management Handbook", Artech House, Third Edition, ISBN 978-1-60807-843-1, 2015.
2. 2
3. Maria E Moriera, “Software Configuration Management Implementation Roadmap", John Wiley & Sons , ISBN 0-470-86264-5, 2004.

OUTCOMES :

Students who complete this course will be able to

- Recognize every configuration item of a software product.
- Apply the formal mechanisms for making changes to configuration items.
- Identify and control defects in a software application.
- Document the project plan per the chosen structure and format.
- Track the changes using the software configuration management system.
- Check the availability of the resource and support their team in the development process

CSC X220	HUMAN COMPUTER INTERACTION	L	T	P	C
		2	0	0	2

OBJECTIVES :

- To understand the basics of foundation for User Interface.
- To describes guidelines for effective interface designs.
- To equip with the human factor methodologies
- To provide the design technology for individuals and persons with disabilities
- To identify the various models that can be used for designing systems.
- To provide guideline for testing and modeling for interactive design

MODULE I INTRODUCTION 10

Usability of Interactive Systems - Universal Usability - Guidelines, Principles, and Theories. Design - Evaluation and the User Experience.

MODULE II INTERACTION STYLES 10

Direct Manipulation and Immersive Environments - Fluid Navigation - Expressive Human and Command Languages – Devices - Communication and Collaboration.

MODULE III DESIGNING ISSUES 10

Advancing the User Experience - The Timely User Experience - Documentation and User Support - Information Search - Data Visualization.

L – 30;TOTAL HOURS-30

REFERENCES :

1. Ben Shneiderman, Catherine, Maxine Cohen,"Designing the User Interface: Strategies for Effective Human-Computer Interaction", 6th Edition, ISBN-9780134380711, 2017.
2. I.Scott Mackenzie,"Human-Computer Interface: An Emprical Research perspective", Elsevier, ISBN: 978012405865, 2013.

OUTCOMES :

Students who complete this course will be able to

- Explore and analyze the basic concepts, terms in user interface
- Explain the guidelines for effective interface designs.

- Apply the Interaction design basics.
- Design the effective HCI for individuals and persons with disabilities.
- Recognize the importance of human factors.
- Develop an interactive user interface.

CSC X221 **GREEN COMPUTING** **L T P C**

3 0 0 3

OBJECTIVES :

- To acquire knowledge to adopt green computing practices to minimize negative impacts on the environment.
- To create awareness of energy efficient computing.
- To examine the power management in computing devices.
- To emphasize skill in energy saving practices in their use of hardware.
- To explore the technology tools that can reduce paper waste and carbon footprint.
- To understand how to minimize equipment disposal requirements.

MODULE I INTRODUCTION 08

Reputation as Motivation-Avoiding Green wash-Green Recruiting and Retention-Money saving efforts-Implementing Energy Efficiency-Current Devices –Digitizing NON-IT Functions.

MODULE II GREEN COMPUTING ENVIRONMENT 08

Environmental Drivers-Green Agenda-Roots of Environmentalism-Environmentalism and IT-Imperative of Climate Change-Go Green-A New vision of computing-Efficiency and cloud computing-Green ability-responsibility-usability-the zen of green computing

MODULE III GREEN DEVICES 08

Device purchases-Dimension of Device pyramid greeness-Green computing-Embodied Energy-Device Green-Supplier Green-Buying principles-Desktop computers-Laptops.

MODULE IV GREEN DATACENTERS 07

Green Data Centers-Model-Power supply considerations-servers-storage-networking-datacenter suppliers-saving energy-Cost savings-Risk Reduction-Carbon Footprint Reduction-Focusing on solar power.

MODULE V GREEN HOUSE GAS AND RESOURCE 07

Sources and sinks of green house gases and warming-doubters-deniers-Reducing Emissions-Resource use check list-Apple-EPEAT-Case Study-Computer Hardware and RSI

MODULE VI DEEP GREEN COMPUTING 07

Megatrends for Green computing-Telepresence-Telecommuting-Platforms for Deep Green computing-Selling Deep Green Computing

L – 45;TOTAL HOURS-45

REFERENCES :

1. Bud E. Smith,"Green Computing: Tools and Techniques for Saving Energy, Money, and Resources",CRC Press,1st Edition,ISBN:9781466503410,2014
2. Wu Chun Fang, "Green computing Book", CRC Press,1st Edition,ISBN:9781439819876, 2014.

OUTCOMES :

Students who complete this course will be able to

- Describe the resources pertaining to green house gases and warming.
- Develop energy efficient computing applications.
- To analyze the consumption of power in data centers.
- Evaluate deep green computing use in relation to environmental perspectives.
- Discuss how the choice of hardware and software can facilitate a more sustainable operation.
- Apply the strategies of going Green.

CSC X222 XML and WEB SERVICES L T P C

2 0 0 2

OBJECTIVES :

- To provide overview on evolution of web services and their architecture.
- To describe, discover & develop web services.
- To inculcate in-built programming skill needed to provide a web service.
- To learn the trade-offs and issues that are involved in designing a web service.
- To demonstrate on how to validate XML documents with the use of Document Type Definitions and XML schemas.
- To practice the technologies in building the web services.

MODULE I XML FUNDAMENTALS 10

XML Fundamentals: XML Documents - XML namespaces - Explicit and Default namespaces, Inheriting namespaces - XML Schema - Implementing XML schema types, Elements, Inheritance, Substitution groups, Global and local type declarations, Managing Schemas, Schemas and instance documents, XML schema best practices.

MODULE II WEB SERVICES 10

Introduction: Web services - SOAP – SOAP message format – SOAP communication style – WSDL – WSDL building blocks – containment structure of a WSDL document – logical relationships between WSDL elements - UDDI - UDDI Business registry- Accessing UDDI – UDDI API – Private versus Public UDDI registries

MODULE III BUILDING WEB SERVICES 10

Developing web services in Java – IBM development tools – preparing sample applications – Building web services clients – Programmatic access to WSDL – UDDI access from Java and web browsers.

L – 30;TOTAL HOURS-30

REFERENCES :

1. Gustavo Alonso, Fabio Casati, Harumi Kuno, Vijay Machiraju, “Web Services: Concepts, Architectures and Applications”,Springer, Illustrated Edition, ISBN:3662108763, 2013.
2. Olaf Zimmermann, Mark Tomlinson, Stefan Peuser,“ Perspectives on Web Services: Applying SOAP, WSDL and UDDI to Real-World”, Springer,2nd Edition, ISBN:9783642624681, 2012.
3. Alex Belotserkovskiy, Stephen Kaufman, Nikhil Sachdeva, “Building Web Services

with Microsoft Azure", Packt publishing, 1st Edition, ISBN: 9781784398, 2015.

OUTCOMES :

Students who complete this course will be able to

- Validate XML documents with the use of Document Type Definitions and schemas according to industry standards.
- Create web based application with the suitable markup languages.
- Describe the role of web services in various applications.
- Build, integrate and consume web services
- Use SOAP, WSDL & UDDI.
- Construct and deploy web services using the current web technologies.

CSC X223 BUSINESS PROCESS MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES :

- Plan to become business or systems analysts that participate in BPM projects.
- To design the Process Modeling and Process Discovery.
- BPM technology helps organizations become more efficient by coordinating activities.
- To Know about the Qualitative And Quantitative Process Analysis
- To analyze organizational performance from a process perspective, redesign processes using value-focused techniques.
- To design Process Automation and Process Intelligence in BPM systems.

MODULE I BUSINESS PROCESS ANALYSIS AND DESIGN 07

Introduction to Business process management- Functional Organization -BPM lifecycle, process modeling - Process Architecture – Introduction to BPM.

MODULE II PROCESS MODELLING AND PROCESS DISCOVERY 08

Branching and Merging - Information Artifacts - Processes Decomposition - More on rework and repetition - Handling Events and Exceptions - Discovery method - Process modeling method.

MODULE III QUALTITATIVE AND QUANTITATIVE PROCESS ANALYSIS 07

Value -added analysis - Root cause Analysis - Performance Measures - Flow analysis - Queue and Simulation.

MODULE IV PROCESS REDESIGN 07

Essence of process redesign - Heuiristic process redesign - The case of heath care institution - Product base design .

MODULE V PROCESS AUTOMATION 08

Automation business process - Advantages and challenges of introducing a BPMS - Turning process models Executable

MODULE VI PROCESS INTELLIGENCE 08

Process Execution and event logs - Automatic process discovery - Performance Analysis - Conformance Checking

L – 45;TOTAL HOURS-45

REFERENCES :

1. Dumas, M., La Rosa, M., Mendling, J., Reijers, H,"Fundamentals of Business Process Management" , Springer ,ISBN 978-3-642-33143-8 ,2013.
2. Alexander Grosskopf, Gero Decker, Mathias Weske ,"Business process modeling using BPMN" , Second Edition,Meghan-Kiffer Press,ISBN : 9780929652269, 2009

OUTCOMES :

Students who complete this course will be able to

- Analyze and improve Business Processes in organizations.
- Evaluate the Process Discovery and Modeling method.
- Implement the Root Cause Analysis and Flow Analysis of Qualitative Analysis.
- Develop the Process Redesign in BPM.
- To improve their ability in Process Automation and Process Intelligence.
- Evaluate BPMN Process Modules.

CSC X224	ADVANCED MACHINE LEARNING	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To teach about deep belief networks.
- To describe the unsupervised machine learning techniques.
- Outline the various semi-supervised learning techniques.
- Comprehend the convolution neural networks.
- To analyze the text feature engineering methods.
- To expose the students to ensemble methods.

MODULE I **UNSUPERVISED MACHINE LEARNING AND DEEP BELIEF NETWORKS** **08**

Unsupervised machine learning – Principal component analysis -PCA – a primer - Employing PCA - Introducing k-means clustering -Clustering – a primer - Kick-starting clustering analysis -Tuning your clustering configurations -Self-organizing maps -SOM – a primer -Employing SOM, Deep Belief Networks - Neural networks – a primer -The composition of a neural network -Network topologies - Restricted Boltzmann Machine - Introducing the RBM –Topology –Training - Applications of the RBM - Further applications of the RBM -Deep belief networks -Training a DBN - Applying the DBN - Validating the DBN.

MODULE II **STACKED DENOISING AUTOENCODERS AND CONVOLUTIONAL NEURAL NETWORKS** **07**

Stacked Denoising Autoencoders – Autoencoders - Introducing the auto encoder- Topology –Training - Denoising autoencoders - Applying adA - Stacked Denoising Autoencoders - Applying the SdA - Assessing SdA performance , Convolutional Neural Networks -Introducing the CNN - Understanding the convnet topology - Understanding convolution layers - Understanding pooling layers - Training a convent - Putting it all together - Applying a CNN.

MODULE III **SEMI-SUPERVISED LEARNING AND TEXT FEATURE ENGINEERING** **08**

Semi-Supervised Learning – Introduction - Understanding semi-supervised learning - Semi-supervised algorithms in action - Self-training - Implementing self-training - Finessing your self-training implementation - Improving the selection process -

Contrastive Pessimistic Likelihood Estimation, Text Feature Engineering –Introduction - Text feature engineering -Cleaning text data - Text cleaning with BeautifulSoup - Managing punctuation and tokenizing - Tagging and categorising words -Tagging with NLTK -Sequential tagging -Backoff tagging -Creating features from text data –Stemming Bagging and random forests -Testing our prepared data.

MODULE IV FEATURE ENGINEERING PART II 08

Introduction - Creating a feature set - Engineering features for ML applications - Using rescaling techniques to improve the learnability of features - Creating effective derived variables - Reinterpreting non-numeric features -Using feature selection techniques - Performing feature selection – Correlation – LASSO - Recursive Feature Elimination - Genetic models - Feature engineering in practice - Acquiring data via RESTful APIs - Testing the performance of our model –Twitter -Translink Twitter -Consumer comments -The Bing Traffic API - Deriving and selecting variables using feature engineering techniques -The weather API.

MODULE V ENSEMBLE METHODS 08

Introducing ensembles - Understanding averaging ensembles - Using bagging algorithms - Using random forests - Applying boosting methods - Using XGBoost - Using stacking ensembles - Applying ensembles in practice - Using models in dynamic applications - Understanding model robustness - Identifying modeling risk factors - Strategies to managing model robustness.

MODULE VI ADDITIONAL PYTHON MACHINE LEARNING TOOLS 06

Alternative development tools -Introduction to Lasagne -Getting to know Lasagne - Introduction to TensorFlow -Getting to know TensorFlow -Using TensorFlow to iteratively improve our models -Knowing when to use these libraries.

L – 45;TOTAL HOURS-45

REFERENCES :

1. By John D. Kelleher, Brian Mac Namee and Aoife D'Arcy, “Fundamentals of Machine Learning for Predictive Data Analytics”, MIT Press, 1st Edition, ISBN: 9780262029445. 2015.
2. Amouzegar, Mahyar (Ed.), “Advances in Machine Learning and Data Analysis”, Springer, 1st Edition, ISBN 978-90-481-3176-1, 2010.
3. Koronacki, Jacek, Ras, Zbigniew W, Wierzchon, Slawomir T. ,“Advances in Machine Learning II” , Springer, 1st Edition, ISBN 978-3-642-05178-4, 2010.

4. John Hearty, “Advanced Machine Learning with Python”, PACKT publishing limited, Kindle Edition, ISBN-13: 978-1784398637, 2016.
5. Christopher M. Bishop, “Pattern Recognition and Machine Learning”, Springer, 2nd Edition, ISBN-10: 0-387-31073-8, 2006.

OUTCOMES :

Students who complete this course will be able to

- Recall the semi-supervised learning techniques.
- Describe the unsupervised learning techniques.
- Improve the effectiveness of your deep learning models further by using powerful ensembling techniques to strap multiple models together.
- Automate large sets of complex data and overcome time-consuming practical challenges.
- Develop the accuracy of models and existing input data using powerful feature engineering techniques.
- Use multiple learning techniques to improve the consistency of results.

Elective 2

CSC X228	INFORMATION VISUALIZATION	L	T	P	C
		2	1	0	3

OBJECTIVES :

- To lay the foundation for visualization of data.
- To understand the features of visualization and impact of using colours.
- To appraise visual attention and categorize texture handling.
- To devise visualization techniques to represent static and dynamic patterns.
- To deduce visual objects space perception.
- To formulate the visualization strategies for information presentation.

MODULE I SCIENCE OF DATA VISUALIZATION 08

Visualization stages, semiotics based on perception, Model of perceptual processing, Types of data, Environment, Optics, Resolution, and Display.

MODULE II LIGHTNESS, BRIGHTNESS, CONTRAST, AND CONSTANCY 07

Neurons, Receptive Fields, and Brightness Illusions, Luminance, Brightness, Lightness, and Gamma, Color Measurement, CIE System of Color Standards, Opponent Process Theory, Color Appearance.

MODULE III VISUAL ATTENTION AND INFORMATION 08

Searching the Visual Field, Preattentive Processing, Rapid Area Judgments, Coding with Combinations of Features, Conjunctions with Spatial Dimensions, Gabor Model and Texture in Visualization, Texture Coding Information, Glyphs and Multivariate Discrete Data.

MODULE IV STATIC AND MOVING PATTERNS 07

Gestalt Laws, Contours, Perception of Transparency, Perceptual Syntax of Diagrams, Patterns in Motion.

MODULE V VISUAL OBJECTS SPACE PERCEPTION 07

Image-Based Object Recognition, Structure-Based Object Recognition, Perceiving the Surface Shapes of Objects, Depth Cue Theory, Task-Based Space Perception.

MODULE IV INTERACTING WITH VISUALIZATIONS AND THINKING WITH VISUALIZATION **08**

Data Selection and Manipulation Loop, Exploration and Navigation Loop, Memory Systems, Eye Movements, Problem Solving with Visualizations, Implications for Interactive Visualization Design, Interfaces to Knowledge Structures.

L – 30; T – 15; TOTAL HOURS-45

REFERENCES :

1. Colin Ware, “Information Visualization : Perception for Design”, Morgan Kaufmann, an imprint of Elsevier, Third edition, ISBN-13: 978-0123814647, 2012.
2. Robert Spence, “Information Visualization: Design for Interaction”, Pearson Publishers, Second Edition, ISBN-13: 978-0132065504, 2007.
3. Andreas Kerren, John Stasko, Jean-Daniel Fekete and Chris North, “Information Visualization: Human-Centered Issues and Perspectives (Lecture Notes in Computer Science)”, Springer edition, ISBN-13: 978-3540709558, 2008.

OUTCOMES :

Students who complete this course will be able to

- Acquire skills for visualization of data.
- Assess the features of visualization and handling of colours in visualization.
- Recognize various visual attention strategies and apply according to the given scenario,
- To analyze and propose appropriate visyualization techniques for static and dynamic patterns.
- To construct visual object space perception.
- To devise visualization strategies for presentation of real time scenarios

CSC X229 **CYBER FORENSICS** **L T P C**

3 0 0 3

OBJECTIVES :

- To inculcate the fundamentals of digital forensics from the viewpoint of courtroom legalities.
- To introduce the different types of cyber crimes.
- To begin the policies and procedures to investigate cyber crime.
- To create forensics concepts and practices focusing on networks and internet.
- To gain the knowledge on digital investigations.
- To explore the current techniques and tools for forensic examinations.

MODULE I FORENSICS FUNDAMENTALS 7

Introduction-Law Enforcement – Services- Benefits of Professional Forensics Methodology – Types of computer forensics technology.

MODULE II FORENSICS SYSTEM & SERVICES 8

Internet Security Systems – Intrusion Detection System – Firewall Security System – Storage area network security systems – Network disaster Recovery System – Satellite Encryption Systems – Fighting Cyber Crime with Risk Management Techniques- Computer Forensics Investigation Services – Forensics Process Improvement.

MODULE III DATA RECOVERY 8

Live data collection – Forensics Duplication – Collecting Network based Evidence – Evidence Handling – Hiding and Recovering Hidden Data – Data backup and Recovery

MODULE IV EVIDENCE COLLECTION & DATA SEIZURE 7

Collection Options – Types of Evidence – Rules of Evidence – Volatile Evidence – Collection& Archiving – Methods of Collection – Artifacts – Collection Steps – Reconstructing the Attack.

MODULE V DATA ANALYSIS 8

Computer System Storage Fundamentals – Data analysis techniques – Analyzing network traffic – Investigating hacker Tool –Investigating Routers – Writing Computer Forensics Reports.

MODULE VI COMPUTER AND DIGITAL FORENSICS 7

Types of cyber crime -Credit card and cyber crime-Web hacking - Digital Detective Work-Cell Phone Forensics - Email and Webmail Forensics - Cyber laws of different countries.

L-45;TOTAL HOURS-45

REFERENCES :

1. John Sammons, “The Basics of Digital Forensics, The Primer for Getting Started in Digital Forensics”, Elsevier, 2nd Edition, ISBN: 9781597496612, 2014.
2. Eoghan Casey, “Digital Evidence and Computer Crime: Forensic Science, Computers and the Internet“, Published by Elsevier, 3rd Edition , ISBN:9780123742681, 2011.

OUTCOMES :

Students who complete this course will be able to

- Analyze the digital and cyber forensics policies and procedures.
- Apply the hacking techniques to secure the Applications.
- Identify the legal and ethical issues surrounding cyber crime and forensics.
- Assess digital evidence and practice forensic investigation.
- Express the legalities, penalties, and punishment associated with cyber.
- Identify the current techniques and tools for forensic examinations.

CSC X230	SMART DEVICES SECURITY	L	T	P	C
		1	0	0	1

OBJECTIVES :

- Instigate with protecting a mobile device from security threats
- To discuss how iOS is secured and hack the iPhones
- To showcase the different security model of Android and iPhone
- To converse the different attacks and information leakage in Android phone
- To gain the knowledge of general web service security and mobile web browser
- To know the mobile development security and mobile payment

MODULE I **MOBILE RISK ECOSYSTEM AND HACKING THE CELLULAR NETWORK – iOS - ANDROID** **07**

The Mobile risk ecosystem, the mobile ecosystem, the mobile risk model, hacking the cellular network, attacks and countermeasures- iOS: how secure is iOS, jailbreaking, hacking other iPhones - Android: Security Model, rooting, Intent based attacks, NFC-based attacks, information leakage.

MODULE II **MOBILE MALWARE AND MOBILE SERVICES AND MOBILE WEB** **08**

Mobile malware: Android malware, iOS malware, Malware Security: Android vs. iOS. Mobile services and Mobile web: General web service security guidelines, mobile web browser and web view security.

L-15;TOTAL HOURS-15

REFERENCES :

1. Neil Bergman, Mike Stanfield , Jason Rouse & Joel Scambray , “Hacking Exposed :Mobile Security Secrets & Solutions “, McGraw Hill, ISBN: 978-0-07-181702-8, 2013.
2. Rich Campagna, Subbu Iyer, Ashwin Krishnan, Mark Bauhaus,“Mobile Device Security For Dummies”,Wiley Publication, ISBN: 978-1-118-09380-1, July 2011.
3. Mike Oliver, Sybase ,”Mobile Device Management for Dummies”, , John wiley & Sons Ltd., ISBN: 978-0-470-69472-5, 2011.
4. Georgina Gilmore & Peter Beardmore ,“Mobile Security & BYOD for Dummies”, Wiley Brand, ISBN:978-1-118-66242-7,2012.

OUTCOMES :

Students who complete this course will be able to

- Point out the physical risk, service risk and app risk in mobile
- Identify the different malware, phishing, virus, worms in mobile
- Make out the security model for Android and iPhone
- Discover the Android and iPhone malware and provide the malware security
- Develop Mobile Device Management to secure the mobile.
- Gain the knowledge in mobile development security and mobile payment

CSC X231 BIOMETRIC SECURITY L T P C

3 0 0 3

OBJECTIVES :

- To provide students with understanding of biometrics, biometric equipment and standards applied to security.
- To learn the fundamental issues and technologies for Biometric security.
- To Recognize physical and behavior biometric characteristics.
- To illustrate the key issues and importance of biometric systems for security concerns.
- To discuss the biometric computing knowledge and methods.
- To learn some basic biometrics systems with real case studies.

MODULE I INTRODUCTION TO BIOMETRICS 08

Cancelable Biometrics and Data Separation Schemes-Minutiae based Finger print representations-reviews-privacy-security and cryptography realization-palmprint template protection technologies.

MODULE II BIOMETRIC KEY AND ENCRYPTION 08

Biometric Discretization for Template Protection and Cryptographic key generation-De Identifying Biometrics Images –Decomposition-Mixing

MODULE III BIOMETRIC SYSTEM ANALYSIS 08

BioPACE:Biometric Protected Authentication Connection Establishment-Privacy and security assessment of biometric systems-A generalized framework for privacy and security assessment of biometric Template Protection.

MODULE IV PRIVACY ENHANCED BIOMETRIC SYSTEMS 07

Secure and Efficient Iris Fingerprint Identification-Security over Outsourced Biometric Data.

MODULE V BIOMETRIC IDENTIFICATION AND AUTHENTICATION 07

A Collaborative Framework Design for Distributed Biometrics based Authentication in cloud-Secure Two party Computation and Biometric Identification.

MODULE VI BIOMETRIC SECURITY TECHNOLOGIES 07

Other Biometric security Technologies-Watermarked Biometrics-3D Fingerprints – case studies

L – 45;TOTAL HOURS-45

REFERENCES :

1. David Chek Ling Ngo, Andrew Beng Jin Teoh, Jiankun Hu, “Biometric Security”Cambridge scholars publishing,1st Edition,2015.
2. Richard Jiang, Somaya Al-Madeed, Ahmed Bouridane, Danny Crookes, Azeddine Beghdadi,” Biometric Security and Privacy:”,Springer,1st Edition,2017.

OUTCOMES :

Students who complete this course will be able to

- Demonstrate knowledge of the basic physical and biological science and engineering principles underlying biometric systems.
- Understand and analyze biometric systems at the component level.
- Analyze and design basic biometric system applications.
- Be able to work effectively in teams and express their work and ideas orally and in writing.
- Identify the sociological and acceptance issues associated with the design and implementation of biometric systems.
- Understand various Biometric security issues.

CSC X232 DATABASE SECURITY L T P C

3 0 0 3

OBJECTIVES :

- To expose the need for Database security in real time systems.
- To compare the architecture model of several Database Management systems.
- To describe database security architecture and password policies.
- To infer the impact of SQL injection in database systems.
- To focus on various auditing and security procedures for Database systems.
- To overview fundamental concepts of multilevel relational databases and its security models.

MODULE I INTRODUCTION 08

Security and Information technology - Database security – Security Architecture – Operating system Security fundamentals.

MODULE II DATABASE (DB) REVIEW 08

DB Definition –DB Structure components –DB Models – DB Relationships – DB types – DB Management systems – DB similarities – Oracle Architecture – MySQL Architecture – Microsoft SQL Server Architecture

MODULE III PASSWORD, PROFILES, PRIVILEGES AND ROLES 08

Defining and Using Profiles – Designing and Implementing Password Policies - Granting and Revoking User privileges – Creating, Assigning and Revoking User Roles.

MODULE IV SQL INJECTION 08

Identification – Understanding SQL Injection – Identifying vulnerabilities – Exploitation and Defense – Exploitation and Information gathering – Extracting the Red Data – Exploitation of Privileges and passwords – Defending against Exploitation.

MODULE V SECURITY AUDITING AND TESTING 07

Virtual private Databases - Database Auditing Models - Auditing Database Activities – Security Testing – Testing Methodology – Case study.

MODULE VI MULTILEVEL DATABASE SECURITY 06

Introduction - Multilevel Database Relations - Polyinstantiation - Multilevel Database

Security Models – Concurrency control - Performance Study .

L – 45;TOTAL HOURS-45

REFERENCES :

1. Alfred Basta , Melissa Zgola, “Database Security”, Delmar Cengage Learning,1st Edition, ISBN : 9781435453906, 2011.
2. Hassan A. Afyouni, “Database Security and Auditing: Protecting Data Integrity and Accessibility”, Cengage India; 1 edition, ISBN-13: 978-8131519059, 2013.
3. Osama S. Faragallah, El-Sayed M. El-Rabaie, Fathi E. Abd El-Samie, Ahmed I. Sallam, Hala S. El-Sayed,” Multilevel Security for Relational Databases”, Auerbach Publications, ISBN 9781482205398, 2014.

OUTCOMES :

Students who complete this course will be able to

- Define the basics of Database management systems.
- Compare and contrast different Database security architecture.
- Analyze the impact of SQL injection attacks and its remedies
- Design secured Database User profiles and provides solutions to overcome password and privilege exploitation.
- Apply different security testing methodology and audit the Database activities in real time environment.
- Relate different multilevel database security models and design in real time environment.

CSC X233	SOFTWARE QUALITY ASSURANCE	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To provide an in depth understanding of software quality management process.
- To introduce concepts, metrics, and models in software quality assurance
- To describe the process and product quality attributes.
- To highlight the various activities of quality assurance, types of reviews and audits.
- To investigate the expectations of software quality in projects.
- To provide an overview of software quality standards.

MODULE I QUALITY ASSURANCE BASICS 07

Quality and Reliability – Evolution of the concepts of Quality – Quality gurus – Total Quality Management – Costs of Quality - Quality in organizations – Quality goals – Current scenario in software development organizations.

MODULE II SOFTWARE QUALITY DIMENSIONS 08

Four Dimensions of Software Quality – Specification – Conformance – Design – Development – Ensuring Quality -Software Product Quality – Measurement of software quality

MODULE III VERIFICATION AND VALIDATION 07

Verification – Walkthroughs – Inspections – Audits – Verification Process-Implementation of Verification activities in projects – Validation of Software Design – Specification – Product Validation

MODULE IV PRODUCT AND PROCESS QUALITY 08

Software Product Quality - Process Quality – Improvement and Stabilization – Process Models - Components of a Process - Metrics for Software Quality –Process and Product Metrics.

MODULE V NEW PARADIGMS OF SOFTWARE QUALITY 07

Current Certification Paradigms-Fallacy of Certifications – Maturity Models – New Paradigms for Software Quality Assurance.

MODULE VI SOFTWARE QUALITY STANDARDS 08

Quality management standards – ISO 9001 and 9000-3 – CMMI – SPICE- Tools for Quality improvement- Quality Control Tools.

L – 45; TOTAL HOURS-45

REFERENCES :

1. Murali Chemuturi, “Mastering Software Quality Assurance: Best Practices, Tools and Techniques “, J.Ross Publishing, ISBN-978-1-60427-032-7., 2011.
2. Daniel Galin, “Software Quality Assurance: From Theory to Implementation” - Addison-Wesley, ISBN 0201709457, 2004.
3. 1.
4. Ivan Mistrik , Richard M Soley ,Nour Ali , John Grundy , Bedir Tekinerdogan “Software Quality Assurance: In Large Scale and Complex Software-intensive Systems “,Morgan Kaufmann, ISBN – 0128023015,2015.
5. Abu Sayed Mahfuz, Software Quality Assurance: Integrating Testing, Security, and Audit, CRC Press, ISBN 149873555X, 9781498735551, 2016.
6. Schulmeyer, G. Gordon and McManus, James, Handbook of Software Quality Assurance, 3rd Ed. Prentice Hall, 2008.

OUTCOMES :

Students who complete this course will be able to

- Define software quality and describe the role of quality assurance in the software development process.
- Describe the quality of specifications, design, construction and conformance as applicable to software development organizations.
- Compare the various quality reviews and audits.
- Assess the quality and reliability of software products and compare software quality metrics.
- Explore the quality of the process from an implementation point of view and apply new paradigms for quality assurance.
- Demonstrate quality assurance tools and explore standards and techniques.

CSC X234 CUSTOMER RELATIONSHIP MANAGEMENT L T P C
1 0 0 1

OBJECTIVES :

- To understand your role in achieving good customer relationship management with a customer and/or stakeholders.
- To be aware of the key skills needed to carry out successful customer relationship management, in order to build more productive & mutually rewarding relationships with customers and/or stakeholders.
- To be able to identify and respond to customers & stakeholders needs, expectations & issues that both meet their needs and protects the interests of your organization.
- To learn the skills to communicate with and influence customers & stakeholders
- To study simple CRM techniques
- To concentrate on customers to build long lasting relationships that allow to beat the competition.

MODULE I DEFINING CRM 06

New Spin on Customer Loyalty – CRM and customer Service – CRM in e-Business – Analytical CRM

MODULE II DELIVERING CRM 09

Defining and Preparing the CRM business plan – Choosing a CRM tool – CRM Implementation

L – 15;TOTAL HOURS-15

REFERENCES :

1. Kyle booth, “The Customer Relationship Management Handbook - Everything You Need to Know about Customer Relationship Management , History Ink Books, Illustrated Edition, ISBN: 9781489123251,2016.
2. Jill Dyche, “CRM Handbook, The: A Business Guide to Customer Relationship Management” ,Addison Wesley Publishers,1st Edition, ISBN: 9780201730623 ,2002.
3. Paul Green Berg, “CRM at the Speed of Light” , Tata McGrawHill,4th Edition, ISBN: 9780071590457,2010.
4. Scott Kostojohn, Mathew Johnson, Brian Paulen, “ CRM Fundamentals”,Apress Publishers, 1st Edition, ISBN: 9781430235903,2011.

OUTCOMES :

Students who complete this course will be able to

- Critically review and interpret the theoretical aspects of CRM across the main areas of e-business.
- Provide an insight into the concepts and strategic implementation of CRM.
- In-depth understanding of the benefits of CRM and the competitive advantage this methodology provides.
- Insight on the challenges and constraints organizations face in attempting to incorporate CRM.
- Analyze how technology can be leveraged to enhance a CRM initiative.
- Assess the best practices in multiple vertical markets.

CSC X235	SERVICE ORIENTED ARCHITECTURE	L	T	P	C
		2	0	0	2

OBJECTIVES :

- To lay the foundation on principles and characteristics of service oriented architecture.
- To learn the importance of SOA in Application Integration
- To explore SOA, Service-Orientation and service composition.
- To provide knowledge on service Technology.
- To understand and design the SOA based solutions.
- To learn service oriented design process.
-

MODULE I SOA BASICS 10

An Overview of SOA & Service-Orientation - Applying Service-Orientation - Principles of Service-Orientation - Characteristics of SOA - Types of SOA - SOA Design Patterns - Goals of Applying Service-Orientation - Planning for and Governing SOA - Pillars of Service-Orientation - Seven Levels of Organizational Maturity

MODULE II SERVICE COMPOSITION 10

Basic Concepts - Service Models and Service Layers - Service and Service Capability Candidates - Breaking down the business problem - Functional decomposition - Service encapsulation - Agnostic Context - Non-Agnostic Context - Process Abstraction and Task Services - Building Up the Service-Oriented Solution - Service Composition

MODULE III SERVICE TECHNOLOGY 10

An Overview of Service Technology - Web-Based Services - SOAP-Based Web Services - REST Services - Components - Service Virtualization - Cloud Computing - Semantic Web - Business Process Management - Social Network Technologies - Mobile Computing - Agent-Driven Architecture - Business Intelligence - Big Data - Service-Driven Industry Models - The Enterprise Service Model - The Virtual Enterprise Model - Case Study

L – 30; TOTAL HOURS-30

REFERENCES :

1. Thomas Erl, “Service-Oriented Architecture: Analysis and Design for Services and Microservices”, PHS Series, 2nd Edition, ISBN : 9780133858587, 2017
2. Thomas Erl, Pethuru Chelliah, Clive Gee, Jürgen Kress, Berthold Maier, Hajo

Normann, Leo Shuster, Bernd Trops, Clemens Utschig, Philip Wik, Torsten Winterberg, “Next Generation SOA: A Concise Introduction to Service Technology & Service-Orientation”, PHS Series, 1st Edition, ISBN : 9780133859041, 2015

3. Olaf Zimmermann, Mark Tomlinson, Stefan Peuser,“ Perspectives on Web Services: Applying SOAP, WSDL and UDDI to Real-World”, Springer, 2nd Edition, ISBN:9783642624681, 2012.
4. Alex Belotserkovskiy, Stephen Kaufman, Nikhil Sachdeva, “Building Web Services with Microsoft Azure”, Packt publishing, 1st edition, ISBN: 9781784398, 2015.

OUTCOMES :

Students who complete this course will be able to

- Describe the Service Orientation principles and business modeling.
- Explore the underlying technology for service design.
- Develop design standards for SOA - based solutions.
- Identify different service technologies and critique upon them.
- Develop the Web services using current technologies.
- Apply SOA concepts to real world problems.

CSC X236 **GENETIC ALGORITHM** **L T P C**

3 0 0 3

OBJECTIVES :

- To familiarize with Mathematical foundations for Genetic algorithm operators.
- To study the Applications of Genetic Algorithms.
- To understand filtering techniques and their broad applicability to a range of optimization problems.
- To emphasize the importance of optimization in engineering activities.
- To provide a broad introduction to the field of Genetic Algorithms and other fields of hierarchical genetic algorithm.
- To teach students how to apply these methods to solve problems in complex domains.

MODULE I INTRODUCTION 08

Chromosome Representation-Objective and Fitness Functions-Selection Methods-Genetic Operators-Intrinsic characteristics-Parallel Genetic algorithm-Multiple objective-Robustness-Multimodel-constraints

MODULE II FILTERING AND H-INFINITY CONTROL 08

Digital IIR Filter Design –Chromosome coding-The Lowest Filter Order Criterion -Time Delay Estimation-Active Noise Control-A Mixed Design Approach-The Distillation Column Design-Bench mark problem.

MODULE III HIERARCHICAL GENETIC ALGORITHM 07

Biological Inspiration-Hierarchical Chromosome Formulation-Genetic Operations-Multiple Objective approach-Neural Networks-Fuzzy Logic

MODULE IV SPEECH RECOGNITION SYSTEMS 08

Back ground of Speech Recognition systems-Dynamic Time Warping-Genetic Time Warping algorithm-Cross over-Mutation-Hidden Markov model-A Multiprocessor system for parallel Genetic Algorithms

MODULE V GENETIC ALGORITHMS IN PLANNING AND SCHEDULING PROBLEMS 07

ETPSPS scheme-Bottle neck analysis-selection key process-operational parameters for GA cycles-GA applications for ETPSP

MODULE VI GENETIC ALGORITHMS IN COMMUNICATION SYSTEMS 07

Virtual path design in ATM-Problem formulation-Combination approach-Design of mesh communication networks-Network optimization using GA-Wireless local area network design

L – 45; TOTAL HOURS-45

REFERENCES :

1. Kim-Fung Man, Kit Sang TANG, Sam Kwong,"Genetic Algorithms: Concepts and Designs", Springer,4th Edition,ISBN:9781852330729,2012.
2. Michael Mutingi, Charles Mbohwa ,"Grouping Genetic Algorithms: Advances and Applications",Springer,1st Edition ,ISBN:9783319443942,2017.

OUTCOMES :

Students who complete this course will be able to

- Appreciate the use of various GA operators In solving different types of GA problems.
- Understand and appreciate the basic concepts of Genetic algorithms in communication systems.
- Creating an understanding about the way the GA is used and the domain of application.
- Formulate a problem as a hierarchical approach by specifying representations, selection and variation operators.
- Write a program or use a package to implement the speech recognition systems.
- Apply genetic algorithms to planning and scheduling problems.

CSC X237 ENTERPRISE RESOURCE PLANNING L T P C

2 1 0 3

OBJECTIVES :

- To gain knowledge on the challenges of ERP in Business.
- To introduce various ERP Products.
- To acquire knowledge on the various core process analysis activities.
- To learn the various issues relating to customization and testing
- To illustrate the accounting process in ERP systems
- To have an overview of the fundamentals of process modeling and ERP implementation

MODULE I INTRODUCTION 06

ERP as a Business Enabler– Evolution of ERP – ERP Life Cycle – ERP Products– Open-Source ERP- Project Initiation- Case Study

MODULE II CORE PROCESS ANALYSIS 07

Business Requirement Definition- Prerequisites- Activities- Deliverables– Decision Matrix – Conference Room Pilot– Business Flow Diagram- Install the CRP Instance.

MODULE III CUSTOMIZATION 08

Process Flow Diagram , Gap Analysis, Design , Interface and Conversion, Implementation Schedule— Interface Development– Interface Integration Testing – Validate Backlog Transaction Data.

MODULE IV SYSTEM INTEGRATION TESTING AND TRAINING 08

Implementation Schedule—System and Regression Testing- Prepare Testing Environment – Task List for Training- Develop Training/User Procedures Strategy - End User Documentation.

MODULE V ACCOUNTING IN ERP SYSTEMS 08

Operational Decision-Making Problem- Product Profitability Analysis- Management Reporting with ERP Systems- Human Resources Processes with ERP

MODULE VI ERP IN BUSINESS SCHOOL 08

Project Management Life Cycle – Risk Management – Problem Management – Problem

Reporting and Escalation- Methodology – Case Study XIMB.- Process Modeling, Process Improvement, and ERP Implementation

L – 30; T – 15;TOTAL HOURS-45

REFERENCES :

1. Ganesh, K., Mohapatra, S., Anbuudayasankar, S.P. and Sivakumar, P., "Enterprise Resource Planning-Fundamentals of Design and Implementation", Springer International Publishing, 1st Edition, ISBN: 978-3-319-05927-3, 2014.
2. Ellen F. Monk and Bret J. Wagner, " Concepts In Enterprise Resource Planning ", Course Technology, Cengage Learning, 4th Edition, ISBN: 978-1-111-82039-8, 2013.
3. Lineke Sneller RC, "A Guide to ERP-benefits,implementation and trends", Bookboon Publication, 1st Edition, ISBN: 9788740307290, 2014.

OUTCOMES :

Students who complete this course will be able to

- Define the terminology, features, and characteristics embodied in ERP
- Apply the principles behind ERP to design real time applications.
- Comprehend the analysis and activities of the business process chosen
- Acquire practical competence in the usage and application of tools to support ERP in B school
- Adopt different accounting process for designing a ERP system.
- Compare the functioning of various ERP Implementations.

CSC X238 **API DESIGN** **L T P C**
2 0 0 2

OBJECTIVES :

- To analyze the background and objectives of the API Specification.
- API fundamentals, including the business and technical cases for building and consuming web-based APIs.
- Recognize the Quality Management Principles.
- Understand the process approach for effective API design.
- Acquire the requirements and implementation steps of the API Specification.
- Learn the API Specification Certification process.

MODULE I CREATE AN API **10**

Distributed Development -Modularizing Applications -Nonlinear Versioning - Communication -Empirical Programming- Method and Field Signatures-Files and Their Content-Environment Variables and Command-Line Options-Text Messages As APIs-Protocols-Behavior - Comprehensibility –Consistency-Discoverability - Life Cycle of an API

MODULE II API DESIGN **10**

A Method -A Factory Is Better Than a Constructor-Allow Access Only from Friend Code Removing a Method or a Field -Removing or Adding a Class or an Interface-Inserting an Interface or a Class into an Existing Hierarchy-Adding a Method or a Field - Types of Modular Design-Intercomponent Lookup and Communication.

MODULE III API SECURITY AND USER MANAGEMENT **10**

User Management-Identification-Authentication-Usernames and Passwords-Session-Based Authentication-Other Authentication Methods-Fortify Authentication with SSL-Encryption-Threat Detection and Prevention-SQL Injection-XML and JSON Attacks-Data Masking-General Recommendations-API Data Protection Recommendations-API Security Recommendations

L – 30;TOTAL HOURS-30

REFERENCES :

1. Jaroslav Tulach," Practical API Design: Confessions of a Java Framework Architect" ISBN=1430243171, 2012
2. Daniel Jacobson, Greg Brail, Dan Woods," APIs: A Strategy Guide",

ISBN=1449308929, 2011

3. Jason Paul Michel “Web Service APIs and Libraries”, ISBN= 978-0838911822,2013

OUTCOMES :

Students who complete this course will be able to

- Translate design requirements into API resources and methods.
- Use API Design process to create API definitions.
- Use RAML to define API resources, methods, parameters, and responses.
- Create document for API processing and test APIs.
- Minimize repetition in API definitions using resource types and traits.
- Model data in APIs using data types.

SEMESTER VII

Programme Elective ##4

Elective 1

CSC X143	**DEEP LEARNING**	**L**	**T**	**P**	**C**
		2	**0**	**2**	**3**

OBJECTIVES :

- To learn the machine learning basics
- To estimate the deep learning networks
- To describe the deep networks.
- To expose the students to sequence modeling
- To appraise the recent advances in deep learning.
- To summarize the practical methodology and applications of deep learning.

MODULE I MACHINE LEARNING BASICS FOR DEEP LEARNING 08

Learning Algorithms - Capacity, Overfitting and Underfitting -Hyper parameters and Validation Sets - Estimators, Bias and Variance - Maximum Likelihood Estimation - Bayesian Statistics - Stochastic Gradient Descent - Building a Machine Learning Algorithm - Challenges Motivating Deep Learning.

MODULE II DEEP LEARNING NETWORKS 07

Introduction – Historical context of Deep Learning – Classes of Deep Learning Network – Deep Networks for Unsupervised learning – Deep Networks for Supervised learning – Hybrid Deep Networks.

MODULE III DEEP NETWORKS: MODERN PRACTICES 08

Deep Feedforward Networks - Architecture Design - Back-Propagation and Other Differentiation Algorithms - Regularization for Deep Learning - Regularization and Under- Constrained Problems - Optimization for Training Deep Models - Optimization Strategies and Meta-Algorithms – Convolutional Network.

MODULE IV SEQUENCE MODELING: RECURRENT AND RECURSIVE NETS 08

Unfolding Computational Graphs - Recurrent Neural Networks - Deep Recurrent Networks - The Challenge of Long-Term Dependencies - Echo State Networks - The Long Short-Term Memory and Other Gated RNNs - Optimization for Long-Term Dependencies.

MODULE V PRACTICAL METHODOLOGY AND APPLICATION 07

Performance Metrics - Default Baseline Models - Selecting Hyperparameters - Debugging Strategies - Example: Multi-Digit Number Recognition – Applications - Computer Vision, Speech Recognition and Natural Language Processing – Other Applications.

MODULE VI RESNET 07

Review of Deep Learning-Problems in Deep Learning- Deep Learning Architecture - Deep Rezidual Learning-Application of ResNet-Case Study.

L – 30; P – 30;TOTAL HOURS-60

REFERENCES :

1. Li Deng and Dong Yu, “Deep Learning Methods and Applications”, Now Publisher, 1st Edition, ISBN: 1932-8346, 2014.
2. Josh Patterson, Adam Gibson, “Deep Learning”, O'Reilly Media, 1st Edition, ISBN: 978-1491914250, 2017.
3. Ian Goodfellow, YoshuaBengio, Aaron Courville, “Deep Learning (Adaptive Computation and Machine Learning Series)”, MIT Press, 1st Edition, ISBN: 978-0262035613, 2017.
4. Tom M. Mitchell, Machine Learning, McGraw Hill Education, 1stEdition, ISBN: 978-1259096952, 2013.
5. LaureneFausett, “Fundamentals of Neural Networks: Architectures, Algorithms and Applications”, Pearson, 1st Edition, ISBN- 978-8131700532, 2004.

OUTCOMES :

Students who complete this course will be able to

- Illustrate the machine language applications in deep learning
- Identify the various deep learning algorithms and its application
- Evaluate the role of sequence modeling
- Compare the various deep learning network algorithms
- Apply the deep learning algorithms to solve real time problems.
- Acquire skills in handling situations involving application of deep learning

CSC X144 INTRUSION DETECTION & PREVENTION

L	T	P	C
3	0	0	3

OBJECTIVES :

- To study the fundamental concepts in Intrusion detection
- To discuss about the various Intrusion detection networks.
- To expose to the advanced detection Methods
- To gain knowledge on Intrusion prevention system
- To train how to choose the appropriate algorithm for designing intrusion detection networks.
- To expose the students to various detection approaches.

MODULE I INTRODUCTION 05

Cyber intrusion – Malware- Intrusion detection system – Intrusion detection networks– co-operation technologies and algorithms.

MODULE II DESIGN OF AN INTRUSION DETECTION NETWORKS 08

Network Architecture design – Collaboration framework – Trust management – Robustness against common treats – simulations and experimental results.

MODULE III WIRELESS INTRUSION DETECTION SYSTEMS 08

Architecture – Data Collection – Intrusion Detection- Detection Methods - Correlation techniques –Evaluation

MODULE IV INTRUSION DETECTION AND PREVENTION SYSTEMS 08

Host-based Intrusion Detection System – Network-Based Intrusion Detection System (IDS) / Intrusion Prevention System (IPS)- Signature-Based Detection-IDS/IPS System Architecture and Framework-Responses by IDPS to the Intrusions

MODULE V DETECTION APPROACHES 08

Anomaly Detection – Data Collection for Host-Based IDSs – Theoretical Foundation of Detection – Intrusion Response-. Examples of Commercial and Open Source IDSs

MODULE VI OTHER TYPES OF IDN DESIGN 08

Intrusion detection rules and alerts– knowledge based Intrusion detection networks –

Bayesian learning and dynamic algorithm – collaborative malware detection network – decision model – evaluations.

L – 45;TOTAL HOURS-45

REFERENCES :

1. Carol Fung and Raouf Boutaba, “Intrusion Detection Networks: A Key to Collaborative Security”, CRC Press, Taylor and Francis Group, 1st Edition, ISBN: 978-1466564121, 2014.
2. Gorbani A.A, Lu w Tavallaee M “Network Intrusion Detection and Prevention-concepts and techniques”, Springer International Publishing, 1st Edition, ISBN: 9780387887708, 2010.
3. Al-Sakib Khan Pathan, “The State of the Art in Intrusion Prevention and Detection”, CRC Press, Taylor and Francis Group, 1st Edition, ISBN: 978-1-4822-0351-6, 2014.
4. Umesh Hodeghatta Rao and Umesha Nayak, “The Infosec Handbook: An introduction to Information Security”, APress, 1st Edition, ISBN: 978-1430263821, 2014.

OUTCOMES :

Students who complete this course will be able to

- Apply the architecture design of various Intrusion detection networks to solve real time applications
- Design, conduct simulations and provide experimental results of detection algorithms
- Identify the needs of Intrusion detection networks
- Adopt advanced detection Methods for solving research problems
- Comprehend the quality attributes of intrusion detection and prevention algorithms.
- Compare the functioning of various detection approaches.

CSC X145 SECURITY LAW AND COMPLIANCE

L	T	P	C
2	0	0	2

OBJECTIVES :

- To understand how to apply the principles of information security management in a variety of contexts.
- To equip students with the analytical skills and tools to address technology law issues.
- To learn the techniques and prove their compliance.
- To understand the main drivers forcing companies to look into Governance, Risk management, Compliance and Information Security solutions.
- To create a security awareness and manage the security laws
- To implement practical steps to cope with technology law risk.

MODULE I MANAGING SECURITY 10

Creating a Security program – Asset Management and Documentation – Policies – Standards and Procedures

MODULE II SECURITY LAW 10

Security – World of Securities Law – Business Context of Securities Law – How Securities are registered under the securities act

MODULE III MANAGEMENT ISSUES 10

IT Security Controls plans - Bottom of Form And procedures – Security Awareness, Training and Education – Security auditing – Legal and Ethical aspects

L – 30;TOTAL HOURS-30

REFERENCES :

1. Lee Brotherston, Amanda Berlin, “Defensive Security Handbook”, O’Reilly publishers, 1st Edition, ISBN: 978-1491960387, 2017.
2. Larry Soderquist &Theresa Gobaldon, “Security Law”, Foundation Press, 5th Edition, ISBN:9781609304690, 2014.
3. William Stallings & Lawrie Brown, “Computer Security Principles and Practice, Pearson Education, 3rd Edition, ISBN: 9780133773927, 2015.

OUTCOMES :

Students who complete this course will be able to

- Evaluate technologies, such as digital signatures, to comply with the law and serve as evidence.
- Appreciate current and imminent legislation pertinent to ICT governance, risk management and compliance.
- Make decisions about the law of data security and investigations.
- Identify the Interrelationship between the various elements of information security management and its role in protecting organizations.
- Demonstrate work in compliance with established standards and relevant legislation in the protection, security and investigation fields.
- Assign and evaluate delegated duties and responsibilities in compliance with organizational policies and procedures.

CSC X146 SOFTWARE DESIGN PATTERNS L T P C

1 0 0 1

OBJECTIVES :

- To explain what specific object oriented design problem the pattern solves.
- To provide a specific context for each pattern in which it can be applied.
- To draw a high level class diagram in UML for each pattern.
- To list the consequences of applying each pattern to the overall software quality
- of a system.
- To study the different types of patterns.
- To implement this pattern to a real world problem.

MODULE I OVERVIEW 06

Essential Elements of design patterns- Catalog of design patterns- Common themes in structural patterns- How to select and use a design pattern-How design pattern solve design problems

MODULE II CATEGORIES OF DESIGN PATTERNS 09

Creational patterns - Structure patterns- Behavior patterns- Anti-patterns

L – 15;TOTAL HOURS-15

REFERENCES :

1. Erich Gamma, Richard Helm, Ralph Johnson & John Vlissidess, “Design Patterns: elements of Reusable Object Oriented Software”, Pearson Education, 2nd Edition, ISBN: 9789332555402, 2015.
2. Eric Freeman, Elisabeth Robson, Bert Bates, Kathy Sierra, “Head First Design Patterns: A Brain-Friendly Guide”, Shroff Publishers & Distributors Pvt. Ltd., 10th Edition, ISBN: 9789352132775,2014.
3. Kerievsky, “Refactoring to Patterns”, Pearson Education, 1st Edition, ISBN: 9780321213358, 2004.

OUTCOMES :

Students who complete this course will be able to

- Recognize the architecture, creating it and moving from one to any, different structural patterns.
- Analyze the architecture and build the system from the components.
- Design creational and structural patterns.

- Demonstrate what tradeoffs need to be made when implementing a design pattern.
- Mix patterns with each other and understand the consequences of mixing patterns on the overall quality of a system.
- Know what design pattern to apply to a specific problem.

CSC X147 WRITING SKILLS FOR ENGINEERING LEADERS L T P C
1 0 0 1

OBJECTIVES :

- To addresses the specific combination of thinking and writing skills needed to succeed in modern engineering.
- To describe how to avoid logical fallacies and use physical reasoning to catch mistakes in claims.
- To covers the essentials of technical grammar and style as well as the elements of mathematical exposition.
- To emphasizes the centrality of the target audience, and thus the need for clear and concise prose.
- To check for spelling, word choice, sentence structure, punctuation, paragraph and essay writing
- To learn the basics of English writing with its clear, concise concept explanations and useful, relevant corresponding exercise.

MODULE I WRITING BY DESIGN 07

Clearly understand the goal – Mindset for Technical writing – Avoid the worst thinking traps- Grammar and style.

MODULE II WRITING SKILLS 08

Basic Structure – The Paragraph – The Essay – Writing skills – Organizing ideas- Choosing quotations- Writing arguments and summaries – Revising and presenting work.

L – 15;TOTAL HOURS-15

REFERENCES :

1. Len Bass Edward J. Rothwell, Michael J. Cloud," Engineering Writing by Design: Creating Formal Documents of Lasting Value", CRC Press, ISBN: 9781482234329,2016.
2. Paige Wilson, Teresa Ferster Glazier," The Least You Should Know About English: Writing Skills, Form C", Cengage Learning, ISBN: 9781111830922,2013.

OUTCOMES :

Students who complete this course will be able to

- Demonstrates how effective writing can be achieved through engineering-based

thinking.

- Locate the basic errors and mistakes for designing a document.
- Become expert in technical writing.
- Describe the writing skills formally.
- Become effective writers.
- Inbuilt confident on writing any technical document.

CSC X148 SOFTWARE RELIABILITY L T P C
2 0 0 2

OBJECTIVES :

- To understand how to apply the principles of software reliability in a variety of context.
- To learn the techniques to find the reliability of software.
- To know the different models of software reliability.
- To study the various metrics used to measure the quality factors of software reliability
- To identify the responsibility of organization and staffing in achieving software reliability, and computer architecture and program correctness
- To explain the fault detection and correction approaches used in developing a quality software
- To illustrate the design principles for achieving higher reliable software system

.

MODULE I SOFTWARE RELIABILITY CONCEPTS 10

Defining failure for the product, common measure for all associated systems, setting system failure intensity objectives, determining develop software failure intensity objectives, software reliability strategies, failures, faults and errors, availability, system and component reliabilities and failure intensities, predicting basic failure intensity.

MODULE II SOFTWAR RELIABILITY MODELING SURVEY 10

Introduction, Historical Perspective and Implementation, Exponential Failure Time Class of Models, Weibull and Gamma Failure Time Class of Models, Infinite Failure Category Models,Bayesian Models, Model Relationship, Software Reliability Prediction in Early Phases of the Life Cycle, software reliability growth modeling.

MODULE III SOFTWARE METRICS FOR RELIABILITY ASSESSMENT 10

Introduction, Static Program Complexity, Dynamic Program Complexity, Software Complexity and Software Quality, Software Reliability Modeling

L – 30;TOTAL HOURS-30

REFERENCES :

1. Betsy Beyer, Chris Jones,“Site Reliability Engineering”, O’Reily Publishers,1st Edition,ISBN: 9781491929124,2016.

2. Shigeru Yamada “Software Reliability Modeling: Fundamentals and Applications”, Springer publishers, ISBN: 9784431545644, 2014.
3. Michael R.Lyu, “ Handbook of Software Reliability Engineering”, Tata McGrawHill Publications, ISBN:9780070394001,2005.

OUTCOMES :

Students who complete this course will be able to

- Know the process and basic activities of software reliability engineering
- Apply methods for ensuring, evaluation and enhancing of software reliability
- Work better with other professionals at an organization to make decisions about the reliability of software.
- Implement different software reliability models and to evaluate the reliability of developed tool using different methods and tools.
- Apply the knowledge and select an appropriate software reliability model
- Perform an evaluation of software reliability and in case of necessity to enhance reliability.

CSC X149	AAIP – ANIMATION WITH PORTFOLIO DEVELOPMENT	L	T	P	C
		2	0	2	3

OBJECTIVES :

- To design a character for both 2D and 3D animation.
- To create new animations that may be needed to supplement existing body of work
- To develop a high quality student animation reel.
- To design and create a web-base location to host animation samples.
- To create a portfolio specific to a particular medium and purpose.
- To demonstrate skill in industry standard tools and techniques of 3D Animation.

MODULE I INTRODUCTION 10

How animation works – Flipping, Flicking and Rolling – Bouncing ball in 2D and 3D– Principles of animation- How to design a 3D Character

MODULE II ANIMATION OF INANIMATED OBJECTS 10

Inanimate Objects : Weight,Solidity,Force- Animation of Solids: Bowling Ball, Soccer Ball– Animation of Liquids : Drip ,Splash – Animal walks.

MODULE III ANIMATIONS & REALISM 10

Design of Animation sequences – animation function – raster animation – key frame systems – motion specification –morphing – tweening.

PRACTICAL

- 2D Digital Animation
- Basic Scripting & Interactivity
- 2D Animation Portfolio
- Claymation – A stop-motion animation technique
- 3D Basics – Modeling to Animation
- Modeling in 3D
- 3D Animation Portfolio
- Pixar RenderMan
- Crowd Simulation

- 3D Projection Mapping
- Augmented Reality
- 3D Modeling
- Texturing, Lighting & Rendering
- Paint Effects - Visor
- Portfolio Demo Reel

L-30; P-30;TOTAL HOURS-60

REFERENCES :

1. Steve Roberts, “Character animation fundamentals: Developing skills for 2D and 3D character Animation”, Elsevier Ltd, ISBN:9780240522272,2012.
2. Peter Shirley, Michael Ashikhmin, Michael Gleicher, Stephen R Marschner, Erik Reinhard, Kelvin Sung, and AK Peters, “Fundamental of Computer Graphics”, CRC Press, Fourth edition, ISBN: 9781498785907, 2015.
3. Chris Webster,"Action Analysis for Animators", Focal Press; 1 edition,ISBN-13: 978-0240812182,2012
4. Sheila Graber, “ Animation A Handy Guide”,A&C Black Published , first edition, ISBN: 978140810283, 2009.

OUTCOMES :

Students who complete this course will be able to

- Create work in a variety of animation techniques including 3D animation, stop-motion and experimental methods.
- Collect and review body of personal animation samples
- Discuss learning experiences across disciplines in the University and establish connections to their own animation practices.
- Build and manipulate web media objects using editing software.
- Make animated sequences from the development of the original concept through design to final film or video production.
- Integrate the concepts, principles and theories involved in the physics of animation in all aspects of drawing.

CSC X150 ADVANCED SAS: MACROS & SQL

L	T	P	C
2	0	0	2

OBJECTIVES :

- To impart about basics of statistical analysis.
- To render the students to apply data analysis concepts.
- To expose the students to use macros and automate a process.
- To apply the SAS concepts in data management, applications development and data warehousing.
- To create macro programs to reduce the complexity of SAS
- To use SQL and SAS in effective database management.

MODULE I DATA MANIPULATION AND THE SAS PROGRAMMING LANGUAGE **10**

Introduction to SAS- Reading Raw Data from External Files - Displaying Your Data- Using Advanced INPUT Techniques.

MODULE II SAS MACRO LANGUAGE **10**

Introduction- Macro Variables-Built-In Macro Variables - LET Statement - Demonstrating a Simple Macro- Tokens -a Macro Variable as a Prefix –transfer of value between DATA Steps.

MODULE III SAS STRUCTURED QUERY LANGUAGE **10**

Basics-Joining Two Tables (Merge) -Left, Right, and Full Joins-Concatenating Data Sets -Summary Functions -an ORDER Clause -Fuzzy Matching.

L – 30;TOTAL HOURS-30

REFERENCES :

1. Alan C. Elliott, Wayne A. Woodward ”SAS Essentials: Mastering SAS for Data Analytics, 2nd Edition,ISBN: 978-1-119-04216-7,2015
2. Ron Cody, “Learning SAS® by Example: A Programmer's Guide”, Sas Inst Edition ISBN: 9781599941653, 1599941651,2010

OUTCOMES :

Students who complete this course will be able to

- Develop new macro code to write more efficient SAS programs .

- Utilize the SQL procedure as an easy, flexible way to query and combine your data.
- Apply advanced SAS programming techniques such as creating samples and indexes, using lookup tables to match data, and modifying and tracking data set changes.
- Transcribe SAS programs to maximize efficiency.
- Create SAS variables and recode data values.
- Using advanced DATA step programming statements to improve efficiency.

CSC X151 ADVANCED PROGRAMMING FOR DATA SCIENCE WITH PYTHON

L	T	P	C
3	0	0	3

OBJECTIVES :

- To know the basics of Data science.
- To Learn different types of tools for data science.
- To Learn theadvanced NumPy (Numerical Python) features.
- To provide computational environments for data scientists using Python.
- To expose the features of DataFrame for efficient storage and manipulation of labeled/columnar data in Python
- To know the capabilities for a flexible range of data visualizations in Python

MODULE I INTRODUCTION 07

Data Science – Python for Data Analysis – Essential Python Libraries – Installation and setup – Dataset Retrieval.

MODULE II IPYTHON 08

IPython: Beyond normal Python – Launching IPython Shell – Launching Jupiter Notebook – Exploring Modules with Tab completion – shortcuts – Ipython Magic Commands – Running External Code – In and Out Objects.

MODULE III NUMPY 08

Understanding Data Types in Python - The Basics of NumPy Arrays - Computation on NumPy Arrays: Universal Functions - Aggregations: Min, Max- Computation on Arrays: Broadcasting - Comparisons, Masks, and Boolean Logic - Fancy Indexing.

MODULE IV DATA MANIPULATION WITH PANDAS 08

Introducing Pandas Objects - Data Indexing and Selection - Operating on Data in Pandas - Handling Missing Data - Combining Datasets: Concat and Append - Combining Datasets: Merge and Join.

MODULE V VISUALIZATION WITH MATPLOTLIB 08

Simple Line Plots - Simple Scatter Plots - Visualizing Errors - Density and Contour Plots - Histograms, Binnings, and Density - Customizing Plot Legends - Customizing Colorbars - Text and Annotation.

MODULE VI APPLICATIONS 06

Analyzing unstructured data with Text Mining – Python in Big Data -Real Time Applications - Case Study.

L – 45;TOTAL HOURS-45

REFERENCES :

1. Jake VanderPlas, “Python Data Science Handbook: Essential Tools for Working with Data”, O'Reilly Media, 1st Edition, ISBN: 9781491912058, 2016.
2. Wes McKinney, “Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython ”, O'Reilly Media, 1st Edition , ISBN: B009NLMB8Q, 2012.
3. Joel Grus, “Data Science from Scratch: First Principles with Python”, O'Reilly Media, 1st Edition , ISBN: 9781491901427, 2015
4. Mark Lutz, Learning Python: Powerful Object-Oriented Programming, 5th Edition, O'Reilly Media, 2013.

OUTCOMES :

Students who complete this course will be able to

- Use high-performance tools to load, clean, transform, merge, and reshape data.
- Apply data analysis tools in the pandas library.
- Demonstrate with Shell commands in Python.
- Apply the pandas group by facility to slice, dice, and summarize datasets.
- Create scatter plots and static or interactive visualizations with matplotlib.
- Solve real world problems in web analytics, social sciences, finance, and economics.

Elective 2

CSC X155	SECURITY ISSUES IN CLOUD COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To study the basic concepts of security systems and Trusted baselines, which are widely used in the design of cloud security.
- To identify the suitable architecture for securing the cloud infrastructure.
- Identify the known threats and risks associated with secure cloud architecture.
- Understand the concepts and guiding principles for designing and implementing appropriate safeguards and countermeasures for Cloud based Datacenters.
- To learn the security attacks in Cloud computing.
- To discuss the basic concepts of cloud computing security to analyze and attract the vital resources required to turn a vision into reality.

MODULE I INTRODUCTION 08

Cloud computing Essentials-Overview of cloud computing-Cloud security baselines-Cloud security baselines-Cloud security, Privacy and Trusted Baselines-Infrastructure as a Service(Iaas)

MODULE II RISK ANALYSIS AND DIVISION OF RESPONSIBILITY 07

Risk and Trust Assessment: Schemes for Cloud services-Managing Risk in the Cloud-Cloud Risk Management-Secure Cloud Risk Management: Risk Mitigation Methods.

MODULE III SECURING THE CLOUD INFRASTRUCTURE 07

Cryptographic Key Management for Data Protection-Cloud security Access control-Cloud security key management-cloud computing security essentials and architecture-secure cloud architecture.

MODULE IV TRUSTED COMPUTING TECHNOLOGY 08

Trusted Computing Technology-Trusted cloud security-cloud computing security problems-Assuring Compliance with Government Certification –Accreditation-Regulations.

MODULE V CLOUD DATA CENTERS 07

Secure Cloud Computing Environments with Cloud Data Centers-Availability-Recovery and Auditing across Data Centers.

MODULE VI ADVANCED CLOUD COMPUTING SECURITY 08

Advanced Security Architectures for cloud computing-side channel Attacks and Defenses on Cloud Traffic-Cloud Computing Security: Risks and challenges.

L – 45;TOTAL HOURS-45

REFERENCES :

1. John vacca ”Cloud Computing Security: Foundations and Challenges”,CRC Press Publisher,1st Edition,ISBN: 978-1-4822-6094-6,1st Edition,2016.
2. Melvin B. Greer, Jr., Kevin L. Jackson,” Practical Cloud Security: A Cross-Industry View”,CRC Press, ISBN: 9781498729444,2016.
3. John Rittinghouse, James Ransome,” Cloud Computing”,CRC Press,1st Edition,ISBN:9781439806814,2016.

OUTCOMES :

Students who complete this course will be able to

- Compare modern security concepts as they are applied to cloud computing.
- Assess the security attacks of cloud computing system.
- Evaluate the schemes related to cloud services.
- Appraise compliance issues that arise from cloud computing.
- Describe the security of cloud computing environment with cloud datacenters.
- Evaluate the security attacks and defenses on cloud traffic.

CSC X156 SECURITY EVALUATION AND ASSESSMENT METHODOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES :

- To learn the basic principles of security evaluation process.
- To choose and apply the right penetration technique for a given situation.
- To evaluate different methods for access control.
- To identify appropriate strategies to assure confidentiality, integrity, and availability of information.
- To identify components and basic requirements for creating a security policy framework.
- To communicate their analyses and decisions effectively.

MODULE I OVERVIEW 07

Introduction to Security Evaluation – Policies, standards, guidelines – elements and Development – Evaluation Criteria.

MODULE II PRE EVALUATION 08

Setting Expectations – Scoping the Evaluation – Legal Principles for Security Evaluation – building the Technical Evaluation Plan

MODULE III ONLINE AND POST EVALUATION 08

How to start Onsite Efforts – Network Discovery Activities – fine tuning the Evaluation – Post Evaluation Analysis – Trending Metrics – final Reporting

MODULE IV SECURITY ASSESSMENT 07

Importance - Process – Methods – Techniques- system and Network Assessment

MODULE V SECURITY COMPONENT FUNDAMENTALS FOR ASSESSMENT 07

Management Controls – Security Services Life Cycle – Physical and Personnel security –wireless Networking

MODULE VI EVIDENCE OF ASSESSMENT AND REPORTING 08

Evidence Types – Documentation Requirements – Key elements of Reporting –

Assessment Findings – Security assessment report – risk assessment report – Artifacts as reports – Executive Summary

L – 45; TOTAL HOURS-45

REFERENCES :

1. Leighton Johnson, “Security Controls Evaluation, Testing, and Assessment Handbook”, Elsevier Publishers, 1st Edition, ISBN: 9780128023242, 2015.
2. Sudhanshu Kairab,”A Practical Guide to Security Assessment”, Auerbach Publications , CRC press,1st Edition, ISBN: 9780849317064,2007.
3. Debra.S.Herrman, “Using the Common Criteria for IT Security Evaluation”, Auerbach Publications , CRC press,1st Edition, ISBN:0849314046,2005.
4. Bryan Cunningham, Ted Dykstra, Ed Fuller, Matthew Hoagberg, Chuck Little, Greg Miles, Travis Schack and Russ Rogers, “Network Security Evaluation using the NSA IEM”, Elsevier Publishers, ISBN: 978159749035,2005.

OUTCOMES :

Students who complete this course will be able to

- Analyze critically the design and document the core issues and requirements in building secure and effective networks systems
- Assess existing systems using the theories, techniques, and software tools that are available in the field of information security and computer networks
- Analyze issues and solutions in security and network design as they affect general and particular communities
- Evaluate and assess the components of assessment.
- Apply and operationalize network security technologies and techniques.
- Analyze how security policies help mitigate risks and support business.

CSC X157 SOFTWARE PROCESS & PRODUCT QUALITY

L	T	P	C
1	0	0	1

OBJECTIVES :

- To explain the basic concepts of the software process and modeling.
- To discuss the detailed concepts of descriptive process modeling.
- To describe the software process engineering meta model and tools.
- To collect data to measure product factors and aggregate the results up to quality aspects.
- To analyze the product quality based on the quality evaluation and measures.
- To focus on the individual development of business information systems.

MODULE I THE SOFTWARE PROCESS 07

Motivation - Software Process Modeling and improvement – Process modeling goals and Benefits – Prescriptive process models – classes – Process standards – Goals of descriptive process models - creation - descriptive process modeling alternatives – Managing risk in descriptive process modeling efforts - Process modeling notations and tools

MODULE II SOFTWARE QUALITY 08

Introduction - Software Quality-Terms and Definitions-Overview of SQuaRE series of standards- Quality Models set into context- Software measures- Quamoco quality models - Quality model maintenance - Model building and requirements-Quality control loop-Quality evaluation and measurements

L – 15;TOTAL HOURS-15

REFERENCES :

1. Jurgen Munch, Ove Armbrust, Martin Kowalczyk, Martín Soto, Software Process Definition and Management, Springer Science & Business Media, ISBN: 978-3-642-24291-5, 2012.
2. Wagner, Stefan, Software product quality control, Springer, ISBN:978-3-642-38570-4, 2013.

OUTCOMES :

Students who complete this course will be able to

- Explore the basic concepts of the software process.
- Illustrate the goals, creation and guidelines of the descriptive process models.

- Understand the process modeling and apply the models using tools.
- To summarize quality terms, definitions, standards and measures.
- Analyze the Product quality based on the quality evaluation and measures.
- Apply the quality control knowledge into real time case study.

CSC X158 SYSTEM INTEGRATION L T P C
2 0 0 2

OBJECTIVES :

- Define the basics and other technical aspects associated in the integration of various applications.
- To analyze various process models and apply for better systems integration.
- To plan the system process for appropriate integrations.
- Identify information systems application and organization characteristics to carry out the concurrency.
- Discuss the characteristics of systems integration process in each project emphasizing various management issues.
- Explain the requirement analysis that help in systems integration by identifying the appropriate tools facilitate the creation of such services.
-

MODULE I INTRODUCTION 10

Introduction to integration-principles of integration-essence of integration-metrics-constraint –framework.

MODULE II PROCESS INTEGRATION 10

Interfaces-Functional Analysis-Organizational models-Issues-limits-Lifecycle stages-metrics-Problem domain analysis-Stakeholder Analysis-Process model.

MODULE III INTEGRATION MANAGEMENT 10

Granularity-Abstraction-process management-quality-Integration strategy-Integration model-patterns

L – 30;TOTAL HOURS-30

REFERENCES :

1. E Gary O. Langford “Engineering Systems Integration: Theory, Metrics, and Methods” by CRC Press, ISBN 9781138074125, 2017.
2. Andrea Prencipe, Andrew Davies, Mike Hobday “.The Business of Systems Integration” Oxford University Press, USA. ISBN-10: 9780199263233,2005
3. Fred A. Cummins ,”Enterprise Integration: An Architecture for Enterprise Application and Systems Integration” Wiley1st Edition. ISBN-10: 0471400106,2002

OUTCOMES :

Students who complete this course will be able to

- Identify the key challenges, basic concepts, and strategies related to systems integration projects.
- Solve organizational and managerial issues related to systems integration projects.
- Apply key systems integration architecture, methodologies, and technologies assessing the application.
- Define and analyze systems integration requirements based on the business process models.
- Design feasible solutions for an integration problem that utilizes proven design solutions described in integration patterns.
- Apply latest integration technologies to implement system integration solutions.

CSC X159 **IBM WEBSPHERE** **L T P C**
2 0 2 3

OBJECTIVES :

- Cognize the basic features and standards in WebSphere Application.
- Learn how to apply architectural concepts relating to WebSphere Application Server .
- Analyze and perform configure messaging with the service integration bus.
- Understand about the management features which can be applied to various applications.
- Describe about the various WebSphere batch features and how to apply in applications.
- Use WebSphere administrative tools to configure and manage enterprise applications.

MODULE I APPLICATION ARCHITECTURE 08

Application Architecture- Architects and Architecture - Application Architecture and Engineering - WebSphere and IBM - IBM WebSphere Application Server – Building Blocks of Application Architecture - Layers Versus Tiers - Deployment Patterns for a Layered Architecture- Layers Versus Modules- A View Perspective on Architecture - Organizational Standards and Conventions .

MODULE II MIDDLE TIERS AND PRESENTATION FRAMEWORKS 07

Types of Persistence Frameworks - Object/Relational Mapping - SQL-Based Frameworks - iBATIS Framework- Implementing the Customer Class and Customer SQL Mapping-DAO Framework - EJB 3 and the Java Persistence - Business Logic - Business Layer Accessible -Unit Testing - Mapping Shared Libraries to Class Loaders- Testing the Business Layer - Choosing a Presentation Framework Lifecycle Phase Listener

MODULE III SOA and Web Services 08

Architecture -Virtual Portal Technology - Business-to-Employee (B2E) Portals- Business Process or Forms-Based Portal--Portals Versus the Web App- Role-based Navigation and Content Delivery - Security and Single Sign-on-Content Personalization- Portlet Aggregation and Composite Applications- The Java Portlet API -Service Modeling- Services as Business Functions - Managing Service Data

Elements-Performance - Standardization – Manageability-Building a New Client Application

MODULE IV CACHING AND PERFORMANCE 08

Designing for Performance- Architecture Concerns- Performance Terminology-Caching Considerations-Caching Design Options - IBM HTTP Server and the Caching Plug-in - Distributed Map

MODULE V SECURITY 07

Security Architect - SQL Injection Example-Protecting against SQL Injection Attacks- WebSphere Security Basics- Authenticating Application Users- Adding a Filter to the Login Process - Architecting for Security - WebSphere Single Sign-on - WebSphere Authorization .

MODULE VI APPLICATIONS 07

Managing Applications - Enforcing Architecture Adherence -Managing Organizational Process - Registry and Repository - Project Methodology - Common Methodology Problems -Change Control Board.

L – 30; P – 30;TOTAL HOURS-60

REFERENCES :

1. Kyle Brown, Roland Barcia, Karl Bishop, Perrins, “Modern Web Development with IBM WebSphere: Developing, Deploying, and Managing Mobile and Multi-Platform Apps” Pearson Education, ISBN9780133067033,2014
2. Joey Bernal” Application Architecture for WebSphere: A Practical Approach to Building WebSphere Applications” IBM Press ISBN: 9780137005772,2008

OUTCOMES :

Students who complete this course will be able to

- Deploy applications in clustered environments by understanding the various technologies.
- Measure the performance information about server and application components.
- Use WebSphere Application Server to ease administration in a scalable, single-server deployment environment.
- Analyze the Web services application platform which delivers a high performance transaction.

- Develop Simple, rapid development and deployment WebSphere Application that helps to improve time and production quickly.
- Improve the flexibility and adaptability of the application services to make it more reusable and accessible to users.

CSC X160 **AVIP - BROADCAST** **L T P C**

1 0 0 1

OBJECTIVES :

- To gain knowledge about existing supporting technologies for broadcasting
- To learn about various broadcast technologies
- To gain knowledge about production components and transmitter systems hardware
- To test and measure the performance of the broadcasting system
- To create and manage the digital content, the interface of digital subsystems, and the operation of the most widespread terrestrial and satellite transmission protocols.
- Analyze digital terrestrial and satellite television signals and assess the impact of each parameter in playback fidelity; select optimal settings for parameters.

MODULE I SUPPORTING TECHNOLOGIES 07

Broadcasting basis-Quantities and Units – Information Theory and Error Correction – Coaxial Cable and Optical Fibers – TCP/IP Networking – SAN and NAS Technologies – Telco Technologies – Color Displays and colorimetry.

MODULE II BROADCAST TECHNOLOGIES AND STANDARDS 08

Linear Digital Audio – Non Linear Audio Systems – Television Standards and Broadcasting Spectrum – Color Encoding and decoding Systems – Time code –Sound in Syncs – VBI Data Carriage – Digital Interfaces for Broadcast Signals – Storage File Formats – HDTV Standards – MPEG-2 – DVB standards –Data Broadcast – ATSC Video, Audio and PSIP Transmission –Interactive TV – Encryption systems.

L – 15;TOTAL HOURS-15

REFERENCES :

1. Tozer EPJ , “Broadcast Engineer's Reference Book ”, Focal Press, 1st Edition, ISBN: 0240519086,ASIN: B00IC84JMC,2012
2. Michael Talbot Smith, “Broadcast Sound Technology”, Butterworth-Heinemann,1st Edition, ASIN: B01DRY5C0I,,2013
3. Jerry C. Whitaker (Author), Sbe Society Of Broadcast Engineers,”The SBE Broadcast Engineering Handbook: A Hands-on Guide to Station Design and Maintenance (Electronics”), McGraw-Hill Education,1st Edition, ISBN-10: 0071826262,ISBN-13: 978- 0071826266, 2013

OUTCOMES :

Students who complete this course will be able to

- Evaluate and critique broadcast and production practices both holistically and in terms of their component parts, namely: audio, video, scripting, production and editing.
- Write effectively for broadcast media and client-based production, with an emphasis on clarity, story structure and brevity.
- Demonstrate competency in shooting and editing video in the field and studio, using professional-level equipment and non-linear editing systems.
- Demonstrate proficiency in recording and editing for audio productions.
- Produce sophisticated deliverables for clients in a variety of areas, namely: corporate/industrial, informational/educational and commercial/promotional.
- Synthesize business, marketing and advertising contexts and concerns with the technical aspects of producing media.

CSC X161 FULL STACK MOBILE APPLICATION DEVELOPMENT I (FRONT END)

L	T	P	C
2	0	2	3

OBJECTIVES :

- Provide an overview of the web framework
- Show the steps in building a web page from scratch
- Introduce the notion of scripting and control functions in web pages
- Explain the Bootstrap CSS framework into web design
- Illustrate the facilities in the Angular JS Javasript App framework
- Show how the views can be redesigned with the ReactJS framework

MODULE I BASICS 07

HTML –Basics - Common elements – Formatting HTML text –Headings - Style – Tables – Forms – Element grouping – Graphics – Media – APIs – Examples –CSS – Syntax – Colors – Backgrounds – Margins – Text – Font – List – Tables – Examples.

MODULE II JAVASCRIPT 08

Javascript – Variables –Operators – Datatypes –Objects – Scope – Events - Functions – Control loops – Arrays –Forms – Forms API - DOM –Events – Strings - Numbers - Simple UI design – JSON.

MODULE III JQUERY 08

Basics –DOM- CSS – Chaining – Jquery function - Filters –custom filters – selector filters - Functions – Traversal –Traversal up the DOM – CSS expressions – Forms – Manipulation - Creating, operating, and adding HTML on the fly- HTML forms Events

MODULE IV BOOTSTRAP 07

User Input - Forms – Tables – Images – Media - Bootstrap Javascript components – Advanced programming - Case studies.

MODULE V DESIGN OF EXPERIMENTS 08

Angular JS - Directives – Filters – Data binding – Views – Controllers – Scope – Modules – Creating a container in a Module - Routes - Role of Routes– Factories - Services – Example Case study .

MODULE VI React JS 07

Statefull Vs Stateless Components – Container react application – Solving a problem using React- React lifecycle – Building complex React components – Using Flux in ReactJS – Case studies on using ReactJS.

L – 30; P – 30;TOTAL HOURS-60

REFERENCES :

1. Laura Lemay, Rafe Colburn, Jennifer Kyrnin, “Mastering HTML, CSS & Javascript”, BPB Publications; First edition, ISBN-10: 8183335152, 2016
2. Chris Aquino, Todd Gandee, “Front-End Web Development: The Big Nerd Ranch Guide”, Oreilly Publishing, ISBN-10: 0134433947, 2016
3. Cody Lindley , “jQuery Cookbook", Oreilly Publishing, ISBN 10: 1449342841 , 2010.
4. Dan Wahlin,”AngularJS in 60 Minutes”, Wahlin Consulting – 2013, ISBN: 989948351620
5. Artemij Fedosejev, “React.JS Essentials”, PACKT Publishing, ISBN: 9781783551620, 2015.

OUTCOMES :

Students who complete this course will be able to

- Build a basic web page using HTML and CSS
- Control the web page design with the Javascript functions
- Expand the views and libraries using CSS and ReactJS
- Use the Bootstrap framework for developing responsive, mobile first projects on the web
- Use JQuery for DOM traversal, event handling and animation
- Implement the MVC pattern to separate presentation, data, and logic components using the AngularJS components
- Update the View for the user and control the application workflow using ReactJS

CSC X162 ADVANCED GAME DESIGN L T P C
2 0 0 2

OBJECTIVES :

- To understand of game design and development
- To understand the processes, mechanics, issues in game design, game engine development
- To expose the students to study OpenGL programming
- To understand modeling, techniques, handling situations, and logic
- To expose the students to study various Gaming tools and platforms.
- To develop 2D and 3D games

MODULE I 3D GRAPHICS FOR GAME PROGRAMMING 08

Coordinate Systems, Ray Tracing, Modeling in Game Production, Vertex Processing, Rasterization, Fragment Processing and Output Merging, Illumination and Shaders, Parametric Curves and Surfaces, Shader Models, Image Texturing, Bump Mapping, Advanced Texturing, Character Animation, Physics-based Simulation

MODULE II GAME DESIGN PRINCIPLES 12

Character development, Story Telling, Narration, Game Balancing, Core mechanics, Principles of level design, Genres of Games, Collision Detection, Game Logic, Game AI, Path Finding. Game Engine Design: Rendering, Controller based animation, collision detection, standard objects, and physics.

MODULE III GAMING PLATFORMS AND FRAMEWORKS 10

Flash, DirectX, OpenGL, Java, Python, XNA with Visual Studio, Mobile Gaming for the Android, iOS, Game engines - Adventure Game Studio, DXStudio, Unity. Game development : Developing 2D and 3D interactive games using OpenGL, DirectX – Puzzle games, Single / Multi player games.

L- 30;TOTAL HOURS-30

REFERENCES :

1. Jeannie Novak, “Game Development Essentials”, 3rd Edition, Delmar Cengage Learning, ISBN-13: 978-1111307653, 2011
2. Jim Thompson, Barnaby Berbank-Green, and Nic Cusworth, “Game Design: Principles, Practice, and Techniques - The Ultimate Guide for the Aspiring Game Designer”, 1st edition, Wiley, ISBN 0471968943, 2007

3. David H. Eberly, “3D Game Engine Design, Second Edition: A Practical Approach to Real-Time Computer Graphics” , Morgan Kaufmann, 2 Edition, ISBN-13: 978-0122290633, 2006

OUTCOMES :

Students who complete this course will be able to

- Able to understand and apply 3 D concepts in Game programming
- Gain knowledge about principles and levels of design in various game development
- Gain knowledge about gaming engine design for controlling
- Explore into various platforms and frameworks available for game development
- Able to design and develop interactive games
- Explore various tools for creating games

Elective 3

CSC X166	WEB APPLICATION SECURITY	L	T	P	C
		2	0	0	2

OBJECTIVES :

To learn about the security concepts.

To summarize the anatomy of the web related to security.

To discuss about the security policies available for the system.

To enhance security for designing the system.

To learn new and future security features.

To identify the security features for the future web applications.

MODULE I ANATOMY OF THE WEB 10

Security in the world of web applications – it starts with a URL – reserved characters and percent encoding – resolution of relative URLs – Hypertext Transfer protocol – Hypertext Markup Language -CSS.

MODULE II BROWSER SECURITY FEATURES 10

Content isolation logic – Origin inheritance – Life outside same origin rules – Content recognition mechanisms.

MODULE III A GLIMPSE OF THINGS TO COME 10

New and upcoming security features – Other browser mechanisms of note - Common web vulnerabilities.

L – 30;TOTAL HOURS-30

REFERENCES :

1. Michal Zalewski, The Tangled Web: A Guide to Securing Modern Web Applications, No Starch Press, ISBN: 9781593273880, 2012.
2. 2.
3. Nishant Das Patnaik, Developing Secure Applications, Apress, ISBN: 978-1-43-025875-9, 2018.

OUTCOMES :

Students who complete this course will be able to

- Describe the server issues and security measures into web applications
- Explore basic ways to secure web application.

- Summarize the security policies available for the system
- Show how to better secure the web applications and how to design the secure system against attacks.
- Identify the security problems existing in the web application.

CSC X167 CYBER LAWS & ETHICS L T P C

2 0 0 2

OBJECTIVES :

- To give awareness about the building blocks of Cyber crime.
- To learn about the ethical values of Internet
- To learn the theoretical and practical aspects of cyber law
- To provide an insight knowledge on Intellectual property rights
- To explore the Computer Security concepts
- To acquire the knowledge of various Case laws relating to IT
-

MODULE I INTRODUCTION 10

Cyber crime - Categories - kinds– Internet Security- Computer Security and legal aspects– Copyright - Cyber Space Jurisdiction.

MODULE II CYBER LAW 10

Internet Governance- IT ACT - Scope and Application - Cyber Contraventions- Adjudication- Appellate Tribunal and Offences -Case laws relating to IT ACT.

MODULE III CYBER ETHICS 10

Internet and ethical values – Ethics of blogging-Facebook threat-- Free speech and content controls in cyber space - Intellectual property in cyber space.

L – 30;TOTAL HOURS-30

REFERENCES :

1. Sushma Arora and Raman Arora, “Cyber Crimes & Laws”, Taxmann Publications, ISBN: 9789350719879, 2016.
2. Richard A. Spinello, “Cyber Ethics-Morality and Law in cyberspace”, Jones and Bartlett Learning, 6th Edition, ISBN: 9781284081398, 2017.
3. Joan Ruttenberg, Paige von Mehren and Julie Yen “, The OPIA Insider’s Guide to Intellectual Property And Cyberlaw”, Bernard Koteen Office of Public Interest Advising Harvard Law School, 7th Edition, ISBN: 978813170205, 2013.

OUTCOMES :

Students who complete this course will be able to

- Comprehend the concepts and categories of cyber crime
- Design and implement ethical laws for Internet

- Develop skills of using IT ACT for solving practical problems.
- Apply the appropriate ethics while using social networks
- Analyze the importance of Intellectual property in cyber space.
- Identify the appropriate laws and ethics required to secure computers.

CSC X168 SECURE INTERCONNECTING SYSTEMS L T P C

3 0 0 3

OBJECTIVES :

- To define fundamentals and basic principles that are necessary for the network security protocols, such as the SSL/TLS protocols.
- To explain the perspective of the various technologies and protocols that can be used to provide basic security services at the transport layer of the TCP/IP protocol stack.
- To illustrate Traffic and security analysis of TLS and DTLS protocols
- To address the issues those are relevant for the understanding of the SSL/TLS protocols and their proper use.
- To estimate security measures of the system and using the techniques detect or protect the security related issues.
- To evaluate the security services based on the security standards.

MODULE I INTRODUCTION 06

OSI security Architecture – Security Definition – Cryptography Systems – Classes – Secure Cryptosystems – History – Legal Situation – Crypto systems – unkeyed – super key – public key

MODULE II TRANSPORT LAYER SECURITY 07

Introduction – protocol evolution – SSL Protocol – Record protocols - Handshake protocol – Change cipher spec protocol – Alert protocol – Application Data Protocol – Traffic analysis of a SSL session - Security analysis

MODULE III TLS PROTOCOL 09

Introduction – TLS1.0 –TLS 1.1 – TLS 1.2 – Traffic analysis of a TLS session – Security analysis – DTLS Protocol – DTLS1.0 – DTLS 1.2 – Security analysis

MODULE IV FIREWALL AND PUBLIC KEY CONCEPT 08

Firewall traversal – SSL/TLS tunneling – SSL/TLS Proxying – Public key Certificates – PGP certificates – X.509 Certificates: Wild card Certificates, International step up and SGC Certificates, Extended validation Certificates – Client Certificates

MODULE V INTERNET SECURITY 08

System Intrusion detection and prevention – Computer forensics – Network forensics –

Forensics tools – Scanning, filtering and blocking – Virus filtering – Content filtering.

MODULE VI STANDARDIZATION AND SECURITY CRITERIA 07

Product standardization – security evaluations – Major security evaluation criteria – Conquering the last frontier in the digital invasion

L – 45;TOTAL HOURS-45

REFERENCES :

1. Oppliger, Rolf. SSL and TLS: Theory and Practice, Second edition, Artech House, ISBN- 978-1-59693-447-4, 2016.
2. Joseph Migga Kizza, Guide to Computer Network Security Computer Communications and Networks, 3rd edition, Springer, ISBN: 9781447166542, 2015.
3. Singh, Brijendra. Network Security and Management, PHI Learning Pvt. Ltd., ISBN: 978-8-12034-497-6, 2011.

OUTCOMES :

Students who complete this course will be able to

- Describe the basic principles of cryptography relevant for the SSL/TLS protocols.
- Summarize the overall activities of SSL protocol.
- Compare and contrast the concepts of TLS, SSL protocols and DTLS protocol.
- Analyze how transport layer protocols securely traverse a firewall and certificates.
- Apply the security related techniques to simple scenarios and discuss the techniques.
- To appraise the security services based on the security standards.

CSC X169 SOFTWARE MAINTENANCE L T P C

2 0 0 2

OBJECTIVES :

- To describe the importance of software maintenance.
- To demonstrate the software maintenance processes and tools for maintenance.
- To explain the normal and special practices for software maintenance.
- To expose coherent and comprehensive coverage of software change concepts.
- To have a theoretical base for the skills required to effect, control and manage changes in software systems.
- To study the requirements reengineering and legacy information system in software maintenance.

MODULE I BASIC CONCEPTS 10

Evolution Versus Maintenance – Software Evolution Models and Processes – Reengineering: Concepts ,Process, Techniques – Legacy Systems – Impact Analysis – Categories of Maintenance Concepts – Maintenance of cost-based Systems

MODULE II MAINTENANCE MODELS 10

Reuse-Oriented Model – Staged Model: Closed Source Model, Open Source Software – Change Mini-Cycle Model – IEEE/EIA Maintenance Process – ISO/IEC 14764 Maintenance Process - Software Configuration Management – CR Workflow.

MODULE III REENGINEERING AND LEGACY INFORMATION SYSTEM 10

Reengineering: Concepts ,Process – Code reverse Engineering - Data reverse engineering – Wrapping – Migration : Planning, Methods.

L – 30;TOTAL HOURS-30

REFERENCES :

1. PriyadarshiTripathy ,KshirasagarNaik , “Software Maintenance and Evolution: A Practitioner's Approach” John Wiley & Sons, Hoboken, NJ , ISBN: 978-0-470-60341-3, 2014.
2. JorgRech , Christian Bunse,” Emerging Technologies for the Evolution and Maintenance of Software Models” ISBN: 9781613504383, 2011.
3. Penny Grubb, Armstrong A .Takang, “Software Maintenance Concepts and Practice”, 3rd Edition, World Scientific Publishing Company, ISBN: 978-9812384263, 2008.
4. Alain April, Alain Abrain, “Software Maintenance Management Evolution and

Continuous Improvement", IEEE computer Society Publication, ISBN: 8780470147078, 2008.

5. Paul Hopkin, "Fundamentals of Risk Management- Understanding, evaluating and implementing effective risk management", 1st Edition, IRM Publishers, Kogan Page Limited, ISBN 978-0-7494-5943-7, 2010.

OUTCOMES :

Students who complete this course will be able to

- Formulate the maintenance procedures in routine maintenance.
- Relate process models and software maintenance tools in Software maintenance.
- Apply methods to solve software problems and analyze the case studies in Software maintenance.
- Identify and correct common faults in software applications.
- Utilize operating system components, diagnostic software and supplied documentation to detect and correct faults.
- Describe the maintenance and measurement of reengineering.

CSC X170 PERSONAL SOFTWARE PROCESS L T P C

1 0 0 1

OBJECTIVES :

- To provide an insight into the fundamentals of personal software process.
- To discuss about the PSP structure.
- To make aware of various Software design.
- To give basic knowledge of project planning.
- To focus on the process extensions.
- To enumerate the process of PSP quality management.

MODULE I INTRODUCTION 08

Introduction– Uses of the PSP– PSP Structure and Terminology– PSP Concepts– Size Measuring and Estimating.

MODULE II PSP QUALITY MANAGEMENT 07

Making and Tracking Project Plans– Planning and Tracking Software Quality – Software Design – Process Extensions and Customization.

L – 15;TOTAL HOURS-15

REFERENCES :

1. Marsha Pomeroy-Huff and William Nichols , ”The Personal Software Process - Body of Knowledge- Version 2.0” , Software Engineering Process Management Program, Carnegie Mellon University, CMU/SEI-2009-SR-018, 2009.
2. Frank Tsui , Orlando Karam and Barbara Bernal, “ Essentials Of Software Engineering”, Jones & Bartlett Learning, 3rd Edition, ISBN: 9781449691998, 2014.
3. Humphrey, Watts S., “PSP: A Self - Improvement Process for Software Engineers”, MA: Addison - Wesley, 1st Edition, ISBN-13: 978-03213054972007, 2005.
4. Humphrey, Watts S. “Introduction to the Personal Software Process”, Pearson Education, 2nd Edition, ISBN-13: 978-8177586725, 2002.

OUTCOMES :

Students who complete this course will be able to

- Define personal software process and explain its applications.
- Describe the PSP structure.
- Analyze the application of PSP Software design templates.

- Outline the role of personal software process in the development of software product.
- Explain the strengths and weakness of process extensions.

CSC X171 WEB ANALYTICS AND SOCIAL MEDIA MINING

L	T	P	C
3	0	0	3

OBJECTIVES :

- To establish connectivity and analyze contents of facebook pages.
- To employ clustering on linkedin contacts and apply natural language techniques for mining
- To construct mining strategies for web page content mining.
- To mine the mail box contents and contacts and visualize the analytics.
- To evaluate the contents of Github and generate interest graphs.
- To research upon any real time social media and perform mining and analytics.

MODULE I MINING TWITTER AND FACEBOOK 08

Twitter Terminologies, Twitter API connectivity, Exploring trending topics, Searching for tweets, Extraction and frequency analysis, Examining patterns, Visualization, Facebook social graph API, Open graph protocol, Analyzing face book pages, Examining friendships

MODULE II MINING LINKEDIN AND GOOGLE+ 07

Making LinkedIn API Requests, Downloading LinkedIn Connections, User Experiences and clustering, Measuring Similarity, Clustering Algorithms, Exploring the Google+ API, Term Frequency and Inverse Document Frequency, Natural Language Toolkit, Finding Similar Documents, Analyzing Bigrams in Human Language.

MODULE III MINING WEB PAGES 08

Scraping, Parsing, and Crawling the Web, Breadth-First Search in Web Crawling, Discovering Semantics by Decoding Syntax, Sentence Detection in Human Language Data, Document Summarization, Entity-Centric Analysis, Quality of Analytics for Processing Human Language Data.

MODULE IV MINING MAIL BOXES 07

Unix Mailboxes, Getting the Enron Data, Converting a Mail Corpus to a Unix Mailbox, Converting Unix Mailboxes to JSON, JSONified Mail Corpus into MongoDB, Accessing MongoDB with Python, Analyzing the Enron Corpus, Discovering and Visualizing Time-Series Trends, Analyzing Your Own Mail Data.

MODULE V MINING GITHUB 07

Creating a GitHub API Connection, Making GitHub API Requests, Modeling Data with Property Graphs, Seeding an Interest Graph, Computing Graph Centrality Measures, Extending the Interest Graph with “Follows” Edges for Users, Using Nodes as Pivots for More Efficient Queries, Visualizing Interest Graphs.

MODULE VI CASE STUDY – TWITTER 08

Case study on twitter, Discovering the Trending Topics, Searching for Tweets, Collecting Time-Series Data, Extracting Tweet Entities, Tabulating Frequency Analysis, Getting All Friends or Followers for a User, Crawling a Friendship Graph, Analyzing Tweet Content, Analyzing a User’s Favorite Tweets.

L – 45;TOTAL HOURS-45

REFERENCES :

1. Matthew A Russell, “Mining the Social Web”, O′Reilly Publications, Second edition, ISBN-13: 978-1449367619, 2013.
2. Reza Zafarani, “Social Media Mining”, Cambridge University Press, ISBN-13: 978-1107512818, 2015.
3. Brian Clifton, “Advanced Web Metrics with Google Analytics”, Sybex Publication, Third revised edition edition, ISBN-13: 978-1118168448, March 2012.

OUTCOMES :

Students who complete this course will be able to

- Acquire skills to connect to facebook and analyze its contents and discover patterns.
- Construct a clustering model to explore the linkedin connectivity patterns and user groups.
- Formulate mining strategies to perform content mining on web pages.
- Establish connectivity to mailbox contents, mine and visually present the outcomes.
- Interpret the interest graphs generated by mining the contents of Github
- Synthesize and analyze the patterns evolved from mining social media contents.

CSC X172	RUBY	L	T	P	C
		1	0	0	1

OBJECTIVES :

- To create the environment for programming with Ruby.
- To give the basic understanding of different types of variables.
- To understand the working principle of conditional structures and working of loops.
- To expose to the concept of objects and object oriented programming.
- To construct classes and derive class inheritance.
- To study the basics of file operations.

MODULE I PROGRAMMING BASICS IN RUBY 08

Installing Ruby, variables, Arithmetic operators, input and output, Conditional Structures, Loop structures, Arrays

MODULE II OBJECTS AND FILES 07

Objects and built-in objects, Defining classes and creating objects, Object inheritance, File input and output

TOTAL HOURS-15

REFERENCES :

1. Ophir Frieder, Gideon Frieder, and David Grossman, “Computer Science Programming Basics in Ruby”, O'Reilly Media, Inc. Publisher, ISBN: 9781449356835, 2013.
2. Hal Fulton and Andre Arko , “The Ruby Way: Solutions and Techniques in Ruby Programming”, Addison Wesley, Third edition, ISBN-13: 978-0321714633, 2015.
3. Huw Collingbourne, “The Little Book Of Ruby”, CreateSpace Independent Publishing Platform, ISBN-13: 978-1533191618, 2016.

OUTCOMES :

Students who complete this course will be able to

- Install and create a working environment for programming with Ruby.
- Analyze a given scenario and suggest suitable data structures.
- To construct the conditional statements and loop structures to solve simple problems.

- Analyze a real time problem and identify classes with attributes and methods.
- To derive the relationship amongst classes and enumerate their inheritance.
- To provide solutions for solving simple real time problems.

CSC X173 FULL STACK MOBILE APPLICATION DEVELOPMENT II (BACK END)

L	T	P	C
2	0	2	3

OBJECTIVES :

- Provide an overview of the server side processes in the web.
- Show the steps in retrieval of data from the back end
- Illustrate the file processing operations.
- Enumerate on the networking angle in data processing.
- Provide the overview of the ExpressJS middleware.
- Elucidate the role of MongoB in web processing.

MODULE I NODE JS BASICS 07

Basics –Web development Framework – Role of Browser – NodeJS to Angular JS components - Installation – Creation – Writing data to console – Event model – Adding work to event queue –Implementing Callbacks

MODULE II NODEJS I/O 07

Working with JSON - Buffer data – Stream data – Compression decompression – Files - Synchronous Versus Asynchronous File System Calls - Opening and Closing Files - Writing Files - Reading Files - Other File System Tasks – Examples.

MODULE III SERVICES IN NODEJS 08

Processing URLs - Processing Query Strings and Form Parameters - Understanding Request, Response, and Server Objects - Implementing HTTP Clients and Servers in Node.js - Implementing HTTPS Servers and Clients - Understanding Network Sockets - Understanding TCP Server and Socket Objects - Implementing TCP Socket Servers and Clients - Implementing TLS Servers and Clients.

MODULE IV EXPRESSJS 07

The core parts of Express – Middleware- Routing – Sub applications - Conveniences - The ecosystem surrounding Express - Express vs. other web application frameworks - What Express is used for - Third-party modules for Node.js and Express – Example App.

MODULE V NOSQL AND MONGODB 08

NoSQL basics – Building the MongoDB Environment - Administering User Accounts -

Configuring Access Control - Administering Databases - Managing Collections - Understanding Database Change Options - Understanding Database Update Operators- Adding Documents to a Collection - Getting Documents from a Collection - Updating Documents in a Collection - Atomically Modifying Documents in a Collection - Saving Documents in a Collection - Using upsert to Insert Documents in a Collection - Deleting Documents from a Collection - Removing a Single Document from a Collection.

MODULE VI NODEJS AND MONGODB 08

Understanding Query Objects - Understanding Query options Objects - Finding Specific Sets of Documents - Counting Documents- Limiting Result Sets - Sorting Result Sets - Finding Distinct Field Values - Grouping Results - Applying MapReduce by Aggregating Results - Adding Indexes - Using Capped Collections - Applying Replication - Implementing Sharding.

L-30; P – 30;TOTAL HOURS-60

REFERENCES :

1. Brad Dayley, “Node.js, MongoDB and AngularJS Web Development”, Addison Wesley, ISBN-10: 0321995783, 2014.
2. Evan M Hahn, “Express in Action: Writing, building and testing NodeJS applications”, Manning Publications, ISBN 9781617292422, 2016.

OUTCOMES :

Students who complete this course will be able to

- Implement a highly scalable and dynamic webserver, using Node.js and Express.
- Build server-side web services in JavaScript
- Provision a MongoDB data store for the web applications
- Access and interact with MongoDB from Node.js JavaScript code.
- Implement client-side services that can interact with the Node.js webserver
- Build dynamic browser views that provide rich user interaction with authenticated user accounts.

CSC X174 5G WIRELESS COMMUNICATION TECHNIQUES L T P C
3 0 0 3

OBJECTIVES :

- To provide an overview of fifth-generation (5G) wireless communications systems.
- To impart knowledge about the 5G enabler mmWave Spectrum
- Expose the students to the radio-access technologies.
- To acquaint students with various types of relaying and coding techniques.
- To improve students' understanding of 5G spectrum and Channel model.
- To impart knowledge on the cutting-edge technologies that are main topic for industrial research departments and standardization groups in industry (as well as many academic research groups).

MODULE I HISTORICAL BACKGROUND 08

Introduction - Historical background - From ICT to the whole economy - Rationale of 5G - Global initiatives - Standardization activities - 5G use cases and system concept - Use cases and requirements -Requirements and key performance indicators - 5G system concept - Concept overview - Extreme mobile broadband- Massive machine-type communication - Ultra-reliable machine-type communication - Dynamic radio access network - Lean system control plane - Localized contents and traffic flows - Spectrum toolbox

MODULE II 5G ARCHITECTURE 08

Introduction - High-level requirements for the 5G architecture - Functional architecture and 5G flexibility - Physical architecture and 5G deployment - Machine-type communications - Fundamental techniques for MTC - Massive MTC - Ultra-reliable low-latency MTC - Device-to-device (D2D) communications - D2D: from 4G to 5G - Radio resource management for mobile broadband D2D - Multi-hop D2D communications for proximity and emergency services - Multi-operator D2D communication - Millimeter wave communications - Spectrum and regulations - Channel propagation - Hardware technologies for mmW systems - Deployment scenarios - Architecture and mobility - Beam forming - Physical layer techniques.

MODULE III RADIO ACCESS TECHNOLOGIES 08

The 5G radio-access technologies - Access design principles for multi-user

communications - Multi-carrier with filtering: a new waveform - Non-orthogonal schemes for efficient multiple access - Radio access for V2X communication - Radio access for massive machine-type communication - Massive multiple-input multiple-output (MIMO) systems - Theoretical background - Pilot design for massive MIMO - Resource allocation and transceiver algorithms for massive MIMO - Fundamentals of baseband and RF implementations in massive MIMO - Channel models.

MODULE IV RELAYING AND WIRELESS NETWORK CODING 08

The role of relaying and network coding in 5G wireless networks - Multi-flow wireless backhauling - Highly flexible multi-flow relaying - Buffer-aided relaying - Interference management, mobility management, and dynamic reconfiguration - Network deployment types - Interference management in 5G - Mobility management in 5G - Dynamic network reconfiguration in 5G.

MODULE V 5G SPECTRUM 07

Spectrum challenges in 5G - 5G spectrum landscape and requirements - Spectrum access modes and sharing scenarios - 5G spectrum technologies - Value of spectrum for 5G: a techno-economic perspective - The 5G wireless propagation channel models - Modeling requirements and scenarios - The METIS channel models.

MODULE VI SECURITY FOR 5G COMMUNICATIONS 06

Overview of a Potential 5G Communications -System Architecture - Security Issues and Challenges in 5G – communicationsSystems - User Equipment - Access Networks - Mobile Operator's Core Network - External IP Networks.

L – 45;TOTAL HOURS-45

REFERENCES :

1. MischaDohler, Jose F. Monserrat, AfifOsseiran, "5G Mobile and Wireless Communications Technology", Cambridge University Press, 1st Edition, ISBN: 9781316653166, June 2016.
2. Fundamentals of 5G Mobile Networks, Jonathan Rodriguez, John Wiley & Sons, Ltd., 2015, 1st Edition, ISBN: 9781118867525..

OUTCOMES :

Students who complete this course will be able to

- Describe the rationale of 5G.
- Understand the limitations of current networks as well as the requirements of the

next generation, motivated by the vertical industries

- Illustrate the foreseen architecture for 5G, harnessing all the common views on the current technology trends and the emerging applications
- Evaluate the benefits and detriments of 5G wireless communication.
- Compose a report with recommendations for an use case
- Describe Key components like use of mm-wave spectrum, massive MIMO systems, heterogeneous networks, and device-to-device communications.

Physics Elective Courses
(To be offered in II Semester)

PHCX 01	FUNDAMENTALS OF ENGINEERING MATERIALS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To help students to acquire the properties and applications of conducting and semiconducting materials.
- To familiarize students with basic ideas about the properties of dielectric and magnetic materials and their applications.
- To familiarize students with basic knowledge of nanomaterials and its electrical, electronic, mechanical and magnetic properties.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I CONDUCTING AND SEMICONDUCTING MATERIALS 7

Conductors: properties, Fermi distribution function, Fermi energy in metals- density of states- conducting polymers-properties-applications, semiconductors: intrinsic and extrinsic semiconductors-carrier concentration, conductivity and energy band gap, semiconducting polymers- properties- applications.

MODULE II DIELECTRIC MATERIALS 8

Polarization- dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – Internal field - Clausius Mosotti relation - dielectric loss – dielectric breakdown – applications of dielectric materials (capacitors and transformers) – Pyroelectricity, Piezoelectricity, ferroelectricity and applications in Ferroelectric Random Access Memory (FeRAM) - multiferroic materials and its applications.

MODULE III MAGNETIC MATERIALS 7

Origin of magnetism-magnetic moment, susceptibility, permeability – Bohr magneton – Dia, Para and Ferro magnetism –Spontaneous magnetization- Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites and its application - Giant Magneto-resistance effect (GMR) - Magnetic resonance imaging(MRI).

MODULE IV NANOMATERIALS 8

Properties of nanomaterials – size effect on thermal, electrical, electronic, mechanical,

optical and magnetic properties – quantum confinement – classification of nanomaterials – quantum well, quantum wire, quantum dot - nanoporous materials - carbon nanotubes, graphene - nanocomposites – applications of nano materials.

PRACTICALS

1. Determination of energy band gap of a semiconductor.
2. Determination of resistivity of metals by four point probe method.
3. Determination of dielectric constant of dielectric material.
4. Determination of time constant of a capacitor using RC circuit.
5. Determination of paramagnetic susceptibility of given liquid.
6. Determination of hysteresis loss in a transformer using BH curve.
7. Analysis of size effect on the absorption spectrum of nanomaterials.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. William D. Callister, “Material Science and Engineering”, Wiley Publications, 2006.
2. Raghavan, V., “Materials Science and Engineering”, 5th edition, Printice Hall of India Pvt Ltd. New Delhi, 2004.
3. Wahab. M.A, “Solid State Physics: Structure and Properties of Materials”, Narosa Publishing House Pvt. Ltd., New Delhi , 2nd Edition, 2010.
4. Pillai, S.O., “Solid State Physics”, New Age International, New Delhi, 2005.
5. Charles P. Poole and Frank J. Owens, ”Introduction to nanotechnology”, Wiley (India), 2009.
6. Pradeep. T., “Textbook of Nanoscience and Nanotechnology”, McGraw Hill Education (India) Private Limited, New York, 2012.

OUTCOMES:

On completion of this course, the student will be able to

- apply the concepts of conducting and semiconducting materials for solid state devices.
- comprehend the significance of properties of dielectric magnetic materials and derive these properties from synthesized materials.
- differentiate between the properties of the nanomaterials compared to bulk materials.
- complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 02	HEAT AND THERMODYNAMICS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To familiarize students with basic concepts of heat.
- To help students acquire the fundamentals of heat conduction and radiation.
- To enable students acquaint with the basics of thermodynamic concepts.
- To make students understand the fundamentals of heat based experiments.

MODULE I CONCEPTS OF HEAT **10**

Definition of temperature, thermal and thermodynamic equilibrium - relationship between temperature and kinetic energy - definition of solid, liquid, gas - Introduction to phase transitions, critical and triple points- definition of heat capacity, mechanical equivalent of heat -Joule's calorimeter- latent heat- microscopic model of ideal gas - equation of state, internal energy, equipartition theorem- equation of state for non-ideal gases.

MODULE II CONDUCTION AND RADIATION **10**

Thermal conductivity – rectilinear flow of heat – thermal conductivity of a good conductor – Forbe’s method – thermal conductivity of a bad conductor – Lee’s disc method – conduction of heat through compound media - radiation – Planck’s law of blackbody radiation – Wien’s law – Stefan’s law – Newton’s law of cooling from Stefan’s law – Solar constant – Pyrometry.

MODULE III FUNDAMENTALS OF THERMODYNAMICS **10**

Thermodynamic equilibrium – zeroth law of thermodynamics – first law of thermodynamics – Reversible and irreversible processes – second law of thermodynamics - Heat engine – Carnot’s engine – Carnot’s theorem – Internal combustion engines – petrol and diesel engines (qualitative) – Entropy and available energy – temperature – entropy diagram for Carnot’s cycle - Third Law of thermodynamics (qualitative).

PRACTICALS

1. Determination of mechanical equivalent of heat by Joule’s calorimeter.
2. Relation between temperature of a body and time by plotting a cooling curve-Newton’s law of cooling.

3. Determination of specific heat capacity of liquid by cooling.
4. Determination of thermal conductivity of a good conductor-Forbe's method
5. Determination of thermal conductivity of a bad conductor-Lee's disc method

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Mathur. D.S, “Heat & Thermodynamics”, S.Chand & Co., 2009.
2. Brijlal & Subramaniam, “Heat and Thermodynamics”, S.Chand & Co, Delhi, 2010.
3. Gupta. A.B and Roy. H, “Thermal Physics”, Books and Allied Ltd., 2002.
4. Sharma. J.K and Sarkar. K.K, “Thermodynamics and statistical Physics”, Himalaya Publishing House, 1988.

OUTCOMES:

On completion of this course, the student will be able to

- understand the concepts of heat and its properties.
- comprehend the ideas governing the conduction and radiation processes.
- apply the knowledge of laws of thermodynamics in thermodynamic systems.
- perform heat based experiments and determine its various properties.

PHCX 03	INTRODUCTION TO NANOSCIENCE AND TECHNOLOGY	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To acquire basic knowledge about the nanomaterials and applications.
- To learn about the synthesis and imaging techniques of nanomaterials.
- To gain the basic concepts of fabrication techniques.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I NANOMATERIALS AND APPLICATIONS **10**

Properties of nanomaterials – size effect on thermal, electrical, electronic, mechanical, optical and magnetic properties – quantum confinement – classification of nanomaterials – quantum well, quantum wire, quantum dot - nanoporous materials - zeolite, mesoporous materials, carbon nanotubes, grapheme - nanocomposites - applications (qualitative): Molecular electronics-nanoelectronics – nanophotonics - single electron transistor-drug delivery.

MODULE II SYNTHESIS AND IMAGING TECHNIQUES **12**

Top-down and bottom up approaches – mechanical alloying and mechanical ball milling - sol-gel approach - hydrothermal method - precipitation method - spray pyrolysis - spin coating-self assembled monolayer (SAM) - Chemical vapour deposition method – Physical vapour deposition method: laser ablation method, sputtering method.

Optical microscopy – Phase contrast and interference microscopy – confocal microscopy - high resolution Scanning electron microscope (HRSEM) - high resolution Transmission electron microscope (HRTEM) - Atomic force microscope - Scanning Tunnelling microscope (STM).

MODULE III NANOFABRICATION **8**

Photolithgraphy - electron beam lithography - X-ray and Ion beam lithography - nanoimprint lithography - soft lithograpy - nanoelectromechnical systems (NEMS) - nanoindentation principles.

PRACTICALS

1. Synthesis of nanomaterials by sol-gel method.

2. Synthesis of nanomaterials by hydrothermal method.
3. Synthesis of nanomaterials by solid state reaction method.
4. Synthesis of nanomaterials by chemical bath deposition method.
5. Synthesis of nanomaterials by co-precipitation method.
6. Synthesis of nano thin films by spray pyrolysis method.
7. Synthesis of nano thin films by pulsed laser deposition (PLD) method.
8. Analysis of size effect on the absorption spectrum of nanomaterials.
9. SEM characterization of nanomaterials.
10. AFM characterization of nano thin films.
11. Phase confirmation by XRD.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Charles P.Poole and Frank J. Owens, ”Introduction to nanotechnology”, Wiley (India), 2009.
2. Cao. G., “Nanostructures & Nanomaterials: Synthesis, Properties & Applications”, Imperial College Press, 2004.
3. Gaddand. W., Brenner. D., Lysherski. S. and Infrate. G.J., “Handbook of NanoScience Engineering and Technology”, CRC Press, 2002.
4. Pradeep. T., “Textbook of Nanoscience and Nanotechnology”, McGraw Hill Education (India) Private Limited, New York, 2012.
5. Chris Mack, “Fundamental Principles of Optical Lithography: The Science of Microfabrication”, John Wiley & Sons, 2008.
6. Bandyopadhyay A.K., “Nano Materials”, New Age International Publishers, New Delhi, 2008.

OUTCOMES:

At the end of the course, the students will be able to

- understand the importance and basic concepts of the nanomaterials.
- comprehend the imaging techniques for nanomaterials.
- illustrate the various nanofabrication techniques.
- complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 04 LASERS AND THEIR APPLICATIONS L T P C

2 0 2 3

OBJECTIVES:

- To recognize the fundamentals of laser and its characteristics.
- To comprehend and compare the different laser systems.
- To apply lasers in metrology and material processing.
- To understand the working of laser instrumentation.
- To correlate the experimental results for applications.

MODULE I LASER THEORY **8**

Spontaneous and stimulated emission - Population inversion – Einstein's A & B coefficients - Threshold condition – super-radiance Laser – Three level and four level laser systems -conditions for CW and pulsed laser action. Q-Switching - experimental methods - cavity dumping - Mode locking - experimental methods - Spatial and Temporal coherence.

MODULE II DIFFERENT LASER SYSTEMS **8**

Laser systems – General description - Laser structure - excitation mechanism - Different laser systems- He-Ne laser, Carbon-dioxide laser - Excimer laser – Free electron laser- Alexandrite laser - Ti-Sapphire laser – Semiconductor diode laser - Diode pumped solid state laser - Pulsed-CW dye laser- Fibre laser.

MODULE III METROLOGICAL AND MATERIAL PROCESSING APPLICATIONS **8**

CW and Pulsed laser beam characteristics and its measurements - Beam focusing effects - spot size - Power and Energy density Measurements - Distance measurement - Interferometric techniques - LIDARS - different experimental arrangements - Pollution monitoring by remote sensing - Laser gyroscope - Laser welding, drilling, machining and cutting - Laser surface treatment - Laser vapour deposition – Biophotonic applications.

MODULE IV LASER INSTRUMENTATION **7**

Laser for measurement of length, current and voltage – Laser Doppler Velocimetry - Holography and speckle in displacement and deformation measurements - Laser for communication with fiber optics as channel.

PRACTICALS

1. Tuning of Dye Laser using DFDL Arrangement
2. Determination of Brewster Angle using He-Ne laser
3. Study of transversely Pumped Dye Lasers
4. Study of longitudinally Pumped Dye Lasers
5. Determination of power and wavelength using Distributed Feedback Dye Laser (DFDL)
6. Determination of fibre optic losses using semiconductor laser.
7. Bandgap determination of a semiconductor diode.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. William T. Silfvast, “Laser Fundamentals”, Cambridge University Press, 2009.
2. Ghatak. A. & Thyagarajan. K. “Optical Electronics”, Cambridge University, 1994.
3. Laud.B.B., “Laser and Non-Linear Optics”, Second Edition, New Age International (p) Limited Publishers, 2011.
4. Nambiar. K.R., “Lasers Principle, Types and Applications”, New Age International (p) Ltd, 2004.
5. Wilson. J. & Hawkes. J.F.B., “Opto Electronics - An Introduction”, Prentice Hall, 1992.
6. William M.Steen, ”Laser Material Processing”, Springer-Verlag, Berlin, Third Edn., 2005.

OUTCOMES:

At the end of the course, the students will be able

- To complement the knowledge acquired in the theory class.
- To work with dye lasers for tunability of laser wavelength.
- To measure the loss of information involved in fibre optic communication.
- To correlate the results for application.

PHCX 05	MATERIALS SCIENCE	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To gain basic knowledge in conducting and semiconducting materials and their properties.
- To provide basic understanding of properties and applications of dielectric materials.
- To impart knowledge on magnetic and optical materials and their properties & applications.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I CONDUCTING AND SEMICONDUCTING MATERIALS 10

Quantum free electron theory of metals and its importance - Energy distribution of electrons in metals - Fermi distribution function - Density of energy states and carrier concentration in metals - Fermi energy – Classification of solids into conductors, semiconductors and insulators on the basis of Band theory – Introduction to Elemental and Compound semiconductors - Carrier concentration derivation for Intrinsic semiconductors - Density of electrons in conduction band & Density of holes in valence band- intrinsic carrier concentration - Fermi energy & Variation of Fermi energy level with temperature - Mobility and electrical conductivity - Band gap determination.

MODULE II DIELECTRIC MATERIALS 7

Introduction to dielectric materials & basic definitions – Electronic, Ionic, Orientation & Space charge polarizations - Total polarization – Frequency and temperature dependence of polarization - Internal field in a dielectric material - Deduction of Clausius - Mosotti's relation - dielectric loss & loss tangent – Different types of dielectric breakdown – Applications of dielectric materials : Capacitors and Transformers.

MODULE III MAGNETIC MATERIALS 6

Introduction to magnetic materials & origin of magnetic moment - Different types of

magnetic materials and their properties - Ferromagnetism & Domain theory of ferromagnetism - Hysteresis, Soft and Hard magnetic materials - Antiferromagnetic materials - Ferrites and its applications – Applications of magnetic materials : Data storage.

MODULE IV OPTICAL MATERIALS 7

Optical properties of semiconductors - Direct and Indirect bandgap semiconductors – Traps, recombination centre, color center and exciton – Luminescence : Fluorescence and Phosphorescence - Liquid crystal display : twisted nematic crystal display – Applications of Optical materials - Optical Sources : light emitting diode and laser diode - Photo detectors : PIN photodiode and Avalanche Photodiode - Pyroelectric devices - Electro optic effect : Kerr effect and Faraday effect.

PRACTICALS

1. Resistivity measurement of a semiconductor using four point probe method.
2. Determination of band gap of a semiconductor diode.
3. Determination of Hall coefficient of a given semiconductor material.
4. Determination of dielectric constant of a given non-polar liquid.
5. Determination of magnetic susceptibility of a given paramagnetic liquid using Quincke's method.
6. Determination of energy loss of a given transformer core using hysteresis method.
7. To study the I-V characteristics of a photodiode.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Palanisamy P.K., ''Physics II'', Material Science for ECE, Scitech Publications (India) Pvt. Ltd., 2006.
2. Kasap. S.O., ''Principles of Electronic materials and devices'', McGraw Hill Publishers, 3rd Edition, 2007.
3. Arumugam. M, "Physics II'', Material Science for ECE, Anuradha Publishers, 5th Edition, 2005.
4. Sze. S.M., ''Semiconductor Devices – Physics and Technology'', John Wiley, 2nd Edition. 2002.
5. Raghavan. V, ''Materials Science and Engineering'', Prentice Hall of India, 5th Edition, 2004.

OUTCOMES:

On the completion of this course, the students will be able to

- Gain knowledge about fundamentals of conducting and semiconducting materials.
- Understand concepts and applications of Dielectric and Magnetic materials.
- Familiarize Optical materials and their applications in Engineering and Medical fields.
- Complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 06	NON-DESTRUCTIVE TESTING	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To study the process and applications of ultrasonic inspection method.
- To understand the basic concepts of radiographic inspection method.
- To acquire the knowledge about the various surface Non-Destructive Testing (NDT) techniques.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I ULTRASONIC INSPECTION METHOD **10**

Ultrasonic Testing - Principle of operations - types of sound waves - types of Transducers - transmission and pulse-echo method - straight beam and angle beam, instrumentation - calibration methods - ultrasonic testing technique- data representation, A Scan, B-scan, C-scan. Phased Array Ultrasound, Time of Flight. Diffraction - thickness determination - advantages, disadvantages and applications.

MODULE II RADIOGRAPHIC INSPECTION METHOD **10**

Radiographic testing – Principle - Interaction of X-ray with matter - X-ray radiography - method of generation-industrial radiography inspection techniques – Equipment - Exposure charts - Types of films – Fluoroscopy - Xero-Radiography – Limitations - Gamma radiography - Equipment, radiation sources - method of generation - film processing - interpretations of radiography - safety in industrial radiography.

MODULE III SURFACE NDT TECHNIQUES **10**

Liquid Penetrant Testing – Principles, Characteristics and types of liquid penetrants – developers - advantages and disadvantages of various methods - Inspection Procedure and Interpretation of results. Applications of Liquid Penetrant testing.

Magnetic Particle Testing - Principle-magnetizing technique - procedure –equipment - Interpretation and evaluation of test indications - applications and limitations - demagnetization.

PRACTICALS

1. Inspection of welds using solvent removable visible dye penetrant.
2. Inspection of welds using solvent removable fluorescent dye penetrant.

3. Inspection on non magnetic materials by eddy current method.
4. Inspection on magnetic materials by eddy current method.
5. Inspection of welds by Eddy current Testing.
6. Inspection of welds by Magnetic Particle Testing - Dry method.
7. Inspection of welds by Magnetic Particle Testing - Wet method.
8. Ultrasonic flaw detector - Inspection of defects.
9. Demonstration of Radiographic inspection.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Baldev Raj., Jayakumar T.,Thavasimuthu., “Practical Non-Destructive Testing”, Narosa Publishing House, 2009.
2. Ravi Prakash., “Non-Destructive Testing Techniques”, 1st revised edition, New Age International Publishers, 2010.
3. ASM Metals Handbook of Non-Destructive Evaluation and Quality Control, American Society of Metals, Metals Park, Ohio, USA, Volume-17, 2000.
4. Paul E Mix,”Introduction to Non-destructive testing: a training guide”, Wiley, 2nd Edition New Jersey, 2005.
5. Charles J., Hellier, “Handbook of Nondestructive evaluation”, McGraw Hill, New York, 2001.

OUTCOMES:

Upon completion of this course, the students will be able to

- illustrate the ultrasonic inspection methods of NDT.
- understand the basic concept of radiographic inspection method.
- test the surfaces by the various surface NDT techniques.
- complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 07	PROPERTIES OF MATTER AND ACOUSTICS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To understand principles and properties of elasticity.
- To understand the basic concepts and application of viscosity.
- To analysis acoustic of building.
- To know about photoelasticity and its applications.

MODULE I ELASTICITY **8**

Stress and strain - Hooke's Law of elasticity - Elastic moduli - Stress-Strain Diagram - Poisson's Ratio - Relation between elastic constants - Work done in stretching and twisting a wire - Twisting couple on a cylinder- Expression for bending moment - Cantilever–Expression for depression - Uniform bending and Non-uniform bending of beams (theory & experiment) - I form Girders (qualitative treatment) and applications.

MODULE II VISCOSITY **8**

Viscosity- Newton’s formula for viscous flow - Streamline and turbulent motion - Reynolds number - Poiseuille's formula - Determination of coefficient of viscosity- factors affecting viscosity - capillary flow method - Stoke's formula- viscosity of highly viscous liquids – Stoke’s method - Lubricants and its applications –viscosity measurements - Viscometer - Variation of Viscosity with Temperature.

MODULE III ACOUSTICS OF BUILDING **7**

Basic requirement for the acoustically good halls - Reverberation and time of reverberation – Sabine’s formula for reverberation time - Absorption coefficient and its measurement -Transmission of sound and transmission loss - Factors affecting the architectural acoustics and their remedy-sound absorbing materials - vibration and noise control systems for buildings.

MODULE IV PHOTOELASTICITY **7**

Polarization - double refraction - Theory of Plane, Circularly and Elliptically polarized light - Quarter wave plate and half wave plate - photo elasticity - Theory of photo-elasticity - Stress optic relations - model materials - analysis techniques - Photo elastic bench - Three dimensional photo elasticity - Digital photo elasticity - Photo elastic

coatings.

PRACTICALS

1. Determination of viscosity of liquid by Poiseuille's method.
2. Determination of viscosity of liquid by Stoke's method.
3. Analysis of stress by photo elastic method.
4. Verification of Hooke's law by spring method.
5. Determination of Young's modulus of the cantilever beam.
6. Determination of rigidity modulus by static torsion method.
7. Visit to acoustically good auditorium and identifying the sound absorbing materials in the auditorium.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Mathur D.S., "Elements of Properties of Matter", S.Chand & Co, Delhi, 2009.
2. Gaur R.K., Gupta S.L.,"Engineering Physics", Dhanpat Rai Publishers, 2010.
3. Brijlal and Subramaniam.," Properties of Matter", Eurasia Publishing Co, New Delhi, 2002.
4. Smith C.J.," General Properties of Matter", Orient & Longman,1960.
5. Kenneth G. Budinski and Michel K., Budinski, "Engineering Materials Properties and Selection", Pearson, Singapore, 2002.

OUTCOMES:

Upon completion of this course, the students will be able to

- understand the basic concepts of the elasticity of materials.
- comprehend the concepts of viscosity of liquid and measurement.
- demonstrate the acoustical aspects of building and its importance in construction.
- apply the fundamental concept of photo elasticity for the stress analysis of the object.

PHCX 08	PROPERTIES OF MATTER AND NONDESTRUCTIVE TESTING	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To impart knowledge about the principles and properties of elasticity.
- To learn the laws governing the dynamic of rigid bodies.
- To acquire the knowledge of the various techniques of Non-Destructive Testing (NDT) of materials.
- To understand the principle and basic concept of low temperature applications.

MODULE I ELASTICITY **8**

Stress and strain - Hooke's Law of elasticity - Elastic moduli - Stress-Strain Diagram - Poisson's Ratio - Relation between elastic constants - Work done in stretching and twisting a wire - Twisting couple on a cylinder- Expression for bending moment- Cantilever–Expression for depression - Uniform Bending and Non-uniform bending of beams (theory & experiment) - I form Girders (qualitative treatment) and applications.

MODULE II DYNAMICS OF RIGID BODIES **8**

Rigid bodies - angular acceleration - Torque on a particle - angular momentum - law of conservation of angular momentum - moment of inertia and its significance - Theorem of parallel and perpendicular axis - moment of inertia of a thin uniform bar - moment of inertia of a rectangular lamina - moment of inertia of uniform circular disc - Moment of inertia of hollow and solid cylinders – flywheel
(qualitative) - kinetic energy of rotating body – Routh rule.

MODULE III NDT TECHNIQUES **6**

Ultrasonic Testing- types of Transducers-transmission and pulse-echo method-Radiographic testing- Principle-Interaction of X-ray with matter-X-ray radiography-method of generation-industrial radiography inspection techniques- Liquid Penetrant Testing**-** Inspection Procedure and Interpretation of results.

MODULE IV LOW TEMPERATURE PHYSICS **8**

Definition of Refrigeration and Air-Conditioning - Types of Refrigeration Systems-

Applications- Comfort Air Conditioning, Industrial Refrigeration, Food processing and food chain - Cryogenic treatment - Low temperature properties of engineering materials: Mechanical properties, Thermal properties, Electrical properties.

PRACTICALS

1. Verification of Hooke's law by spring method.
2. Determination of Young's modulus of the beam by bending method.
3. Inspection of welds using solvent removable visible dye penetrant.
   Inspection of welds using solvent removable fluorescence dye penetrant.
5. Inspection of welds by Magnetic Particle Testing.
6. Determination of moment of inertia of the disc by torsion pendulum method.
7. Determination of moment of inertia of the disc by static torsion method.
8. Demonstration of working of flywheel.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Mathur D.S.,"Elements of Properties of Matter", S.Chand & Co, Delhi, 2009.
2. Brijlal & Subramaniam," Properties of Matter", Eurasia Publishing Co, Delhi, 2002.
3. Gaur R.K., Gupta S.L., "Engineering Physics" Dhanpat Rai Publishers, 2010.
4. Baldev Raj.,Jayakumar T., Thavasimuthu M.,"Practical Non-Destructive testing", Narosa Publishing House, 2009.
5. Brijlal & Subrahmanyam., "Heat and Thermodynamics" S.Chand & Company Ltd, 2002.
6. Paul E Mix.," Introduction to Non-destructive testing: a training guide", Wiley, 2nd Edition, New Jersey, 2005.
7. Charles J., Hellier.," Handbook of Nondestructive evaluation", McGraw Hill, New York, 2001.

OUTCOMES:

Upon completion of this course, the students will be able to

- understand the basic of concept of elasticity of materials.
- comprehend the basic concepts of motion of rigid bodies and its applications.
- demonstrate the various NDT techniques and its importance.
- know the low temperature systems and its applications.

PHCX 09	SEMICONDUCTOR PHYSICS AND OPTOELECTRONICS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To understand the Physics of Semiconductor devices.
- To make the students learn the fundamentals of Photoluminous - semiconductors, Optoelectronic devices, Optical modulators/detectors.
- To make them understand the technology behind latest Display devices like LCD, Plasma and LED Panels.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I PHYSICS OF SEMICONDUCTORS **8**

Elemental and compound semiconductors – Drift and diffusion current - Intrinsic semiconductors – Carrier concentration (derivation) – Fermi energy – Variation of Fermi energy level with temperature – Mobility and electrical conductivity – Band gap determination – Extrinsic semiconductors – Carrier concentration in n-type and p-type semiconductor (derivation) – Variation of Fermi level with temperature and impurity concentration – Variation of Electrical conductivity with temperature – Hall effect – Experiment and applications of Hall effect.

MODULE II OPTOELECTRONIC DEVICES **7**

Light Emitting Diodes (LED) – power and efficiency - double hetero LED - LED structure - LED characteristics - White LED – Applications. Liquid crystal displays – Dynamic scattering and Twisted nematic display, Semiconductor Lasers, Homojunction and Heterojunction laser diodes - Optical processes in semiconductor lasers.

MODULE III OPTICAL MODULATORS **7**

Modulation of light – birefringence –Modulation Techniques - Electro optic effect – Electro optic materials –Types of Electro optic Modulators : Kerr and Pockel modulators –- Magneto optic effect - Magneto optic Modulators – Acousto Optic modulators.

MODULE IV OPTICAL DETECTORS **8**

Photo detectors - photodiodes - phototransistors - noise characteristics - PIN diode – Avalanche Photodiode (APD) characteristics - APD design of detector arrays – Charged Couple Device - Solar cells - Materials and design considerations, Thin film

solar cells, amorphous silicon solar cells.

PRACTICALS

1. Resistivity measurement of a semiconductor using four point probe method.
2. Determination of band gap of a semiconductor diode.
3. Determination of Hall coefficient of a given semiconductor material.
4. Determination of the wavelength of a given laser source using diffraction grating.
5. Determination of Planck's constant using LED.
6. To study the I-V characteristics of photodiode and phototransistor.
7. To study the characteristics of a solar cell.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Arumugam. M, "Physics II", Anuradha Publishers, 5th Edition, 2005.
2. Sze. S.M., "Semiconductor Devices – Physics and Technology", 2nd edn. John Wiley, 2002.
3. Wilson & J.F.B. Hawkes, "Optoelectronics – An Introduction", Prentice Hall, India, 1996.
4. Bhattacharya, "Semiconductor optoelectronic devices", Second Edn, Pearson Education, 2002.
5. Safa O. Kasap, "Optoelectronics & Photonics:Principles & Practices", Second Edn, Pearson Education,2013.
6. Palanisamy P.K., "Semiconductor physics and optoelectronics" Scitech Publications, 2003.

OUTCOMES:

On completion of this course, the student will be able to

- understand the principles of Physics behind semiconductor devices.
- choose the correct semiconductors for electronic devices and display.
- differentiate the working principle of LED and Diode Laser.
- apply the knowledge of modulation of light for different types of optical modulators.
- select suitable photodetectors for different types of applications.
- complement the knowledge acquired in the theory class and correlate the results for applications.

Chemistry Elective Courses
(To be offered II Semester)

CHCX01	ANALYTICAL INSTRUMENTATION	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make the student conversant with

- principles, instrumentation and applications of different electroanalytical techniques
- different chromatographic techniques
- principles, instrumentation and applications of various types of absorption and emission spectroscopy
- different thermal analytical methods and their applications

MODULE I ELECTROANALYTICAL TECHNIQUES **7**

Principle and applications: conductometric titrations – potentiometrIc titrations, ion-selective electrodes and pH-metry – coulometry – voltammetry - polarography, amperometric titrations.

MODULE II CHROMATOGRAPHY **8**

Basic concepts of chromatography – paper chromatography – column chromatography – thin layer chromatography – gas chromatography – high performance liquid chromatography – gel permeation chromatography.

MODULE III SPECTROSCOPY **8**

Absorption spectroscopy (principle, instrumentation and applications): Colorimetric analysis – UV-Visible spectroscopy – FTIR spectroscopy - Emission Spectroscopy (principle, instrumentation and applications): fluorescence, phosphorescence and chemiluminescence – Atomic absorption spectroscopy – flame emission spectroscopy.

MODULE IV THERMAL ANALYSIS **7**

Principle, instrumentation and applications: Thermo gravimetric analysis – Differential thermal analysis – Differential scanning calorimetry

PRACTICALS

1. Conductometric titrations: acid-base and precipitation titrations

2. Potentiometric titrations
3. Determination of pH of the unknown solution
4. Estimation of alkali metals using flame emission spectroscopy
5. Estimation of metal ions of coloured solutions using colorimetric analysis
6. Separation of compounds using gas chromatography
7. Separation of compounds using high performance liquid chromatography
8. Analysis of the given sample and interpretation of the data using IR, UV-Visible spectroscopy
9. Demonstration of TGA/DTA and DSC and interpretation of data.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Skoog D.A., West D.M., Holler F.J. and Crouch S.R., Fundamentals of Analytical Chemistry, 8th Edition, Thomson Brooks/Cole Publication., Singapore, 2004.
2. Willard H.H., Merritt L.L., Dean J.A. and Settle F.A., Instrumental Methods of Analysis, 7th Edition, CBS Publication, New Delhi Reprint, 2004.
3. A.I. Vogel, Vogel's Textbook of Practical Organic Chemistry, 5th Edition, Prentice Hall, London, 2008.
4. Christian G.D., Analytical Chemistry, 6th Edition, John Wiley, Singapore, 2003.
5. Fifield F.W. and Kealey D., Principles and Practice of Analytical Chemistry, 5th Edition, Blackwell Publication, London, 2000.
6. Settle F. (Editor), Handbook of Instrumental Techniques for Analytical Chemistry, Pearson Education, Singapore, 2004.

OUTCOMES:

The student will be able to

- state the principle and applications of various electro-analytical techniques
- identify the right separation method for a given sample using different chromatographic techniques
- explain the principle, instrumentation & applications of various spectroscopic methods and also to interpret the data
- elaborate the principle, instrumentation and applications of various thermal analytical techniques and interpret the data.

CHCX02	CORROSION AND ITS CONTROL	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students should be conversant with the

- Basic concepts, principles and factors affecting corrosion
- Types and mechanism of corrosion
- Control measures of corrosion by material selection, proper design and by applying organic coatings
- Control of corrosion by applying inorganic coating

MODULE I BASIC CONCEPTS OF CORROSION 8

Corrosion – causes and impacts of corrosion – mechanism of corrosion: Dry corrosion- oxidation corrosion - corrosion by other gases – Pilling-Bedworth rule- Corrosion by hydrogen: hydrogen blistering, hydrogen embritttlement, decarburization and hydrogen attack – corrosion of silver and copper by sulphur compounds – liquid metal corrosion (embritttlement or cracking) – Wet corrosion : hydrogen evolution – presence and absence of oxygen and absorption of oxygen – difference between dry and wet corrosion-factors influencing corrosion-polarization-passivity-emf series and galvanic series- corrosion current -rate of corrosion.

MODULE II FORMS OF CORROSION 7

Forms of corrosion-conditions for electrochemical corrosion –galvanic corrosion – differential aeration corrosion: pitting, water line, wire fencing, crevice and filiform corrosion – stress corrosion – Intergranular corrosion- erosion corrosion – soil corrosion – microbiological corrosion- fretting corrosion- corrosion in composites.

MODULE III CORROSION CONTROL AND ORGANIC COATINGS 8

Corrosion control – selection of materials and designing- cathodic protection – sacrificial anode and impressed current cathodic protection – corrosion inhibitors: anodic, cathodic and vapour phase inhibitors.

Organic protective coatings – paints: constituents – functions – varnishes : types-constituents – functions – lacquers : constituents – functions –enamels-constituents – functions – special paints : fire retardant, water repellant, heat resistant, temperature indicating and luminous paints.

MODULE IV INORGANIC COATINGS 7

Treatment of metal surface-inorganic coatings- classification- metallic coatings : anodic and cathodic coatings-hot dipping : galvanizing and tinning- electroplating—electroless plating – cementation (diffusion) : sherardizing, calorizing and chromizing – metal cladding-metal spraying – non metallic coatings (chemical conversion coatings) : phosphate, chromate, oxide coatings and anodizing – comparison of anodic and cathodic protection.

PRACTICALS

1. Determination and comparison of rate of corrosion of metals in the presence of acid, base and neutral medium by weight loss method.
2. Determination of rate of corrosion of iron in the presence of various acids by weight loss method.
3. Determination of rate of corrosion of iron in the presence and absence of anodic Inhibitor by weight loss method.
4. Determination of rate of corrosion of iron in the presence and absence of cathodic Inhibitor by weight loss method.
5. Electroplating of base metal with copper.
6. Electrolessplating of base metal with copper
7. Chemical conversion coatings such as chromate and phosphate coatings.
8. Demonstration on the study of rate of corrosion by using cyclic voltametry.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. P.C Jain & Monica Jain, Engineering Chemistry Dhanpatrai Publishing Company (P) Ltd., New Delhi (2013).
2. S S Umare & S S Dara, A text Book of Engineering Chemistry, S. Chand& Company Ltd, New Delhi, 2014.
3. M.G. Fontana and N.G. Green, Corrosion Engineering, McGraw Hill Book Company, NewYork, 1984.
4. S. Banerjee, A.K. Tyagi, Functional Materials- Preparation, Processing and Applications, ELSEVIER Publications, London ; Waltham, MA : 2011

OUTCOMES:

Students will be able to

- explain the mechanism, compare and enumerate the factors affecting

corrosion

- describe and identify the place and types for a given situation.
- choose and elaborate the suitable organic coating method for a given real time situation.
- apply a suitable metallic coating for a given situation

CHCX03	ELECTRICAL MATERIALS AND BATTERIES	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students should be conversant with

- preparation, properties and applications of plastics used in electrical and electronic applications
- properties and uses of electrical engineering materials
- classification and description of different types of batteries.
- classification and types of fuel cells

MODULE I POLYMERS FOR ELECTRICAL AND ELECTRONIC APPLICATIONS **8**

Preparation, properties and applications **:** polyethylene, polypropylene, EPDM, Nylon-6,6, PVC, PTFE, polycarbonates, ABS, phenol formaldehyde, urea formaldehyde, epoxy resins – polymer blends and alloys.

MODULE II ELECTRICAL ENGINEERING MATERIALS **7**

Conductors: Silver, Copper, Gold, Aluminum – Semiconductors: Germanium, Silicon, Gallium Arsenic – Insulating Materials: Rubbers, Mica, Plastics, Ceramics, Insulating papers – Magnetic Materials: ferromagnetic materials, paramagnetic materials, diamagnetic materials, antiferromagnetic materials, ferrites

MODULE III BATTERIES **7**

Electrochemical and electrolytic cell – batteries: types (primary, secondary and flow cell) – primary batteries: dry cells, alkaline batteries – secondary batteries: nickel-cadmium cell – lead acid storage cell, lithium battery: primary and secondary type – solar cell – dye sensitized solar cell.

MODULE IV FUEL CELLS **8**

Difference between batteries and fuel cells - chemistry of fuel cells - types of fuel cell (based on temperature and electrolyte) – principle, characteristic features, advantages, disadvantages and applications of polymer electrolyte membrane or proton exchange membrane fuel cell (PEMFC), direct methanol fuel cell (DMFC), alkaline fuel cell (AFC), phosphoric acid fuel cell (PAFC), molten carbonate fuel cell (MCFC) and solid oxide

fuel cells (SOFC).

PRACTICALS

1. Free radical polymerization of styrene.
2. Free radical polymerization of PMMA.
3. Preparation of phenol-formaldehyde.
4. Preparation of urea-formaldehyde.
5. Synthesis of epoxy resin.
6. Demonstration of mechanical properties of insulating materials using UTM
7. Demonstration of electrical properties of insulating materials
8. Construction of batteries using natural resources
9. Measurement of EMF for different batteries.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Jain P.C. and Renuka Jain, Engineering Chemistry, Dhanpat Rai Publication Co. (P) Ltd., New Delhi, 2013.
2. Michael L. Berins, Plastics Engineering Hand Book, 5th Edition, Chapman and Hall, New York, 1991.
3. H.F. Mark and N. Gaylord, Encyclopedia of Polymer Science and Technology, Vol. 1 to XIV Interscience, 2nd Ed. 1988.
4. Gowarikar V.R., Viswanathan N.V and Jayadev Sreedhar, Polymer Science, Wiley Eastern Limited, Madras, 1981.
5. R.K. Rajput,A Textbook of Electrical Engineering Materials, Firewall Media, 2004
6. Vladimir S. Bagotsky, Fuel Cells: Problems and Solutions, 2nd Edition, John Wiley and Sons, 2012.
7. B. Viswanathan and M. Aulice Scibioh, Fuel Cells: Principles and Applications, Taylor and Francis Group, 2007.

OUTCOMES:

The student will be able to

- summarise the preparation, properties and applications of plastics used in electrical and electronic applications
- enumerate the properties and uses of electrical engineering materials
- illustrate various types of batteries with the aid of a diagram
- classify the fuel cells and elaborate the different types of fuel cells.

CHCX04	ENGINEERING MATERIALS	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students should be conversant with

- properties and uses of different types of refractories and abrasives
- adhesives, cements and lime, setting of cements and their chemical behaviors.
- types, properties and uses of lubricants.
- various types of composite materials.

MODULE I REFRACTORIES AND ABRASIVES **8**

Introduction refractory: -classification - based on chemical nature- characteristic and selection of good refractory - general manufacture of refractory- preparation properties and uses of: silica refractory - magnesite refractory - zirconia refractory, properties of refractories: refractoriness - refractoriness under load - thermal spalling - porosity and dimensional stability, Cermets - super refractory.

Abrasives : introduction - Moh's scale - natural abrasives: diamond – corundum – emery - garnet and quartz, synthetic abrasives: preparation properties and uses: carborundum (silicon carbide)– alundum - boron (norbide) carbide

MODULE II ADHESIVES AND BINDING MATERIALS **7**

Introduction - classification of adhesives –advantage –limitation of adhesive bonding – development of adhesive- factors influencing adhesive action: chemical and physical, application techniques of adhesive – Lime: classification – manufacture - setting and hardening, Gypsum: -Manufacture and properties and uses - Cement : chemical composition- Manufacture – setting and hardening – concrete – weathering of cement and concrete and its prevention- special cements: high alumina cement - sorel cement - white portland cement – water proof cement.

MODULE III LUBRICANTS **7**

Introduction –functions of lubricant- mechanism of lubrication - classification of lubricant – liquid lubricant: vegetable and animal oils – mineral oils, semisolid: grease(calcium, lithium, aluminium) – petroleum jelly, solid lubricant: graphite - molybdenum disulphide, Properties of lubricant: viscosity - viscosity index - flash point and fire point - cloud point and pour point – oiliness - aniline point - carbon residue.

MODULE IV COMPOSITE MATERIALS 7

Introduction – advantageous characteristics of composites, applications of composites, main constituent of composites, types and applications of composites: RCC fibre-reinforced plastics (glass , carbon and aramid) - particulate composite - metal matrix composite - layered composites - failures in fibre-reinforced composites, ceramic matrix composites (CMC) – properties and applications.

PRACTICALS

1. Preparation of refractory bricks
2. Preparation of abrasive papers/cloth
3. Preparation of simple adhesives
4. Estimation of alkalinity in cements
5. Determination of cloud point and pour point
6. Determination of flash point and fire point
7. Preparation of fibre-reinforced composite

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. P.C Jain & Monica Jain, Engineering Chemistry Dhanpatrai Publishing Company (P) Ltd., New Delhi (2013).
2. B.Sivasnakar, “Engineering Chemistry”, Tata McGrow-Hill Publication Limited, New Delhi, second reprint 2008.
3. Engineering Chemistry, Wiley India Editorial Team, Willey India Publisher, New Delhi, 2011.
4. S S Umare & S S Dara, A text Book of Engineering Chemistry, S. Chand& Company Ltd, New Delhi, 2014.

OUTCOMES:

The student will be able to

- classify and describe the manufacture the refractories and enumerate the properties and uses of abrasive materials.
- elaborate the manufacture, properties and uses of various adhesives and binding materials.
- classify lubricants and describe the properties and uses of them
- enumerate the properties and uses of various composite materials.

CHCX05	FUELS AND COMBUSTION	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make the students conversant with the

- three types of fuels available and the different processes involved in it.
- analysis of fuel characteristics and manufacture of fuels
- calculations involved in calorific values and minimum air requirement for complete combustion.
- classification, functions, mechanism and properties of lubricants.

MODULE I SOLID FUELS **7**

Characteristics of good fuel. Solid fuel – Wood, Coal – Ranking of coal – selection of coal. Analysis of coal – Proximate analysis. Pulverized coal – Metallurgical coke – Carbonization of coal – types. Manufacture of metallurgical coke – Beehive oven and Otto Hoffman's by-product oven methods.

MODULE II LIQUID AND GASEOUS FUELS **8**

Liquid fuel: Petroleum: Refining of petroleum, Liquid fuels derived from petroleum – Cracking: Thermal (Liquid and Vapour phase) – Catalytic (fixed bed and moving bed cracking – Synthetic petrol: Fischer-Tropsch method– Knocking in petrol and diesel engine: octane number and antiknocking – cetane number and improvement of cetane number – biodiesel (trans-esterification) – Gaseous fuels: Compressed natural gas (CNG) – LPG – oil gas – producer gas – water (blue) gas – biogas.

MODULE III COMBUSTION **8**

Calorific value: Gross and net caloric value – Bomb Calorimeter, Gas calorimeter - Definition of combustion – calculation of minimum requirement of air (problems) – theoretical calculation of calorific values (Dulong's formula), Gross and net calorific values ((problems) – Analysis of flue gas: Orsat's gas analysis method, explosive range, Ignition temperature. Introduction to air pollution from IC (Internal combustion) engines, photochemical smog, primary and secondary pollutants.

MODULE IV LUBRICANTS **7**

Friction and wear – lubricants: definition, functions and mechanism of lubrication

(thick film and thin film) –classification: liquid lubricants: animal and vegetable origin, mineral oil, blended oils, lubricating emulsions and silicones – properties of lubricating oils: viscosity and viscosity index; Flash and fire-point, Cloud and pour point, oiliness, emulsification number, volatility, carbon residue, aniline point – semisolid lubricant: greases and waxes – solid lubricant: graphite and molybdenum disulphide –nanolubricants.

PRACTICALS

1. Testing of fuels - proximate analysis (moisture, volatile matter, ash content and fixed carbon present in coal, coke, charcoal etc)
2. Ash content and carbon residue test
3. Biodiesel synthesis by trans-esterification method (from coconut, groundnut, mustard oil, palm oil)
4. Determination of calorific value of a solid fuel using Bomb calorimeter (coal, charcoal, coke etc)
5. Determination of calorific value of a liquid fuel using Bomb calorimeter (petrol, diesel, biodiesel etc)
6. Determination of cloud point and pour point of a lubricant
7. Determination of flash and fire point of diesel.
8. Aniline Point of diesel
9. Viscosity Index of lubricants and Fuels by Viscometer
10. Flue gas analysis by Orsat's gas analysis method – Demonstration
11. Working of internal combustion engine – Demonstration

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai and Sons, New Delhi, 2001.
2. Engineering Chemistry, Wiley India Editorial Team, Willey India Publisher, New Delhi, 2011.
3. John Griswold, Fuels Combustion and Furnaces, Mc-Graw Hill Book Company Inc. University of Michigan, 1946.
4. J.B. Heywood, Internal Combustion Engine Fundamentals, McGraw Hill International Editions, 1989.
5. Bahl B.S., Tuli and Arun Bahl, Essentials of Physical Chemistry, S. Chand and Company Ltd., New Delhi, 2004.

OUTCOMES:

The students will be able to

- compare and contrast the solid, liquid and gaseous fuels and also describe the processes involved in liquid and gaseous fuels.
- analyse the fuel properties such as moisture, votalite matter, ash content, calorific value etc
- calculate minimum air required for complete combustion and calorific values of fuels.
- categorize different lubricants into three types, explain the preparation and determine their properties.

CHCX06	FUNDAMENTALS OF PHYSICAL CHEMISTRY	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students will be conversant with the

- various thermodynamic terms and relate the laws of thermodynamics in chemical processes
- molecularity and order of reaction and derive the rate constant for different order of reactions
- basics of adsorption of different materials and propose mechanisms and surface area measurement
- conditions for equilibrium and learn different components at equilibrium

MODULE I BASIC THERMODYNAMICS **8**

Introduction - Thermodynamic terms - Thermodynamic equilibrium and processes - 1st law of thermodynamics: internal energy, enthalpy, heat capacity, isothermal and adiabatic expansion, Joule-Thomson effect - Zeroth law of thermodynamics: absolute temperature - 2nd law of thermodynamics: - spontaneous and cyclic process, Entropy in isothermal, isobaric and isochoric processes, work and free energy function, Maxwell's relation - 3rd law of thermodynamics

MODULE II CHEMICAL KINETICS **8**

Rate of chemical reaction - order and molecularity of a reaction - Rate constant - kinetics of opposing, parallel and consecutive and chain reactions - isotope effects - effect of temperature on reaction rate - collision theory - absolute reaction rate theory - kinetics in enzyme catalysis

MODULE III SURFACE SCIENCE AND CATALYSIS **8**

Adsorption - adsorption isotherms - uni and bimolecular adsorption reactions - parahydrogen conversion - factors affecting adsorption – Langmuir adsorption isotherm - Hinshelwood mechanism and *Eley-Rideal* mechanism with example - adsorption of gases on solids and surface area measurement by BET method - Terms in catalysis - homogeneous and heterogeneous and enzyme catalysis with example

MODULE IV PHASE RULE **6**

Terms involved - Conditions for equilibrium - application of phase rule to water, lead-

silver system, freezing mixtures, thermal analysis: cooling curves.

PRACTICALS

1. Determination of the heat capacity of benzoic acid, internal energy of combustion of camphor using Bomb calorimeter. Calculation of enthalpy of combustion and formation for camphor.
2. Determination of adsorption isotherm of (i) acetic acid on charcoal (ii) oxalic acid on charcoal.
3. *Kineticsoffirst and second order reactions.*
4. Phase rule experiments with organic compounds: (i) naphthalene and p-dichloro benzene (ii) naphthalene and diphenyl (iii) m-dinitrobenzenzene and p-nitro toluene.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Rajaram J. and Kuriacose J.C., Chemical Thermodynamics: Classical, Statistical and Irreversible, Pearson Education, India, 2013.
2. Samuel Glasstone, Thermodynamics for Chemists, Read Books, United Kingdom, 2007.
3. James E. House, Principles of Chemical Kinetics, 2nd Edition, Academic Press, United States of America, 2007.
4. Keith J. Laidler, Chemical Kinetics, Pearson Education, India, 1987.
5. Douglas M. Ruthven, Principles of Adsorption and Adsorption Processes, John Wiley & Sons, 1984.
6. Puri B.R., Sharma L.R. and Pathania M.S., Principles of Physical Chemistry, 47th Edition, Vishal Publishing Co. India, 2016.

OUTCOMES:

The student will be able to

- calculate entropy, enthalpy and free energy change for different chemical processes
- calculate the rate constant for any chemical and biochemical processes
- differentiate the adsorption processes and calculate the surface area and predict the suitability of catalysts for different chemical processes
- predict the equilibrium conditions for water, alloys, freezing mixtures and draw the thermal curves for phase transition

CHCX07	GREEN TECHNOLOGY	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make students conversant with the

- basic principles of green chemistry and green technology.
- wastes that causes hazards to human health
- chemicals that harms our environment
- need for green processes in various industries

MODULE I GREEN CHEMISTRY PROTOCOL **7**

Need – Significance – 12 Principles with examples – R4 model – Life cycle analysis – sustainable and cleaner production - Green Technology: definition, examples: CFC free refrigerants, green building, energy, 3D printers, nanotechnology – Awards for Green chemistry – organization promoting green chemistry.

MODULE II WASTE & WASTE MINIMISATION **8**

Source of wastes: domestic, industrial, medical, nuclear, e-waste; problems; prevention – economy of waste disposal – Waste minimization techniques: general waste treatment and recycling – alternate waste water treatment technologies: hybrid process – Green computing: goals, green cloud, green ICT - Pollution statistics from various industries (Industrial case studies).

MODULE III GREEN SYNTHESIS **7**

Introduction - Solvent free reactions - green reagents, green solvents in synthesis - microwave and ultrasound assisted reactions – supercritical fluid extraction – green oxidation and photochemical reactions – catalyst and biocatalysts.

MODULE IV GREEN INDUSTRIAL PROCESSES **8**

Polymer industry: biodegradable polymer - textile industry: greener approaches of dyeing, waste disposal – ecofriendly agrochemicals: biofertilizers, biopesticides – Pharmaceutical industry: atom economy, reduction of toxicity, use of biocatalyst, zero waste disposal – Leather industry: greener process in tanning, crusting, surface coating – ecofriendly batteries & fuel cells.

PRACTICALS

1. Synthesis of an ionic liquids (Ex: imidazolium) and testing the solubility of organic

chemicals.

2. Green bromination of stilbene (using pyridine hydrobromide).
3. Green synthesis: Photocatalytic reactions, solvent-free organic reaction – Aldol; green oxidation, green reduction.
4. Microwave assisted chemical reaction. (synthesis of aspirin, pinacol-pinacolone reaction, etc).
5. Comparison of conventional reaction with microwave assisted reactions (atom economy, solvent, etc) [Ex: aldehyde and ketones with hydrazines to give hydrazones].
6. Diels-Alder reaction in eucalyptus oil (green process).

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai and Sons, New Delhi. 2001.
2. V. K. Ahluwalia, Green Chemistry: Environmentally Benign Reactions, Ane Books India, New Delhi, 2006.
3. Paul Anastas, John C.Warner, John Warner Joint; Green Chemistry: Theory & Practice New Ed Edition; Oxford University press, USA, 2000.
4. Rashmi Sanghi, M. M. Srivastava, Green chemistry, Narosa publishers, New Delhi, 2003.

OUTCOMES:

The students will be able to

- outline the principles and implications of green chemistry.
- comprehend the potential risks of waste generated and analyse the threats to human and environment.
- integrate information into design of molecules to avoid/eliminate toxic solvents & reagents or reduce toxic products.
- identify various alternate greener technologies for various industries.

CHCX08	ORGANIC CHEMISTRY OF BIOMOLECULES	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make students conversant with the

- basic concepts in organic chemistry
- types and structure of carbohydrates and lipids
- formation of different structures of proteins from amino acid
- structure of nucleic acids

MODULE I BASIC CONCEPTS IN ORGANIC CHEMISTRY **8**

Classification and IUPAC nomenclature of organic compounds – stereochemistry – optical, stereo and geometrical isomerism – types of reagents: electrophiles and nucleophiles – types of reactions: addition, substitution, elimination and rearrangement reactions.

MODULE II CARBOHYDRATES, LIPIDS AND VITAMINS **7**

Structure and functions of carbohydrates: mono, di, oligo and polysaccharides – lipids: phospholipids, glycolipids, sphingolipids – cholesterol – steroids – Structure, functions and deficiency disorders of fat soluble vitamins: A, D, E & K - Water soluble vitamins B & C: Thiamine, riboflavin, pantothenic acid, niacin, pyridoxine, biotin, cobalamine, folic acid and ascorbic acid.

MODULE III AMINO ACIDS, PEPTIDES AND PROTEINS **7**

Aminoacids: classification, properties - peptides – polypeptides – proteins: primary, secondary, tertiary and quaternary structure – glycoproteins – lipoproteins – Enzymes: classification and functions

MODULE IV NUCLEIC ACIDS **8**

Nucleic acids – importance - structure of purines and pyrimidines – nucleotides – polynucleotides - RNA – types & structure - DNA – phosphodiester bonds – chemical, helical structure and functions – DNA replication – gene modification.

PRACTICALS

1. Qualitative tests to identify carbohydrates.

2. Quantitative estimation of carbohydrates.
3. Separation of sugars – TLC and/or paper chromatography.
4. Quantitative estimation of lipids.
5. Separation of amino acids – TLC and/or paper chromatography.
6. Quantitative estimation of proteins by Lowry's method.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. V. K. Ahluwalia, Organic Reaction Mechanism, Narosa Publishers, New Delhi, 2002.
2. Johnson Arthur T., Biology for Engineers, CRC Press, Finland, 2011.
3. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai and Sons, New Delhi. 2001.
4. David L. Nelson, Michael M. Cox, Lehninger Principles of biochemistry, Macmillan press, London, 2010

OUTCOMES:

The students will be able to

- classify organic compounds and explain the mechanism of various organic reactions.
- draw the structures and enumerate the functions of carbohydrate, lipids and vitamins.
- correlate the relationship among amino acids, peptides and proteins.
- recognize the role of nucleic acid in the formation of RNA & DNA and differentiate DNA & RNA using their structure and function.

CHCX09	POLYMER SCIENCE AND TECHNOLOGY	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make the student conversant with the

- basic concepts of polymers, classification, types of polymerization and molecular weight & its distribution
- preparation, properties and applications of thermoplastics and introduction to biodegradable polymers
- properties and applications of thermosets, elastomers and FRP
- different types of moulding techniques

MODULE I BASIC CONCEPTS OF POLYMERS **8**

Definitions: monomer, polymer, functionality, degree of polymerization – classification of polymers: source, structure, application, thermal processing behavior (thermoplastics and thermosets), composition and structure (addition and condensation), mechanism (chain growth and step-wise growth) – copolymer: types – Definition –nomenclature of polymers – tacticity – types of polymerization : free radical, cationic and anionic polymerization (concepts only) – average molecular weight of polymer: number, weight – molecular weight distribution (problems)

MODULE II THERMOPLASTICS AND BIODEGRADABLE POLYMERS **8**

Preparation, properties and applications : LDPE, HDPE, polypropylene, PVC, PTFE, PET, polyamides (Nylon-6 and Nylon 6,6) and polycarbonates – polymer blends and alloys – basics of biodegradable polymers.

MODULE III THERMOSET RESINS, ELASTOMERS AND FRP **7**

Thermoset resins : phenolic resins, amino resins (urea and melamine formaldehyde), epoxy resins, unsaturated polyesters – polyurethanes – elastomers : vulcanization of natural rubber, diene based elastomers –fibre reinforced plastics: glass, aramid and carbon.

MODULE IV MOULDING TECHNIQUES 7

Moulding constituents**:** functions – moulding techniques**:** compression, injection, extrusion (single screw), blow moulding, thermoforming, (mechanical and vacuum forming), lamination.

PRACTICALS

1. Determination of molecular weight and degree of polymerization using Oswald's viscometer.
2. Free radical polymerization of styrene.
3. Free radical polymerization of PMMA.
4. Preparation of phenol-formaldehyde.
5. Preparation of urea-formaldehyde.
6. Synthesis of epoxy resin.
7. Synthesis of unsaturated polyester.
8. Preparation of FRP laminates.
9. Demonstration of injection moulding, compression moulding and blow moulding.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Billmeyer F.N., Text Book of Polymer Science, 3rd Edition, John Wiley and Sons, New York, 1994.
2. George Odian, Principles of Polymerisation, 3rd Edition, McGraw Hill Book Company, New York, 1991.
3. Michael L. Berins, Plastics Engineering Hand Book, 5th Edition, Chapman and Hall, New York, 1991.
4. Jacqueline I., Kroschwitz, Concise Encyclopedia of Polymer Science and Engineering, John Wiley and Sons, New York, 1998.
5. Encyclopedia of Polymer Science and Technology, Vol. 1 to XIV, H.F. Mark and N. Gaylord, Interscience, 2nd Ed. 1988.
6. Gowarikar V.R., Viswanathan N.V and Jayadev Sreedhar, Polymer Science, Wiley Eastern Limited, Madras, 1981.

OUTCOMES:

The student will be able to

- classify various polymers, name the polymers and types of polymerization

reactions, calculate molecular weight of polymers,

- summarise preparation, properties and applications of thermoplastics and give examples of biodegradable polymers
- elaborate the properties and applications of thermosets, elastomers and FRP
- select the appropriate moulding technique for a given polymer, based on the application

Maths Elective Courses

(to be offered in IV

Semester)

MACX 01	**DISCRETE MATHEMATICS AND GRAPH THEORY**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

OBJECTIVES:

The aims of this course are to

- introduce Logical and Mathematical ability to deal with abstraction.
- familiarize the basic mathematical ideas and terminologies used in computer science.
- translate real life situations into diagrammatic representations.

MODULE I PROPOSITIONAL CALCULUS 8

Propositions – Logical connectives – Compound propositions – Conditional and biconditional propositions – Truth tables – Tautologies and contradictions – Contrapositive – Logical equivalences and implications – DeMorgan's Laws – Normal forms – Principal conjunctive and disjunctive normal forms – Rules of inference – Arguments – Validity of arguments.

MODULE II PREDICATE CALCULUS 7+3

Predicates – Statement function – Variables – Free and bound variables – Quantifiers – Universe of discourse – Logical equivalences and implications for quantified statements – Theory of inference – The rules of universal specification and generalization – Validity of arguments.

MODULE III FUNCTIONS 7+3

Functions – Classification of functions –– Composition of functions – Inverse functions – Binary and n–ary operations – Characteristic function of a set – Hashing functions – Recursive functions – Permutation functions.

MODULE IV ALGEBRAIC SYSTEMS 8+2

Groups, Cyclic Groups, Subgroups, Cosets, Lagrange's theorem, Normal subgroups – Codes and group codes – Basic notions of error correlation – Error recovery in group codes.

MODULE V GRAPH THEORY 7+3

Graphs – incidence and degree – subgraphs – isomorphism – complement of a graph – operations on graphs

MODULE VI PATH AND CIRCUIT 8+2

Walks, trails and paths – Eulerian graphs – Konigsburg bridge problem - Hamiltonian graphs

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1 Trembly J.P and Manohar R, “Discrete Mathematical Structures with Applications to Computer Science”, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, 30th Reprint 2011.

2 Kenneth H.Rosen, “Discrete Mathematics and its Applications:, 7th Edition, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, Special Indian Edition, 2011.

REFERENCES:

1 Ralph.P.Grimaldi, “Discrete and Combinatorial Mathematics: An Introduction”, 4th Edition, Pearson Education Asia, Delhi, 2007.

2 Thomas Koshy, “Discrete Mathematics with Applications”, Elsevier Publications, 2006.

3 C.L.Liu, D.P.Mohapatra, “Elements of Discrete Mathematics”, 4th Edition, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, 2012.

OUTCOMES:

At the end of the course, student will be able to

- use the concepts of propositional calculus.
- use the concepts of predicate calculus.
- identify types of functions and their importance.
- decode and encode the messages using group theory concepts.
- apply the basic concepts of graph theory.
- represent some real life situations into diagrammatic representation.

MACX 02 PROBABLITY AND STATISTICS L T P C

3 1 0 4

OBJECTIVES:

The aims of this course are to impart the

- knowledge of the theory of probability and random variables
- techniques to carry out probability calculations and identifying probability distributions
- application of statistical inference in practical data analysis

MODULE I BASICS OF PROBABILITY AND STATISTICS 8+2

Sample space, events- axioms of probability and interpretation – Addition, multiplication rules – conditional probability, Independent events - Total probability – Baye's theorem - Descriptive Statistics.

MODULE II ONE DIMENSIONAL RANDOM VARIABLE AND PROBABILITY DISTRIBUTION FUNCTIONS 7+3

Discrete random variable –continuous random variable – Expectation - probability distribution - Moment generating function – Binomial, Poisson, Geometric, Uniform (continuous), Exponential and Normal distributions.

MODULE III TWO DIMENSIONAL RANDOM VARIABLES 8+2

Joint, marginal, conditional probability distributions –covariance, correlation - transformation of random variables.

MODULE IV SAMPLING AND ESTIMATION 7+3

Sampling distributions – basic knowledge on Random , simple random , stratified and cluster samplings – Test of Hypotheses - concepts- Point estimation and Interval estimation.

MODULE V THEORY OF INFERENCE 8+2

Large sample tests – test for single and difference on proportions, single mean, difference of means, difference of variances – confidence intervals. Small sample tests – Student's t test, F test and Chi square test on theory of goodness of fit and analyses of independence of attributes.

MODULE VI DESIGN OF EXPERIMENTS 7+3

Analysis of variance – one way classification – two way classification – Completely

Randomised Block Designs – Randomised Block Design – Latin square designs - Interpretations - case studies.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. T.Veerarajan, “Probability and Statistics”, Tata McGraw-Hill Education, 2008.
2. Miller, I., Miller, M.,Freund, J. E., “Mathematical statistics”, 7th Edition, Prentice Hall International, 1999.
3. S.P.Gupta, “Applied Statistics”, Sultan Chand & Sons

REFERENCES:

1. S.M.Ross, “Introduction to Probability and Statistics for Engineers and Scientists” Fifth Edition, Elesvier.
2. S.C.Gupta and V.K.Kapoor, “Fundamentals of Mathematical Statistics” First edition, Sultan Chand and Sons.
3. Arora and Arora, “Comphrensive Statistical Methods”, S. Chand, 2007

OUTCOMES:

On completion of the course, students will be able to

- do basic problems on probability and descriptive statistics.
- derive the probability mass / density function of a random variable.
- calculate probabilities and derive the marginal and conditional distributions of bivariate random variables.
- calculate point and interval estimates.
- apply some large sample tests and small sample tests.
- carry out the data collection representation analysis and implications and the importance of inferences.

MACX 03	RANDOM PROCESSES	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aims of the course are to

- acquire the knowledge of the theory of probability and random variables
- study discrete and continuous probability distributions.
- demonstrate the techniques of two dimensional random variables and its distributions.
- introduce the random process, stationarity, Markov process and the study of correlation function and spectral analysis.

MODULE I Basics of Probability 7+3

Sample space, events- axioms of probability and interpretation – Addition, multiplication rules – conditional probability, Independent events - Total probability – Baye's theorem - Tchebychev's inequality.

MODULE II One dimensional Random variable and Probability Distribution functions 7+3

Discrete random variable –continuous random variable – Expectation - probability distribution - Moment generating function – Binomial, Poisson, Geometric, Uniform (continuous), Exponential and Normal distributions.

MODULE III Two dimensional random variables 7+3

Joint, marginal, conditional probability distributions - covariance, correlation and regression lines - transformation of random variables.

MODULE IV RANDOM PROCESSES 8+2

Classification of Random process - Stationary process - WSS and SSS processes - Poisson process – Markov Chain and transition probabilities.

MODULE V CORRELATION FUNCTIONS 8+2

Autocorrelation function and its properties - Cross Correlation function and its properties - Linear system with random inputs – Ergodicity.

MODULE VI SPECTRAL DENSITY 8+2

Power spectral Density Function - Properties - System in the form of convolution - Unit Impulse Response of the System – Weiner-Khinchine Theorem - Cross Power

Density Spectrum.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Veerarajan T., “Probability, Statistics and Random Processes”, Tata McGraw Hill,3rd edition, 2008.
2. Papoulis, “Probability, Random Variables and Stochastic Processes”, 4th Edition, Tata McGraw Hill Company, 2002.
3. S.M.Ross, “Introduction to Probability and Statistics for Engineers and Scientists” Fifth Edition, Elesvier

REFERENCES:

1. Scott L. Miller,Donald G. Childers, Probability and Random Processes, Academic Press,2009.
2. Trivedi K S, “ Probability and Statistics with reliability, Queueing and Computer Science Applications”,Prentice Hall of India,New Delhi,2nd revised edition, 2002

OUTCOMES:

On completion of the course, students will be able to

- do basic problems on probability.
- derive the probability mass / density function of a random variable.
- calculate probabilities and derive the marginal and conditional distributions of bivariate random variables.
- identify and study the different random processes.
- compute correlation functions and related identities.
- compute power spectral density functions and apply Weiner-Khinchine formula.

MACX 04 APPLIED NUMERICAL METHODS L T P C
3 1 0 4

OBJECTIVES:

The aims of the course are to

- introduce basic computational methods for analyzing problems that arise in engineering and physical sciences.
- acquire knowledge about approximation theory and convergence analysis associated with numerical computation.

MODULE I NUMERICAL SOLUTIONS OF EQUATIONS 7+3

Bisection method - Regula Falsi method – Secant method - Fixed point iteration method - Newton's Raphson method –Gauss Elimination method - Gauss-Jordon method – Gauss Jacobi method - Gauss-Seidel method.

MODULE II INTERPOLATION 8+2

Finite difference operators – Gregory Newton's forward and backward interpolations – Cubic spline interpolation - Lagrange interpolation - Newton's divided difference formula.

MODULE III NUMERICAL DIFFERENTIATION AND INTEGRATION 8+2

Numerical differentiation using Newton's forward and backward formulae – Numerical integration : Trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Gaussian Two Point and Three Point Quadrature formulae – Double integrals using Trapezoidal and Simpson's 1/3 rule.

MODULE IV INITIAL VALUE PROBLEMS FOR FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS 7+3

Numerical solutions by Taylor's Series method, Euler's method, Modified Euler's Method - Runge – Kutta Method of fourth order – Milne's and Adam's Bashforth Predictor and Corrector methods

MODULE V INITIAL AND BOUNDARY VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 8+2

Numerical solutions by Taylor's Series method - Runge – Kutta Method of fourth order of second order ODE. Finite difference methods.

MODULE VI BOUNDARY VALUE PROBLEMS FOR PARTIAL DIFFERENTIAL EQUATIONS 7+3

Finite difference solution of one dimensional heat equation by explicit and implicit

methods – One dimensional wave equation and two dimensional Laplace equation.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Grewal, B.S., “Numerical methods in Engineering and Science”, 7th edition, Khanna
   Publishers, 2007.
2. C.F.Gerald, P.O.Wheatley, “Applied Numerical Analysis” ,Pearson Education, New Delhi, 2002.

REFERENCES:

1. Chapra S.C, Canale R.P. “Numerical Methods for Engineers”, 5th Ed., McGraw Hill, 2006.
2. M.K.Jain, S.R.K.Iyengar, R.K.Jain, “Numerical methods for Scientific and Engineering Computation”, New Age International Publishers, New Delhi, 2003

OUTCOMES:

At the end of this course, students will be able to

- solve algebraic, transcendental and system of equations.
- apply interpolation techniques.
- carry out numerical differentiation and integration using different methods.
- solve first order ODE using single and multi step methods.
- solve second order ODE, initial and boundary value problems.
- solve the boundary value problems in PDE.

Maths Elective Courses
(To be offered in VI Semester)

MACX 05	MATHEMATICAL PROGRAMMING	L	T	P	C
		2	0	0	2

OBJECTIVES:

The aims of the course are to

- acquire knowledge and training in optimization techniques.
- obtain knowledge about optimization in utilization of resources.
- understand and apply operations research techniques to industrial operations.

MODULE I LINEAR PROGRAMMING PROBLEM 10

Linear programming – formulation of the problem - graphical interpretation of optimality - Simplex method – to obtain basic feasible solution – types of linear programming solution – complications and their resolution.

MODULE II ADVANCED LINEAR PROGRAMMING PROBLEMS 8

Artificial variable - Big M method – Two phase method – alternative optimal solution – unbounded solution - Duality – primal dual relationships.

MODULE III TRANSPORTATION PROBLEM 7

Transportation problems – Initial basic feasible solutions, MODI method, Unbalanced transportation problem, Degeneracy in transportation models,.

MODULE IV ASSIGNMENT PROBLEM 5

Assignment problem – Minimization and Maximization type of problems by Hungarian method.

Total Hours –30

TEXT BOOKS:

1. Hamdy A Taha, “Operations Research - An introduction”, 8th edition, Phil Pearson, 2007.
2. Winston.W.L., “Operations Research”, 4th edition, Thompson-Brooks/Cole, 2003.

REFERENCES:

1. Wayne.L. Winston, “Operations Research Applications and Algorithms”,

4th edition, Thomson learning, 2007.

2. Frederick. S. Hiller and Gerald J Lieberman, “Operations Research Concepts and Cases”, 8th edition (SIE), Tata McGraw – Hill Pub. Co. Ltd., New Delhi, 2006.
3. A. Ravindran, D. T. Phillips and J. J. Solberg, "Operations Research: Principles and Practice", 2nd edition, John Wiley & Sons, New York, 1992.
4. Robertazzi. T.G., “Computer networks and systems-Queuing theory and performance evaluation”, 3rd edition, Springer, 2002.

OUTCOMES:

At the end of the course, students will be able to

- formulate industrial problems as mathematical programming problems.
- solve linear programming problems by different methods.
- solve transportation problems by different methods.
- solve assignment problems by Hungarian method.

MACX 06	STATISTICAL METHODS FOR DATA ANALYSIS	L	T	P	C
		2	0	0	2

OBJECTIVES:

The aim of the course is to

- introduce statistical quality control tools.

MODULE I TESTS OF HYPOTHESES AND STATISTICAL INFERENCES 8

Small sample tests – Student's ' t ' test for single mean , difference of means, paired t test – F test for difference of variances – Chi square test on theory of goodness of fit and analyses of independence of attributes.

MODULE II DESIGN OF EXPERIMENTS 7

Analysis of variance – one way classification – two way classification – Completely Randomised Block Designs – Randomised Block Design – Latin square designs - Statistical analysis -Interpretations - case studies.

MODULE III STATISTICAL QUALITY CONTROL-I 8

Quality improvement and statistics –Statistical quality control- statistical process control – control charts – design of control charts –analysis of patterns on control charts - X bar chart, R chart and S chart.

MODULE IV STATISTICAL QUALITY CONTROL-II 7

Process and product control – attribute charts – P, np and C charts – control charts performance.

Total Hours –30

TEXT BOOKS:

1. Douglas C.Montgomery, George C. Runger "Applied Statistics and probability for Engineers" V Edition – John Wiley & Sons Inc.
2. Miller, I., Miller, M., Freund, J. E. "Mathematical statistics" 7th Edition. Prentice Hall International, 1999.

REFERENCES:

1. Dekking, F.M., Kraaikamp, C., Lopuhaä, H.P., Meester, L.E. "A Modern Introduction to Probability and Statistics" Springer, 2nd Edition.
2. Chin Long chiang "Statistical Methods of Analysis "World Scientific Books,

2003.
3. S.C.Gupta and V.K. Kapoor, “Mathematical Statistics” , Sultan Chand publications.
4. Veerarajan “Fundamentals of Mathematical Statistics” I Edition, Yes Dee Publishing Pvt. Ltd., 2017.

OUTCOMES:

On completion of the course, students will be able to

- develop and test hypothesis for different statistical tests
- design an experiment and case study the experiment with different data.
- analyze the industrial data using quality control design tools statistically.
- analyze the industrial data using process and product control tools statistically.

MACX 07 NUMERICAL METHODS FOR INTEGRATION AND DIFFERENTIAL EQUATIONS

L	T	P	C
2	0	0	2

OBJECTIVES:

- This course aims to solve numerically integral and differential equations.

MODULE I NUMERICAL INTEGRATION **8**

Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Two Point and Three point Gaussian quadrature formulae.

MODULE II NUMERICAL DOUBLE INTEGRATION **6**

Double integrals using trapezoidal and Simpson's 1/3 rules

MODULE III NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS **8**

Milne's Predictor and Corrector Method – Adam's Predictor-Corrector Method - Finite difference methods for two – point Boundary Value problems for Ordinary Differential Equations.

MODULE IV BOUNDARY VALUE PROBLEMS FOR PARTIAL DIFFERENTIAL EQUATIONS **8**

Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace and Poisson equations

Total Hours –30

TEXT BOOKS:

1. M.K.Jain, S.R.K.Iyengar, R.K.Jain, "Numerical methods for Scientific and Engineering Computation", New Age International Publishers, New Delhi, 2003.
2. Grewal, B.S., "Numerical methods in Engineering and Science" 7th edition, Khanna Publishers, 2007

REFERENCES:

1. C.F.Gerald, P.O.Wheatley, "Applied Numerical Analysis" Pearson Education, New Delhi 2002.
2. P.Dechaumphai, N. Wansophark, "Numerical Methods in Engineering", Narosa Publications, 2012.

OUTCOMES:

At the end of the course students will be able to

- solve the integration by numerical methods.
- solve the double integration by numerical methods
- find numerical solution of ordinary differential equations in engineering problems.
- find numerical solution of partial differential equations in engineering problems.

MACX 08 MATHEMATICAL MODELLING

L	T	P	C
3	0	0	3

OBJECTIVES:

The aims of the course are to

- provide basic idea of formation and use of Mathematical models for different purposes.
- determine the extent to which models are able to replicate real-world phenomena under different conditions

MODULE I PRINCIPLES OF MATHEMATICAL MODELING 7

Mathematics as a modelling language - Classification of models - Building, studying, testing and using models - Black and white box models – Difference equations

MODULE II PHENOMENOLOGICAL MODELS 7

Linear, Multiple linear and nonlinear regression - Neural networks - Fuzzy model - Stability and higher dimensional systems

MODULE III MECHANISTIC MODELS –I 8

Setting up ODE models – Initial and Boundary value problems - Numerical solutions - Fitting ODE to data - Applications

L	T	P	C
2	0	0	2

MODULE IV MECHANISTIC MODELS –II 8

Linear and nonlinear equations - Elliptic, parabolic and hyperbolic equations - Closed form solutions - Finite difference and finite element methods

Total Hours –30

TEXT BOOKS:

1. G . Ledder , “Calculus, modelling , probability and dynamic systems”, Springer 2013
2. Kei Velten, “Mathematical modelling and simulation”, J. Wiley and sons,2009

REFERENCES:

1. Michael D Alder, “An introduction to Mathematical modelling”, Heaven for Books.com
2. Alfio Quarteroni, “Mathematical models in science and engineering”, Notices of AMS
3. J.N. Kapur, “Mathematical models in Biology and Medicine”, Affiliated East-

West Press Private Limited, New Delhi, 1992.

OUTCOMES:

On completion of the course, the students will be able to

- identify the relationship between real world and mathematical models
- Classify the data and choose the appropriate model
- Distinguish between linear and nonlinear models
- identify the relationship between empirical and mechanistic models

MACX 09 **GRAPH THEORY** **L T P C**

3 0 0 3

OBJECTIVES:

The aims of this course are to

- represent the real life situations diagrammatically.
- appraise different methods to find solutions to graph theory problems.

MODULE I INTRODUCTION TO GRAPH THEORY 8

Graphs - finite and infinite graphs - Incident and degree-isolated vertex, pendent vertex and null vertex.

MODULE II PATH AND CIRCUIT 8

Isomorphism – sub graphs-walks, paths and circuits – connected and disconnected graphs- Euler graphs – operation on a graph.

MODULE III TREES AND FUNDAMENTAL CIRCUITS 7

Trees- some properties of trees- pendent vertices in a tree – rooted binary tree-spanning trees-fundamental circuits.

MODULE IV CUT SETS AND CUT VERTICES

Cut sets – some properties of cut sets- fundamental circuits and cut sets-network flows.

Total Hours –30

TEXT BOOKS:

1. NARSINGH DEO, Graph theory with applications to Engineering and Computer Science, Prentice Hall INC, New Delhi,
2. J.A. Pondy and U.S.R. Murthy, North Holland, Oxford, New York Graph theory with applications

REFERENCES:

1. Trembly J.P and Manohar R, “Discrete Mathematical Structures with Applications to Computer Science”, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, 30th Reprint 2011
2. Kenneth H.Rosen, “Discrete Mathematics and its Applications”, 7th Edition, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, Special Indian Edition, 2011

3. Md. Saidur Rahman, “Basic graph theory”, Springer, 2017

OUTCOMES:

At the end of the course, students will be able to

- demonstrate the basic concepts of Graph theory.
- explore connected and disconnected graphs.
- identify the real life problems with trees and circuits.
- bring out the cut set properties and network flows properties.

Humanities Elective I

(To be offered in III Semester)

SSCXO1	**FUNDAMENTALS OF ECONOMICS**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**2**

OBJECTIVES:

- To identify and present the basic concepts of demand, supply and equilibrium.
- To explain and discuss the types and concepts of national income and inflation.
- To illustrate the fundamental concepts of money, banking and public finance.
- To apprise the students about Indian economy and the role of engineers in economic development.

MODULE I DEMAND AND SUPPLY ANALYSIS 8

Classification of economy – open and closed economy, Demand - Types of demand - Determinants of demand – Law of Demand - Demand elasticity - Supply - Determinants of Supply – Law of Supply - Supply elasticity - Pricing strategies.

MODULE II NATIONAL INCOME AND INFLATION 7

Concepts of National income and measurement – Importance and difficulties of estimating National Income in India - Aggregate demand and aggregate supply, Macroeconomic equilibrium – meaning of inflation- types - causes and preventive measures

MODULE III MONEY, BANKING AND PUBLIC FINANCE 9

Money – Meaning, types, functions, importance - Commercial Banks - Central Bank - Monetary policy – meaning, objectives, Methods of Credit Control By RBI, Government Budget – Government revenue and Expenditures – Fiscal policy - Its objectives, instruments and limitations - Deficit Financing - The Fiscal Responsibility and Budget Management Act, 2003 (FRBMA) .

MODULE IV INDIAN ECONOMY AND THE ROLE OF ENGINEERS 6

Economic reforms – Liberalization, Privatization and Globalization - challenges and opportunities, Engineers – Engineers' contributions to the economic growth.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Dutt and Sundharam (2013), *Indian Economy*, S. Chand & Company Pvt. Ltd, New Delhi.
2. Hussain, Moon Moon (2015), *Economics for Engineers*, Himalaya Publishing House, New Delhi.

REFERENCES:

1. Cleaver Tony (2004), "*Economics: The Basics*", Routledge, London.
2. Mell Andrew and Walker Oliver (2014), "*The Rough Guide to Economics*", Rough Guide Ltd.

OUTCOMES:

On successful completion of this course,

- Students will have had exposure to the basic concepts of demand, supply and various pricing strategies.
- Students will have understood the macroeconomic concepts of national income and inflation.
- Students will be able to apply the knowledge of money, banking and public finance in their real life situations.
- Students will have an overview of the economic reforms introduced in Indian economy.

SSCXO2 PRINCIPLES OF SOCIOLOGY.

L	T	P	C
2	0	0	2

OBJECTIVES:

- To acquaint the students with Concepts and perspectives of Sociology
- To explain the reflection of society in Individuals and vice versa
- To describe the hierarchical arrangement of individuals and groups in society
- To explicate the dimensions, forms and factors of Social change.
- To examine the context, impact and agencies of Globalization

MODULE I THE FOUNDATIONAL CANON 8

Sociology-Definition, scope and importance; Major theoretical perspectives- Functionalism, Conflict Theorising and Interactionism; Elements of social formation- Society, Community, Groups and Association; Associative Social Process- Co-operation, Accommodation and Assimilation; Dissociative Social Process- Competition and Conflict.

MODULE II INDIVIDUAL AND SOCIETY 7

Culture-definition, characteristics, functions, types, cultural lag and civilization, Socialization – definition, process, stages, agencies and anticipatory socialization; Social Control- definition, characteristics, importance, types & agencies.

MODULE III SOCIAL INEQUALITY AND STRATIFICATION 7

Concepts- inequality, hierarchy, differentiation, Social Exclusion, and Social Stratification. Forms of Social Stratification- Caste, Class and Estate. Gender and Social Stratification- sex and gender, patriarchy, factors perpetuating gender stratification; Globalization and gender inequality

MODULE IV SOCIAL CHANGE AND GLOBALIZATION 8

Social Change-definition, nature, direction; Forms- evolution, development, progress and transformation; Factors of social change- demography, economy, technology, polity and culture. Globalization- definition, characteristics, historical and social context and Impact, agencies of globalization- IGOs, INGOs, Nation-State, MNEs and Media

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Giddens A. 1989. “Sociology” Cambridge: Polity Press.
2. Heald Haralambos, R.M(2014) . ‘‘Sociology Themes and Perspectives”,

Oxford, New Delhi-92

3. Bhushan Vidya and D.R. Sachdeva (2012). ‘‘Fundamental of Sociology”, Pearson, Delhi.

REFERENCES:

1. Das Gupta, Samir and Paulomi Saha (2012), ‘‘An Introduction to Sociology”, Pearson, Delhi
2. Bottomore, T.B. 1972. *Sociology- A Guide to Literature and Problems*, New Delhi,

OUTCOMES:

On successful completion of this course,

- Students will have exposure to the fundamentals tenets of Sociology.
- Students will be trained to understand social reality with sociological perspective.
- Students will be oriented to constructively analyze human interactions, social relationship and social issues
- Students will gain exposure to the dynamics of human society with special reference to the contemporary trends of globalization.

SSCXO3	SOCIOLOGY OF INDIAN SOCIETY.	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To present a portrayal of the components of the Indian Social structure
- To describe the nature and contemporary structure of Indian social Institutions.
- To examine the causality and magnitude of social problem facing the contemporary India.
- To elucidate the processes forms and impact of change and development in Indian society

MODULE I INDIAN SOCIAL STRUCTURE 7

Unity and Diversity; Concepts of unity and diversity- racial, religious, ethnic and linguistic composition of India. Types of communities-rural, urban and tribal; Social backwardness- OBC, SC and ST; Indian minorities- religious, ethnic, linguistic and LGBT

MODULE II INDIAN SOCIAL INSTITUTIONS 7

Family- definition, types, characteristics, functions of family; Joint Family- definition features, utility, changes; Marriage- definition, characteristics, marriage as sacrament or contract. Caste- definition, principles, contemporary changes, dominant caste, caste -class interface.

MODULE III SOCIAL PROBLEMS IN INDIA 8

Social Problem-definition, nature, social disorganization; Population explosion-causes, effects, relationship with development; Child Labour- causes, magnitude and consequences; Unemployment-nature , types, causes and effects; Gender issues-social status of women, violence against women and women in work place; Contemporary issues- communalism, terrorism and corruption.

MODULE IV SOCIAL CHANGE AND DEVELOPMENT IN INDIA 8

Socio-cultural Change- Sanskritization, Westernization, Secularization, Modernization; Processes of Social change- Industrialization, Urbanization, Globalization; Development- definition, elements, role of government, industry and corporate sector. Technology and change- invention and innovation, impact of technology on social institutions, technology and development.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Sharma,K.L.2008. *Indian Social Structure and Change*. Jaipur: Rawat Publications,.
2. Shah, A.M. 1998. *The Family in India: Critical Essays*. New Delhi: Orient Longman,
3. Ahuja Ram. 1999. *Social problems in India*, Rawat Publication: New Delhi.
4. Ahuja Ram. 2014. *Society in India,*, Rawat Publication: New Delhi.

REFERENCES:

1. Jayapalan, N.(2001), **"**Indian Society and Social Institutions" Atlantic Publishers & Distri,
2. Atal, yogesh (2006), "Changing Indian Society" Rawat Publications, Jaipur

OUTCOMES:

On successful completion of this course,

- Students will gain an in-depth understanding of the social structure and social institutions that constitute society in India.
- Students will be sensitized to the various categories ,Inequalities and their challenges
- Students will be exposed to the social problems encountered in contemporary India.
- Students will gain knowledge about the various forms and trends of the social change.
- Students will become aware about the challenges in the path of progress of Indian society and realize relevance of their role in bringing about development

Humanities Elective II

(To be offered in IV Semester)

		L	T	P	C
SSCXO4	**ECONOMICS OF SUSTAINABLE DEVELOPMENT**	**2**	**0**	**0**	**2**

OBJECTIVES:

- To have an increased awareness on the concept and components of sustainable development.
- To develop the ability to demonstrate the need of sustainable development and international responses to environmental challenges.
- To have an insight into global environmental issues and sustainable globalization.
- To establish a clear understanding of the policy instruments of sustainable development.

MODULE I CONCEPT OF SUSTAINABLE DEVELOPMENT 7

Evolution of the Concept – Rio Summit and sustainable development - various definitions of sustainable development - Components of sustainable development: Social, environmental and economic components.

MODULE II NEED FOR SUSTAINABLE DEVELOPMENT 8

Need for sustainability – Global environmental challenges: population growth, resource depletion, pollution, energy use, climate change, pollution, growing water scarcity, other urban problems, loss of biodiversity, hazardous wastes disposal.International responses to environmental challenges - Global policy such as Kyoto Protocol, Montreal Protocol, Basel Convention.

MODULE III GLOBALIZATION AND ENVIRONMENT SUSTAINABILITY 8

Impact of Globalization on sustainable development, Co - existence of globalization and Environment sustainability, Globalization and Global Governance.Green economy - Renewable energy, sustainable transport, sustainable construction, land and water management, waste management.

MODULE IV POLICIES FOR ACHIEVING SUSTAINABLE DEVELOPMENT 7

Principles of environmental policy for achieving sustainable development:

precautionary principle and polluter pays principle – Business Charter for Sustainable Development.Policy instruments for sustainable development: direct regulation – market based pollution control instruments such as pollution tax, subsidy, pollution permits.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Anderson, David A (2010), "*Environmental Economics and Natural Resource Management*", Routledge, 3rd edition.
2. Karpagam M (1999), "*Environmental Economics: A Textbook*", Sterling Publishers Pvt. Ltd, New Delhi.

REFERENCES:

1. Karpagam M and Jaikumar Geetha (2010), "*Green Management Theory and Applications*", Ane Books Pvt. Ltd, New Delhi.
2. Sengupta Ramprasad (2004), "*Ecology and Economics: An Approach to Sustainable Development*", Oxford University Press, New Delhi.

OUTCOMES:

On successful completion of this course,

- The students will have understood the concepts and components of sustainable development.
- The students will have a holistic overview on the challenges of sustainable development and International responses to environmental challenges.
- The students will have gained knowledge on the global environment issues and demonstrate responsible globalization through global governance.
- The students will have developed awareness of the ethical, economic, social and political dimensions that influence sustainable development.

SSCXO5 INDUSTRIAL SOCIOLOGY

L	T	P	C
2	0	0	2

OBJECTIVES:

- To introduce sociological approaches and perspectives to understand the social relationship in manufacturing industries and corporate sector.
- To explain the structure and functions of industrial organizations.
- To elucidate the dynamics of organizational behavior, leadership and communication.
- To inculcate professional ethics and values to equip students to work in organizational settings.

MODULE I INTRODUCTION 8

Industrial Sociology- definition, scope and importance; Theoretical approaches- scientific management, human relations approach, theory of bureaucracy, Fordism and post-fordism; Production system- concept and characteristics of factory system, automation and rationalization; Industrial conflict- strike , lockout and trade unions.

MODULE II INDUSTRIAL ORGANIZATION 7

Formal organization- definition, features, utility; Informal organization- definition, characteristics, types and relevance; Structure of industrial organization- features and functions of line organization, characteristics and roles of staff organization, distinction;

Industrial hierarchy-white collar, blue collar, supervisors and managers.

MODULE III DYNAMICS OF INDUSTRIAL RELATIONS 8

Group dynamics- Definition, Group behaviour model, Group decision making process, group cohesiveness; Leadership- definitions, style and effective supervision; Communication- concepts, types, model barriers; Job satisfaction- nature, employee compensation and job satisfaction.

MODULE IV PROFESSIONAL ETHICS AND VALUES 7

Concepts- values- morals, and ethics, Integrity, work ethics , service learning - Civic Virtue - caring - Sharing - Honesty - Courage - Valuing Time - Co-operation - commitment - empathy - Self-Confidence - Environmental Ethics, Cyber issues - computer ethics, cyber crimes, plagiarism Ethical living-concept of harmony in life.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Narender Singh, Industrial Sociology, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2012.
2. Gisbert Pascal, Fundamentals of Industrial Sociology, Tata Mc. Graw Hill Publishing Co., New Delhi, 1972
3. Schneider Engeno. V, Industrial Sociology 2nd Edition, Mc. Graw Hill Publishing Co., New Delhi, 1979.

REFERENCES:

1. Robbins, Stephen, Organizational Behaviour , Prentice Hall of India PVT ltd new Delhi, 1985
2. Devis Keith , Human Behaviour at work place, Mc. Graw Hill Publishing Co., New Delhi,1984

OUTCOMES:

On successful completion of this course,

- Students will have acclimatized with sociological perspectives for dealing with social relationships in production and service organizations.
- Students will be familiar with structure of authority, roles and responsibility in organizational settings.
- Students will imbibe leadership, communication and behavioral acumen to govern organization
- Students will be sensitized to standards of desirable behavior to engage in industrial and corporate sector.

SSCXO6 LAW FOR ENGINEERS

L	T	P	C
2	0	0	2

OBJECTIVES:

- To understand the Constitution and Governance of our country.
- To apprise the students of human rights - local and international and redressal mechanism.
- To have an insight into the industrial, corporate and labour laws of our country.
- To establish a clear understanding about the importance of intellectual property related laws.

MODULE I INDIAN CONSTITUTION AND GOVERNANCE 8

Constitution – salient features, Preamble, Citizenship, Fundamental rights, Fundamental duties, Directive principles, Union executive, Legislature – Union – State and union territories – Election Commission – Election for parliament and state legislature, Judiciary- basic functioning of the Supreme Court and High Courts, Right to information Act 2005 – evolution – concept – practice.

MODULE II HUMAN RIGHTS 7

Human rights – meaning and significance, Covenant on civil and political rights, Covenant on Economic, Social and Cultural rights, UN mechanism and agencies, The Protection of Human Rights Act, 1993 – watch on human rights and enforcement.

MODULE III INDUSTRIAL, CORPORATE AND LABOUR LAWS 8

Corporate laws – meaning and scope, Companies Act 1956 – Indian Contract Act 1872 - Principles of Arbitration - Industrial Employment (Standing Orders) Act 1946 - Industrial Disputes Act 1947 - Workmen's Compensation Act 1923 - The Factories Act, 1948.

MODULE IV LAWS RELATED TO IPR 7

IPR – meaning and scope, International organization – WIPO – TRIPS, Major Indian IPR Acts – Copyright laws, Patent and Design Act, Trademarks Act, Trade Secret Act, Geographical Indicator.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. M.P. Jain (2005) *Indian Constitutional Law*, Wadhwa & Co.

2. H. D, Agarwal (2008), *International Law and Human Rights,* Central Law Publications,
3. Rao, Meena (2006), *Fundamental Concepts in Law of Contract*, 3rd edn., Professional offset.
4. Ramappa (2010), *Intellectual Property Rights Law in India*, Asia Law House.
5. Singh, Avtar (2007), *Company Law*, Eastern Book Co.
6. R.F, Rustamji (1967)*, Introduction to the Law of Industrial Disputes*, Asia Publishing House.

REFERENCES:

1. Acts: Right to Information Act, Industrial Employees (standing order) Act, Factories Act, Workmen Compensate Act.

OUTCOMES:

On successful completion of this course,

- Students will `be able to apply the basic concepts of Indian Constitution, Governance and power in their real life situation.
- Students will have gained knowledge in human rights, cultural, social and political rights.
- Students will have synthesized knowledge about industrial, corporate and labour laws of our country.
- Students will have an overview of IPRs and laws related to Intellectual Property Rights.

General Elective Courses
Group I courses
(To be offered in V Semester)

GECX101	DISASTER MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To give an exposure to various environmental hazards and disasters: and various concepts and principles to manage disaster.
- To give exposure to various environmental policies & programs in India for disaster management

MODULE I ENVIRONMENTAL HAZARDS 7

Environmental hazards, Environmental Disasters and Environmental stress-Meaning and concepts. Vulnerability and disaster preparedness.

MODULE II NATURAL DISASTERS 7

Natural hazards and Disasters - Volcanic Eruption, Earthquakes, Tsunamis, Landslides, Cyclones, Lightning, Hailstorms, Floods, Droughts, Cold waves, Heat waves and Fire.

MODULE III MAN-MADE DISASTERS 7

Man induced hazards & Disasters - Soil Erosion, Chemical hazards, Population Explosion

MODULE IV DISASTER MANAGEMENT 8

Emerging approaches in Disaster Management- Preparing hazard zonation maps, Predictability / forecasting & warning, Preparing disaster preparedness plan, Land use zoning, Communication. Disaster resistant house construction, Population reduction in vulnerable areas, Awareness - Rescue training for search & operation at national & regional level - Immediate relief, Assessment surveys, Political, Administrative, Social, Economic, Environmental Aspects.

MODULE V NATURAL DISASTER REDUCTION & MANAGEMENT 8

Provision of Immediate relief measures to disaster affected people, Prediction of Hazards & Disasters, Measures of adjustment to natural hazards

MODULE VI ENVIRONMENTAL POLICIES & PROGRAMMES IN INDIA 8

Regional survey of Land Subsidence, Coastal Disaster, Cyclonic Disaster & Disaster in Hills with particular reference to India. Ecological planning for sustainability & sustainable development in India, Sustainable rural development: A Remedy to Disasters, Role of Panchayats in Disaster mitigations, Environmental policies & programmes in India- Institutions & National Centers for Natural Disaster reduction, Environmental Legislations in India, Awareness, Conservation Movement, Education & training.

L – 45; Total Hours –45

REFERENCES:

1. Satender, “Disaster Management in Hills”, Concept Publishing Co., New Delhi, 2003.
2. Singh, R.B. (Ed.), “Environmental Geography”, Heritage Publishers, New Delhi,1990.
3. Savinder Singh, “Environmental Geography”, Prayag Pustak Bhawan,1997.
4. Kates, B.I. and White, G.F., “The Environment as Hazards”, Oxford University Press, New York, 1978.
5. Gupta, H.K., (Ed), “Disaster Management”, University Press, India, 2003.
6. Singh, R.B.,“Space Technology for Disaster Mitigation in India (INCED)”, University of Tokyo, 1994.
7. Bhandani, R.K., “An overview on Natural & Manmade Disaster & their Reduction”, IIPA Publication, CSIR, New Delhi, 1994.
8. Gupta, M.C., “Manuals on Natural Disaster management in India”, National Centre for Disaster Management, IIPA Publication, New Delhi, 2001.

OUTCOMES:

At the end of the course, the students will

- achieve sufficient knowledge on the disaster prevention strategy, early warning system, disaster preparedness, response and human resource development.
- be familiar with the National Policy on Disaster Management.

GECX102 TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

- To understand the various principles, practices of TQM to achieve quality.
- To get acquainted with the various statistical tools and approaches for quality control and continuous improvement.
- To get aware of the importance of ISO and Quality Systems.

MODULE I INTRODUCTION 8

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

MODULE II TQM PRINCIPLES 7

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits.

MODULE III TQM IMPROVEMENT PROCESS 8

Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

MODULE IV STATISTICAL PROCESS CONTROL (SPC) 8

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

MODULE V TQM TOOLS 7

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

MODULE VI QUALITY SYSTEMS 7

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System– Elements, Implementation of Quality System, Documentation, Quality Auditing, TS 16949, ISO 14000 – Concept, Requirements and Benefits

L – 45; Total Hours –45

TEXT BOOKS:

1. Dale H.Besterfiled, et al., “Total Quality Management”, Pearson Education, Inc. 2003.

REFERENCES:

1. James R.Evans & William M.Lidsay, “The Management and Control of Quality”, 5th Edition, South-Western (Thomson Learning), 2002.
2. Feigenbaum.A.V., “Total Quality Management”, McGraw-Hill, 1991.
3. Oakland.J.S., “Total Quality Management”, Butterworth Hcinemann Ltd., Oxford, 1989.
4. Narayana V. and Sreenivasan. N.S., “Quality Management – Concepts and Tasks”, New Age International, 1996.
5. Zeiri, “Total Quality Management for Engineers”, Wood Head Publishers, 1991.

OUTCOMES:

The student should be able to

- apply the various statistical tools and approaches for Quality control.
- achieve continuous process improvement through TQM.

GECX103 ENERGY STUDIES L T P C

3 0 0 3

OBJECTIVES:

- To learn the growing demand, supply of energy on global and national levels and the need for renewable energy promotion.
- To understand the basic need for energy conservation and waste heat recovery.
- To learn the important aspects of energy audit and management.
- To get acquainted with the global environmental issues and carbon credits.

MODULE I GLOBAL AND NATIONAL ENERGY SCENARIO 7

Role of energy in economic development, various energy resources - overall energy demand and availability- Energy consumption in various sectors and its changing pattern - Exponential increase in energy consumption and projected future demands. Need for renewable energy.

MODULE II SOLAR ENERGY 8

Solar Radiation – Measurements of Solar Radiation - Flat Plate and Concentrating Collectors – Solar direct Thermal Applications – Solar thermal Power Generation - Fundamentals of Solar Photo Voltaic Conversion – Solar Cells – Solar PV Power Generation – Solar PV Applications.

MODULE III OTHER RENEWABLE ENERGY SOURCES 8

Power from wind – wind turbine working and types, solar thermal power plants – low medium and high power generation, power from wave , tidal, geothermal sources, OTEC system. MHD power plants – working, types, merits and demerits. Energy from biomass.

MODULE IV COGENERATION, WASTE HEAT RECOVERY AND COMBINED CYCLE PLANTS 8

Cogeneration principles- topping and bottoming cycles, role in process industries. Energy from wastes- waste heat recovery- heat recovery from industrial processes. Heat exchange systems – recuperative and regenerative heat exchangers – commercially available waste heat recovery devices. Combined cycle plants – concept, need and

advantages, different combinations and practical scope.

MODULE V ENERGY CONSERVATION AND MANAGEMENT 7

Need for energy conservation – use of energy efficient equipment. Energy conservation opportunities - in educational institutions, residential, transport, municipal, industrial and commercial sectors – concept of green building. Energy audit in industries – need, principle and advantages. Case studies.

MODULE VI GLOBAL ENERGY ISSUES AND CARBON CREDITS 7

Energy crisis, fossil consumption and its impact on environmental climate change. Energy treaties – Montreal and Kyoto protocols - Transition from carbon rich and nuclear to carbon free technologies, carbon foot print – credits – clean development mechanism.

L – 45; Total Hours –45

TEXT BOOKS:

1. S.S. Rao and B.B. Parulekar, “Energy Technology”, 3rd Edition, Khanna Publishers, New Delhi, 2011.
2. O. Callaghn. P.W., “Design and Management for Energy Conservation”, Pergamon Press, Oxford, 1981.

REFERENCES:

1. G.D. Rai, “Non Conventional Energy Sources”, Khanna Publishers, New Delhi, 2011.
2. Archie, W Culp. “Principles of Energy Conservation”, McGraw Hill, 1991.
3. D Patrick and S W Fardo, “Energy Management and Conservation”, PHI,1990
4. P. O’Callaghan: “Energy Management”, McGraw - Hill Book Company, 1993.
5. Kenney, W. F., “Energy Conservation in Process Industries”, Academic Press, 1983.

OUTCOMES:

The student should be able to

- Realize the global and national energy status and need to switch over to renewable energy technology.
- Energy audit and suggest methodologies for energy savings.
- Utilize the available resources in an optimal way.
- Concern about the global environmental issues & promote carbon credits.

GECX104 ROBOTICS L T P C

3 0 0 3

OBJECTIVES:

To learn about the robots, various components, of Robots, programming and their applications.

MODULE I **8**

Definition- Need - Application, Types of robots – Classifications – Configuration, work volume, control loops, controls and intelligence- basic parts - functions – specifications. of robot, degrees of freedoms, end effectors – types, selection

MODULE II ROBOT DRIVES AND CONTROL **8**

Controlling the Robot motion – Position and velocity sensing devices – Design of drive systems – Hydraulic and Pneumatic drives – Linear and rotary actuators and control valves – Electro hydraulic servo valves, electric drives – Motors – Designing of end effectors – Vacuum, magnetic and air operated grippers.

MODULE III ROBOT SENSORS **8**

Transducers and Sensors – Tactile sensor – Proximity and range sensors – Sensing joint forces – Robotic vision system – Image Representation - Image Grabbing –Image processing and analysis – Edge Enhancement – Contrast Stretching – Band Rationing - Image segmentation – Pattern recognition – Training of vision system.

MODULE IV ROBOT PROGRAMMING & AI TECHNIQUES **7**

Types of Programming – Teach pendant programming – Basic concepts in AI techniques – Concept of knowledge representations – Expert system and its components.

MODULE V ROBOTIC WORK CELLS AND APPLICATIONS OF ROBOTS **7**

Robotic cell layouts – Inter locks – Humanoid robots – Micro robots – Application of robots in surgery, Manufacturing industries, space and underwater.

MODULE VI ROBOT KINEMATICS AND DYNAMICS 7

Forward and inverse Kinematic equations, Denvit – Hartenbers representations Fundamental problems with D-H representation, differential motion and velocity
of frames - Dynamic equations for sing, double and multiple DOF robots – static force analysis of robots.

L – 45; Total Hours –45

REFERENCES:

1. Yoram Koren," Robotics for Engineers", Mc Graw-Hill, 1987.
2. Kozyrey, Yu, "Industrial Robots", MIR Publishers Moscow, 1985.
3. Richard. D, Klafter, Thomas, A, Chmielewski, Michael Negin, "Robotics Engineering – An Integrated Approach", Prentice-Hall of India Pvt. Ltd., 1984.
4. Deb, S.R. "Robotics Technology and Flexible Automation", Tata Mc Graw-Hill, 1994.
5. Mikell, P. Groover, Mitchell Weis, Roger, N. Nagel, Nicholas G. Odrey, "Industrial Robotics Technology, Programming and Applications", Mc Graw- Hill, Int. 1986.
6. Timothy Jordanides et al,"Expert Systems and Robotics", Springer – Verlag, New York, May 1991.

OUTCOMES:

Students would be able to

- Understand about the robots, its various components.
- Design Robots for industrial applications.
- Do programming for robots and apply them in real time applications.

GECX105 TRANSPORT MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the transport fleet and their related activities for minimizing operational cost.
- To understand the need of maintenance and its importance.
- To understand the functions and applications of various types of transport system.

MODULE I INTRODUCTION 7

Personnel management; objectives and functions of personnel management, psychology, sociology and their relevance to organization, personality problems. Selection process: job description, employment tests, interviewing, introduction to training objectives, advantages, methods of training, training procedure, psychological tests.

MODULE II ORGANISATION AND MANAGEMENT 7

Forms of Ownership – principle of Transport Management – Staff administration – Recruitment and Training – welfare – health and safety. Basic principles of supervising. Organizing time and people. Driver and mechanic hiring - Driver checklist - Lists for driver and mechanic - Trip leasing - Vehicle operation and types of operations.

MODULE III TRANSPORT SYSTEMS 9

Introduction to various transport systems. Advantages of motor transport. Principal function of administrative, traffic, secretarial and engineering divisions. chain of responsibility, forms of ownership by state, municipality, public body and private undertakings.

MODULE IV SCHEDULING AND FARE STRUCTURE 8

Principal features of operating costs for transport vehicles with examples of estimating the costs. Fare structure and method of drawing up of a fare table. Various types of fare collecting methods. Basic factors of bus scheduling. Problems on bus scheduling.

MODULE V MOTOR VEHICLE ACT 7

Traffic signs, fitness certificate, registration requirements, permit insurance, constructional regulations, description of vehicle-tankers, tippers, delivery vans, recovery vans, Power wagons and fire fighting vehicles. Spread over, running time, test for competence to drive.

MODULE VI MAINTENANCE 7

Preventive maintenance system in transport industry, tyre maintenance procedures. Causes for uneven tyre wear; remedies, maintenance procedure for better fuel economy, Design of bus depot layout.

L – 45; Total Hours –45

TEXT BOOKS:

1. John Duke, "Fleet Management", McGraw-Hill Co, USA, 1984.
2. Kitchin.L.D., "Bus Operation", III edition, Illiffee and Sons Co., London, 1992

REFERENCES:

1. Government Motor Vehicle Act, Publication on latest act to be used as on date.

OUTCOMES:

Upon completion of the course, students will

- Know about different aspects related to transport system and management.
- Features of scheduling, fixing the fares
- Know about the motor vehicle act and maintenance aspects of transport.

GECX106 CONTROL SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the system modeling and to derive their transfer function.
- To provide adequate knowledge of time response of systems and steady state error analysis.
- To accord basic knowledge in obtaining the open loop and closed–loop frequency responses of Control systems.

MODULE I BASIC CONCEPTS AND SYSTEM REPRESENTATION **8**

Control System - Basic elements in control systems – Open and closed loop systems – Electrical analogy of mechanical and thermal systems – Transfer function – Block diagram reduction techniques – Signal flow graphs.

MODULE II TIME RESPONSE ANALYSIS AND DESIGN **8**

Time response – Time domain specifications – Types of test input – First and Second order system - Type I and Type II System – Response - Error coefficients – Generalized error series – Steady state error – P, PI, PID modes of feedback control.

MODULE III FREQUENCY RESPONSE ANALYSIS AND DESIGN **7**

Performance specifications - correlation to time domain specifications - bode plots and polar plots – gain and phase margin – constant M and N circles and Nichols chart – all pass and non-minimum phase systems.

MODULE IV STABILITY **8**

Characteristics equation – Location of roots in s plane for stability – Routh Hurwitz criterion – Root locus construction – Effect of pole, zero addition – Gain margin and phase margin – Nyquist stability criterion.

MODULE V COMPENSATOR DESIGN **8**

Performance criteria – Lag, lead and lag-lead networks – Compensator design using bode plots and root locus technique.

MODULE VI CONTROL SYSTEM COMPONENTS AND APPLICATION OF CONTROL SYSTEMS **6**

Synchros – AC servomotors - DC Servo motors - Stepper motors - AC

Tacho generator - DC Tacho generator - Typical applications of control system in industry.

L – 45; Total Hours –45

REFERENCES:

1. K. Ogata, “Modern Control Engineering”, 4th Edition, Pearson Education, New Delhi, 2003.
2. I.J. Nagrath & M. Gopal, “Control Systems Engineering”, New Age International Publishers, 2003.
3. C.J.Chesmond, “Basic Control System Technology”, Viva student edition, 1998.
4. I.J.Nagarath and M.Gopal, “Control System Engineering”, Wiley Eastern Ltd., Reprint, 1995.
5. R.C.Dorf and R.H.Bishop, “Modern Control Systems”, Addison-Wesley (MATLAB Reference), 1995.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Proper understanding of basics of Control Systems.
- Ability and skill to carry-out time domain and frequency domain analysis.
- Capable of determining stability of the system using Routh Hurwitz criterion, Root locus and Nyquist criterion.
- Ability to design lag, lead and lag lead compensator networks.

GECX107 INTRODUCTION TO VLSI DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- Basic concepts of HDL.
- Verilog language and its syntax constructs.
- Programmable Logic Devices and FPGAs
- MOS devices theory
- CMOS based combinational and sequential circuits

PREREQUISITES:

Fundamentals of Electronics

Basics knowledge in Digital Electronics.

MODULE I REVIEW OF BASIC DIGITAL SYSTEMS 7

Boolean algebra, Building blocks of combinational logic design-Adders, multiplexer, encoder, decoder, comparator, Latches & flip-flops, counters, shift registers.

MODULE II LOGIC DESIGN USING VERILOG HDL 8

Overview of Digital Design with Verilog HDL, Levels of Design Description, Concurrency, Hierarchical Modeling Concepts, Modules and Ports, Component instantiation Data flow and RTL, structural, gate level, switch level modeling and Behavioral Modeling.

MODULE III LANGUAGE CONSTRUCTS OF VERILOG HDL 7

Identifiers- gate primitives, gate delays, operators, timing controls, procedural assignments, conditional statements Variable types, arrays and tables, Tasks and functions, Test bench.

MODULE IV BUILDING BLOCKS OF DIGITAL VLSI SYSTEMS 8

HDL Design -Data Path Operations-Addition/Subtraction, Parity Generators, Comparators, Zero/One Detectors, Binary Counters, ALUs, Multiplication, Shifters, Memory Elements. Programmable logic elements and AND-OR arrays, FPGAs programming methods.

MODULE V TRANSISTOR THEORY 7

Introduction to MOS Transistors-NMOS & PMOS Characteristics, Current Equations, Complementary CMOS Inverter-DC Characteristics, Static Load MOS Inverters.

MODULE VI BASICS OF DIGITAL CMOS DESIGN 8

NMOS & PMOS Logic Gate, CMOS Logic Gate, Basic layout design of simple gate-stick diagram, CMOS Logic Structures-full adder, multiplexers.

Total Hours –45

TEXT BOOKS:

1. M.Morris Mano "Digital Design", 3rd Edition, Prentice Hall of India Pvt. Ltd New Delhi, 2003

REFERENCES:

1. Michael D. Ciletti“Advanced Digital Design with the Verilog HDL" (2nd Edition) Hardcover – January 31, 2010
2. J.Bhasker: Verilog HDL primer, BS publication, 2001.
3. J. P. Uyemura, "Introduction to VLSI Circuits and System", Wiley, 2002
4. Neil Weste and K. Eshragian, “Principles of CMOS VLSI Design: A System Perspective,” 2nd edition, Pearson Education (Asia) Pvt.Ltd., 2000
5. Douglas A Pucknell& Kamran Eshragian , “Basic VLSI Design” PHI 3rd Edition (original edition – 1994)

OUTCOMES:

At the end of the course the students will be able to

- Create basic Register Transfer Level (RTL) models for combinational circuits & Sequential circuits using Verilog HDL.
- Create basic behavioral models for combinational circuits & Sequential circuits using Verilog HDL.
- Describe the usage of Programmable Logic Devices and FPGAs.
- Describe MOS devices theory and inverter circuit DC characteristics
- Design the basic digital building blocks using MOS circuit.
- Apply VLSI design concepts based on the requirements to conduct experiments or projects

GECX108 PLANT ENGINEERING

L	T	P	C
3	0	0	4

OBJECTIVES:

- To provide in depth knowledge on Plant Engineering
- To introduce detail engineering and P&ID
- To learn about the support to Instrumentation from other disciplines
- To study about the Installation and commissioning

MODULE I INTRODUCTION OF PLANTS 7

General Project Cycle – Feed – Sales - Plant Description, Component / Areas of Plant, Plant Layout, Plant Interfaces, Plant Location

MODULE II ELEMENTS OF PLANT 8

Main Elements of a Plant, Process Flow Scheme (PFD – Process Flow Diagram) P&ID's, Plant Legend Finalization.

MODULE III DETAIL ENGINEERING 10

P& ID Development with PFD's, Major Discipline Involvement & Inter discipline Interaction, Major Instrumentation & Control Systems - Development Phase – Instrument List , I/O Count, Specification Sheets, Instrument Installation (Hook ups) , Control Philosophy – Detail Engineering.

MODULE IV SUPPORT FROM OTHER DISCIPLINE 8

Other Discipline Supports to Instrumentation – Plot Plan, Piping / Equipment Plan, Electrical Area Classification, Fire Hazardous Classification Telecommunication Systems - Control Network architecture.

MODULE V INSTALLATION AND COMMISSIONING 7

Plant Construction - Key Drawings for Construction Support Construction Activities, System Testing, Startup / Commissioning, Production.

MODULE VI CASE STUDIES 5

Case studies of Water Treatment Plant - Paper Industry – Power Plant etc

L – 45; Total Hours –45

REFERENCES:

1. Duncan C Richardson, Plant Equipment and Maintenance Engineering Handbook, McGraw-Hill Education: New York, Chicago, San Francisco, Athens, London, Madrid, Mexico City, Milan, New Delhi, Singapore, Sydney, Toronto, 2014 McGraw-Hill Education
2. Gabriel Salvendy, Handbook of Industrial Engineering – Technology and operations Management, John Wiley & Sons, 2001.
3. Robert C Rosaler , Standard Handbook of Plant Engineering, Mc Graw Hill third Edition, 2004
4. R. Keith Mobley, Plant Engineer's Handbook, Technology and Engineering, 2001.

OUTCOMES:

At the end of the course, the student will be able to

- Review and correct P&IDs
- Do installation and commissioning of new plants
- Apply plant engineering in design and maintenance of water treatment plant / power plant etc

GECX109	NETWORK SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

The students should be able to

- Discuss the basic concepts of computer security, model and attacks
- Examine the major types of threats and the associated attacks
- Identify the encryption techniques in real time applications
- Understand the special requirements for wireless security and how authentication is implemented in wireless systems
- Understand the functions of Network Security Device Firewall and its types
- Interpret the various network intrusion such as computer viruses, network worms etc

MODULE I INTRODUCTION 6

Computer Security Concepts - The OSI Security Architecture - Security Attacks - Security Services - Security Mechanisms - A Model for Network Security - Standards – classical encryption techniques.

MODULE II SYMMETRIC ENCRYPTION AND MESSAGE CONFIDENTIALITY 7

Symmetric Encryption Principles - Symmetric Block Encryption Algorithms - Random and Pseudorandom Numbers - Stream Ciphers and RC4 - Cipher Block Modes of Operation

MODULE III PUBLIC KEY CRYPTOGRAPHY AND MESSAGE AUTHENTICATION 8

Approaches to Message Authentication - Secure Hash Functions - Message Authentication Codes - Public-Key Cryptography Principles - Public-Key Cryptography Algorithms - Digital Signatures

MODULE IV KEY DISTRIBUTION ,USER AUTHENTICATION AND TRANSPORT-LEVEL SECURITY 8

Symmetric Key Distribution Using Symmetric Encryption - Kerberos - Key Distribution Using Asymmetric Encryption - X.509 Certificates - Public-Key Infrastructure -Federated Identity Management - Web Security Considerations -

Secure Socket Layer and Transport Layer Security - Transport Layer Security

MODULE V WIRELESS NETWORK SECURITY, ELECTRONIC MAIL SECURITY AND IP SECURITY **8**

IEEE 802.11 Wireless LAN Overview -IEEE 802.11i Wireless LAN Security - Wireless Application Protocol Overview - Wireless Transport Layer Security - WAP End-to-End Security - Pretty Good Privacy - S/MIME – Domain Keys Identified Mail- IP Security Overview -IP Security Policy - Encapsulating Security Payload - Combining Security Associations - Internet Key Exchange - Cryptographic Suites

MODULE VI SYSTEM SECURITY **8**

Intruders -Intrusion Detection -Password Management - Types of Malicious Software - Viruses Virus Countermeasures – Worms - Distributed Denial of Service Attacks- The Need for Firewalls - Firewall Characteristics - Types of Firewalls - Firewall Basing - Firewall Location and Configurations

L – 45; Total Hours –45

REFERENCES:

1. William Stallings,"Network security Essentials:Applications and standards", Prentice Hall, Fifth Edition , ISBN-13: 978-0134527338, 2013
2. William Stallings, "Cryptography and Network Security: Principles and Practice", Pearson, ISBN-13:978-0-273-79335-9,2013
3. Behrouz Forouzan, Debdeep Mukhopadhyay,Cryptography and network security (sie) 2nd edition, ISBN-13: 978-0070702080, 2016
4. Wikipedia, "Network Security and Management" , https://en.wikipedia.org/wiki/Book:Network Security and Management, 2014.
5. Nitesh Dhanjani, Justin Clarke, "Network Security Tools", O'Reilly Media, ISBN-13: 9780596007942, 2005.

OUTCOMES:

Students who complete this course will be able to

- Recognize the computer security concepts, architecture attacks and model
- Distinguish the symmetric and asymmetric encryption techniques
- Apply the cryptographic algorithms in different applications
- Express the network security designs using available secure solutions

such as PGP,SSL, IPSec, etc.

- Describe the firewalls principles and different types of firewalls applied in organization
- Identify abnormalities within the network caused by worms, viruses and Network related security treats**.**

GECX110	KNOWLEDGE MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course

- Focuses on positioning knowledge as a valuable commodity, embedded in products and in the tacit knowledge of highly mobile individual employees.
- Presents KM as a deliberate and systematic approach to cultivating and sharing an organization's knowledge base.
- Brings out the paradigm in terms of information technology and intellectual capital.

MODULE I KNOWLEDGE MANAGEMENT 6

KM Myths – KM Life Cycle – Understanding Knowledge – Knowledge, intelligence – Experience – Common Sense – Cognition and KM – Types of Knowledge – History of Knowledge Management - From Physical assets to Knowledge Assets – Expert knowledge – Human Thinking and Learning.

MODULE II KNOWLEDGE MANAGEMENT SYSTEMS AND MODELS 9

Challenges in Building KM Systems – Conventional Vs KM System Life Cycle (KMSLS) – Knowledge Creation and Knowledge Architecture – KM cycle - Different variants of KM cycle - KM models - Implications and practical implementations.

MODULE III CAPTURING KNOWLEDGE AND SHARING 9

Tacit knowledge capture - Explicit knowledge codification – Knowledge taxonomies - Knowledge sharing - Communities - Obstacles to knowledge capture and sharing.

MODULE IV KNOWLEDGE MANAGEMENT TOOLS 9

KM System tools – Neural Network – Association Rules – Classification Trees – Data Mining and Business Intelligence – Knowledge capture and creation tools - Content creation tools - Data mining and knowledge discovery – Content management tools - Knowledge sharing and dissemination tools – Group ware

and Collaboration tools - Intelligent filtering tools.

MODULE V KNOWLEDGE APPLICATION 6

KM at individual level - Knowledge workers - Task analysis and modeling - Knowledge application at group and organizational levels – Knowledge repositories - Knowledge reuse -Case study: e-learning.

MODULE VI VALUE OF KNOWLEDGE MANAGEMENT 6

KM return on investment and metrics - Benchmarking method – Balanced scorecard method - House of quality method - Results based assessment method - Measuring success - Future challenges for KM.

L – 45; Total Hours –45

TEXT BOOKS:

1. Elias M. Awad, Hassan M. Ghaziri, “Knowledge Management”, Prentice Hall, 2nd Edition, 2010.
2. Jay Liebowitz, “Handbooks on Knowledge Management”, 2nd Edition, 2012.
3. Irma Becerra-Fernandez, Rajiv Sabherwal, ”Knowledge Management: Systems and Processes”, 2010.

OUTCOMES:

Students who complete this course will be able to

- Describe the fundamental concepts in the study of knowledge and its creation, acquisition, representation, dissemination, use and re-use, and management.
- Explains the core concepts, methods, techniques, and tools for computer support of knowledge management.
- Critically evaluate current trends in knowledge management and apply it for e-learning

GECX111 CYBER SECURITY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the basics of Cyber Security Standards and Policies.
- To know the legal, ethical and professional issues in Cyber security.
- To understand Cyber Frauds and Abuse and its Security Measures.
- To know the technological aspects of Cyber Security.

MODULE I FUNDAMENTALS OF CYBER SECURITY 7

Security problem in computing – Cryptography Basics – History of Encryption – Modern Methods – Legitimate versus Fraudulent Encryption methods – Encryption used in Internet.

MODULE II CYBERCRIME AND CYBEROFFENSES 8

Cybercrime and Information Security – Cybercriminals – Classifications of Cybercrimes – Email Spoofing – Spamming – Cyber defamation – Internet Time Theft – Forgery – Web jacking – Hacking – Online Frauds – Software Piracy – Mail Bombs – Password Sniffing – Cyberoffenses – Categories – Planning the attacks – Cyberstalking – Cybercafe and Cybercrimes – Botnets.

MODULE III CYBERCRIME: MOBILE AND WIRELESS DEVICES 8

Proliferation of Mobile and Wireless Devices – Trends in Mobility – Credit card frauds in Mobile and Wireless Computing – Security Challenges – Authentication Service Security – Attacks on Mobile Phones.

MODULE IV TOOLS AND METHODS USED IN CYBERCRIME 8

Proxy Servers and Anonymizers – Phishing – Password Cracking – Keyloggers and Spywares – Virus and Worms – Trojan Horses and Backdoors – Steganography – DoS and DDoS Attacks.

MODULE V SECURITY POLICIES 7

Introduction - Defining User Policies – Passwords – Internet Use – Email Usage – Installing/ Uninstalling Software – Instant Messaging – Defining System Administrative Policies – Defining Access Control Developmental Policies Standards, Guidelines and Procedures – Basics of assessing a system

MODULE VI COMPUTER FORENSICS 7

General Guidelines – Finding Evidence on the PC - Finding Evidence in System Logs – Windows Logs – Linux Logs – Getting Back Deleted Files – Operating System Utilities – The Windows Registry.

L – 45; Total Hours –45

TEXT BOOKS:

1. Nina Godbole, Sunit Belapure, “Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Wiley, 2011.

2. Chuck Easttom, “Computer Security Fundamentals”, 2nd Edition, Pearson Education, 2012.

REFERENCES:

1. Charles B. Pfleeger, Shari Lawrence Pfleeger, “Security in Computing”, 3rd Edition, Pearson Education, 2003.
2. William Stallings, “Cryptography and Network Security – Principles and Practices”, 3rd Edition, Pearson Education, 2003.
3. Atul Kahate, “Cryptography and Network Security”, Tata McGraw Hill, 2000.

OUTCOMES:

Upon completion of this course, students will be able to

- Explain the general security issues.
- Discuss various cybercrimes and offenses.
- Outline the occurrence of Cybercrime in mobile and wireless environment.
- Use relevant tools and methods in cybercrime
- Apply security policies in cyber forensics.
- Outline the strategies adopted in computer forensics.

GECX112 GENETIC ENGINEERING L T P C
4 0 0 4

OBJECTIVES:

The course aims to provide an advanced understanding of the core principles and topics of Cell and Organism reproduction and the Principles of heredity and their experimental basis, and to enable students to be able to apply these principles in assessment of pedigrees to identify genotypes and predict the mating outcomes.

MODULE I GENETICS AND ORGANISM 10

Genetics and human affairs, Genetics and Biology, Genes and Environment, Techniques of genetic analysis, The chromosome theory of heredity, Sex chromosomes, Sex linkage, The parallel behaviour of autosomal genes and chromosomes.

MODULE II MENDELISM AND LINKAGE 12

Mendel's laws of inheritance, Interaction of genes, Variations on dominance, Multiple alleles, Lethal alleles, Several genes affecting the same character, Penetrance and expressivity, Linkage- Basic eukaryotic chromosome mapping, The discovery of linkage, Recombination linkage symbolism, Linkage of genes on X chromosomes, Linkage maps, Examples of linkage maps.

MODULE III FINE STRUCTURE OF GENES 10

The concept of promoter, Coding sequence, Terminator, Induction of gene for expression. The concept of extranuclear genome in higher plants and animals, Overview of mitochondrial genome, Chloroplast genome.

MODULE IV RECOMBINATION IN BACTERIA AND VIRUSES 10

Conjugation recombination and mapping the E.coli chromosomes, Transformation, Transduction, Chromosome mapping. Population genetics: Darwin's revolution, Variation and its modulation, The effect of sexual reproduction on variation, The sources of variation, Selection quantitative genetics

MODULE V PRINCIPLES OF PLANT BREEDING 9

Objectives, Selfing and crossing techniques, Male sterility,Incompatability, Hybrid vigour.

MODULE VI HUMAN GENOME PROJECT 9

Genetic diseases in humans, Genetics and society

L – 45; T – 15; Total Hours –60

REFERENCES:

1. In Introduction to genetic analysis, Griffiths, Miller, Suzuki, Lewontin and Gelbart, Freeman and Company.
2. Genetics, A.V.S.S. Sambamurty, Narosa Publishing House.
3. Concepts of Genetics, Klug & Cummings, Prientice Hall.
4. Molecular Cloning, Moniatisetal, Cold Spring Harbor Laboratory.

OUTCOMES:

At the end of the course students will be able to

- Describe the structure, function and replication of DNA as the genetic material
- Describe gene structure, expression and regulation
- Describe the chromosomal basis of inheritance and how alterations in chromosome number or structure may arise during mitosis and meiosis

GECX113	FUNDAMENTALS OF PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The students would gain knowledge on

- Technicalities attached to Project Management and Significance of Quality Consideration
- Project management methodologies – tools and techniques, supplemented with examples from case studies
- The importance of Efficient HR team and role of Communication in executing Projects.
- Managing Risks in Project Management

MODULE I INTRODUCTION TO PROJECT MANAGEMENT 9

Introduction to Project and Project Management-Project Management as a Career-Project Management Skill Sets-Project Scope Management: Project Charter, Scope Creep, Scope Validation, Scope Change Control-Type of Organization: Organization Structure-Influence of Organization Structure on Project, Project Stakeholders and Organizational Productivity.

MODULE II PROJECT MANAGEMENT PROCESS, TOOLS AND TECHNIQUES 8

Project life cycle-Initiation, Planning, Execution, Monitoring and Closing Phase; - Link between project management process, process groups and knowledge areas; Project management tools and techniques- Project Stakeholders description and mapping - Stakeholder Management Process

MODULE III PROJECT QUALITY, COST AND SCHEDULE MANAGEMENT 10

Triple constraints of project-quality, cost and schedule-Quality Planning, Quality Assurance and Quality Control, Process Control, Cost of Quality, Seven Tools of Quality Control- Cost Management: Cost Estimating Methods, Estimating Completion Cost, Earned Value Management, Budgeting, Life-Cycle Cost analysis- Project Time Management: Duration Estimation Method, FS/FF/SS/ SF Relations, Lead/Lag, Arrow Diagram Method and Precedence Diagram Method for Scheduling-Resource Allocation

MODULE IV PROJECT HR MANAGEMENT 5

Organizational Goals- (MBO/MBE/MBP)-Responsibility Assignment Matrix (RAM)-Types of Powers- Manage or Lead-Conflict management Techniques-Performance Evaluation Process-Motivation Theories and its Application for execution of Projects-Leadership Styles-Project Team Building-Project Staffing Constraints/Policies

MODULE V COMMUNICATION MANAGEMENT 5

Communication Management: Understanding Body languages of Project Personnel-Effective Communications- Interpersonal Skills for project Managers-PMIS-Communicating with the Customer-Communicating with Management- Formal vs. Informal Communications-Written, Verbal and Non-Verbal Communications.

MODULE VI PROJECT PROCUREMENT & RISK MANAGEMENT 8

Introduction to Project Procure Management: Soliciting RFQ/RFP-Contract Proposals-Contract Negotiation-Contract Closure-Risk Management: Defining risks-Risk management process-Risk identification-Qualitative and Quantitative Risk-Probability and Decision trees-Risk Response strategies / methods-Expected monetary value-Risk vs. life cycle phases

L – 45; Total Hours –45

REFERENCES:

1. Jack. R. Meredith, Samuel. J. Mantel & Scott. M. Shafer, Project Management in Practice, Fifth Edition, Bangalore: Wiley, 2015
2. Bob Hughes, Mike Cotterrel “Software Project Management”, Tata McGraw-Hill, 2009

OUTCOMES:

- Learners will be able to identify the Key Knowledge Areas and apply PM process in hypothetical project assignments given as continuous assessment.
- They would be able to suitably recognize tools and techniques required for various phases included in a project.
- They would also be able to manage scope, time, cost and other major components that would help them to execute the project efficiently.

GECX114 OPERATIONS RESEARCH

L	T	P	C
3	0	0	3

OBJECTIVES:

- To acquire knowledge and training in optimization techniques.
- To get knowledge about optimization in utilization of resources.
- To understand and apply operations research techniques to industrial operations

MODULE I LINEAR PROGRAMMING PROBLEM 8

Linear programming – formulation of the problem - graphical interpretation of optimality - Simplex method – to obtain basic feasible solution – types of linear programming solution – complications and their resolution.

MODULE II ARTIFICIAL VARIABLE AND TWO PHASE METHOD, DUALITY 6

Artificial variable - Big M method – Two phase method – alternative optimal solution – unbounded solution - Duality – primal dual relationships - rules of constructing the dual from primal.

MODULE III TRANSPORTATION PROBLEM & ASSIGNMENT PROBLE 8

Transportation problems – Initial basic feasible solutions, MODI method, Unbalance in transportation, Degeneracy in transportation models, Assignment problem – Minimization and Maximization type of problems by Hungarian method.

MODULE IV NETWORK AND SEQUENCING PROBLEMS 8

PERT and CPM – Network diagram – Fulkerson's rule - CPM Probability of achieving completion date – Crash time – Cost analysis. Sequencing N jobs through 2 machines and 3 machines.

MODULE V QUEUING THEORY & SIMULATION 7

Poisson arrivals and exponential service times – characteristics of Queuing models – single channel – Introduction to multi channel models – Random number generation – Monte Carlo Simulation.

MODULE VI INVENTORY CONTROL, REPLACEMENT MODELS AND GAME THEORY 8

Types of inventory- Inventory cost - EOQ - Deterministic inventory problems – Introduction to probabilistic models & system level inventory control - Replacement models – Replacement of items that deteriorate with time – value of money changing with time – not changing with time – Individual and group replacement policy - Game theory – simple games.

L – 45; Total Hours –45

TEXT BOOKS:

3. Hamdy ATaha, “Operations Research an introduction”, 8th edition, Phil Pearson, 2007.
4. Winston.W.L., “Operations Research”, 4th edition, Thompson-Brooks/Cole, 2003.

REFERENCES:

1. Wayne.L. Winston, “Operations Research applications and algorithms”, 4th edition, Thomson learning, 2007.
2. Frederick. S. Hiller and Gerald.J.Lieberman, “Operations Research concepts and cases”, 8th edition (SIE), Tata McGraw – Hill Pub. Co. Ltd., New Delhi, 2006.
3. A. Ravindran, D. T. Phillips and J. J. Solberg, "Operations Research:Principles and Practice", 2nd edition, John Wiley & Sons, New York, 1992.
4. Robertazzi. T.G., “Computer networks and systems-Queuing theory and performance evaluation”, 3rd edition, Springer, 2002.

OUTCOMES:

At the end of the course students will be able to

- solve linear programming problems
- solve transportation and assignment problems.
- solve network and sequencing problems.
- apply the operations research techniques to solve industrial problems.

GECX115	NANO TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the basic concepts of Nanoscience relevant to the field of engineering.
- To provide an exposure about the importance of various synthesis method.
- To enrich the knowledge of students in various characterisation techniques.

MODULE I INTRODUCTION & CLASSIFICATION OF NANOMATERIALS 9

Definition - Origin of nanotechnology - Difference between bulk and nanomaterials- Top-down and bottom-up processes - Size dependent properties (magnetic, electronic,transport and optical), Classification based on dimensional property - 0D, 1D, 2D and 3D nanostructures – Kubo gap.

MODULE II TYPES OF NANOMATERIALS 9

Metal oxides and metal nano particles - Ceramic nano particles - Semi conducting quantum dots - Core-shell quantum dots - Nanocomposites - Micellar nanoparticles.

MODULE III PRODUCTION OF NANOPARTICLES 7

Sol-gel, hydrothermal, solvothermal, Plasma Arcing, Electro deposition, RF sputtering, Pulsed laser deposition, Chemical vapour, deposition.

MODULE IV CARBON BASED NANOMATERIALS 6

Carbon nanotubes: Single wall nanotubes (SWNT), Multiwall nanotubes (MWNT) - structures-carbon nanofibre, Fullerenes-Application of carbon nanotubes and Fullerenes.

MODULE V NANOPHOTONICS 7

Light and nanotechnology, Interaction of light and nanotechnology, Nanoholes and photons, nanoparticles and nanostructures; Nanostructured polymers, Photonic Crystals, Solar cells.

MODULE VI CHARACTERISATION TECHNIQUES 7

Basic principles of scanning Electron Microscopy (SEM), Atomic force microscopy (AFM), Scanning tunneling microscopy (STM), Scanning probe

microscopy (SPM) and Transmission electron microscopy (TEM), Particle size analyzer, Luminescence techniques.

L – 45; Total Hours –45

TEXT BOOKS:

1. Hari Singh Nalwa, “Handbook of Nanostructured Materials and Nanotechnology”, Academic Press, 2000.
2. Guozhong Cao, “Nanostructures and Nano materials-Synthesis, Properties and Applications”, Imperial College Press (2011).
3. Zhong Lin Wang, “Handbook of Nanophase and Nanomaterials (Vol 1 and II)”, Springer, 2002.
4. Mick Wilson, Kamali Kannangara, Geoff smith, “Nanotechnology: Basic Science and Emerging Technologies”, Overseas press, 2005.

REFERENCES:

1. A. Nabok, “Organic and Inorganic Nanostructures”, Artech House, 2005.
2. C.Dupas, P.Houdy, M.Lahmani, Nanoscience: “Nanotechnologies and Nanophysics”, Springer-Verlag Berlin Heidelberg, 2007.
3. Mick Wilson, Kamali Kannangara, Michells Simmons and Burkhard Raguse, “Nano Technology – Basic Science and Emerging Technologies”, 1st Edition, Overseas Press, New Delhi,2005.
4. M.S. Ramachandra Rao, Shubra SinghH, “Nanoscience and Nanotechnology: Fundamentals to Frontiers”, Wiley, 2013.

OUTCOMES:

At the end of this course, the students will be able to:

- Apply the knowledge of different types of nanomaterials for various engineering applications.
- Acquire the knowledge of various methods of production of nanomaterials.
- Familiarize with various characterization techniques.

GECX116	VEHICLE MAINTENANCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To know about the various methods of maintaining procedure, vehicle insurance and basic problems in a vehicle.
- The student able to impart knowledge in maintaining of engine components and subsystems.
- The student able to impart knowledge in maintaining of transmission, driveline, steering, suspension, braking and wheels.
- The student able to impart **carefully maintaining their vehicle and can increase driving safety.**

MODULE I MAINTENANCE, WORKSHOP PRACTICES, SAFETY AND TOOLS **7**

Maintenance – Need, importance, primary and secondary functions, policies - classification of maintenance work - vehicle insurance - basic problem diagnosis. Automotive service procedures – workshop operations – workshop manual - vehicle identification. Safety – Personnel, machines and equipment, vehicles, fire safety - First aid. Basic tools – special service tools – measuring instruments – condition checking of seals, gaskets and sealants. Scheduled maintenance services – service intervals - Towing and recovering.

MODULE II ENGINE AND ENGINE SUBSYSTEM MAINTENANCE **8**

General Engine service- Dismantling of Engine components- Engine repair- working on the underside, front, top, ancillaries- Service of basic engine parts, cooling and lubricating system, fuel system, Intake and Exhaust system, electrical system - Electronic fuel injection and engine management service - fault diagnosis- servicing emission controls.

MODULE III TRANSMISSION AND DRIVELINE MAINTENANCE **8**

Clutch- general checks, adjustment and service- Dismantling, identifying, checking and reassembling transmission, transaxle- road testing- Removing and replacing propeller shaft, servicing of cross and yoke joint and constant velocity joints- Rear axle service points- removing axle shaft and bearings- servicing differential assemblies- fault diagnosis.

MODULE IV STEERING AND SUSPENSION MAINTENANCE 7

Maintenance and Service of Mc person strut, coil spring, leaf spring, shock absorbers. Dismantling and assembly procedures. Inspection, Maintenance and Service of steering linkage, steering column, Rack and pinion steering, Recirculating ball steering service- Worm type steering, and power steering system.

MODULE V BRAKE AND WHEEL MAINTENANCE 7

Inspection, Maintenance and Service of Hydraulic brake, Drum brake, Disc brake, parking brake. Bleeding of brakes. Wheel alignment and balance, removing and fitting of tyres, tyre wear and tyre rotation.

MODULE VI AUTO ELECTRICAL AND AIR CONDITIOING MAINTENANCE 8

Maintenance of batteries, starting system, charging system and body electrical -Fault diagnosis using Scan tools. Maintenance of air conditioning parts like compressor, condenser, expansion valve, evaporator - Replacement of hoses- Leak detection- AC Charging- Fault diagnosis Vehicle body repair like panel beating, tinkering, soldering, polishing, painting.

L – 45; Total Hours –45

TEXT BOOKS:

1. Ed May, "Automotive Mechanics Volume One" , Mc Graw Hill Publications, 2003
2. Ed May, "Automotive Mechanics Volume Two" , Mc Graw Hill Publications, 2003
3. Vehicle Service Manuals of reputed manufacturers
4. Vehicle maintenance and garage practice by Jigar A.Doshi Dhru U.Panchal,Jayesh P.Maniar. 2014
5. A Practical Approach to Motor Vehicle Engineering and Maintenance 3rd Edition by Allan Bonnick.

REFERENCES:

1. Bosch Automotive Handbook, Sixth Edition, 2004.
2. Advanced Automotive Fault Diagnosis by Tom Denton 2011.
3. Nissan Patrol Automotive Repair Manual: 1998-2014 by Haynes Manuals Inc.
4. Automobile electrical manual a comprehensive guide by Haynes manual car repair.

OUTCOMES:

On completion of the course student should be able to

- Prepare maintenance schedules and procedures with appropriate tools.
- Demonstrate the procedure and methods to repair and calibrate the engine.
- **Analyze the causes and remedies for fault in transmission and drive line systems.**
- **Analyze the causes and remedies of steering and suspension systems.**
- **Analyze the causes and remedies of brake system.**
- **Demonstrate the procedure for wheel alignment and wheel balanced.**

GECX117	FUNDAMENTALS OF DIGITAL IMAGE PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Describe and explain basic principles of digital image processing
- Design and implement algorithms that perform basic image processing
- Design and implement algorithms for advanced image analysis
- Assess the performance of image processing algorithms and systems

PRE-REQUISITES:

- Basic knowledge of transforms in Mathematics

MODULE I DIGITAL IMAGE FUNDAMENTALS 8

Elements of Image Processing System, Fundamentals steps in Digital Image Processing, Image Sampling & Quantization, Spatial and Gray Level Resolution.

MODULE II COLOR IMAGE PROCESSING 8

Fundamental of color image processing, color models- RGB, CMY, HIS, Pseudo color image processing

MODULE III IMAGE ENHANCEMENT 7

Basic gray level Transformations, Histogram Processing, Spatial Filtering

MODULE IV IMAGE TRANSFORMS 7

2D-DFT, DCT, Haar Transform, Fundamentals of 2D-wavelet transform, sub-band coding

MODULE V IMAGE SEGMENTATION AND RESTORATION 8

Point, line and edge detection methods ,Image Segmentation and its types, Restoration: Noise model, Inverse filter and Wiener filter.

MODULE VI IMAGE COMPRESSION 7

Fundamentals of redundancies, Basic Compression Methods: Huffman coding, Arithmetic coding, JPEG and MPEG Compression standards.

TOTAL HOURS 45

TEXT BOOKS

1. Gonzalez and Woods, "Digital Image Processing", 3rd Edition, Pearson Education, 2016.
2. Anil. K. Jain, "Fundamentals of Digital Image Processing"; 4th Edition, PHI, 2007

REFERENCES

1. Pratt William, "Digital Image Processing", John Wiley & Sons, 2007.
2. Arthur Weeks Jr., "Fundamentals of Digital Image Processing", PHI, 2006.

OUTCOMES:

On completion of the course, students will be able to

- Explain the fundamental concepts of digital image processing.
- Discuss about color image processing
- Recognize & apply various image enhancement techniques.
- Apply various transforms for image processing.
- Apply various techniques for image segmentation and restoration.
- Identify and use appropriate image compression techniques

Group II courses
(To be offered in VII Semester)

GECX201	GREEN DESIGN AND SUSTAINABILITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart knowledge to face challenges, the technology poses for water, energy, and climate change by implementing sustainable design.

MODULE I CONCEPTS OF SUSTAINABLE DEVELOPMENT 7

Objectives of Sustainable Development - Need for sustainable development-Environment and development linkages - Globalisation and environment-Population, poverty and pollution- global, regional and local environment issues-Green house gases and climate change.

MODULE II SUSTAINABLE DEVELOPMENT OF SOCIO ECONOMIC SYSTEMS 8

Demographic dynamics of sustainability- Policies for socio economic development- Sustainable Development through trade- Economic growth- Action Plan for implementing sustainable development- Sustainable Energy and Agriculture.

MODULE III FRAME WORK FOR ACHIEVING SUSTAINBAILITY 7

Sustainability indicators- Hurdles to sustainability- Business and Industry – Science and Technology for Sustainable Development- Performance indicators of sustainability and assessment mechanism- Constraints and barriers of Sustainable Development.

MODULE IV GREEN BUILDINGS 8

Introduction to Green Building- Energy- Water- Materials and Resources - Sustainable Sites and Land Use - Indoor Environmental Quality- Life Cycle Assessment- Energy, water and materials efficiency.

MODULE V ENERGY CONSERVATION AND EFFICIENCY 7

Energy savings- Energy Audit- Requirements- Benefits of Energy conservation-Energy conservation measures for buildings- Energy wastage- impact to the environment.

MODULE VI GREEN BUILDINGS DESIGN 8

Elements of Green Buildings Design- Foundation, Electrical, Plumbing, flooring, Decking, roofing, insulation, wall coverings, windows, siding, doors and finishing, LEED certification for Green Buildings, Green Buildings for sustainability.

L – 45; Total Hours –45

TEXT BOOKS:

1. Kirby, J., Okeefe, P., and Timber lake, “Sustainable Development”, Earthscan Publication, London, 1995.

REFERENCES:

1. Charles Kibert, J., “Sustainable Construction: Green Building Design and Delivery”, 2nd Edition, John Wiley and sons, 2007.

OUTCOMES:

At the end of the course, the students will be able to

- Explain the relationship between sustainability and emergence of green building practices.
- Address the economic, environmental, and social concerns.

GECX202 APPROPRIATE TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES:

- To impart students knowledge about the basics and applications of various appropriate technologies in the field of civil engineering.

MODULE I BASICS CONCEPTS 7

Back ground, Tools, Choices and Implications, Appropriate Technology Movement (an overview) - Basic design process, basic financial analysis-discounted cash flow, and energy fundamentals.

MODULE II APPROPRIATE TECHNOLOGY WITH REFERENCE TO BUILDING DESIGN 7

Appropriate Building Materials, Appropriate Energy Saving Techniques, Water Conservation (Indoor), Rain Water Harvesting.

MODULE III WATER, HEALTH AND SANITATION MANAGEMENT 7

Water Storage: Designing Dams and Pipelines, Appropriate Selection for Sanitation Technique, Sewerage, Communal Health and Waste Water Recycling.

MODULE IV WASTE MANAGEMENT 8

Types of Waste - Sources - Collections and On-Site Processing -Transferring Stations - Disposal Systems - Recycling.

MODULE V ENERGY EFFICIENT TECHNIQUES 8

Green building concepts-renewable energy sources- Solar – Steam and wind-Biofuels - Biogas – Electricity.

MODULE VI TECHNOLOGY POLICY 8

Government Policies- Energy Policy-Appropriate technology Development Centre-its function and responsibilities-Building policies-Case Studies.

L – 45; Total Hours –45

TEXT BOOKS:

1. Barrett Hazeltine and Christopher Bull, “Appropriate Technology: Tools Choices and Implications”, Academic Press, Orlando, USA, 1998.
2. Ken Darrow and Mike Saxenian, “Appropriate Technology Source Book : A Guide to Practical Books for Village and Small Community Technology”, Stanford, 1986.

REFERENCES:

1. Richard Heeks, “Technology and Developing Countries: Practical Applications Theoretical Issues”, 1995.
2. John Pickford, “The Worth of Water : Technical Briefs on Health, Water and Sanitation”, Intermediate Technology Publications, 1998.

OUTCOMES:

- At the end of the course, the students will be able to use suitable technologies for various conditions for sustainable development.

GECX203 ENGINEERING SYSTEM MODELLING AND SIMULATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn the concepts, techniques, tools for modeling and simulation systems and environments through the use of computers.
- To study the various aspects of discrete dynamic, stochastic systems modeling and conducting experiments with those models on a computer.

MODULE I INTRODUCTION 6

Systems – Modelling – types – systems components – Steps in model building- Simulation Algorithms and Heuristics; Simulation Languages.

MODULE II RANDOM NUMBERS / VARIATES 7

Random numbers – methods of generation – random variates for standard distributions like uniform, exponential, Poisson, binomial, normal etc. – Testing of Random variates – Monte Carlo Simulation.

MODULE III MODELLING PROCESS 7

Primitive Models : Establishing relationships via physical laws; Establishing relationships via curve fitting; Parameters estimation problems; Elementary state transition models.

MODULE IV DESIGN OF SIMULATION EXPERIMENTS 9

Steps on Design of Simulation Experiments – Development of models using of Highlevel language for systems like Queuing, Inventory, Replacement, Production etc., – Model validation and verification, Output analysis.

MODULE V SIMULATION LANGUAGES 10

Need for simulation Languages – Comparisons & Selection of Languages – GPSSARENA- EXTEND – Study of any one of the languages.

MODULE VI CASE STUDIES USING SIMULATION LANGUAGES 6

Case Study using simulation languages

L – 45; Total Hours –45

REFERENCES:

1. Law, A.M., & W.D. Kelton, “Simulation Modelling and Analysis”, McGraw

Hill, Singapore, 2000.
2. Harrel, C.R., et. al., “System Improvement Using Simulation”, 3rd Edition, JMI Consulting Group and ProModel Corporation, 1995.
3. Harrel, C.R. & T. Kerim, “Simulation Made Easy, A Manager’s Guide”, IIE Press, 1995.
4. Geoffrey Gordon, “Systems Simulation”, Prentice Hall, 2002.
5. David Kelton, Rondall P Sadowski, David T Sturrock, “Simulation with Arena”, Mc Graw Hill, 2004.

OUTCOMES:

The student should be able to

- Model and simulate systems and environments through the use of computers.
- Conduct experiments with discrete dynamic, stochastic system models on a computer.

GECX204 VALUE ANALYSIS AND ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To get acquainted with value analysis and engineering tool for productivity improvement.
- To understand and analyze the theory and methodology of Value Engineering.

MODULE I VALUE ENGINEERING BASICS 8

Origin of Value Engineering, Meaning of value, Definition of Value Engineering and Value analysis, Difference between Value analysis and Value Engineering, Types of Value, function - Basic and Secondary functions, concept of cost and worth, creativity In Value Engineering.

MODULE II VALUE ENGINEERING JOB PLAN AND PROCESS 6

Seven phases of job plan, FAST Diagram as Value Engineering Tool, Behavioural and organizational aspects of Value Engineering, Ten principles of Value analysis, Benefits of Value Engineering.

MODULE III ORIENTATION AND INFORMATION PHASES 8

Launching Value Engineering project work - Objectives and Targets - VE Project work: a time-bound programme - Projects and Teams - Time Schedule - Co-ordination - Consultant. Technical data - Marketing related information - Competition profile - Cost data - Materials Management related information - Quality related information - Manufacturing data.

MODULE IV FUNCTION ANALYSIS AND CREATIVE PHASES 9

Objectives - Function definition - Classification of functions - Higher level functions – Function – Cost – Function – Worth - Value Gap - Value index - How to carry out Function Analysis? – Fast Diagraming - Cost Modelling.

Creativity - How to improve creativity of an individual? – How to promote creativity in the organisation? - Obstacles to Creativity - Mental road blocks - Creativity killer phrases. Positive thinking - Ideas stimulators - Creativity techniques - Brainstorming.

MODULE V EVALUATION, INVESTIGATION AND RECOMMENDATION 6

Paired comparison and Evaluation Matrix techniques - Criteria for selection of

VE solutions. Design – Materials – Quality – Marketing – Manufacturing - Preview session. The report - presentation.

MODULE VI IMPLEMENTATION PHASE AND CASE STUDIES 8

Design department - Materials department - Production Planning & Control - Quality Control – Manufacturing – Marketing - Need for co-ordinated teams - The Action Plan. Value Engineering case studies.

L – 45; Total Hours –45

TEXT BOOKS:

1. Mudge, Arthur E. “Value Engineering- A systematic approach”, McGraw Hill, New York, 2000.
2. Kumar S, Singh R K and Jha J K (Ed), “Value Engineering”, Narosa Publishing House, 2005.

REFERENCES:

1. Park RJ, “Value Engineering: A Plan for Invention”, St.Lucie Press, New York, 1999.
2. Lawrence, D.M., “Techniques of Value Analysis and Engineering”, McGraw Hill 1988.
3. George, E.D., “Engineering Design: a Material and Processing Approach”, McGraw Hill, 1991.
4. Heller, D.E., “Value Management, Value Engineering and Cost Reduction”, Addison Wesley, 1988.

OUTCOMES:

- The student will be able to realize the value of products, processes and implement value analysis to achieve productivity improvement.

GECX205 INDUSTRIAL SAFETY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the various safety measures to be taken in different industrial environments.

MODULE I SAFETY MANAGEMENT **7**

Evolution of modern safety concept- Safety policy - Safety Organization - line and staff functions for safety- Safety Committee- budgeting for safety. safety education and training.

MODULE II SAFETY IN MANUFACTURING **7**

Safety in metal working-Machine guarding -Safety in welding and gas cutting - Safety in cold forming and hot working of metals -Safety in finishing, inspection and testing -Regulation.

MODULE III SAFETY IN CONSTRUCTION **8**

General safety consideration in Excavation, foundation and utilities – Cordoning – Demolition – Dismantling –Clearing debris – Types of foundations – Open footings.

Safety in Erection and closing operation - Safety in typical civil structures – Dams-bridges-water Tanks-Retaining walls-Critical factors for failure-Regular Inspection and monitoring.

MODULE IV ELECTRICAL SAFETY **8**

Electrical Hazards – Energy leakage – Clearance and insulation – Excess energy – Current surges – Electrical causes of fire and explosion – National electrical Safety code.

Selection of Environment, Protection and Interlock – Discharge rods and earthing device – Safety in the use of portable tools - Preventive maintenance.

MODULE V SAFETY IN MATERIAL HANDLING **8**

General safety consideration in material handling devices - Ropes, Chains, Sling, Hoops, Clamps, Arresting gears – Prime movers.

Ergonomic consideration in material handling, design, installation, operation and

maintenance of Conveying equipments, hoisting, traveling and slewing mechanisms.

Storage and Retrieval of common goods of shapes and sizes in a general store of a big industry.

MODULE VI SAFETY EDUCATION AND TRAINING 7

Importance of training-identification of training needs-training methods – programme, seminars, conferences, competitions – method of promoting safe practice - motivation – communication - role of government agencies and private consulting agencies in safety training – creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign – Domestic Safety and Training.

L – 45; Total Hours –45

REFERENCES:

1. Krishnan N.V, “Safety Management in Industry”, Jaico Publishing House, Bombay, 1997.
2. Blake R.B., “Industrial Safety”, Prentice Hall, Inc., New Jersey, 1973.
3. Fulman J.B., “Construction Safety, Security, and Loss Prevention”, John Wiley and Sons, 1979.
4. Fordham Cooper W., “Electrical Safety Engineering”, Butterworths, London, 1986.
5. Alexandrov M.P., “Material Handling Equipment”, Mir Publishers, Moscow, 1981.

OUTCOMES:

Students would be able to

- Acquire knowledge on various safety Hazards.
- Carry out safety measures for different industrial environments.

GECX206 ADVANCED OPTIMIZATION TECHNIQUES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the various advanced optimization tools.
- To provide an understanding to deal with ill identified and fuzzy problems.

MODULE I INTRODUCTION **7**

Review of conventional optimization techniques - limitations - limitation of exhaustive search - need for artificial intelligence - bio mimicking methods

MODULE II HEURISTICS METHODS **8**

Introduction – Advanced methods of algorithm design: Greedy method, Backtracking method, Divide and Conquer method – Dynamic programming – Heuristics exploration algorithms – Greedy search - Local search – Hill climbing – Tabu search – Gradient search – Beam search – Simulated Annealing.

MODULE III GENETIC ALGORITHM **7**

Introduction - Basics of GA – Population – Reproduction – Cross over – Mutation -genetic algorithms in search, optimization and machine learning-practical genetic algorithms.

MODULE IV ANT COLONY OPTIMIZATION **8**

Introduction: Ant Colony Optimization – Meta-heuristic Optimization – History – The ACO Meta-heuristic – ACO Algorithms: Main ACO – Ant system – Ant colony system – Max-Min Ant system – Applications: Routing in telecommunication networks – Travelling salesmen – Graph Coloring – Advantages & Disadvantages

MODULE V FUZZY LOGIC AND ANN **8**

Fuzzy logic, knowledge representation and inference mechanism – Fuzzy and expert control – standard Takagi-Sugeno mathematical characterizations – Design example – Biological foundations to intelligent systems: Artificial neural networks, Back-propagation networks, Radial basis function networks, and recurrent networks.

MODULE VI IMPLEMENTATIONS & APPLICATIONS 7

Reduction of size of an optimization problem – multilevel optimization – parallel processing – multi objective optimization – Job shop scheduling – Vehicle scheduling – Line balancing – Sensor integration.

L – 45; Total Hours –45

REFERENCES:

1. Singiresu S. Rao, “Engineering optimization – Theory and practices”, John Wiley and Sons, 1996.
2. Ravindran – Phillips –Solberg, “Operations Research – Principles and Practice, John Wiley and Sons, 1987.
3. Fredrick S.Hillier and G.J.Liberman, “Introduction to Operations Research”, McGraw Hill Inc. 1995.
4. Kalymanoy Deb, “Optimization for Engineering Design”, PHI, 2003
5. Christos H. Papadimitriou, Kenneth Steiglitz, Combinatorial Optimization, PHI 2006

OUTCOMES:

At the end of the course student will be able to

1. Formulate a real life situation as an optimization the problem.
2. Identify the appropriate solution methodology and provide a solution

GECX207 MATLAB SIMULINK

L	T	P	C
3	0	0	3

OBJECTIVES:

- Teach students how to mathematically model engineering systems
- Teach students how to use computer tools to solve the resulting mathematical models. The computer tool used is MATLAB and the focus will be on developing and solving models of problems encountered in engineering fields

MODULE I INTRODUCTION MATLAB DATA PRESENTATION 7

Vectors, Matrices -Vector/Matrix Operations & Manipulation- Functions vs scripts- Making clear and compelling plots-Solving systems of linear equations numerically and symbolically- Least squares regression -Curve fitting.

MODULE II MATLAB PLOT FUNCTION 7

Introduction- Plot Function – Animation- 3D Plots-Customizing Plots – Plot Applications- Saving &Painting Plots.

MODULE III ROOT FINDING AND COMPUTER REPRESENTATION OF NUMBERS 7

Linearization and solving non-linear systems of equations- The Newton-Rapson method- Integers and rational numbers in different bases- Floating point numbers- Round off and errors in basic arithmetic-Significant digits when reporting results

MODULE IV ORDINARY DIFFERENTIAL EQUATIONS 8

Numerical integration and solving 1^{st} order, ordinary differential equations (Euler's method and Runge-Kutta)- Use of ODE function in MATLAB

MODULE V NON-LINEAR DIFFERENTIAL EQUATIONS 8

Converting 2^{nd} order and higher ODEs to systems of 1^{st} order ODEs- Solving systems of ODEs via Euler's method and Runge-Kutta)- Solving single and systems of non-linear differential equations by linearization-Use of the function ODE in MATLAB to solve differential equations

MODULE VI INTRODUCTION OF SIMULINK 8

Simulink & its relations to MATLAB – Modeling a Electrical Circuit- Modeling a fourth order differential equations- Modeling the solution of three equations with three unknowns- Representing a model as a subsystem-Simulink demos.

L – 45; Total Hours –45

REFERENCES:

1. Griffiths D V and Smith I M, Numerical Methods for Engineers, Blackwell, 1991.
2. Laurene Fausett, Applied Numerical Analysis Using MATLAB, Pearson 2008.
3. Moin P, Fundamentals of Engineering Numerical Analysis, Cambridge University Press, 2001.
4. Wilson HB, Turcotte LH, Advanced mathematics and mechanics applications using MATLAB. CRC Press, 1997
5. Ke Chen, Peter Giblin and Alan Irving , Mathematical Exploration with MATLAB, Cambridge University Press, 1999.

OUTCOMES:

At the end of this unit students will be able to:

1. Use Matlab as a convenient tool for solving a broad range of practical problems in engineering from simple models to real examples.
2. Write programs using first principles without automatic use of built-in ones.
3. Write programs for solving linear and nonlinear systems, including those arising from boundary value problems and integral equations, and for root-finding and interpolation, including piecewise approximations.
4. Be fluent in exploring Matlab's capabilities, such as using matrices as the fundamental data-storage unit, array manipulation, control flow, script and function m-files, function handles, graphical output.
5. Make use of Maltab visual capabilities for all engineering applications.
6. An ability to identify, formulate, and solve engineering problems. This will be accomplished by using MATLAB to simulate the solution to various problems in engineering fields

GECX208	EMBEDDED SYSTEMS AND ITS APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide a detailed overview of embedded system.
- To equip students with the software development skills necessary for practitioners in the embedded systems field.
- To understand entire software development lifecycle and examine the various issues involved in developing software for embedded systems.

MODULE I EMBEDDED SYSTEMS OVERVIEW 8

Introduction –Embedded Systems vs. General computing systems- Fundamental Components of embedded systems- Characteristics- Challenges-Examples- Embedded System design process.

MODULE II EMBEDDED COMPUTING PLATFORM 8

Overview of Processors and hardware units in an embedded system-CPU buses – Memory devices –Memory types- I/O devices – Designing with computing platforms- Consumer electronics architecture-Design example: Alarm clock.

MODULE III REAL TIME EMBEDDED SYSTEMS 8

Programming embedded systems in assembly and C – Real time systems – Hard and Soft real time systems- Need for RTOS in Embedded Systems- Multiple tasks and processes –Context switching-Scheduling policies- Interprocess communication and synchronization.

MODULE IV EMBEDDED SOFTWARE DEVELOPMENT PROCESS and TOOLS 8

Development process of an embedded system-software modules and tools for implementation of an embedded system- Integrated development environment- Host and target machines-cross compiler-cross assembler-Choosing right platform.

MODULE V PROGRAM MODELING IN EMBEDDED SYSTEMS 8

Program Models – Data Flow Graph model-control DFG model-Synchronous DFG model- Finite state machines- UML modeling – UML Diagrams.

MODULE VI EMBEDDED SYSTEMS APPLICATION 5

Application specific embedded system – case study: digital camera hardware and software architecture, embedded systems in automobile, embedded system for a smart card.

Total Hours –45

TEXT BOOKS:

1. Marilyn Wolf , "Computers as components", Elsevier 2012.
2. Shibu. K.V, “Introduction to Embedded Systems”, Tata Mcgraw Hill,2009.
3. Rajkamal, "Embedded Systems Architecture, Programming and Design",1st Reprint,Tata McGraw-Hill, 2003
4. Frank Vahid and Tony Gwargie, "Embedded System Design", John Wiley & sons, 2002.

REFERENCES:

1. Sriram V Iyer and PankajGupta ,”Embedded Realtime Systems Programming ”Tata McGraw-Hill,2008
2. Qing Li and Carolyn Yao," Real-Time Concepts for Embedded Systems", CMPBooks, 2003
3. David E.Simon, "An Embedded Software Primer", Pearson Education, 2003

OUTCOMES:

On completion of this course, the students will be able to

- Identify the suitable processor and peripherals in embedded applications
- Develop embedded programs in assembly and c
- Choose the right platform for designing an embedded system
- Explore different scheduling mechanism in rtos
- Design the program model for embedded applications.
- Analyze different domain specific applications in embedded systems.

GECX209 USABILITY ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

The objective of this course is

- To understand the emerging concept of usability, requirements gathering and analysis.
- To learn about human computer interaction with the help of interfaces that has high usability.

MODULE I INTRODUCTION 6

Cost Savings – Usability Now – Usability Slogans – Discount Usability Engineering – Usability – Definition – Example – Trade-offs – Categories – Interaction Design – Understanding & Conceptualizing Interaction – Cognitive Aspects.

MODULE II USER INTERFACES 8

Generation of User Interfaces – Batch Systems, Line Oriented Interfaces, Full Screen Interfaces, Graphical User Interfaces, Next Generation Interfaces, Long Term Trends – Usability Engineering Life Cycle – Interfaces – Data Gathering – Data Analysis Interpretation and Presentation.

MODULE III INTERACTION DESIGN 8

Process of Interaction Design - Establishing Requirements – Design,Prototyping and Construction - Evaluation and Framework.

MODULE IV USABILITY TESTING 8

Usability Heuristics – Simple and Natural Dialogue, Users' Language, Memory Load, Consistency, Feedback, Clearly Marked Exits, Shortcuts, Error Messages, Prevent Errors, Documentation, Heuristic Evaluation – Usability Testing - Test Goals and Test Plans, Getting Test Users, Choosing Experimenters, Ethical Aspects, Test Tasks, Stages of a Test, Performance Measurement, Thinking Aloud, Usability Laboratories.

MODULE V USABILITY ASSESSMENT METHODS 8

Observation, Questionnaires and Interviews, Focus Groups, Logging Actual Use, User Feedback, Usability Methods – Interface Standards - National, International and Vendor Standards, Producing Usable In-House Standards.

MODULE VI USER INTERFACES 7

International Graphical Interfaces, International Usability Engineering, Guidelines for Internationalization, Resource Separation, Multilocale Interfaces – Future Developments – Case Study.

L – 45; Total Hours –45

TEXT BOOKS:

1. Yvonne Rogers, Helen Sharp, Jenny Preece, “Interaction Design: Beyond Human - Computer Interaction”, John Wiley & Sons, 3rd Edition, 2011 (Module I, II, III).
2. Jakob Nielsen, “Usability Engineering”, Morgan Kaufmann Academic Press, 1994. (Module I – VI).

REFERENCES:

1. Ben Shneiderman, Plaisant, Cohen, Jacobs, “Designing the User Interface: Strategies for Effective Human Interaction”, Pearson Education, 5th Edition, 2010.
2. Laura M. Leventhal, Julie A. Barnes, “Usability Engineering: Process, Products, and Examples”, Pearson/Prentice Hall, 2008

OUTCOMES:

Students who complete this course will be able to

- build effective, flexible and robust user interfaces.
- translate system requirements into appropriate human/computer interaction sequences.
- choose mode, media and device for the application requirements.

GECX210 SUPPLY CHAIN MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the various decision phases in a supply chain
- To be aware of the Supply Chain and its drivers
- To design Supply Chain Network
- To build a aggregate plan in supply chain
- To understand Sourcing Decisions in Supply Chain
- To comprehend the influence of Information technology in Supply Chain

MODULE I INTRODUCTION TO SUPPLY CHAIN 7

Understanding Supply Chain - Decision phases - Supply chain performance - Competitive and supply chain strategies - Achieving strategic fit - Expanding strategic scope

MODULE II SUPPLY CHAIN DRIVERS AND DESIGN 7

Drivers of supply chain performance – Designing distribution network - Network Design in the Supply Chain - Network design in Uncertain Environment

MODULE III AGGREGATE PLANNING AND MANAGING SUPPLY, DEMAND AND INVENTORY 8

Aggregate Planning in a Supply chain: role - Managing Supply - Managing Demand in Supply Chain – Cycle and Safety inventory in supply chain – Level of product availability.

MODULE IV MANAGING INVENTORY IN SUPPLY CHAIN 8

Managing Economies of Scale in a Supply Chain : Cycle Inventory- Managing uncertainty in a Supply Chain Safety Inventory- Determining optimal level of Product Availability

MODULE V SOURCING AND TRANSPORTATION 8

Sourcing decision in supply chain - Third and Fourth – Party Logistics providers - Supplier scoring and assessment - Transportation in a Supply Chain – Risk and Trade-offs in transportation design.

MODULE VI INFORMATION TECHNOLOGY IN A SUPPLY CHAIN 7

Information technology in a supply chain – CRM, ISCM, SRM in supply chain -

Over view of recent trends in Supply Chain: e-SRM, e-LRM, e-SCM.

L – 45; Total Hours –45

REFERENCES:

1. Sunil Chopra and Peter Meindl, “Supply Chain Management-Strategy Planning and Operation”, Pearson Education, 5th Indian Reprint, 2013.
2. Jananth Shah “Supply Chain Management – Text and Cases“ Pearson Education, 2008.
3. Altekar Rahul V, “Supply Chain Management-Concept and Cases”, Prentice Hall India, 2005.
4. Monczka et al., “Purchasing and Supply Chain Management”, Thomson Learning, 2nd Edition, 2nd Reprint, 2002.

OUTCOMES:

- After taking up the course the student will be able to brighten his prospects of taking up a career on supply chain management.
- The student decision making capability specific to supply chain issues in an industry is improved.
- The student can plan a well defined execution of supply chain strategy in companies.
- The student will be able to design a optimal distribution network as per the demands of the industry.
- The student can also determine the most favorable transportation plan for a company.
- The student will also be able to bring in company from paper environment to paperless environment.

GECX211 SYSTEMS ANALYSIS AND DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To describe the phases of the systems development life cycle
- To teach the automated tools for system development
- To develop and evaluate system requirements.
- To explain the organizational issues in system implementation
- To teach the usability testing and electronic data interchange
- To elucidate the importance of System analysis and design in electronic commerce.

MODULE I FUNDAMENTALS OF SYSTEM DEVELOPMENT 8

System Concept – Characteristics – Elements of System – Types of System – Modern Approach to System Analysis and Design – System Development Life Cycle – Approaches to Improving Development – Tools for System Development – Succeeding as a System Analyst – Skills – Managing the Project.

MODULE II AUTOMATED TOOLS FOR SYSTEMS DEVELOPMENT 7

What is requirements determination? Fact finding techniques, Tools for documenting procedure and decision-CASE Tools-Need for CASE tools-Reverse engineering and reengineering- phases of the software life cycle-Ranking projects-Value Chain Analysis- Corporate Strategic Planning vs. Information Systems Planning.

MODULE III SYSTEM ANALYSIS 8

Determining System Requirements – Traditional Methods - Modern Methods – Radical Methods – Structuring System Requirements – Process Modeling – Data Flow Diagramming – Logic Modeling – Conceptual Data Modeling – E-R Modeling.

MODULE IV SYSTEM DESIGN 8

System Implementation – Software Application Testing – Installation – Documentation – Training and Support – Organizational Issues in Systems Implementation – Maintaining Information System – Conducting System Maintenance.

MODULE V USABILITY AND MEASURING USER SATISFACTION **7**

Usability Testing-User satisfaction test- A tool for analyzing user satisfaction – Unified Modeling Language(UML)- Case study: System Design: Application in Human Resource-Financial Applications

MODULE VI SAD IN E-COMMERCE **7**

Systems analysis and design in the era of electronic commerce: B2B, B2C and C2C e-commerce -advantages and disadvantages of e-commerce. E-commerce system architecture – physical networks, logical network, World Wide Web, web-services - HTML, XML - case studies-El electronic data interchange: EDI standards - virtual private networks - XML and EDI

L – 45; Total Hours –45

REFERENCES:

1. Jeffrey A. Hoffer, Joey F. George, Joseph S. Valacich, “Modern Systems Analysis and Design”,Fifth Edition, Prentice Hall,March 2007.

2.Ned Kock, “Systems Analysis & Design Fundamentals” Sage South Asia, May 2008.

3. Joseph S. Valacich, Jeffrey A. Hoffer, Joey F. George, “Essentials Of System Analysis And Design” Prentice Hall , August 2005.

4. Rumbaugh et al, “Succeeding with Booch and Rambaugh Methods”, Addisson Wesley, second Edition, 1998.

5.Larman, C.,” Applying UML and Patterns. An introduction to Object-Oriented Analysis and Design”. Prentice-Hall PTR, 2002.

OUTCOMES:

- List the characteristics of the system and specify the approaches in the development of the system.
- Summarize the phases of the software life cycle
- Differentiate Corporate Strategic Planning and Information Systems Planning.
- Illustrate the system requirements through various modeling diagrams.
- Use tools and techniques for process and data modeling.
- Solve realistic systems analysis problems and perform user satisfaction test.

GECX212 ADVANCED MATERIALS L T P C

3 0 0 3

OBJECTIVES:

To make the student conversant with

- Dielectric materials
- Magnetic materials
- Energy materials
- Nano materials
- Semi conductors
- Smart materials

MODULE I **8**

Dielectric Materials- Polarization and Mechanism-Internal or local field-Clausius-Mossotti relation- Dielectric loss- Temperature and Frequency effect- Measurement of Dielectric constant and loss using Scherring bridge- electric break down- ferro, piezo, pyroelectric materials and its application.

MODULE II **8**

Magnetic Materials- Terminology and classification of magnetic materials (Dia, Para, Ferro & Ferri) – Magnetic moments due to electrospin – Domain theory of Hysteresis – Heisenberg theory of Exchange Interaction (without derivation)- Structure and properties of Ferrites- Properties of Soft and Hard Magnetic Materials- Application: floppy disk, CD ROM, Magneto optical recording.

MODULE III **8**

Energy Materials (Nuclear) - Introduction to nuclear materials- Materials for nuclear fuel in fission and fusion reactors, Fissile and fertile materials- Control & Construction Materials for Nuclear reactors, Moderators, Heat Exchangers- Radiation proof materials- Brief discussion of safety and radioactive waste disposal.

MODULE IV **7**

Nano Materials- The nanosize range- classification of nanomaterials- processing of nanomaterials-properties of nanomaterials- mechanical, electrical, magnetic properties- other properties- carbon based nanomaterials- other nanomaterials and its application.

MODULE V **7**

Semiconductors- The energy gap in solids-Extrinsic Semiconductors- Intrinsic Semiconductors- Hall Effect in semiconductors- Application of Hall Effect- Basic ideas of compound semiconductors -Semiconductor materials- Fabrication of Integrated Circuits- Some semiconductor Devices

MODULE VI **7**

Smart materials- aerospace materials Ni and Co based super alloys, Special steels, Titanium alloys, Intermetallics, ceramics and their composites, New High strength material, Properties of Materials, Materials in Medical Applications, Stainless steel alloys,Cobalt based alloys, titanium based alloys, polymers

L – 45; Total Hours –45

REFERENCES:

1. Materials science and Engineering: A first course by V. RAGHAVAN, 6th ed., Eastern Economy edition,Prentice Hall of India,2015
2. Materials science and Engineering: An Introduction by William D. Callister Jr., 7th ed. John Wiley & Sons Inc. 2007
3. Material science by Dr.M.Arumugam, Anurasha agencies ,third revised edition ,2002

OUTCOMES:

Students will be able to know

- significance of dielectric materials
- types and applications of magnetic materials
- applications of nuclear materials for energy harvesting
- applications of nano materials
- significance of semi conductor devices
- applications of smart materials

GECX213 NATIONAL SERVICE SCHEME

L	T	P	C
2	0	0	2

OBJECTIVES:

Primary Objective: Personality development through community service.
To achieve the above objective, the following should be adhered:

1. To provide an understanding about the aims, structure and programmes and activities of National Service scheme in terms of Nation Building
2. To develop certain basic skills for personality development through community development.
3. Understand the community in which they work and their relation
4. Identify the needs and problems of the community and involve them in problem-solving and
5. Practice national integration and social harmony.

MODULE I INTRODUCTION TO NSS 8

Orientation and structure of NSS,-Aims and Objectives of National Service Scheme- The history of NSS- Symbol and meaning- NSS hierarchy from national to college level – Role and responsibilities of various NSS functionaries

MODULE II PERSONALITY AND COMMUNITY DEVELOPMENT SKILLS 8

Importance of youth Leadership, Traits of Good Leadership and Personality Development. Role of youth in creating awareness through NSS Programmes on Health & Hygiene; Environmental Conservation and Enrichment for Sustainable Development; Sanitation and Swachh Bharat.

MODULE III UNDERSTANDING YOUTH 7

Definition and Profiles of youth categories, Youth Issues, Challenges and Opportunities for Youth, Youth as agent of social change & Community Mobilization .Role of Youth in Nation Building. National Youth Policy.

MODULE IV SOCIAL HARMONY AND NATIONAL INTEGRATION 7

National Integration, Various obstacles in the way of National Integration; such as caste, religion, language and provisional problems etc. Role of youth in Peace building and conflict resolution- Globalization and its Economic Social Political and

Cultural impacts.

L – 30; Total Hours –30

TEXT BOOKS:

1. National Service Scheme – A Youth Volunteers Programme for Under Graduate students as per UGC guidelines J.D.S.Panwar et al. Astral International. New Delhi.
2. National Service Scheme Revised Manual, 2006.Govt. of India. Ministry of Youth Affairs & Sports. New Delhi.
3. Social Problems in India, *Ram Ahuja.*

REFERENCES:

1. National Youth Policy-2014. Ministry of Youth Affairs & Sports. .Govt. of India

OUTCOMES:

On successful completion of this course-

- Students will have exposure to the the aims, structure and programmes and activities of National Service scheme in terms of Nation Building
- Students will be trained to skills for personality development through community development.
- Students will gain knowledge about national integration and social harmony.
- Students will be exposed to the role of youths in Nation building Students will gain

GECX214	AUTOMOTIVE POLLUTION AND CONTROL	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To have a fair knowledge in automotive pollution control.
- To understand the concept of formation and control techniques of pollutants like UBHC, CO, NOx, particulate matter and smoke for both SI and CI engine will be taught to the students.
- To know about the instruments for measurement of pollutants
- To get introduced about emission standards

MODULE I EMISSION FROM AUTOMOBILES 8

Sources of Air Pollution. Various emissions from Automobiles — Formation — Effects of ollutants on environment and human beings. Emission control techniques – Modification of fuel, after treatment devices. Emission standards. Automotive waste management, old vehicle disposal, recycling, tyre recycling

MODULE II SI ENGINE EMISSIONS AND CONTROL 9

Emission formation in SI Engines- Carbon monoxide & Carbon di oxide - Unburned hydrocarbon, NOx, Smoke —Effects of design and operating variables on emission formation – controlling of pollutants - Catalytic converters, Charcoal Canister, Positive Crank case ventilation system, Secondary air injection, thermal reactor

MODULE III CI ENGINE EMISSION AND CONTROL 8

Formation of White, Blue, and Black Smokes, NOx, soot, Effect of Operating variables on Emission formation — Fumigation, Split injection, Catalytic Coating, EGR, Particulate Traps, SCR, Fuel additives — Cetane number Effect.

MODULE IV NOISE POLLUTION FROM AUTOMOBILES 8

Sources of Noise — Engine Noise, Transmission Noise, vehicle structural Noise, aerodynamics noise, Exhaust Noise. Noise reduction in Automobiles — Encapsulation technique for noise reduction —Silencer Design.

MODULE V TEST PROCEDURES 6

Constant Volume Sampling I and 3 (CVSI &CVS3) Systems- Sampling Procedures — Chassis dynamometers - Seven mode and thirteen mode cycles for Emission Sampling.

MODULE VI EMISSION MEASUREMENTS 6

Emission analysers —NDIR, FID, Chemiluminesecent, Smoke meters, Dilution Tunnel, SHED Test, Sound level meters.

L – 45; Total Hours –45

TEXT BOOKS:

1. V.Ganesan, 'Internal combustion Engines', Tata McGraw Hill Book Co, Eighth Reprint, 2005.
2. Crouse and Anglin, 'Automotive Emission Control', McGraw Hill company., Newyork 1993.

REFERENCES:

1. G.P.Springer ad D.J.Patterson, Engine Emissions, Pollutant formation, Plenum Press, New York. 1986.
2. D.J.Patterson and N.A.Henin, 'Emission from Combustion Engine and their control', Anna Arbor Science Publication,1985.
3. L.Lberanek, 'Noise Reduction', Mcgrawhill Company., Newyork1993.
4. C.Duerson, 'Noise Abatment', Butterworths ltd., London1990.
5. A.Alexander, J.P.Barde, C.lomure and F.J. Langdan, 'Road traffic noise', Applied science publisher ltd., London,1987.

OUTCOMES:

On completion of the course student should be able to

- Identify the sources of emission from vehicles.
- Analyse the causes and effects of emissions.
- Analyse causes and effects of noise pollution
- Bring out solutions for control of emissions.
- Demonstrate the test procedures and emission norms.
- Select suitable instruments for measurement of emissions.

GECX215	MOTOR VEHICLE ACT, INSURANCE & POLICY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn about basic act and regulation followed for road vehicle
- To learn about systematic steps involved to get licence and registration of motor vehicle
- To learn arbour various types of motor vehicle polices and insurances

MODULE I BASIC RULES FOR ROAD VEHICLE 8

Display and Use of Number Plates- Attachment of number plates- Number plates in horizontal position- Removal of number plates on transfer- Hours prescribed for lighted lamps- Mounting of lamps and reflectors- Multiple beam headlamps- Daytime running lamps- Auxiliary driving lamps- Parking lamps- Brakes- Stopping distances- Emergency or parking brakes- Horn- Muffler- Mirrors- Inspection of motor vehicles- Standards of safety and repair

MODULE II LICENSING OF DRIVERS OF MOTOR VEHICLES 8

Necessity of driving licence- Age limit in connection with driving of motor vehicle-Responsibility of owners of motor vehicles-Restriction on the holding of driving licence-Grant of learner's licence-Grant of driving licence-Addition to driving licence- Renewal of driving licence-Revocation of driving licence on grounds of disease or disability-Driving licence to drive motor vehicle belonging to the central government- power of court to disqualify- suspension of driving licence in certain cases- suspension or cancellation of driving licence on convection- Endorsement.

MODULE III REGISTRATION OF MOTOR VEHICLE 7

Necessity for registration – Registration Where and how to be made- Special provision for registration of motor vehicle of diplomatic officers-Temporary registration- Production of vehicle at the time of registration- Refusal of registration- renewal of certificate of registration- effectiveness in India of registration- Change of residence or place of business-transfer of ownership-Suspension of registration – cancellation of registration suspended under section 53- certificate of fitness of transport vehicle-cancellation of registration.

MODULE IV INSURANCE OF MOTOR VEHICLE 8

Necessity for insurance against third party – Requirements of policies and limits of liability- - Duty of insurers to satisfy judgements and awards against person insured in respect of third party risks-Duty to give information as to insurance-Settlement between insurers and insured persons- transfer of certificate of insurance-production of certain certificates, licences and permit in certain cases-Special provisions as to compensation in case of hit and run motor accident – Types of motor polices

MODULE V CONTROL OF TRANSPORT VEHICLES 7

Power to State Government to control road transport- Transport authorities-General provision as to applications for permits- Application for stage carriage permit- Procedure of Regional Transport Authority in considering application for stage carriage permit- Scheme for renting of motor cabs- Application for private service vehicle permit- Procedure in applying for and granting permits- Duration and renewal of permits- Transfer of permit- Replacement of vehicles-Temporary permits

MODULE VI OFFENCES AND PUNISHMENT 7

Driving without holding an effective driving licence- Driving by an under-aged person (Minor driving vehicle)- Holding of a driving licence permitting it to be used by other person.- Driving a vehicle at an excessive speed- Driving or permitting to drive a vehicle carrying excess load- Driving dangerously / its Abetment Driving an uninsured vehicle

Rider and pillion rider failing to wear protective head gear (Helmet) -Violation of Mandatory Signs -.e-challan and spot challan

L – 45; Total Hours –45

TEXT BOOKS:

1. The motor vehicle act 1988, Universal law publishing co.cpvt ltd. Newdelhi 2011
2. A Commentary On The Motor Vehicles Act, 1988 by SUKHDEV AGGARWAL The Bright Law House, New Delhi

REFERENCES:

1. The Motor Vehicles Act, 1988 Along with Latest Case Law, Notifications

& Table of Offences and Punishments Asia Law House; 15th edition (2014)

2. Assessment of Compensation in Accidents under Motor Vehicles Act by Karkara Delhi Law House (2013)

OUTCOMES:

On completion of the course students should be able to

- Explain the analysis of rules and regulations for road vehicles
- Analyze the procedure for getting driving license for vehicles at national and international level
- Analyze the procedure for registration of vehicles.
- Analyze the procedure for Insurance of vehicles and claims.
- Analyze the procedure for obtaining Government Permits and renewal
- Analyze the consequences of not following the rules and regulations

GECX216	PRINCIPLES OF COMMUNICATION SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

To introduce the analog and digital modulation techniques.
To elaborate the working of communication receivers in the presence of noise.
To give an overview of various communication systems.

MODULE I LINEAR MODULATION 8

Baseband signals, Amplitude Modulation – Modulation Index, Power Transmitted, Double Side Band and Single Side Band AM, AM Modulators and AM Receivers, AM Radio systems, Frequency Division Multiplexing.

MODULE II ANGLE MODULATION 8

Frequency Modulation and Phase Modulation, Frequency deviation and modulation index, Bandwidth of FM, FM Modulators and FM receivers, FM Radio and FM Stereo Systems

MODULE III SAMPLING AND PULSE MODULATION 7

Sampling, Nyquist's Sampling Theorem, Pulse Modulations - PAM, PPM and PWM, Time Division Multiplexing, Bandwidth of TDM systems.

MODULE IV DIGITAL COMMUNICATION 7

Digital baseband data, Digital Modulations – ASK, FSK, PSK and QPSK. Digital Communication Transmitters and Receivers.

MODULE V NOISE 8

Sources of Noise, Thermal Noise, shot noise, White noise, Narrow band Noise, Effect of noise in communication, SNR, Receiver Noise Temperature and Noise Equivalent Bandwidth.

MODULE VI COMMUNICATION SYSTEMS & NETWORK 7

FM Radio Systems, Cellular Mobile network, Satellite Communications, Optical Fiber Communication.

L – 45; T – 0; Total Hours – 45

TEXT BOOKS:

1. A. Bruce Carlson, Paul B. Crilly, "Communication Systems", 5th Edition,

McGraw Hill Int., 2011.
2. B.P. Lathi, Zhi Ding, Hari M. Gupta, “Modern Digital and Analog Communication Systems”, 4th Edition, Oxford University Press, 2017.

REFERENCES:

1. Herbert Taub, Donald L. Schilling, Goutam Saha, “Principles of Communication Systems” 4th Edition, McGraw Hill Int. 2013.
2. Simon Haykin, “An Introduction To Analog And Digital Communications”, 1st Edition, Wiley India, 2010.
3. Simon Haykin , “Communications Systems” 4th Edition, Wiley India, 2006.
4. Hwei P. Hsu, “Analog and Digital Communications” 3rd Edition,

OUTCOMES:

On completion of the course students will be able to

1. Identify various communication systems and the corresponding modulation schemes.
2. Predict the characteristics of various analog and digital modulation schemes.
3. Interpret the effect of noise and bandwidth in a communication systems
4. Apply the Nyquist criteria for a given baseband signals.
5. Evaluate the performance of communication receivers.
6. Demonstrate the applications of common communication systems.

GECX217 **LEAN MANAGEMENT** **L T P C**

3 1 0 4

OBJECTIVES:

The objective of the Course to make the student know about

- the basics of lean production management,
- how Lean principles are applied to the Construction industry to improve the operation management and product development.

MODULE I **8**

lean production? – Introduction, background, and lean thinking. Importance of philosophy, strategy, culture, alignment, focus and systems view. Discussion of Toyota Production System.

MODULE II **8**

Manufacturing systems – an overview of manufacturing strategies. Job shops, batch flow, and flexible manufacturing systems Flow production and lean production systems

MODULE III **7**

Value stream mapping in process design and product development Waste reduction - lead time reduction

Process cycle time and value-added vs. non-value added activities Optimum lot sizing

MODULE IV **8**

Lean production processes, approaches and techniques.—Importance of focusing upon flow. Tools -. Workplace organization – 5S. - Stability. - Just-In-Time – One piece flow – Pull. - . Cellular systems. - . Quick change and set-up reduction methods. f. Total productive maintenance. -. Poka-Yoke – mistake proofing, quality improvement. Standards. - . Leveling. - . Visual management. Just-in-time techniques – SMED and Takt Times - Standard work processes and line balancing Poka-yoke and pull systems material handling reduction and facilities planning

MODULE V **8**

Managing change in the lean organization Human resource management and the lean enterprise Employee involvement – Teams – Training – Supporting and encouraging involvement – Involving people in the change process -- communication -- Importance of culture. Startup of lean processes and examples of applications.

Sustaining improvement and change, auditing, follow-up actions.

7

MODULE VI

The lean enterprise and supply chain management Costs and risks of lean initiatives - Measuring lean initiatives

L – 45; Total Hours –45

TEXT BOOKS:

1. The Toyota Way Fieldbook, Jeffrey Liker and David Meier, McGraw-Hill, 2006. Lean Production Simplified, Pascal Dennis, Productivity Press, 2007.
2. Womack, James P., and Daniel T. Jones. Lean Thinking. New York, NY: Simon and Schuster, 2003. ISBN: 0743249275.
3. Murman, Earll. Lean Enterprise Value. New York, NY: Palgrave Macmillan, 2002. ISBN: 0333976975.

REFERENCES:

1. Readings at http://www.leanconstruction.org/readings.htm
2. Hopp, W. J., and Spearman, M. L. (2011). Factory Physics, Third Edition, Waveland Press, Long Grove, Il. 720 pp.

OUTCOMES:

The student will be able to

- Describe the manufacturing approaches employed and the background and philosophy of lean production.
- Illustrate the concept of waste reduction
- Apply evaluation techniques that can be used in preparation for and use in learn production activities.
- Select the tools that can be used implementing lean production in production operations.
- Discuss the importance of workplace organization, pull production, cellular arrangement and employee involvement, need for employee creativity
- Describe about the Methods for promoting success in implementing lean transformations

GECX218 GEOSPATIAL MODELING & ANALYSIS L T P C
3 0 0 3

OBJECTIVES:

- To equip the students with fundamental representation and analysis of geospatial phenomena and provides foundations in methods and algorithms used in GIS analysis.
- To focus is on terrain modeling, geomorphometry, watershed analysis and introductory GIS-based modeling of landscape processes (water, sediment). The course includes analysis from lidar data, coastal change assessment and 3D visualization.

MODULE I INTRODUCTION TO GEOSPATIAL DATA 7

Mapping natural phenomena –Concept of continuous fields and discrete sampling – Units, projections, coordinate transformation – Georeferencing, geospatial formats, conversions, geospatial data abstraction library – Raster and vector representation, raster and vector conversions and resampling.

MODULE II DATA DISPLAY AND VISUALIZATION 7

Display of continuous and discrete data, use of color, shading, symbols, to extract the spatial pattern and relationships – 3D visualization: multiple surfaces and volumes, 3D vector objects – visualization for data analysis (lighting, scaling, transparency, cutting planes, animations) – view/create maps/post your data on-line (Google Earth/Maps, GPS visualizer)

MODULE III GEOSPATIAL ANALYSIS 7

Foundations for analysis of continuous and discrete phenomena – neighborhood operations and buffers – analysis and modeling with map algebra – cost surfaces and least cost path – spatial interpolation and approximation (gridding)

MODULE IV TERRAIN MODELING AND ANALYSIS 9

terrain and bathymetry mapping – mathematical and digital representations (point clouds, contour, raster, TIN) – DEM and DSM, working with multiple return lidar data – spatial interpolation of elevation data and topographic analysis, line of sight, view shed analysis – solar irradiation, photovoltaic energy potential, time series of elevation data, analysis of coastal change.

MODULE V FLOW TRACING, WATERSHED ANALYSIS AND LANDFORMS **8**

Methods for flow routing and flow accumulation – Extraction of stream networks – Extraction of watershed boundaries and building watershed hierarchies – feature extraction, types of landforms.

MODULE VI MODELING OF GEOSPATIAL PROCESSES **7**

Model formulation, input data processing – introduction to GIS-based hydrologic, erosion and environmental modeling – Geocomputational methods, including agent-based modeling, artificial neural networks and evolutionary computing.

L – 45; T – 0; Total Hours –45

TEXT BOOKS:

1. Hassan A, Karimi (2017), *Geospatial Data Science Techniques and Applications*, CRS Press & Co.
2. Sudipto Banerjee, Bradley P, Carlin, Alan E. Gelfand (2014), *Hierarchical Modeling and Analysis for Spatial Data*, CRS Press & Co.

REFERENCES:

1. Maguire, D., M. Batty, and M. Goodchild. 2015. GIS, Spatial analysis, and modeling. ESRI Press (G70.212 .G584 2005)
2. Zeiler, M. 2010. Modeling Our World: The ESRI Guide to Geodatabase Design. Second Ed. ESRI Press, Redlands, California

OUTCOMES:

On successful completion of this course,

- Students will be able to apply the basic concepts of Conceptualize models as representations of real life systems with inputs, outputs, and processes.
- Students will have gained knowledge in spatial tools to make simulations and predictions of real life phenomena.
- Students will have synthesized knowledge about Apply, integrate, and develop models with geospatial data through a GIS.
- Students will have an overview of Evaluate models in terms of accuracy, sensitivity, and uncertainty.
- Students will have Use of a system-based approach for problem solving, with an emphasis on sustainability.

B.S. Abdur Rahman Crescent Institute of Science & Technology

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REGULATIONS 2017

CURRICULUM AND SYLLABI

B.TECH.

ELECTRONICS AND INSTRUMENTATION ENGINEERING

DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION

VISION AND MISSION

VISION

- The Department aspires to excel in, providing quality education, training and research in the area of Electronics and Instrumentation Engineering to meet the industrial and societal needs

MISSION

- To provide quality education in the field of Electronics and Instrumentation Engineering by offering Under Graduate, Post Graduate and Doctoral Programs
- To impart technical knowledge and hands on experience, leadership and managerial skills to meet the current industrial and societal needs
- To enhance problem solving capabilities through design projects, internship and industrial projects
- To maintain active linkages with industries and research institutions
- To develop analytical skills, leadership quality and team spirit through balanced curriculum and a judicial mix of co-curricular, extra-curricular and professional society activities
- To enrich the knowledge and skills of faculty through continuous learning and active research

PROGRAMME EDUCATIONAL OBJECTIVES

- To provide fundamental knowledge of Mathematics and Science to enable the student understand the basic concepts of Electronics and Instrumentation Engineering.
- To impart sound theoretical and practical knowledge in the broad areas of Electrical and Electronic Measurements, Transducers, Industrial Instruments, Analytical Instruments Biomedical instruments, Microelectronics and Process Control.
- To provide knowledge and skill in the design, installation, maintenance, and calibration of different types of instruments used in process industries.
- To develop skills for devising solutions in the design of conventional and advanced Control Systems required for Industrial Automation.
- To inculcate sustained interest in the process of life- long learning to keep abreast of state-of-art technologies in the fields of Electronics and Instrumentation.
- To impart necessary managerial and soft skills required to face the challenges in the process industries and software companies.

PROGRAMME OUTCOMES

On successful completion of the programme, the graduates will

- Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- Identify, formulate, research literature, and analyses complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- Use research –based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.

- Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change
- Test, Calibrate and Select measuring Instruments and analyzers for different Industrial applications.
- Design & fabricate signal conditioning circuits for measurement systems.
- Design, simulate and implement conventional, multi loop, intelligent and model based controllers for Industrial Automation.

B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE AND TECHNOLOGY

Vandalur, Chennai – 600048

B.TECH. ELCTRONICS & INSTRUMENTATION ENGINEERING

CURRICULUM & SYLLABUS, REGULATIONS 2017

SEMESTER I

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	BS	MAC 1181	Differential Calculus and Geometry	3	1	0	4	
2.	HS	ENC 1181/ ISC 1181/ LNC 1181/ LNC 1182 / LNC 1183	English / Arabic / Mandarin / German / Japanese	3	0	0	3	
3.	BS	PHC 1181	Physics	3	0	2	4	
4.	BS	CHC 1181	Chemistry	3	0	2	4	
5.	ESF	GEC 1101	Engineering Graphics	2	0	2	3	
6.	ESF	GEC 1102	Engineering Design	2	0	0	2	
7.	ESF	GEC 1103	Basic Engineering Practices Laboratory	0	0	2	1	
8.	ESF	GEC 1104	Computer Programming I	1	0	2	2	**23**

SEMESTER II

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	BS	MAC 1281	Advanced Calculus	3	1	0	4
2.	BS	-	Physics Elective	2	0	2	3
3.	BS	-	Chemistry Elective	2	0	2	3
4.	ESF	GEC 1211	Basic Engineering Mechanics	3	1	0	4
5.	BS	GEC 1212	Environmental Studies	2	0	0	2
6.	ESF	GEC 1213	Computer Programming II	1	0	2	2

7.	EC	EIC 1211	Electrical Circuits	3	0	2	4	
8.	EC	EIC 1212	Electronic Devices	2	0	0	2	**24**

SEMESTER III

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	BS	MAC2181	Partial Differential Equations and Transforms	3	1	0	4	
2.	HS	-	Humanities Elective I	2	0	0	2	
3.	HS	ENC 2181	Oral Communication	0	0	2	1	
4.	EC	EIC 2101	Transducer Engineering	3	0	0	3	
5.	EC	EIC 2102	Electrical, Electronic and Physical Measurements	3	0	0	3	
6.	EC	EIC 2103	Analog and Linear Integrated Circuits	3	1	0	4	
7.	EC	EIC 2104	Electrical Machines	3	0	0	3	
8.	EC	EIC 2105	Transducer Engineering Lab	0	0	2	1	
9.	EC	EIC 2106	Electrical Machines and Measurements Lab	0	0	3	1	
10.	EC	EIC2107	Analog Electronics Lab	0	0	3	1	**23**

SEMESTER IV

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	BS	-	Mathematics Elective I	3	1	0	4
2.	HS	-	Humanities Elective II	2	0	0	2
3.	HS	ENC2282	Written Communication	0	0	2	1
4.	EC	EIC 2211	Thermodynamics and Fluid Mechanics	3	0	2	4
5.	EC	EIC 2212	Digital Electronics	3	1	0	4
6.	EC	EIC 2213	Industrial Instrumentation I	3	0	0	3
7.	EC	EIC 2214	Digital Electronics Lab	0	0	2	1
8.	EC	EIC 2215	Industrial Instrumentation I Lab	0	0	2	1

9.	PE		Programme Elective			3	**23**

SEMESTER V

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	MS	MSC 3181 MSC 3182	Leadership and CEO Training/ Social Entrepreneurship	3	0	0	3	
2.	GE	-	General Elective I	3	0	0	3	
3.	HS	ENC3181	Communication and soft skill I Career Choice	0	0	2	1	
4.	EC	EIC 3101	Control Systems	3	1	0	4	
5.	EC	EIC 3102	Microprocessor and Microcontroller	3	0	0	3	
6.	EC	EIC 3103	Industrial Instrumentation II	3	0	0	3	
7.	EC	EIC 3104	Control Systems Laboratory	0	0	2	1	
8.	EC	EIC 3105	Microprocessor and Microcontroller Laboratory	0	0	2	1	
9.	EC	EIC 3106	Industrial Instrumentation II Lab	0	0	2	1	
10.	PE		Programme Elective				3	**23**

SEMESTER VI

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	MS	MSC 3181 MSC 3182	Leadership and CEO Training/ Social Entrepreneurship	3	0	0	3
2.	BS	-	Mathematics Elective II	2	0	0	2
3.	HS	ENC3281	Communication and soft skill II Confidence Building	0	0	2	1
4.	EC	EIC 3211	Process control	3	0	0	3
5.	EC	EIC 3212	Communication Engineering	3	0	0	3
6.	EC	EIC 3213	Digital signal processing	3	1	0	4
7.	EC	EIC 3214	Process control Lab	0	0	3	1

8.	PE	-	Programme Elective	6	**23**

SEMESTER VII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	GE	-	General Elective II	3	0	0	3	
2.	EC	EIC4101	Digital Process control	3	0	0	3	
3.	EC	EIC4102	Industrial Automation	3	0	0	3	
4.	EC	-	Programme Elective				9	
5.	PE	EIC4103	Industrial Automation Lab	0	0	4	2	
6.	EC	EIC4104	Instrumentation System Design	0	0	4	2	
7.	EC	EIC4105	Internship	0	0	0	1*	**23**

SEMESTER VIII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	EC	EIC4211	Project Work	0	0	24	12	**12**

Total credits – 174

* Industrial training will be undertaken during Third year summer vacation for 15 days. The credit will be awarded in the 7th Semester.

PROGRAMME ELECTIVES

GROUP I

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	EICX01	Biomedical Instrumentation	3	0	0	3
2.	PE	EICX02	Fiber Optic and Laser Instrumentation	3	0	0	3
3.	PE	EICX03	Micro Electro Mechanical Systems	3	0	0	3
4.	PE	EICX04	Qt software	1	0	4	3
5.	PE	EICX05	Telemetry and Tele control	3	0	0	3

GROUP II

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	EICX11	Control system components	3	0	0	3
2.	PE	EICX12	Advanced Sensors	3	0	0	3
3.	PE	EICX13	Ultrasonic Instrumentation	3	0	0	3
4.	PE	EICX14	Computer networks	3	0	0	3

GROUP III

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	EICX21	Industrial Data Networks	3	0	0	3
2.	PE	EICX22	Robotics and Automation	3	0	0	3
3.	PE	EICX23	Virtual Instrumentation	3	0	0	3
4.	PE	EICX24	Applied Analytical Instrumentation	3	0	0	3

GROUP IV

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	EICX31	Modeling and Simulation	3	0	0	3

2.	PE	EICX32	Digital Image Processing	3	0	0	3
3.	PE	EICX33	Instrumentation and Control in Petrochemical Industries	3	0	0	3
4.	PE	EICX34	Wireless sensor networks	3	0	0	3

GROUP V

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	EICX41	Nonlinear Control System	3	0	0	3
2.	PE	EICX42	Advanced Digital Signal Processing	3	0	0	3
3.	PE	EICX43	Instrumentation and control in Iron and Steel Industries	3	0	0	3
4.	PE	EICX44	Internet of Things for automation	3	0	0	3

GROUP VI

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	EICX51	Modern Control System	3	0	0	3
2.	PE	EICX52	Embedded System and RTOS	3	0	0	3
3.	PE	EICX53	System Identification	3	0	0	3
4.	PE	EICX54	Industrial Drives and Control	3	0	0	3

GROUP VII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	EICX61	Adaptive Control	3	0	0	3
2.	PE	EICX62	Thermal Power Plant Instrumentation	3	0	0	3
3.	PE	EICX63	Applied soft computing for Instrumentation Engineers	3	0	0	3
4.	PE	EICX64	VLSI Design	3	0	0	3

Physics Elective Courses

(To be offered in II Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	PHCX 01	Fundamentals of Engineering Materials	2	0	2	3
2.	PHCX 02	Heat and Thermodynamics	2	0	2	3
3.	PHCX 03	Introduction to Nanoscience and Technology	2	0	2	3
4.	PHCX 04	Lasers and their applications	2	0	2	3
5.	PHCX 05	Materials Science	2	0	2	3
6.	PHCX 06	Non-Destructive Testing	2	0	2	3
7.	PHCX 07	Properties of Matter and Acoustics	2	0	2	3
8.	PHCX 08	Properties of Matter and Nondestructive Testing	2	0	2	3
9.	PHCX 09	Semiconductor Physics and Optoelectronics	2	0	2	3

Chemistry Elective Courses

(To be offered in II Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	CHCX01	Analytical Instrumentation	2	0	2	3
2.	CHCX02	Corrosion and its Control	2	0	2	3
3.	CHCX03	Electrical Materials and Batteries	2	0	2	3
4.	CHCX04	Engineering Materials	2	0	2	3
5.	CHCX05	Fuels and Combustion	2	0	2	3
6.	CHCX06	Fundamentals of Physical Chemistry	2	0	2	3
7.	CHCX07	Green Technology	2	0	2	3
8.	CHCX08	Organic Chemistry of Biomolecules	2	0	2	3
9.	CHCX09	Polymer Science and Technology	2	0	2	3

Maths Elective Courses

(To be offered in IV Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	MACX 01	Discrete Mathematics And Graph Theory	3	1	0	4
2.	MACX 02	Probability And Statistics	3	1	0	4
3.	MACX 03	Random Processes	3	1	0	4
4.	MACX 04	Applied Numerical Methods	3	1	0	4

Maths Elective Courses

(To be offered in VI Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	MACX 05	Mathematical Programming	2	0	0	2
2.	MACX 06	Statistical Methods for Data Analysis	2	0	0	2
3.	MACX 07	Numerical Methods for Integral and Differential Equations	2	0	0	2
4.	MACX 08	Mathematical Modelling	2	0	0	2
5.	MACX 09	Graph Theory	2	0	0	2

Humanities Elective I

(To be offered in III Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	SSCX01	Fundamentals of Economics	2	0	0	2
2.	SSCX02	Principles of Sociology	2	0	0	2
3.	SSCX03	Sociology of Indian Society	2	0	0	2

Humanities Elective II

(To be offered in IV Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	SSCX04	Economics of Sustainable Development	2	0	0	2
2.	SSCX05	Industrial Sociology	2	0	0	2
3.	SSCX06	Law for Engineers	2	0	0	2

General Elective

Group I Courses

(To be offered in V semester)

Sl. No.	Course Code	Course Title	Offering Department
1.	GECX101	Disaster Management	Civil
2.	GECX102	Total Quality Management	Mechanical
3.	GECX103	Energy Studies	Mechanical
4.	GECX104	Robotics	Mechanical
5.	GECX105	Transport Management	Automobile
6.	GECX106	Control Systems	EEE
7.	GECX107	Introduction to VLSI Design	ECE
8.	GECX108	Plant Engineering	EIE
9.	GECX109	Network Security	CSE
10.	GECX110	Knowledge management	CSE
11.	GECX111	Cyber security	IT
12.	GECX112	Genetic Engineering	LS
13.	GECX113	Fundamentals of Project Management	CBS
14.	GECX114	Operations Research	Mathematics
15.	GECX115	Nano Technology	Physics / Chemistry
16.	GECX116	Vehicle Maintenance	Automobile
17.	GECX117	Fundamentals of Digital Image Processing	ECE

Group II Courses

(To be offered in VII semester)

Sl. No.	Course Code	Course Title	Offering Department
1.	GECX201	Green Design and Sustainability	Civil
2.	GECX202	Appropriate Technology	Civil / Mechanical
3.	GECX203	Engineering System Modelling and Simulation	Mechanical
4.	GECX204	Value Analysis and Engineering	Mechanical
5.	GECX205	Industrial Safety	Mechanical
6.	GECX206	Advanced Optimization Techniques	Mechanical
7.	GECX207	Mat Lab Simulation	EEE
8.	GECX208	Embedded Systemsand its Applications	ECE
9.	GECX209	Usability Engineering	CSE
10.	GECX210	Supply Chain Management	CBS
11.	GECX211	System Analysis and Design	CA
12.	GECX212	Advanced Materials	Physics & Chemistry
13.	GECX213	National Service Scheme	School of Humanities
14.	GECX214	Automotive Pollution and Control	Automobile
15.	GECX215	Motor Vehicle Act, Insurance and Policy	Automobile
16.	GECX216	Principles of Communication Systems	ECE
17.	GECX217	Lean Management	Civil
18.	GECX218	Spatial Data Modeling & Analysis	Civil

SEMESTER I

MAC 1181	DIFFERENTIAL CALCULUS AND GEOMETRY	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aims of this course are to

- introduce eigen values and eigenvectors of matrix algebra.
- make the student knowledgeable in the area of Three Dimensional Analytical Geometry.
- demonstrate the application of Differential Calculus.
- familiarize the student with the functions of several variables.
- develop the use of ODE solvable techniques necessary for engineering applications.
- motivate the students with some basic engineering application problems in ODE.

MODULE I MATRICES 8+2

Characteristic Equation- Eigenvalues and Eigenvectors of a real matrix – Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton Theorem (without proof) – Orthogonal matrices – orthogonal transformations of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation.

MODULE II THREE DIMENSIONAL ANALYTICAL GEOMETRY 7+3

Direction cosines and ratios – angle between two lines – equations of a plane – equations of a straight line, coplanar lines - shortest distance between skew lines - sphere – tangent plane – plane section of a sphere – orthogonal spheres.

MODULE III DIFFERENTIAL GEOMETRY 7+3

Curvature – Cartesian and polar coordinates – centre and radius of curvature – circle of curvature – involutes and evolutes – envelopes.

MODULE IV DIFFERENTIAL CALCULUS OF SEVERAL VARIABLES 8+2

Functions of two variables – partial derivatives – total differential – Implicit Functions – Jacobian - Taylor’s series expansion – Optima of two variables –

Lagrange's multiplier method.

MODULE V **ORDINARY DIFFERENTIAL EQUATIONS** **8+2**

Linear equations of second order with constant and variable coefficients – Simultaneous first order linear equations with constant coefficients – homogeneous equations of Euler's type – method of undetermined coefficients, method of variation of parameters

MODULE VI **APPLICATIONS OF ORDINARY DIFFERENTIAL EQUATIONS** **7+3**

Solution of Ordinary Differential Equation Related to Electric Circuits – Bending of Beams- Motion of a Particle in a resisting medium – Simple harmonic motion.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Ramana, B.V, "Higher Engineering Mathematics" Tata McGraw Hill Publishing Co. New Delhi, 2006.
2. Grewal B.S., "Higher Engineering Mathematics" (43rd edition), Khanna Publishers, New Delhi, 2012.
3. John W. Cell "Engineering Problems Illustrating Mathematics" Mc Graw Hill Publishing Co., New York 1943.

REFERENCES:

1. Veerarajan.T., "Engineering Mathematics" (5th edition) Tata Mc Graw Hill Publishing Co. New Delhi, 2012
2. Kreyszig, E., "Advanced Engineering Mathematics", 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
3. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th edition, Cengage Learning, 2011.
4. Dennis G. Zill, Warren S. Wright, "Advanced Engineering Mathematics", 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
5. Alan Jeffrey, "Advanced Engineering Mathematics", Academic Press, USA, 2002.
6. Venkataraman, M.K., "Engineering Mathematics", Volume I, 2nd edition, National Publishing Co., Chennai, 2003.
7. James Stewart ".Calculus" (7th edition),Brooks/Cole cengage learning,UK

OUTCOMES:

After completing the course, student will be able to

- Understand the matrix techniques and compute eigen values and eigenvectors of a given matrix.
- Do the problems based on three dimensional analytic geometry.
- Apply differential calculus in engineering problems.
- Differentiate more than one variable and their applications.
- Solve the differential equations with constant coefficient and variable coefficient.
- Form and solve differential equations.

ENC 1181	ENGLISH	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To train students to use appropriate vocabulary in academic and technical contexts.
- To facilitate students to speak effectively while exchanging ideas and making presentations.
- To develop students' listening skill for comprehending and analyzing information.
- To develop their reading skill through sub skills like skimming , scanning and critical reading of a text.
- To sharpen their academic writing skills.
- To expose them to the correct usage of language and help them to apply that knowledge appropriately.

MODULE I **8**

L: Listening for general information
S : Self Introduction, Introducing one another.
R: Predicting the content
W: Paragraph Writing
Language Focus: Affixes, Simple Present tense , Connective & Prepositions.

MODULE II **8**

L: Listening for specific information (from dialogues)
S:Exchanging opinion.
R: Skimming technical Passages
W: Argumentative Writing (using the concept of Flipped Learning), Letter to the Editor.
Language Focus: Idioms, use of Modals, Simple Past tense & use of "Wh" and question tags.

MODULE III **7**

L: Learning the ways of describing images and presenting specific information (focusing on note making)

S: Making Presentations using visuals.

R : Scanning short texts for gist of information

W: Letter of Invitation, Expository Writing

Language Focus: Homophones, Homographs, Simple Future & Collocations.

MODULE IV **7**

L: Understanding prepared presentation techniques through videos

S: Short Presentations.

R: Reading for coherence and cohesion

W: Letter seeking permission for Industrial Visit

Language Focus: S-V agreement, Euphemism

MODULE V **8**

L : Understanding Non- Verbal Communications while listening to narration of incidents.

S: Narrating an expereince

R: Inferential Reading

W: Process Description – Transcoding a Flow chart.

Language Focus: Interchange of Active & passive voice, Impersonal Passive voice.

MODULE VI **7**

L: Learning Story telling techniques (stories & visuals) through audio files

S: Discussion in groups

R: Reading for critical appreciation

W: Developing an idea, Slogan writing, Interpreting a Bar Chart.

Language Focus: If clause and phrasal verbs.

TOTAL HOURS :45

REFERENCES:

1. Carol Rosenblun perry(2011). The Fine Art of Technical Writing. Create Space Independent Publishing Platform, New Delhi.
2. Dutt, P.K. Rajeevan. G and Prakash , C.L.N. (2007) A course in Communication Skills. Cambridge Univesity Press, India.
3. Kala, Abdul & Arun Tiwari (2004). Wings of Fire: An Autobiography (Simplified and A bridged by Mukul Chowdhri). Hyderabad Univeristy Press.

4. Sen, Leena. (2004) Communication Skills. Prentice Hall, New Delhi.
5. Matt Firth, Chris Sowton et.al. (2012). Academic English: An Integrated Skills Course for EAP. Cambridge University Press, Cambridge.

OUTCOMES:

After completion of the course, students will have the ability to

- Demonstrate their range of vocabulary in academic and technical contexts
- Exchange ideas and make presentations
- Comprehend and respond appropriately to listening tasks.
- Read a text efficiently and process information.
- Create and draft different kinds of academic documents
- Communicate effectively using grammatically correct expressions.

ISC1181	ARABIC	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To read and write in Arabic language.
- To learn vocabulary of different fields
- To develop situational communication skills.

MODULE I PREPARATORY ARABIC 7

Introducing Arabic Alphabets.
Listening and Reading.
Audio & Video aided listening, Tajweed listening,
Writing Arabic Alphabets (connected & unconnected).
Introducing words.
Reading simple sentences.
Learning names of the things in and around the class room.
Exercises.

MODULE II FUNCTIONAL ARABIC 7

Listening Arabic texts, stories and action verbs
Communicating Simple sentences.
Jumla' Ismiyya and Jumla' Fi'liyya
Situational Conversation:
Greetings, Introduction.
Classroom, College, Picnic.
Dining and Kitchen.
Reading skills.
Exercises

MODULE III FUNCTIONAL ARABIC 8

Implication of effective listening.
Audio aids.
Writing Simple sentences.
Communicating ordinal and cardinal numbers.
Situational communication:

Playground, library.
Forms of plural – Sample sentences.
Introduction to tenses.
Exercises.

MODULE IV FUNCTIONAL ARABIC 8

Communication:
Family, travel
Market, Prayer hall
Writing skills:
Note making.
Sequencing of sentences.
Developing answers from the questions.
Exercises.

MODULE V TECHNICAL ARABIC 8

Importance of technical communication.
Reading and writing skills.
Audio & Video aided listening.
Introduction to Arabic terms related to administration.
Situation communication:
Air travel, Office administration, passport, visa.
Exercises

MODULE VI TECHNICAL ARABIC 7

Situation communication:
Contractual work, machineries and equipments..
Computer, internet browsing.
Banking,
Exercises.

TOTAL HOURS :45

TEXT BOOKS:

1. Arabic for professionals and employees, Kilakarai Bukhari Aalim Arabic College, Chennai, India, 2013.

REFERENCES:

1. Arabic Reader for Non Arabs (Ummul Qura University, Makkah), Kilakarai Bukhari Aalim Arabic College, 2005.

OUTCOMES:

On successful completion of the course, the student will be able to:

- Write correct sentences in Arabic.
- Communicate in Arabic at primary level in working situations in the fields of engineering and administration.

LNC1181	MANDARIN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To improve the proficiency of students in Mandarin language.
- To develop their knowledge of vocabulary.
- To train them in using appropriate grammatical forms during communications.
- To empower them for successful communication in social and academic contexts.
- To make them appreciate the language usage in real life situations.

MODULE I **8**

· General Introduction to Chinese • Pinyin and Tones • Introduction to the Writing System: basic strokes and stroke order · Numbers 1-100, song · Days of the Week · Months of the Year

MODULE II **8**

· Chinese names and related culture · Chinese family structures and values · Greetings · Introducing Yourself · Family members · Occupations

MODULE III **7**

· Languages and Nationalities · Daily Routine · Chinese breakfast · Negative Sentences and Interrogative Sentences · Asking for Personal Information · The Verb *shi* and Basic Sentence Structures

MODULE IV **7**

· Answering an Affirmative-negative Question · Food and drinks · Transportation · Likes and dislikes · Adverbs *bu*, *jiu* and *dou* · Verb-absent Sentences

MODULE V **8**

·*Jisui* and *duoda* Questions · S+V+O Construction · Routines and Daily Activities ·*Haishi* Questions · Modal Verbs · Hobbies and Habits

MODULE VI **7**

· Making Suggestions with *haoma* ·Colors · Clothing · Body parts · Talking about Likes

and Dislikes · Measurement Words in Chinese

TOTAL HOURS :45

TEXT BOOKS:

1.Ma, Yanmin, and Li, Xinying. *Easy Steps to Chinese, Vol*. *1 Textbook*. Beijing: Beijing Language and Culture University Press, 2006. Print.

2. Ma, Yanmin, and Li, Xinying. *Easy Steps to Chinese, Vol. 1 Workbook*. Beijing: Beijing Language and Culture University Press, 2006. Print.

OUTCOMES:

On completion of the course, students will be able to

- Exhibit proficiency in Chinese Language.
- Use vocabulary in appropriate contexts.
- Use appropriate grammatical forms effectively.
- Use the language in social and academic contexts.
- Appreciate the use of language forms.

LNC1182	GERMAN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To improve the proficiency of students in German language.
- To create awareness of using vocabulary among students.
- To expose them to correct grammatical forms of the language.
- To empower them for successful communication in social and academic contexts.

MODULE I **8**

Introduction to German alphabets, phonetics and pronunciation- Introducing themselves and others using simple sentences and answer to some basic personal questions-: Introduction to different types of articles and verbs, Nouns

MODULE II **8**

Understanding and responding to everyday queries like instruction, questions, - number & gender, pronouns, present and past tense.

MODULE III **7**

Short telephone messages, requests etc., if spoken slowly and clearly-- Detailed overview of articles, adjectives with/without articles, Prepositions

MODULE IV **7**

Ask and giving directions using simple prepositions- Ability to fill basic information on forms while registering for courses / classes.

MODULE V **8**

Ability to extract and understand relevant information in a public announcement, broadcast, newspaper, radio etc-- dative & accusative

MODULE VI **7**

Ability to describe about people, work, immediate environment, education and other topics related to personal needs in a concise manner-- Understanding of matters that are familiar and are encountered regularly like instances at school, work, at public places, places of leisure etc.

TOTAL HOURS :45

TEXT BOOKS:

1. Course book : Tangram aktuell 1 – Lektion 1–4 (Kursbuch + Arbeitsbuch mit Audio-CD zum Arbeitsbuch), Rosa-Maria Dallapiazza, Eduard von Jan, Til Schönherr, Hueber Publisher, ISBN 978-3-19-001801-7
2. Practice book: Tangram aktuell 1 – Lektion 1–4 (Kursbuch + Arbeitsbuch mit Audio-CD zum Arbeitsbuch), Rosa-Maria Dallapiazza, Eduard von Jan, Til Schönherr, Hueber Publisher, ISBN 978-3-19-001801-7.

REFERENCES:

1. NETZWERK A1 TEXTBOOK, Deutsch als Fremdsprache,Stefanie Dengler,Paul Rusch, Helen Schmitz, Tanja Sieber, Langenscheidt and Klett, ISBN : 9788183076968
2. STUDIO D A1 (SET OF 3 BOOKS + CD), Hermann Funk. Cornelsen, ISBN: 9788183073509
3. Willkommen! Beginner's course. Paul Coggle, Heiner Schenke. 2nd edition. (chapter 1 - 6) ISBN: 9781444165159 –
4. Willkommen! Beginner's course. Paul Coggle, Heiner Schenke. ISBN: 978-1-444-16518-0
5. An Introduction to the German Language and Culture for Communication, Updated Edition Lovik, Thomas A., J. Douglas Guy & Monika Chavez. Vorsprung -. New York, Houghton Mifflin Company, 1997/2002. ISBN 0-618-14249-5.

OUTCOMES:

On completion of the course, students will be able to

- Show their proficiency in German Language.
- Use appropriate vocabulary in real life contexts.
- Use appropriate grammatical forms while communicating with people.
- Effectively use the language in social and academic contexts.

LNC1183	JAPANESE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To train students to use appropriate vocabulary in academic and technical contexts.
- To facilitate students to speak effectively while exchanging ideas and making presentations.
- To develop their reading skill through sub skills like skimming, scanning and critical reading of a text.
- To sharpen their academic writing skills.
- To expose them to the correct usage of language and help them to apply that knowledge appropriately.

MODULE I **7**

Introduction of the Japanese writing system, i.e. *Hiragana*, *Katakana* and *Kanji*, word-building, writing foreign names and loan words in Katakana.

MODULE II **8**

Oral practice of pronunciation and intonation of Japanese sounds, Japanese greetings, self introduction, identifying things, time of the day, calendar; counting using Japanese numerical classifiers; describing things;

MODULE III **7**

Making comparisons; talking of daily activities, kinship terms used for address and reference, seasons, giving and receiving, shopping; making requests, talking of one's likes and dislikes.

MODULE IV **8**

Extensive practice of basic patterns at the lower intermediate level through drills and exercises.

MODULE V **7**

Comprehension of passages in simple Japanese and writing of composition in Japanese applying lower intermediate grammatical patterns.

MODULE VI **8**

Diverse texts based on Japanese culture, customs, history, food habits, and science etc, for the development of communicative competence of students; skimming, scanning of texts with emphasis on advanced sentence patterns, grammatical structures and idiomatic phrases, reading and writing of approximately

TOTAL HOURS :45

REFERENCES:

1. Nihongo I, Kokusaigakuyukai, and other supplementary material
2. Exersice book 1of Nihongo 1, and other supplementary material
3. Nippon, the Land and its People & Encyclopedia of Contemporary Japanese
4. Japani: Japanese Conversation for Improving Spoken Proficiency, By P.A. George, Inoue Yoriko and Itsuko Nandi, Books Plus.
5. Chukyu Nihongo, Tokyo Gaikokugo Daigaku; Nihongo II, Kokusaigakuyukai, and other supplementary material.

OUTCOMES:

After completion of the course, students will have the ability to

- Demonstrate their range of vocabulary in academic and technical contexts
- Exchange ideas and make presentations
- Comprehend and respond appropriately to listening tasks.
- Read a text efficiently and process information.
- Create and draft different kinds of academic documents
- Communicate effectively using grammatically correct expressions.

PHC 1181	PHYSICS	L	T	P	C
		3	0	2	4

OBJECTIVES:

To make students conversant with the

- basic concepts of crystal physics and its structures
- production and applications of ultrasonic waves
- study of thermal conductivities of good and bad conductors
- phenomenon of wave optics and its applications
- principle of fibre optic communication and its applications to sensors
- wave mechanics principle and its applications in electron microscopy
- green energy physics and its environmental impacts to society

MODULE I CRYSTAL PHYSICS **8**

Crystalline and amorphous solids – Unit Cell – Seven Crystal Systems – Bravais Lattice – Miller Indices – Interplanar Spacing – Characteristics of Unit Cell - Calculation of Number of atoms per unit cell, Atomic Radius, Coordination Number and Packing Factor for SC, BCC, FCC and HCP and Diamond structures –Defects in crystals-Point defects –Edge and screw dislocations and their significance - Surface Defects.

MODULE II ULTRASONICS AND THERMAL PHYSICS **8**

Introduction to Ultrasonics - Properties - Production methods - Magnetostriction Oscillator method- Piezoelectric Oscillator method – Detection of Ultrasonics – Thermal method – Piezoelectric method – Kundt's tube method – Applications of Ultrasonics – Acoustic Grating – SONAR – Depth of sea – Velocity of blood flow, Ultrasonic Flaw detector (qualitative).

Transmission of heat – Conduction, Convection and Radiation – Thermal Conductivity of good Conductor – Forbe's method- Thermal Conductivity of bad Conductor – Lee's Disc method.

MODULE III APPLIED OPTICS **8**

Interference – Air Wedge – Michelson's Interferometer – Determination of wavelength of light and thickness of thin transparent sheet.

Introduction to Laser – Characteristics of Laser – Spontaneous and Stimulated Emissions – Einstein's Coefficients - Population inversion – Pumping Mechanism –

Laser Action – Types of Laser: He-Ne laser, CO2 laser and Nd:YAG laser - Applications : Laser Materials Processing .

MODULE IV FIBRE OPTICS 7

Optical fibre – Principle and propagation of light in optical fibre – Numerical aperture and acceptance angle – Types of optical fibres – Attenuation – Absorption, Scattering losses, Bending losses and Dispersion in Optical fibres – Fiber Connectors and Couplers - Applications – Fibre optic communication system (block diagram only)- Fibre optic sensors - displacement and pressure sensors (qualitative) - Medical endoscope.

MODULE V QUANTUM MECHANICS 7

Black body radiation – Planck's theory of radiation – Deduction of Wien's displacement law and Rayleigh – Jean's law from Planck's theory –Dual nature of matter – de Broglie's wavelength- Physical significance of wave function – Schrodinger wave equation – Time independent and time dependent wave equation – Particle in one dimensional box – Harmonic oscillator(qualitative).

MODULE VI RENEWABLE ENERGY SOURCES 7

Present Energy sources and sustainability - Solar energy - Solar photovoltaics - Solar cells – Bioenergy - Biomass – production of liquid fuels from biomass – Wind energy – Wind turbines – energy and power from wind turbines - Geothermal energy - Ocean energy: Wave energy – Wave energy conversion devices – Tidal energy – Tidal power basics – power generation –Tidal energy potential – Environmental benefits and impacts of renewable energy sources

PRACTICALS

1. Determination of Velocity of Ultrasonic waves in a given liquid using Ultrasonic Interferometer.
2. Determination of wavelength of ultrasonic waves using Kundt's tube method.
3. Determination of thickness of a thin wire using Air Wedge method.
4. Determination of wavelength of light using spectrometer diffraction grating.
5. Determination of angle of divergence of a laser beam using He-Ne laser.
6. Determination of particle size of lycopodium powder using semiconductor laser.
7. Determination of wavelength of laser light using semiconductor laser diffraction.
8. Determination of Acceptance angle and Numerical Aperture using fiber optic cable.

9. Determination of thermal conductivity of a good conductor by Forbe's method.
10. Determination of thermal conductivity of a bad conductor by Lee's disc method.
11. Determination of solar cell characteristics.

L – 45; P – 30; TOTAL HOURS – 75

REFERENCES :

1. Gaur R.K. and Gupta S.L., "Engineering Physics'', 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2013.
2. Palanisamy P.K., Physics for Engineers, Vol1 & Vol2, 2nd Edition, Scitech Publications, 2003.
3. Serway R.A. and Jewett, J.W. "Physics for Scientists and Engineers with Modern Physics". Brooks/cole Publishing Co., 2010.
4. Tipler P.A. and Mosca, G.P., "Physics for Scientists and Engineers with Modern Physics", W.H. Freeman, 2007.
5. Markert J.T., Ohanian. H. and Ohanian, M. "Physics for Engineers and Scientists". W.W. Norton & Co. 2007.
6. Godfrey Boyle, "Renewable Energy: Power for sustainable future", 2nd edition, Oxford University Press, UK, 2009.

OUTCOMES:

At the end of the course, students will be able to

- understand the different types of crystal structures
- apply the concept of ultrasonic principle in engineering and medical field
- calculate thermal conductivities of good and bad conductors
- differentiate the various laser systems and its applications in engineering and medical field
- apply the principle of fibre optics for communication and sensor applications
- formulate wave mechanics principle for applications in electron microscopy
- Correlate the different renewable energy sources for societal needs.
- To complement the knowledge acquired in the theory class.
- To correlate the experimental results for application.

CHC1181	CHEMISTRY	L	T	P	C
		3	0	2	4

OBJECTIVES:

The students should be conversant with

- the basic problems like hardness, alkalinity, dissolved oxygen associated with the water used for domestic and industrial purpose and treatment process involved.
- the synthesis, properties and applications of nanomaterials.
- the importance of renewable energy sources like solar, wind, biogas, biomass, geothermal, ocean and their limitations.
- the basic analytical techniques like UV-Visible, FT-IR, NMR, AAS, AES, Circular Dichroism and XRD etc.
- photochemistry concepts related to physical processes and chemical reactions induced by photon absorption and their applications.
- basic principles of electrochemistry, cell construction and evaluation and to understand general methodologies for construction & design of electrochemical cell

MODULE I WATER TECHNOLOGY 9

Impurities present in water, hardness : types of hardness, demerits of hard water in boilers, estimation of hardness by EDTA method (problems) – alkalinity : estimation of alkalinity (problems) – dissolved oxygen: estimation of dissolved oxygen – conditioning methods : external treatment method: – lime soda and zeolite process (principle only), Ion exchange process – Internal treatment : colloidal, carbonate, phosphate and calgon methods – drinking water: standards (BIS), treatment of domestic water {screening, sedimentation, coagulation, filtration, disinfection }– desalination: electrodialysis, reverse osmosis.

MODULE II NANOCHEMISTRY 6

Introduction – distinction between molecules, bulk materials and nanoparticles – classification based on dimension with examples – synthesis (top-down and bottom-up approach} : sol-gel, thermolysis (hydrothermal and solvothermal), electrodeposition, chemical vapour deposition, laser ablation – properties and applications (electronic, magnetic and catalytic) – risk factors and future perspectives.

MODULE III ENERGY SOURCES 8

Energy: past, today, and future – a brief history of energy consumption – present energy scenario of conventional and renewable energy sources – renewable energy : needs of renewable energy, advantages and limitations of renewable energy – solar energy: basics, solar energy in the past , photovoltaic, advantages and disadvantages – bioenergy: conversion, bio degradation, biogas generation, biomass gasifier, factors affecting biogas generation, advantages and disadvantages – geothermal energy: geothermal resources (hot dry rock and magma resources, natural and artificial), advantages and disadvantages – wind energy: wind resources, wind turbines, advantages and disadvantages – ocean energy: wave energy, wave energy conversion devices, ocean thermal energy, advantages and disadvantages.

MODULE IV PHOTOCHEMISTRY 7

Introduction: absorption and emission, chromophores, auxochromes – laws of photochemistry : Grotthus-Draper law, Stark Einstein law – quantum yield (problems) –photo physical processes : fluorescence and phosphorescence - Jablonski diagram (electronic states and transitions) – quenching, annihilation – photosensitization: principle and applications – chemiluminescence, bioluminescence.

MODULE V ANALYTICAL TECHNIQUES 7

Spectroscopy: electromagnetic radiation and spectrum – types of transitions – types of spectra (atomic and molecular with their chemical usefulness) – Beer-Lamberts law (problems) – principles, instrumentation and applications of: Colourimetry – UV-Vis spectrophotometer – atomic absorption spectroscopy – atomic emission spectroscopy – principles and applications of: IR, NMR, mass and X-ray diffraction analysis.

MODULE VI ELECTROCHEMISTRY 8

Electrochemistry - types of electrodes (principle and working) : gas (SHE), metal/metal ion electrode, metal-metal insoluble salt (calomel electrode), ion-selective (glass electrode and fluoride ion selective electrode) – Electrolytic and galvanic cells, construction of cell, EMF measurement and applications (problems), standard cell (Weston-cadmium), reversible and irreversible cell,

concentration cell. Determination of fluoride ion using fluoride ion selective electrode – Chemically modified electrodes (CMEs) : concept, approaches and applications.

PRACTICALS

1. Estimation of hardness in given water sample.
2. Estimation of the alkalinity of the given water sample.
3. Estimation of strong acid by conductometry.
4. Estimation of Fe^{2+} present in the given sample by potentiometry.
5. Verification of Beer-Lamberts law and estimation of Cu^{2+} present in unknown sample.
6. Estimation of sodium and potassium present in the given sample by flame photometry.
7. Determination of molecular weight and degree of polymerisation of a polymer by viscosity method.
8. Synthesis of thermosetting polymer.

L – 45; P – 30; TOTAL HOURS – 75

REFERENCES:

1. S. Vairam, P. Kalyani and Suba Ramesh, “Engineering Chemistry”, Wiley India Ltd., New Delhi, 2011.
2. G.A. Ozin and A.C. Arsenault, “Nanochemistry: A Chemical Approach to Nanomaterials”, RSC Publishing, Thomas Graham House, Cambridge, 2005.
3. P.C Jain & Monica Jain, Engineering Chemistry Dhanpatrai Publishing Company (P) Ltd., New Delhi (2013).
4. S S Umare & S S Dara, A text Book of Engineering Chemistry, S. Chand& Company Ltd, New Delhi, 2014.
5. G.D.Rai, “Non conventional energy sources,” Khanna Publishers, New Delhi, 2011.
6. John Twidell and Tony Weir, “Renewable Energy Resources, Taylor & Francis Ltd, London, United Kingdom, 2005
7. Principles of molecular photochemistry: An introduction, Nicholas J. Turro, V.Ramamurthy and Juan C. Scaiano, University Science Books, Sausalito, CA, 2009.

OUTCOMES:

The students will be able to

- solve problems related to hardness, alkalinity, dissolved oxygen associated with the water and describe the treatment processes.
- classify nanomaterials and apply the nanochemistry approach to synthesize the nanomaterials.
- explain the principle and enumerate the advantages and disadvantages of various renewable energy sources.
- state the principle and illustrate the instrumentation of various analytical techniques.
- apply the concepts of photochemistry to elaborate various photo-physical and photochemical reactions.
- construct a electrochemical cell and describe the various types of electrodes and determine the fluoride content.

GEC 1101 ENGINEERING GRAPHICS L T P C

2 0 2 3

OBJECTIVES:

- To introduce the students of all engineering programs, the basic concepts of engineering drawing, which is the basic communication medium for all engineers
- To provide practical exposure on important aspects like drawing analytic curves, orthographic projections, section of solids, development of surfaces, isometric projection, perspective projection and free hand drawing.
- To introduce computerized drafting.

MODULE I BASICS AND ENGINEERING CURVES 10

Drawing instruments, dimensioning, BIS conventions, types of lines, simple geometric constructions.

Conic sections: ellipse, parabola, hyperbola.

Special curves: cycloid, epicycloid, hypocycloid and involutes.

MODULE II ORTHOGRAPHIC PROJECTION 8

Orthographic projection – first angle, second angle, third angle and fourth angle projections –setup - assumptions, principle. Free hand sketching of orthographic views of simple machine parts as per first angle projection. Orthographic projection of points in all quadrants. Some commands and demonstration of drafting packages.

MODULE III PROJECTION OF STRAIGHT LINES AND PLANES 10

Projection of straight lines in first quadrant – true length and true inclinations – Rotating line and trapezoidal methods –traces of straight line.

Projection of plane lamina in first quadrant and its traces

MODULE IV PROJECTION OF SOLIDS 10

Projection of solids in first quadrant: Axis inclined to one reference plane only- prism, pyramid, cone, cylinder – change of position and auxiliary projection methods.

MODULE V SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES 12

Section of solids: prism, pyramid, cone, cylinder, and sphere – sectional view – true shape of section Solids in simple position and cutting plane inclined to one reference

plane only.

Development of surface of truncated solids: prism, pyramid, cone cylinder – frustum of cone, pyramid and simple sheet metal parts.

MODULE VI PICTORIAL PROJECTIONS 10

Isometric projection: Isometric scale – isometric axes- iso sheet - Isometric projection and view of prism, pyramid, cylinder, cone, frustums, truncated solids and simple products

Perspective projection: station point – vanishing point – Perspective projection and views of prism, pyramid, cylinder and frustums by Visual ray method.

L – 30; P – 30; TOTAL HOURS – 60

TEXT BOOKS:

1. N.D. Bhatt, 'Engineering Drawing' Charotar Publishing house, 53rd Edtion, (2014)

REFERENCES:

1. K.V. Natarajan, 'A text book of Engineering Graphics', Dhanalakshmi publishers, Chennai. (2009)
2. Venugopal. K, and V. Prabhu Raja, Engineering Graphics, New Age International (P) Ltd., Publication, Chennai. (2011)

OUTCOMES:

- Students should be able to read the specifications and standards of technical drawing and able to draw conic sections and special curves.
- Students should be able to understand the insight of orthographic projection and to draw the various views of orthographic projection of a point and various components.
- Students should be able to draw the orthographic views of straight lines and plane figures.
- Students should be able to draw the orthographic views of simple solids.
- Students should be able to draw the sections of solids and development of solid surfaces.
- Students should be able to draw the isometric and perspective projection of simple solids and components.

GEC 1102	ENGINEERING DESIGN	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To understand the role of design in Engineering
- To understand the basic design concepts
- To understand the role of innovation in design

MODULE I DESIGN AS A CENTRAL ACTIVITY IN ENGINEERING 08

Product design – products and processes – product design methodology Design of systems; Software design

MODULE II NEED ANALYSIS AND CONCEPT DEVELOPMENT 07

Voice of customers – product specification - need analysis Bench marking Product architecture – concept generation and evaluation;

MODULE III CASE STUDIES IN ENGINEERING DESIGN 08

Product design – process design; system design; software design -Ergonomics – usability

MODULE IV INNOVATION AND DESIGN 07

Role of innovation in Engineering – incremental changes and systemic changes; scientific approach to driving innovation – case studies.

TOTAL HOURS – 30

REFERENCES:

1. Clive L. Dym and David C. Brown,“Engineering Design: Representation and Reasoning”, 2nd Edition, Cambridge University Press, New Delhi, 2011.
2. Daniel G. Dorner, G. E. Gorman and Philip J. Calvert, “Information Needs Analysis: Principles and practice in information organizations”, Published by Faced Publishing, London. 2015.
3. Cliff Matthews, “Case Studies in Engineering Design”, John Wiley & Sons Pvt. Ltd, New York, 1998.
4. Bengt-Arne Vedin, “The Design-Inspired Innovation Workbook”, World Scientific, 2011.
5. Navi Radjou, Jaideep Prabhu and Simone Ahuja, “Jugaad Innovation”, Published

by Random House India, 2012.

OUTCOMES:

The students will be able to

- Apply the basic knowledge of design in engineering products / process / service.
- Analyse the problems and give innovative solutions.
- Correlate the basic knowledge of design in the real world problems.
- Apply innovative approaches to engineering design.

GEC1103	BASIC ENGINEERING PRACTICES LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To provide a practical exposure to basic engineering practices like carpentry, fitting, plumbing, welding and making of simple electrical and electronic circuits
- To have an understanding on the use of various tools, instruments and methods
- To enable the students to appreciate the practical difficulties and safety issues

CIVIL ENGINEERING PRACTICE

1. Study of plumbing in general household and industrial systems
2. Making a small window frame with Lap and Mortise & Tenon Joints
3. Introduction to power tools

MECHANICAL ENGINEERING PRACTICE

1. Fabrication of a small Table frame with Butt, Lap and Fillet Joints
2. Machining of a simple component like a table weight using lathe
3. Mold preparation for simple component

ELECTRICAL ENGINEERING PRACTICE

1. Comparison of incandescent, Fluorescent, CFL and LED lamps.
2. Study of Protection Circuits (small relay, fuse, MCB, HRC, MCCB, ECCB).
3. Familiarization of households Electrical Gadgets (Iron Box, Wet Grinder).
4. Understanding of Domestic and Industrial wiring.
5. Earthing and its significance.
6. Troubleshooting in Electrical Circuits.
7. Study of inverter fed UPS/Emergency lamp

ELECTRONICS ENGINEERING PRACTICE

1. Identifications symbolic representation of active and passive electronic components
2. Soldering and tracing of electronic circuits and checking its continuity
3. Assembling of A.C. to D.C, D.C to A.C. Circuits in bread Board and Mini project.

TOTAL HOURS – 30

OUTCOMES:

Upon the completion of the course, students should be able to

- Appreciate the practical skills needed even in making of simple objects, assemblies and circuits
- Attend minor defects especially in items used in day to day life
- Aware of the safety aspects involved in using tools and instruments

GEC 1104	COMPUTER PROGRAMMING I	L	T	P	C
		1	0	2	2

OBJECTIVES:

- To identify the hardware and software components of the computer.
- To know the basic concept of operating system and get knowledge about different operating systems.
- To learn various database concepts and operations
- To develop efficient algorithms for solving a problem.
- To implement the algorithms in C language.
- To use arrays in solving problems.

MODULE I COMPUTER FUNDAMENTALS **7**

Introduction -. Number System - Planning the computer program - Computer Software - Basic operating system concepts - Database Operations

MODULE II PROGRAMMING IN C **8**

Introduction to C Programming Language – Operators - Control statements -Iterative statements - Arrays.

LIST OF EXPERIMENTS:

1. Computer organization –Hardware in a typical computer Identification – Booting- error messages and what it means
2. Types of Operating systems – Windows and Linux
3. Structure of a basic program - Hello world program – Debugging it
4. Data types: Type conversions
5. Input / Output: Formatted functions – Unformatted functions – Library functions
6. Properties of operators – Priority of operators – Arithmetic relational logical and bitwise operators
7. If – if else- nested if else- goto- switch case – nested switch case – for loops – nested for loops – while loop – do-while loop – break and continue statement
8. Arrays – Operation with arrays
9. Sorting and searching.

L – 15; P – 30; TOTAL HOURS – 45

REFERENCES:

1. Ashok N Kamthane, “Computer Programming”, Pearson Education, 2nd Edition, ISBN 13: 9788131704370, 2012
2. Paul J. Deitel, Deitel & Associates, “C How to Program”, Pearson Education, 7th Edition, ISBN-13: 978-0132990448, 2012

OUTCOMES:

Students who complete this course will be able to

- Recognize Modular design, logic flow, data abstraction
- Analyze the working of the programming constructs, functions, and I/O.
- Write down programs for sorting and searching algorithms
- Write down programs developing cycle for different applications
- Debug the programs and solve some practical problems in programming
- Develop programs using arrays.

SEMESTER II

MAC 1281	ADVANCED CALCULUS	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aims of this course are to

- train the students in solving problems using multiple integration.
- provide knowledge in using special functions to find out the area and volume of a region.
- acquire knowledge in tangent and normal vectors.
- gain knowledge in finding the areas of a curve and surface using vector integration.
- learn about the analytic functions and their properties along with bilinear transformation.
- know complex integration using Cauchy's theorems.

MODULE I MULTIPLE INTEGRATION AND ITS APPLICATIONS 8+2

Multiple integrals– Cartesian and Polar coordinates – change of order of integration – Multiple integral to compute area and volume.

MODULE II TRANSFORMATION OF COORDINATES AND SPECIAL FUNCTIONS 7+3

Change of variables between Cartesian, polar, cylindrical and spherical coordinates - Beta and Gamma functions – Properties and applications.

MODULE III VECTOR DIFFERENTIATION 7+3

Operations on vectors – Scalar Product, Vector Product, Projection of Vectors - Angle between two vectors - Gradient, divergence and curl

MODULE IV VECTOR INTEGRATION 8+2

Line, surface and volume integrals – Green's Theorem, Gauss Divergence Theorem and Stokes Theorem (statement only) – verification and evaluation of integrals.

MODULE V ANALYTIC FUNCTION 8+2

Analytic function - Necessary and Sufficient condition (statement only) – Cauchy-

Riemann equations in polar coordinates - properties of analytic function – determination of analytic function – conformal mapping (w = z+a, az and 1/z) and bilinear transformation.

MODULE VI COMPLEX INTEGRATION **7+3**

Statement and application of Cauchy's integral theorem – Cauchy's integral formula – Taylor's series and Laurent's series expansion – singularities - classification – residues - Cauchy's residue theorem – contour integration – Unit circle and semi circular contours (excluding poles on the real axis).

L – 45; T – 15; TOTAL HOURS – 60

TEXT BOOKS:

1. Veerarajan.T., "Engineering Mathematics "(5th edition) Tata Mc Graw Hill Publishing Co. New Delhi, 2012
2. Grewal B.S., "Higher Engineering Mathematics" (43rd edition), Khanna Publishers, New Delhi, 2012.
3. John W. Cell "Engineering Problems Illustrating Mathematics" Mc Graw Hill Publishing Co., New York 1943

REFERENCES:

1. Kreyszig, E., "Advanced Engineering Mathematics", 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
2. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th edition, Cengage Learning, 2011.
3. Dennis G. Zill, Warren S. Wright, "Advanced Engineering Mathematics", 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
4. Alan Jeffrey, "Advanced Engineering Mathematics", Academic Press, USA, 2002.
5. Ramana, B.V., "Higher Engineering Mathematics" Tata Mc Graw Hill Publishing Co. New Delhi, 2006.
6. Venkataraman, M.K., "Engineering Mathematics", Volume 2, 2nd edition, National Publishing Co., Chennai, 2003.
7. James Stewart ".Calculus" (7th edition),Brooks/Cole cengage learning,UK.

OUTCOMES:

After completing the course, student will be able to

- compute the area and volume using multiple integrals.

- apply special functions to solve integration problems.
- apply differentiation in scalar and vector fields.
- find area and volume of a region using vector integration.
- verify analyticity, conformity and bilinearity of complex functions.
- evaluate complex integrals.

GEC 1211	BASIC ENGINEERING MECHANICS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To impart knowledge about the basic laws of statics and dynamics and their applications in problem solving
- To acquaint both with scalar and vector approaches for representing forces and moments acting on particles and rigid bodies and their equilibrium
- To give on exposure on inertial properties of surfaces and solids
- To provide an understanding on the concept of work energy principle, friction, kinematics of motion and their relationship

MODULE I VECTOR APPROACH TO MECHANICS **07**

Introduction - Units and Dimensions- Vectors – Vectorial representation of forces and moments –Vector Algebra and its Physical relevance in Mechanics - Laws of Mechanics – Parallelogram and triangular Law of forces -Lame's theorem, Coplanar Forces – Resolution and Composition of forces- Equilibrium of a particle.

MODULE II EQUILIBRIUM OF PARTICLE **06**

Forces in space - Equilibrium of a particle in space - Equivalent systems of forces – Principle of transmissibility – Single equivalent force

MODULE III EQUILIBRIUM OF RIGID BODY **06**

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis –Vectorial representation of moments and couples – Scalar components of a moment –Varignon's theorem - Equilibrium of Rigid bodies in two dimensions - Examples

MODULE IV PROPERTIES OF SURFACES **08**

Determination of Areas – First moment of area and the Centroid of sections – Rectangle, circle, triangle from integration – T section, I section, Angle section, Hollow section by using standard formula – second and product moments of plane area – Physical relevance - Rectangle, triangle, circle from integration - T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia- Mass moment

of Area

MODULE V FRICTION 08

Introduction to friction- types of friction- Laws of Coloumb friction- Frictional force – simple contact friction – Rolling resistance –ladder friction

MODULE VI LAWS OF MOTION 10

Review of laws of motion – Newton's law – Work Energy Equation of particles– Impulse and Momentum – Impact of elastic bodies.

L – 45; T – 15; TOTAL HOURS – 60

REFERENCES:

1. Beer, F.P and Johnston Jr. E.R, "Vector Mechanics for Engineers, Dynamics & Statics", Third SI Metric Edition, Tata McGraw-Hill International Edition, 2001.
2. Hibbeller, R.C., Engineering Mechanics, Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., 2000.
3. Irving H. Shames, Engineering Mechanics – Statics and Dynamics, IV Edition Pearson Education Asia Pvt. Ltd., 2003.

OUTCOMES:

On completion of this course students should be able

- Analyse and resolve forces, moments and solve problems using various principles and laws of Mechanics
- Apply the concept of equilibrium to particles and solve problems
- Apply the concept of equilibrium to rigid bodies and solve problems
- Analyse and determine the properties of surfaces
- Analyse and evaluate the fractional forces between the bodies
- Apply the laws of motion in solving dynamics problems

GEC 1212	ENVIRONMENTAL STUDIES	L	T	P	C
		2	0	0	2

OBJECTIVES:

The student will be conversant with the

- various natural resources, availability, utilisation and its current scenario
- different ecosystems, energy transfer, values, threats and conservation of biodiversity
- levels of different pollutants and its impact and the causes and effects of natural disasters
- impacts of human population, impact assessment, human rights and environmental acts and sustainable development

MODULE I NATURAL RESOURCES **8**

Land resources: land degradation, soil erosion and desertification - Forest resources: use and over-exploitation, deforestation - Water resources: use and over-utilisation of surface and ground water, conflicts over water (inter-state and international), dams (benefits and problems), water conservation (rainwater harvesting and watershed management) - Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources, mining - Food resources: world food problems, changes in land use by agriculture and overgrazing, modern agriculture and its effects, fertilizer and pesticide problems, water logging and salinity - Energy resources: increasing energy needs, renewable and non-renewable, use of alternate energy sources.

MODULE II ECOSYSTEM AND BIODIVERSITY **8**

Ecosystem- energy flow in the ecosystem - food chains, food webs and ecological pyramids - characteristics, structure and function of (a) Terrestrial ecosystems (forest, grassland, desert) and (b) Aquatic fresh water ecosystems (pond, lake, river) (c) Aquatic salt water ecosystems (ocean, estuary) - ecological succession.

Biodiversity - genetic, species and ecosystem diversity – hot-spots of biodiversity –biogeographic classification of India - endangered, endemic, extinct and invasive species of India - red data book - values of biodiversity: consumptive, productive, social, ethical, aesthetic and option values - threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts - conservation of biodiversity: in-situ and ex-situ conservation of biodiversity

MODULE III ENVIRONMENTAL POLLUTION AND NATURAL DISASTER **8**

Definition, cause, effects and control measures of (a) air pollution (b) water pollution (c) soil pollution (d) marine pollution (e) noise pollution (f) thermal pollution (g) nuclear hazards - ill-effects of fireworks and upkeep of clean environment - solid waste management: types (urban, industrial, biomedical and electronic wastes), collection, processing and disposal (incineration, composting and land-fill) - natural disaster and management: flood, cyclone, drought, landslide, avalanche, volcanic eruptions, earthquake and tsunami.

MODULE IV HUMAN POPULATION, HEALTH AND SOCIAL ISSUES **6**

Population and population growth, population variation among nations, population explosion, family welfare programme.

Human health: air-borne, water borne diseases, infectious diseases, risks due to chemicals in food and environment.

Sustainable development - environmental legislation and laws: water act, air act, wildlife protection act, forest conservation act, environment protection act - environmental impact assessment, steps in EIA - human rights - women and child welfare.

Case studies related to current situation

TOTAL HOURS – 30

TEXT BOOKS:

1. Erach Bharucha, Textbook for Environmental Studies For Undergraduate Courses of all Branches of Higher Education for University Grants Commission, Orient Blackswan Pvt Ltd, Hyderabad, India, 2013.
2. Benny Joseph, Environmental Studies, Tata McGraw-Hill Education, India, 2009.
3. Ravikrishnan A, Environmental Science and Engineering, Sri Krishna Publications, Tamil Nadu, India, 2015.
4. Raman Sivakumar, Introduction to Environmental Science and Engineering, McGraw Hill Education, India, 2009.
5. Venugopala Rao P, Principles of Environmental Science and Engineering, Prentice Hall India Learning Private Limited; India, 2006.
6. Anubha Kaushik and Kaushik C.P., Environmental Science and

Engineering, New Age International Pvt Ltd., New Delhi, India, 2009.

REFERENCES:

1. Masters G.M., Introduction to Environmental Engineering and Science, Prentice Hall, New Delhi, 1997.
2. Henry J.G. and Heike G.W., Environmental Science and Engineering, Prentice Hall International Inc., New Jersy, 1996.
3. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co. Boston, USA, 2016.

OUTCOMES:

The student will be able to

- predict the scenario of various natural resources and suggest remedies to curb the exploitation of these resources.
- identify food chain and web and its role in various ecosystems, assess the impacts on biodiversity and provide solutions to conserve it.
- analyse the impacts of pollutants in the environment and propose suitable method to alleviate the pollutants and the natural disasters.
- assess on the impact of human population and the health related issues and the ethics to be followed for sustainable life.

GEC 1213	COMPUTER PROGRAMMING II	L	T	P	C
		1	0	2	2

OBJECTIVES:

- To provide knowledge about the benefits of Object Oriented Programming over Procedure oriented programming.
- To learn various File operations
- To expose fundamental concepts of object-oriented programming in classes, invoking methods and functions.
- To prepare students to get full use of code reusability using object oriented programming.
- To implement the basic concepts of object oriented programming using C++concepts.
- To focus on solving problems based on analyzing, designing and implementing programs in C and C++.

MODULE I PROGRAMMING IN C 7

Functions - Storage Classes - Structures and Unions – Pointers -Self Referential Structures and Linked Lists - File Processing.

MODULE II PROGRAMMING IN C++ 8

Programming in C++ - Overview of OOP in C – Inheritance - Polymorphism - Type Casting – Exceptions.

LIST OF EXPERIMENTS:

1. Functions
2. One dimensional arrays, Pointers
3. Recursion
4. Multi dimensional arrays, Linked lists.
5. Operating on Files.
6. Simple C++ program with Control statements.
7. Getting input from user console.
8. Classes, Object and Constructors.
9. Method overloading.
10. Inheritance

L – 15; P – 30; TOTAL HOURS – 45

REFERENCES:

1. Bjarne Stroustrup," The C++ Programming Language", Addison Wesley, 4th edition, ISBN-13: 978-0321563842, 2013.
2. Brian W. Kernighan and Dennis M. Ritchie, " The C Programming Language", Prentice Hall, ISBN 0-13-110362-8, 2015.
3. Bjarne Stroustrup, " Programming: Principles and Practice Using C++ ", Addison Wesley, 2nd edition, ISBN-13: 978-0321992789, 2014.
4. Brian W. Kernighan and Dennis M. Ritchie, " The C Programming Language (Ansi C Version)", Prentice Hall India Learning Private Limited, 2nd edition, ISBN-13: 978-8120305960, 1990.

OUTCOMES:

Students who complete this course will be able to

- Develop efficient algorithms for solving problems
- Handle files in C
- Use simple data structures like arrays and linked lists in solving problems.
- Write simple programs using concepts of object oriented programming.
- Implement algorithms in C++ Language.
- Demonstrate the Object Oriented Programming concepts applied in networking, web development and Database applications.

EIC 1211	ELECTRIC CIRCUIT ANALYSIS	L	T	P	C
		3	0	2	4

OBJECTIVES:

- To introduce basic concepts of AC and DC circuits and to explore the basics of R,L, C circuits.
- To explore various network reduction techniques and theorems.
- To introduce the concept of transient analysis of first and second order linear circuits.
- To explore the concept of resonance in Series and Parallel circuits.
- To explore the concept of two port networks and the analysis of three-phase balanced and unbalanced circuits.

MODULE I BASIC CIRCUIT CONCEPTS **10**

THEORY

Linear, Nonlinear, Unilateral, Bilateral, Active and Passive elements. Voltage and Current sources: Ideal, Practical, Dependent and Independent. Ohm's and Kirchhoff's Laws. Current and Voltage relationship in R, L, and C circuits, Impedance and admittance, Series and Parallel connections of resistances and impedances - Y-Δ transformation, Voltage and Current division in series and parallel circuits.

PRACTICAL

Experimental verification of Ohm's law, Kirchhoff's voltage and current laws.

MODULE II SINUSOIDAL STEADY STATE ANALYSIS **10**

THEORY

Concept of phasor, complex impedance (z) and admittance (y) - Sinusoidal and other periodic waveforms: Average and RMS value, Form factor. Phasor representation of A.C quantities - Analysis of simple series and parallel circuits; Active power, reactive power, apparent power, power factor, concept of complex power, impedance and power triangles, energy associated with these circuits - Resonance in parallel and series circuits: Half power frequencies, Bandwidth, Quality and Dissipation factor.

PRACTICAL

Study of CRO and measurement of frequency, RMS voltage and power factor.
Steady state analysis of series RL and RC circuits.

Design and Simulation of frequency response of series resonant circuits.
Design and Simulation of frequency response of parallel resonant circuits.

MODULE III NETWORK REDUCTION TECHNIQUES AND THEOREMS **10**

THEORY

Network reduction: Mesh and Nodal analysis of D.C and A.C circuits. Theorems for D.C and A.C networks:-Superposition, Thevenin's, Norton's, Maximum Power Transfer and Reciprocity.

PRACTICAL

Experimental verification of network theorems (Thevenin's, Norton's, Superposition, maximum power transfer Theorem and reciprocity theorem).

MODULE IV TRANSIENT ANALYSIS OF FIRST AND SECOND ORDER LINEAR CIRCUITS **10**

THEORY

Source free RC, RL, RLC Circuit responses. Standard test signals. Step response of RC, RL, RLC series and parallel circuits. Responses of RC, RL and RLC series circuits to sinusoidal excitation.

PRACTICAL

Experimental determination of time constant of series RL, RC circuits.
Experimental determination of frequency response of RLC circuits.

MODULE V MAGNETIC AND COUPLED CIRCUITS **10**

THEORY

Electromagnetism, Magnetic materials - MMF, flux, flux density, field intensity, reluctance, permeability – comparison of magnetic and electric circuits - Self and Mutual Inductance in coupled coils, Dot convention, Coefficient of coupling. Sinusoidal steady state analysis of network with coupled inductance.

PRACTICAL

Measurement of Self and Mutual Inductance

MODULE VI THREE PHASE CIRCUITS AND TWO PORT NETWORKS **10**

THEORY

Three phase balanced and unbalanced voltage sources and loads– Line voltage,

Phase voltage, Phasor diagram, power and Power factor in three -phase circuit. Analysis with star and delta balanced and unbalanced loads. Network terminals and ports: – Z-parameters, T-equivalent of reciprocal network, Y-parameter, π-equivalent of reciprocal networks, h-parameters and g-parameters.

PRACTICAL

Experimental determination of power in a three phase circuits by two-watt meter method.

Determination of Z, Y and h parameters of a two port network.

L – 45; P – 30; TOTAL HOURS – 75

TEXT BOOKS:

1. Boylsted, R.L., “Introductory Circuit Analysis”, 12th Edition, Prentice Hall, 2010.
2. Husain, A., “Networks and Systems”, 2nd Edition Khanna Publishers, 2006.

REFERENCES:

1. Edminister, J.A. and Nahvi, M., “Electric Circuits”, 6thEdition, Schaum’s Outline series, McGraw-Hill, 2013.
2. HAYT, Jr.W.H.,Kemmerly, J.E., and Durbin, S.M., “Engineering Circuit Analysis”, 7th edition,McGraw-Hill, 2007.
3. Alexander, C.K., Matthew, N.O., and Sadiku, “Fundamentals of Electric Circuits”, McGraw- Hill, 2007.
4. Decarlo, R.A. and Lin, P.M., “Linear Circuit Analysis”, 2nd Edition,Oxford University Press, 2001.

OUTCOMES:

At the end of the course, the students will be able to

- Analyze the basic concepts of D.C circuits.
- Analyze the A.C circuits and understand the concept of resonance in series and parallel circuits.
- Solve the electrical circuits using the network theorems.
- Understand the transient analysis of first and second order linear networks.
- Analyze magnetic and coupled circuits
- Analyze three phase circuits and be in a position to understand the concept of two port networks.

EIC1212	ELECTRON DEVICES	L	T	P	C
		2	0	0	2

OBJECTIVES:

• To acquaint the students with construction, theory and characteristics of the following electronic devices.

1. P-N junction diode
2. Bipolar transistor
3. Field effect transistor
4. Rectifier, filters and regulators

• To familiarize the student with the principle of operation, capabilities and limitation of various electron devices and their applications.

MODULE I DIODES **8**

Construction, working, characteristics and Applications**:** PN junction diode, Energy band diagram of PN junction diode, Biasing, Zener diode- Avalanche breakdown, Zener break down, Tunnel diode, Schottky Diode, Gunn Diode.

MODULE II BIPOLAR JUNCTION TRANSISTORS AND FIELD EFFECT TRANSISTORS **8**

BJT Construction - Operation of PNP and NPN transistors – Types of Configurations - CC,CE,CB configurations, Transistor Biasing: Methods of Transistor biasing - Bias Stability - Bias Compensation - Transistor as an Amplifier - Comparison of BJT and FET, JFET- Construction - Drain and Transfer characteristics - Pinch off voltage, MOSFET - Types of MOSFET - Construction and Characteristics. Biasing FET and MOSFET.

MODULE III RECTIFIERS **7**

Half wave rectifier, ripple factor, full wave rectifier, Harmonic components in a rectifier circuit, clippers, clampers, voltage multipliers.

MODULE IV FILTERS AND REGULATORS **7**

Inductor filter, Capacitor filter, L- section filter, p- section filter, Multiple L- section and Multiple p- π section filter and comparison of various filter circuits in terms of ripple factors,. Simple circuit of a regulator using zener diode. Series and Shunt voltage

regulators- Analysis and design- Protection circuits for voltage regulators.

TOTAL HOURS – 30

TEXT BOOKS:

1. Jacob Millman & Christos C. Halkias, “Electronic Devices and Circuits” TataMcGraw-Hill, 1991.
2. Millman J and Gabriel A, “Microelectronics”, Tata McGraw-Hill Publishing Company Limited, New Delhi, 3rd Edition, 2000.

REFERENCES:

1. Thomas .L.Floyd, Electronic Devices- Elctron flow Version- 9th Edition,Pearson Education- Prentice Hall of India , 2012
2. S.Salivahanan, N. Sureshkumar and A. Vallavaraj, Electronic Devices and Circuits, TMH, 2008.
3. S.M. Sze, Semiconductor Devices – Physics and Technology, 2nd Edn., John Wiley, 2002.

OUTCOMES:

At the end of this course, the students will be able to

- Understand the characteristics of PN junction diode, biasing and its breakdown mechanism.
- Analyze and design amplifier circuits , oscillators and filter circuits employing BJT, FET devices.
- Acquire knowledge in Rectifier, clipper and clampers.
- Gain knowledge about the working of filters and regulators and its applications.

SEMESTER III

		L	T	P	C
MAC 2181	**PARTIAL DIFFERENTIAL EQUATIONS AND TRANSFORMS**	**3**	**1**	**0**	**4**

OBJECTIVES:

The aims of this course are to

- Familiarize in solving partial differential equation of first, second and higher orders.
- Introduce basics and engineering applications of Fourier series, Laplace Transform, Fourier Transform and Z- Transform.

MODULE I PARTIAL DIFFERENTIAL EQUATIONS 8 + 2

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solution of standard types of first order partial differential equations – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients.

MODULE II FOURIER SERIES 8+2

Fourier Series and Dirichlet's conditions - General Fourier series - Half range Fourier series - Parseval's identity - Harmonic Analysis.

MODULE III FOURIER TRANSFORMS 7+3

Fourier integral theorem (without proof) - Fourier transform pair - Fourier Inverse Transform – Properties - Convolution theorem - Parseval's identity.

MODULE IV APPLICATIONS OF FOURIER SERIES AND FOURIER TRANSFORMS 7+3

Applications of Fourier series and Fourier Transform to solution of PDEs having constant coefficients with special reference to Heat & Wave equations, Discrete & point Spectrum and Single pulse.

MODULE V LAPLACE TRANSFORM 8+2

Introduction to Laplace transform - Existence of Laplace Transform - Properties of Laplace Transforms - Initial & Final Value Theorems - Inverse Laplace Transform - Convolution Theorem – Circuits to signal square wave: Integral equations with unrepeated complex factors – Damped forced vibrations: repeated complex

factors – Resonance - Solution of differential equations

MODULE VI Z – TRANSFORM 7+3

Introduction and Definition of Z-transform - Properties of Z- Transform - Convolution Theorem of Z-Transform - Inverse Z–transform - Convolution Theorem of Inverse Z-Transform - Formation of difference equations - Solving Difference Equations using Z-Transform.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Kreyszig .E., “Advanced Engineering Mathematics“, 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
2. Grewal B.S., “Higher Engineering Mathematics”, 42nd edition, Khanna Publishers, New Delhi, 2012.
3. Ramana, B.V, “Higher Engineering Mathematics” Tata Mc Graw Hill Publishing Co. New Delhi, 2006.

REFERENCES:

1. Veerarajan.T., “Engineering Mathematics“, 5th edition, Tata Mc Graw Hill Publishing Co. New Delhi, 2012.
2. Peter V. O'Neil, “Advanced Engineering Mathematics**”**, 7th edition, Cengage Learning, 2011.
3. Dennis G. Zill, Warren S. Wright, “Advanced Engineering Mathematics”, 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
4. Alan Jeffrey, “Advanced Engineering Mathematics”, Academic Press, USA, 2002.

OUTCOMES:

After completing the course, student will be able to

- solve the partial differential equations.
- derive a Fourier series of a given periodic function by evaluating Fourier coefficients.
- apply integral expressions for the forward and inverse Fourier transform to a range of non-periodic waveforms.
- solve wave equation and heat flow equation.
- solve ordinary differential equations using Laplace transform.
- solve difference equation using Z-transform.

ENC 2181	ORAL COMMUNICATION	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To expose students to a range of professional contexts through podcasts for learning appropriate expressions.
- To train them in making poster presentations.
- To enable them to make effective business presentations.
- To help them learn persuasive and negotiation skills.
- To train them to debate on issues of current relevance
- To train them to participate in group discussions on current affairs

MODULE I **4**

Orientation to the Importance of Oral Communication -– Verbal and non-verbal communication -Paralinguistic features.

One-minute presentations (using Audacity/Voicethread) – Just a minute (JAM) on random topics

MODULE II **4**

Negotiating and persuading through effective arguments – to arrive at a conclusion (pair-work)

Understanding Negotiation, persuasion and marketing skills through Podcasts

Listening to short conversations and monologues for understanding real life conversations

MODULE III **4**

Making Poster presentations on current issues

Understanding nuances of making effective presentations (TED Videos)

MODULE IV **6**

Deliberation on social and scientific issues – Debates (focus on rebuttal skills and deconstructing arguments)

Viewing videos on debates (NDTV Discussions)

MODULE V **6**

Discussing social issues or current affairs in groups

Viewing group discussions and listening for specific information

MODULE VI **6**

Making full length presentation (through Voicethread) with the focus on one's career

plans and prospects (discipline specific)

Listening to interviews for understanding speakers' perception (on industry related issues)

P – 30; Total Hours –30

REFERENCES:

1. Hancock, Mark (2012). *English Pronunciation in Use*. Cambridge University Press, UK.
2. Anderson, Kenneth & et.al (2007). *Study Speaking: A Course in Spoken English for Academic Purposes* (Second Edition). Cambridge University Press, UK.
3. Hurlock, B.Elizabeth (2011). *Personality Development*. Tata McGraw Hill, New York.
4. Dhanavel,S.P (2015). *English and Soft Skills*. Orient Blackswan, Chennai.
5. Whitby, Norman (2014). *Business Benchmark: Pre-Intermediate to Intermediate.* Cambridge University Press, UK.

OUTCOMES:

On completion of the course, students will be able to

- Listen to business conversations and do related tasks.
- Deliver effective poster presentations.
- Make effective business presentations.
- Use persuasive and negotiating skills for justifying arguments.
- Participate effectively in debates.
- Speak English intelligibly, fluently and accurately in group discussions.

EIC2101 TRANSDUCER ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To give knowledge about basic measurement Systems and Units & standards.
- To provide an introductory knowledge about transducers.
- To give adequate knowledge about the characteristics of transducer.
- To have in depth knowledge about Resistive, capacitive and inductive
- transducers.
- To introduce basic knowledge about other types of transducers like
- Piezoelectric, magnetostrictive transducers and smart transducers.

MODULE I SCIENCE OF MEASUREMENT 7

Importance of measurement – Methods of measurement – Functional blocks of a measurement system - Errors - Classification of errors – Error analysis – Statistical methods – Odds and uncertainty and its analysis- Calibration methods.

MODULE II CLASSIFICATION & CHARACTERISTICS OF TRANSDUCERS 9

Definition of transducers - classification of transducers - Static characteristics : Accuracy, precision, resolution, sensitivity, linearity, threshold, hysteresis, bias, range, span and loading effect - Dynamic characteristics: Mathematical model of transducer – Zero, I and II order transducers - Response to impulse, step, ramp , sinusoidal and nonlinear inputs.

MODULE III VARIABLE RESISTANCE TRANSDUCERS 7

Principle of operation, construction details, characteristics and applications of resistance potentiometer, strain gauge, resistance thermometer, thermistor, hotwire anemometer, piezo-resistive sensor and humidity sensor.

MODULE IV VARIABLE INDUCTANCE AND VARIABLE CAPACITANCE TRANSDUCERS 8

Inductive Transducers: Principle of operation, Construction details,-Induction potentiometer – variable reluctance transducers – EI pick up – LVDT– synchro – MicroSyn. Capacitive transducers: Principle of operation, Construction details three types - capacitor microphone – capacitive pressure sensor - proximity sensor

MODULE V OTHER TRANSDUCERS 7

Piezoelectric transducer – Hall Effect Transducers- magnetostrictive transducer – Introduction to IC sensors -Thick & Thin film sensors (Bio Sensor & Chemical sensor), Photo emissive cells, Photo Multiplier Tube, Environmental Monitoring Sensors, Radiation Detectors

MODULE VI MEMS & NANO TRANSDUCERS 7

Introduction to MEMS – Digital transducers– Smart Transducer – Fiber optic transducer – SQUID(superconducting quantum interference device)-Introduction to nano materials - carbon nano tube - Nano transducers – different types of nano position sensors - nano actuators – applications - nano wire based solar cells.

L – 45; T – 0; Total Hours –45

TEXT BOOKS:

1. Doebelin E.O, and Manik D.N., “Measurement Systems – Applications and Design”, Tata McGraw Hill, New York, 2011.
2. Neubert, H.K.P., “Instrument Transducers – An introduction to their Performance and Design”, Oxford University Press, Cambridge, 2003

REFERENCES:

1. A.K. Sawhney, “A course in Electrical & Electronic Measurement and Instrumentation”, Dhanpat Rai and Co (P) Ltd., 2014.
2. D. Patranabis, “Sensors and Transducers”, Prentice Hall of India, 2010.
3. John P. Bentley, “Principles of Measurement Systems”, 3rd edition, Pearson Education,2004.
4. D.V.S Murthy, “Transducers and Instrumentation”, Prentice Hall of India, 2010.
5. Renganathan S., “Transducer Engineering”, Allied Publishers, New Delhi, 2003.

OUTCOMES:

After completion of this course the students will be able to

- Carry out error analysis and find the probable error in a measurement system
- Analyze the static and dynamic characteristics of the transducers

- Compare the construction, characteristics and operation of different variable resistance transducers
- Select the appropriate variable inductance and capacitive transducers for industrial applications
- Evaluate the characteristics and applications of piezoelectric, magnetostrictive, digital, and smart transducers
- Identify the salient features of nano transducers, nano actuators and solar cells based on nano particles

EIC2102 ELECTRICAL, ELECTRONIC AND PHYSICAL MEASUREMENTS **L T P C 3 0 0 3**

OBJECTIVES:

- To provide an acquaintance of units of measurements and standards.
- To introduce the student to the various measurement of electrical parameters
- To provide the analog meters used for measurements
- To bring out the importance of bridges for measurement of electrical parameters.
- To introduce knowledge of signal generators and analyzers.
- To provide awareness of measurement using Oscilloscopes

MODULE I UNITS, DIMENSIONS AND STANDARDS 6

Measurement - Units of Measurements - Basic Units and their definitions – Derived units – International system of Units – Use of Dimensional analysis – Limitations of Dimensional analysis – Standards – Primary standard – secondary standard – standard unit of length , mass , time , temperature and luminous intensity - Standard Units of Electrical Quantities and non electrical quantities – Resistance, Ampere, Volt and Watts.

MODULE II MEASUREMENT OF ELECTRICAL PARAMETERS 8

Galvanometers – Ballistic, D' Arsonval galvanometer – Theory, calibration, application – Principle, construction, operation and comparison of moving coil, moving iron meters, dynamometer, induction type, Electrodynamometer type wattmeter – Theory & its errors – Methods of correction – LPF wattmeter – Phantom loading.

MODULE III ANALOG METERS 9

D.C, A.C voltmeters, ammeters - multimeter, Energy meter, power meter, Q-meter, true RMS meter, vector impedance meter, vector voltmeter, component measuring instrument, Electronic ohm meter, Differential Voltmeter - Instrument Transformers.

MODULE IV BRIDGES 9

DC Bridges-Wheatstone bridge – Kelvin double bridge - A.C bridges – Measurement of inductance, capacitance – Q of coil – Maxwell Bridge – Wein's bridge – Hay's bridge – Schering bridge—High voltage Schering bridge – Anderson bridge – Universal Impedance bridge– Bridge sensitivity - Errors, Wagner Earthing Device.

MODULE V SIGNAL GENERATORS & ANALYZERS 7

Sine wave generator – Frequency synthesized sine wave generator – Sweep

frequency generator, pulse and square wave generator—Triangular wave generator Wave analyzer – Applications – Harmonic distortion analyzer –Total harmonic distortion analyzer- spectrum analyzer.

MODULE VI OSCILLOSCOPE 6

General purpose oscilloscope - Specification of Oscilloscope - Special oscilloscopes: Digital Storage oscilloscopes – Sampling oscilloscope – Comparison between Analog and Digital oscilloscopes

L – 45; T – 0; Total Hours –45

TEXT BOOKS:

1. E.W. Golding and F. C. Widdis, “Electrical Measurements and Measuring Instruments”, 5th Edition, Reem Publications,2011.
2. A.K. Sawhney, “Electrical & Electronic Measurements and Instrumentation”, Dhanpath Rai & Co (P) Ltd, 2014.

REFERENCES:

1. J.B.Gupta, “A Course in Electronic and Electrical Measurements and Instrumentation”, S.K. Kataria & Sons, Delhi, 2008.
2. H.S.Kalsi, “Electronic Instrumentation”, Tata McGraw Hill, 1995.
3. Martia U. Reissland, “Electrical Measurement”, New Age International (P) Ltd., 2001.
4. B.M.Oliver and J.M.cage, “Electronic Measurements & Instrumentation”, McGraw Hill International Edition, 2009.
5. D. A. Bell, “Electronic Instrumentation and Measurements”, Prentice Hall of India, 2010

OUTCOMES:

On completion of this course the student will be able to

- Use appropriate units of measurements and standards
- Choose proper meters for measurement of electrical parameters
- Suggest / Identify typical analog meters for specific applications
- Measure electrical parameters using bridges
- Generate and analyze different test signals using analyzers.
- Choose proper Oscilloscopes during measurements for different applications

EIC2103	ELECTRONIC CIRCUITS AND LINEAR INTEGRATED CIRCUITS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To provide basic knowledge about the characteristics of diodes and transistors
- To give adequate knowledge to design electronic circuits such as amplifiers, power converter circuits, oscillators, rectifiers and power supply circuits.
- To provide information to analyze and design analog electronic circuits by both small and large signal models.

MODULE I BIASING AND ANALYSIS OF SMALL-SIGNAL AMPLIFIERS 10

Various biasing of BJT– Design – Stability- Bias compensation, Thermal stability - Small signal analysis of Common Emitter – Small signal analysis of JFET amplifier - Cascade and Darlington connections - Bootstrapping technique - Cascade amplifier.

MODULE II LARGE SIGNAL AMPLIFIERS 9

Classification of amplifiers - Class A,Efficiency of classes A,complimentary Symmetry Class-B Power Amplifier, Calculation of power output, efficiency and power dissipation. Crossover distortion and methods of eliminating it,RC coupled amplifiers, transformer-coupled power amplifiers.

MODULE III FEEDBACK AMPLIFIER AND OSCILLATORS 10

Feedback Amplifiers : Concept of feedback Amplifiers, General characteristics of negative feedback amplifiers, Effect of Feedback on Amplifier characteristics, Voltage series, voltage shunt ,Current series and current shunt Feedback configurations.

Oscillators: Conditions for oscillations, Frequency and Amplitude Stability of Oscillators, Generalized analysis of LC Oscillators, Quartz, Hartley, and Colpitt's Oscillators

MODULE IV IC FABRICATION AND CHARACTERISTICS OF OPAMP 10

OP- AMP- internal circuit ; characteristics; DC characteristics, AC characteristics - Differential amplifier - CMRR. Applications of op-amp : Inverting and Non Inverting amplifier- summer, differentiator, integrator. Comparators, zero crossing detector, Instrumentation amplifier- data sheet interpretation of OPAMP

MODULE V WAVEFORM GENERATORS AND DATA CONVERTERS 9

Sine wave generator, Square wave generator, Triangular wave generator, function generator- D/A converter (R-2R ladder and weighted resistor types), A/D converter : Dual slope, successive approximation and flash types-data sheet interpretation

MODULE VI FILTERS AND 555 TIMERS 12

First and Second order active filters, V/I & I/V converters, Precision rectifier, peak detector, S/H circuit, 555 Timer circuit – Functional block, applications: Astable, monostable multivibrators, Schmitt Trigger- VCO-PLL

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Robert. L. Boylestad & Lo Nashelsky, “Electronic Devices & Circuit Theory”, 8th edition, Pearson Education, Third Indian Reprint, 2002 / PHI.
2. Ramakant A.Gayakward, “Op-amps and Linear Integrated Circuits”, 4th edition, Pearson Education, 2003 / PHI.
3. Robert F.Coughlin, Fredrick F.Driscoll, “Op-amp and Linear ICs”, Pearson Education,4th edition, 2002 / PHI.

REFERENCES:

1. D.Roy Choudhary, Sheil B.Jani, “Linear Integrated Circuits”, 2nd edition, New Age, 2003.
2. David A. Bell, “Electronic Devices & Circuits”, Prentice Hall of India/Pearson Education, 4th Edition, Eighth printing, 2003.
3. Jacob Millman & Christos. C. Halkias, “Integrated Electronics: Analog and Digital Circuits and System”, Tata McGraw Hill, 1991.

OUTCOMES:

On completion of this course the student will be able to

- Analyse the small signal amplifiers performance.
- Design and anlayse large signal amplifiers using transistor circuits.
- Evaluate the characteristics of feedback amplifiers and different type of oscilloscope.
- Carry out analysis and design of OPAMP circuits for different applications.
- Generate different wave form and convert data from one form to other.
- Apply OP amplifier for signal conditioning.

EIC 2104 ELECTRICAL MACHINES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To study the working principles of DC machines as Generator types, determination of their no load/load characteristics, starting and methods of speed control of motors.
- To estimate the various losses taking place in D.C. Motor and to study the different testing methods to arrive at their performance
- To familiarize the constructional details, the principle of operation, prediction of performance, the methods of testing the transformers and three phase transformer connections.
- To study the working principles of AC machines as Generator types, determination of their no load/load characteristics,
- To study the working principles of Special electrical machines and its types, applications

MODULE I DC GENERATORS 6

DC Generator: Construction features, emf equation of dc generator, methods of excitation, losses condition for maximum efficiency, armature reaction, interpoles and compensating winding, commutation, methods of improving commutation, characteristics of separately excited and self excited dc generator

MODULE II DC MOTOR 9

Working principle, voltage equation, condition for maximum power, characteristics, operating characteristics of dc motor, torque developed, starting, 3 point and 4 points

MODULE III TRANSFORMER 8

Single phase transformer – equivalent circuit, phasor diagram, Working principle, Construction, types, EMF equation, Transformer on no load and on load, vector diagram, regulation of transformer, losses &efficiency, condition for maximum efficiency, Auto transformer. Introduction to three phase transformer connections

MODULE IV SYNCHRONOUS MACHINE 8

Alternator - Construction and principle of operations Equation of induced EMF and Vector Diagram-Voltage regulation; Synchronous motor - Starting methods, Torque, V -curves, Speed control techniques

MODULE V AC MACHINES 9

Induction motor, Construction and principle of operation, Classification of induction Motor, Torque equation, Condition for maximum torque, Equivalent Circuit, Power losses, Efficiency, Starting methods and Speed control.

MODULE VI SPECIAL MACHINES 9

Types of single phase motor, Double revolving field theory, Cross field theory, Capacitor start capacitor run motors, Shaded pole motor, Repulsion type motor, Universal motor, Hysteresis motor, Permanent magnet synchronous motor, Switched reluctance motor, Brushless D.C motor(BLDC),stepper motor

L – 45; T – 0; Total Hours –60

TEXT BOOKS:

1. Nagrath I. J and Kothari D. P. 'Electric Machines', Fourth Edition, Tata McGraw Hill Publishing Company Ltd, 2010.
2. B.L Theraja 'Textbook of Electrical Technology : AC and DC Machines (Volume - 2) 1st Revised Edition , S. Chand & Company Ltd-New Delhi

REFERENCES:

1. P. S. Bimbhra Electrical Machinery 7th Edition Khanna Publishers, 2011
2 .E. G. Janardanan Special Electrical Machines.2014

OUTCOMES:

Students can able to

- Analyze the characteristics of DC generator and DC motor
- Test the transformer for various load conditions
- Analyze the speed-torque characteristics of induction motor
- Solve the electrical parameters problems in alternators

EIC 2105 TRANSDUCER ENGINEERING LABORATORY L T P C
0 0 3 1

OBJECTIVES:

- To provide practical knowledge in sensors and transducers.
- Emphasis on characteristics and response of various transducers like resistive, inductive and capacitive type.

LIST OF EXPERIMENTS

1. Characteristics of LDR and phototransistor
2. Characteristics of Temperature Transducer(RTD, thermocouple and IC temp. sensor) - Temperature compensation circuit
3. Thermistor characteristics and its linearization
4. Characteristics and signal conditioning of Strain Gauge and Load cell
5. Characteristics of Capacitive Transducer
6. Position transducer (potentiometer- Loading Effect of potentiometer, LVDT)
7. Characteristics of Hall Effect Voltage Sensor
8. Characteristics of Piezoelectric Transducer
9. Characteristics of synchro
10. Humidity sensor and piezoresistive sensor
11. Step response of RTD and thermocouple
12. Response of Digital transducer
13. Characterisitcs of Fibre optic transducer

P – 30; Total Hours –30

OUTCOMES:

After completion of this course the students will have

- An enhanced knowledge in characteristics of various transducers like resistive, inductive and capacitive type.
- Skills to use transducer for Instrument and control systems applications.

EIC 2106	ELECTRICAL MACHINES & MEASUREMENT LABORATORY	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To calibrate and test the voltmeter and Ammeter
- To measure the unknown resistance, Capacitance and inductance
- To test various load conditions on DC shunt and series motors and generators

LIST OF EXPERIMENTS

1. Calibration and testing of Voltmeter and Ammeter.
2. Calibration and testing of Wattmeter
3. Measurement of resistance using Kelvin Double Bridge and Wheatstone Bridge
4. Measurement of Capacitance using Schering Bridge
5. Load test on dc shunt motor to draw speed – torque and horse power – efficiency characteristics
6. Speed Control of a D.C Shunt Motor
7. Swinburne's Test on dc motor.
8. Load test on single phase induction motor to determine its characteristics
9 To draw the equivalent circuit of single phase induction motor and determine performance parameters
10. Conduct an experiment to draw V and Λ curves of synchronous motor at no load and load conditions.

P – 30; Total Hours –30

OUTCOMES:

After completion of this course the students can

- Able to calibrate the voltmeter and ammeter
- Able to measure the unknown resistance, Inductance and capacitance
- Test the DC machines and AC machine for various load conditions
- Able to analyze the characteristics and performance of AC and DC motors

EIC 2107	ELECTRONIC CIRCUITS AND LINEAR INTERGRATED CIRCUITS LABORATORY	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To familiarize the students with the analysis and design of basic Transistor,
- amplifier circuits, power supply and oscillators
- To study and verify the characteristics of Op-Amp.
- To design and verify the linear and non-linear applications of Op-Amp
- To verify the operation of special purpose ICs namely 555 timer

LIST OF EXPERIMENTS

1. Characteristics of BJT for CE configuration.
2. Characteristics of FET.
3. Characteristics of Half wave and Full wave Rectifier.
4. Design and testing of Hartley oscillators.
5. Design and testing of collpitts oscillators.
6. Series and shunt voltage regulator.
7. Frequency Response of CE amplifier
8. Characteristics of op-amp and op-amp linear applications.
9. Waveform generation using op-amp
10. 555 timer in mono stable and Astable operation
11. Instrumentation amplifier (IC form)

P – 30; Total Hours –30

OUTCOMES:

On completion of this course the student will have skills to

- Design simple amplifier circuits.
- Analyse and design Voltage regulators
- Design simple linear integrated circuits like comparator, Astable and Monostable multivibrator using Op-Amp.
- Design waveform generation circuits.

SEMESTER IV

ENC 2282	WRITTEN COMMUNICATION	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To help students identify content specific vocabulary and learn its usage.
- To expose them to reading for specific purposes, especially in professional contexts.
- To expose them to the process of different kinds of formal writing.
- To help them learn corporate correspondence for different purposes.
- To train them in preparing effective applications with résumé
- To make them write different types of reports.

MODULE I **4**

Introduction - process of writing – Fundamentals of academic and professional writing – Understanding short, real world notices, messages, etc.

MODULE II **4**

Reading industry related texts (ex. Manufacturing, textile, hospitality sector etc.) for specific information.

Writing Instructions and recommendations

MODULE III **6**

Understanding format and conventions of writing email, memo, fax, agenda and minutes of the meeting.

Writing email, memo, fax, agenda and minutes of the meeting for various purposes (industry specific)

MODULE IV **6**

Viewing letter of application and Résumé, letter calling for an interview, letter of inquiry and Promotional letter

Writing Functional résumé and letter of application using Edmodo,

MODULE V **6**

Viewing a Video and reading a case study (industry specific) – collaborative writing using Edmodo –reading and information transfer

Writing reports- Survey, feasibility and progress – exposure to discipline specific reports

MODULE VI **4**

Writing Statement of purpose (Higher Education)-- Justifying and writing about one's preparedness for job (Statement of Purpose highlighting strengths and weaknesses) – Peer evaluation skills through Edmodo.

P – 30; Total Hours –30

REFERENCES:

1. Riordan,D (2013). *Technical Report Writing Today*. Cengage Learning, 10th edition. USA.
2. Oliu, W. E., Brusaw, C.T., & Alred, G.J.(2012). *Writing that Works: Communicating Effectively on the Job* . Bedford/St. Martin's. Eleventh Edition.
3. Garner, B.A. (2013). *HBR Guide to Better Business Writing (HBR Guide Series)*. Harvard Business Review Press. USA.
4. Sharma, R.C. & Krishna M. (2002). *Business Correspondence and Report Writing*. Tata MacGraw – Hill Publishing Company Limited, New Delhi.
5. Macknish, C. (2010). *Academic and Professional Writing for Teachers*. McGraw-Hill Education. USA.
6. Whitby, Norman (2014). *Business Benchmark: Pre-Intermediate to Intermediate.* Cambridge University Press, UK.

OUTCOMES:

On completion of the course, the students will have the ability to

- Identify content specific vocabulary and also use them in appropriate contexts.
- Demonstrate reading skills with reference to business related texts.
- Draft professional documents by using the three stages of writing.
- Create different types of documents for various corporate correspondences.
- Write effective letter of applications, résumé and statement of purpose.
- Write business related reports efficiently.

EIC2211	THERMODYNAMICS AND FLUID MECHANICS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To study the concepts and laws of thermodynamics and their application in analyzing cyclic process
- To gather knowledge in the working of various thermal systems like engines and turbines
- To learn the basic properties of fluids and laws of fluid mechanics
- To understand the laws governing the fluid flow

MODULE I BASIC CONCEPTS AND LAWS OF THERMODYNAMICS 8

Basic concepts, types of thermodynamic systems, Property, state, path and process, quasi-static process, work, modes of work, Zeroth law of thermodynamics – concept of temperature and heat, Concept of ideal and real gases, First law of thermodynamics – application to closed and open systems, internal energy, specific heat capacities, enthalpy, steady flow process, Second law of thermodynamics – Kelvin's and Clausius statements.

MODULE II POWER GENERATING MACHINES 10

Layout of thermal power station, Standard Rankine cycle, Air standard Cycles for IC engines: Otto cycle - plot on P-V, T-S planes, Thermal efficiency and working of SI engines, Diesel cycle - plot on P-V, T-S planes, Thermal efficiency and working of CI engines.

MODULE III COMPRESSORS, REFRIGERATION AND AIR CONDITIONING 10

Classification of Compressors, Vapour Compression Refrigeration System, Air conditioning systems, Basics of Heat Transfer

MODULE IV BASIC CONCEPTS AND PROPERTIES OF FLUIDS 12

Introduction, Properties of fluids - Density, Specific weight, Specific volume, Specific gravity, Viscosity, Compressibility,Vapour pressure, Surface tension and Capillarity, Fluid pressure and its measurement.

MODULE V FLUID FLOWS AND FLUID MECHANICS 8

Types of Fluids, Classification of fluid flows, the concepts of streamline and stream tube, the principles of continuity, energy and momentum, Bernoulli's Equation, flow measurement by Orifice meter, Venturi meter and Pitot tube.

MODULE VI TURBINES AND PUMPS 12

Turbines: definition and classifications – Pelton turbine, Francis turbine, Kaplan turbine – working principles, velocity triangle, work done, specific speed, efficiencies, performance curve for turbines.

Pumps: definition and classifications - Centrifugal pump, Reciprocating pump - working principles, velocity triangles, specific speed, efficiency and performance curves.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Nag P K, “Engineering Thermodynamics”, Tata McGraw Hill, Delhi, 2004.
2. Bansal R.K “Fluid Mechanics and hydraulics Machines“, (5th edition), Laxmi Publications (P) Ltd, New Delhi, 1995.

REFERENCES:

1. Cengel Y Al and Boles M A "Thermodynamics, An Engineering Approach” Tata McGraw Hill, 2003.
2. Holman J P, “Thermodynamics”, Tata McGraw Hill, 1998.
3. Holman J P, "Heat Transfer", 9th edition, Tata McGraw Hill Inc., New York, 2008.
4. White, F.M., Fluid Mechanics”, Tata Mc Graw hill, 5th Edition, New Delhi.-2003.
5. Streeter Wylie and Bedford, "Fluid Mechanics", McGraw- Hill Publishing Company Limited, New York, 1998.

OUTCOMES:

Students will be able to

- Realize and apply the laws of thermodynamics to any real life situation.
- Design and analyze steam and air power cycles.
- Elite the various Compressors, Refrigeration and Air conditioning systems.
- Conceptualize the behavior of fluids and fluid flows.
- Recognize the behavior of fluids under static and dynamic conditions.

Apply knowledge in the design and analysis of hydraulic turbines and pumps.

EIC 2212 DIGITAL ELECTRONICS L T P C
3 1 0 4

OBJECTIVES:

- To provide knowledge on various number systems and to simplify the mathematical expressions using Boolean functions – simple problems.
- To impart implementation of combinational circuits.
- To learn the design of various synchronous and asynchronous circuits.
- To expose the students to various memory devices.

MODULE I NUMBER SYSTEMS & BOOLEAN ALGEBRA 9

Number systems and data representation, Binary, Octal, Hexadecimal representations and their conversions, Signed numbers and floating point number representation. Codes, Basic logic operations, Boolean algebra, De-Morgan theorems, Algebraic reductions, Digital logic gates-NAND and NOR based logic

MODULE II GATE –LEVEL MINIMIZATION & GATE LEVEL IMPLEMENTATION 9

Canonical logic forms, Extracting canonical forms, Karnaugh maps and Tabular methods, Don't care conditions, minimisation of multiple output functions. NAND and NOR implementation of Boolean functions – Two –Level Implementaion and Multilevel implementation.

MODULE III COMBINATIONAL CIRCUITS 12

Synthesis of combinational functions: Arithmetic circuits-Adder, carry look-ahead adder, number complements subtraction using adders, signed number addition and subtraction, Multiplier (any one type) BCD adders. Design of comparators, code converters, encoders, decoders, multiplexers and demultiplexers. Function realization using gates & multiplexers.

MODULE IV SEQUENTIAL LOGIC CIRCUITS 12

Flip flops - SR, D, JK and T. Design of synchronous sequential circuits: state diagram; state reduction; state assignment, Counters: synchronous, asynchronous, up-down and Johnson counters, Modulo counter; shift registers.

MODULE V ASYNCHRONOUS SEQUENTIAL CIRCUITS 9

Design of asynchronous sequential machines – Transition Table, Flow Table, Race

conditions, stability considerations-Hazards

MODULE VI PROGRAMMABLE LOGIC DEVICES / LOGIC FAMILIES 9

Memories : ROM, PROM, EPROM. PLA, classification of PLD, FPGA, digital logic families: TTL, ECL,CMOS

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. M.M. Mano and Ciletti M.D., , “Digital Design”, 4th Edition, Prentice Hall of India,2006
2. Floyd T.L, “Digital Fundamentals”, 8th Edition, Universal Book Stall, New Delhi, 2005.
3. J.P. Uyemura, “A First Course in Digital Systems Design”, Brooks/Cole Publishing Co. (Available from Vikas Publishing House in India).

REFERENCES:

1. J.M. Rabaey, “Digital Integrated Circuits: A Design Perspective”, 2nd Edition, Prentice Hall of India, 2005.
2. D. Hodges and H. Jackson, “Analysis and Design of Digital Integrated Circuits”, 2nd Edition, McGraw Hill, 1988.
3. N.H.E. Weste, and K. Eshraghian, “Principles of CMOS VLSI Design: A Systems Perspective”, 2nd Edition, Pearson Education Inc., (Asia), 2002.

OUTCOMES:

- At the end of the course, the students would be acquainted with the basic concepts of digital electronics.
- Students will be able to implement the logics in combinational circuits.
- Students will use the skill to design the synchronous and asynchronous circuits.

EIC2213 INDUSTRIAL INSTRUMENTATION – I

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide sound knowledge about various techniques used for the measurement of Industrial Parameters.
- Introduction to Load cells, torque meter and various velocity pickups.
- Exposure to various accelerometer pickups, vibrometers, density and viscosity measuring instruments.
- To provide an adequate knowledge about pressure measuring instruments.
- To provide an idea about the temperature standards, calibration and signal conditioning used in RTD's.
- To provide knowledge regarding characteristics of thermocouples and signal conditioning modules.
- To learn about measuring high temperatures with pyrometers.

MODULE I MEASUREMENT OF FORCE, TORQUE AND VELOCITY 7

Electric balance – Different types of load cells – Magnets - Elastic load cells– Strain gauge load cell – Different methods of torque measurement – Strain gauge, relative regular twist – Speed measurement – Revolution counter-Capacitive tacho-drag cup type tacho – D.C. and A.C. tacho generators – Stroboscope.

MODULE II MEASUREMENT OF ACCELERATION AND VIBRATION 7

Accelerometers – LVDT, piezoelectric, strain gauge and variable reluctance type accelerometers. – Mechanical type vibration instruments – Seismic instrument as an accelerometer and vibrometers – Calibration of vibration pickups.

MODULE III PRESSURE MEASUREMENT 10

Modules of pressure – Manometers – Different types – Elastic type pressure gauges – Bourdon type bellows – Diaphragms – Electrical methods – Elastic elements with LVDT and strain gauges – Capacitive type pressure gauge – Piezo resistive pressure sensor - Measurement of Vacuum – McLeod gauge– Thermal conductivity gauges - Ionization gauge – Testing and calibration of pressure gauges – Dead weight tester. Differential Pressure Transmitter, Low Pressure Measurement.

MODULE IV TEMPERATURE MEASUREMENT 7

Different types of filled in system thermometer Bimettalic thermometer – Electrical methods of temperature measurement, signal conditioning of industrial RTD and their

characteristics - three lead and four lead RTD. Fabrication of industrial thermocouples – signal containing of thermocouples - commercial circuits for cold junction compensation smart temperature transmitter and its advantages.

MODULE V HIGH TEMPERATURE MEASUREMENTS 7

Types of thermocouple - Response of thermocouple – special techniques for measuring high temperature using thermocouples. Radiation method of Temperature measurements - Radiation fundamentals, Total Radiation and selective Radiation , pyrometer optical pyrometer-Two colour radiation pyrometers. Fibre optic temperature measurements systems.

MODULE VI CASE STUDY 7

Selection of pressure, Temperature, using sensors and transducers: mounting and installations -Typical application of sensors in chemical industries petrochemical industries -iron and steel industries and Bio medical instrumentation.

L – 45; Total Hours –45

TEXT BOOKS:

1. E.O. Doebelin, "Measurement Systems – Application and Design", Tata McGraw Hill Publishing Company, 2008.
2. R.K. Jain, "Mechanical and Industrial Measurements", Khanna Publishers, New Delhi, 1999.

REFERENCES:

1. D.S. Kumar, "Mechanical Measurements and Control", 3rd edition, Metropolitan books, 1979.
2. Jone's "Industrial Technology", Vol.2, Butterworth – Meineman, International Edition, 2003.

OUTCOMES:

After completion of this course the students will be able to

- Know relevant details pertaining to Process Industries.
- Select transducers like LVDT, Strain gauge and load cells etc to identify
- pplications in various process Industries.
- Effectively carry out operation and maintenance of pressure, temperature and flow instruments in process industries.

EIC2214	DIGITAL ELECTRONICS LABORATORY	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To study Boolean function and implementation using basic gates.
- To design and implement combinational and sequential circuits using basic gates and specialized ICs

LIST OF EXPERIMENTS

1. Realization of basic gates using universal logic gates
2. Design and implementation of Adders and Subtractors using logic gates.
3. Design and verification of code converters using logic gates
4. To exhibit the use of IC 7483 as 4–bit binary Adder/ Subtractor and BCD adder
5. To design and implement a 2 Bit Magnitude Comparator using logic gates and 8 Bit Magnitude Comparator using IC 7485
6. Design and implementation of encoder and decoder using logic gates and study of IC 7445 and IC 74154
7. Design and implementation of Multiplexer and De-multiplexer using logic gates and study of IC 74150 and IC 74154
8. Implementation and study of SR ,JK, D, T Flip Flops.
9. Design and implementation of 3-Bit synchronous counter
10. Construction and verification of Asycnhronous counters
11. Implementation of universal shift registers / Modulo counters using ICs.

P – 30; Total Hours –30

OUTCOMES:

On Completion of this course the student will be able to formulate

- The design, implementation and operation of combinational circuits like adders, subtractors, code converters, multiplexer – demultiplexer, encoder – decoder and magnitude comparator.
- The design, implementation and operation of sequential circuits like flip flops, counters and shift registers.
- To select and Integrate digital circuits for mini projects.

EIC2215	INDUSTRIAL INSTRUMENTATION LABORATORY- I	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To provide good hands on experience on industrial instruments.
- To familiarize with pressure Instruments, vacuum Instruments, pyrometers.
- They may able tackle any problem when working in core industry.
- To expose the students pertaining to various lab instruments which they will come across in the Industry.

LIST OF EXPERIMENTS

1. Measurement of Pressure using Diaphragms, Bellow and Bourdon.
2. Measurement of acceleration, velocity displacement using Accelerometer.
3. Torque measurement.
4. Vacuum pressure measurement
5. IR spectrophotometer UV-visible spectrophotometer
6. Speed control of stroboscope
7. Signal conditioning of RTD
8. Cold junction compensation of thermocouple.
9. Radiation pyrometer.
10. Blood pressure measurement, ECG and Oxymetry
11. Study on industry standards
12. Three way and Five way manifold

P – 30; Total Hours –30

OUTCOMES:

After completion of this course the students will be able to

- Know various instruments pertaining tom process industries.
- Acquire knowledge in load cell, strain gauge and torque measurements.
- Acquire knowledge in spectrometer, measurements of temperature and related cold junction compensation and high temperature measurement using radiation parameter.
- This will be stepping stone for the student to work in process industries

SEMESTER V

MSB 3181	LEADERSHIP & CEO TRAINING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course aims at

- Bringing about positive transformation in students' attitude.
- Building unique leadership competencies that would ensure successful transition of students across all career stages.
- Sensitizing students to identify their strengths & weakness and training them to deal with it
- Assisting students in enhancing their expressive ability and inducing a high level of self confidence to manage both business and emotions
- Training students to become more adaptable and flexible to changing business environment

MODULE I INTRODUCTION TO LEADERSHIP 12

Leadership concept - meaning, definitions, importance of leadership, leadership traits. Leadership functions- general functions, listening, observing, managing and decision making. Components of leadership - leaders, followers and situation. Leadership theories – Trait theory, Skills theory, Style theory, Situational theory, Transformational theory, Transactional theory, Path Goal Theory and LMX. Assessing emotional intelligence and exploring the capabilities and inherent traits through psychometric tests - Multi factor leadership questionnaire and personal reflections

MODULE II LEADERSHIP STYLE AND COMMUNICATION 08

Leadership styles-visionary, Coaching, Affiliative, Democratic, Pacesetting Commanding, Transformational, Transactional. Autocratic, Participative, Laissez-Faire Leader versus Managers. Leadership communication - Rationale, tactic, assertive, formal, informal, communication in crisis- leadership and negotiations, Leadership Presentations-convincing and impressive style

MODULE III LEADERSHIP ROLES 08

Facets of leadership- Leader as an individual – personality and leadership, values, attitudes and ethics of a leader. **Leader as a relationship builder**- empowering people to meet higher order needs, initiating organization wide

motivational programs, involvement with all stakeholders- focusing on organization growth. **Leader as an inspirer**- motivation and leadership, recognizing and appreciating contributions, empowering others to lead **Leader as an innovator** –leader's role in shaping culture and values in an organization. **Leader as a Liaison- Leader as team player**

MODULE IV LEADERSHIP CHALLENGES AND STRATEGIES 09

Challenges in leadership: Perception of organization culture and values, interpreting the power dynamics in the organization, establishing work life balance. Bad leadership – Reasons and impact.-Case Study of Marissa Mayer-Yahoo.Inc Organizational transformation through efficient leaders-Case study of Apple Inc. Blue Ocean Leadership-Steps to Blue ocean Leadership-Four Pillars of Blue Ocean leadership-Blue Ocean leadership grid

MODULE V LEADERSHIP AND CEO TRAINING 08

Leader as a CEO: Traits of a successful CEO, Key responsibilities of a CEO, the path to be a CEO ,Training on Board Room Discussions, Meeting the CEO –Live sessions with industry CEO's. Requirements of Leadership: - Cognitive skills, Interpersonal skills, Business skills, Strategic skills. Role of Emotional Intelligence in taking up key-positions in the organization.

Teaching Pedagogy:

Nurturing – Based on the identified strengths and weaknesses, training will be given to enhance the strengths and overcome the weakness.

Assessment - Continuous evaluation will be effected through group discussions, oratory assignments and situational enactments. Pre-and post-training assessment through peer reviews and faculty feedback.

Sustained development – Training will be imparted for self-development and monitoring of leadership skills to ensure sustained applicability of the skills learnt.

L – 45; Total Hours – 45

REFERENCES:

1. Andrew J DuBrin. "Leadership: Research Findings, Practice, and Skills", 8th Edition, South-Western College Pub, 2015.
2. Yukl G , "Leadership in Organisations", 8th Edition, Pearson Education, 2013.
3. Richard L Daft , "Leadership", 5th Edition, South Western Cengage Learning 2012.

4. Stephen P. Robbins and Timothy A. Judge. “Organizational Behaviour”, 15th Edition, New Delhi: Pearson, 2013.
5. Fred Luthans, “Organizational Behavior, An Evidence Based Approach”, 12th Edition, New Delhi: McGraw Hill Education, 2013.
6. Emotional Intelligence, Why it can matter no more than IQ by Daniel Goleman (include a book) Publisher: Bloomsbury Publishing India Private Limited; Latest edition (2017)
7. Primal Leadership: Unleashing the Power of Emotional Intelligence by Prof Daniel Goleman , Richard Boyatzis and McKee ,Harvard Business Review Press

Recommended Readings:

1. Jim Collins, (2001). “Good To Great: Why Some Companies Make the Leap...And Others Don't”, Random House Publishers India Pvt.Ltd, New Delhi
2. George, B. with Sims, P. True North: Discover Your Authentic Leadership, The Times Group Books; First edition (1 October 2015)
3. Kim, W. C., & Mauborgne, R. A. (2014). Blue ocean strategy, expanded edition: How to create uncontested market space and make the competition irrelevant. Harvard business review Press.
4. Leadership Wisdom by Robin Sharma Jaico Publishing House;

OUTCOMES:

The students will be able to

- Explore through self-introspection one’s own leadership style, their strength and weakness
- Gain self confidence to lead a team in the organization
- Realize the role of leadership in making or breaking of an organization
- Acquire the practice of self introspection and development of leadership competencies thorough continuous efforts
- Manage their own emotions as well as other resulting in successful relationship building with all stakeholders

MSB 3182 SOCIAL ENTREPRENEURSHIP

L	T	P	C
3	0	0	3

OBJECTIVES:

- To be able to understand the field of social entrepreneurship and Social problems
- To be able to describe and understand the traits of social entrepreneurs
- To recognize the social business opportunities
- To synthesize the resource mobilization ways for social entrepreneurship
- To understand the social entrepreneurship models
- To recognize the impact of social entrepreneurship on societies

MODULE I INTRODUCTION TO SOCIAL ENTREPRENEURSHIP 07

Introduction - Emergence and Development of Social Entrepreneurship. Social Problems in India: An Overview. Social Development: The Indian Scenario. Emergence of Social Entrepreneurs and Sustainable Solutions to Social Problem. Characteristics and Context of Social Entrepreneurship .The Role of Social Entrepreneurship in Societies & Economies.

MODULE II SOCIAL ENTREPRENEURSHIP: DRIVERS AND CHALLENGES 07

The Drivers of Social Entrepreneurship. Elements of the Social Entrepreneurial Personality. Challenges of financial constraints. Challenge to attract and cultivate talented workers. Challenge of evaluation of social entrepreneur impact. Challenge of scaling and its impact. Cases

MODULE III SOCIAL ENTREPRENEURSHIP: OPPORTUNITY RECOGNITION 07

Opportunity Recognition and Planning Process. Opportunities for Social Entrepreneurs. The Nature of Social Entrepreneurial Opportunities. Social Problems into Opportunities. Idea development and conceptualization of social problem. Cases

MODULE IV RESOURCE MOBILIZATION FOR SOCIAL VENTURE 08

Resources at Initial Stage. Social Network as a role of Social Capital. Team and Collective Efforts. Need and Determination of Important Resources. Resource of Knowledge, Skills and Abilities. overview of venture capital and angel investment.

Cases

MODULE V **BUSINESS MODELS AND BUSINESS PLAN FOR SOCIAL ENTERPRISES** **08**

Design Principles of Social Entrepreneurship Business Models , Evaluation of the Root Cause of a Societal Problem. Developing business plan for social ventures. Developing an investor presentation. Feasibility study and report. How to start a business - Procedures for registration of small scale industry

MODULE VI **THE IMPACT OF SOCIAL ENTREPRENEURSHIP ON SOCIETY** **08**

Static Impact of Social Entrepreneurship. Impact of Charitable NGOs vs. Social Entrepreneurship, Impact of For-Profit Companies vs. Social Entrepreneurship. Social entrepreneurship report preparation by students.

Case Study of Social Entrepreneurs

L – 45; Total Hours –60

REFERENCES:

1. “Social Entrepreneurship : New models of sustainable social change” . Alex Nicholls, Oxford University Press 2006
2. The Process of social value creation : A multiple case study on Social Entrepreneurship in India , Archana Singh Springer 2016
3. “Social Entrepreneurship and social business” Christine K Volkmann, Springer Gabler 2012
4. “Social Entrepreneurship” Manuel London ,Routlege, 2010

OUTCOMES:

The students can able to

- Conceptualize social entrepreneurship in terms of a theoretical framework between changing social values and institutions
- Think and communicate about social values
- Learn about practical models of social change to launch, lead, manage, and evaluate a social venture
- Analyze funding needs and sources for the social venture
  Experience the ideas can be critically and collaboratively examined prior to commitment.

ENC 3181	COMMUNICATION AND SOFT SKILLS - I CAREER CHOICE	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To create awareness of industrial trends and market demands.
- To encourage students to explore career opportunities in an industry and evaluate themselves in relation to industry preparedness

MODULE I **6**

Knowledge about specific industry-Discussion with industry experts --Self evaluating career prospects through survey questionnaire (based on his/her eligibility for taking up a job (industry preparedness)

MODULE II **6**

. Knowing case studies of industries(pertaining to students' choice of career)- Reading and discussing about job markets-goal setting, working on creativity.

MODULE III **4**

SWOC analysis and discussing outcomes--exploring mini projects or case studies of latest industries.

MODULE IV **6**

Writing statement of purpose pertaining to career choice---- Outcomes

MODULE V **8**

Project or case study presentations (Presentation in pairs) -mini project report or case study report.

Total Hours – 30

REFERENCES:

1. Brown,D.(2002). Career Choice and Development. Wiley,J. & Sons.USA
2. Lore,N.(1998). The Pathfinder: How to Choose or Change Your Career for a Lifetime of Satisfaction and Success. Simon & Schuster.USA.
3. Shell, G.R.(2013). Springboard Launching your Personal Search for Success.Portfolio.USA.

OUTCOMES:

After the completion of the course, students would be able to

- Speak about their career choice.

- Self evaluate their strengths and weaknesses and speak about it.
- Make effective presentations on case studies or relating to projects.
- Write the statement of purpose relating to their career choice.

EIC3101	CONTROL SYSTEMS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To prepare the student to understand the open loop and closed loop systems.
- To acquaint the student to understand time domain and frequency domain analysis of control systems required for stability analysis.
- To provide the student to learn the compensation technique that can be used to stabilize the control systems.

MODULE I **12**

System Analysis – Systems, subsystems, and stochastic and deterministic systems - Principles of automatic control -Open loop and closed loop systems - Principles of superposition and homogeneity. Transfer Function Approach – Mathematical models of physical systems and transfer function approach - Impulse response and transfer function -Determination of transfer functions for simple electrical, mechanical, electromechanical, hydraulic and pneumatic systems

MODULE II **6**

Block diagram algebra - block diagram reduction - signal flow graphs - mason’s gain formula.

MODULE III **NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION** **9**

Time response – Types of test inputs - I and II order system responses - Error coefficients – Generalized error series - Steady state error - Time domain specifications.

MODULE IV **INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS** **9**

Frequency response - Frequency domain specifications - Bode plot- Polar plot - Determination of phase margin and gain margin - Constant M and N circles - Nichols chart - Determination of closed loop response from open loop response - Computer simulation.

MODULE V **NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS** **12**

Concepts of stability – Location of roots in s-plane for stability – Routh Hurwitz

criterion – Root locus techniques – Construction – Nyquist stability criterion - Computer simulation.

MODULE VI BOUNDARY VALUE PROBLEMS FOR PARTIAL DIFFERENTIAL EQUATIONS **12**

PID controllers - Performance criteria - Selection of controller modes – Lag, Lead, and Lag-Lead networks – Compensator design for desired response using Root locus and Bode diagrams - Computer simulation.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Gopal, M., “Control Systems, Principles and Design”, Tata McGraw-Hill Pub. Co., 2nd Edition, New Delhi, 2012.
2. Nagrath, I.J. and Gopal, M., “Control System Engineering”, 4th edition, New-age International (P) Ltd., New Delhi, 2006.

REFERENCES:

1. Ogata, K., “Modern Control Engineering”, Prentice Hall of India Ltd., 4th Edition, New Delhi, 2006.
2. Kuo, B.C., “Automatic Control Systems”, Prentice Hall of India Ltd., New Delhi, 2003.

OUTCOMES:

On completion of the course the student will be able to

- Obtain the mathematical model of physical system.
- Analyse physical systems using block diagram algebra and SFG
- Find the response of different physical systems for standard test inputs
- Draw frequency response plots and determine the relative stability
- Analyse the stability of control system using root locus and RH criterion
- Design phase lag, phase lead compensations to get desired performance

EIC3102	MICROPROCESSOR AND MICROCONTROLLER	L	T	P	C
		3	0	0	3

OBJECTIVES:

During the course the student will be able

- To know the concept of microprocessors and microcontroller.
- To acquire knowledge on interfacing devices.
- To learn about simple applications of microcontroller.
- To familiarize with advanced processors.

MODULE I ARCHITECTURE OF 8051 & 8085 7

Introduction to concept of microprocessor - 8085 microprocessor architecture - comparison between microcontroller and microprocessor. Intel 8051 microcontroller - architecture, pin diagram, special function registers, stack, external memory - interface with 8051, I/O ports.

MODULE II 8051 INSTRUCTION SET 9

8051 instruction set – Moving data – Introduction – Address modes – External data moves – Code memory data moves – Push & pop – Data exchanges – Logical operations – Introduction – Byte level logical operation – Bit level – Rotate and swap – Arithmetic operation – Introduction – Flags – Increment & decrement – Addition – Subtraction – Multiplication & division – Decimal arithmetic – Jump and call instructions – Introduction – Range – Short and long absolute range – Jumps – Calls –Stack –Interrupts and returns – Detailed interrupts.

MODULE III 8051 TIMERS, INTERRUPTS, AND SERIAL PORTS 7

ON – Chip Timers – Modes of operation – mode 0 – mode 1 – mode 2 – mode 3, On chip serial port – Features mode 0 – mode 1 – mode 2 – mode 3 – Interrupts – Timer Flag – Serial port Interrupt – External Interrupts – Reset – Interrupt control – Interrupt Priority – Interrupt Destinations

MODULE IV PERIPHERAL INTERFACING DEVICES 8

Interfacing Serial I/O (8251) - parallel I/O (8255) –Keyboard and Display controller (8279)–ADC/DAC Interfacing Bus – RS232C-RS485-GPIB Introduction, Generation of I/O Ports, Sample-and-Hold Circuit and Multiplexer, Programmable Interval timers (Intel 8253, 8254), Printer Interface.

MODULE V APPLICATIONS OF 8051 7

Application – Stepper motor control, speed and position control of dc motors, closed loop control of servo motor, control of physical parameters like temp, pressure, flow and level, case study-home protection system, Traffic light control, washing machine control

MODULE VI ADVANCED MICROPROCESSOR AND MICROCONTROLLER 7

Advanced Microprocessor Architectures- 286, 486, Pentium; Introduction to RISC processors; ARM microcontrollers, core 2 duo processor, i7 core processor

L – 45; Total Hours –45

TEXT BOOKS:

1. Ramesh .S.Gaonkar, “Microprocessor architecture, programming and applications with the 8085”, 5th Edition, Prentice Hall, 2010
2. Ayala, “The 8051 Microcontroller” 3rd Edition
3. Subrata Ghoshal, “8051 Microcontroller Internals, Instructions, Programming and Interfacing”, Pearson press.
4. Satish shah, “8051 Microcontroller MCS51 family and its variants”, Oxford.

REFERENCES:

1. Mohammed Ali Mazidi, “The 8051 Microcontroller and embedded systems using Assembly and C”
2. N. Senthil Kumar, “Microprocessors and controllers”

OUTCOMES:

After completion of the course the students will be able to

- Compare the concept of microprocessor and microcontroller
- Effectively utilize instructions and develop an assembly language program using 8051
- Grasp the working of timers, interrupts and serial port in 8051 microcontroller
- Interface external I/O devices with 8-bit microcontroller
- Design an interface that allows microcontroller to communicate with external devices like LED, LCD, Motors etc..
- Identify the basic elements and functions of contemporary microprocessors (80286, 80386, 80486, Pentium) and microcontrollers

EIC3103 INDUSTRIAL INSTRUMENTATION II

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide knowledge on density, viscosity, humidity and moisture measurements
- To familiarize with area flow meters, mass flow meters and calibration techniques.
- To expose various types of level measurements adopted in industrial environment.
- Being engineering practioners, who would help solve industry's technological problem
- Will interact with peers in industry and society and contribute to the economic growth of the country.

MODULE I MEASUREMENT OF DENSITY AND VISCOSITY 7

Modules of density, specific gravity and viscosity used in industries – Baume scale, API scale – Pressure head type densitometer – Float type densitometer– Ultrasonic densitometer – Bridge type gas densitometer – Viscosity – Saybolt viscometer, Redwood Viscometer

MODULE II MEASUREMENT OF HUMIDITY & MOISTURE 8

Humidity terms – Dry and wet bulb psychrometers – Hot wire electrode type hygrometer – Dew cell – Commercial type dew point meter – moisture terms– Different methods of moisture measurement – Moisture measurement in granular materials, solid penetrable materials like wood, web type material.

MODULE III VARIABLE HEAD FLOW METERS AND VARIABLE AREA METERS 8

Flow measurement: Introduction, definitions and MODULEs, Reynolds number. Theory of fixed restriction variable head type flow meters –Orifice plate – Venturi tube – Flow nozzle – Dall tube – Pitot tube- Installation of head flow meters – Piping arrangement for different fluids. Rota meter– Theory and installation

MODULE IV QUANTITY FLOW METERS AND MASS FLOW METERS 7

Positive displacement flow meters – Constructional details and theory of operation of nutating disc, oval gears and helix type flow meters- Angular momentum mass flow meter – Coriolis mass flow meters – Thermal mass flow meters - Calibration of flow

meters – Dynamic weighing method

MODULE V ELECTRICAL TYPE FLOW METER 7

Principle and constructional details of electromagnetic flow meter – Different types of excitation schemes used -Ultrasonic flow meters – transit time-frequency difference type – Vortex shedding flow meter –– Solid flow rate measurement– Guidelines for selection of flow meter.

MODULE VI LEVEL MEASUREMENT 8

Gauge glass techniques – Float type level indication – Different schemes – Level switches, level measurement using displacer and torque tube – Bubble system. Boiler drum level measurement – Differential pressure method – Hydra step systems – Electrical types of level gauges using resistance, capacitance, nuclear radiation sensors.

L – 45; Total Hours –45

TEXT BOOKS:

1. E.O. Doebelin, “Measurement Systems – Application and Design”, Tata McGraw Hill publishing company, 2004.
2. R.K. Jain, “Mechanical and Industrial Measurements”, Khanna Publishers, New Delhi, 2010.
3. D.S.Kumar, “Mechanical measurements and control”, 3rd edition, Metropolitan
4. Liptak, B.G., “Mechanical and Industrial Measurements” Khanna Publishers, Delhi, 1999.

REFERENCES:

1. S.K. Singh, “Industrial Instrumentation and Control”, Tata McGraw Hill, 2003.
2. D.P. Eckman, “Industrial Instrumentation”, Wiley Eastern Ltd.,
3. D. Patranabis, “Principles of Industrial Instrumentation”, Tata McGraw Hill Publishing Company Ltd, 1996.
4. A.K. Sawhney, “A Course on Mechanical Measurements, Instrumentation and Control”, Dhanpath Rai and Co, 2004.

OUTCOMES:

After completion of the course the student will be,

- Able to function with multidisciplinary team
- Understand professional and ethical responsibility
- Has the ability to use the techniques, skills and modern engineering tools for

engineering practice.

- Will have the relevant knowledge to select electrical type meters, mechanical flow meters
- With the knowledge gained he/she will select appropriate instruments for liquid level, solid level measurement.
- Depending upon the industry need with the knowledge gained he/she will select a proper viscosity and density measuring instruments.

EIC3104	CONTROL SYSTEMS LABORATORY	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To provide knowledge on modelling of different systems
- To impart details regarding the time domain and frequency domain analysis of various systems
- To educate the students to determine the stability of a system
- To train the students to perform automation of simple process

LIST OF EXPERIMENTS:

1. Determine transfer function of armature controlled DC motor
2. Determine transfer function of armature controlled DC generator
3. Determine transfer function of field controlled DC motor
4. Determine transfer function of a level process
5. Simulation of standard test signals: Impulse, Step, Ramp, Parabolic
6. Response of first order system to standard test signals and its time domain analysis
7. Step response of second order system and time domain analysis
8. Frequency response of various systems using bode plot and to determine the gain margin and phase margin
9. Frequency response of various systems using Nichols' plot
10. Stability analysis of a system using Nyquist criterion
11. On-Off control of a simple thermal system
12. Implementation of P, PI, PID controller for pressure process
13. Closed loop control of flow process station
14. Automation of position control system
15. Response of Lead and Lag Network

OUTCOMES:

The student will be able to

- Model a process and analyse the time domain specification
- Perform stability analysis given a system
- Automate the process using conventional on-off or PID controller
- Determine the transfer function of DC motor and DC generator by conducting suitable experiment

- Plot the time response and open loop / closed loop frequency responses of different systems
- Estimate the stability margins using bode plot and Nyquist plot
- Design and implement lead and lag compensators to improve the performance

EIC3105	MICROPROCESSOR AND MICROCONTROLLER LABORATORY	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To familiarize the students to use assembly language for programming a microcontroller
- To impart the students to understand the hardware and software components of a microcontroller-based system to implement system level features.
- To teach students both hardware and software aspects of integrating digital devices (such as memory and I/O interfaces) into microcontroller-based systems.
- To provide students the operating principles and hands-on experience with, common microcontroller peripherals such as UARTs, timers, and analog-to-digital and digital-to-analog converters.

LIST OF EXPERIMENTS:

1. Arithmetic operations using 8051
    a. Addition and subtraction of 8-bit numbers
    b. Addition and subtraction of 16-bit numbers
    c. Multiplication and division of 8-bit numbers
    d. To find Largest and Smallest number in a number series
    e. To arrange the number series in ascending and descending order.
2. Logical operations using 8051
3. To transfer a block of data from one memory zone to the others.
4. Code conversion of Decimal number to HEXA and HEXA to Decimal number

APPLICATION PROGRAMS USING 8051

5. Stepper motor interfacing with 8051
    a. for full and half step rotation
    b. for rotating motor in clockwise and anticlockwise direction
6. Write a program to transmit ASCII character continuously with 9600 based by polled operation using 8251.
7. Interfacing of D/A converter MODULEs with 8051 to generate the following waveform and to measure the time period and frequency of each waveform.
    a. Saw tooth waveform
    b. Triangular waveform

c. Square waveform

8. Interface 8253 to generate 1 MHZ square wave.
9. Interfacing traffic light control system
10. Interface 8279 with 8051 to perform the following functions
    a. To display different alphabets and numbers in the 7 segment display
    b. to read various keys form the keyboard
11. Build a Home security system with 4 sensor and 2 alarms interfaced to 8051

OUTCOMES:

- The students will effectively carryout programming of microcontroller interfacing for industrial applications.

EIC3106	INDUSTRIAL INSTRUMENTATION II LABORATORY	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To provide an overview of different types of power semi-conductor devices and their switching characteristics.
- To make the students to understand the operation, characteristics and performance parameters of controlled rectifiers.
- To study the characteristics of DC and AC drives
- To learn the different modulation techniques of pulse width modulation
- To provide knowledge about the practical application for power electronics converters in conditioning the power supply.

LIST OF EXPERIMENTS:

1. Determination of Discharge coefficient of Orifice plate
2. Measurement of flow rate using Orifice, Venturi.
3. Level Measurement using DP transmitter.
4. Electrical level measurement using resistance and capacitance methods
5. Measurement of conductivity of test solutions.
6. Measurement of pH values of test solutions.
7. Calibration of temperature transducers
8. Calibration of pressure gauges
9. Characteristics of P /I and I /P Converters.
10. Determination of Viscosity using Saybolt and Redwood Viscometer
11. Study of P&I diagrams.
12. Study of IR spectrophotometer.
13. Study of smart transmitter and smart valve positioner.

OUTCOMES:

At the end of the course, the student will be able to

- Analyze the characteristics of power semiconductor devices
- Evaluate the characteristics of single phase and three phase converter
- Solve the power conversion problems for renewable energy source systems
- Analyze the different methods of speed control for AC and DC drives
- Use the power electronic devices for industrial application such as UPS, Induction and dielectric heating
- Carry out mini project by hardware implementation of converters, inverters etc.

SEMESTER VI

ENC 3281	**COMMUNICATION AND SOFT SKILLS - II**	**L**	**T**	**P**	**C**
	CONFIDENCE BUILDING	**0**	**0**	**2**	**1**

OBJECTIVES:

- To develop professional skills like work ethics, analytical skills, presentation skills etc.
- To train them in problem solving skills and leadership skills pertaining to industries.
- To train them in team building skills.
- To train in setting up career goals

MODULE I **6**

Brief about Multinational companies- Analysing work ethics of multinational companies and small industries- discussing as pairs-Knowledge about etiquette (different types)

MODULE II **6**

Visit to an Industry and prepare reports --Critically reading of industry specific journal articles and write ups-- preparing reports.

MODULE III **4**

Analysing problem solving situations in industries (relating to application of core subject to specific jobs) and discussing about them- working on a sample case

MODULE IV **6**

Developing Leadership in team projects-- debating about various aspects of leadership: for example, responsibility and reliability-time management

MODULE V **8**

Team building skills-- group discussions pertaining to industries-- presenting career goals. -- preparing for interviews- interpersonal skills

Total Hours – 30

REFERENCES:

1. Covey,S.R. (2004). The 7Habits of Highly Effective People: Powerful Lessons in Personal Change. Free Press.UK
2. Fine, P.M.& Alice Olins. (2016).Step up: Confidence, Success and Your Stellar Career in 10 Minutes a Day. Vermilion.UK
3. Pai, A. (1993).How to Develop Self-Confidence. Amazon.com
4. Wentz,F.H.(2012). Soft skills training: A Workbook to Develop Skills for Employment. Amazon.com

OUTCOMES:

After completing the course students would be able to

- Exhibit critical reading skills through review of industry specific articles.
- Provide solutions to problem based situations.
- Exhibit leadership qualities by debating over industry specific issues.
- Participate in group discussions confidently.
- Present their career goals.

EIC3211	PROCESS CONTROL	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To provide students with the theories and knowledge of process control systems and necessary skills required for an instrumentation engineer.
- To describe the needs and incentives for controlling a process.
- To develop mathematical model of system from the mathematical equations describing dynamics of the process.
- To analyze control loop characteristics
- To apply computer based hardware and software tools for process control (MATLAB).

MODULE I INTRODUCTION TO PROCESS CONTROL 6

Need for process control, Process characteristics- Self regulating process, continuous and batch processes, degrees of freedom, piping and Instrumentation diagram. Modeling of liquid, thermal, pressure, chemical process, interacting and non-interacting processes. Servo and regulator operations. Simulation of mathematical modeling of processes using Control system toolbox.

MODULE II BASIC CONTROL ACTIONS 8

Discontinuous: ON/OFF, Multiposition Control, Floating Control. Continuous: Proportional, integral, derivative mode. Composite controller modes: P-I, P-D, P-I-D. Auto/Manual transfer, Bumpless transfer. Response of controllers for different test inputs. Selection of control modes for processes like level, pressure, temperature and flow. Electronic controllers to realize various control actions. Design of electronic PID for different processes using SIMSCAPE.

MODULE III OPTIMUM CONTROLLER SETTINGS 8

Evaluation criteria – IAE, ISE, ITAE and ¼ decay ratio – determination of optimum settings for mathematically described processes using time response and frequency response – Tuning – Process reaction curve method – Ziegler Nichols method – Damped oscillation method. Tuning of composite controllers for various processes using Control system toolbox.

MODULE IV PID ENHANCEMENTS 7

Different forms of industrial PID controllers- Practical aspects of PID control:

proportional band, issues in implementing an industrial PID controller- Proportional kick, Integral wind-up, derivative kick and its prevention, reverse acting controller. Implementing PID enhancements in SIMULINK

MODULE V FINAL CONTROL ELEMENT 8

Pneumatic and electric actuator. Valve positioner. Control valves: construction details, types, Selection, Performance, sizing And characteristics(inherent and installed).control valve terminology turndown, valve coefficient: rangeability,

Air-to-open, Air-to-close, direct acting ,reverse acting, fail safe conditions, cavitations, flashing and noise, their effects and remedies. Control valve design for specific applications (liquid, gas and slurries), testing of control valves.

MODULE VI ADVANCED CONTROL TECHNIQUE 8

Cascade control, Feed forward control, feedback- feedforward control, Ratio control, Selective Control, Split range control- Basic principles, Design Criteria, Controller Algorithm and Tuning, Implementation issues. Case studies-advanced control schemes for level, thermal and chemical process.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Stephanopoulis. G, “Chemical Process Control”, Prentice Hall of India, New Delhi, 2006.
2. Eckman. D.P., “Automatic Process Control”, Wiley Eastern Ltd., New Delhi, 1993

REFERENCES:

1. Pollard A., “Process Control”, Heinemann educational books, London, 1971.
2. Harriott. P., “Process Control”, Tata McGraw-Hill Publishing Co., New Delhi, 2003

OUTCOMES:

At the end of this course, the students will

- Become familiar with process control tools and he/she will be in a position to measure, acquire and control the process parameters in process industries.
- Have ability to formulate mathematical descriptions of control loops, and to develop system model equations according to various constraints.

- Be able to mimic a physical system using MATLAB.
- Have the ability to use modern engineering tools for control loop analysis, tuning, and troubleshooting.
- Have knowledge of contemporary control technologies, and have recognition of the need for life-long learning.

EIC 3212 COMMUNICATION ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the concepts of various modulations
- To understand the properties of transmission medium.
- To introduce the concepts of various communication systems and protocol.
- To study the study the satellite, optical and fibre communications.

MODULE I MODULATION SYSTEMS 08

Time and frequency domain representation of signals, amplitude modulation and demodulation, frequency modulation and demodulation, super heterodyne radio receiver. Frequency division multiplexing. Pulse width modulation.

MODULE II TRANSMISSION MEDIUM 08

Transmission lines – Types, equivalent circuit, losses, standing waves, impedance matching, bandwidth; radio propagation – Ground wave and space wave propagation, critical frequency, maximum usable frequency, path loss, white Gaussian noise.

MODULE III DIGITAL COMMUNICATION 08

Pulse code modulation, time division multiplexing, digital T-carrier system. Digital radio system. Digital modulation: Frequency and phase shift keying – Modulator and demodulator, bit error rate calculation.

MODULE IV DATA COMMUNICATION AND NETWORK PROTOCOL 08

Data Communication codes, error control. Serial and parallel interface, telephone network, data modem, ISDN, LAN, ISO-OSI seven layer architecture for WAN

MODULE V SATELLITE AND OPTICAL COMMUNICATIONS 08

Orbital satellites, geostationary satellites, look angles, satellite system link models, satellite system link equations; advantages of optical fibre communication

MODULE VI FIBRE COMMUNICATIONS 05

Fibre communication - Light propagation through fibre, fibre loss, light sources and detectors.

L – 45; Total Hours –45

REFERENCES:

5. Wayne Tomasi, 'Electronic Communication Systems', Pearson Education, 3rd Edition, 2001.
6. Roy Blake, 'Electronic Communication Systems', Thomson Delmar, 2nd Edition, 2002.
7. William Schweber, 'Electronic Communication Systems', Prentice Hall of India, 2002.
8. G. Kennedy, 'Electronic Communication Systems', McGraw Hill, 4th edition, 2002.
9. Miller, 'Modern Electronic Communication', Prentice Hall of India, 2003.

OUTCOMES:

The students can able to

- Understand the concepts of various modulations
- study the properties of transmission medium.
- Apply the concepts of various communication systems and protocol.
- Study the satellite communications.

EIC3213	DIGITAL SIGNAL PROCESSING	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To introduce signals, systems, time and frequency domain concepts and the associated mathematical tools that are fundamental to all DSP techniques.
- To provide a thorough understanding and working knowledge of design, implementation, analysis and comparison of digital filters for processing of discrete time signals.
- To study the effect of finite word lengths and applications of DSP

MODULE I DISCRETE TIME SIGNALS AND SYSTEMS 12

Discrete time signals and systems: Linear time invariant (LTI) systems– Convolution and interconnection of LTI systems – Casual LTI systems – Stability– Recursive and non Recursive Systems – Implementation – Correlation of discrete time signals – Auto correlation and Cross correlation of sequences– Z transform – Properties – Analysis of LTI systems in Z domain. Signal processing toolbox.

MODULE II FREQUENCY DOMAIN ANALYSIS 8

Frequency domain Analysis: Fourier Analysis of Continuous time periodic and a periodic signals – Power density spectrum – Fourier series and transform for discrete time signals – Frequency domain characteristic of LTI systems – System function and frequency response Function – Computation.

MODULE III DISCRETE FOURIER TRANSFORM 12

Introduction to Discrete Fourier Transform, Direct computation of DFT, Properties of DFT- Efficient computation of DFT - FFT algorithms – Radix -2 FFT algorithms - Decimation in Time - Decimation in Frequency algorithms, Computing Inverse DFT Computation of FFT,IDFT using MATLAB toolbox.

MODULE IV DESIGN OF DIGITAL FILTERS-FIR FILTER 8

FIR Filters: Symmetric & Antisymmteric FIR filters - Design of Linear phase FIR filters using windows – Frequency sampling realization structures for FIR filters.

MODULE V DESIGN OF DIGITAL FILTERS- IIR FILTER 9

IIR Filters: System Design of Discrete time IIR filter from continuous time filter - Butterworth filter design using Impulse invariance and bilinear transformation, realization structures for

IIR filters

MODULE VI APPLICATIONS OF DSP 8

Sampling theorem - Reconstruction of a Signal from its samples, aliasing - Sampling rate conversion - Interpolation and Decimation - Decimation and Interpolation by an integer factor - Quadrature Mirror Filter banks, Sub-band Coding, few applications using sub-band coding. FIR adaptive filters -adaptive filter based on LMS adaptive algorithm - Adaptive echo cancellation-Adaptive noise cancellation, Model of Speech Wave Form –Vocoder.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. John G.Proakis and Dimitus G.Manolakis, “Digital Signal Processing, Principles, Algorithms and applications”, 3rd edition, Prentice Hall of India, New Delhi, 2008
.

REFERENCES:

1. Sanjit K.Mitra, “Digital Signal Processing”, Tata McGraw Hill, New Delhi, 2001.
2. Alan V Oppenheim, Ronald W Schafer, John R Back, “Discrete Time Signal Processing”, 2nd edition, PHI, 2000.
3. Johny R.Johnson, “Introduction to Digital Signal Processing”, Prentice Hall of India/Pearson Education, 2002.

OUTCOMES:

At the end of this course the students will be able to

- Evaluate the properties of digital and analog signals and systems
- Analyze the frequency domain characteristics of LTI systems and find fourier series of discrete time signals
- Compute Discrete Fourier transform (DFT) and Fast Fourier Transform (FFT) using software packages
- Design symmetric and asymmetric FIR filters
- Design discrete time IIR filters and butterworth filters
- Use knowledge and skill to design, analyze and process signals for different industrial and medical applications

EIB3214 PROCESS CONTROL LABORATORY

L	T	P	C
0	0	3	1

OBJECTIVES:

- To derive an empirical linear model for a real process by generating experimental data and its analysis.
- To design, tune and implement SISO controllers for a real process.

LIST OF EXPERIMENTS:

Study of interacting and non-interacting systems.
2. Response of different order processes with and without transportation lag.
3. Simulation of
    a. Mass Spring Dashpot system
    b. DC Motor
    c. Level Process
4. Tuning of PID controller.
5. Response of P+I+D controller.
6. Study of characteristics of control valve.
7. Characteristics of control valve with and without positioner.
8. Response of cascade control system.
9. Closed loop response of level control loop.
10. Closed loop response of temperature control loop.
11. Closed loop response of pressure control loop.
12. Closed loop response of flow control loop.
13. Design of PI controller for level process.

OUTCOMES:

On completion of the course the student will have

- The ability to apply current knowledge and adapt to engineering applications of mathematics, science, engineering and technology.
- An ability to conduct, analyze and interpret experiments and apply experimental results to improve processes,
- An ability to identify, analyze, and solve technical problems in core industries

SEMESTER VII

EIC4101	DIGITAL PROCESS CONTROL	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide knowledge on discrete time systems and control, control algorithms, digital controller, identification, predictive and adaptive control.

MODULE I DISCRETE TIME SYSTEMS AND CONTROL 12

Continuous and discrete systems sample data system- Z transform – inverse Z transform- selection of sampling period – mathematical representation of sampler- transfer function of zero order hold and first order hold device-Pulse transfer function – open loop and closed response of linear sample data control system for step input – stability analysis: Jury's test and bilinear transformation-State space representation of sample data systems.

MODULE II DIGITAL CONTROL ALGORITHMS 10

Deadbeat Algorithm – Dahlin's method – ringing – Kalman's approach – discrete equivalent to an analog Controller – design for load changes. PID Algorithms - Velocity & Position forms of Digital PID Controller – tuning techniques. Selection of sampling time. Dead time Compensation – Smith Predictor Algorithm

MODULE III COMPUTER AS A CONTROLLER 10

Basic building blocks of computer control system- Data Acquisition systems-Direct Digital Control – Introduction to AI and expert control system – Design of computerized multiloop controller.

MODULE IV MODEL IDENTIFICATION 10

Modelling and identification – ARMAX model structure – Model structure selection – Least square method of estimating the model parameters – Extended least square method – Real time identification.

MODULE V PREDICTIVE CONTROL 8

Introduction - Model predictive control – Dynamic matrix control – Model algorithmic control – Generalized predictive control.

MODULE VI ADAPTIVE CONTROL 10

Introduction Adaptive control – Gain scheduling – Self tuning regulator – Model reference adaptive control – Design of model reference controller.

L – 45; T-0;Total Hours –45

TEXT BOOKS:

1. P.B. Deshpande and RH. Ash, “Elements of Computer Process Control”, Instrument Society of America. 1981.
2. M.Chidambaram, “Computer control of processes”, Alpha Science International Ltd, 2002.
3. Shanthisasidharan, “Computer control of process”, CBA Publishers, 2011.

REFERENCES:

1. B.W.Bequette. “Process control” Prentice Hall Inc. 2006.
2. C.L. Smith, “Digital Computer Process Control”, Intext Educational Publishers, 1972.
3. Vance Vandoren, “Techniques for Adaptive Control” BH publishers, 2003.

OUTCOMES:

At the end of the course the student will be able to

- Design digital control systems using state space techniques.
- Analyse digital systems using control algorithms.
- Mathematically formulate, model and identify digital control systems using predictive and adaptive control.

EIC4102 INDUSTRIAL AUTOMATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn concept of PLC and the Programming using Ladder logic.
- To study about industrial DCS.

MODULE I PROGRAMMABLE LOGIC CONTROLLER (PLC) BASICS 8

Evolution of PLCs — Sequential and programmable controllers, PLC hardware components

– Basics of PLC programming-developing fundamental PLC wiring diagrams and ladder programs-programming timers and counters.

MODULE II PLC INTERMEDIATE FUNCTIONS 8

Program control instructions-Data manipulation Instructions-Arithmetic instructions - Sequencer instructions- Design of interlocks and alarms using PLC

MODULE III COMMUNICATION, INSTALLATION AND TROUBLESHOOTING IN PLC 8

Requirement of communication networks for PLC — connecting PLC to computer - PLC applications in Industrial Automation. PLC installation and Trouble shooting.

MODULE IV DISTRIBUTED CONTROL 7

Introduction to DCS-Evolution, Architectures-Hybrid, centralized computer control, Generalized DCS. Architectures-Comparison, Local control MODULE, LCU-Configurations, Comparison, Process interfacing issues, Communication facilities.

MODULE V INTERFACES IN DCS 7

Operator interfaces-Low level and High level operator interfaces, Operator displays, Engineering interfacing- Low level and High level engineering interfaces, Case studies — Factors to be considered in selecting DCS.

MODULE VI PROGRAMMING IN YOKOGOWA DCS (CS3000) 7

System Hardware Overview - I/O Modules - Operation Screens - System Maintenance Windows - HIS Setup - Process and Historical Reports - Control Programs - Creating a Feedback Control Loop.

L – 45; Total Hours –45

TEXT BOOKS:

1. Petrezeulla, Programmable Controllers, tenth edition , Mc-Graw Hill, 2010.
2. Michael P.Lucas, Distributed Control System, Van Nastrand Reinhold Company, New York,1986.
3. Romilly Bowden, HART application Guide, HART Communication Foundation, 1999.

REFERENCES:

1. G.K.Mc-Millan, Process/Industrial Instrument and controls and handbook, Mc Graw Hill, New York, 1999.
2. Hughes T, Programmable Logic Controllers, ISA Press, 1989.
3. W. Bolton, —PLC‖, Elsevier Newnes.

OUTCOMES:

At the end of the course, the student will be able to

- Get the appropriate knowledge and skills in Industrial automation systems with the use of DCS, PLCs.
- Interface DCS and the Level, Pressure process systems.
- Implement appropriate industrial automation systems

EIC4103	INDUSTRIAL AUTOMATION LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To know fundamentals of PLC and DCS Programming.
- To provide hands on experience with industrial PLC (Allen Bradley & Siemens) and DCS (Yokogowa CS3000).
- To automate real time systems using PLC and DCS.

LIST OF EXPERIMENTS

- Configuration of Input/Output, power supply, CPU in Siemen's PLC and Allen Bradley PLC
- Development of Ladder program for simple on-off applications
- Development of Ladder Logic program to demonstrate latching
- Develop simple programming using FBD
- Program a PLC to use timers
- Program a PLC to use counters
- Perform program control operations using PLC
- Automate car parking using Allen Bradley PLC
- Automate bottle filling process operation using Allen Bradley PLC
- Control Level process station using PID control with Siemen's PLC
- Programming HMI with Siemen's PLC
- Configuring Screens and Graphics (DCS).
- Programming of HMI interfacing with PLC.
- Tag Assignments to Field Devices in DCS.
- DCS based PID control for temperature loop.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on building Industrial automation systems with the use of PLC and DCS.

EIC4104 INSTRUMENTATION SYSTEM DESIGN L T P C
0 0 4 2

OBJECTIVES:

- This course will provide a basic understanding of instrumentation system design and implications of working with process control systems
- To provide the various methods of signal transmission, selection and implementation.
- To provide knowledge in selection of the equipment used in current loops, temperature measurement, pressure measurement, level measurement, flow measurement, output devices.

MODULE I INTRODUCTION 5

Introduction to Instrumentation System Design (ISD), Scope of ISD in Process Industry, An overview of General transducer Design, Selection of Transducer, General procedure for Testing of transducer.

MODULE II DESIGN USING OPERATIONAL AMPLIFIER 8

Design using operational Amplifier and PCB Design: Design of instrumentation amplifiers – multivibrators – comparators – active filter: low and high pass.

MODULE III DESIGN OF SIGNAL CONDITIONING CIRCUITS AND SYMBOLS 8

Design of signal conditioning circuits and symbols: Design of bridge circuits for strain gauge - design of RTD – design of reference junction compensation for thermocouple –thermistor based temperature measurement.

MODULE IV INSTRUMENTATION CONTROLLERS 8

Instrumentation controllers: Design of ON/OFF controller design - design of pneumatic – electronic controller – PID controllers Orifice Sizing: design of square root extractor – Orifice sizing for Liquid, Gas and steam applications.

MODULE V CONTROL VALVE SIZING AND ANNUNCIATORS 8

Control valve sizing and Annunciators: Choice of valve body, materials – flow – lift characteristics – control valve sizing procedure. Cavitation and flashing – Selection criteria. Annunciators & Data Loggers: Annunciators - PLC as an annunciator – Data loggers

MODULE VI PCB DESIGN **8**

PCB Design: PCB board design guide lines – layout scheme – single and multi layer PCB.

Total Hours –45

TEXT BOOKS:

1. B. G. Liptak, “Instrument Engineers Handbook”, Vol. I and II, 3rd edition, Chilton and Book Company, 2010.
2. D. M. Considine, “Process/Industrial Instruments and Control Handbook”, 4th Edition, McGraw-Hill Inc., 1999.
3. C. D. Johnson, “Process Control Instrumentation Technology”, 4th Edition, PHI, 2005.

REFERENCES:

1. Andrew and Williams, “Applied Instrumentation in Process Industries”, Vol. I, II, III, IV, Gulf Publishing Company, 1979.
2. John P. Bentley, “Principles of Measurement Systems”, Addison-Wesley publication, 1999.
3. T.R.Padmanabhan, “Industrial Instrumentation: Principles and Design”, Springer-Verlag Publications, 1999.
4. B. C. Nakra and K. K. Choudhari, “Instrumentation: Measurement and Analysis”, Tata McGraw Hill pub, 2008.

OUTCOMES:

At the end of the course, the students will possess knowledge and achieve skills on the following:

- Be able to interpret and formulate design specifications for instrumentation systems.
- Be able to design, construct, and verify an instrumentation system to meet desired specifications, with the aid of computer-aided design techniques.

SEMESTER VIII

EIC4211	PROJECT	L	T	P	C
		0	0	24	12

OBJECTIVES:

- To design, develop, and deploy advanced state-of-the-art instrument systems and custom application software in support of the ongoing experimental research efforts.
- To provide in-house solutions to assist the researcher through a complete life cycle of system development.
- To gain competency in analyzing experimental data and in comparing the results to data and theories in the literature.
- To acquire more knowledge in designing of hardware as well as applications of softwares like CAD tool, Matlab, LabVIEW & embedded C.
- To apply basic and contemporary science, engineering, and experimentation skills to identifying manufacturing problems and developing practical solutions.

COURSE OUTLINE

Project shall be carried out in the following areas,

- Design/ fabrication of sensors and transmitters,
- Microcontroller based digital control system design,
- Embedded system design for automation,
- Micro-electronics and VLSI Design,
- Applications of Digital image processing for process industries,
- Analysis and design of advanced process control techniques,
- Medical imaging and instrumentation,
- Microsensors and Microactuators design and
- MEMS in instrumentation and biomedical.

SOFTWARE:

MATLAB/SIMULINK, PSPICE, LabVIEW and CAD tool, embedded C, MEMS software

OUTCOMES:

On completion of the course the student will be able to

Apply Knowledge of Mathematics, Science and Engineering

- Design, model, analyze and improve a manufacturing process or system utilizing modern technologies

- Design and conduct experiments, as well as to analyze and interpret data
- Identify, formulate and solve engineering problems
- Use the techniques, skills and modern engineering tools necessary for engineering practice
- Function on multi-disciplinary teams and to communicate effectively

PROFESSIONAL ELECTIVES
GROUP I

		L	T	P	C
EICX01	**BIO MEDICAL INSTRUMENTATION**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To provide an acquaintance of the physiology of the heart, lung, brain and biopotentials.
- To introduce the student to the various electrodes and amplifiers and typical measurement devices of electrical origin
- To provide the latest ideas on devices of non-electrical devices
- To bring out the important and modern methods of imaging techniques and latest knowledge of medical assistance / techniques and therapeutic equipments.
- To provide awareness of electrical safety of medical equipments

MODULE I PHYSIOLOGY AND BASIC CONCEPTS OF MEDICAL NSTRUMENTATION 5

Generalized Medical Instrumentation system – Medical and physiological parameters - Nervous system: Functional organisation of peripheral nervous system – Structure of nervous system, neurons - synapse – transmitters and neural communication – Cardiovascular system – respiratory system - Resting and Action Potential – Bio potentials.

MODULE II ELECTRO – PHYSIOLOGICAL MEASUREMENTS 5

Electrodes – Limb electrodes – floating electrodes – pregelled disposable electrodes - Micro, needle and surface electrodes – Blood glucose sensors - Practical hints in using electrodes. Bio potential amplifiers: Basic requirements– ECG preamplifiers and ECG isolation amplifiers.

MODULE III ORIGIN OF BIOPOTENTIALS 10

Electrocardiogram (ECG) –Electroencephalogram (EEG) – Electromyogram (EMG) – Electroretinogram (ERG) – Lead systems and recording methods – Typical waveforms – case study of ECG, EEG.

MODULE IV NON-ELECTRICAL PARAMETER MEASUREMENTS 10

Measurement of blood pressure: Direct and indirect measurement – Blood flow

meters – Cardiac output – Heart rate – Heart sounds – Pulmonary function measurements: lung volume spirometer – Photo Plethysmography, Body Plethysmography – Blood Gas analyzers :finger-tip oxymeter - BSR, GSR measurements.

MODULE V ASSISTING AND THERAPEUTIC EQUIPMENTS 10

Computer tomography – PET - MRI – Ultrasonography – Endoscopy – Mammography - Different types of biotelemetry systems - patient monitoring - Pacemakers – Defibrillators - Diathermy – Dialysers.

MODULE VI ELECTRICAL SAFETY 5

Electrical safety in medical environment: Physiological effects of Electricity – micro and macro shock hazards – Protection against shock - Electrical Safety analyzers.

L – 45; Total Hours –45

TEXT BOOKS:

1. J.Webster, “Medical Instrumentation – Application and Design”, 4th Edition, John Wiley & Sons, 2009.

REFERENCES:

1. R.S.Khandpur, “Hand Book of Bio-Medical Instrumentation”, 12th reprint, Tata McGraw Hill Publishing Co Ltd., 2008.
2. Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer, “Bio-Medical Instrumentation and Measurements”, 2nd edition, Pearson Education, 2008 / PHI.
3. M.Arumugam, “Bio-Medical Instrumentation”, Anuradha Agencies, 2009.
4. L.A. Geddes and L.E.Baker, “Principles of Applied Bio-Medical Instrumentation”, John Wiley & Sons, 1975.

OUTCOMES:

At the end of the course, the student will be able to

- Analyze typical waveforms of bio potentials of the human system
- They will be able provide safety during measurement.
- Capable of pursuing biomedical engineering and biotechnology at master level programme.
- Able to apply the knowledge of biomedical for designing biomedical equipments

EICX02	FIBRE OPTICS AND LASER INSTRUMENTATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide knowledge about the characteristics, losses and fabrication of optical fibres.
- The impart knowledge of optical fibre as a sensor for different applications.
- To provide the use of laser for various measurements and applications

MODULE I OPTICAL FIBRES AND THEIR PROPERTIES 7

Principles of light propagation through a fibre – Fibre materials and their characteristics-Different types of fibres and their properties - Transmission characteristics of optical fibre- Absorption losses -Scattering losses - Dispersion-Optical fibre measurement.

MODULE II OPTICAL SOURCES AND DETECTORS 7

Introduction to Optical sources LED-structures, Types, characteristics, Applications, LD. Optical detectors, PIN structures, Types, characteristics, Applications, APD -, Wavelength Division Multiplexing.

MODULE III INDUSTRIAL APPLICATIONS OF OPTICAL FIBRES 9

Fibre optic sensors- Fibre optic instrumentation system-Different types of modulators –Detectors-Application in instrumentation- Interferometer method of measurement of length-Moiré fringes-Measurement of pressure, Temperature, current, Voltage, liquid level and strain–Fibre optic gyroscope– polarization.

MODULE IV LASER FUNDAMENTALS 8

Fundamental characteristics of laser-Three level and four level lasers-Properties of lasers-Laser modes-Resonator configuration-Q-switching and mode locking-Cavity dumping-Types of laser-Gas laser, solid laser, liquid laser, semi conductor laser.

MODULE V INDUSTRIAL APPLICATION OF LASER 7

Laser for measurement of distance, length, velocity, acceleration, current, voltage, and atmospheric effect-Material processing-Laser heating, welding, melting and trimming materials, removal and vaporization

MODULE VI HOLOGRAPHY & MEDICAL APPLICATIONS OF LASER 7

Holography- Basic principle, methods-Holographic interferometer and applications –

Holography for non destructive testing-Holographic components-Medical application of lasers-laser and tissue interaction-Removal of tumors of vocal cards-Plastic surgery-Endoscopy.

L – 45; Total Hours –45

TEXT BOOKS:

1. Gerd Keiser, “Optical Fibre Communications”, McGraw-Hill, International Edition, 2010

REFERENCES:

1 D.C.O’shea, Russel Callen, “Introduction to lasers and their applications”, Mc Millan, 1977.
2 John and Harry, “Industrial lasers and their applications”, McGraw Hill, 1974.
3 John senior, “Optical communications”, PHI
4 Thyagarajan.K, Ajoy k Ghata, “Laser theory and applications”, Plenna press, 1981
5 John F Ready, “Industrial applications of lasers”, Academic press, 1978.
6 Monte Ross, “Laser applications”, McGraw Hill, 1968.
7 Ghatak A.K. and Thiagarajan K, “Optical electronics foundation book”, TMH, New Delhi, 1991.
8 John Palais, “Fibre Optic Communications”, Pearson Education.

OUTCOMES:

- Students will be able to select suitable optical and laser instruments for various engineering and biomedical applications.

EICX03 INTRODUCTION TO MEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide knowledge on Micro electro mechanical systems, basic mechanics for design and modeling.

MODULE I INTRODUCTION TO MEMS 8

MEMS and Microsystems, Miniaturization, Typical products, Micro sensors, Micro actuation, MEMS with micro actuators, Micro accelerometers and Micro fluidics, MEMS materials, Micro fabrication.

MODULE II MECHANICS FOR MEMS DESIGN 8

Elasticity, Stress, strain and material properties, Bending of thin plates, Spring configurations, torsional deflection, Mechanical vibration, Resonance, Thermo mechanics – actuators, force and response time, Fracture and thin film mechanics

MODULE III ELECTRO STATIC DESIGN 8

Electrostatics: basic theory, electro static instability. Surface tension, gap and finger pull up, Electro static actuators, Comb generators, gap closers, rotary motors, inch worms, Electromagnetic actuators. Bistable actuators.

MODULE IV CIRCUIT AND SYSTEM ISSUES 8

Electronic Interfaces, Feedback systems, Noise, Circuit and system issues, Case studies – Capacitive accelerometer, Piezo electric pressure sensor.

MODULE V INTRODUCTION TO OPTICAL AND RF MEMS 8

Optical MEMS - System design basics – Gaussian optics, matrix operations, resolution. Case studies, MEMS scanners and retinal scanning display, Digital Micro mirror devices. RF MEMS – design basics, case study – Capacitive RF MEMS switch, performance.

MODULE VI MODELING OF MEMs 9

Modelling of MEMS systems, CAD for MEMS. Modelling the dynamics of MEMs resonators

L – 45; Total Hours –45

TEXT BOOKS:

1. Stephen Santuria,” Microsystems Design”, Kluwer publishers, 2000.

REFERENCES:

1. Nadim Maluf, “An introduction to Micro Electro Mechanical System Design”, Artech House, 2000
2. Mohamed Gad-el-Hak, editor, “The MEMS Handbook”, CRC press Baco Raton, 2000.
3. Tai Ran Hsu, “MEMS & Micro systems Design and Manufacture” Tata McGraw Hill, New Delhi, 2002.

OUTCOMES:

At the end of the course , the student will be able to

- Select Micro electro mechanical systems for specific application.
- Identify specific sensor for design pertaining to different applications.
- Model Micro electro mechanical systems using CAD software.

EICX04	Qt SOFTWARE	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To introduce the students to the basics of OOPs
- To create awareness of Qt basics
- To provide knowledge on object based, embedded programming
- To make the students understand user interface
- To make the students understand custom UI

MODULE I OBJECT ORIENTED PROGRAMMING 6

OOPS: Definition, Concepts - Relationship with C++ - C++: Program Structure - Compiling and Linking - File Organization -Pointers, Classes and Structures - Templates, Virtual Inheritance, Abstract Classes & Interfaces

MODULE II Qt: INTRODUCTION 6

Qt: Introduction - Types of Applications - Relationship with C++ - Program Structure - File Organization - Compiling and Linking - Pointers, Classes and Structures – Qt Creator IDE Introduction - Console Applications in Qt – Debugging

MODULE III OBJECT BASED PROGRAMING 6

Object Based Programing - Program Design – File IO - Class Libraries

MODULE IV USER INTERFACE 6

UI Classes - Simple UI Programing - Signals and Slots - Serial IO - Programing for the Internet

MODULE V PROGRAMMING 6

Embedded Programing - Controller Programing - Custom UI - HMI Development - Charts - Final Assignment

L – 30; P – 30; Total Hours –60

REFERENCES:

1. https://www.qt.io/
2. qt-project.org/
3. Qt Programming for Linux and Windows 2000, Patrick Ward, 2001
4. Practical Qt: Real World Solutions to Real World Problems Paperback, Matthias Kalle Dalheimer & Jesper Pedersen , 2004

5. Advanced Qt Programming: Creating Great Software with C++ and Qt 4 (Prentice Hall Open Source Software Development Series) Hardcover – 11 Jul 2010

OUTCOMES:

The students will be able to

- Write programming using OOPs
- Create structure and apply using Qt software
- Design and program using object based, embedded programming
- Do simple UI programming for HMI and the internet
- Write programs on embedded based and control HMI

EICX05	TELEMETRY AND TELECONTROL	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide knowledge on telemetry fundamentals, landline, radio, optical and biotelemetry
- To make the students to understand telecontrol methods

MODULE I TELEMETRY FUNDAMENTALS AND CLASSIFICATION 8

Fundamental concepts – Significance, Principle, functional blocks of Telemetry and Telecontrol system - Methods of telemetry – Electrical, Pneumatic, Hydraulic and Optical Telemetry – State of the art-Telemetry standards.

MODULE II LANDLINE TELEMETRY 8

Electrical Telemetry-Current Systems – Voltage Systems - Synchro Systems– Frequency systems – Position and Pulse systems – Example of a landline telemetry system

MODULE III RADIO TELEMETRY 8

Block diagram of a Radio Telemetry system – Transmitting and receiving techniques – AM, FM, PM, Multiplexing and demultiplexing – Transmitting and receiving techniques – Digital coding methods – Advantages of PCM, PWM, PM, FSK – Delta modulation – coding and decoding equipment – Example of a radio telemetry system.

MODULE IV OPTICAL TELEMETRY 8

Optical fibers for signal transmission – Sources for fiber optic transmission – Optical detectors – trends in fiber – optic device development – Example of an optical telemetry system.

MODULE V TELECONTROL METHODS 8

Analog and Digital techniques in telecontrol, telecontrol apparatus – Remote adjustment, Guidance and regulation – Telecontrol using information theory – Example of a telecontrol system.

MODULE VI BIO TELEMETRY METHODS 5

Bio telemetry – single channel telemetry – multi channel telemetry – telemetry for biomedical applications.

L – 45; Total Hours –45

REFERENCES:

1. Gruenberg. L “Handbook of telemetry and remote control”, McGraw Hill, New York, 1987.
2. Swobodoa. G., “Telecontrol methods and applications of Telemetry and Remote Control”, Reinhold Publishing Corp., London, 1988.
3. Young R.E., “Telemetry Engineering”, Little Books Ltd, London 1988.

OUTCOMES:

At the end of the course, the student will be able to

- Apply the concepts to design a radio telemetry system.
- Design a biotelemetry system.
- Choose optical cables to meet specific requirement .

Physics Elective Courses
(To be offered in II Semester)

PHCX 01	FUNDAMENTALS OF ENGINEERING MATERIALS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To help students to acquire the properties and applications of conducting and semiconducting materials.
- To familiarize students with basic ideas about the properties of dielectric and magnetic materials and their applications.
- To familiarize students with basic knowledge of nanomaterials and its electrical, electronic, mechanical and magnetic properties.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I CONDUCTING AND SEMICONDUCTING MATERIALS 7

Conductors: properties, Fermi distribution function, Fermi energy in metals- density of states- conducting polymers-properties-applications, semiconductors: intrinsic and extrinsic semiconductors-carrier concentration, conductivity and energy band gap, semiconducting polymers- properties- applications.

MODULE II DIELECTRIC MATERIALS 8

Polarization- dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – Internal field - Clausius Mosotti relation - dielectric loss – dielectric breakdown – applications of dielectric materials (capacitors and transformers) – Pyroelectricity, Piezoelectricity, ferroelectricity and applications in Ferroelectric Random Access Memory (FeRAM) - multiferroic materials and its applications.

MODULE III MAGNETIC MATERIALS 7

Origin of magnetism-magnetic moment, susceptibility, permeability – Bohr magneton – Dia, Para and Ferro magnetism –Spontaneous magnetization- Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites and its application - Giant Magneto-resistance effect (GMR) - Magnetic resonance imaging(MRI).

MODULE IV NANOMATERIALS 8

Properties of nanomaterials – size effect on thermal, electrical, electronic, mechanical,

optical and magnetic properties – quantum confinement – classification of nanomaterials – quantum well, quantum wire, quantum dot - nanoporous materials - carbon nanotubes, graphene - nanocomposites – applications of nano materials.

PRACTICALS

1. Determination of energy band gap of a semiconductor.
2. Determination of resistivity of metals by four point probe method.
3. Determination of dielectric constant of dielectric material.
4. Determination of time constant of a capacitor using RC circuit.
5. Determination of paramagnetic susceptibility of given liquid.
6. Determination of hysteresis loss in a transformer using BH curve.
7. Analysis of size effect on the absorption spectrum of nanomaterials.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. William D. Callister, “Material Science and Engineering”, Wiley Publications, 2006.
2. Raghavan, V., “Materials Science and Engineering”, 5th edition, Printice Hall of India Pvt Ltd. New Delhi, 2004.
3. Wahab. M.A, “Solid State Physics: Structure and Properties of Materials”, Narosa Publishing House Pvt. Ltd., New Delhi , 2nd Edition, 2010.
4. Pillai, S.O., “Solid State Physics”, New Age International, New Delhi, 2005.
5. Charles P. Poole and Frank J. Owens, ”Introduction to nanotechnology”, Wiley (India), 2009.
6. Pradeep. T., “Textbook of Nanoscience and Nanotechnology”, McGraw Hill Education (India) Private Limited, New York, 2012.

OUTCOMES:

On completion of this course, the student will be able to

- apply the concepts of conducting and semiconducting materials for solid state devices.
- comprehend the significance of properties of dielectric magnetic materials and derive these properties from synthesized materials.
- differentiate between the properties of the nanomaterials compared to bulk materials.
- complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 02	HEAT AND THERMODYNAMICS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To familiarize students with basic concepts of heat.
- To help students acquire the fundamentals of heat conduction and radiation.
- To enable students acquaint with the basics of thermodynamic concepts.
- To make students understand the fundamentals of heat based experiments.

MODULE I CONCEPTS OF HEAT **10**

Definition of temperature, thermal and thermodynamic equilibrium - relationship between temperature and kinetic energy - definition of solid, liquid, gas - Introduction to phase transitions, critical and triple points- definition of heat capacity, mechanical equivalent of heat -Joule's calorimeter- latent heat- microscopic model of ideal gas - equation of state, internal energy, equipartition theorem- equation of state for non-ideal gases.

MODULE II CONDUCTION AND RADIATION **10**

Thermal conductivity – rectilinear flow of heat – thermal conductivity of a good conductor – Forbe’s method – thermal conductivity of a bad conductor – Lee’s disc method – conduction of heat through compound media - radiation – Planck’s law of blackbody radiation – Wien’s law – Stefan’s law – Newton’s law of cooling from Stefan’s law – Solar constant – Pyrometry.

MODULE III FUNDAMENTALS OF THERMODYNAMICS **10**

Thermodynamic equilibrium – zeroth law of thermodynamics – first law of thermodynamics – Reversible and irreversible processes – second law of thermodynamics - Heat engine – Carnot’s engine – Carnot’s theorem – Internal combustion engines – petrol and diesel engines (qualitative) – Entropy and available energy – temperature – entropy diagram for Carnot’s cycle - Third Law of thermodynamics (qualitative).

PRACTICALS

1. Determination of mechanical equivalent of heat by Joule’s calorimeter.
2. Relation between temperature of a body and time by plotting a cooling curve-Newton’s law of cooling.

3. Determination of specific heat capacity of liquid by cooling.
4. Determination of thermal conductivity of a good conductor-Forbe's method
5. Determination of thermal conductivity of a bad conductor-Lee's disc method

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Mathur. D.S, “Heat & Thermodynamics”, S.Chand & Co., 2009.
2. Brijlal & Subramaniam, “Heat and Thermodynamics”, S.Chand & Co, Delhi, 2010.
3. Gupta. A.B and Roy. H, “Thermal Physics”, Books and Allied Ltd., 2002.
4. Sharma. J.K and Sarkar. K.K, “Thermodynamics and statistical Physics”, Himalaya Publishing House, 1988.

OUTCOMES:

On completion of this course, the student will be able to

- understand the concepts of heat and its properties.
- comprehend the ideas governing the conduction and radiation processes.
- apply the knowledge of laws of thermodynamics in thermodynamic systems.
- perform heat based experiments and determine its various properties.

PHCX 03	INTRODUCTION TO NANOSCIENCE AND TECHNOLOGY	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To acquire basic knowledge about the nanomaterials and applications.
- To learn about the synthesis and imaging techniques of nanomaterials.
- To gain the basic concepts of fabrication techniques.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I NANOMATERIALS AND APPLICATIONS **10**

Properties of nanomaterials – size effect on thermal, electrical, electronic, mechanical, optical and magnetic properties – quantum confinement – classification of nanomaterials – quantum well, quantum wire, quantum dot - nanoporous materials - zeolite, mesoporous materials, carbon nanotubes, grapheme - nanocomposites - applications (qualitative): Molecular electronics-nanoelectronics – nanophotonics - single electron transistor-drug delivery.

MODULE II SYNTHESIS AND IMAGING TECHNIQUES **12**

Top-down and bottom up approaches – mechanical alloying and mechanical ball milling - sol-gel approach - hydrothermal method - precipitation method - spray pyrolysis - spin coating-self assembled monolayer (SAM) - Chemical vapour deposition method – Physical vapour deposition method: laser ablation method, sputtering method.

Optical microscopy – Phase contrast and interference microscopy – confocal microscopy - high resolution Scanning electron microscope (HRSEM) - high resolution Transmission electron microscope (HRTEM) - Atomic force microscope - Scanning Tunnelling microscope (STM).

MODULE III NANOFABRICATION **8**

Photolithgraphy - electron beam lithography - X-ray and Ion beam lithography - nanoimprint lithography - soft lithograpy - nanoelectromechnical systems (NEMS) - nanoindentation principles.

PRACTICALS

1. Synthesis of nanomaterials by sol-gel method.

2. Synthesis of nanomaterials by hydrothermal method.
3. Synthesis of nanomaterials by solid state reaction method.
4. Synthesis of nanomaterials by chemical bath deposition method.
5. Synthesis of nanomaterials by co-precipitation method.
6. Synthesis of nano thin films by spray pyrolysis method.
7. Synthesis of nano thin films by pulsed laser deposition (PLD) method.
8. Analysis of size effect on the absorption spectrum of nanomaterials.
9. SEM characterization of nanomaterials.
10. AFM characterization of nano thin films.
11. Phase confirmation by XRD.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Charles P.Poole and Frank J. Owens, ”Introduction to nanotechnology”, Wiley (India), 2009.
2. Cao. G., “Nanostructures & Nanomaterials: Synthesis, Properties & Applications”, Imperial College Press, 2004.
3. Gaddand. W., Brenner. D., Lysherski. S. and Infrate. G.J., “Handbook of NanoScience Engineering and Technology”, CRC Press, 2002.
4. Pradeep. T., “Textbook of Nanoscience and Nanotechnology”, McGraw Hill Education (India) Private Limited, New York, 2012.
5. Chris Mack, “Fundamental Principles of Optical Lithography: The Science of Microfabrication”, John Wiley & Sons, 2008.
6. Bandyopadhyay A.K., “Nano Materials”, New Age International Publishers, New Delhi, 2008.

OUTCOMES:

At the end of the course, the students will be able to

- understand the importance and basic concepts of the nanomaterials.
- comprehend the imaging techniques for nanomaterials.
- illustrate the various nanofabrication techniques.
- complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 04	LASERS AND THEIR APPLICATIONS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To recognize the fundamentals of laser and its characteristics.
- To comprehend and compare the different laser systems.
- To apply lasers in metrology and material processing.
- To understand the working of laser instrumentation.
- To correlate the experimental results for applications.

MODULE I LASER THEORY **8**

Spontaneous and stimulated emission - Population inversion – Einstein's A & B coefficients - Threshold condition – super-radiance Laser – Three level and four level laser systems -conditions for CW and pulsed laser action. Q-Switching - experimental methods - cavity dumping - Mode locking - experimental methods - Spatial and Temporal coherence.

MODULE II DIFFERENT LASER SYSTEMS **8**

Laser systems – General description - Laser structure - excitation mechanism - Different laser systems- He-Ne laser, Carbon-dioxide laser - Excimer laser – Free electron laser- Alexandrite laser - Ti-Sapphire laser – Semiconductor diode laser - Diode pumped solid state laser - Pulsed-CW dye laser- Fibre laser.

MODULE III METROLOGICAL AND MATERIAL PROCESSING APPLICATIONS **8**

CW and Pulsed laser beam characteristics and its measurements - Beam focusing effects - spot size - Power and Energy density Measurements - Distance measurement - Interferometric techniques - LIDARS - different experimental arrangements - Pollution monitoring by remote sensing - Laser gyroscope - Laser welding, drilling, machining and cutting - Laser surface treatment - Laser vapour deposition – Biophotonic applications.

MODULE IV LASER INSTRUMENTATION **7**

Laser for measurement of length, current and voltage – Laser Doppler Velocimetry - Holography and speckle in displacement and deformation measurements - Laser for communication with fiber optics as channel.

PRACTICALS

1. Tuning of Dye Laser using DFDL Arrangement
2. Determination of Brewster Angle using He-Ne laser
3. Study of transversely Pumped Dye Lasers
4. Study of longitudinally Pumped Dye Lasers
5. Determination of power and wavelength using Distributed Feedback Dye Laser (DFDL)
6. Determination of fibre optic losses using semiconductor laser.
7. Bandgap determination of a semiconductor diode.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. William T. Silfvast, “Laser Fundamentals”, Cambridge University Press, 2009.
2. Ghatak. A. & Thyagarajan. K. “Optical Electronics”, Cambridge University, 1994.
3. Laud.B.B., “Laser and Non-Linear Optics”, Second Edition, New Age International (p) Limited Publishers, 2011.
4. Nambiar. K.R., “Lasers Principle, Types and Applications”, New Age International (p) Ltd, 2004.
5. Wilson. J. & Hawkes. J.F.B., “Opto Electronics - An Introduction”, Prentice Hall, 1992.
6. William M.Steen, ”Laser Material Processing”, Springer-Verlag, Berlin, Third Edn., 2005.

OUTCOMES:

At the end of the course, the students will be able

- To complement the knowledge acquired in the theory class.
- To work with dye lasers for tunability of laser wavelength.
- To measure the loss of information involved in fibre optic communication.
- To correlate the results for application.

PHCX 05	MATERIALS SCIENCE	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To gain basic knowledge in conducting and semiconducting materials and their properties.
- To provide basic understanding of properties and applications of dielectric materials.
- To impart knowledge on magnetic and optical materials and their properties & applications.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I CONDUCTING AND SEMICONDUCTING MATERIALS 10

Quantum free electron theory of metals and its importance - Energy distribution of electrons in metals - Fermi distribution function - Density of energy states and carrier concentration in metals - Fermi energy – Classification of solids into conductors, semiconductors and insulators on the basis of Band theory – Introduction to Elemental and Compound semiconductors - Carrier concentration derivation for Intrinsic semiconductors - Density of electrons in conduction band & Density of holes in valence band- intrinsic carrier concentration - Fermi energy & Variation of Fermi energy level with temperature - Mobility and electrical conductivity - Band gap determination.

MODULE II DIELECTRIC MATERIALS 7

Introduction to dielectric materials & basic definitions – Electronic, Ionic, Orientation & Space charge polarizations - Total polarization – Frequency and temperature dependence of polarization - Internal field in a dielectric material - Deduction of Clausius - Mosotti's relation - dielectric loss & loss tangent – Different types of dielectric breakdown – Applications of dielectric materials : Capacitors and Transformers.

MODULE III MAGNETIC MATERIALS 6

Introduction to magnetic materials & origin of magnetic moment - Different types of

magnetic materials and their properties - Ferromagnetism & Domain theory of ferromagnetism - Hysteresis, Soft and Hard magnetic materials - Antiferromagnetic materials - Ferrites and its applications – Applications of magnetic materials : Data storage.

MODULE IV OPTICAL MATERIALS 7

Optical properties of semiconductors - Direct and Indirect bandgap semiconductors – Traps, recombination centre, color center and exciton – Luminescence : Fluorescence and Phosphorescence - Liquid crystal display : twisted nematic crystal display – Applications of Optical materials - Optical Sources : light emitting diode and laser diode - Photo detectors : PIN photodiode and Avalanche Photodiode - Pyroelectric devices - Electro optic effect : Kerr effect and Faraday effect.

PRACTICALS

1. Resistivity measurement of a semiconductor using four point probe method.
2. Determination of band gap of a semiconductor diode.
3. Determination of Hall coefficient of a given semiconductor material.
4. Determination of dielectric constant of a given non-polar liquid.
5. Determination of magnetic susceptibility of a given paramagnetic liquid using Quincke's method.
6. Determination of energy loss of a given transformer core using hysteresis method.
7. To study the I-V characteristics of a photodiode.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Palanisamy P.K., ''Physics II'', Material Science for ECE, Scitech Publications (India) Pvt. Ltd., 2006.
2. Kasap. S.O., ''Principles of Electronic materials and devices'', McGraw Hill Publishers, 3rd Edition, 2007.
3. Arumugam. M, "Physics II'', Material Science for ECE, Anuradha Publishers, 5th Edition, 2005.
4. Sze. S.M., ''Semiconductor Devices – Physics and Technology'', John Wiley, 2nd Edition. 2002.
5. Raghavan. V, ''Materials Science and Engineering'', Prentice Hall of India, 5th Edition, 2004.

OUTCOMES:

On the completion of this course, the students will be able to

- Gain knowledge about fundamentals of conducting and semiconducting materials.
- Understand concepts and applications of Dielectric and Magnetic materials.
- Familiarize Optical materials and their applications in Engineering and Medical fields.
- Complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 06	NON-DESTRUCTIVE TESTING	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To study the process and applications of ultrasonic inspection method.
- To understand the basic concepts of radiographic inspection method.
- To acquire the knowledge about the various surface Non-Destructive Testing (NDT) techniques.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I ULTRASONIC INSPECTION METHOD **10**

Ultrasonic Testing - Principle of operations - types of sound waves - types of Transducers - transmission and pulse-echo method - straight beam and angle beam, instrumentation - calibration methods - ultrasonic testing technique- data representation, A Scan, B-scan, C-scan. Phased Array Ultrasound, Time of Flight. Diffraction - thickness determination - advantages, disadvantages and applications.

MODULE II RADIOGRAPHIC INSPECTION METHOD **10**

Radiographic testing – Principle - Interaction of X-ray with matter - X-ray radiography - method of generation-industrial radiography inspection techniques – Equipment - Exposure charts - Types of films – Fluoroscopy - Xero-Radiography – Limitations - Gamma radiography - Equipment, radiation sources - method of generation - film processing - interpretations of radiography - safety in industrial radiography.

MODULE III SURFACE NDT TECHNIQUES **10**

Liquid Penetrant Testing – Principles, Characteristics and types of liquid penetrants – developers - advantages and disadvantages of various methods - Inspection Procedure and Interpretation of results. Applications of Liquid Penetrant testing.

Magnetic Particle Testing - Principle-magnetizing technique - procedure –equipment - Interpretation and evaluation of test indications - applications and limitations - demagnetization.

PRACTICALS

1. Inspection of welds using solvent removable visible dye penetrant.
2. Inspection of welds using solvent removable fluorescent dye penetrant.

3. Inspection on non magnetic materials by eddy current method.
4. Inspection on magnetic materials by eddy current method.
5. Inspection of welds by Eddy current Testing.
6. Inspection of welds by Magnetic Particle Testing - Dry method.
7. Inspection of welds by Magnetic Particle Testing - Wet method.
8. Ultrasonic flaw detector - Inspection of defects.
9. Demonstration of Radiographic inspection.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Baldev Raj., Jayakumar T.,Thavasimuthu., “Practical Non-Destructive Testing”, Narosa Publishing House, 2009.
2. Ravi Prakash., “Non-Destructive Testing Techniques”, 1st revised edition, New Age International Publishers, 2010.
3. ASM Metals Handbook of Non-Destructive Evaluation and Quality Control, American Society of Metals, Metals Park, Ohio, USA, Volume-17, 2000.
4. Paul E Mix,”Introduction to Non-destructive testing: a training guide”, Wiley, 2nd Edition New Jersey, 2005.
5. Charles J., Hellier, “Handbook of Nondestructive evaluation”, McGraw Hill, New York, 2001.

OUTCOMES:

Upon completion of this course, the students will be able to

- illustrate the ultrasonic inspection methods of NDT.
- understand the basic concept of radiographic inspection method.
- test the surfaces by the various surface NDT techniques.
- complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 07	PROPERTIES OF MATTER AND ACOUSTICS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To understand principles and properties of elasticity.
- To understand the basic concepts and application of viscosity.
- To analysis acoustic of building.
- To know about photoelasticity and its applications.

MODULE I ELASTICITY **8**

Stress and strain - Hooke's Law of elasticity - Elastic moduli - Stress-Strain Diagram - Poisson's Ratio - Relation between elastic constants - Work done in stretching and twisting a wire - Twisting couple on a cylinder- Expression for bending moment - Cantilever–Expression for depression - Uniform bending and Non-uniform bending of beams (theory & experiment) - I form Girders (qualitative treatment) and applications.

MODULE II VISCOSITY **8**

Viscosity- Newton’s formula for viscous flow - Streamline and turbulent motion - Reynolds number - Poiseuille's formula - Determination of coefficient of viscosity- factors affecting viscosity - capillary flow method - Stoke's formula- viscosity of highly viscous liquids – Stoke’s method - Lubricants and its applications –viscosity measurements - Viscometer - Variation of Viscosity with Temperature.

MODULE III ACOUSTICS OF BUILDING **7**

Basic requirement for the acoustically good halls - Reverberation and time of reverberation – Sabine’s formula for reverberation time - Absorption coefficient and its measurement -Transmission of sound and transmission loss - Factors affecting the architectural acoustics and their remedy-sound absorbing materials - vibration and noise control systems for buildings.

MODULE IV PHOTOELASTICITY **7**

Polarization - double refraction - Theory of Plane, Circularly and Elliptically polarized light - Quarter wave plate and half wave plate - photo elasticity - Theory of photo-elasticity - Stress optic relations - model materials - analysis techniques - Photo elastic bench - Three dimensional photo elasticity - Digital photo elasticity - Photo elastic

coatings.

PRACTICALS

1. Determination of viscosity of liquid by Poiseuille's method.
2. Determination of viscosity of liquid by Stoke's method.
3. Analysis of stress by photo elastic method.
4. Verification of Hooke's law by spring method.
5. Determination of Young's modulus of the cantilever beam.
6. Determination of rigidity modulus by static torsion method.
7. Visit to acoustically good auditorium and identifying the sound absorbing materials in the auditorium.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Mathur D.S., "Elements of Properties of Matter", S.Chand & Co, Delhi, 2009.
2. Gaur R.K., Gupta S.L.,"Engineering Physics", Dhanpat Rai Publishers, 2010.
3. Brijlal and Subramaniam.," Properties of Matter", Eurasia Publishing Co, New Delhi, 2002.
4. Smith C.J.," General Properties of Matter", Orient & Longman,1960.
5. Kenneth G. Budinski and Michel K., Budinski, "Engineering Materials Properties and Selection", Pearson, Singapore, 2002.

OUTCOMES:

Upon completion of this course, the students will be able to

- understand the basic concepts of the elasticity of materials.
- comprehend the concepts of viscosity of liquid and measurement.
- demonstrate the acoustical aspects of building and its importance in construction.
- apply the fundamental concept of photo elasticity for the stress analysis of the object.

PHCX 08	PROPERTIES OF MATTER AND NONDESTRUCTIVE TESTING	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To impart knowledge about the principles and properties of elasticity.
- To learn the laws governing the dynamic of rigid bodies.
- To acquire the knowledge of the various techniques of Non-Destructive Testing (NDT) of materials.
- To understand the principle and basic concept of low temperature applications.

MODULE I ELASTICITY **8**

Stress and strain - Hooke's Law of elasticity - Elastic moduli - Stress-Strain Diagram - Poisson's Ratio - Relation between elastic constants - Work done in stretching and twisting a wire - Twisting couple on a cylinder- Expression for bending moment- Cantilever–Expression for depression - Uniform Bending and Non-uniform bending of beams (theory & experiment) - I form Girders (qualitative treatment) and applications.

MODULE II DYNAMICS OF RIGID BODIES **8**

Rigid bodies - angular acceleration - Torque on a particle - angular momentum - law of conservation of angular momentum - moment of inertia and its significance - Theorem of parallel and perpendicular axis - moment of inertia of a thin uniform bar - moment of inertia of a rectangular lamina - moment of inertia of uniform circular disc - Moment of inertia of hollow and solid cylinders – flywheel
(qualitative) - kinetic energy of rotating body – Routh rule.

MODULE III NDT TECHNIQUES **6**

Ultrasonic Testing- types of Transducers-transmission and pulse-echo method- Radiographic testing- Principle-Interaction of X-ray with matter-X-ray radiography-method of generation-industrial radiography inspection techniques- Liquid Penetrant Testing**-** Inspection Procedure and Interpretation of results.

MODULE IV LOW TEMPERATURE PHYSICS **8**

Definition of Refrigeration and Air-Conditioning - Types of **Refrigeration Systems-**

Applications- Comfort Air Conditioning, Industrial Refrigeration, Food processing and food chain - **Cryogenic treatment - Low temperature properties of engineering materials: Mechanical properties, Thermal properties, Electrical properties.**

PRACTICALS

1. Verification of Hooke's law by spring method.
2. Determination of Young's modulus of the beam by bending method.
3. Inspection of welds using solvent removable visible dye penetrant.
   Inspection of welds using solvent removable fluorescence dye penetrant.
5. Inspection of welds by Magnetic Particle Testing.
6. Determination of moment of inertia of the disc by torsion pendulum method.
7. Determination of moment of inertia of the disc by static torsion method.
8. Demonstration of working of flywheel.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Mathur D.S.,"Elements of Properties of Matter", S.Chand & Co, Delhi, 2009.
2. Brijlal & Subramaniam," Properties of Matter", Eurasia Publishing Co, Delhi, 2002.
3. Gaur R.K., Gupta S.L., "Engineering Physics" Dhanpat Rai Publishers, 2010.
4. Baldev Raj.,Jayakumar T., Thavasimuthu M.,"Practical Non-Destructive testing", Narosa Publishing House, 2009.
5. Brijlal & Subrahmanyam., "Heat and Thermodynamics" S.Chand & Company Ltd, 2002.
6. Paul E Mix.," Introduction to Non-destructive testing: a training guide", Wiley, 2nd Edition, New Jersey, 2005.
7. Charles J., Hellier.," Handbook of Nondestructive evaluation", McGraw Hill, New York, 2001.

OUTCOMES:

Upon completion of this course, the students will be able to

- understand the basic of concept of elasticity of materials.
- comprehend the basic concepts of motion of rigid bodies and its applications.
- demonstrate the various NDT techniques and its importance.
- know the low temperature systems and its applications.

PHCX 09	SEMICONDUCTOR PHYSICS AND OPTOELECTRONICS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To understand the Physics of Semiconductor devices.
- To make the students learn the fundamentals of Photoluminous - semiconductors, Optoelectronic devices, Optical modulators/detectors.
- To make them understand the technology behind latest Display devices like LCD, Plasma and LED Panels.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I PHYSICS OF SEMICONDUCTORS **8**

Elemental and compound semiconductors – Drift and diffusion current - Intrinsic semiconductors – Carrier concentration (derivation) – Fermi energy – Variation of Fermi energy level with temperature – Mobility and electrical conductivity – Band gap determination – Extrinsic semiconductors – Carrier concentration in n-type and p-type semiconductor (derivation) – Variation of Fermi level with temperature and impurity concentration – Variation of Electrical conductivity with temperature – Hall effect – Experiment and applications of Hall effect.

MODULE II OPTOELECTRONIC DEVICES **7**

Light Emitting Diodes (LED) – power and efficiency - double hetero LED - LED structure - LED characteristics - White LED – Applications. Liquid crystal displays – Dynamic scattering and Twisted nematic display, Semiconductor Lasers, Homojunction and Heterojunction laser diodes - Optical processes in semiconductor lasers.

MODULE III OPTICAL MODULATORS **7**

Modulation of light – birefringence –Modulation Techniques - Electro optic effect – Electro optic materials –Types of Electro optic Modulators : Kerr and Pockel modulators –- Magneto optic effect - Magneto optic Modulators – Acousto Optic modulators.

MODULE IV OPTICAL DETECTORS **8**

Photo detectors - photodiodes - phototransistors - noise characteristics - PIN diode – Avalanche Photodiode (APD) characteristics - APD design of detector arrays – Charged Couple Device - Solar cells - Materials and design considerations, Thin film

solar cells, amorphous silicon solar cells.

PRACTICALS

1. Resistivity measurement of a semiconductor using four point probe method.
2. Determination of band gap of a semiconductor diode.
3. Determination of Hall coefficient of a given semiconductor material.
4. Determination of the wavelength of a given laser source using diffraction grating.
5. Determination of Planck's constant using LED.
6. To study the I-V characteristics of photodiode and phototransistor.
7. To study the characteristics of a solar cell.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Arumugam. M, "Physics II", Anuradha Publishers, 5th Edition, 2005.
2. Sze. S.M., "Semiconductor Devices – Physics and Technology", 2nd edn. John Wiley, 2002.
3. Wilson & J.F.B. Hawkes, "Optoelectronics – An Introduction", Prentice Hall, India, 1996.
4. Bhattacharya, "Semiconductor optoelectronic devices", Second Edn, Pearson Education, 2002.
5. Safa O. Kasap, "Optoelectronics & Photonics:Principles & Practices", Second Edn, Pearson Education,2013.
6. Palanisamy P.K., "Semiconductor physics and optoelectronics" Scitech Publications, 2003.

OUTCOMES:

On completion of this course, the student will be able to

- understand the principles of Physics behind semiconductor devices.
- choose the correct semiconductors for electronic devices and display.
- differentiate the working principle of LED and Diode Laser.
- apply the knowledge of modulation of light for different types of optical modulators.
- select suitable photodetectors for different types of applications.
- complement the knowledge acquired in the theory class and correlate the results for applications.

Chemistry Elective Courses
(To be offered II Semester)

CHCX01	ANALYTICAL INSTRUMENTATION	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make the student conversant with

- principles, instrumentation and applications of different electroanalytical techniques
- different chromatographic techniques
- principles, instrumentation and applications of various types of absorption and emission spectroscopy
- different thermal analytical methods and their applications

MODULE I ELECTROANALYTICAL TECHNIQUES **7**

Principle and applications: conductometric titrations – potentiometrIc titrations, ion-selective electrodes and pH-metry – coulometry – voltammetry - polarography, amperometric titrations.

MODULE II CHROMATOGRAPHY **8**

Basic concepts of chromatography – paper chromatography – column chromatography – thin layer chromatography – gas chromatography – high performance liquid chromatography – gel permeation chromatography.

MODULE III SPECTROSCOPY **8**

Absorption spectroscopy (principle, instrumentation and applications): Colorimetric analysis – UV-Visible spectroscopy – FTIR spectroscopy - Emission Spectroscopy (principle, instrumentation and applications): fluorescence, phosphorescence and chemiluminescence – Atomic absorption spectroscopy – flame emission spectroscopy.

MODULE IV THERMAL ANALYSIS **7**

Principle, instrumentation and applications: Thermo gravimetric analysis – Differential thermal analysis – Differential scanning calorimetry

PRACTICALS

1. Conductometric titrations: acid-base and precipitation titrations

2. Potentiometric titrations
3. Determination of pH of the unknown solution
4. Estimation of alkali metals using flame emission spectroscopy
5. Estimation of metal ions of coloured solutions using colorimetric analysis
6. Separation of compounds using gas chromatography
7. Separation of compounds using high performance liquid chromatography
8. Analysis of the given sample and interpretation of the data using IR, UV-Visible spectroscopy
9. Demonstration of TGA/DTA and DSC and interpretation of data.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Skoog D.A., West D.M., Holler F.J. and Crouch S.R., Fundamentals of Analytical Chemistry, 8th Edition, Thomson Brooks/Cole Publication., Singapore, 2004.
2. Willard H.H., Merritt L.L., Dean J.A. and Settle F.A., Instrumental Methods of Analysis, 7th Edition, CBS Publication, New Delhi Reprint, 2004.
3. A.I. Vogel, Vogel's Textbook of Practical Organic Chemistry, 5th Edition, Prentice Hall, London, 2008.
4. Christian G.D., Analytical Chemistry, 6th Edition, John Wiley, Singapore, 2003.
5. Fifield F.W. and Kealey D., Principles and Practice of Analytical Chemistry, 5th Edition, Blackwell Publication, London, 2000.
6. Settle F. (Editor), Handbook of Instrumental Techniques for Analytical Chemistry, Pearson Education, Singapore, 2004.

OUTCOMES:

The student will be able to

- state the principle and applications of various electro-analytical techniques
- identify the right separation method for a given sample using different chromatographic techniques
- explain the principle, instrumentation & applications of various spectroscopic methods and also to interpret the data
- elaborate the principle, instrumentation and applications of various thermal analytical techniques and interpret the data.

CHCX02	CORROSION AND ITS CONTROL	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students should be conversant with the

- Basic concepts, principles and factors affecting corrosion
- Types and mechanism of corrosion
- Control measures of corrosion by material selection, proper design and by applying organic coatings
- Control of corrosion by applying inorganic coating

MODULE I BASIC CONCEPTS OF CORROSION 8

Corrosion – causes and impacts of corrosion – mechanism of corrosion: Dry corrosion- oxidation corrosion - corrosion by other gases – Pilling-Bedworth rule- Corrosion by hydrogen: hydrogen blistering, hydrogen embritttlement, decarburization and hydrogen attack – corrosion of silver and copper by sulphur compounds – liquid metal corrosion (embritttlement or cracking) – Wet corrosion : hydrogen evolution – presence and absence of oxygen and absorption of oxygen – difference between dry and wet corrosion-factors influencing corrosion-polarization-passivity-emf series and galvanic series- corrosion current -rate of corrosion.

MODULE II FORMS OF CORROSION 7

Forms of corrosion-conditions for electrochemical corrosion –galvanic corrosion – differential aeration corrosion: pitting, water line, wire fencing, crevice and filiform corrosion – stress corrosion – Intergranular corrosion- erosion corrosion – soil corrosion – microbiological corrosion- fretting corrosion- corrosion in composites.

MODULE III CORROSION CONTROL AND ORGANIC COATINGS 8

Corrosion control – selection of materials and designing- cathodic protection – sacrificial anode and impressed current cathodic protection – corrosion inhibitors: anodic, cathodic and vapour phase inhibitors.

Organic protective coatings – paints: constituents – functions – varnishes : types-constituents – functions – lacquers : constituents – functions –enamels-constituents – functions – special paints : fire retardant, water repellant, heat resistant, temperature indicating and luminous paints.

MODULE IV INORGANIC COATINGS 7

Treatment of metal surface-inorganic coatings- classification- metallic coatings : anodic and cathodic coatings-hot dipping : galvanizing and tinning- electroplating—electroless plating – cementation (diffusion) : sherardizing, calorizing and chromizing – metal cladding-metal spraying – non metallic coatings (chemical conversion coatings) : phosphate, chromate, oxide coatings and anodizing – comparison of anodic and cathodic protection.

PRACTICALS

1. Determination and comparison of rate of corrosion of metals in the presence of acid, base and neutral medium by weight loss method.
2. Determination of rate of corrosion of iron in the presence of various acids by weight loss method.
3. Determination of rate of corrosion of iron in the presence and absence of anodic Inhibitor by weight loss method.
4. Determination of rate of corrosion of iron in the presence and absence of cathodic Inhibitor by weight loss method.
5. Electroplating of base metal with copper.
6. Electrolessplating of base metal with copper
7. Chemical conversion coatings such as chromate and phosphate coatings.
8. Demonstration on the study of rate of corrosion by using cyclic voltametry.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. P.C Jain & Monica Jain, Engineering Chemistry Dhanpatrai Publishing Company (P) Ltd., New Delhi (2013).
2. S S Umare & S S Dara, A text Book of Engineering Chemistry, S. Chand& Company Ltd, New Delhi, 2014.
3. M.G. Fontana and N.G. Green, Corrosion Engineering, McGraw Hill Book Company, NewYork, 1984.
4. S. Banerjee, A.K. Tyagi, Functional Materials- Preparation, Processing and Applications, ELSEVIER Publications, London ; Waltham, MA : 2011

OUTCOMES:

Students will be able to

- explain the mechanism, compare and enumerate the factors affecting

corrosion

- describe and identify the place and types for a given situation.
- choose and elaborate the suitable organic coating method for a given real time situation.
- apply a suitable metallic coating for a given situation

CHCX03	ELECTRICAL MATERIALS AND BATTERIES	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students should be conversant with

- preparation, properties and applications of plastics used in electrical and electronic applications
- properties and uses of electrical engineering materials
- classification and description of different types of batteries.
- classification and types of fuel cells

MODULE I POLYMERS FOR ELECTRICAL AND ELECTRONIC APPLICATIONS **8**

Preparation, properties and applications **:** polyethylene, polypropylene, EPDM, Nylon-6,6, PVC, PTFE, polycarbonates, ABS, phenol formaldehyde, urea formaldehyde, epoxy resins – polymer blends and alloys.

MODULE II ELECTRICAL ENGINEERING MATERIALS **7**

Conductors: Silver, Copper, Gold, Aluminum – Semiconductors: Germanium, Silicon, Gallium Arsenic – Insulating Materials: Rubbers, Mica, Plastics, Ceramics, Insulating papers – Magnetic Materials: ferromagnetic materials, paramagnetic materials, diamagnetic materials, antiferromagnetic materials, ferrites

MODULE III BATTERIES **7**

Electrochemical and electrolytic cell – batteries: types (primary, secondary and flow cell) – primary batteries: dry cells, alkaline batteries – secondary batteries: nickel-cadmium cell – lead acid storage cell, lithium battery: primary and secondary type – solar cell – dye sensitized solar cell.

MODULE IV FUEL CELLS **8**

Difference between batteries and fuel cells - chemistry of fuel cells - types of fuel cell (based on temperature and electrolyte) – principle, characteristic features, advantages, disadvantages and applications of polymer electrolyte membrane or proton exchange membrane fuel cell (PEMFC), direct methanol fuel cell (DMFC), alkaline fuel cell (AFC), phosphoric acid fuel cell (PAFC), molten carbonate fuel cell (MCFC) and solid oxide

fuel cells (SOFC).

PRACTICALS

1. Free radical polymerization of styrene.
2. Free radical polymerization of PMMA.
3. Preparation of phenol-formaldehyde.
4. Preparation of urea-formaldehyde.
5. Synthesis of epoxy resin.
6. Demonstration of mechanical properties of insulating materials using UTM
7. Demonstration of electrical properties of insulating materials
8. Construction of batteries using natural resources
9. Measurement of EMF for different batteries.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Jain P.C. and Renuka Jain, Engineering Chemistry, Dhanpat Rai Publication Co. (P) Ltd., New Delhi, 2013.
2. Michael L. Berins, Plastics Engineering Hand Book, 5th Edition, Chapman and Hall, New York, 1991.
3. H.F. Mark and N. Gaylord, Encyclopedia of Polymer Science and Technology, Vol. 1 to XIV Interscience, 2nd Ed. 1988.
4. Gowarikar V.R., Viswanathan N.V and Jayadev Sreedhar, Polymer Science, Wiley Eastern Limited, Madras, 1981.
5. R.K. Rajput,A Textbook of Electrical Engineering Materials, Firewall Media, 2004
6. Vladimir S. Bagotsky, Fuel Cells: Problems and Solutions, 2nd Edition, John Wiley and Sons, 2012.
7. B. Viswanathan and M. Aulice Scibioh, Fuel Cells: Principles and Applications, Taylor and Francis Group, 2007.

OUTCOMES:

The student will be able to

- summarise the preparation, properties and applications of plastics used in electrical and electronic applications
- enumerate the properties and uses of electrical engineering materials
- illustrate various types of batteries with the aid of a diagram
- classify the fuel cells and elaborate the different types of fuel cells.

CHCX04	ENGINEERING MATERIALS	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students should be conversant with

- properties and uses of different types of refractories and abrasives
- adhesives, cements and lime, setting of cements and their chemical behaviors.
- types, properties and uses of lubricants.
- various types of composite materials.

MODULE I REFRACTORIES AND ABRASIVES **8**

Introduction refractory: -classification - based on chemical nature- characteristic and selection of good refractory - general manufacture of refractory- preparation properties and uses of: silica refractory - magnesite refractory - zirconia refractory, properties of refractories: refractoriness - refractoriness under load - thermal spalling - porosity and dimensional stability, Cermets - super refractory.

Abrasives : introduction - Moh's scale - natural abrasives: diamond – corundum – emery - garnet and quartz, synthetic abrasives: preparation properties and uses: carborundum (silicon carbide)– alundum - boron (norbide) carbide

MODULE II ADHESIVES AND BINDING MATERIALS **7**

Introduction - classification of adhesives –advantage –limitation of adhesive bonding – development of adhesive- factors influencing adhesive action: chemical and physical, application techniques of adhesive – Lime: classification – manufacture - setting and hardening, Gypsum: -Manufacture and properties and uses - Cement : chemical composition- Manufacture – setting and hardening – concrete – weathering of cement and concrete and its prevention- special cements: high alumina cement - sorel cement - white portland cement – water proof cement.

MODULE III LUBRICANTS **7**

Introduction –functions of lubricant- mechanism of lubrication - classification of lubricant – liquid lubricant: vegetable and animal oils – mineral oils, semisolid: grease(calcium, lithium, aluminium) – petroleum jelly, solid lubricant: graphite - molybdenum disulphide, Properties of lubricant: viscosity - viscosity index - flash point and fire point - cloud point and pour point – oiliness - aniline point - carbon residue.

MODULE IV COMPOSITE MATERIALS 7

Introduction – advantageous characteristics of composites, applications of composites, main constituent of composites, types and applications of composites: RCC fibre-reinforced plastics (glass , carbon and aramid) - particulate composite - metal matrix composite - layered composites - failures in fibre-reinforced composites, ceramic matrix composites (CMC) – properties and applications.

PRACTICALS

1. Preparation of refractory bricks
2. Preparation of abrasive papers/cloth
3. Preparation of simple adhesives
4. Estimation of alkalinity in cements
5. Determination of cloud point and pour point
6. Determination of flash point and fire point
7. Preparation of fibre-reinforced composite

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. P.C Jain & Monica Jain, Engineering Chemistry Dhanpatrai Publishing Company (P) Ltd., New Delhi (2013).
2. B.Sivasnakar, “Engineering Chemistry”, Tata McGrow-Hill Publication Limited, New Delhi, second reprint 2008.
3. Engineering Chemistry, Wiley India Editorial Team, Willey India Publisher, New Delhi, 2011.
4. S S Umare & S S Dara, A text Book of Engineering Chemistry, S. Chand& Company Ltd, New Delhi, 2014.

OUTCOMES:

The student will be able to

- classify and describe the manufacture the refractories and enumerate the properties and uses of abrasive materials.
- elaborate the manufacture, properties and uses of various adhesives and binding materials.
- classify lubricants and describe the properties and uses of them
- enumerate the properties and uses of various composite materials.

CHCX05	FUELS AND COMBUSTION	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make the students conversant with the

- three types of fuels available and the different processes involved in it.
- analysis of fuel characteristics and manufacture of fuels
- calculations involved in calorific values and minimum air requirement for complete combustion.
- classification, functions, mechanism and properties of lubricants.

MODULE I SOLID FUELS **7**

Characteristics of good fuel. Solid fuel – Wood, Coal – Ranking of coal – selection of coal. Analysis of coal – Proximate analysis. Pulverized coal – Metallurgical coke – Carbonization of coal – types. Manufacture of metallurgical coke – Beehive oven and Otto Hoffman's by-product oven methods.

MODULE II LIQUID AND GASEOUS FUELS **8**

Liquid fuel: Petroleum: Refining of petroleum, Liquid fuels derived from petroleum – Cracking: Thermal (Liquid and Vapour phase) – Catalytic (fixed bed and moving bed cracking – Synthetic petrol: Fischer-Tropsch method– Knocking in petrol and diesel engine: octane number and antiknocking – cetane number and improvement of cetane number – biodiesel (trans-esterification) – Gaseous fuels: Compressed natural gas (CNG) – LPG – oil gas – producer gas – water (blue) gas – biogas.

MODULE III COMBUSTION **8**

Calorific value: Gross and net caloric value – Bomb Calorimeter, Gas calorimeter - Definition of combustion – calculation of minimum requirement of air (problems) – theoretical calculation of calorific values (Dulong's formula), Gross and net calorific values ((problems) – Analysis of flue gas: Orsat's gas analysis method, explosive range, Ignition temperature. Introduction to air pollution from IC (Internal combustion) engines, photochemical smog, primary and secondary pollutants.

MODULE IV LUBRICANTS **7**

Friction and wear – lubricants: definition, functions and mechanism of lubrication

(thick film and thin film) –classification: liquid lubricants: animal and vegetable origin, mineral oil, blended oils, lubricating emulsions and silicones – properties of lubricating oils: viscosity and viscosity index; Flash and fire-point, Cloud and pour point, oiliness, emulsification number, volatility, carbon residue, aniline point – semisolid lubricant: greases and waxes – solid lubricant: graphite and molybdenum disulphide –nanolubricants.

PRACTICALS

1. Testing of fuels - proximate analysis (moisture, volatile matter, ash content and fixed carbon present in coal, coke, charcoal etc)
2. Ash content and carbon residue test
3. Biodiesel synthesis by trans-esterification method (from coconut, groundnut, mustard oil, palm oil)
4. Determination of calorific value of a solid fuel using Bomb calorimeter (coal, charcoal, coke etc)
5. Determination of calorific value of a liquid fuel using Bomb calorimeter (petrol, diesel, biodiesel etc)
6. Determination of cloud point and pour point of a lubricant
7. Determination of flash and fire point of diesel.
8. Aniline Point of diesel
9. Viscosity Index of lubricants and Fuels by Viscometer
10. Flue gas analysis by Orsat's gas analysis method – Demonstration
11. Working of internal combustion engine – Demonstration

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai and Sons, New Delhi, 2001.
2. Engineering Chemistry, Wiley India Editorial Team, Willey India Publisher, New Delhi, 2011.
3. John Griswold, Fuels Combustion and Furnaces, Mc-Graw Hill Book Company Inc. University of Michigan, 1946.
4. J.B. Heywood, Internal Combustion Engine Fundamentals, McGraw Hill International Editions, 1989.
5. Bahl B.S., Tuli and Arun Bahl, Essentials of Physical Chemistry, S. Chand and Company Ltd., New Delhi, 2004.

OUTCOMES:

The students will be able to

- compare and contrast the solid, liquid and gaseous fuels and also describe the processes involved in liquid and gaseous fuels.
- analyse the fuel properties such as moisture, votalite matter, ash content, calorific value etc
- calculate minimum air required for complete combustion and calorific values of fuels.
- categorize different lubricants into three types, explain the preparation and determine their properties.

CHCX06	FUNDAMENTALS OF PHYSICAL CHEMISTRY	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students will be conversant with the

- various thermodynamic terms and relate the laws of thermodynamics in chemical processes
- molecularity and order of reaction and derive the rate constant for different order of reactions
- basics of adsorption of different materials and propose mechanisms and surface area measurement
- conditions for equilibrium and learn different components at equilibrium

MODULE I BASIC THERMODYNAMICS **8**

Introduction - Thermodynamic terms - Thermodynamic equilibrium and processes - 1st law of thermodynamics: internal energy, enthalpy, heat capacity, isothermal and adiabatic expansion, Joule-Thomson effect - Zeroth law of thermodynamics: absolute temperature - 2nd law of thermodynamics: - spontaneous and cyclic process, Entropy in isothermal, isobaric and isochoric processes, work and free energy function, Maxwell's relation - 3rd law of thermodynamics

MODULE II CHEMICAL KINETICS **8**

Rate of chemical reaction - order and molecularity of a reaction - Rate constant - kinetics of opposing, parallel and consecutive and chain reactions - isotope effects - effect of temperature on reaction rate - collision theory - absolute reaction rate theory - kinetics in enzyme catalysis

MODULE III SURFACE SCIENCE AND CATALYSIS **8**

Adsorption - adsorption isotherms - uni and bimolecular adsorption reactions - parahydrogen conversion - factors affecting adsorption – Langmuir adsorption isotherm - Hinshelwood mechanism and *Eley-Rideal* mechanism with example - adsorption of gases on solids and surface area measurement by BET method - Terms in catalysis - homogeneous and heterogeneous and enzyme catalysis with example

MODULE IV PHASE RULE **6**

Terms involved - Conditions for equilibrium - application of phase rule to water, lead-

silver system, freezing mixtures, thermal analysis: cooling curves.

PRACTICALS

1. Determination of the heat capacity of benzoic acid, internal energy of combustion of camphor using Bomb calorimeter. Calculation of enthalpy of combustion and formation for camphor.
2. Determination of adsorption isotherm of (i) acetic acid on charcoal (ii) oxalic acid on charcoal.
3. *Kineticsoffirst and second order reactions.*
4. Phase rule experiments with organic compounds: (i) naphthalene and p-dichloro benzene (ii) naphthalene and diphenyl (iii) m-dinitrobenzenzene and p-nitro toluene.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Rajaram J. and Kuriacose J.C., Chemical Thermodynamics: Classical, Statistical and Irreversible, Pearson Education, India, 2013.
2. Samuel Glasstone, Thermodynamics for Chemists, Read Books, United Kingdom, 2007.
3. James E. House, Principles of Chemical Kinetics, 2nd Edition, Academic Press, United States of America, 2007.
4. Keith J. Laidler, Chemical Kinetics, Pearson Education, India, 1987.
5. Douglas M. Ruthven, Principles of Adsorption and Adsorption Processes, John Wiley & Sons, 1984.
6. Puri B.R., Sharma L.R. and Pathania M.S., Principles of Physical Chemistry, 47th Edition, Vishal Publishing Co. India, 2016.

OUTCOMES:

The student will be able to

- calculate entropy, enthalpy and free energy change for different chemical processes
- calculate the rate constant for any chemical and biochemical processes
- differentiate the adsorption processes and calculate the surface area and predict the suitability of catalysts for different chemical processes
- predict the equilibrium conditions for water, alloys, freezing mixtures and draw the thermal curves for phase transition

CHCX07	GREEN TECHNOLOGY	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make students conversant with the

- basic principles of green chemistry and green technology.
- wastes that causes hazards to human health
- chemicals that harms our environment
- need for green processes in various industries

MODULE I GREEN CHEMISTRY PROTOCOL **7**

Need – Significance – 12 Principles with examples – R4 model – Life cycle analysis – sustainable and cleaner production - Green Technology: definition, examples: CFC free refrigerants, green building, energy, 3D printers, nanotechnology – Awards for Green chemistry – organization promoting green chemistry.

MODULE II WASTE & WASTE MINIMISATION **8**

Source of wastes: domestic, industrial, medical, nuclear, e-waste; problems; prevention – economy of waste disposal – Waste minimization techniques: general waste treatment and recycling – alternate waste water treatment technologies: hybrid process – Green computing: goals, green cloud, green ICT - Pollution statistics from various industries (Industrial case studies).

MODULE III GREEN SYNTHESIS **7**

Introduction - Solvent free reactions - green reagents, green solvents in synthesis - microwave and ultrasound assisted reactions – supercritical fluid extraction – green oxidation and photochemical reactions – catalyst and biocatalysts.

MODULE IV GREEN INDUSTRIAL PROCESSES **8**

Polymer industry: biodegradable polymer - textile industry: greener approaches of dyeing, waste disposal – ecofriendly agrochemicals: biofertilizers, biopesticides – Pharmaceutical industry: atom economy, reduction of toxicity, use of biocatalyst, zero waste disposal – Leather industry: greener process in tanning, crusting, surface coating – ecofriendly batteries & fuel cells.

PRACTICALS

1. Synthesis of an ionic liquids (Ex: imidazolium) and testing the solubility of organic

chemicals.

2. Green bromination of stilbene (using pyridine hydrobromide).
3. Green synthesis: Photocatalytic reactions, solvent-free organic reaction – Aldol; green oxidation, green reduction.
4. Microwave assisted chemical reaction. (synthesis of aspirin, pinacol-pinacolone reaction, etc).
5. Comparison of conventional reaction with microwave assisted reactions (atom economy, solvent, etc) [Ex: aldehyde and ketones with hydrazines to give hydrazones].
6. Diels-Alder reaction in eucalyptus oil (green process).

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai and Sons, New Delhi. 2001.
2. V. K. Ahluwalia, Green Chemistry: Environmentally Benign Reactions, Ane Books India, New Delhi, 2006.
3. Paul Anastas, John C.Warner, John Warner Joint; Green Chemistry: Theory & Practice New Ed Edition; Oxford University press, USA, 2000.
4. Rashmi Sanghi, M. M. Srivastava, Green chemistry, Narosa publishers, New Delhi, 2003.

OUTCOMES:

The students will be able to

- outline the principles and implications of green chemistry.
- comprehend the potential risks of waste generated and analyse the threats to human and environment.
- integrate information into design of molecules to avoid/eliminate toxic solvents & reagents or reduce toxic products.
- identify various alternate greener technologies for various industries.

CHCX08	ORGANIC CHEMISTRY OF BIOMOLECULES	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make students conversant with the

- basic concepts in organic chemistry
- types and structure of carbohydrates and lipids
- formation of different structures of proteins from amino acid
- structure of nucleic acids

MODULE I BASIC CONCEPTS IN ORGANIC CHEMISTRY **8**

Classification and IUPAC nomenclature of organic compounds – stereochemistry – optical, stereo and geometrical isomerism – types of reagents: electrophiles and nucleophiles – types of reactions: addition, substitution, elimination and rearrangement reactions.

MODULE II CARBOHYDRATES, LIPIDS AND VITAMINS **7**

Structure and functions of carbohydrates: mono, di, oligo and polysaccharides – lipids: phospholipids, glycolipids, sphingolipids – cholesterol – steroids – Structure, functions and deficiency disorders of fat soluble vitamins: A, D, E & K - Water soluble vitamins B & C: Thiamine, riboflavin, pantothenic acid, niacin, pyridoxine, biotin, cobalamine, folic acid and ascorbic acid.

MODULE III AMINO ACIDS, PEPTIDES AND PROTEINS **7**

Aminoacids: classification, properties - peptides – polypeptides – proteins: primary, secondary, tertiary and quaternary structure – glycoproteins – lipoproteins – Enzymes: classification and functions

MODULE IV NUCLEIC ACIDS **8**

Nucleic acids – importance - structure of purines and pyrimidines – nucleotides – polynucleotides - RNA – types & structure - DNA – phosphodiester bonds – chemical, helical structure and functions – DNA replication – gene modification.

PRACTICALS

1. Qualitative tests to identify carbohydrates.

2. Quantitative estimation of carbohydrates.
3. Separation of sugars – TLC and/or paper chromatography.
4. Quantitative estimation of lipids.
5. Separation of amino acids – TLC and/or paper chromatography.
6. Quantitative estimation of proteins by Lowry's method.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. V. K. Ahluwalia, Organic Reaction Mechanism, Narosa Publishers, New Delhi, 2002.
2. Johnson Arthur T., Biology for Engineers, CRC Press, Finland, 2011.
3. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai and Sons, New Delhi. 2001.
4. David L. Nelson, Michael M. Cox, Lehninger Principles of biochemistry, Macmillan press, London, 2010

OUTCOMES:

The students will be able to

- classify organic compounds and explain the mechanism of various organic reactions.
- draw the structures and enumerate the functions of carbohydrate, lipids and vitamins.
- correlate the relationship among amino acids, peptides and proteins.
- recognize the role of nucleic acid in the formation of RNA & DNA and differentiate DNA & RNA using their structure and function.

CHCX09	POLYMER SCIENCE AND TECHNOLOGY	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make the student conversant with the

- basic concepts of polymers, classification, types of polymerization and molecular weight & its distribution
- preparation, properties and applications of thermoplastics and introduction to biodegradable polymers
- properties and applications of thermosets, elastomers and FRP
- different types of moulding techniques

MODULE I BASIC CONCEPTS OF POLYMERS **8**

Definitions: monomer, polymer, functionality, degree of polymerization – classification of polymers: source, structure, application, thermal processing behavior (thermoplastics and thermosets), composition and structure (addition and condensation), mechanism (chain growth and step-wise growth) – copolymer: types – Definition –nomenclature of polymers – tacticity – types of polymerization : free radical, cationic and anionic polymerization (concepts only) – average molecular weight of polymer: number, weight – molecular weight distribution (problems)

MODULE II THERMOPLASTICS AND BIODEGRADABLE POLYMERS **8**

Preparation, properties and applications : LDPE, HDPE, polypropylene, PVC, PTFE, PET, polyamides (Nylon-6 and Nylon 6,6) and polycarbonates – polymer blends and alloys – basics of biodegradable polymers.

MODULE III THERMOSET RESINS, ELASTOMERS AND FRP **7**

Thermoset resins : phenolic resins, amino resins (urea and melamine formaldehyde), epoxy resins, unsaturated polyesters – polyurethanes – elastomers : vulcanization of natural rubber, diene based elastomers –fibre reinforced plastics: glass, aramid and carbon.

MODULE IV MOULDING TECHNIQUES 7

Moulding constituents**:** functions – moulding techniques**:** compression, injection, extrusion (single screw), blow moulding, thermoforming, (mechanical and vacuum forming), lamination.

PRACTICALS

1. Determination of molecular weight and degree of polymerization using Oswald's viscometer.
2. Free radical polymerization of styrene.
3. Free radical polymerization of PMMA.
4. Preparation of phenol-formaldehyde.
5. Preparation of urea-formaldehyde.
6. Synthesis of epoxy resin.
7. Synthesis of unsaturated polyester.
8. Preparation of FRP laminates.
9. Demonstration of injection moulding, compression moulding and blow moulding.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Billmeyer F.N., Text Book of Polymer Science, 3rd Edition, John Wiley and Sons, New York, 1994.
2. George Odian, Principles of Polymerisation, 3rd Edition, McGraw Hill Book Company, New York, 1991.
3. Michael L. Berins, Plastics Engineering Hand Book, 5th Edition, Chapman and Hall, New York, 1991.
4. Jacqueline I., Kroschwitz, Concise Encyclopedia of Polymer Science and Engineering, John Wiley and Sons, New York, 1998.
5. Encyclopedia of Polymer Science and Technology, Vol. 1 to XIV, H.F. Mark and N. Gaylord, Interscience, 2nd Ed. 1988.
6. Gowarikar V.R., Viswanathan N.V and Jayadev Sreedhar, Polymer Science, Wiley Eastern Limited, Madras, 1981.

OUTCOMES:

The student will be able to

- classify various polymers, name the polymers and types of polymerization

reactions, calculate molecular weight of polymers,

- summarise preparation, properties and applications of thermoplastics and give examples of biodegradable polymers
- elaborate the properties and applications of thermosets, elastomers and FRP
- select the appropriate moulding technique for a given polymer, based on the application

Maths Elective Courses

(to be offered in IV

Semester)

MACX 01	**DISCRETE MATHEMATICS AND GRAPH THEORY**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

OBJECTIVES:

The aims of this course are to

- introduce Logical and Mathematical ability to deal with abstraction.
- familiarize the basic mathematical ideas and terminologies used in computer science.
- translate real life situations into diagrammatic representations.

MODULE I PROPOSITIONAL CALCULUS 8

Propositions – Logical connectives – Compound propositions – Conditional and biconditional propositions – Truth tables – Tautologies and contradictions – Contrapositive – Logical equivalences and implications – DeMorgan's Laws – Normal forms – Principal conjunctive and disjunctive normal forms – Rules of inference – Arguments – Validity of arguments.

MODULE II PREDICATE CALCULUS 7+3

Predicates – Statement function – Variables – Free and bound variables – Quantifiers – Universe of discourse – Logical equivalences and implications for quantified statements – Theory of inference – The rules of universal specification and generalization – Validity of arguments.

MODULE III FUNCTIONS 7+3

Functions – Classification of functions –– Composition of functions – Inverse functions – Binary and n–ary operations – Characteristic function of a set – Hashing functions – Recursive functions – Permutation functions.

MODULE IV ALGEBRAIC SYSTEMS 8+2

Groups, Cyclic Groups, Subgroups, Cosets, Lagrange's theorem, Normal subgroups – Codes and group codes – Basic notions of error correlation – Error recovery in group codes.

MODULE V GRAPH THEORY 7+3

Graphs – incidence and degree – subgraphs – isomorphism – complement of a graph – operations on graphs

MODULE VI PATH AND CIRCUIT 8+2

Walks, trails and paths – Eulerian graphs – Konigsburg bridge problem - Hamiltonian graphs

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1 Trembly J.P and Manohar R, “Discrete Mathematical Structures with Applications to Computer Science”, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, 30th Reprint 2011.

2 Kenneth H.Rosen, “Discrete Mathematics and its Applications:, 7th Edition, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, Special Indian Edition, 2011.

REFERENCES:

1 Ralph.P.Grimaldi, “Discrete and Combinatorial Mathematics: An Introduction”, 4th Edition, Pearson Education Asia, Delhi, 2007.

2 Thomas Koshy, “Discrete Mathematics with Applications”, Elsevier Publications, 2006.

3 C.L.Liu, D.P.Mohapatra, “Elements of Discrete Mathematics”, 4th Edition, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, 2012.

OUTCOMES:

At the end of the course, student will be able to

- use the concepts of propositional calculus.
- use the concepts of predicate calculus.
- identify types of functions and their importance.
- decode and encode the messages using group theory concepts.
- apply the basic concepts of graph theory.
- represent some real life situations into diagrammatic representation.

MACX 02 PROBABLITY AND STATISTICS L T P C
3 1 0 4

OBJECTIVES:

The aims of this course are to impart the

- knowledge of the theory of probability and random variables
- techniques to carry out probability calculations and identifying probability distributions
- application of statistical inference in practical data analysis

MODULE I BASICS OF PROBABILITY AND STATISTICS 8+2

Sample space, events- axioms of probability and interpretation – Addition, multiplication rules – conditional probability, Independent events - Total probability – Baye's theorem - Descriptive Statistics.

MODULE II ONE DIMENSIONAL RANDOM VARIABLE AND PROBABILITY DISTRIBUTION FUNCTIONS 7+3

Discrete random variable –continuous random variable – Expectation - probability distribution - Moment generating function – Binomial, Poisson, Geometric, Uniform (continuous), Exponential and Normal distributions.

MODULE III TWO DIMENSIONAL RANDOM VARIABLES 8+2

Joint, marginal, conditional probability distributions –covariance, correlation - transformation of random variables.

MODULE IV SAMPLING AND ESTIMATION 7+3

Sampling distributions – basic knowledge on Random , simple random , stratified and cluster samplings – Test of Hypotheses - concepts- Point estimation and Interval estimation.

MODULE V THEORY OF INFERENCE 8+2

Large sample tests – test for single and difference on proportions, single mean, difference of means, difference of variances – confidence intervals. Small sample tests – Student's t test, F test and Chi square test on theory of goodness of fit and analyses of independence of attributes.

MODULE VI DESIGN OF EXPERIMENTS 7+3

Analysis of variance – one way classification – two way classification – Completely

Randomised Block Designs – Randomised Block Design – Latin square designs - Interpretations - case studies.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. T.Veerarajan, “Probability and Statistics”, Tata McGraw-Hill Education, 2008.
2. Miller, I., Miller, M.,Freund, J. E., “Mathematical statistics”, 7th Edition, Prentice Hall International, 1999.
3. S.P.Gupta, “Applied Statistics”, Sultan Chand & Sons

REFERENCES:

1. S.M.Ross, “Introduction to Probability and Statistics for Engineers and Scientists” Fifth Edition, Elesvier.
2. S.C.Gupta and V.K.Kapoor, “Fundamentals of Mathematical Statistics” First edition, Sultan Chand and Sons.
3. Arora and Arora, “Comphrensive Statistical Methods”, S. Chand, 2007

OUTCOMES:

On completion of the course, students will be able to

- do basic problems on probability and descriptive statistics.
- derive the probability mass / density function of a random variable.
- calculate probabilities and derive the marginal and conditional distributions of bivariate random variables.
- calculate point and interval estimates.
- apply some large sample tests and small sample tests.
- carry out the data collection representation analysis and implications and the importance of inferences.

MACX 03	RANDOM PROCESSES	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aims of the course are to

- acquire the knowledge of the theory of probability and random variables
- study discrete and continuous probability distributions.
- demonstrate the techniques of two dimensional random variables and its distributions.
- introduce the random process, stationarity, Markov process and the study of correlation function and spectral analysis.

MODULE I Basics of Probability 7+3

Sample space, events- axioms of probability and interpretation – Addition, multiplication rules – conditional probability, Independent events - Total probability – Baye's theorem - Tchebychev's inequality.

MODULE II One dimensional Random variable and Probability Distribution functions 7+3

Discrete random variable –continuous random variable – Expectation - probability distribution - Moment generating function – Binomial, Poisson, Geometric, Uniform (continuous), Exponential and Normal distributions.

MODULE III Two dimensional random variables 7+3

Joint, marginal, conditional probability distributions - covariance, correlation and regression lines - transformation of random variables.

MODULE IV RANDOM PROCESSES 8+2

Classification of Random process - Stationary process - WSS and SSS processes - Poisson process – Markov Chain and transition probabilities.

MODULE V CORRELATION FUNCTIONS 8+2

Autocorrelation function and its properties - Cross Correlation function and its properties - Linear system with random inputs – Ergodicity.

MODULE VI SPECTRAL DENSITY 8+2

Power spectral Density Function - Properties - System in the form of convolution - Unit Impulse Response of the System – Weiner-Khinchine Theorem - Cross Power

Density Spectrum.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Veerarajan T., “Probability, Statistics and Random Processes”, Tata McGraw Hill,3rd edition, 2008.
2. Papoulis, “Probability, Random Variables and Stochastic Processes”, 4th Edition, Tata McGraw Hill Company, 2002.
3. S.M.Ross, “Introduction to Probability and Statistics for Engineers and Scientists” Fifth Edition, Elesvier

REFERENCES:

1. Scott L. Miller,Donald G. Childers, Probability and Random Processes, Academic Press,2009.
2. Trivedi K S, “ Probability and Statistics with reliability, Queueing and Computer Science Applications”,Prentice Hall of India,New Delhi,2nd revised edition, 2002

OUTCOMES:

On completion of the course, students will be able to

- do basic problems on probability.
- derive the probability mass / density function of a random variable.
- calculate probabilities and derive the marginal and conditional distributions of bivariate random variables.
- identify and study the different random processes.
- compute correlation functions and related identities.
- compute power spectral density functions and apply Weiner-Khinchine formula.

MACX 04 APPLIED NUMERICAL METHODS L T P C
3 1 0 4

OBJECTIVES:

The aims of the course are to

- introduce basic computational methods for analyzing problems that arise in engineering and physical sciences.
- acquire knowledge about approximation theory and convergence analysis associated with numerical computation.

MODULE I NUMERICAL SOLUTIONS OF EQUATIONS 7+3

Bisection method - Regula Falsi method – Secant method - Fixed point iteration method - Newton's Raphson method –Gauss Elimination method - Gauss-Jordon method – Gauss Jacobi method - Gauss-Seidel method.

MODULE II INTERPOLATION 8+2

Finite difference operators – Gregory Newton's forward and backward interpolations – Cubic spline interpolation - Lagrange interpolation - Newton's divided difference formula.

MODULE III NUMERICAL DIFFERENTIATION AND INTEGRATION 8+2

Numerical differentiation using Newton's forward and backward formulae – Numerical integration : Trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Gaussian Two Point and Three Point Quadrature formulae – Double integrals using Trapezoidal and Simpson's 1/3 rule.

MODULE IV INITIAL VALUE PROBLEMS FOR FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS 7+3

Numerical solutions by Taylor's Series method, Euler's method, Modified Euler's Method - Runge – Kutta Method of fourth order – Milne's and Adam's Bashforth Predictor and Corrector methods

MODULE V INITIAL AND BOUNDARY VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 8+2

Numerical solutions by Taylor's Series method - Runge – Kutta Method of fourth order of second order ODE. Finite difference methods.

MODULE VI BOUNDARY VALUE PROBLEMS FOR PARTIAL 7+3

DIFFERENTIAL EQUATIONS

Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace equation.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Grewal, B.S., “Numerical methods in Engineering and Science”, 7th edition, Khanna
   Publishers, 2007.
2. C.F.Gerald, P.O.Wheatley, “Applied Numerical Analysis” ,Pearson Education, New Delhi, 2002.

REFERENCES:

1. Chapra S.C, Canale R.P. “Numerical Methods for Engineers”, 5th Ed., McGraw Hill, 2006.
2. M.K.Jain, S.R.K.Iyengar, R.K.Jain, “Numerical methods for Scientific and Engineering Computation”, New Age International Publishers, New Delhi, 2003

OUTCOMES:

At the end of this course, students will be able to

- solve algebraic, transcendental and system of equations.
- apply interpolation techniques.
- carry out numerical differentiation and integration using different methods.
- solve first order ODE using single and multi step methods.
- solve second order ODE, initial and boundary value problems.
- solve the boundary value problems in PDE.

Maths Elective Courses
(To be offered in VI Semester)

MACX 05	MATHEMATICAL PROGRAMMING	L	T	P	C
		2	0	0	2

OBJECTIVES:

The aims of the course are to

- acquire knowledge and training in optimization techniques.
- obtain knowledge about optimization in utilization of resources.
- understand and apply operations research techniques to industrial operations.

MODULE I LINEAR PROGRAMMING PROBLEM 10

Linear programming – formulation of the problem - graphical interpretation of optimality - Simplex method – to obtain basic feasible solution – types of linear programming solution – complications and their resolution.

MODULE II ADVANCED LINEAR PROGRAMMING PROBLEMS 8

Artificial variable - Big M method – Two phase method – alternative optimal solution – unbounded solution - Duality – primal dual relationships.

MODULE III TRANSPORTATION PROBLEM 7

Transportation problems – Initial basic feasible solutions, MODI method, Unbalanced transportation problem, Degeneracy in transportation models,.

MODULE IV ASSIGNMENT PROBLEM 5

Assignment problem – Minimization and Maximization type of problems by Hungarian method.

Total Hours –30

TEXT BOOKS:

1. Hamdy A Taha, “Operations Research - An introduction”, 8th edition, Phil Pearson, 2007.
2. Winston.W.L., “Operations Research”, 4th edition, Thompson-Brooks/Cole, 2003.

REFERENCES:

1. Wayne.L. Winston, “Operations Research Applications and Algorithms”,

4th edition, Thomson learning, 2007.

2. Frederick. S. Hiller and Gerald J Lieberman, “Operations Research Concepts and Cases”, 8th edition (SIE), Tata McGraw – Hill Pub. Co. Ltd., New Delhi, 2006.
3. A. Ravindran, D. T. Phillips and J. J. Solberg, "Operations Research: Principles and Practice", 2nd edition, John Wiley & Sons, New York, 1992.
4. Robertazzi. T.G., “Computer networks and systems-Queuing theory and performance evaluation”, 3rd edition, Springer, 2002.

OUTCOMES:

At the end of the course, students will be able to

- formulate industrial problems as mathematical programming problems.
- solve linear programming problems by different methods.
- solve transportation problems by different methods.
- solve assignment problems by Hungarian method.

MACX 06	STATISTICAL METHODS FOR DATA ANALYSIS	L	T	P	C
		2	0	0	2

OBJECTIVES:

The aim of the course is to

- introduce statistical quality control tools.

MODULE I TESTS OF HYPOTHESES AND STATISTICAL INFERENCES 8

Small sample tests – Student's ' t ' test for single mean , difference of means, paired t test – F test for difference of variances – Chi square test on theory of goodness of fit and analyses of independence of attributes.

MODULE II DESIGN OF EXPERIMENTS 7

Analysis of variance – one way classification – two way classification – Completely Randomised Block Designs – Randomised Block Design – Latin square designs - Statistical analysis -Interpretations - case studies.

MODULE III STATISTICAL QUALITY CONTROL-I 8

Quality improvement and statistics –Statistical quality control- statistical process control – control charts – design of control charts –analysis of patterns on control charts - X bar chart, R chart and S chart.

MODULE IV STATISTICAL QUALITY CONTROL-II 7

Process and product control – attribute charts – P, np and C charts – control charts performance.

Total Hours –30

TEXT BOOKS:

1. Douglas C.Montgomery, George C. Runger "Applied Statistics and probability for Engineers" V Edition – John Wiley & Sons Inc.
2. Miller, I., Miller, M., Freund, J. E. "Mathematical statistics" 7th Edition. Prentice Hall International, 1999.

REFERENCES:

1. Dekking, F.M., Kraaikamp, C., Lopuhaä, H.P., Meester, L.E. "A Modern Introduction to Probability and Statistics" Springer, 2nd Edition.
2. Chin Long chiang "Statistical Methods of Analysis "World Scientific Books,

2003.

3. S.C.Gupta and V.K. Kapoor, “Mathematical Statistics” , Sultan Chand publications.
4. Veerarajan “Fundamentals of Mathematical Statistics” I Edition, Yes Dee Publishing Pvt. Ltd., 2017.

OUTCOMES:

On completion of the course, students will be able to

- develop and test hypothesis for different statistical tests
- design an experiment and case study the experiment with different data.
- analyze the industrial data using quality control design tools statistically.
- analyze the industrial data using process and product control tools statistically.

MACX 07	NUMERICAL METHODS FOR INTEGRATION AND DIFFERENTIAL EQUATIONS	L	T	P	C
		2	0	0	2

OBJECTIVES:

- This course aims to solve numerically integral and differential equations.

MODULE I NUMERICAL INTEGRATION 8

Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Two Point and Three point Gaussian quadrature formulae.

MODULE II NUMERICAL DOUBLE INTEGRATION 6

Double integrals using trapezoidal and Simpson's 1/3 rules

MODULE III NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS 8

Milne's Predictor and Corrector Method – Adam's Predictor-Corrector Method - Finite difference methods for two – point Boundary Value problems for Ordinary Differential Equations.

MODULE IV BOUNDARY VALUE PROBLEMS FOR PARTIAL DIFFERENTIAL EQUATIONS 8

Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace and Poisson equations

Total Hours –30

TEXT BOOKS:

1. M.K.Jain, S.R.K.Iyengar, R.K.Jain, "Numerical methods for Scientific and Engineering Computation", New Age International Publishers, New Delhi, 2003.
2. Grewal, B.S., "Numerical methods in Engineering and Science" 7th edition, Khanna Publishers, 2007

REFERENCES:

1. C.F.Gerald, P.O.Wheatley, "Applied Numerical Analysis" Pearson Education, New Delhi 2002.
2. P.Dechaumphai, N. Wansophark, "Numerical Methods in Engineering", Narosa Publications, 2012.

OUTCOMES:

At the end of the course students will be able to

- solve the integration by numerical methods.
- solve the double integration by numerical methods
- find numerical solution of ordinary differential equations in engineering problems.
- find numerical solution of partial differential equations in engineering problems.

MACX 08 MATHEMATICAL MODELLING L T P C

3 0 0 3

OBJECTIVES:

The aims of the course are to

- provide basic idea of formation and use of Mathematical models for different purposes.
- determine the extent to which models are able to replicate real-world phenomena under different conditions

MODULE I PRINCIPLES OF MATHEMATICAL MODELING 7

Mathematics as a modelling language - Classification of models - Building, studying, testing and using models - Black and white box models – Difference equations

MODULE II PHENOMENOLOGICAL MODELS 7

Linear, Multiple linear and nonlinear regression - Neural networks - Fuzzy model - Stability and higher dimensional systems

MODULE III MECHANISTIC MODELS –I 8

Setting up ODE models – Initial and Boundary value problems - Numerical solutions - Fitting ODE to data - Applications

MODULE IV MECHANISTIC MODELS –II 8

Linear and nonlinear equations - Elliptic, parabolic and hyperbolic equations - Closed form solutions - Finite difference and finite element methods

Total Hours –30

TEXT BOOKS:

1. G . Ledder , “Calculus, modelling , probability and dynamic systems”, Springer 2013
2. Kei Velten, “Mathematical modelling and simulation”, J. Wiley and sons,2009

REFERENCES:

1. Michael D Alder, “An introduction to Mathematical modelling”, Heaven for Books.com
2. Alfio Quarteroni, “Mathematical models in science and engineering”, Notices of AMS
3. J.N. Kapur, “Mathematical models in Biology and Medicine”, Affiliated East-West Press Private Limited, New Delhi, 1992.

OUTCOMES:

On completion of the course, the students will be able to

- identify the relationship between real world and mathematical models
- Classify the data and choose the appropriate model
- Distinguish between linear and nonlinear models
- identify the relationship between empirical and mechanistic models

MACX 09 **GRAPH THEORY** **L T P C**

3 0 0 3

OBJECTIVES:

The aims of this course are to

- represent the real life situations diagrammatically.
- appraise different methods to find solutions to graph theory problems.

MODULE I INTRODUCTION TO GRAPH THEORY 8

Graphs - finite and infinite graphs - Incident and degree-isolated vertex, pendent vertex and null vertex.

MODULE II PATH AND CIRCUIT 8

Isomorphism – sub graphs-walks, paths and circuits – connected and disconnected graphs- Euler graphs – operation on a graph.

MODULE III TREES AND FUNDAMENTAL CIRCUITS 7

Trees- some properties of trees- pendent vertices in a tree – rooted binary tree-spanning trees-fundamental circuits.

MODULE IV CUT SETS AND CUT VERTICES

Cut sets – some properties of cut sets- fundamental circuits and cut sets-network flows.

Total Hours –30

TEXT BOOKS:

1. NARSINGH DEO, Graph theory with applications to Engineering and Computer Science, Prentice Hall INC, New Delhi,
2. J.A. Pondy and U.S.R. Murthy, North Holland, Oxford, New York Graph theory with applications

REFERENCES:

1. Trembly J.P and Manohar R, “Discrete Mathematical Structures with Applications to Computer Science”, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, 30th Reprint 2011
2. Kenneth H.Rosen, “Discrete Mathematics and its Applications”, 7th Edition, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, Special Indian Edition, 2011
3. Md. Saidur Rahman, “Basic graph theory”, Springer, 2017

OUTCOMES:

At the end of the course, students will be able to

- demonstrate the basic concepts of Graph theory.
- explore connected and disconnected graphs.
- identify the real life problems with trees and circuits.
- bring out the cut set properties and network flows properties.

Humanities Elective I

(To be offered in III Semester)

SSCXO1	FUNDAMENTALS OF ECONOMICS	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To identify and present the basic concepts of demand, supply and equilibrium.
- To explain and discuss the types and concepts of national income and inflation.
- To illustrate the fundamental concepts of money, banking and public finance.
- To apprise the students about Indian economy and the role of engineers in economic development.

MODULE I DEMAND AND SUPPLY ANALYSIS 8

Classification of economy – open and closed economy, Demand - Types of demand - Determinants of demand – Law of Demand - Demand elasticity - Supply - Determinants of Supply – Law of Supply - Supply elasticity - Pricing strategies.

MODULE II NATIONAL INCOME AND INFLATION 7

Concepts of National income and measurement – Importance and difficulties of estimating National Income in India - Aggregate demand and aggregate supply, Macroeconomic equilibrium – meaning of inflation- types - causes and preventive measures

MODULE III MONEY, BANKING AND PUBLIC FINANCE 9

Money – Meaning, types, functions, importance - Commercial Banks - Central Bank - Monetary policy – meaning, objectives, Methods of Credit Control By RBI, Government Budget – Government revenue and Expenditures – Fiscal policy - Its objectives, instruments and limitations - Deficit Financing - The Fiscal Responsibility and Budget Management Act, 2003 (FRBMA) .

MODULE IV INDIAN ECONOMY AND THE ROLE OF ENGINEERS 6

Economic reforms – Liberalization, Privatization and Globalization - challenges and opportunities, Engineers – Engineers' contributions to the economic growth.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Dutt and Sundharam (2013), *Indian Economy*, S. Chand & Company Pvt. Ltd, New Delhi.
2. Hussain, Moon Moon (2015), *Economics for Engineers*, Himalaya Publishing House, New Delhi.

REFERENCES:

1. Cleaver Tony (2004), "*Economics: The Basics*", Routledge, London.
2. Mell Andrew and Walker Oliver (2014), "*The Rough Guide to Economics*", Rough Guide Ltd.

OUTCOMES:

On successful completion of this course,

- Students will have had exposure to the basic concepts of demand, supply and various pricing strategies.
- Students will have understood the macroeconomic concepts of national income and inflation.
- Students will be able to apply the knowledge of money, banking and public finance in their real life situations.
- Students will have an overview of the economic reforms introduced in Indian economy.

SSCXO2	PRINCIPLES OF SOCIOLOGY.	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To acquaint the students with Concepts and perspectives of Sociology
- To explain the reflection of society in Individuals and vice versa
- To describe the hierarchical arrangement of individuals and groups in society
- To explicate the dimensions, forms and factors of Social change.
- To examine the context, impact and agencies of Globalization

MODULE I THE FOUNDATIONAL CANON 8

Sociology-Definition, scope and importance; Major theoretical perspectives- Functionalism, Conflict Theorising and Interactionism; Elements of social formation- Society, Community, Groups and Association; Associative Social Process- Co-operation, Accommodation and Assimilation; Dissociative Social Process- Competition and Conflict.

MODULE II INDIVIDUAL AND SOCIETY 7

Culture-definition, characteristics, functions, types, cultural lag and civilization, Socialization – definition, process, stages, agencies and anticipatory socialization; Social Control- definition, characteristics, importance, types & agencies.

MODULE III SOCIAL INEQUALITY AND STRATIFICATION 7

Concepts- inequality, hierarchy, differentiation, Social Exclusion, and Social Stratification. Forms of Social Stratification- Caste, Class and Estate. Gender and Social Stratification- sex and gender, patriarchy, factors perpetuating gender stratification; Globalization and gender inequality

MODULE IV SOCIAL CHANGE AND GLOBALIZATION 8

Social Change-definition, nature, direction; Forms- evolution, development, progress and transformation; Factors of social change- demography, economy, technology, polity and culture. Globalization- definition, characteristics, historical and social context and Impact, agencies of globalization- IGOs, INGOs, Nation-State, MNEs and Media

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Giddens A. 1989. “Sociology” Cambridge: Polity Press.
2. Heald Haralambos, R.M(2014) . ‘‘Sociology Themes and Perspectives”,

Oxford, New Delhi-92

3. Bhushan Vidya and D.R. Sachdeva (2012). ‘‘Fundamental of Sociology”, Pearson, Delhi.

REFERENCES:

1. Das Gupta, Samir and Paulomi Saha (2012), ‘‘An Introduction to Sociology”, Pearson, Delhi
2. Bottomore, T.B. 1972. *Sociology- A Guide to Literature and Problems*, New Delhi,

OUTCOMES:

On successful completion of this course,

- Students will have exposure to the fundamentals tenets of Sociology.
- Students will be trained to understand social reality with sociological perspective.
- Students will be oriented to constructively analyze human interactions, social relationship and social issues
- Students will gain exposure to the dynamics of human society with special reference to the contemporary trends of globalization.

SSCXO3	SOCIOLOGY OF INDIAN SOCIETY.	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To present a portrayal of the components of the Indian Social structure
- To describe the nature and contemporary structure of Indian social Institutions.
- To examine the causality and magnitude of social problem facing the contemporary India.
- To elucidate the processes forms and impact of change and development in Indian society

MODULE I INDIAN SOCIAL STRUCTURE 7

Unity and Diversity; Concepts of unity and diversity- racial, religious, ethnic and linguistic composition of India. Types of communities-rural, urban and tribal; Social backwardness- OBC, SC and ST; Indian minorities- religious, ethnic, linguistic and LGBT

MODULE II INDIAN SOCIAL INSTITUTIONS 7

Family- definition, types, characteristics, functions of family; Joint Family- definition features, utility, changes; Marriage- definition, characteristics, marriage as sacrament or contract. Caste- definition, principles, contemporary changes, dominant caste, caste -class interface.

MODULE III SOCIAL PROBLEMS IN INDIA 8

Social Problem-definition, nature, social disorganization; Population explosion-causes, effects, relationship with development; Child Labour- causes, magnitude and consequences; Unemployment-nature , types, causes and effects; Gender issues-social status of women, violence against women and women in work place; Contemporary issues- communalism, terrorism and corruption.

MODULE IV SOCIAL CHANGE AND DEVELOPMENT IN INDIA 8

Socio-cultural Change- Sanskritization, Westernization, Secularization, Modernization; Processes of Social change- Industrialization, Urbanization, Globalization; Development- definition, elements, role of government, industry and corporate sector. Technology and change- invention and innovation, impact of technology on social institutions, technology and development.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Sharma,K.L.2008. *Indian Social Structure and Change*. Jaipur: Rawat Publications,.
2. Shah, A.M. 1998. *The Family in India: Critical Essays*. New Delhi: Orient Longman,
3. Ahuja Ram. 1999. *Social problems in India*, Rawat Publication: New Delhi.
4. Ahuja Ram. 2014. *Society in India,*, Rawat Publication: New Delhi.

REFERENCES:

1. Jayapalan, N.(2001), **"**Indian Society and Social Institutions" Atlantic Publishers & Distri,
2. Atal, yogesh (2006), "Changing Indian Society" Rawat Publications, Jaipur

OUTCOMES:

On successful completion of this course,

- Students will gain an in-depth understanding of the social structure and social institutions that constitute society in India.
- Students will be sensitized to the various categories ,Inequalities and their challenges
- Students will be exposed to the social problems encountered in contemporary India.
- Students will gain knowledge about the various forms and trends of the social change.
- Students will become aware about the challenges in the path of progress of Indian society and realize relevance of their role in bringing about development

Humanities Elective II

(To be offered in IV Semester)

		L	T	P	C
SSCXO4	**ECONOMICS OF SUSTAINABLE DEVELOPMENT**	**2**	**0**	**0**	**2**

OBJECTIVES:

- To have an increased awareness on the concept and components of sustainable development.
- To develop the ability to demonstrate the need of sustainable development and international responses to environmental challenges.
- To have an insight into global environmental issues and sustainable globalization.
- To establish a clear understanding of the policy instruments of sustainable development.

MODULE I CONCEPT OF SUSTAINABLE DEVELOPMENT 7

Evolution of the Concept – Rio Summit and sustainable development - various definitions of sustainable development - Components of sustainable development: Social, environmental and economic components.

MODULE II NEED FOR SUSTAINABLE DEVELOPMENT 8

Need for sustainability – Global environmental challenges: population growth, resource depletion, pollution, energy use, climate change, pollution, growing water scarcity, other urban problems, loss of biodiversity, hazardous wastes disposal.International responses to environmental challenges - Global policy such as Kyoto Protocol, Montreal Protocol, Basel Convention.

MODULE III GLOBALIZATION AND ENVIRONMENT SUSTAINABILITY 8

Impact of Globalization on sustainable development, Co - existence of globalization and Environment sustainability, Globalization and Global Governance.Green economy - Renewable energy, sustainable transport, sustainable construction, land and water management, waste management.

MODULE IV POLICIES FOR ACHIEVING SUSTAINABLE DEVELOPMENT 7

Principles of environmental policy for achieving sustainable development:

precautionary principle and polluter pays principle – Business Charter for Sustainable Development.Policy instruments for sustainable development: direct regulation – market based pollution control instruments such as pollution tax, subsidy, pollution permits.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Anderson, David A (2010), "*Environmental Economics and Natural Resource Management*", Routledge, 3rd edition.
2. Karpagam M (1999), "*Environmental Economics: A Textbook*", Sterling Publishers Pvt. Ltd, New Delhi.

REFERENCES:

1. Karpagam M and Jaikumar Geetha (2010), "*Green Management Theory and Applications*", Ane Books Pvt. Ltd, New Delhi.
2. Sengupta Ramprasad (2004), "*Ecology and Economics: An Approach to Sustainable Development*", Oxford University Press, New Delhi.

OUTCOMES:

On successful completion of this course,

- The students will have understood the concepts and components of sustainable development.
- The students will have a holistic overview on the challenges of sustainable development and International responses to environmental challenges.
- The students will have gained knowledge on the global environment issues and demonstrate responsible globalization through global governance.
- The students will have developed awareness of the ethical, economic, social and political dimensions that influence sustainable development.

SSCXO5 INDUSTRIAL SOCIOLOGY

L	T	P	C
2	0	0	2

OBJECTIVES:

- To introduce sociological approaches and perspectives to understand the social relationship in manufacturing industries and corporate sector.
- To explain the structure and functions of industrial organizations.
- To elucidate the dynamics of organizational behavior, leadership and communication.
- To inculcate professional ethics and values to equip students to work in organizational settings.

MODULE I INTRODUCTION 8

Industrial Sociology- definition, scope and importance; Theoretical approaches- scientific management, human relations approach, theory of bureaucracy, Fordism and post-fordism; Production system- concept and characteristics of factory system, automation and rationalization; Industrial conflict- strike , lockout and trade unions.

MODULE II INDUSTRIAL ORGANIZATION 7

Formal organization- definition, features, utility; Informal organization- definition, characteristics, types and relevance; Structure of industrial organization- features and functions of line organization, characteristics and roles of staff organization, distinction;

Industrial hierarchy-white collar, blue collar, supervisors and managers.

MODULE III DYNAMICS OF INDUSTRIAL RELATIONS 8

Group dynamics- Definition, Group behaviour model, Group decision making process, group cohesiveness; Leadership- definitions, style and effective supervision; Communication- concepts, types, model barriers; Job satisfaction- nature, employee compensation and job satisfaction.

MODULE IV PROFESSIONAL ETHICS AND VALUES 7

Concepts- values- morals, and ethics, Integrity, work ethics , service learning - Civic Virtue - caring - Sharing - Honesty - Courage - Valuing Time - Co-operation - commitment - empathy - Self-Confidence - Environmental Ethics, Cyber issues - computer ethics, cyber crimes, plagiarism Ethical living-concept of harmony in life.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Narender Singh, Industrial Sociology, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2012.
2. Gisbert Pascal, Fundamentals of Industrial Sociology, Tata Mc. Graw Hill Publishing Co., New Delhi, 1972
3. Schneider Engeno. V, Industrial Sociology 2nd Edition, Mc. Graw Hill Publishing Co., New Delhi, 1979.

REFERENCES:

1. Robbins, Stephen, Organizational Behaviour , Prentice Hall of India PVT ltd new Delhi, 1985
2. Devis Keith , Human Behaviour at work place, Mc. Graw Hill Publishing Co., New Delhi,1984

OUTCOMES:

On successful completion of this course,

- Students will have acclimatized with sociological perspectives for dealing with social relationships in production and service organizations.
- Students will be familiar with structure of authority, roles and responsibility in organizational settings.
- Students will imbibe leadership, communication and behavioral acumen to govern organization
- Students will be sensitized to standards of desirable behavior to engage in industrial and corporate sector.

SSCXO6	LAW FOR ENGINEERS	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To understand the Constitution and Governance of our country.
- To apprise the students of human rights - local and international and redressal mechanism.
- To have an insight into the industrial, corporate and labour laws of our country.
- To establish a clear understanding about the importance of intellectual property related laws.

MODULE I INDIAN CONSTITUTION AND GOVERNANCE 8

Constitution – salient features, Preamble, Citizenship, Fundamental rights, Fundamental duties, Directive principles, Union executive, Legislature – Union – State and union territories – Election Commission – Election for parliament and state legislature, Judiciary- basic functioning of the Supreme Court and High Courts, Right to information Act 2005 – evolution – concept – practice.

MODULE II HUMAN RIGHTS 7

Human rights – meaning and significance, Covenant on civil and political rights, Covenant on Economic, Social and Cultural rights, UN mechanism and agencies, The Protection of Human Rights Act, 1993 – watch on human rights and enforcement.

MODULE III INDUSTRIAL, CORPORATE AND LABOUR LAWS 8

Corporate laws – meaning and scope, Companies Act 1956 – Indian Contract Act 1872 - Principles of Arbitration - Industrial Employment (Standing Orders) Act 1946 - Industrial Disputes Act 1947 - Workmen's Compensation Act 1923 - The Factories Act, 1948.

MODULE IV LAWS RELATED TO IPR 7

IPR – meaning and scope, International organization – WIPO – TRIPS, Major Indian IPR Acts – Copyright laws, Patent and Design Act, Trademarks Act, Trade Secret Act, Geographical Indicator.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. M.P. Jain (2005) *Indian Constitutional Law*, Wadhwa & Co.

2. H. D, Agarwal (2008), *International Law and Human Rights,* Central Law Publications,
3. Rao, Meena (2006), *Fundamental Concepts in Law of Contract*, 3rd edn., Professional offset.
4. Ramappa (2010), *Intellectual Property Rights Law in India*, Asia Law House.
5. Singh, Avtar (2007), *Company Law*, Eastern Book Co.
6. R.F, Rustamji (1967)*, Introduction to the Law of Industrial Disputes*, Asia Publishing House.

REFERENCES:

1. Acts: Right to Information Act, Industrial Employees (standing order) Act, Factories Act, Workmen Compensate Act.

OUTCOMES:

On successful completion of this course,

- Students will `be able to apply the basic concepts of Indian Constitution, Governance and power in their real life situation.
- Students will have gained knowledge in human rights, cultural, social and political rights.
- Students will have synthesized knowledge about industrial, corporate and labour laws of our country.
- Students will have an overview of IPRs and laws related to Intellectual Property Rights.

General Elective Courses
Group I courses
(To be offered in V Semester)

GECX101	DISASTER MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To give an exposure to various environmental hazards and disasters: and various concepts and principles to manage disaster.
- To give exposure to various environmental policies & programs in India for disaster management

MODULE I ENVIRONMENTAL HAZARDS 7

Environmental hazards, Environmental Disasters and Environmental stress-Meaning and concepts. Vulnerability and disaster preparedness.

MODULE II NATURAL DISASTERS 7

Natural hazards and Disasters - Volcanic Eruption, Earthquakes, Tsunamis, Landslides, Cyclones, Lightning, Hailstorms, Floods, Droughts, Cold waves, Heat waves and Fire.

MODULE III MAN-MADE DISASTERS 7

Man induced hazards & Disasters - Soil Erosion, Chemical hazards, Population Explosion

MODULE IV DISASTER MANAGEMENT 8

Emerging approaches in Disaster Management- Preparing hazard zonation maps, Predictability / forecasting & warning, Preparing disaster preparedness plan, Land use zoning, Communication. Disaster resistant house construction, Population reduction in vulnerable areas, Awareness - Rescue training for search & operation at national & regional level - Immediate relief, Assessment surveys, Political, Administrative, Social, Economic, Environmental Aspects.

MODULE V NATURAL DISASTER REDUCTION & MANAGEMENT 8

Provision of Immediate relief measures to disaster affected people, Prediction of Hazards & Disasters, Measures of adjustment to natural hazards

MODULE VI ENVIRONMENTAL POLICIES & PROGRAMMES IN INDIA 8

Regional survey of Land Subsidence, Coastal Disaster, Cyclonic Disaster & Disaster in Hills with particular reference to India. Ecological planning for sustainability & sustainable development in India, Sustainable rural development: A Remedy to Disasters, Role of Panchayats in Disaster mitigations, Environmental policies & programmes in India- Institutions & National Centers for Natural Disaster reduction, Environmental Legislations in India, Awareness, Conservation Movement, Education & training.

L – 45; Total Hours –45

REFERENCES:

1. Satender, “Disaster Management in Hills”, Concept Publishing Co., New Delhi, 2003.
2. Singh, R.B. (Ed.), “Environmental Geography”, Heritage Publishers, New Delhi,1990.
3. Savinder Singh, “Environmental Geography”, Prayag Pustak Bhawan,1997.
4. Kates, B.I. and White, G.F., “The Environment as Hazards”, Oxford University Press, New York, 1978.
5. Gupta, H.K., (Ed), “Disaster Management”, University Press, India, 2003.
6. Singh, R.B.,“Space Technology for Disaster Mitigation in India (INCED)”, University of Tokyo, 1994.
7. Bhandani, R.K., “An overview on Natural & Manmade Disaster & their Reduction”, IIPA Publication, CSIR, New Delhi, 1994.
8. Gupta, M.C., “Manuals on Natural Disaster management in India”, National Centre for Disaster Management, IIPA Publication, New Delhi, 2001.

OUTCOMES:

At the end of the course, the students will

- achieve sufficient knowledge on the disaster prevention strategy, early warning system, disaster preparedness, response and human resource development.
- be familiar with the National Policy on Disaster Management.

GECX102 TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

- To understand the various principles, practices of TQM to achieve quality.
- To get acquainted with the various statistical tools and approaches for quality control and continuous improvement.
- To get aware of the importance of ISO and Quality Systems.

MODULE I INTRODUCTION 8

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

MODULE II TQM PRINCIPLES 7

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits.

MODULE III TQM IMPROVEMENT PROCESS 8

Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

MODULE IV STATISTICAL PROCESS CONTROL (SPC) 8

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

MODULE V TQM TOOLS 7

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

MODULE VI QUALITY SYSTEMS 7

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System– Elements, Implementation of Quality System, Documentation, Quality Auditing, TS 16949, ISO 14000 – Concept, Requirements and Benefits

L – 45; Total Hours –45

TEXT BOOKS:

1. Dale H.Besterfiled, et al., “Total Quality Management”, Pearson Education, Inc. 2003.

REFERENCES:

1. James R.Evans & William M.Lidsay, “The Management and Control of Quality”, 5th Edition, South-Western (Thomson Learning), 2002.
2. Feigenbaum.A.V., “Total Quality Management”, McGraw-Hill, 1991.
3. Oakland.J.S., “Total Quality Management”, Butterworth Hcinemann Ltd., Oxford, 1989.
4. Narayana V. and Sreenivasan. N.S., “Quality Management – Concepts and Tasks”, New Age International, 1996.
5. Zeiri, “Total Quality Management for Engineers”, Wood Head Publishers, 1991.

OUTCOMES:

The student should be able to

- apply the various statistical tools and approaches for Quality control.
- achieve continuous process improvement through TQM.

GECX103 ENERGY STUDIES L T P C
3 1 0 4

OBJECTIVES:

- To learn the growing demand, supply of energy on global and national levels and the need for renewable energy promotion.
- To understand the basic need for energy conservation and waste heat recovery.
- To learn the important aspects of energy audit and management.
- To get acquainted with the global environmental issues and carbon credits.

MODULE I GLOBAL AND NATIONAL ENERGY SCENARIO 7

Role of energy in economic development, various energy resources - overall energy demand and availability- Energy consumption in various sectors and its changing pattern - Exponential increase in energy consumption and projected future demands. Need for renewable energy.

MODULE II SOLAR ENERGY 8

Solar Radiation – Measurements of Solar Radiation - Flat Plate and Concentrating Collectors – Solar direct Thermal Applications – Solar thermal Power Generation - Fundamentals of Solar Photo Voltaic Conversion – Solar Cells – Solar PV Power Generation – Solar PV Applications.

MODULE III OTHER RENEWABLE ENERGY SOURCES 8

Power from wind – wind turbine working and types, solar thermal power plants – low medium and high power generation, power from wave , tidal, geothermal sources, OTEC system. MHD power plants – working, types, merits and demerits. Energy from biomass.

MODULE IV COGENERATION, WASTE HEAT RECOVERY AND COMBINED CYCLE PLANTS 8

Cogeneration principles- topping and bottoming cycles, role in process industries. Energy from wastes- waste heat recovery- heat recovery from industrial processes. Heat exchange systems – recuperative and regenerative heat exchangers – commercially available waste heat recovery devices. Combined cycle plants – concept, need and advantages, different combinations and practical scope.

MODULE V ENERGY CONSERVATION AND MANAGEMENT 7

Need for energy conservation – use of energy efficient equipment. Energy conservation opportunities - in educational institutions, residential, transport, municipal, industrial and commercial sectors – concept of green building. Energy audit in industries – need, principle and advantages. Case studies.

MODULE VI GLOBAL ENERGY ISSUES AND CARBON CREDITS 7

Energy crisis, fossil consumption and its impact on environmental climate change. Energy treaties – Montreal and Kyoto protocols - Transition from carbon rich and nuclear to carbon free technologies, carbon foot print – credits – clean development mechanism.

L – 45; Total Hours –45

TEXT BOOKS:

1. S.S. Rao and B.B. Parulekar, “Energy Technology”, 3rd Edition, Khanna Publishers, New Delhi, 2011.
2. O. Callaghn. P.W., “Design and Management for Energy Conservation”, Pergamon Press, Oxford, 1981.

REFERENCES:

1. G.D. Rai, “Non Conventional Energy Sources”, Khanna Publishers, New Delhi, 2011.
2. Archie, W Culp. “Principles of Energy Conservation”, McGraw Hill, 1991.
3. D Patrick and S W Fardo, “Energy Management and Conservation”, PHI,1990
4. P. O’Callaghan: “Energy Management”, McGraw - Hill Book Company, 1993.
5. Kenney, W. F., “Energy Conservation in Process Industries”, Academic Press, 1983.

OUTCOMES:

The student should be able to

- Realize the global and national energy status and need to switch over to renewable energy technology.
- Energy audit and suggest methodologies for energy savings.
- Utilize the available resources in an optimal way.
- Concern about the global environmental issues & promote carbon credits.

GECX104	ROBOTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

To learn about the robots, various components, of Robots, programming and their applications.

MODULE I **8**

Definition- Need - Application, Types of robots – Classifications – Configuration, work volume, control loops, controls and intelligence- basic parts - functions – specifications. of robot, degrees of freedoms, end effectors – types, selection

MODULE II ROBOT DRIVES AND CONTROL **8**

Controlling the Robot motion – Position and velocity sensing devices – Design of drive systems – Hydraulic and Pneumatic drives – Linear and rotary actuators and control valves – Electro hydraulic servo valves, electric drives – Motors – Designing of end effectors – Vacuum, magnetic and air operated grippers.

MODULE III ROBOT SENSORS **8**

Transducers and Sensors – Tactile sensor – Proximity and range sensors – Sensing joint forces – Robotic vision system – Image Representation - Image Grabbing –Image processing and analysis – Edge Enhancement – Contrast Stretching – Band Rationing - Image segmentation – Pattern recognition – Training of vision system.

MODULE IV ROBOT PROGRAMMING & AI TECHNIQUES **7**

Types of Programming – Teach pendant programming – Basic concepts in AI techniques – Concept of knowledge representations – Expert system and its components.

MODULE V ROBOTIC WORK CELLS AND APPLICATIONS OF ROBOTS **7**

Robotic cell layouts – Inter locks – Humanoid robots – Micro robots – Application of robots in surgery, Manufacturing industries, space and underwater.

MODULE VI ROBOT KINEMATICS AND DYNAMICS 7

Forward and inverse Kinematic equations, Denvit – Hartenbers representations Fundamental problems with D-H representation, differential motion and velocity
of frames - Dynamic equations for sing, double and multiple DOF robots – static force analysis of robots.

L – 45; Total Hours –45

REFERENCES:

1. Yoram Koren," Robotics for Engineers", Mc Graw-Hill, 1987.
2. Kozyrey, Yu, "Industrial Robots", MIR Publishers Moscow, 1985.
3. Richard. D, Klafter, Thomas, A, Chmielewski, Michael Negin, "Robotics Engineering – An Integrated Approach", Prentice-Hall of India Pvt. Ltd., 1984.
4. Deb, S.R. "Robotics Technology and Flexible Automation", Tata Mc Graw-Hill, 1994.
5. Mikell, P. Groover, Mitchell Weis, Roger, N. Nagel, Nicholas G. Odrey, "Industrial Robotics Technology, Programming and Applications", Mc Graw- Hill, Int. 1986.
6. Timothy Jordanides et al,"Expert Systems and Robotics", Springer – Verlag, New York, May 1991.

OUTCOMES:

Students would be able to

- Understand about the robots, its various components.
- Design Robots for industrial applications.
- Do programming for robots and apply them in real time applications.

GECX105	TRANSPORT MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the transport fleet and their related activities for minimizing operational cost.
- To understand the need of maintenance and its importance.
- To understand the functions and applications of various types of transport system.

MODULE I INTRODUCTION 7

Personnel management; objectives and functions of personnel management, psychology, sociology and their relevance to organization, personality problems. Selection process: job description, employment tests, interviewing, introduction to training objectives, advantages, methods of training, training procedure, psychological tests.

MODULE II ORGANISATION AND MANAGEMENT 7

Forms of Ownership – principle of Transport Management – Staff administration – Recruitment and Training – welfare – health and safety. Basic principles of supervising. Organizing time and people. Driver and mechanic hiring - Driver checklist - Lists for driver and mechanic - Trip leasing - Vehicle operation and types of operations.

MODULE III TRANSPORT SYSTEMS 9

Introduction to various transport systems. Advantages of motor transport. Principal function of administrative, traffic, secretarial and engineering divisions. chain of responsibility, forms of ownership by state, municipality, public body and private undertakings.

MODULE IV SCHEDULING AND FARE STRUCTURE 8

Principal features of operating costs for transport vehicles with examples of estimating the costs. Fare structure and method of drawing up of a fare table. Various types of fare collecting methods. Basic factors of bus scheduling. Problems on bus scheduling.

MODULE V MOTOR VEHICLE ACT 7

Traffic signs, fitness certificate, registration requirements, permit insurance, constructional regulations, description of vehicle-tankers, tippers, delivery vans, recovery vans, Power wagons and fire fighting vehicles. Spread over, running time, test for competence to drive.

MODULE VI MAINTENANCE 7

Preventive maintenance system in transport industry, tyre maintenance procedures. Causes for uneven tyre wear; remedies, maintenance procedure for better fuel economy, Design of bus depot layout.

L – 45; Total Hours –60

TEXT BOOKS:

1. John Duke, "Fleet Management", McGraw-Hill Co, USA, 1984.
2. Kitchin.L.D., "Bus Operation", III edition, Illiffee and Sons Co., London, 1992

REFERENCES:

1. Government Motor Vehicle Act, Publication on latest act to be used as on date.

OUTCOMES:

Upon completion of the course, students will

- Know about different aspects related to transport system and management.
- Features of scheduling, fixing the fares
- Know about the motor vehicle act and maintenance aspects of transport.

GECX106 CONTROL SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the system modeling and to derive their transfer function.
- To provide adequate knowledge of time response of systems and steady state error analysis.
- To accord basic knowledge in obtaining the open loop and closed–loop frequency responses of Control systems.

MODULE I BASIC CONCEPTS AND SYSTEM REPRESENTATION **8**

Control System - Basic elements in control systems – Open and closed loop systems – Electrical analogy of mechanical and thermal systems – Transfer function – Block diagram reduction techniques – Signal flow graphs.

MODULE II TIME RESPONSE ANALYSIS AND DESIGN **8**

Time response – Time domain specifications – Types of test input – First and Second order system - Type I and Type II System – Response - Error coefficients – Generalized error series – Steady state error – P, PI, PID modes of feedback control.

MODULE III FREQUENCY RESPONSE ANALYSIS AND DESIGN **7**

Performance specifications - correlation to time domain specifications - bode plots and polar plots – gain and phase margin – constant M and N circles and Nichols chart – all pass and non-minimum phase systems.

MODULE IV STABILITY **8**

Characteristics equation – Location of roots in s plane for stability – Routh Hurwitz criterion – Root locus construction – Effect of pole, zero addition – Gain margin and phase margin – Nyquist stability criterion.

MODULE V COMPENSATOR DESIGN **8**

Performance criteria – Lag, lead and lag-lead networks – Compensator

design using bode plots and root locus technique.

MODULE VI CONTROL SYSTEM COMPONENTS AND APPLICATION OF CONTROL SYSTEMS **6**

Synchros – AC servomotors - DC Servo motors - Stepper motors - AC Tacho generator - DC Tacho generator - Typical applications of control system in industry.

L – 45; Total Hours –60

REFERENCES:

1. K. Ogata, “Modern Control Engineering”, 4th Edition, Pearson Education, New Delhi, 2003.
2. I.J. Nagrath & M. Gopal, “Control Systems Engineering”, New Age International Publishers, 2003.
3. C.J.Chesmond, “Basic Control System Technology”, Viva student edition, 1998.
4. I.J.Nagarath and M.Gopal, “Control System Engineering”, Wiley Eastern Ltd., Reprint, 1995.
5. R.C.Dorf and R.H.Bishop, “Modern Control Systems”, Addison-Wesley (MATLAB Reference), 1995.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Proper understanding of basics of Control Systems.
- Ability and skill to carry-out time domain and frequency domain analysis.
- Capable of determining stability of the system using Routh Hurwitz criterion, Root locus and Nyquist criterion.
- Ability to design lag, lead and lag lead compensator networks.

GECX107	INTRODUCTION TO VLSI DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Basic concepts of HDL.
- Verilog language and its syntax constructs.
- Programmable Logic Devices and FPGAs
- MOS devices theory
- CMOS based combinational and sequential circuits

PREREQUISITES:

Fundamentals of Electronics

Basics knowledge in Digital Electronics.

MODULE I REVIEW OF BASIC DIGITAL SYSTEMS 7

Boolean algebra, Building blocks of combinational logic design-Adders, multiplexer, encoder, decoder, comparator, Latches & flip-flops, counters, shift registers.

MODULE II LOGIC DESIGN USING VERILOG HDL 8

Overview of Digital Design with Verilog HDL, Levels of Design Description, Concurrency, Hierarchical Modeling Concepts, Modules and Ports, Component instantiation Data flow and RTL, structural, gate level, switch level modeling and Behavioral Modeling.

MODULE III LANGUAGE CONSTRUCTS OF VERILOG HDL 7

Identifiers- gate primitives, gate delays, operators, timing controls, procedural assignments, conditional statements Variable types, arrays and tables, Tasks and functions, Test bench.

MODULE IV BUILDING BLOCKS OF DIGITAL VLSI SYSTEMS 8

HDL Design -Data Path Operations-Addition/Subtraction, Parity Generators, Comparators, Zero/One Detectors, Binary Counters, ALUs, Multiplication, Shifters, Memory Elements. Programmable logic elements and AND-OR arrays, FPGAs programming methods.

MODULE V TRANSISTOR THEORY 7

Introduction to MOS Transistors-NMOS & PMOS Characteristics, Current Equations, Complementary CMOS Inverter-DC Characteristics, Static Load MOS Inverters.

MODULE VI BASICS OF DIGITAL CMOS DESIGN 8

NMOS & PMOS Logic Gate, CMOS Logic Gate, Basic layout design of simple gate-stick diagram, CMOS Logic Structures-full adder, multiplexers.

Total Hours –45

TEXT BOOKS:

1. M.Morris Mano "Digital Design", 3rd Edition, Prentice Hall of India Pvt. Ltd New Delhi, 2003

REFERENCES:

1. Michael D. Ciletti“Advanced Digital Design with the Verilog HDL" (2nd Edition) Hardcover – January 31, 2010
2. J.Bhasker: Verilog HDL primer, BS publication, 2001.
3. J. P. Uyemura, "Introduction to VLSI Circuits and System", Wiley, 2002
4. Neil Weste and K. Eshragian, “Principles of CMOS VLSI Design: A System Perspective,” 2nd edition, Pearson Education (Asia) Pvt.Ltd., 2000
5. Douglas A Pucknell& Kamran Eshragian , “Basic VLSI Design” PHI 3rd Edition (original edition – 1994)

OUTCOMES:

At the end of the course the students will be able to

- Create basic Register Transfer Level (RTL) models for combinational circuits & Sequential circuits using Verilog HDL.
- Create basic behavioral models for combinational circuits & Sequential circuits using Verilog HDL.
- Describe the usage of Programmable Logic Devices and FPGAs.
- Describe MOS devices theory and inverter circuit DC characteristics
- Design the basic digital building blocks using MOS circuit.
- Apply VLSI design concepts based on the requirements to conduct experiments or projects

GECX108 PLANT ENGINEERING

L	T	P	C
3	1	0	4

OBJECTIVES:

- To provide in depth knowledge on Plant Engineering
- To introduce detail engineering and P&ID
- To learn about the support to Instrumentation from other disciplines
- To study about the Installation and commissioning

MODULE I INTRODUCTION OF PLANTS 7

General Project Cycle – Feed – Sales - Plant Description, Component / Areas of Plant, Plant Layout, Plant Interfaces, Plant Location

MODULE II ELEMENTS OF PLANT 8

Main Elements of a Plant, Process Flow Scheme (PFD – Process Flow Diagram) P&ID's, Plant Legend Finalization.

MODULE III DETAIL ENGINEERING 10

P& ID Development with PFD's, Major Discipline Involvement & Inter discipline Interaction, Major Instrumentation & Control Systems - Development Phase – Instrument List , I/O Count, Specification Sheets, Instrument Installation (Hook ups) , Control Philosophy – Detail Engineering.

MODULE IV SUPPORT FROM OTHER DISCIPLINE 8

Other Discipline Supports to Instrumentation – Plot Plan, Piping / Equipment Plan, Electrical Area Classification, Fire Hazardous Classification Telecommunication Systems - Control Network architecture.

MODULE V INSTALLATION AND COMMISSIONING 7

Plant Construction - Key Drawings for Construction Support Construction Activities, System Testing, Startup / Commissioning, Production.

MODULE VI CASE STUDIES 5

Case studies of Water Treatment Plant - Paper Industry – Power Plant etc

L – 45; Total Hours –45

REFERENCES:

1. Duncan C. Richardson, Plant Equipment and Maintenance Engineering Handbook, McGraw-Hill Education: New York, Chicago, San Francisco, Athens, London, Madrid, Mexico City, Milan, New Delhi, Singapore, Sydney, Toronto, 2014 McGraw-Hill Education

2. Gabriel Salvendy, Handbook of Industrial Engineering - Technology and operations management, John Wiley & Sons, 2001

3. Robert C Rosaler, Standard Handbook of Plant Engineering, McGraw-Hill third edition, 2004.

4. R. Keith Mobley, Plant Engineer's Handbook, Technology and Engineering, 2001.

OUTCOMES:

At the end of the course, the student will be able to

- Review and correct P&IDs
- Do installation and commissioning of new plants
- Apply plant engineering in design and maintenance of water treatment plant / power plant etc

GECX109	NETWORK SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

The students should be able to

- Discuss the basic concepts of computer security, model and attacks
- Examine the major types of threats and the associated attacks
- Identify the encryption techniques in real time applications
- Understand the special requirements for wireless security and how authentication is implemented in wireless systems
- Understand the functions of Network Security Device Firewall and its types
- Interpret the various network intrusion such as computer viruses, network worms etc

MODULE I INTRODUCTION 6

Computer Security Concepts - The OSI Security Architecture - Security Attacks - Security Services - Security Mechanisms - A Model for Network Security - Standards – classical encryption techniques.

MODULE II SYMMETRIC ENCRYPTION AND MESSAGE CONFIDENTIALITY 7

Symmetric Encryption Principles - Symmetric Block Encryption Algorithms - Random and Pseudorandom Numbers - Stream Ciphers and RC4 - Cipher Block Modes of Operation

MODULE III PUBLIC KEY CRYPTOGRAPHY AND MESSAGE AUTHENTICATION 8

Approaches to Message Authentication - Secure Hash Functions - Message Authentication Codes - Public-Key Cryptography Principles - Public-Key Cryptography Algorithms - Digital Signatures

MODULE IV KEY DISTRIBUTION ,USER AUTHENTICATION AND TRANSPORT-LEVEL SECURITY 8

Symmetric Key Distribution Using Symmetric Encryption - Kerberos - Key Distribution Using Asymmetric Encryption - X.509 Certificates - Public-Key Infrastructure -Federated Identity Management - Web Security Considerations -

Secure Socket Layer and Transport Layer Security - Transport Layer Security

MODULE V WIRELESS NETWORK SECURITY, ELECTRONIC MAIL SECURITY AND IP SECURITY **8**

IEEE 802.11 Wireless LAN Overview -IEEE 802.11i Wireless LAN Security - Wireless Application Protocol Overview - Wireless Transport Layer Security - WAP End-to-End Security - Pretty Good Privacy - S/MIME – Domain Keys Identified Mail- IP Security Overview -IP Security Policy - Encapsulating Security Payload - Combining Security Associations - Internet Key Exchange - Cryptographic Suites

MODULE VI SYSTEM SECURITY **8**

Intruders -Intrusion Detection -Password Management - Types of Malicious Software - Viruses Virus Countermeasures – Worms - Distributed Denial of Service Attacks- The Need for Firewalls - Firewall Characteristics - Types of Firewalls - Firewall Basing - Firewall Location and Configurations

L – 45; Total Hours –45

REFERENCES:

1. William Stallings,"Network security Essentials:Applications and standards", Prentice Hall, Fifth Edition , ISBN-13: 978-0134527338, 2013
2. William Stallings, "Cryptography and Network Security: Principles and Practice", Pearson, ISBN-13:978-0-273-79335-9,2013
3. Behrouz Forouzan, Debdeep Mukhopadhyay,Cryptography and network security (sie) 2nd edition, ISBN-13: 978-0070702080, 2016
4. Wikipedia, "Network Security and Management" , https://en.wikipedia.org/wiki/Book:Network Security and Management, 2014.
5. Nitesh Dhanjani, Justin Clarke, "Network Security Tools", O'Reilly Media, ISBN-13: 9780596007942, 2005.

OUTCOMES:

Students who complete this course will be able to

- Recognize the computer security concepts, architecture attacks and model
- Distinguish the symmetric and asymmetric encryption techniques
- Apply the cryptographic algorithms in different applications
- Express the network security designs using available secure solutions

such as PGP,SSL, IPSec, etc.

- Describe the firewalls principles and different types of firewalls applied in organization
- Identify abnormalities within the network caused by worms, viruses and Network related security treats**.**

GECX110 KNOWLEDGE MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

The course

- Focuses on positioning knowledge as a valuable commodity, embedded in products and in the tacit knowledge of highly mobile individual employees.
- Presents KM as a deliberate and systematic approach to cultivating and sharing an organization's knowledge base.
- Brings out the paradigm in terms of information technology and intellectual capital.

MODULE I KNOWLEDGE MANAGEMENT 6

KM Myths – KM Life Cycle – Understanding Knowledge – Knowledge, intelligence – Experience – Common Sense – Cognition and KM – Types of Knowledge – History of Knowledge Management - From Physical assets to Knowledge Assets – Expert knowledge – Human Thinking and Learning.

MODULE II KNOWLEDGE MANAGEMENT SYSTEMS AND MODELS 9

Challenges in Building KM Systems – Conventional Vs KM System Life Cycle (KMSLS) – Knowledge Creation and Knowledge Architecture – KM cycle - Different variants of KM cycle - KM models - Implications and practical implementations.

MODULE III CAPTURING KNOWLEDGE AND SHARING 9

Tacit knowledge capture - Explicit knowledge codification – Knowledge taxonomies - Knowledge sharing - Communities - Obstacles to knowledge capture and sharing.

MODULE IV KNOWLEDGE MANAGEMENT TOOLS 9

KM System tools – Neural Network – Association Rules – Classification Trees – Data Mining and Business Intelligence – Knowledge capture and creation tools - Content creation tools - Data mining and knowledge discovery – Content management tools - Knowledge sharing and dissemination tools – Group ware

and Collaboration tools - Intelligent filtering tools.

MODULE V KNOWLEDGE APPLICATION 6

KM at individual level - Knowledge workers - Task analysis and modeling - Knowledge application at group and organizational levels – Knowledge repositories - Knowledge reuse -Case study: e-learning.

MODULE VI VALUE OF KNOWLEDGE MANAGEMENT 6

KM return on investment and metrics - Benchmarking method – Balanced scorecard method - House of quality method - Results based assessment method - Measuring success - Future challenges for KM.

L – 45; Total Hours –45

TEXT BOOKS:

1. Elias M. Awad, Hassan M. Ghaziri, “Knowledge Management”, Prentice Hall, 2nd Edition, 2010.
2. Jay Liebowitz, “Handbooks on Knowledge Management”, 2nd Edition, 2012.
3. Irma Becerra-Fernandez, Rajiv Sabherwal, ”Knowledge Management: Systems and Processes”, 2010.

OUTCOMES:

Students who complete this course will be able to

- Describe the fundamental concepts in the study of knowledge and its creation, acquisition, representation, dissemination, use and re-use, and management.
- Explains the core concepts, methods, techniques, and tools for computer support of knowledge management.
- Critically evaluate current trends in knowledge management and apply it for e-learning

GECX111	CYBER SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basics of Cyber Security Standards and Policies.
- To know the legal, ethical and professional issues in Cyber security.
- To understand Cyber Frauds and Abuse and its Security Measures.
- To know the technological aspects of Cyber Security.
-

MODULE I FUNDAMENTALS OF CYBER SECURITY 7

Security problem in computing – Cryptography Basics – History of Encryption – Modern Methods – Legitimate versus Fraudulent Encryption methods – Encryption used in Internet.

MODULE II CYBERCRIME AND CYBEROFFENSES 8

Cybercrime and Information Security – Cybercriminals – Classifications of Cybercrimes – Email Spoofing – Spamming – Cyber defamation – Internet Time Theft – Forgery – Web jacking – Hacking – Online Frauds – Software Piracy – Mail Bombs – Password Sniffing – Cyberoffenses – Categories – Planning the attacks – Cyberstalking – Cybercafe and Cybercrimes – Botnets.

MODULE III CYBERCRIME: MOBILE AND WIRELESS DEVICES 8

Proliferation of Mobile and Wireless Devices – Trends in Mobility – Credit card frauds in Mobile and Wireless Computing – Security Challenges – Authentication Service Security – Attacks on Mobile Phones.

MODULE IV TOOLS AND METHODS USED IN CYBERCRIME 8

Proxy Servers and Anonymizers – Phishing – Password Cracking – Keyloggers and Spywares – Virus and Worms – Trojan Horses and Backdoors – Steganography – DoS and DDoS Attacks.

MODULE V SECURITY POLICIES 7

Introduction - Defining User Policies – Passwords – Internet Use – Email Usage – Installing/ Uninstalling Software – Instant Messaging – Defining System Administrative Policies – Defining Access Control – Developmental Policies – Standards, Guidelines and Procedures – Basics of Assessing a System.

MODULE VI COMPUTER FORENSICS 7

General Guidelines – Finding Evidence on the PC - Finding Evidence in System Logs – Windows Logs – Linux Logs – Getting Back Deleted Files – Operating System Utilities – The Windows Registry.

L – 45; Total Hours –45

TEXT BOOKS:

1. Nina Godbole, Sunit Belapure, “Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Wiley, 2011.
2. Chuck Easttom, “Computer Security Fundamentals”, 2nd Edition, Pearson Education, 2012.

REFERENCES:

1. Charles B. Pfleeger, Shari Lawrence Pfleeger, “Security in Computing”, 3rd Edition, Pearson Education, 2003.
2. William Stallings, “Cryptography and Network Security – Principles and Practices”, 3rd Edition, Pearson Education, 2003.
3. Atul Kahate, “Cryptography and Network Security”, Tata McGraw Hill, 2000.

OUTCOMES:

Upon completion of this course, students will be able to

- Explain the general security issues.
- Discuss various cybercrimes and offenses.
- Outline the occurrence of Cybercrime in mobile and wireless environment.
- Use relevant tools and methods in cybercrime
- Apply security policies in cyber forensics.
- Outline the strategies adopted in computer forensics.

GECX112	GENETIC ENGINEERING	L	T	P	C
		4	0	0	4

OBJECTIVES:

The course aims to provide an advanced understanding of the core principles and topics of Cell and Organism reproduction and the Principles of heredity and their experimental basis, and to enable students to be able to apply these principles in assessment of pedigrees to identify genotypes and predict the mating outcomes.

MODULE I GENETICS AND ORGANISM 10

Genetics and human affairs, Genetics and Biology, Genes and Environment, Techniques of genetic analysis, The chromosome theory of heredity, Sex chromosomes, Sex linkage, The parallel behaviour of autosomal genes and chromosomes.

MODULE II MENDELISM AND LINKAGE 12

Mendel's laws of inheritance, Interaction of genes, Variations on dominance, Multiple alleles, Lethal alleles, Several genes affecting the same character, Penetrance and expressivity, Linkage- Basic eukaryotic chromosome mapping, The discovery of linkage, Recombination linkage symbolism, Linkage of genes on X chromosomes, Linkage maps, Examples of linkage maps.

MODULE III FINE STRUCTURE OF GENES 10

The concept of promoter, Coding sequence, Terminator, Induction of gene for expression. The concept of extranuclear genome in higher plants and animals, Overview of mitochondrial genome, Chloroplast genome.

MODULE IV RECOMBINATION IN BACTERIA AND VIRUSES 10

Conjugation recombination and mapping the E.coli chromosomes, Transformation, Transduction, Chromosome mapping. Population genetics: Darwin's revolution, Variation and its modulation, The effect of sexual reproduction on variation, The sources of variation, Selection quantitative genetics

MODULE V PRINCIPLES OF PLANT BREEDING 9

Objectives, Selfing and crossing techniques, Male sterility,Incompatability, Hybrid vigour.

MODULE VI HUMAN GENOME PROJECT 9

Genetic diseases in humans, Genetics and society

L – 45; T – 15; Total Hours –60

REFERENCES:

1. In Introduction to genetic analysis, Griffiths, Miller, Suzuki, Lewontin and Gelbart, Freeman and Company.
2. Genetics, A.V.S.S. Sambamurty, Narosa Publishing House.
3. Concepts of Genetics, Klug & Cummings, Prientice Hall.
4. Molecular Cloning, Moniatisetal, Cold Spring Harbor Laboratory.

OUTCOMES:

At the end of the course students will be able to

- Describe the structure, function and replication of DNA as the genetic material
- Describe gene structure, expression and regulation
- Describe the chromosomal basis of inheritance and how alterations in chromosome number or structure may arise during mitosis and meiosis

GECX113	FUNDAMENTALS OF PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The students would gain knowledge on

- Technicalities attached to Project Management and Significance of Quality Consideration
- Project management methodologies – tools and techniques, supplemented with examples from case studies
- The importance of Efficient HR team and role of Communication in executing Projects.
- Managing Risks in Project Management

MODULE I INTRODUCTION TO PROJECT MANAGEMENT 9

Introduction to Project and Project Management-Project Management as a Career-Project Management Skill Sets-Project Scope Management: Project Charter, Scope Creep, Scope Validation, Scope Change Control-Type of Organization: Organization Structure-Influence of Organization Structure on Project, Project Stakeholders and Organizational Productivity.

MODULE II PROJECT MANAGEMENT PROCESS, TOOLS AND TECHNIQUES 8

Project life cycle-Initiation, Planning, Execution, Monitoring and Closing Phase; - Link between project management process, process groups and knowledge areas; Project management tools and techniques- Project Stakeholders description and mapping - Stakeholder Management Process

MODULE III PROJECT QUALITY, COST AND SCHEDULE MANAGEMENT 10

MODULE IV PROJECT HR MANAGEMENT 5

Organizational Goals- (MBO/MBE/MBP)-Responsibility Assignment Matrix (RAM)-Types of Powers- Manage or Lead-Conflict management Techniques-Performance Evaluation Process-Motivation Theories and its Application for execution of Projects-Leadership Styles-Project Team Building-Project Staffing Constraints/Policies

MODULE V COMMUNICATION MANAGEMENT 5

Communication Management: Understanding Body languages of Project Personnel-Effective Communications- Interpersonal Skills for project Managers-PMIS-Communicating with the Customer-Communicating with Management- Formal vs. Informal Communications-Written, Verbal and Non-Verbal Communications.

MODULE VI PROJECT PROCUREMENT & RISK MANAGEMENT 8

Introduction to Project Procure Management: Soliciting RFQ/RFP-Contract Proposals-Contract Negotiation-Contract Closure-Risk Management: Defining risks-Risk management process-Risk identification-Qualitative and Quantitative Risk-Probability and Decision trees-Risk Response strategies / methods-Expected monetary value-Risk vs. life cycle phases

L – 45; Total Hours –45

REFERENCES:

1. Jack. R. Meredith, Samuel. J. Mantel & Scott. M. Shafer, Project Management in Practice, Fifth Edition, Bangalore: Wiley, 2015
2. Bob Hughes, Mike Cotterrel “Software Project Management”, Tata McGraw-Hill, 2009

OUTCOMES:

- Learners will be able to identify the Key Knowledge Areas and apply PM process in hypothetical project assignments given as continuous assessment.
- They would be able to suitably recognize tools and techniques required for various phases included in a project.
- They would also be able to manage scope, time, cost and other major components that would help them to execute the project efficiently.

GECX114	OPERATIONS RESEARCH	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To acquire knowledge and training in optimization techniques.
- To get knowledge about optimization in utilization of resources.
- To understand and apply operations research techniques to industrial operations

MODULE I LINEAR PROGRAMMING PROBLEM 8

Linear programming – formulation of the problem - graphical interpretation of optimality - Simplex method – to obtain basic feasible solution – types of linear programming solution – complications and their resolution.

MODULE II ARTIFICIAL VARIABLE AND TWO PHASE METHOD, DUALITY 6

Artificial variable - Big M method – Two phase method – alternative optimal solution – unbounded solution - Duality – primal dual relationships - rules of constructing the dual from primal.

MODULE III TRANSPORTATION PROBLEM & ASSIGNMENT PROBLE 8

Transportation problems – Initial basic feasible solutions, MODI method, Unbalance in transportation, Degeneracy in transportation models, Assignment problem – Minimization and Maximization type of problems by Hungarian method.

MODULE IV NETWORK AND SEQUENCING PROBLEMS 8

PERT and CPM – Network diagram – Fulkerson's rule - CPM Probability of achieving completion date – Crash time – Cost analysis. Sequencing N jobs through 2 machines and 3 machines.

MODULE V QUEUING THEORY & SIMULATION 7

Poisson arrivals and exponential service times – characteristics of Queuing models – single channel – Introduction to multi channel models – Random number generation – Monte Carlo Simulation.

MODULE VI INVENTORY CONTROL, REPLACEMENT MODELS AND GAME THEORY 8

Types of inventory- Inventory cost - EOQ - Deterministic inventory problems – Introduction to probabilistic models & system level inventory control - Replacement models – Replacement of items that deteriorate with time – value of money changing with time – not changing with time – Individual and group replacement policy - Game theory – simple games.

L – 45; Total Hours –45

TEXT BOOKS:

3. Hamdy ATaha, “Operations Research an introduction”, 8th edition, Phil Pearson, 2007.
4. Winston.W.L., “Operations Research”, 4th edition, Thompson-Brooks/Cole, 2003.

REFERENCES:

1. Wayne.L. Winston, “Operations Research applications and algorithms”, 4th edition, Thomson learning, 2007.
2. Frederick. S. Hiller and Gerald.J.Lieberman, “Operations Research concepts and cases”, 8th edition (SIE), Tata McGraw – Hill Pub. Co. Ltd., New Delhi, 2006.
3. A. Ravindran, D. T. Phillips and J. J. Solberg, "Operations Research:Principles and Practice", 2nd edition, John Wiley & Sons, New York, 1992.
4. Robertazzi. T.G., “Computer networks and systems-Queuing theory and performance evaluation”, 3rd edition, Springer, 2002.

OUTCOMES:

At the end of the course students will be able to

- solve linear programming problems
- solve transportation and assignment problems.
- solve network and sequencing problems.
- apply the operations research techniques to solve industrial problems.

GECX115 NANO TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES:

- To introduce the basic concepts of Nanoscience relevant to the field of engineering.
- To provide an exposure about the importance of various synthesis method.
- To enrich the knowledge of students in various characterisation techniques.

MODULE I INTRODUCTION & CLASSIFICATION OF NANOMATERIALS 9

Definition - Origin of nanotechnology - Difference between bulk and nanomaterials- Top-down and bottom-up processes - Size dependent properties (magnetic, electronic,transport and optical), Classification based on dimensional property - 0D, 1D, 2D and 3D nanostructures – Kubo gap.

MODULE II TYPES OF NANOMATERIALS 9

Metal oxides and metal nano particles - Ceramic nano particles - Semi conducting quantum dots - Core-shell quantum dots - Nanocomposites - Micellar nanoparticles.

MODULE III PRODUCTION OF NANOPARTICLES 7

Sol-gel, hydrothermal, solvothermal, Plasma Arcing, Electro deposition, RF sputtering, Pulsed laser deposition, Chemical vapour, deposition.

MODULE IV CARBON BASED NANOMATERIALS 6

Carbon nanotubes: Single wall nanotubes (SWNT), Multiwall nanotubes (MWNT) - structures-carbon nanofibre, Fullerenes-Application of carbon nanotubes and Fullerenes.

MODULE V NANOPHOTONICS 7

Light and nanotechnology, Interaction of light and nanotechnology, Nanoholes and photons, nanoparticles and nanostructures; Nanostructured polymers, Photonic Crystals, Solar cells.

MODULE VI CHARACTERISATION TECHNIQUES 7

Basic principles of scanning Electron Microscopy (SEM), Atomic force

microscopy (AFM), Scanning tunneling microscopy (STM), Scanning probe microscopy (SPM) and Transmission electron microscopy (TEM), Particle size analyzer, Luminescence techniques.

L – 45; Total Hours –45

TEXT BOOKS:

1. Hari Singh Nalwa, “Handbook of Nanostructured Materials and Nanotechnology”, Academic Press, 2000.
2. Guozhong Cao, “Nanostructures and Nano materials-Synthesis, Properties and Applications”, Imperial College Press (2011).
3. Zhong Lin Wang, “Handbook of Nanophase and Nanomaterials (Vol 1 and II)”, Springer, 2002.
4. Mick Wilson, Kamali Kannangara, Geoff smith, “Nanotechnology: Basic Science and Emerging Technologies”, Overseas press, 2005.

REFERENCES:

1. A. Nabok, “Organic and Inorganic Nanostructures”, Artech House, 2005.
2. C.Dupas, P.Houdy, M.Lahmani, Nanoscience: “Nanotechnologies and Nanophysics”, Springer-Verlag Berlin Heidelberg, 2007.
3. Mick Wilson, Kamali Kannangara, Michells Simmons and Burkhard Raguse, “Nano Technology – Basic Science and Emerging Technologies”, 1st Edition, Overseas Press, New Delhi,2005.
4. M.S. Ramachandra Rao, Shubra SinghH, “Nanoscience and Nanotechnology: Fundamentals to Frontiers”, Wiley, 2013.

OUTCOMES:

At the end of this course, the students will be able to:

- Apply the knowledge of different types of nanomaterials for various engineering applications.
- Acquire the knowledge of various methods of production of nanomaterials.
- Familiarize with various characterization techniques.

GECX116	VEHICLE MAINTENANCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To know about the various methods of maintaining procedure, vehicle insurance and basic problems in a vehicle.
- The student able to impart knowledge in maintaining of engine components and subsystems.
- The student able to impart knowledge in maintaining of transmission, driveline, steering, suspension, braking and wheels.
- The student able to impart carefully maintaining their vehicle and can increase driving safety.

MODULE I MAINTENANCE, WORKSHOP PRACTICES, SAFETY AND TOOLS **7**

Maintenance – Need, importance, primary and secondary functions, policies - classification of maintenance work - vehicle insurance - basic problem diagnosis. Automotive service procedures – workshop operations – workshop manual - vehicle identification. Safety – Personnel, machines and equipment, vehicles, fire safety - First aid. Basic tools – special service tools – measuring instruments – condition checking of seals, gaskets and sealants. Scheduled maintenance services – service intervals - Towing and recovering.

MODULE II ENGINE AND ENGINE SUBSYSTEM MAINTENANCE **8**

General Engine service- Dismantling of Engine components- Engine repair- working on the underside, front, top, ancillaries- Service of basic engine parts, cooling and lubricating system, fuel system, Intake and Exhaust system, electrical system - Electronic fuel injection and engine management service - fault diagnosis- servicing emission controls.

MODULE III TRANSMISSION AND DRIVELINE MAINTENANCE **8**

Clutch- general checks, adjustment and service- Dismantling, identifying, checking and reassembling transmission, transaxle- road testing- Removing and replacing propeller shaft, servicing of cross and yoke joint and constant velocity joints- Rear axle service points- removing axle shaft and bearings- servicing differential assemblies- fault diagnosis.

MODULE IV STEERING AND SUSPENSION MAINTENANCE 7

Maintenance and Service of Mc person strut, coil spring, leaf spring, shock absorbers. Dismantling and assembly procedures. Inspection, Maintenance and Service of steering linkage, steering column, Rack and pinion steering, Recirculating ball steering service- Worm type steering, and power steering system.

MODULE V BRAKE AND WHEEL MAINTENANCE 7

Inspection, Maintenance and Service of Hydraulic brake, Drum brake, Disc brake, parking brake. Bleeding of brakes. Wheel alignment and balance, removing and fitting of tyres, tyre wear and tyre rotation.

MODULE VI AUTO ELECTRICAL AND AIR CONDITIOING MAINTENANCE 8

Maintenance of batteries, starting system, charging system and body electrical -Fault diagnosis using Scan tools. Maintenance of air conditioning parts like compressor, condenser, expansion valve, evaporator - Replacement of hoses- Leak detection- AC Charging- Fault diagnosis Vehicle body repair like panel beating, tinkering, soldering, polishing, painting.

L – 45; Total Hours –45

TEXT BOOKS:

1. Ed May, "Automotive Mechanics Volume One" , Mc Graw Hill Publications, 2003
2. Ed May, "Automotive Mechanics Volume Two" , Mc Graw Hill Publications, 2003
3. Vehicle Service Manuals of reputed manufacturers
4. Vehicle maintenance and garage practice by Jigar A.Doshi Dhru U.Panchal,Jayesh P.Maniar. 2014
5. A Practical Approach to Motor Vehicle Engineering and Maintenance 3rd Edition by Allan Bonnick.

REFERENCES:

1. Bosch Automotive Handbook, Sixth Edition, 2004.
2. Advanced Automotive Fault Diagnosis by Tom Denton 2011.
3. Nissan Patrol Automotive Repair Manual: 1998-2014 by Haynes Manuals Inc.
4. Automobile electrical manual a comprehensive guide by Haynes manual car repair.

OUTCOMES:

On completion of the course student should be able to

- Prepare maintenance schedules and procedures with appropriate tools.
- Demonstrate the procedure and methods to repair and calibrate the engine.
- Analyze the causes and remedies for fault in transmission and drive line systems.
- Analyze the causes and remedies of steering and suspension systems.
- Analyze the causes and remedies of brake system.
- Demonstrate the procedure for wheel alignment and wheel balanced.

GECX117 FUNDAMENTALS OF DIGITAL IMAGE PROCESSING

L	T	P	C
3	0	0	3

OBJECTIVES:

- Describe and explain basic principles of digital image processing
- Design and implement algorithms that perform basic image processing
- Design and implement algorithms for advanced image analysis
- Assess the performance of image processing algorithms and systems

PRE-REQUISITES:

- Basic knowledge of transforms in Mathematics

MODULE I DIGITAL IMAGE FUNDAMENTALS 8

Elements of Image Processing System, Fundamentals steps in Digital Image Processing, Image Sampling & Quantization, Spatial and Gray Level Resolution.

MODULE II COLOR IMAGE PROCESSING 8

Fundamental of color image processing, color models- RGB, CMY, HIS, Pseudo color image processing

MODULE III IMAGE ENHANCEMENT 7

Basic gray level Transformations, Histogram Processing, Spatial Filtering

MODULE IV IMAGE TRANSFORMS 7

2D-DFT, DCT, Haar Transform, Fundamentals of 2D-wavelet transform, sub-band coding

MODULE V IMAGE SEGMENTATION AND RESTORATION 8

Point, line and edge detection methods ,Image Segmentation and its types, Restoration: Noise model, Inverse filter and Wiener filter.

MODULE VI IMAGE COMPRESSION 7

Fundamentals of redundancies, Basic Compression Methods: Huffman coding, Arithmetic coding, JPEG and MPEG Compression standards.

TOTAL HOURS 45

TEXT BOOKS

1. Gonzalez and Woods, "Digital Image Processing", 3rd Edition, Pearson Education, 2016.
2. Anil. K. Jain, "Fundamentals of Digital Image Processing"; 4th Edition, PHI, 2007

REFERENCES

1. Pratt William, "Digital Image Processing", John Wiley & Sons, 2007.
2. Arthur Weeks Jr., "Fundamentals of Digital Image Processing", PHI, 2006.

OUTCOMES:

On completion of the course, students will be able to

- Explain the fundamental concepts of digital image processing.
- Discuss about color image processing
- Recognize & apply various image enhancement techniques.
- Apply various transforms for image processing.
- Apply various techniques for image segmentation and restoration.
- Identify and use appropriate image compression techniques

Group II courses
(To be offered in VII Semester)

		L	T	P	C
GECX201	**GREEN DESIGN AND SUSTAINABILITY**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To impart knowledge to face challenges, the technology poses for water, energy, and climate change by implementing sustainable design.

MODULE I CONCEPTS OF SUSTAINABLE DEVELOPMENT 7

Objectives of Sustainable Development - Need for sustainable development-Environment and development linkages - Globalisation and environment-Population, poverty and pollution- global, regional and local environment issues-Green house gases and climate change.

MODULE II SUSTAINABLE DEVELOPMENT OF SOCIO ECONOMIC SYSTEMS 8

Demographic dynamics of sustainability- Policies for socio economic development- Sustainable Development through trade- Economic growth- Action Plan for implementing sustainable development- Sustainable Energy and Agriculture.

MODULE III FRAME WORK FOR ACHIEVING SUSTAINBAILITY 7

Sustainability indicators- Hurdles to sustainability- Business and Industry – Science and Technology for Sustainable Development- Performance indicators of sustainability and assessment mechanism- Constraints and barriers of Sustainable Development.

MODULE IV GREEN BUILDINGS 8

Introduction to Green Building- Energy- Water- Materials and Resources - Sustainable Sites and Land Use - Indoor Environmental Quality- Life Cycle Assessment- Energy, water and materials efficiency.

MODULE V ENERGY CONSERVATION AND EFFICIENCY 7

Energy savings- Energy Audit- Requirements- Benefits of Energy conservation-Energy conservation measures for buildings- Energy wastage- impact to the environment.

MODULE VI GREEN BUILDINGS DESIGN 8

Elements of Green Buildings Design- Foundation, Electrical, Plumbing, flooring, Decking, roofing, insulation, wall coverings, windows, siding, doors and finishing, LEED certification for Green Buildings, Green Buildings for sustainability.

L – 45; Total Hours –45

TEXT BOOKS:

1. Kirby, J., Okeefe, P., and Timber lake, “Sustainable Development”, Earthscan Publication, London, 1995.

REFERENCES:

1. Charles Kibert, J., “Sustainable Construction: Green Building Design and Delivery”, 2nd Edition, John Wiley and sons, 2007.

OUTCOMES:

At the end of the course, the students will be able to

- Explain the relationship between sustainability and emergence of green building practices.
- Address the economic, environmental, and social concerns.

		L	T	P	C
GECX202	**APPROPRIATE TECHNOLOGY**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To impart students knowledge about the basics and applications of various appropriate technologies in the field of civil engineering.

MODULE I BASICS CONCEPTS 7

Back ground, Tools, Choices and Implications, Appropriate Technology Movement (an overview) - Basic design process, basic financial analysis-discounted cash flow, and energy fundamentals.

MODULE II APPROPRIATE TECHNOLOGY WITH REFERENCE TO BUILDING DESIGN 7

Appropriate Building Materials, Appropriate Energy Saving Techniques, Water Conservation (Indoor), Rain Water Harvesting.

MODULE III WATER, HEALTH AND SANITATION MANAGEMENT 7

Water Storage: Designing Dams and Pipelines, Appropriate Selection for Sanitation Technique, Sewerage, Communal Health and Waste Water Recycling.

MODULE IV WASTE MANAGEMENT 8

Types of Waste - Sources - Collections and On-Site Processing -Transferring Stations - Disposal Systems - Recycling.

MODULE V ENERGY EFFICIENT TECHNIQUES 8

Green building concepts-renewable energy sources- Solar – Steam and wind-Biofuels - Biogas – Electricity.

MODULE VI TECHNOLOGY POLICY 8

Government Policies- Energy Policy-Appropriate technology Development Centre-its function and responsibilities-Building policies-Case Studies.

L – 45; Total Hours –45

TEXT BOOKS:

1. Barrett Hazeltine and Christopher Bull, “Appropriate Technology: Tools Choices and Implications”, Academic Press, Orlando, USA, 1998.
2. Ken Darrow and Mike Saxenian, “Appropriate Technology Source Book : A Guide to Practical Books for Village and Small Community Technology”, Stanford, 1986.

REFERENCES:

1. Richard Heeks, “Technology and Developing Countries: Practical Applications Theoretical Issues”, 1995.
2. John Pickford, “The Worth of Water : Technical Briefs on Health, Water and Sanitation”, Intermediate Technology Publications, 1998.

OUTCOMES:

- At the end of the course, the students will be able to use suitable technologies for various conditions for sustainable development.

GECX203	ENGINEERING SYSTEM MODELLING AND SIMULATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the concepts, techniques, tools for modeling and simulation systems and environments through the use of computers.
- To study the various aspects of discrete dynamic, stochastic systems modeling and conducting experiments with those models on a computer.

MODULE I INTRODUCTION 6

Systems – Modelling – types – systems components – Steps in model building- Simulation Algorithms and Heuristics; Simulation Languages.

MODULE II RANDOM NUMBERS / VARIATES 7

Random numbers – methods of generation – random variates for standard distributions like uniform, exponential, Poisson, binomial, normal etc. – Testing of Random variates – Monte Carlo Simulation.

MODULE III MODELLING PROCESS 7

Primitive Models : Establishing relationships via physical laws; Establishing relationships via curve fitting; Parameters estimation problems; Elementary state transition models.

MODULE IV DESIGN OF SIMULATION EXPERIMENTS 9

Steps on Design of Simulation Experiments – Development of models using of Highlevel language for systems like Queuing, Inventory, Replacement, Production etc., – Model validation and verification, Output analysis.

MODULE V SIMULATION LANGUAGES 10

Need for simulation Languages – Comparisons & Selection of Languages – GPSSARENA- EXTEND – Study of any one of the languages.

MODULE VI CASE STUDIES USING SIMULATION LANGUAGES 6

L – 45; Total Hours –45

REFERENCES:

1. Law, A.M., & W.D. Kelton, “Simulation Modelling and Analysis”, McGraw Hill, Singapore, 2000.
2. Harrel, C.R., et. al., “System Improvement Using Simulation”, 3rd Edition, JMI Consulting Group and ProModel Corporation, 1995.
3. Harrel, C.R. & T. Kerim, “Simulation Made Easy, A Manager’s Guide”, IIE Press, 1995.
4. Geoffrey Gordon, “Systems Simulation”, Prentice Hall, 2002.
5. David Kelton, Rondall P Sadowski, David T Sturrock, “Simulation with Arena”, Mc Graw Hill, 2004.

OUTCOMES:

The student should be able to

- Model and simulate systems and environments through the use of computers.
- Conduct experiments with discrete dynamic, stochastic system models on a computer.

GECX204 VALUE ANALYSIS AND ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To get acquainted with value analysis and engineering tool for productivity improvement.
- To understand and analyze the theory and methodology of Value Engineering.

MODULE I VALUE ENGINEERING BASICS 8

Origin of Value Engineering, Meaning of value, Definition of Value Engineering and Value analysis, Difference between Value analysis and Value Engineering, Types of Value, function - Basic and Secondary functions, concept of cost and worth, creativity In Value Engineering.

MODULE II VALUE ENGINEERING JOB PLAN AND PROCESS 6

Seven phases of job plan, FAST Diagram as Value Engineering Tool, Behavioural and organizational aspects of Value Engineering, Ten principles of Value analysis, Benefits of Value Engineering.

MODULE III ORIENTATION AND INFORMATION PHASES 8

Launching Value Engineering project work - Objectives and Targets - VE Project work: a time-bound programme - Projects and Teams - Time Schedule - Co-ordination - Consultant. Technical data - Marketing related information - Competition profile - Cost data - Materials Management related information - Quality related information - Manufacturing data.

MODULE IV FUNCTION ANALYSIS AND CREATIVE PHASES 9

Objectives - Function definition - Classification of functions - Higher level functions – Function – Cost – Function – Worth - Value Gap - Value index - How to carry out Function Analysis? – Fast Diagraming - Cost Modelling.

Creativity - How to improve creativity of an individual? – How to promote creativity in the organisation? - Obstacles to Creativity - Mental road blocks - Creativity killer phrases. Positive thinking - Ideas stimulators - Creativity techniques - Brainstorming.

MODULE V EVALUATION, INVESTIGATION AND RECOMMENDATION **6**

Paired comparison and Evaluation Matrix techniques - Criteria for selection of VE solutions. Design – Materials – Quality – Marketing – Manufacturing - Preview session. The report - presentation.

MODULE VI IMPLEMENTATION PHASE AND CASE STUDIES **8**

Design department - Materials department - Production Planning & Control - Quality Control – Manufacturing – Marketing - Need for co-ordinated teams - The Action Plan. Value Engineering case studies.

L – 45; Total Hours –45

TEXT BOOKS:

1. Mudge, Arthur E. “Value Engineering- A systematic approach”, McGraw Hill, New York, 2000.
2. Kumar S, Singh R K and Jha J K (Ed), “Value Engineering”, Narosa Publishing House, 2005.

REFERENCES:

1. Park RJ, “Value Engineering: A Plan for Invention”, St.Lucie Press, New York, 1999.
2. Lawrence, D.M., “Techniques of Value Analysis and Engineering”, McGraw Hill 1988.
3. George, E.D., “Engineering Design: a Material and Processing Approach”, McGraw Hill, 1991.
4. Heller, D.E., “Value Management, Value Engineering and Cost Reduction”, Addison Wesley, 1988.

OUTCOMES:

- The student will be able to realize the value of products, processes and implement value analysis to achieve productivity improvement.

GECX205 INDUSTRIAL SAFETY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the various safety measures to be taken in different industrial environments.

MODULE I SAFETY MANAGEMENT **7**

Evolution of modern safety concept- Safety policy - Safety Organization - line and staff functions for safety- Safety Committee- budgeting for safety. safety education and training.

MODULE II SAFETY IN MANUFACTURING **7**

Safety in metal working-Machine guarding -Safety in welding and gas cutting - Safety in cold forming and hot working of metals -Safety in finishing, inspection and testing -Regulation.

MODULE III SAFETY IN CONSTRUCTION **8**

General safety consideration in Excavation, foundation and utilities – Cordoning – Demolition – Dismantling –Clearing debris – Types of foundations – Open footings.

Safety in Erection and closing operation - Safety in typical civil structures – Dams-bridges-water Tanks-Retaining walls-Critical factors for failure-Regular Inspection and monitoring.

MODULE IV ELECTRICAL SAFETY **8**

Electrical Hazards – Energy leakage – Clearance and insulation – Excess energy – Current surges – Electrical causes of fire and explosion – National electrical Safety code.

Selection of Environment, Protection and Interlock – Discharge rods and earthing device – Safety in the use of portable tools - Preventive maintenance.

MODULE V SAFETY IN MATERIAL HANDLING **8**

General safety consideration in material handling devices - Ropes, Chains, Sling, Hoops, Clamps, Arresting gears – Prime movers.

Ergonomic consideration in material handling, design, installation, operation and maintenance of Conveying equipments, hoisting, traveling and slewing mechanisms.

Storage and Retrieval of common goods of shapes and sizes in a general store of a big industry.

MODULE VI SAFETY EDUCATION AND TRAINING 7

Importance of training-identification of training needs-training methods – programme, seminars, conferences, competitions – method of promoting safe practice - motivation – communication - role of government agencies and private consulting agencies in safety training – creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign – Domestic Safety and Training.

L – 45; Total Hours –45

REFERENCES:

1. Krishnan N.V, “Safety Management in Industry”, Jaico Publishing House, Bombay, 1997.
2. Blake R.B., “Industrial Safety”, Prentice Hall, Inc., New Jersey, 1973.
3. Fulman J.B., “Construction Safety, Security, and Loss Prevention”, John Wiley and Sons, 1979.
4. Fordham Cooper W., “Electrical Safety Engineering”, Butterworths, London, 1986.
5. Alexandrov M.P., “Material Handling Equipment”, Mir Publishers, Moscow, 1981.

OUTCOMES:

Students would be able to

- Acquire knowledge on various safety Hazards.
- Carry out safety measures for different industrial environments.

GECX206 ADVANCED OPTIMIZATION TECHNIQUES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the various advanced optimization tools.
- To provide an understanding to deal with ill identified and fuzzy problems.

MODULE I INTRODUCTION **7**

Review of conventional optimization techniques - limitations - limitation of exhaustive search - need for artificial intelligence - bio mimicking methods

MODULE II HEURISTICS METHODS **8**

Introduction – Advanced methods of algorithm design: Greedy method, Backtracking method, Divide and Conquer method – Dynamic programming – Heuristics exploration algorithms – Greedy search - Local search – Hill climbing – Tabu search – Gradient search – Beam search – Simulated Annealing.

MODULE III GENETIC ALGORITHM **7**

Introduction - Basics of GA – Population – Reproduction – Cross over – Mutation -genetic algorithms in search, optimization and machine learning-practical genetic algorithms.

MODULE IV ANT COLONY OPTIMIZATION **8**

Introduction: Ant Colony Optimization – Meta-heuristic Optimization – History – The ACO Meta-heuristic – ACO Algorithms: Main ACO – Ant system – Ant colony system – Max-Min Ant system – Applications: Routing in telecommunication networks – Travelling salesmen – Graph Coloring – Advantages & Disadvantages

MODULE V FUZZY LOGIC AND ANN **8**

Fuzzy logic, knowledge representation and inference mechanism – Fuzzy and expert control – standard Takagi-Sugeno mathematical characterizations – Design example – Biological foundations to intelligent systems: Artificial neural networks, Back-propagation networks, Radial basis function networks, and recurrent networks.

MODULE VI IMPLEMENTATIONS & APPLICATIONS 7

Reduction of size of an optimization problem – multilevel optimization – parallel processing – multi objective optimization – Job shop scheduling – Vehicle scheduling – Line balancing – Sensor integration.

L – 45; Total Hours –45

REFERENCES:

1. Singiresu S. Rao, “Engineering optimization – Theory and practices”, John Wiley and Sons, 1996.
2. Ravindran – Phillips –Solberg, “Operations Research – Principles and Practice, John Wiley and Sons, 1987.
3. Fredrick S.Hillier and G.J.Liberman, “Introduction to Operations Research”, McGraw Hill Inc. 1995.
4. Kalymanoy Deb, “Optimization for Engineering Design”, PHI, 2003
5. Christos H. Papadimitriou, Kenneth Steiglitz, Combinatorial Optimization, PHI 2006

OUTCOMES:

At the end of the course student will be able to

1. Formulate a real life situation as an optimization the problem.
2. Identify the appropriate solution methodology and provide a solution

GECX207	MATLAB SIMULINK	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Teach students how to mathematically model engineering systems
- Teach students how to use computer tools to solve the resulting mathematical models. The computer tool used is MATLAB and the focus will be on developing and solving models of problems encountered in engineering fields

MODULE I INTRODUCTION MATLAB DATA PRESENTATION

Vectors, Matrices -Vector/Matrix Operations & Manipulation- Functions vs scripts- Making clear and compelling plots-Solving systems of linear equations numerically and symbolically- Least squares regression -Curve fitting.

MODULE II MATLAB PLOT FUNCTION

Introduction- Plot Function – Animation- 3D Plots-Customizing Plots – Plot Applications- Saving &Painting Plots.

MODULE III ROOT FINDING AND COMPUTER REPRESENTATION OF NUMBERS

Linearization and solving non-linear systems of equations- The Newton-Rapson method- Integers and rational numbers in different bases- Floating point numbers- Round off and errors in basic arithmetic-Significant digits when reporting results

MODULE IV ORDINARY DIFFERENTIAL EQUATIONS

Numerical integration and solving 1^{st} order, ordinary differential equations (Euler's method and Runge-Kutta)- Use of ODE function in MATLAB

MODULE V NON-LINEAR DIFFERENTIAL EQUATIONS

Converting 2^{nd} order and higher ODEs to systems of 1^{st} order ODEs- Solving systems of ODEs via Euler's method and Runge-Kutta)- Solving single and systems of non-linear differential equations by linearization-Use of the function ODE in MATLAB to solve differential equations

MODULE VI INTRODUCTION OF SIMULINK

Simulink & its relations to MATLAB – Modeling a Electrical Circuit- Modeling a fourth order differential equations- Modeling the solution of three equations with three unknowns- Representing a model as a subsystem-Simulink demos.

L – 45; Total Hours –45

REFERENCES:

1. Griffiths D V and Smith I M, Numerical Methods for Engineers, Blackwell, 1991.
2. Laurene Fausett, Applied Numerical Analysis Using MATLAB, Pearson 2008.
3. Moin P, Fundamentals of Engineering Numerical Analysis, Cambridge University Press, 2001.
4. Wilson HB, Turcotte LH, Advanced mathematics and mechanics applications using MATLAB. CRC Press, 1997
5. Ke Chen, Peter Giblin and Alan Irving , Mathematical Exploration with MATLAB, Cambridge University Press, 1999.

OUTCOMES:

At the end of this unit students will be able to:

1. Use Matlab as a convenient tool for solving a broad range of practical problems in engineering from simple models to real examples.
2. Write programs using first principles without automatic use of built-in ones.
3. Write programs for solving linear and nonlinear systems, including those arising from boundary value problems and integral equations, and for root-finding and interpolation, including piecewise approximations.
4. Be fluent in exploring Matlab's capabilities, such as using matrices as the fundamental data-storage unit, array manipulation, control flow, script and function m-files, function handles, graphical output.
5. Make use of Maltab visual capabilities for all engineering applications.
6. An ability to identify, formulate, and solve engineering problems. This will be accomplished by using MATLAB to simulate the solution to various problems in engineering fields

GECX208	EMBEDDED SYSTEMS AND ITS APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide a detailed overview of embedded system.
- To equip students with the software development skills necessary for practitioners in the embedded systems field.
- To understand entire software development lifecycle and examine the various issues involved in developing software for embedded systems.

MODULE I EMBEDDED SYSTEMS OVERVIEW 8

Introduction –Embedded Systems vs. General computing systems- Fundamental Components of embedded systems- Characteristics- Challenges-Examples- Embedded System design process.

MODULE II EMBEDDED COMPUTING PLATFORM 8

Overview of Processors and hardware units in an embedded system-CPU buses – Memory devices –Memory types- I/O devices – Designing with computing platforms- Consumer electronics architecture-Design example: Alarm clock.

MODULE III REAL TIME EMBEDDED SYSTEMS 8

Programming embedded systems in assembly and C – Real time systems – Hard and Soft real time systems- Need for RTOS in Embedded Systems- Multiple tasks and processes –Context switching-Scheduling policies- Interprocess communication and synchronization.

MODULE IV EMBEDDED SOFTWARE DEVELOPMENT PROCESS and TOOLS 8

Development process of an embedded system-software modules and tools for implementation of an embedded system- Integrated development environment- Host and target machines-cross compiler-cross assembler-Choosing right platform.

MODULE V PROGRAM MODELING IN EMBEDDED SYSTEMS 8

Program Models – Data Flow Graph model-control DFG model-Synchronous DFG model- Finite state machines- UML modeling – UML Diagrams.

MODULE VI EMBEDDED SYSTEMS APPLICATION 5

Application specific embedded system – case study: digital camera hardware and software architecture, embedded systems in automobile, embedded system for a smart card.

Total Hours –45

TEXT BOOKS:

1. Marilyn Wolf , "Computers as components", Elsevier 2012.
2. Shibu. K.V, “Introduction to Embedded Systems”, Tata Mcgraw Hill,2009.
3. Rajkamal, "Embedded Systems Architecture, Programming and Design",1st Reprint,Tata McGraw-Hill, 2003
4. Frank Vahid and Tony Gwargie, "Embedded System Design", John Wiley & sons, 2002.

REFERENCES:

1. Sriram V Iyer and PankajGupta ,”Embedded Realtime Systems Programming ”Tata McGraw-Hill,2008
2. Qing Li and Carolyn Yao," Real-Time Concepts for Embedded Systems", CMPBooks, 2003
3. David E.Simon, "An Embedded Software Primer", Pearson Education, 2003

OUTCOMES:

On completion of this course, the students will be able to

- Identify the suitable processor and peripherals in embedded applications
- Develop embedded programs in assembly and c
- Choose the right platform for designing an embedded system
- Explore different scheduling mechanism in rtos
- Design the program model for embedded applications.
- Analyze different domain specific applications in embedded systems.

GECX209 USABILITY ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

The objective of this course is

- To understand the emerging concept of usability, requirements gathering and analysis.
- To learn about human computer interaction with the help of interfaces that has high usability.

MODULE I INTRODUCTION 6

Cost Savings – Usability Now – Usability Slogans – Discount Usability Engineering – Usability – Definition – Example – Trade-offs – Categories – Interaction Design – Understanding & Conceptualizing Interaction – Cognitive Aspects.

MODULE II USER INTERFACES 8

Generation of User Interfaces – Batch Systems, Line Oriented Interfaces, Full Screen Interfaces, Graphical User Interfaces, Next Generation Interfaces, Long Term Trends – Usability Engineering Life Cycle – Interfaces – Data Gathering – Data Analysis Interpretation and Presentation.

MODULE III INTERACTION DESIGN 8

Process of Interaction Design - Establishing Requirements – Design,Prototyping and Construction - Evaluation and Framework.

MODULE IV USABILITY TESTING 8

Usability Heuristics – Simple and Natural Dialogue, Users' Language, Memory Load, Consistency, Feedback, Clearly Marked Exits, Shortcuts, Error Messages, Prevent Errors, Documentation, Heuristic Evaluation – Usability Testing - Test Goals and Test Plans, Getting Test Users, Choosing Experimenters, Ethical Aspects, Test Tasks, Stages of a Test, Performance Measurement, Thinking Aloud, Usability Laboratories.

MODULE V USABILITY ASSESSMENT METHODS 8

Observation, Questionnaires and Interviews, Focus Groups, Logging Actual Use, User Feedback, Usability Methods – Interface Standards - National, International and Vendor Standards, Producing Usable In-House Standards.

MODULE VI USER INTERFACES 7

International Graphical Interfaces, International Usability Engineering, Guidelines for Internationalization, Resource Separation, Multilocale Interfaces – Future Developments – Case Study.

L – 45; Total Hours –45

TEXT BOOKS:

1. Yvonne Rogers, Helen Sharp, Jenny Preece, “Interaction Design: Beyond Human - Computer Interaction”, John Wiley & Sons, 3rd Edition, 2011 (Module I, II, III).
2. Jakob Nielsen, “Usability Engineering”, Morgan Kaufmann Academic Press, 1994. (Module I – VI).

REFERENCES:

1. Ben Shneiderman, Plaisant, Cohen, Jacobs, “Designing the User Interface: Strategies for Effective Human Interaction”, Pearson Education, 5th Edition, 2010.
2. Laura M. Leventhal, Julie A. Barnes, “Usability Engineering: Process, Products, and Examples”, Pearson/Prentice Hall, 2008

OUTCOMES:

Students who complete this course will be able to

- build effective, flexible and robust user interfaces.
- translate system requirements into appropriate human/computer interaction sequences.
- choose mode, media and device for the application requirements.

GECX210	SUPPLY CHAIN MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the various decision phases in a supply chain
- To be aware of the Supply Chain and its drivers
- To design Supply Chain Network
- To build a aggregate plan in supply chain
- To understand Sourcing Decisions in Supply Chain
- To comprehend the influence of Information technology in Supply Chain

MODULE I INTRODUCTION TO SUPPLY CHAIN 7

Understanding Supply Chain - Decision phases - Supply chain performance - Competitive and supply chain strategies - Achieving strategic fit - Expanding strategic scope

MODULE II SUPPLY CHAIN DRIVERS AND DESIGN 7

Drivers of supply chain performance – Designing distribution network - Network Design in the Supply Chain - Network design in Uncertain Environment

MODULE III AGGREGATE PLANNING AND MANAGING SUPPLY, DEMAND AND INVENTORY 8

Aggregate Planning in a Supply chain: role - Managing Supply - Managing Demand in Supply Chain – Cycle and Safety inventory in supply chain – Level of product availability.

MODULE IV MANAGING INVENTORY IN SUPPLY CHAIN 8

Managing Economies of Scale in a Supply Chain : Cycle Inventory- Managing uncertainty in a Supply Chain Safety Inventory- Determining optimal level of Product Availability

MODULE V SOURCING AND TRANSPORTATION 8

Sourcing decision in supply chain - Third and Fourth – Party Logistics providers - Supplier scoring and assessment - Transportation in a Supply Chain – Risk and Trade-offs in transportation design.

MODULE VI INFORMATION TECHNOLOGY IN A SUPPLY CHAIN 7

Information technology in a supply chain – CRM, ISCM, SRM in supply chain - Over view of recent trends in Supply Chain: e-SRM, e-LRM, e-SCM.

L – 45; Total Hours –45

REFERENCES:

1. Sunil Chopra and Peter Meindl, “Supply Chain Management-Strategy Planning and Operation”, Pearson Education, 5th Indian Reprint, 2013.
2. Jananth Shah “Supply Chain Management – Text and Cases“ Pearson Education, 2008.
3. Altekar Rahul V, “Supply Chain Management-Concept and Cases”, Prentice Hall India, 2005.
4. Monczka et al., “Purchasing and Supply Chain Management”, Thomson Learning, 2nd Edition, 2nd Reprint, 2002.

OUTCOMES:

- After taking up the course the student will be able to brighten his prospects of taking up a career on supply chain management.
- The student decision making capability specific to supply chain issues in an industry is improved.
- The student can plan a well defined execution of supply chain strategy in companies.
- The student will be able to design a optimal distribution network as per the demands of the industry.
- The student can also determine the most favorable transportation plan for a company.
- The student will also be able to bring in company from paper environment to paperless environment.

GECX211 SYSTEMS ANALYSIS AND DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To describe the phases of the systems development life cycle
- To teach the automated tools for system development
- To develop and evaluate system requirements.
- To explain the organizational issues in system implementation
- To teach the usability testing and electronic data interchange
- To elucidate the importance of System analysis and design in electronic commerce.

MODULE I FUNDAMENTALS OF SYSTEM DEVELOPMENT 8

System Concept – Characteristics – Elements of System – Types of System – Modern Approach to System Analysis and Design – System Development Life Cycle – Approaches to Improving Development – Tools for System Development – Succeeding as a System Analyst – Skills – Managing the Project.

MODULE II AUTOMATED TOOLS FOR SYSTEMS DEVELOPMENT 7

What is requirements determination? Fact finding techniques, Tools for documenting procedure and decision-CASE Tools-Need for CASE tools-Reverse engineering and reengineering- phases of the software life cycle-Ranking projects-Value Chain Analysis- Corporate Strategic Planning vs. Information Systems Planning.

MODULE III SYSTEM ANALYSIS 8

Determining System Requirements – Traditional Methods - Modern Methods – Radical Methods – Structuring System Requirements – Process Modeling – Data Flow Diagramming – Logic Modeling – Conceptual Data Modeling – E-R Modeling.

MODULE IV SYSTEM DESIGN 8

System Implementation – Software Application Testing – Installation – Documentation – Training and Support – Organizational Issues in Systems Implementation – Maintaining Information System – Conducting System Maintenance.

MODULE V USABILITY AND MEASURING USER SATISFACTION 7

Usability Testing-User satisfaction test- A tool for analyzing user satisfaction – Unified Modeling Language(UML)- Case study: System Design: Application in Human Resource-Financial Applications

MODULE VI SAD IN E-COMMERCE 7

Systems analysis and design in the era of electronic commerce: B2B, B2C and C2C e-commerce -advantages and disadvantages of e-commerce. E-commerce system architecture – physical networks, logical network, World Wide Web, web-services - HTML, XML - case studies-El electronic data interchange: EDI standards - virtual private networks - XML and EDI

L – 45; Total Hours –45

REFERENCES:

1. Jeffrey A. Hoffer, Joey F. George, Joseph S. Valacich, “Modern Systems Analysis and Design”,Fifth Edition, Prentice Hall,March 2007.

2.Ned Kock, “Systems Analysis & Design Fundamentals” Sage South Asia, May 2008.

3. Joseph S. Valacich, Jeffrey A. Hoffer, Joey F. George, “Essentials Of System Analysis And Design” Prentice Hall , August 2005.

4. Rumbaugh et al, “Succeeding with Booch and Rambaugh Methods”, Addisson Wesley, second Edition, 1998.

5.Larman, C.,” Applying UML and Patterns. An introduction to Object-Oriented Analysis and Design”. Prentice-Hall PTR, 2002.

OUTCOMES:

- List the characteristics of the system and specify the approaches in the development of the system.
- Summarize the phases of the software life cycle
- Differentiate Corporate Strategic Planning and Information Systems Planning.
- Illustrate the system requirements through various modeling diagrams.
- Use tools and techniques for process and data modeling.
- Solve realistic systems analysis problems and perform user satisfaction test.

GECX212	ADVANCED MATERIALS	L	T	P	C
		3	1	0	4

OBJECTIVES:

To make the student conversant with

- Dielectric materials
- Magnetic materials
- Energy materials
- Nano materials
- Semi conductors
- Smart materials

MODULE I

Dielectric Materials- Polarization and Mechanism-Internal or local field-Clausius-Mossotti relation- Dielectric loss- Temperature and Frequency effect- Measurement of Dielectric constant and loss using Scherring bridge- electric break down- ferro, piezo, pyroelectric materials and its application.

MODULE II

Magnetic Materials- Terminology and classification of magnetic materials (Dia, Para, Ferro & Ferri) – Magnetic moments due to electrospin – Domain theory of Hysteresis – Heisenberg theory of Exchange Interaction (without derivation)- Structure and properties of Ferrites- Properties of Soft and Hard Magnetic Materials- Application: floppy disk, CD ROM, Magneto optical recording.

MODULE III

Energy Materials (Nuclear) - Introduction to nuclear materials- Materials for nuclear fuel in fission and fusion reactors, Fissile and fertile materials- Control & Construction Materials for Nuclear reactors, Moderators, Heat Exchangers- Radiation proof materials- Brief discussion of safety and radioactive waste disposal.

MODULE IV

Nano Materials- The nanosize range- classification of nanomaterials- processing of nanomaterials-properties of nanomaterials- mechanical, electrical, magnetic properties- other properties- carbon based nanomaterials- other nanomaterials and its application.

MODULE V

Semiconductors- The energy gap in solids-Extrinsic Semiconductors- Intrinsic Semiconductors- Hall Effect in semiconductors- Application of Hall Effect- Basic ideas of compound semiconductors -Semiconductor materials- Fabrication of Integrated Circuits- Some semiconductor Devices

MODULE VI

Smart materials- aerospace materials Ni and Co based super alloys, Special steels, Titanium alloys, Intermetallics, ceramics and their composites, New High strength material, Properties of Materials, Materials in Medical Applications, Stainless steel alloys,Cobalt based alloys, titanium based alloys, polymers

L – 45; Total Hours –45

REFERENCES:

1. Materials science and Engineering: A first course by V. RAGHAVAN, 6th ed., Eastern Economy edition,Prentice Hall of India,2015
2. Materials science and Engineering: An Introduction by William D. Callister Jr., 7th ed. John Wiley & Sons Inc. 2007
3. Material science by Dr.M.Arumugam, Anurasha agencies ,third revised edition ,2002

OUTCOMES:

Students will be able to know

- significance of dielectric materials
- types and applications of magnetic materials
- applications of nuclear materials for energy harvesting
- applications of nano materials
- significance of semi conductor devices
- applications of smart materials

GECX213	NATIONAL SERVICE SCHEME	L	T	P	C
		2	0	0	2

OBJECTIVES:

Primary Objective: Personality development through community service.
To achieve the above objective, the following should be adhered:

1. To provide an understanding about the aims, structure and programmes and activities of National Service scheme in terms of Nation Building
2. To develop certain basic skills for personality development through community development.
3. Understand the community in which they work and their relation
4. Identify the needs and problems of the community and involve them in problem-solving and
5. Practice national integration and social harmony.

MODULE I INTRODUCTION TO NSS 8

Orientation and structure of NSS,-Aims and Objectives of National Service Scheme- The history of NSS- Symbol and meaning- NSS hierarchy from national to college level – Role and responsibilities of various NSS functionaries

MODULE II PERSONALITY AND COMMUNITY DEVELOPMENT SKILLS 8

Importance of youth Leadership, Traits of Good Leadership and Personality Development. Role of youth in creating awareness through NSS Programmes on Health & Hygiene; Environmental Conservation and Enrichment for Sustainable Development; Sanitation and Swachh Bharat.

MODULE III UNDERSTANDING YOUTH 7

Definition and Profiles of youth categories, Youth Issues, Challenges and Opportunities for Youth, Youth as agent of social change & Community Mobilization .Role of Youth in Nation Building. National Youth Policy.

MODULE IV SOCIAL HARMONY AND NATIONAL INTEGRATION 7

National Integration, Various obstacles in the way of National Integration; such as caste, religion, language and provisional problems etc. Role of youth in Peace

building and conflict resolution- Globalization and its Economic Social Political and Cultural impacts.

L – 30; Total Hours –30

TEXT BOOKS:

1. National Service Scheme – A Youth Volunteers Programme for Under Graduate students as per UGC guidelines J.D.S.Panwar et al. Astral International. New Delhi.
2. National Service Scheme Revised Manual, 2006.Govt. of India. Ministry of Youth Affairs & Sports. New Delhi.
3. Social Problems in India, *Ram Ahuja.*

REFERENCES:

1. National Youth Policy-2014. Ministry of Youth Affairs & Sports. .Govt. of India

OUTCOMES:

On successful completion of this course-

- Students will have exposure to the the aims, structure and programmes and activities of National Service scheme in terms of Nation Building
- Students will be trained to skills for personality development through community development.
- Students will gain knowledge about national integration and social harmony.
- Students will be exposed to the role of youths in Nation building Students will gain

GECX214	AUTOMOTIVE POLLUTION AND CONTROL	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To have a fair knowledge in automotive pollution control.
- To understand the concept of formation and control techniques of pollutants like UBHC, CO, NOx, particulate matter and smoke for both SI and CI engine will be taught to the students.
- To know about the instruments for measurement of pollutants
- To get introduced about emission standards

MODULE I EMISSION FROM AUTOMOBILES 8

Sources of Air Pollution. Various emissions from Automobiles — Formation — Effects of ollutants on environment and human beings. Emission control techniques – Modification of fuel, after treatment devices. Emission standards. Automotive waste management, old vehicle disposal, recycling, tyre recycling

MODULE II SI ENGINE EMISSIONS AND CONTROL 9

Emission formation in SI Engines- Carbon monoxide & Carbon di oxide - Unburned hydrocarbon, NOx, Smoke —Effects of design and operating variables on emission formation – controlling of pollutants - Catalytic converters, Charcoal Canister, Positive Crank case ventilation system, Secondary air injection, thermal reactor

MODULE III CI ENGINE EMISSION AND CONTROL 8

Formation of White, Blue, and Black Smokes, NOx, soot, Effect of Operating variables on Emission formation — Fumigation, Split injection, Catalytic Coating, EGR, Particulate Traps, SCR, Fuel additives — Cetane number Effect.

MODULE IV NOISE POLLUTION FROM AUTOMOBILES 8

Sources of Noise — Engine Noise, Transmission Noise, vehicle structural Noise, aerodynamics noise, Exhaust Noise. Noise reduction in Automobiles — Encapsulation technique for noise reduction —Silencer Design.

MODULE V TEST PROCEDURES 6

Constant Volume Sampling I and 3 (CVSI &CVS3) Systems- Sampling Procedures — Chassis dynamometers - Seven mode and thirteen mode cycles for Emission Sampling.

MODULE VI EMISSION MEASUREMENTS 6

Emission analysers —NDIR, FID, Chemiluminesecent, Smoke meters, Dilution Tunnel, SHED Test, Sound level meters.

L – 45; Total Hours –45

TEXT BOOKS:

1. V.Ganesan, 'Internal combustion Engines', Tata McGraw Hill Book Co, Eighth Reprint, 2005.
2. Crouse and Anglin, 'Automotive Emission Control', McGraw Hill company., Newyork 1993.

REFERENCES:

1. G.P.Springer ad D.J.Patterson, Engine Emissions, Pollutant formation, Plenum Press, New York. 1986.
2. D.J.Patterson and N.A.Henin, 'Emission from Combustion Engine and their control', Anna Arbor Science Publication,1985.
3. L.Lberanek, 'Noise Reduction', Mcgrawhill Company., Newyork1993.
4. C.Duerson, 'Noise Abatment', Butterworths ltd., London1990.
5. A.Alexander, J.P.Barde, C.lomure and F.J. Langdan, 'Road traffic noise', Applied science publisher ltd., London,1987.

OUTCOMES:

On completion of the course student should be able to

- Identify the sources of emission from vehicles.
- Analyse the causes and effects of emissions.
- Analyse causes and effects of noise pollution
- Bring out solutions for control of emissions.
- Demonstrate the test procedures and emission norms.
- Select suitable instruments for measurement of emissions.

GECX215	MOTOR VEHICLE ACT, INSURANCE & POLICY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn about basic act and regulation followed for road vehicle
- To learn about systematic steps involved to get licence and registration of motor vehicle
- To learn arbour various types of motor vehicle polices and insurances

MODULE I BASIC RULES FOR ROAD VEHICLE 8

Display and Use of Number Plates- Attachment of number plates- Number plates in horizontal position- Removal of number plates on transfer- Hours prescribed for lighted lamps- Mounting of lamps and reflectors- Multiple beam headlamps- Daytime running lamps- Auxiliary driving lamps- Parking lamps- Brakes- Stopping distances- Emergency or parking brakes- Horn- Muffler- Mirrors- Inspection of motor vehicles- Standards of safety and repair

MODULE II LICENSING OF DRIVERS OF MOTOR VEHICLES 8

Necessity of driving licence- Age limit in connection with driving of motor vehicle-Responsibility of owners of motor vehicles-Restriction on the holding of driving licence-Grant of learner's licence-Grant of driving licence-Addition to driving licence- Renewal of driving licence-Revocation of driving licence on grounds of disease or disability-Driving licence to drive motor vehicle belonging to the central government- power of court to disqualify- suspension of driving licence in certain cases- suspension or cancellation of driving licence on convection- Endorsement.

MODULE III REGISTRATION OF MOTOR VEHICLE 7

Necessity for registration – Registration Where and how to be made- Special provision for registration of motor vehicle of diplomatic officers-Temporary registration- Production of vehicle at the time of registration- Refusal of registration- renewal of certificate of registration- effectiveness in India of registration- Change of residence or place of business-transfer of ownership-Suspension of registration – cancellation of registration suspended under section 53- certificate of fitness of transport vehicle-cancellation of registration.

MODULE IV INSURANCE OF MOTOR VEHICLE 8

Necessity for insurance against third party – Requirements of policies and limits of liability- - Duty of insurers to satisfy judgements and awards against person insured in respect of third party risks-Duty to give information as to insurance-Settlement between insurers and insured persons- transfer of certificate of insurance-production of certain certificates, licences and permit in certain cases-Special provisions as to compensation in case of hit and run motor accident – Types of motor polices

MODULE V CONTROL OF TRANSPORT VEHICLES 7

Power to State Government to control road transport- Transport authorities-General provision as to applications for permits- Application for stage carriage permit- Procedure of Regional Transport Authority in considering application for stage carriage permit- Scheme for renting of motor cabs- Application for private service vehicle permit- Procedure in applying for and granting permits- Duration and renewal of permits- Transfer of permit- Replacement of vehicles-Temporary permits

MODULE VI OFFENCES AND PUNISHMENT 7

Driving without holding an effective driving licence- Driving by an under-aged person (Minor driving vehicle)- Holding of a driving licence permitting it to be used by other person.- Driving a vehicle at an excessive speed- Driving or permitting to drive a vehicle carrying excess load- Driving dangerously / its Abetment Driving an uninsured vehicle

Rider and pillion rider failing to wear protective head gear (Helmet) -Violation of Mandatory Signs -.e-challan and spot challan

L – 45; Total Hours –45

TEXT BOOKS:

1. The motor vehicle act 1988, Universal law publishing co.cpvt ltd. Newdelhi 2011
2. A Commentary On The Motor Vehicles Act, 1988 by SUKHDEV AGGARWAL The Bright Law House, New Delhi

REFERENCES:

1. The Motor Vehicles Act, 1988 Along with Latest Case Law, Notifications & Table of Offences and Punishments Asia Law House; 15th edition (2014)
2. Assessment of Compensation in Accidents under Motor Vehicles Act by Karkara Delhi Law House (2013)

OUTCOMES:

On completion of the course students should be able to

- Explain the analysis of rules and regulations for road vehicles
- Analyze the procedure for getting driving license for vehicles at national and international level
- Analyze the procedure for registration of vehicles.
- Analyze the procedure for Insurance of vehicles and claims.
- Analyze the procedure for obtaining Government Permits and renewal
- Analyze the consequences of not following the rules and regulations

GECX216	PRINCIPLES OF COMMUNICATION SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

To introduce the analog and digital modulation techniques.
To elaborate the working of communication receivers in the presence of noise.
To give an overview of various communication systems.

MODULE I LINEAR MODULATION 8

Baseband signals, Amplitude Modulation – Modulation Index, Power Transmitted, Double Side Band and Single Side Band AM, AM Modulators and AM Receivers, AM Radio systems, Frequency Division Multiplexing.

MODULE II ANGLE MODULATION 8

Frequency Modulation and Phase Modulation, Frequency deviation and modulation index, Bandwidth of FM, FM Modulators and FM receivers, FM Radio and FM Stereo Systems

MODULE III SAMPLING AND PULSE MODULATION 7

Sampling, Nyquist's Sampling Theorem, Pulse Modulations - PAM, PPM and PWM, Time Division Multiplexing, Bandwidth of TDM systems.

MODULE IV DIGITAL COMMUNICATION 7

Digital baseband data, Digital Modulations – ASK, FSK, PSK and QPSK. Digital Communication Transmitters and Receivers.

MODULE V NOISE 8

Sources of Noise, Thermal Noise, shot noise, White noise, Narrow band Noise, Effect of noise in communication, SNR, Receiver Noise Temperature and Noise Equivalent Bandwidth.

MODULE VI COMMUNICATION SYSTEMS & NETWORK 7

FM Radio Systems, Cellular Mobile network, Satellite Communications, Optical Fiber Communication.

L – 45; T – 0; Total Hours – 45

TEXT BOOKS:

1. A. Bruce Carlson, Paul B. Crilly, “Communication Systems”, 5th Edition, McGraw Hill Int., 2011.
2. B.P. Lathi, Zhi Ding, Hari M. Gupta, “Modern Digital and Analog Communication Systems”, 4th Edition, Oxford University Press, 2017.

REFERENCES:

1. Herbert Taub, Donald L. Schilling, Goutam Saha, “Principles of Communication Systems” 4th Edition, McGraw Hill Int. 2013.
2. Simon Haykin, “An Introduction To Analog And Digital Communications”, 1st Edition, Wiley India, 2010.
3. Simon Haykin , “Communications Systems” 4th Edition, Wiley India, 2006.
4. Hwei P. Hsu, “Analog and Digital Communications” 3rd Edition,

OUTCOMES:

On completion of the course students will be able to

1. Identify various communication systems and the corresponding modulation schemes.
2. Predict the characteristics of various analog and digital modulation schemes.
3. Interpret the effect of noise and bandwidth in a communication systems
4. Apply the Nyquist criteria for a given baseband signals.
5. Evaluate the performance of communication receivers.
6. Demonstrate the applications of common communication systems.

GECX217	LEAN MANAGEMENT	L	T	P	C
		3	1	0	4

OBJECTIVES:

The objective of the Course to make the student know about

- the basics of lean production management,
- how Lean principles are applied to the Construction industry to improve the operation management and product development.

MODULE I **8**

lean production? – Introduction, background, and lean thinking. Importance of philosophy, strategy, culture, alignment, focus and systems view. Discussion of Toyota Production System.

MODULE II

Manufacturing systems – an overview of manufacturing strategies. Job shops, batch flow, and flexible manufacturing systems Flow production and lean production systems

MODULE III

Value stream mapping in process design and product development Waste reduction - lead time reduction

Process cycle time and value-added vs. non-value added activities Optimum lot sizing

MODULE IV

Lean production processes, approaches and techniques.—Importance of focusing upon flow. Tools -. Workplace organization – 5S. - Stability. - Just-In-Time – One piece flow – Pull. - . Cellular systems. - . Quick change and set-up reduction methods. f. Total productive maintenance. -. Poka-Yoke – mistake proofing, quality improvement. Standards. - . Leveling. - . Visual management. Just-in-time techniques – SMED and Takt Times - Standard work processes and line balancing Poka-yoke and pull systems material handling reduction and facilities planning

MODULE V

Managing change in the lean organization Human resource management and the lean enterprise Employee involvement – Teams – Training – Supporting and encouraging involvement – Involving people in the change process -- communication -- Importance of culture. Startup of lean processes and examples of applications.

Sustaining improvement and change, auditing, follow-up actions.

MODULE VI

The lean enterprise and supply chain management Costs and risks of lean initiatives - Measuring lean initiatives

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. The Toyota Way Fieldbook, Jeffrey Liker and David Meier, McGraw-Hill, 2006. Lean Production Simplified, Pascal Dennis, Productivity Press, 2007.
2. Womack, James P., and Daniel T. Jones. Lean Thinking. New York, NY: Simon and Schuster, 2003. ISBN: 0743249275.
3. Murman, Earll. Lean Enterprise Value. New York, NY: Palgrave Macmillan, 2002. ISBN: 0333976975.

REFERENCES:

1. Readings at http://www.leanconstruction.org/readings.htm
2. Hopp, W. J., and Spearman, M. L. (2011). Factory Physics, Third Edition, Waveland Press, Long Grove, Il. 720 pp.

OUTCOMES:

The student will be able to

- Describe the manufacturing approaches employed and the background and philosophy of lean production.
- Illustrate the concept of waste reduction
- Apply evaluation techniques that can be used in preparation for and use in learn production activities.
- Select the tools that can be used implementing lean production in production operations.
- Discuss the importance of workplace organization, pull production, cellular arrangement and employee involvement, need for employee creativity
- Describe about the Methods for promoting success in implementing lean transformations

GECX218	GEOSPATIAL MODELING & ANALYSIS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To equip the students with fundamental representation and analysis of geospatial phenomena and provides foundations in methods and algorithms used in GIS analysis.
- To focus is on terrain modeling, geomorphometry, watershed analysis and introductory GIS-based modeling of landscape processes (water, sediment). The course includes analysis from lidar data, coastal change assessment and 3D visualization.

MODULE I INTRODUCTION TO GEOSPATIAL DATA 7

Mapping natural phenomena –Concept of continuous fields and discrete sampling – Units, projections, coordinate transformation – Georeferencing, geospatial formats, conversions, geospatial data abstraction library – Raster and vector representation, raster and vector conversions and resampling.

MODULE II DATA DISPLAY AND VISUALIZATION 7

Display of continuous and discrete data, use of color, shading, symbols, to extract the spatial pattern and relationships – 3D visualization: multiple surfaces and volumes, 3D vector objects – visualization for data analysis (lighting, scaling, transparency, cutting planes, animations) – view/create maps/post your data on-line (Google Earth/Maps, GPS visualizer)

MODULE III GEOSPATIAL ANALYSIS 7

Foundations for analysis of continuous and discrete phenomena – neighborhood operations and buffers – analysis and modeling with map algebra – cost surfaces and least cost path – spatial interpolation and approximation (gridding)

MODULE IV TERRAIN MODELING AND ANALYSIS 9

terrain and bathymetry mapping – mathematical and digital representations (point clouds, contour, raster, TIN) – DEM and DSM, working with multiple return lidar data – spatial interpolation of elevation data and topographic analysis, line of sight, view shed analysis – solar irradiation, photovoltaic energy potential, time series of elevation data, analysis of coastal change.

MODULE V FLOW TRACING, WATERSHED ANALYSIS AND LANDFORMS **8**

Methods for flow routing and flow accumulation – Extraction of stream networks – Extraction of watershed boundaries and building watershed hierarchies – feature extraction, types of landforms.

MODULE VI MODELING OF GEOSPATIAL PROCESSES **7**

Model formulation, input data processing – introduction to GIS-based hydrologic, erosion and environmental modeling – Geocomputational methods, including agent-based modeling, artificial neural networks and evolutionary computing.

L – 45; T – 0; Total Hours –45

TEXT BOOKS:

7. Hassan A, Karimi (2017), *Geospatial Data Science Techniques and Applications*, CRS Press & Co.
8. Sudipto Banerjee, Bradley P, Carlin, Alan E. Gelfand (2014), *Hierarchical Modeling and Analysis for Spatial Data*, CRS Press & Co.

REFERENCES:

1. Maguire, D., M. Batty, and M. Goodchild. 2015. GIS, Spatial analysis, and modeling. ESRI Press (G70.212 .G584 2005)
2. Zeiler, M. 2010. Modeling Our World: The ESRI Guide to Geodatabase Design. Second Ed. ESRI Press, Redlands, California

OUTCOMES:

On successful completion of this course,

- Students will be able to apply the basic concepts of Conceptualize models as representations of real life systems with inputs, outputs, and processes.
- Students will have gained knowledge in spatial tools to make simulations and predictions of real life phenomena.
- Students will have synthesized knowledge about Apply, integrate, and develop models with geospatial data through a GIS.
- Students will have an overview of Evaluate models in terms of accuracy, sensitivity, and uncertainty.
- Students will have Use of a system-based approach for problem solving, with an emphasis on sustainability.

B.S. Abdur Rahman Crescent Institute of Science & Technology

Deemed to be University u/s 3 of the UGC Act, 1956

REGULATIONS 2017

CURRICULUM AND SYLLABI

B.TECH.

POLYMER ENGINEERING

DEPARTMENT OF POLYMER ENGINEERING
VISION AND MISSION

VISION

To offer quality education and training in Polymer Engineering through well structured curriculum and syllabi to produce engineers with sound technical knowledge and expertise to meet the needs of the society.

MISSION

- To impart knowledge and skill in the field of Polymer Science and Engineering through well designed programs
- To equip the students with necessary skills for the development of polymers and polymeric products using appropriate techniques and software
- To promote engineering spirit for the product development through effective integration of design engineering and material technology
- To undertake research in multi- disciplinary polymer science and engineering and related areas and to encourage enterprise, innovation, growth and development in the emerging areas of new technology
- To develop analytical skills, leadership quality and team spirit through balanced curriculum and a judicial mix of co-curricular, extra-curricular and professional society activities
- To disseminate knowledge through seminars, conferences and research publications for the benefit of society

PROGRAMME EDUCATIONAL OBJECTIVES

- To impart basic knowledge in mathematics, science and engineering principles required for understanding the concepts in polymer science and technology
- To provide broad exposure to various societal, ecological, ethical and commercial issues.
- To provide knowledge in synthesis & characterization of materials and design & manufacture of polymer products
- To impart practical skills in design, development and processing of polymer compounds and products
- To equip with necessary knowledge in developing advanced materials for engineering applications
- To provide necessary managerial and soft skills to become an effective professional

PROGRAMME OUTCOMES

On successful completion of the programme, the graduates will

- Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- Identify, formulate, research literature, and analyses complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- Use research –based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.
- Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

- Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change
- Synthesis polymers by using various techniques and characterize their physical properties.
- Select polymers, formulate them for specific applications and characterize the performance properties.
- Process plastics, rubbers and composites materials to various components and products.

B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE AND TECHNOLOGY

B.TECH. POLYMER ENGINEERING

CURRICULUM & SYLLABUS, REGULATIONS 2017

SEMESTER I

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	BS	MAC 1181	Differential Calculus and Geometry	3	1	0	4	
2.	HS	ENC 1181/ ISC 1181/ LNC 1181/ LNC 1182 / LNC 1183	English / Arabic / Mandarin / German / Japanese	3	0	0	3	
3.	BS	PHC 1181	Physics	3	0	2	4	
4.	BS	CHC 1181	Chemistry	3	0	2	4	
5.	ESF	GEC 1101	Engineering Graphics	2	0	2	3	
6.	ESF	GEC 1102	Engineering Design	2	0	0	2	
7.	ESF	GEC 1103	Basic Engineering Practices Laboratory	0	0	2	1	
8.	ESF	GEC 1104	Computer Programming I	1	0	2	2	**23**

SEMESTER II

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	BS	MAC 1281	Advanced Calculus	3	1	0	4
2.	BS	-	Physics Elective	2	0	2	3
3.	BS	-	Chemistry Elective	2	0	2	3
4.	ESF	GEC 1211	Basic Engineering Mechanics	3	1	0	4
5.	BS	GEC 1212	Environmental Studies	2	0	0	2
6.	ESF	GEC 1213	Computer Programming II	1	0	2	2

7.	EC	PEC 1211	Basic Mechanical Operations	2	0	0	2	
8.	EC	PEC 1212	Principles of Chemical Engineering	3	0	0	3	
9.	EC	PEC 1213	Chemical Engineering Lab	0	0	2	1	**24**

SEMESTER III

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	BS	MAC2181	Partial Differential Equations and Transforms	3	1	0	4	
2.	HS	-	Humanities Elective I	2	0	0	2	
3.	HS	ENC 2181	Oral Communication	0	0	2	1	
4.	EC	PEC 2101	Chemistry of Macromolecules	3	0	0	3	
5.	EC	PEC 2102	Physics of Macromolecules	3	0	0	3	
6.	EC	PEC 2103	Plastic Materials Technology	3	0	0	3	
7.	ESF	EEC 2181	Introduction to Electrical and Electronics Engineering	3	1	0	4	
8.	EC	PEC 2104	Polymer Synthesis Lab	0	0	2	1	
9.	ESF	EEC 2182	Electrical and Electronics Lab	0	0	2	1	
10.	EC	PEC 2105	Machining Practice Lab	0	0	2	1	**23**

SEMESTER IV

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	BS	-	Mathematics Elective I	3	1	0	4
2.	HS	-	Humanities Elective II	2	0	0	2
3.	HS	ENC2282	Written Communication	0	0	2	1
4.	EC	PEC 2211	Polymer Rheology	3	0	0	3
5.	EC	PEC 2212	Science and Technology of Rubbers	3	0	0	3
6.	EC	PEC 2213	Plastics Compounding Technology	3	0	0	3
7.	EC	PEC 2214	Polymer Analysis and Characterization	3	0	0	3
8.	EC	-	Programme Elective –I	3	0	0	3

9.	PE	PEC 2215	Polymer Characterization Lab	0	0	2	1	**23**

SEMESTER V

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	MS	MSC 3181 MSC 3182	Leadership and CEO Training/ Social Entrepreneurship	3	0	0	3	
2.	GE	-	General Elective I	3	0	0	3	
3.	HS	ENC3181	Communication and soft skill I Career Choice	0	0	2	1	
4.	EC	PEC 3101	Plastics Process Engineering	3	0	0	3	
5.	EC	PEC 3102	Strength of Materials	3	0	0	3	
6.	EC	PEC 3103	Plastic and Rubber Testing Technology	3	0	0	3	
7.	PE	-	Programme Elective – II	1	0	0	1	
8.	PE	-	Programme Elective – III	2	0	0	2	
9.	PE	-	Programme Elective – IV	3	0	0	3	
10.	EC	PEC 3104	Plastics Processing Lab	0	0	2	1	
11.	EC	PEC 3105	Rubber Processing Lab	0	0	2	1	**24**

SEMESTER VI

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	MS	MSC 3181 MSC 3182	Leadership and CEO Training / Social Entrepreneurship	3	0	0	3
2.	BS	-	Mathematics Elective II	2	0	0	2
3.	HS	ENC3281	Communication & soft skill II Confidence Building	0	0	2	1
4.	EC	PEC 3211	Plastic and Rubber Product Design	3	1	0	4
5.	EC	PEC 3212	Process Control and Instrumentation	3	0	0	3
6.	EC	PEC 3213	Polymer Reaction Engineering	3	0	0	3

7.	PE	-	Programme Elective – V	1	0	0	1	
8.	PE	-	Programme Elective – VI	2	0	0	2	
9.	PE	-	Programme Elective – VII	3	0	0	3	
10.	EC	PEC 3214	Plastic Product Design using CAD	0	0	2	1	
11.	EC	PEC 3215	Polymer Testing Lab	0	0	2	1	**24**

SEMESTER VII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	GE	-	General Elective II	3	0	0	3	
2.	EC	PEC 4101	Mould and Die Design	3	1	0	4	
3.	EC	PEC 4102	Polymer Composite Engineering	3	0	0	3	
4.	EC	PEC 4103	Polymer Nanocomposites	3	0	0	3	
5.	PE	-	Programme Elective –VIII	1	0	0	1	
6.	PE	-	Programme Elective – IX	2	0	0	2	
7.	PE	-	Programme Elective –X	3	0	0	3	
8.	PE	-	Programme Elective –XI	3	0	0	3	
9.	EC	PEC 4104	Mould Design and Flow Simulation lab	0	0	2	1	
10.	EC		Internship				1*	**24**

SEMESTER VIII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	EC	PEC 4211	Project Work	0	0	24	12	**12**

Total credits – 177

* Industrial training will be undertaken during Third year summer vacation. The credit will be awarded in the 7th Semester.

PROGRAMME ELECTIVES
GROUP I (Materials)

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	PECX 001	Thermoplastic Polyesters	1	0	0	1
2.	PE	PECX 002	Thermoplastic Elastomers	1	0	0	1
3.	PE	PECX 003	Electroactive Polymers	1	0	0	1
4.	PE	PECX 004	Heat Resistant Polymers	1	0	0	1
5.	PE	PECX 005	Biodegradable Plastics	2	0	0	2
6.	PE	PECX 006	Bioplastics Technology	2	0	0	2
7.	PE	PECX 007	Biomedical Polymers	2	0	0	2
8.	PE	PECX 008	High Performance Polymers	2	0	0	2
9.	PE	PECX 009	Nanotechnology	3	0	0	3
10.	PE	PECX 010	Nanomaterials Technology	3	0	0	3
11.	PE	PECX 011	Polymers for Electronics	1	0	0	1
12.	PE	PECX 012	Polymers for Energy Technology	2	0	0	2

GROUP II (Process Engineering)

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	PECX 013	PVC Technology	1	0	0	1
2.	PE	PECX 014	Nylon Technology	1	0	0	1
3.	PE	PECX 015	Latex Technology	1	0	0	1
4.	PE	PECX 016	Thermoforming Process	1	0	0	1
5.	PE	PECX 017	Injection Moulding Technology	2	0	0	2
6.	PE	PECX 018	Extrusion Moulding Technology	2	0	0	2

7.	PE	PECX 019	Blow Moulding Technology	2	0	0	2
8.	PE	PECX 020	Post Processing Operations	1	0	0	1
9.	PE	PECX 021	Rubber Product Manufacturing Technology	3	0	0	3
10.	PE	PECX 022	Rubber Process Engineering	3	0	0	3
11.	PE	PECX 023	Tyre Manufacturing Technology	3	0	0	3
12.	PE	PECX 024	Plastics Recycling	2	0	0	2
13.	PE	PECX 025	Plastic Waste Management	1	0	0	1

GROUP III (Product & Mould Design)

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	PECX 026	Computer Aided Modelling	2	0	0	2
2.	PE	PECX 027	Computer Aided Manufacturing	2	0	0	2
3.	PE	PECX 028	Design of Composite Structures	2	0	0	2
4.	PE	PECX 029	Industrial Hydraulics and Pneumatics	2	0	0	2
5.	PE	PECX 030	Rapid Prototyping - 3D Printing	2	0	0	2
6.	PE	PECX 031	Failure Analysis of Polymers	2	0	0	2
7.	PE	PECX 032	Mould Manufacturing Techniques	2	0	0	2

GROUP IV (Blends, Composites, Adhesives and Coatings)

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	PECX 033	Biocomposite Technology	2	0	0	2
2.	PE	PECX 034	Mechanics of Composites	2	0	0	2

3.	PE	PECX 035	Analysis of Composite Structures	2	0	0	2
4.	PE	PECX 036	Polymer Blends and Alloys	2	0	0	2
5.	PE	PECX 037	Paint Technology	1	0	0	1
6.	PE	PECX 038	Adhesives Technology	1	0	0	1
7.	PE	PECX 039	Surface Coating Technology	2	0	0	2
8.	PE	PECX 040	Plastic Packaging Technology	3	0	0	3
9.	PE	PECX 033	Biocomposite Technology	2	0	0	2

Physics Elective Courses

(To be offered in II Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	PHCX 01	Fundamentals of Engineering Materials	2	0	2	3
2.	PHCX 02	Heat and Thermodynamics	2	0	2	3
3.	PHCX 03	Introduction to Nanoscience and Technology	2	0	2	3
4.	PHCX 04	Lasers and their applications	2	0	2	3
5.	PHCX 05	Materials Science	2	0	2	3
6.	PHCX 06	Non-Destructive Testing	2	0	2	3
7.	PHCX 07	Properties of Matter and Acoustics	2	0	2	3
8.	PHCX 08	Properties of Matter and Nondestructive Testing	2	0	2	3
9.	PHCX 09	Semiconductor Physics and Optoelectronics	2	0	2	3

Chemistry Elective Courses

(To be offered in II Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	CHCX01	Analytical Instrumentation	2	0	2	3
2.	CHCX02	Corrosion and its Control	2	0	2	3
3.	CHCX03	Electrical Materials and Batteries	2	0	2	3
4.	CHCX04	Engineering Materials	2	0	2	3
5.	CHCX05	Fuels and Combustion	2	0	2	3
6.	CHCX06	Fundamentals of Physical Chemistry	2	0	2	3
7.	CHCX07	Green Technology	2	0	2	3
8.	CHCX08	Organic Chemistry of Biomolecules	2	0	2	3
9.	CHCX09	Polymer Science and Technology	2	0	2	3

Maths Elective Courses

(To be offered in IV Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	MACX 01	Discrete Mathematics And Graph Theory	3	1	0	4
2.	MACX 02	Probability And Statistics	3	1	0	4
3.	MACX 03	Random Processes	3	1	0	4
4.	MACX 04	Applied Numerical Methods	3	1	0	4

Maths Elective Courses

(To be offered in VI Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	MACX 05	Mathematical Programming	2	0	0	2
2.	MACX 06	Statistical Methods for Data Analysis	2	0	0	2
3.	MACX 07	Numerical Methods for Integral and Differential Equations	2	0	0	2
4.	MACX 08	Mathematical Modelling	2	0	0	2
5.	MACX 09	Graph Theory	2	0	0	2

Humanities Elective I

(To be offered in III Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	SSCX01	Fundamentals of Economics	2	0	0	2
2.	SSCX02	Principles of Sociology	2	0	0	2
3.	SSCX03	Sociology of Indian Society	2	0	0	2

Humanities Elective II

(To be offered in IV Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	SSCX04	Economics of Sustainable Development	2	0	0	2
2.	SSCX05	Industrial Sociology	2	0	0	2
3.	SSCX06	Law for Engineers	2	0	0	2

General Elective

Group I Courses

(To be offered in V semester)

Sl. No.	Course Code	Course Title	Offering Department
1.	GECX101	Disaster Management	Civil
2.	GECX102	Total Quality Management	Mechanical
3.	GECX103	Energy Studies	Mechanical
4.	GECX104	Robotics	Mechanical
5.	GECX105	Transport Management	Automobile
6.	GECX106	Control Systems	EEE
7.	GECX107	Introduction to VLSI Design	ECE
8.	GECX108	Plant Engineering	EIE
9.	GECX109	Network Security	CSE
10.	GECX110	Knowledge management	CSE
11.	GECX111	Cyber security	IT
12.	GECX112	Genetic Engineering	LS
13.	GECX113	Fundamentals of Project Management	CBS
14.	GECX114	Operations Research	Mathematics
15.	GECX115	Nano Technology	Physics / Chemistry
16.	GECX116	Vehicle Maintenance	Automobile
17.	GECX117	Fundamentals of Digital Image Processing	ECE

Group II Courses

(To be offered in VII semester)

Sl. No.	Course Code	Course Title	Offering Department
1.	GECX201	Green Design and Sustainability	Civil
2.	GECX202	Appropriate Technology	Civil / Mechanical
3.	GECX203	Engineering System Modelling and Simulation	Mechanical
4.	GECX204	Value Analysis and Engineering	Mechanical
5.	GECX205	Industrial Safety	Mechanical
6.	GECX206	Advanced Optimization Techniques	Mechanical
7.	GECX207	Mat Lab Simulation	EEE
8.	GECX208	Embedded Systemsand its Applications	ECE
9.	GECX209	Usability Engineering	CSE
10.	GECX210	Supply Chain Management	CBS
11.	GECX211	System Analysis and Design	CA
12.	GECX212	Advanced Materials	Physics & Chemistry
13.	GECX213	National Service Scheme	School of Humanities
14.	GECX214	Automotive Pollution and Control	Automobile
15.	GECX215	Motor Vehicle Act, Insurance and Policy	Automobile
16.	GECX216	Principles of Communication Systems	ECE
17.	GECX217	Lean Management	Civil
18.	GECX218	Spatial Data Modeling & Analysis	Civil

SEMESTER I

MAC 1181	DIFFERENTIAL CALCULUS AND GEOMETRY	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aims of this course are to

- introduce eigen values and eigenvectors of matrix algebra.
- make the student knowledgeable in the area of Three Dimensional Analytical Geometry.
- demonstrate the application of Differential Calculus.
- familiarize the student with the functions of several variables.
- develop the use of ODE solvable techniques necessary for engineering applications.
- motivate the students with some basic engineering application problems in ODE.

MODULE I MATRICES 8+2

Characteristic Equation- Eigenvalues and Eigenvectors of a real matrix –Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton Theorem (without proof) – Orthogonal matrices – orthogonal transformations of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation.

MODULE II THREE DIMENSIONAL ANALYTICAL GEOMETRY 7+3

Direction cosines and ratios – angle between two lines – equations of a plane – equations of a straight line, coplanar lines - shortest distance between skew lines - sphere – tangent plane – plane section of a sphere – orthogonal spheres.

MODULE III DIFFERENTIAL GEOMETRY 7+3

Curvature – Cartesian and polar coordinates – centre and radius of curvature – circle of curvature – involutes and evolutes – envelopes.

MODULE IV DIFFERENTIAL CALCULUS OF SEVERAL VARIABLES 8+2

Functions of two variables – partial derivatives – total differential – Implicit Functions – Jacobian - Taylor’s series expansion – Optima of two variables – Lagrange’s multiplier method.

MODULE V **ORDINARY DIFFERENTIAL EQUATIONS** **8+2**

Linear equations of second order with constant and variable coefficients – Simultaneous first order linear equations with constant coefficients – homogeneous equations of Euler's type – method of undetermined coefficients, method of variation of parameters

MODULE VI **APPLICATIONS OF ORDINARY DIFFERENTIAL EQUATIONS** **7+3**

Solution of Ordinary Differential Equation Related to Electric Circuits – Bending of Beams- Motion of a Particle in a resisting medium – Simple harmonic motion.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Ramana, B.V, "Higher Engineering Mathematics" Tata McGraw Hill Publishing Co. New Delhi, 2006.
2. Grewal B.S., "Higher Engineering Mathematics" (43rd edition), Khanna Publishers, New Delhi, 2012.
3. John W. Cell "Engineering Problems Illustrating Mathematics" Mc Graw Hill Publishing Co., New York 1943.

REFERENCES:

1. Veerarajan.T., "Engineering Mathematics" (5th edition) Tata Mc Graw Hill Publishing Co. New Delhi, 2012
2. Kreyszig, E., "Advanced Engineering Mathematics", 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
3. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th edition, Cengage Learning, 2011.
4. Dennis G. Zill, Warren S. Wright, "Advanced Engineering Mathematics", 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
5. Alan Jeffrey, "Advanced Engineering Mathematics", Academic Press, USA, 2002.
6. Venkataraman, M.K., "Engineering Mathematics", Volume I, 2nd edition, National Publishing Co., Chennai, 2003.
7. James Stewart ".Calculus" (7th edition),Brooks/Cole cengage learning,UK

OUTCOMES:

After completing the course, student will be able to

- Understand the matrix techniques and compute eigen values and eigenvectors of a given matrix.
- Do the problems based on three dimensional analytic geometry.
- Apply differential calculus in engineering problems.
- Differentiate more than one variable and their applications.
- Solve the differential equations with constant coefficient and variable coefficient.
- Form and solve differential equations.

ENC 1181	ENGLISH	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To train students to use appropriate vocabulary in academic and technical contexts.
- To facilitate students to speak effectively while exchanging ideas and making presentations.
- To develop students' listening skill for comprehending and analyzing information.
- To develop their reading skill through sub skills like skimming , scanning and critical reading of a text.
- To sharpen their academic writing skills.
- To expose them to the correct usage of language and help them to apply that knowledge appropriately.

MODULE I **8**

L: Listening for general information

S : Self Introduction, Introducing one another.

R: Predicting the content

W: Paragraph Writing

Language Focus: Affixes, Simple Present tense , Connective & Prepositions.

MODULE II **8**

L: Listening for specific information (from dialogues)

S:Exchanging opinion.

R: Skimming technical Passages

W: Argumentative Writing (using the concept of Flipped Learning), Letter to the Editor.

Language Focus: Idioms, use of Modals, Simple Past tense & use of "Wh" and question tags.

MODULE III **7**

L: Learning the ways of describing images and presenting specific information (focusing on note making)

S: Making Presentations using visuals.

R : Scanning short texts for gist of information

W: Letter of Invitation, Expository Writing

Language Focus: Homophones, Homographs, Simple Future & Collocations.

MODULE IV **7**

L: Understanding prepared presentation techniques through videos

S: Short Presentations.

R: Reading for coherence and cohesion

W: Letter seeking permission for Industrial Visit

Language Focus: S-V agreement, Euphemism

MODULE V **8**

L : Understanding Non- Verbal Communications while listening to narration of incidents.

S: Narrating an expereince

R: Inferential Reading

W: Process Description – Transcoding a Flow chart.

Language Focus: Interchange of Active & passive voice, Impersonal Passive voice.

MODULE VI **7**

L: Learning Story telling techniques (stories & visuals) through audio files

S: Discussion in groups

R: Reading for critical appreciation

W: Developing an idea, Slogan writing, Interpreting a Bar Chart.

Language Focus: If clause and phrasal verbs.

TOTAL HOURS :45

REFERENCES:

1. Carol Rosenblun perry(2011). The Fine Art of Technical Writing. Create Space Independent Publishing Platform, New Delhi.
2. Dutt, P.K. Rajeevan. G and Prakash , C.L.N. (2007) A course in Communication Skills. Cambridge Univesity Press, India.
3. Kala, Abdul & Arun Tiwari (2004). Wings of Fire: An Autobiography (Simplified and A bridged by Mukul Chowdhri). Hyderabad Univeristy Press.
4. Sen, Leena. (2004) Communication Skills. Prentice Hall, New Delhi.

5. Matt Firth, Chris Sowton et.al. (2012). Academic English: An Integrated Skills Course for EAP. Cambridge University Press, Cambridge.

OUTCOMES:

After completion of the course, students will have the ability to

- Demonstrate their range of vocabulary in academic and technical contexts
- Exchange ideas and make presentations
- Comprehend and respond appropriately to listening tasks.
- Read a text efficiently and process information.
- Create and draft different kinds of academic documents
- Communicate effectively using grammatically correct expressions.

ISC1181	ARABIC	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To read and write in Arabic language.
- To learn vocabulary of different fields
- To develop situational communication skills.

MODULE I PREPARATORY ARABIC **7**

Introducing Arabic Alphabets.
Listening and Reading.
Audio & Video aided listening, Tajweed listening,
Writing Arabic Alphabets (connected & unconnected).
Introducing words.
Reading simple sentences.
Learning names of the things in and around the class room.
Exercises.

MODULE II FUNCTIONAL ARABIC **7**

Listening Arabic texts, stories and action verbs
Communicating Simple sentences.
Jumla' Ismiyya and Jumla' Fi'liyya
Situational Conversation:
Greetings, Introduction.
Classroom, College, Picnic.
Dining and Kitchen.
Reading skills.
Exercises

MODULE III FUNCTIONAL ARABIC **8**

Implication of effective listening.
Audio aids.
Writing Simple sentences.
Communicating ordinal and cardinal numbers.
Situational communication:

Playground, library.
Forms of plural – Sample sentences.
Introduction to tenses.
Exercises.

MODULE IV FUNCTIONAL ARABIC 8

Communication:
Family, travel
Market, Prayer hall
Writing skills:
Note making.
Sequencing of sentences.
Developing answers from the questions.
Exercises.

MODULE V TECHNICAL ARABIC 8

Importance of technical communication.
Reading and writing skills.
Audio & Video aided listening.
Introduction to Arabic terms related to administration.
Situation communication:
Air travel, Office administration, passport, visa.
Exercises

MODULE VI TECHNICAL ARABIC 7

Situation communication:
Contractual work, machineries and equipments..
Computer, internet browsing.
Banking,
Exercises.

TOTAL HOURS :45

TEXT BOOKS:

1. Arabic for professionals and employees, Kilakarai Bukhari Aalim Arabic College, Chennai, India, 2013.

REFERENCES:

1. Arabic Reader for Non Arabs (Ummul Qura University, Makkah), Kilakarai Bukhari Aalim Arabic College, 2005.

OUTCOMES:

On successful completion of the course, the student will be able to:

- Write correct sentences in Arabic.
- Communicate in Arabic at primary level in working situations in the fields of engineering and administration.

LNC1181	MANDARIN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To improve the proficiency of students in Mandarin language.
- To develop their knowledge of vocabulary.
- To train them in using appropriate grammatical forms during communications.
- To empower them for successful communication in social and academic contexts.
- To make them appreciate the language usage in real life situations.

MODULE I **8**

· General Introduction to Chinese • Pinyin and Tones • Introduction to the Writing System: basic strokes and stroke order · Numbers 1-100, song · Days of the Week · Months of the Year

MODULE II **8**

· Chinese names and related culture · Chinese family structures and values · Greetings · Introducing Yourself · Family members · Occupations

MODULE III **7**

· Languages and Nationalities · Daily Routine · Chinese breakfast · Negative Sentences and Interrogative Sentences · Asking for Personal Information · The Verb *shi* and Basic Sentence Structures

MODULE IV **7**

· Answering an Affirmative-negative Question · Food and drinks · Transportation · Likes and dislikes · Adverbs *bu*, *jiu* and *dou* · Verb-absent Sentences

MODULE V **8**

·*Jisui* and *duoda* Questions · S+V+O Construction · Routines and Daily Activities ·*Haishi* Questions · Modal Verbs · Hobbies and Habits

MODULE VI **7**

· Making Suggestions with *haoma* ·Colors · Clothing · Body parts · Talking about Likes and Dislikes · Measurement Words in Chinese

TOTAL HOURS :45

TEXT BOOKS:

1.Ma, Yanmin, and Li, Xinying. *Easy Steps to Chinese, Vol*. *1 Textbook*. Beijing: Beijing Language and Culture University Press, 2006. Print.

2. Ma, Yanmin, and Li, Xinying. *Easy Steps to Chinese, Vol. 1 Workbook*. Beijing: Beijing Language and Culture University Press, 2006. Print.

OUTCOMES:

On completion of the course, students will be able to

- Exhibit proficiency in Chinese Language.
- Use vocabulary in appropriate contexts.
- Use appropriate grammatical forms effectively.
- Use the language in social and academic contexts.
- Appreciate the use of language forms.

LNC1182	GERMAN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To improve the proficiency of students in German language.
- To create awareness of using vocabulary among students.
- To expose them to correct grammatical forms of the language.
- To empower them for successful communication in social and academic contexts.

MODULE I **8**

Introduction to German alphabets, phonetics and pronunciation- Introducing themselves and others using simple sentences and answer to some basic personal questions-: Introduction to different types of articles and verbs, Nouns

MODULE II **8**

Understanding and responding to everyday queries like instruction, questions, - number & gender, pronouns, present and past tense.

MODULE III **7**

Short telephone messages, requests etc., if spoken slowly and clearly-- Detailed overview of articles, adjectives with/without articles, Prepositions

MODULE IV **7**

Ask and giving directions using simple prepositions- Ability to fill basic information on forms while registering for courses / classes.

MODULE V **8**

Ability to extract and understand relevant information in a public announcement, broadcast, newspaper, radio etc-- dative & accusative

MODULE VI **7**

Ability to describe about people, work, immediate environment, education and other topics related to personal needs in a concise manner-- Understanding of matters that are familiar and are encountered regularly like instances at school, work, at public places, places of leisure etc.

TOTAL HOURS :45

TEXT BOOKS:

1. Course book : Tangram aktuell 1 – Lektion 1–4 (Kursbuch + Arbeitsbuch mit Audio-CD zum Arbeitsbuch), Rosa-Maria Dallapiazza, Eduard von Jan, Til Schönherr, Hueber Publisher, ISBN 978-3-19-001801-7

2. Practice book: Tangram aktuell 1 – Lektion 1–4 (Kursbuch + Arbeitsbuch mit Audio-CD zum Arbeitsbuch), Rosa-Maria Dallapiazza, Eduard von Jan, Til Schönherr, Hueber Publisher, ISBN 978-3-19-001801-7.

REFERENCES:

1. NETZWERK A1 TEXTBOOK, Deutsch als Fremdsprache,Stefanie Dengler,Paul Rusch, Helen Schmitz, Tanja Sieber, Langenscheidt and Klett, ISBN : 9788183076968

2. STUDIO D A1 (SET OF 3 BOOKS + CD), Hermann Funk. Cornelsen, ISBN: 9788183073509

3. Willkommen! Beginner's course. Paul Coggle, Heiner Schenke. 2nd edition. (chapter 1 - 6) ISBN: 9781444165159 –

4. Willkommen! Beginner's course. Paul Coggle, Heiner Schenke. ISBN: 978-1-444-16518-0

5. An Introduction to the German Language and Culture for Communication, Updated Edition Lovik, Thomas A., J. Douglas Guy & Monika Chavez. Vorsprung -. New York, Houghton Mifflin Company, 1997/2002. ISBN 0-618-14249-5.

OUTCOMES:

On completion of the course, students will be able to

- Show their proficiency in German Language.
- Use appropriate vocabulary in real life contexts.
- Use appropriate grammatical forms while communicating with people.
- Effectively use the language in social and academic contexts.

LNC1183	JAPANESE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To train students to use appropriate vocabulary in academic and technical contexts.
- To facilitate students to speak effectively while exchanging ideas and making presentations.
- To develop their reading skill through sub skills like skimming, scanning and critical reading of a text.
- To sharpen their academic writing skills.
- To expose them to the correct usage of language and help them to apply that knowledge appropriately.

MODULE I **7**

Introduction of the Japanese writing system, i.e. *Hiragana*, *Katakana* and *Kanji*, word-building, writing foreign names and loan words in Katakana.

MODULE II **8**

Oral practice of pronunciation and intonation of Japanese sounds, Japanese greetings, self introduction, identifying things, time of the day, calendar; counting using Japanese numerical classifiers; describing things;

MODULE III **7**

Making comparisons; talking of daily activities, kinship terms used for address and reference, seasons, giving and receiving, shopping; making requests, talking of one's likes and dislikes.

MODULE IV **8**

Extensive practice of basic patterns at the lower intermediate level through drills and exercises.

MODULE V **7**

Comprehension of passages in simple Japanese and writing of composition in Japanese applying lower intermediate grammatical patterns.

MODULE VI **8**

Diverse texts based on Japanese culture, customs, history, food habits, and science etc, for the development of communicative competence of students; skimming, scanning of texts with emphasis on advanced sentence patterns, grammatical structures and idiomatic phrases, reading and writing of approximately

TOTAL HOURS :45

REFERENCES:

1. Nihongo I, Kokusaigakuyukai, and other supplementary material
2. Exersice book 1of Nihongo 1, and other supplementary material
3. Nippon, the Land and its People & Encyclopedia of Contemporary Japanese
4. Japani: Japanese Conversation for Improving Spoken Proficiency, By P.A. George, Inoue Yoriko and Itsuko Nandi, Books Plus.
5. Chukyu Nihongo, Tokyo Gaikokugo Daigaku; Nihongo II, Kokusaigakuyukai, and other supplementary material.

OUTCOMES:

After completion of the course, students will have the ability to

- Demonstrate their range of vocabulary in academic and technical contexts
- Exchange ideas and make presentations
- Comprehend and respond appropriately to listening tasks.
- Read a text efficiently and process information.
- Create and draft different kinds of academic documents
- Communicate effectively using grammatically correct expressions.

PHC 1181	PHYSICS	L	T	P	C
		3	0	2	4

OBJECTIVES:

To make students conversant with the

- basic concepts of crystal physics and its structures
- production and applications of ultrasonic waves
- study of thermal conductivities of good and bad conductors
- phenomenon of wave optics and its applications
- principle of fibre optic communication and its applications to sensors
- wave mechanics principle and its applications in electron microscopy
- green energy physics and its environmental impacts to society

MODULE I CRYSTAL PHYSICS **8**

Crystalline and amorphous solids – Unit Cell – Seven Crystal Systems – Bravais Lattice – Miller Indices – Interplanar Spacing – Characteristics of Unit Cell - Calculation of Number of atoms per unit cell, Atomic Radius, Coordination Number and Packing Factor for SC, BCC, FCC and HCP and Diamond structures –Defects in crystals-Point defects –Edge and screw dislocations and their significance - Surface Defects.

MODULE II ULTRASONICS AND THERMAL PHYSICS **8**

Introduction to Ultrasonics - Properties - Production methods - Magnetostriction Oscillator method- Piezoelectric Oscillator method – Detection of Ultrasonics – Thermal method – Piezoelectric method – Kundt's tube method – Applications of Ultrasonics – Acoustic Grating – SONAR – Depth of sea – Velocity of blood flow, Ultrasonic Flaw detector (qualitative).

Transmission of heat – Conduction, Convection and Radiation – Thermal Conductivity of good Conductor – Forbe's method- Thermal Conductivity of bad Conductor – Lee's Disc method.

MODULE III APPLIED OPTICS **8**

Interference – Air Wedge – Michelson's Interferometer – Determination of wavelength of light and thickness of thin transparent sheet.

Introduction to Laser – Characteristics of Laser – Spontaneous and Stimulated Emissions – Einstein's Coefficients - Population inversion – Pumping Mechanism – Laser Action – Types of Laser: He-Ne laser, CO2 laser and Nd:YAG laser - Applications : Laser Materials

Processing .

MODULE IV FIBRE OPTICS 7

Optical fibre – Principle and propagation of light in optical fibre – Numerical aperture and acceptance angle – Types of optical fibres – Attenuation – Absorption, Scattering losses, Bending losses and Dispersion in Optical fibres – Fiber Connectors and Couplers - Applications – Fibre optic communication system (block diagram only)- Fibre optic sensors - displacement and pressure sensors (qualitative) - Medical endoscope.

MODULE V QUANTUM MECHANICS 7

Black body radiation – Planck's theory of radiation – Deduction of Wien's displacement law and Rayleigh – Jean's law from Planck's theory –Dual nature of matter – de Broglie's wavelength- Physical significance of wave function – Schrodinger wave equation – Time independent and time dependent wave equation – Particle in one dimensional box – Harmonic oscillator(qualitative).

MODULE VI RENEWABLE ENERGY SOURCES 7

Present Energy sources and sustainability - Solar energy - Solar photovoltaics - Solar cells – Bioenergy - Biomass – production of liquid fuels from biomass – Wind energy – Wind turbines – energy and power from wind turbines - Geothermal energy - Ocean energy: Wave energy – Wave energy conversion devices – Tidal energy – Tidal power basics – power generation –Tidal energy potential – Environmental benefits and impacts of renewable energy sources

PRACTICALS

1. Determination of Velocity of Ultrasonic waves in a given liquid using Ultrasonic Interferometer.
2. Determination of wavelength of ultrasonic waves using Kundt's tube method.
3. Determination of thickness of a thin wire using Air Wedge method.
4. Determination of wavelength of light using spectrometer diffraction grating.
5. Determination of angle of divergence of a laser beam using He-Ne laser.
6. Determination of particle size of lycopodium powder using semiconductor laser.
7. Determination of wavelength of laser light using semiconductor laser diffraction.
8. Determination of Acceptance angle and Numerical Aperture using fiber optic cable.
9. Determination of thermal conductivity of a good conductor by Forbe's method.
10. Determination of thermal conductivity of a bad conductor by Lee's disc method.
11. Determination of solar cell characteristics.

L – 45; P – 30; TOTAL HOURS – 75

REFERENCES :

1. Gaur R.K. and Gupta S.L., “Engineering Physics’’, 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2013.
2. Palanisamy P.K., Physics for Engineers, Vol1 & Vol2, 2nd Edition, Scitech Publications, 2003.
3. Serway R.A. and Jewett, J.W. “Physics for Scientists and Engineers with Modern Physics”. Brooks/cole Publishing Co., 2010.
4. Tipler P.A. and Mosca, G.P., “Physics for Scientists and Engineers with Modern Physics”, W.H. Freeman, 2007.
5. Markert J.T., Ohanian. H. and Ohanian, M. “Physics for Engineers and Scientists”. W.W. Norton & Co. 2007.
6. Godfrey Boyle, “Renewable Energy: Power for sustainable future”, 2nd edition, Oxford University Press, UK, 2009.

OUTCOMES:

At the end of the course, students will be able to

- understand the different types of crystal structures
- apply the concept of ultrasonic principle in engineering and medical field
- calculate thermal conductivities of good and bad conductors
- differentiate the various laser systems and its applications in engineering and medical field
- apply the principle of fibre optics for communication and sensor applications
- formulate wave mechanics principle for applications in electron microscopy
- Correlate the different renewable energy sources for societal needs.
- To complement the knowledge acquired in the theory class.
- To correlate the experimental results for application.

CHC1181	CHEMISTRY	L	T	P	C
		3	0	2	4

OBJECTIVES:

The students should be conversant with

- the basic problems like hardness, alkalinity, dissolved oxygen associated with the water used for domestic and industrial purpose and treatment process involved.
- the synthesis, properties and applications of nanomaterials.
- the importance of renewable energy sources like solar, wind, biogas, biomass, geothermal, ocean and their limitations.
- the basic analytical techniques like UV-Visible, FT-IR, NMR, AAS, AES, Circular Dichroism and XRD etc.
- photochemistry concepts related to physical processes and chemical reactions induced by photon absorption and their applications.
- basic principles of electrochemistry, cell construction and evaluation and to understand general methodologies for construction & design of electrochemical cell

MODULE I WATER TECHNOLOGY 9

Impurities present in water, hardness : types of hardness, demerits of hard water in boilers, estimation of hardness by EDTA method (problems) – alkalinity : estimation of alkalinity (problems) – dissolved oxygen: estimation of dissolved oxygen – conditioning methods : external treatment method: – lime soda and zeolite process (principle only), Ion exchange process – Internal treatment : colloidal, carbonate, phosphate and calgon methods – drinking water: standards (BIS), treatment of domestic water {screening, sedimentation, coagulation, filtration, disinfection }– desalination: electrodialysis, reverse osmosis.

MODULE II NANOCHEMISTRY 6

Introduction – distinction between molecules, bulk materials and nanoparticles – classification based on dimension with examples – synthesis (top-down and bottom-up approach} : sol-gel, thermolysis (hydrothermal and solvothermal), electrodeposition, chemical vapour deposition, laser ablation – properties and applications (electronic, magnetic and catalytic) – risk factors and future perspectives.

MODULE III ENERGY SOURCES 8

Energy: past, today, and future – a brief history of energy consumption – present energy scenario of conventional and renewable energy sources – renewable energy : needs of renewable energy, advantages and limitations of renewable energy – solar energy: basics, solar energy in the past , photovoltaic, advantages and disadvantages – bioenergy: conversion, bio degradation, biogas generation, biomass gasifier, factors affecting biogas generation, advantages and disadvantages – geothermal energy: geothermal resources (hot dry rock and magma resources, natural and artificial), advantages and disadvantages – wind energy: wind resources, wind turbines, advantages and disadvantages – ocean energy: wave energy, wave energy conversion devices, ocean thermal energy, advantages and disadvantages.

MODULE IV PHOTOCHEMISTRY 7

Introduction: absorption and emission, chromophores, auxochromes – laws of photochemistry : Grotthus-Draper law, Stark Einstein law – quantum yield (problems) –photo physical processes : fluorescence and phosphorescence - Jablonski diagram (electronic states and transitions) – quenching, annihilation – photosensitization: principle and applications – chemiluminescence, bioluminescence.

MODULE V ANALYTICAL TECHNIQUES 7

Spectroscopy: electromagnetic radiation and spectrum – types of transitions – types of spectra (atomic and molecular with their chemical usefulness) – Beer-Lamberts law (problems) – principles, instrumentation and applications of: Colourimetry – UV-Vis spectrophotometer – atomic absorption spectroscopy – atomic emission spectroscopy – principles and applications of: IR, NMR, mass and X-ray diffraction analysis.

MODULE VI ELECTROCHEMISTRY 8

Electrochemistry - types of electrodes (principle and working) : gas (SHE), metal/metal ion electrode, metal-metal insoluble salt (calomel electrode), ion-selective (glass electrode and fluoride ion selective electrode) – Electrolytic and galvanic cells, construction of cell, EMF measurement and applications (problems), standard cell (Weston-cadmium), reversible and irreversible cell, concentration cell. Determination of fluoride ion using fluoride ion selective electrode – Chemically modified electrodes (CMEs) : concept, approaches and applications.

PRACTICALS

1. Estimation of hardness in given water sample.
2. Estimation of the alkalinity of the given water sample.
3. Estimation of strong acid by conductometry.
4. Estimation of Fe^{2+} present in the given sample by potentiometry.
5. Verification of Beer-Lamberts law and estimation of Cu^{2+} present in unknown sample.
6. Estimation of sodium and potassium present in the given sample by flame photometry.
7. Determination of molecular weight and degree of polymerisation of a polymer by viscosity method.
8. Synthesis of thermosetting polymer.

L – 45; P – 30; TOTAL HOURS – 75

REFERENCES:

1. S. Vairam, P. Kalyani and Suba Ramesh, “Engineering Chemistry”, Wiley India Ltd., New Delhi, 2011.
2. G.A. Ozin and A.C. Arsenault, “Nanochemistry: A Chemical Approach to Nanomaterials”, RSC Publishing, Thomas Graham House, Cambridge, 2005.
3. P.C Jain & Monica Jain, Engineering Chemistry Dhanpatrai Publishing Company (P) Ltd., New Delhi (2013).
4. S S Umare & S S Dara, A text Book of Engineering Chemistry, S. Chand& Company Ltd, New Delhi, 2014.
5. G.D.Rai, “Non conventional energy sources,” Khanna Publishers, New Delhi, 2011.
6. John Twidell and Tony Weir, “Renewable Energy Resources, Taylor & Francis Ltd, London, United Kingdom, 2005
7. Principles of molecular photochemistry: An introduction, Nicholas J. Turro, V.Ramamurthy and Juan C. Scaiano, University Science Books, Sausalito, CA, 2009.

OUTCOMES:

The students will be able to

- solve problems related to hardness, alkalinity, dissolved oxygen associated with the water and describe the treatment processes.
- classify nanomaterials and apply the nanochemistry approach to synthesize the

nanomaterials.

- explain the principle and enumerate the advantages and disadvantages of various renewable energy sources.
- state the principle and illustrate the instrumentation of various analytical techniques.
- apply the concepts of photochemistry to elaborate various photo-physical and photochemical reactions.
- construct a electrochemical cell and describe the various types of electrodes and determine the fluoride content.

GEC 1101	ENGINEERING GRAPHICS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To introduce the students of all engineering programs, the basic concepts of engineering drawing, which is the basic communication medium for all engineers
- To provide practical exposure on important aspects like drawing analytic curves, orthographic projections, section of solids, development of surfaces, isometric projection, perspective projection and free hand drawing.
- To introduce computerized drafting.

MODULE I BASICS AND ENGINEERING CURVES 10

Drawing instruments, dimensioning, BIS conventions, types of lines, simple geometric constructions.

Conic sections: ellipse, parabola, hyperbola.

Special curves: cycloid, epicycloid, hypocycloid and involutes.

MODULE II ORTHOGRAPHIC PROJECTION 8

Orthographic projection – first angle, second angle, third angle and fourth angle projections –setup - assumptions, principle. Free hand sketching of orthographic views of simple machine parts as per first angle projection. Orthographic projection of points in all quadrants. Some commands and demonstration of drafting packages.

MODULE III PROJECTION OF STRAIGHT LINES AND PLANES 10

Projection of straight lines in first quadrant – true length and true inclinations – Rotating line and trapezoidal methods –traces of straight line.

Projection of plane lamina in first quadrant and its traces

MODULE IV PROJECTION OF SOLIDS 10

Projection of solids in first quadrant: Axis inclined to one reference plane only- prism, pyramid, cone, cylinder – change of position and auxiliary projection methods.

MODULE V SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES 12

Section of solids: prism, pyramid, cone, cylinder, and sphere – sectional view – true shape of section Solids in simple position and cutting plane inclined to one reference

plane only.

Development of surface of truncated solids: prism, pyramid, cone cylinder – frustum of cone, pyramid and simple sheet metal parts.

MODULE VI PICTORIAL PROJECTIONS 10

Isometric projection: Isometric scale – isometric axes- iso sheet - Isometric projection and view of prism, pyramid, cylinder, cone, frustums, truncated solids and simple products

Perspective projection: station point – vanishing point – Perspective projection and views of prism, pyramid, cylinder and frustums by Visual ray method.

L – 30; P – 30; TOTAL HOURS – 60

TEXT BOOKS:

1. N.D. Bhatt, 'Engineering Drawing' Charotar Publishing house, 53rd Edtion, (2014)

REFERENCES:

1. K.V. Natarajan, 'A text book of Engineering Graphics', Dhanalakshmi publishers, Chennai. (2009)
2. Venugopal. K, and V. Prabhu Raja, Engineering Graphics, New Age International (P) Ltd., Publication, Chennai. (2011)

OUTCOMES:

- Students should be able to read the specifications and standards of technical drawing and able to draw conic sections and special curves.
- Students should be able to understand the insight of orthographic projection and to draw the various views of orthographic projection of a point and various components.
- Students should be able to draw the orthographic views of straight lines and plane figures.
- Students should be able to draw the orthographic views of simple solids.
- Students should be able to draw the sections of solids and development of solid surfaces.
- Students should be able to draw the isometric and perspective projection of simple solids and components.

GEC 1102	ENGINEERING DESIGN	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To understand the role of design in Engineering
- To understand the basic design concepts
- To understand the role of innovation in design

MODULE I DESIGN AS A CENTRAL ACTIVITY IN ENGINEERING 08

Product design – products and processes – product design methodology Design of systems; Software design

MODULE II NEED ANALYSIS AND CONCEPT DEVELOPMENT 07

Voice of customers – product specification - need analysis Bench marking Product architecture – concept generation and evaluation;

MODULE III CASE STUDIES IN ENGINEERING DESIGN 08

Product design – process design; system design; software design -Ergonomics – usability

MODULE IV INNOVATION AND DESIGN 07

Role of innovation in Engineering – incremental changes and systemic changes; scientific approach to driving innovation – case studies.

TOTAL HOURS – 30

REFERENCES:

1. Clive L. Dym and David C. Brown,“Engineering Design: Representation and Reasoning”, 2nd Edition, Cambridge University Press, New Delhi, 2011.
2. Daniel G. Dorner, G. E. Gorman and Philip J. Calvert, “Information Needs Analysis: Principles and practice in information organizations”, Published by Faced Publishing, London. 2015.
3. Cliff Matthews, “Case Studies in Engineering Design”, John Wiley & Sons Pvt. Ltd, New York, 1998.
4. Bengt-Arne Vedin, “The Design-Inspired Innovation Workbook”, World Scientific, 2011.
5. Navi Radjou, Jaideep Prabhu and Simone Ahuja, “Jugaad Innovation”, Published

by Random House India, 2012.

OUTCOMES:

The students will be able to

- Apply the basic knowledge of design in engineering products / process / service.
- Analyse the problems and give innovative solutions.
- Correlate the basic knowledge of design in the real world problems.
- Apply innovative approaches to engineering design.

GEC1103	BASIC ENGINEERING PRACTICES LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To provide a practical exposure to basic engineering practices like carpentry, fitting, plumbing, welding and making of simple electrical and electronic circuits
- To have an understanding on the use of various tools, instruments and methods
- To enable the students to appreciate the practical difficulties and safety issues

CIVIL ENGINEERING PRACTICE

1. Study of plumbing in general household and industrial systems
2. Making a small window frame with Lap and Mortise & Tenon Joints
3. Introduction to power tools

MECHANICAL ENGINEERING PRACTICE

1. Fabrication of a small Table frame with Butt, Lap and Fillet Joints
2. Machining of a simple component like a table weight using lathe
3. Mold preparation for simple component

ELECTRICAL ENGINEERING PRACTICE

1. Comparison of incandescent, Fluorescent, CFL and LED lamps.
2. Study of Protection Circuits (small relay, fuse, MCB, HRC, MCCB, ECCB).
3. Familiarization of households Electrical Gadgets (Iron Box, Wet Grinder).
4. Understanding of Domestic and Industrial wiring.
5. Earthing and its significance.
6. Troubleshooting in Electrical Circuits.
7. Study of inverter fed UPS/Emergency lamp

ELECTRONICS ENGINEERING PRACTICE

1. Identifications symbolic representation of active and passive electronic components
2. Soldering and tracing of electronic circuits and checking its continuity
3. Assembling of A.C. to D.C, D.C to A.C. Circuits in bread Board and Mini project.

TOTAL HOURS – 30

OUTCOMES:

Upon the completion of the course, students should be able to

- Appreciate the practical skills needed even in making of simple objects, assemblies and circuits
- Attend minor defects especially in items used in day to day life
- Aware of the safety aspects involved in using tools and instruments

GEC 1104	COMPUTER PROGRAMMING I	L	T	P	C
		1	0	2	2

OBJECTIVES:

- To identify the hardware and software components of the computer.
- To know the basic concept of operating system and get knowledge about different operating systems.
- To learn various database concepts and operations
- To develop efficient algorithms for solving a problem.
- To implement the algorithms in C language.
- To use arrays in solving problems.

MODULE I COMPUTER FUNDAMENTALS **7**

Introduction -. Number System - Planning the computer program - Computer Software - Basic operating system concepts - Database Operations

MODULE II PROGRAMMING IN C **8**

Introduction to C Programming Language – Operators - Control statements -Iterative statements - Arrays.

LIST OF EXPERIMENTS:

1. Computer organization –Hardware in a typical computer Identification – Booting- error messages and what it means
2. Types of Operating systems – Windows and Linux
3. Structure of a basic program - Hello world program – Debugging it
4. Data types: Type conversions
5. Input / Output: Formatted functions – Unformatted functions – Library functions
6. Properties of operators – Priority of operators – Arithmetic relational logical and bitwise operators
7. If – if else- nested if else- goto- switch case – nested switch case – for loops – nested for loops – while loop – do-while loop – break and continue statement
8. Arrays – Operation with arrays
9. Sorting and searching.

L – 15; P – 30; TOTAL HOURS – 45

REFERENCES:

1. Ashok N Kamthane, “Computer Programming”, Pearson Education, 2nd Edition, ISBN 13: 9788131704370, 2012
2. Paul J. Deitel, Deitel & Associates, “C How to Program”, Pearson Education, 7th Edition, ISBN-13: 978-0132990448, 2012

OUTCOMES:

Students who complete this course will be able to

- Recognize Modular design, logic flow, data abstraction
- Analyze the working of the programming constructs, functions, and I/O.
- Write down programs for sorting and searching algorithms
- Write down programs developing cycle for different applications
- Debug the programs and solve some practical problems in programming
- Develop programs using arrays.

SEMESTER II

MAC 1281	ADVANCED CALCULUS	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aims of this course are to

- train the students in solving problems using multiple integration.
- provide knowledge in using special functions to find out the area and volume of a region.
- acquire knowledge in tangent and normal vectors.
- gain knowledge in finding the areas of a curve and surface using vector integration.
- learn about the analytic functions and their properties along with bilinear transformation.
- know complex integration using Cauchy's theorems.

MODULE I MULTIPLE INTEGRATION AND ITS APPLICATIONS 8+2

Multiple integrals– Cartesian and Polar coordinates – change of order of integration – Multiple integral to compute area and volume.

MODULE II TRANSFORMATION OF COORDINATES AND SPECIAL FUNCTIONS 7+3

Change of variables between Cartesian, polar, cylindrical and spherical coordinates - Beta and Gamma functions – Properties and applications.

MODULE III VECTOR DIFFERENTIATION 7+3

Operations on vectors – Scalar Product, Vector Product, Projection of Vectors - Angle between two vectors - Gradient, divergence and curl

MODULE IV VECTOR INTEGRATION 8+2

Line, surface and volume integrals – Green's Theorem, Gauss Divergence Theorem and Stokes Theorem (statement only) – verification and evaluation of integrals.

MODULE V

ANALYTIC FUNCTION 8+2

Analytic function - Necessary and Sufficient condition (statement only) – Cauchy-Riemann equations in polar coordinates - properties of analytic function – determination of analytic function – conformal mapping (w = z+a, az and 1/z) and bilinear transformation.

MODULE VI COMPLEX INTEGRATION **7+3**

Statement and application of Cauchy's integral theorem – Cauchy's integral formula – Taylor's series and Laurent's series expansion – singularities - classification – residues - Cauchy's residue theorem – contour integration – Unit circle and semi circular contours (excluding poles on the real axis).

L – 45; T – 15; TOTAL HOURS – 60

TEXT BOOKS:

1. Veerarajan.T., "Engineering Mathematics "(5th edition) Tata Mc Graw Hill Publishing Co. New Delhi, 2012
2. Grewal B.S., "Higher Engineering Mathematics" (43rd edition), Khanna Publishers, New Delhi, 2012.
3. John W. Cell "Engineering Problems Illustrating Mathematics" Mc Graw Hill Publishing Co., New York 1943

REFERENCES:

1. Kreyszig, E., "Advanced Engineering Mathematics", 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
2. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th edition, Cengage Learning, 2011.
3. Dennis G. Zill, Warren S. Wright, "Advanced Engineering Mathematics", 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
4. Alan Jeffrey, "Advanced Engineering Mathematics", Academic Press, USA, 2002.
5. Ramana, B.V., "Higher Engineering Mathematics" Tata Mc Graw Hill Publishing Co. New Delhi, 2006.
6. Venkataraman, M.K., "Engineering Mathematics", Volume 2, 2nd edition, National Publishing Co., Chennai, 2003.
7. James Stewart ".Calculus" (7th edition),Brooks/Cole cengage learning,UK.

OUTCOMES:

After completing the course, student will be able to

- compute the area and volume using multiple integrals.

- apply special functions to solve integration problems.
- apply differentiation in scalar and vector fields.
- find area and volume of a region using vector integration.
- verify analyticity, conformity and bilinearity of complex functions.
- evaluate complex integrals.

GEC 1211	BASIC ENGINEERING MECHANICS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To impart knowledge about the basic laws of statics and dynamics and their applications in problem solving
- To acquaint both with scalar and vector approaches for representing forces and moments acting on particles and rigid bodies and their equilibrium
- To give on exposure on inertial properties of surfaces and solids
- To provide an understanding on the concept of work energy principle, friction, kinematics of motion and their relationship

MODULE I VECTOR APPROACH TO MECHANICS **07**

Introduction - Units and Dimensions- Vectors – Vectorial representation of forces and moments –Vector Algebra and its Physical relevance in Mechanics - Laws of Mechanics – Parallelogram and triangular Law of forces -Lame's theorem, Coplanar Forces – Resolution and Composition of forces- Equilibrium of a particle.

MODULE II EQUILIBRIUM OF PARTICLE **06**

Forces in space - Equilibrium of a particle in space - Equivalent systems of forces – Principle of transmissibility – Single equivalent force

MODULE III EQUILIBRIUM OF RIGID BODY **06**

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis –Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem - Equilibrium of Rigid bodies in two dimensions -Examples

MODULE IV PROPERTIES OF SURFACES **08**

Determination of Areas – First moment of area and the Centroid of sections – Rectangle, circle, triangle from integration – T section, I section, Angle section, Hollow section by using standard formula – second and product moments of plane area – Physical relevance - Rectangle, triangle, circle from integration - T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia- Mass moment of Area

MODULE V FRICTION **08**

Introduction to friction- types of friction- Laws of Coloumb friction- Frictional force – simple contact friction – Rolling resistance –ladder friction

MODULE VI LAWS OF MOTION 10

Review of laws of motion – Newton's law – Work Energy Equation of particles– Impulse and Momentum – Impact of elastic bodies.

L – 45; T – 15; TOTAL HOURS – 60

REFERENCES:

1. Beer, F.P and Johnston Jr. E.R, "Vector Mechanics for Engineers, Dynamics & Statics", Third SI Metric Edition, Tata McGraw-Hill International Edition, 2001.
2. Hibbeller, R.C., Engineering Mechanics, Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., 2000.
3. Irving H. Shames, Engineering Mechanics – Statics and Dynamics, IV Edition Pearson Education Asia Pvt. Ltd., 2003.

OUTCOMES:

On completion of this course students should be able

- Analyse and resolve forces, moments and solve problems using various principles and laws of Mechanics
- Apply the concept of equilibrium to particles and solve problems
- Apply the concept of equilibrium to rigid bodies and solve problems
- Analyse and determine the properties of surfaces
- Analyse and evaluate the fractional forces between the bodies
- Apply the laws of motion in solving dynamics problems

GEC 1212	ENVIRONMENTAL STUDIES	L	T	P	C
		2	0	0	2

OBJECTIVES:

The student will be conversant with the

- various natural resources, availability, utilisation and its current scenario
- different ecosystems, energy transfer, values, threats and conservation of biodiversity
- levels of different pollutants and its impact and the causes and effects of natural disasters
- impacts of human population, impact assessment, human rights and environmental acts and sustainable development

MODULE I NATURAL RESOURCES **8**

Land resources: land degradation, soil erosion and desertification - Forest resources: use and over-exploitation, deforestation - Water resources: use and over-utilisation of surface and ground water, conflicts over water (inter-state and international), dams (benefits and problems), water conservation (rainwater harvesting and watershed management) - Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources, mining - Food resources: world food problems, changes in land use by agriculture and overgrazing, modern agriculture and its effects, fertilizer and pesticide problems, water logging and salinity - Energy resources: increasing energy needs, renewable and non-renewable, use of alternate energy sources.

MODULE II ECOSYSTEM AND BIODIVERSITY **8**

Ecosystem- energy flow in the ecosystem - food chains, food webs and ecological pyramids - characteristics, structure and function of (a) Terrestrial ecosystems (forest, grassland, desert) and (b) Aquatic fresh water ecosystems (pond, lake, river) (c) Aquatic salt water ecosystems (ocean, estuary) - ecological succession.

Biodiversity - genetic, species and ecosystem diversity – hot-spots of biodiversity – biogeographic classification of India - endangered, endemic, extinct and invasive species of India - red data book - values of biodiversity: consumptive, productive, social, ethical, aesthetic and option values - threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts - conservation of biodiversity: in-situ and ex-situ conservation of biodiversity

MODULE III ENVIRONMENTAL POLLUTION AND NATURAL DISASTER **8**

Definition, cause, effects and control measures of (a) air pollution (b) water pollution (c) soil pollution (d) marine pollution (e) noise pollution (f) thermal pollution (g) nuclear hazards - ill-effects of fireworks and upkeep of clean environment - solid waste management: types (urban, industrial, biomedical and electronic wastes), collection, processing and disposal (incineration, composting and land-fill) - natural disaster and management: flood, cyclone, drought, landslide, avalanche, volcanic eruptions, earthquake and tsunami.

MODULE IV HUMAN POPULATION, HEALTH AND SOCIAL ISSUES **6**

Population and population growth, population variation among nations, population explosion, family welfare programme.

Human health: air-borne, water borne diseases, infectious diseases, risks due to chemicals in food and environment.

Sustainable development - environmental legislation and laws: water act, air act, wildlife protection act, forest conservation act, environment protection act - environmental impact assessment, steps in EIA - human rights - women and child welfare.

Case studies related to current situation

TOTAL HOURS – 30

TEXT BOOKS:

1. Erach Bharucha, Textbook for Environmental Studies For Undergraduate Courses of all Branches of Higher Education for University Grants Commission, Orient Blackswan Pvt Ltd, Hyderabad, India, 2013.
2. Benny Joseph, Environmental Studies, Tata McGraw-Hill Education, India, 2009.
3. Ravikrishnan A, Environmental Science and Engineering, Sri Krishna Publications, Tamil Nadu, India, 2015.
4. Raman Sivakumar, Introduction to Environmental Science and Engineering, McGraw Hill Education, India, 2009.
5. Venugopala Rao P, Principles of Environmental Science and Engineering, Prentice Hall India Learning Private Limited; India, 2006.
6. Anubha Kaushik and Kaushik C.P., Environmental Science and Engineering,

New Age International Pvt Ltd., New Delhi, India, 2009.

REFERENCES:

1. Masters G.M., Introduction to Environmental Engineering and Science, Prentice Hall, New Delhi, 1997.
2. Henry J.G. and Heike G.W., Environmental Science and Engineering, Prentice Hall International Inc., New Jersy, 1996.
3. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co. Boston, USA, 2016.

OUTCOMES:

The student will be able to

- predict the scenario of various natural resources and suggest remedies to curb the exploitation of these resources.
- identify food chain and web and its role in various ecosystems, assess the impacts on biodiversity and provide solutions to conserve it.
- analyse the impacts of pollutants in the environment and propose suitable method to alleviate the pollutants and the natural disasters.
- assess on the impact of human population and the health related issues and the ethics to be followed for sustainable life.

GEC 1213	COMPUTER PROGRAMMING II	L	T	P	C
		1	0	2	2

OBJECTIVES:

- To provide knowledge about the benefits of Object Oriented Programming over Procedure oriented programming.
- To learn various File operations
- To expose fundamental concepts of object-oriented programming in classes, invoking methods and functions.
- To prepare students to get full use of code reusability using object oriented programming.
- To implement the basic concepts of object oriented programming using C++concepts.
- To focus on solving problems based on analyzing, designing and implementing programs in C and C++.

MODULE I PROGRAMMING IN C 7

Functions - Storage Classes - Structures and Unions – Pointers -Self Referential Structures and Linked Lists - File Processing.

MODULE II PROGRAMMING IN C++ 8

Programming in C++ - Overview of OOP in C – Inheritance - Polymorphism - Type Casting – Exceptions.

LIST OF EXPERIMENTS:

1. Functions
2. One dimensional arrays, Pointers
3. Recursion
4. Multi dimensional arrays, Linked lists.
5. Operating on Files.
6. Simple C++ program with Control statements.
7. Getting input from user console.
8. Classes, Object and Constructors.
9. Method overloading.
10. Inheritance

L – 15; P – 30; TOTAL HOURS – 45

REFERENCES:

1. Bjarne Stroustrup," The C++ Programming Language", Addison Wesley, 4th edition, ISBN-13: 978-0321563842, 2013.
2. Brian W. Kernighan and Dennis M. Ritchie, " The C Programming Language", Prentice Hall, ISBN 0-13-110362-8, 2015.
3. Bjarne Stroustrup, " Programming: Principles and Practice Using C++ ", Addison Wesley, 2nd edition, ISBN-13: 978-0321992789, 2014.
4. Brian W. Kernighan and Dennis M. Ritchie, " The C Programming Language (Ansi C Version)", Prentice Hall India Learning Private Limited, 2nd edition, ISBN-13: 978-8120305960, 1990.

OUTCOMES:

Students who complete this course will be able to

- Develop efficient algorithms for solving problems
- Handle files in C
- Use simple data structures like arrays and linked lists in solving problems.
- Write simple programs using concepts of object oriented programming.
- Implement algorithms in C++ Language.
- Demonstrate the Object Oriented Programming concepts applied in networking, web development and Database applications.

PEC1211	BASIC MECHANICAL OPERATIONS	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To impart knowledge of heat treatment and metal cutting in mould manufacturing process.
- To provide understanding of machining operations in mould manufacturing.
- To introduce metrology and its applications in mould making.
- To enhance the understanding of electroforming and hobbing process in manufacturing processes.

MODULE I METAL CUTTING AND MACHINING OPERATIONS 8

Mechanics of metal cutting – types of chips, cutting tool geometry, types of tools, influence of tool angles, cutting fluids, tool materials used including coated tools. Study of various machining operations: Turning, drilling, shaping, planning.,Milling – horizontal / Vertical / ram / copy milling, Grinding – surface and cylindrical.

MODULE II ADVANCE MACHINING OPERATIONS 7

Electrical discharge machining – characteristics, physical processes, special technological features, design consideration and typical applications .Electro forming for mold manufacturing – process, materials and design. Hobbing for mold making – process & its advantages, elements of hobbing – hobbing punch, shape of hob, materials used for cavity blanks.

MODULE III POLISHING 8

Definition of surface roughness, basis of polishing technology. Polishing – lapping, lapping and polishing, ultrasonic finishing, principles of electro deposition in damaged molding surfaces, surface texturing of molds – process description, types of molds, types of patterns and mold shapes, metals that can be etched, mold preparation, limitations of chemical texturing.

MODULE IV METROLOGY 7

Metrology and inspection: Scope of inspection, procedures, choices of basic measuring instruments, vernier, micrometer, surface plates, angle plates, squares, vernier height

gauges, depth gauges, slip gauges, dial gauges, surface roughness measurement, hardness testing, comparators, optical profiles projectors, tool makers microscope, optical flats – types and uses.

TOTAL HOURS – 30

TEXT BOOKS:

1. Hajra Choudhury, “Elements of Workshop Technology”, Vol. I and II, Media Promoters Pvt Ltd., Mumbai, 2007.
2. P.C. Sharma, “A Text Book of Production Technology”, S. Chand and Company, X Edition, 2008.
3. P.N. Rao, “Manufacturing Technology”, Tata McGraw-Hill Publishing Limited, II Edition, 2009.
4. HMT – “Production Technology”, Tata McGraw-Hill, 2001.

REFERENCES:

1. Geofrey Boothroyd, “Fundamentals of Metal Machining and Machine Tools”, McGraw Hill, 2006.
2. Richerd R. Kibbe, John E. Neely, Roland O. Merges and Warren J. White, “Machine Tool Practices”, Prentice Hall of India, 2003.

OUTCOMES:

At the end of the course, the students will be able to

- Explain the mechanics of metal cutting and machining operations involved in mold manufacturing.
- Compare the milling and hobbing processes for core and cavity manufacturing.
- Describe various polishing techniques involved in mold manufacturing.
- Identify the basic measuring instruments used in machine shop.

PEC1212	PRINCIPLES OF CHEMICAL ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To teach the basic concepts of principles of chemical engineering.
- To teach the fundamentals, applications of unit operations with related examples.
- To equip students to understand the design principles in the unit operations.
- To develop the ability to analyse the processes and contribute to new designs.

MODULE I HEAT TRANSFER **10**

Unit conversion systems. Heat transfer - Modes of heat transfer, Fourier's law of heat conduction, steady state conduction across composite walls, cylinder and hollow sphere. Heat transfer by natural & forced convection, Radiation. Heat exchanger- Parallel, Countercurrent and Cross flow. Individual and overall heat transfer coefficients. Logarithmic mean temperature difference (LMTD**).** Heat exchanger (Equipment description & solution to simple problems).

MODULE II MASS TRANSFER **8**

Mass Transfer - Principles of diffusion, theory of diffusion, Distillation - Industrial equipment for distillation, Adsorption - Principle and equipment for adsorption.

MODULE III DRYING **7**

Principles and definitions, Equipments for drying, Classification of dryers- dryers for solids and pastes, dryers for solution and slurries, Drying - simple problems to find time for drying.

MODULE IV HUMIDIFICATION **5**

Humidity, dry bulb and wet bulb temperatures, dew point, specific volume and enthalpy Equipment - Water - cooling towers.

MODULE V SIZE REDUCTION **5**

Size reduction - Empirical relationships: Rittinger's and Kick's laws, bond crushing

law and work index, principles, criteria and characteristics of comminuted products. Laws of crushing, Equipment classification - Crushers and Grinders.

MODULE VI SEPARATION PROCESSES 10

Membrane separation process - evaporation and reverse osmosis. Screening and screening equipments, Filtration - principle and filtration equipment (filter press, shell and leaf filter, rotary drum filter, centrifugal filter and centrifuges), filter media, filter aids. Gravity settlers, cyclones and hydro cyclones.

TOTAL HOURS – 45

TEXT BOOKS:

1. Mc Cabe W L , Smith J C and Peter Harriot Emeritus "Unit Operations of Chemical Engineering", - 7th edition McGraw Hill Chemical Engineering Series, New York (2004).
2. Introduction to Chemical Engineering, S.Puspavanam, PHI Learning Pvt. Ltd., 2012
3. Badger W L, Banchero JT, "Introduction to Chemical Engineering", McGraw Hill, UK, (1997).
4. Richardson and Coulson, "Chemical Engineering" Vol. 1 & Vol. 2, Asian Books Pvt. Ltd, India (1996)

REFERENCES:

1. Robert Perry H, Cecil Chilton H, "Chemical Engineer's Handbook (McGraw-Hill Chemical Engineering Series, McGraw-Hill, 5th edition, (1973).
2. Cengel and Ghajar, "Heat and Mass Transfer", McGraw-Hill, 4th edition,(2011).

OUTCOMES:

At the end of the course, the students will be able to

- Outline the different types of heat exchangers.
- Explain the different systems of mass transfer
- Explain the fundamentals of unit operations and industrial processes.
- Identify the appropriate size reduction equipment and separation process.
- Analyze the processes and contribute to new designs in polymer engineering.

PEC1213	CHEMICAL ENGINEERING LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To impart skill to students in measuring the heat transfer coefficients for different modes of heat transfer.
- To train the students in assessing the flow performance of fluids through different systems.
- To familiarize students with the experimental determination of efficiency of particle size reduction.
- To provide skills for separating mixtures of liquids by using different distillation techniques.

LIST OF EXPERIMENTS

1. Flow through Fluidized Bed Reactor
2. Pressure Drop in Packed Bed Reactor
3. Flow through Rough and Smooth Pipes
4. Determination of Friction Factor Flow Through a Pipe
5. Calibration of Orifice Meter by Variable Head Method
6. Performance Test on Centrifugal Pump
7. Performance Test on Two Stage Air Compressor
8. Determination of Emissivity of Given Surface
9. Determination of Thermal Conductivity of Solids
10. Heat transfer in Lagged Pipe
11. Parallel / Counter Flow Heat Exchanger
12. Simple Distillation
13. Steam Distillation
14. Size reduction using Ball Mill and Jaw Crusher

TOTAL HOURS – 30

REFERENCES :

1. Warren L. McCabe, Julian C.Smith and Peter Harriott, “Unit Operations of Chemical Engineering”, 7th Edition, McGraw Hill’s Chemical Engineering Series, 2004.

2. Don W.Green and Robert H. Perry, Perry's Chemical Engineers Handbook, 8th Edition, McGraw Hill Book Company, 2007.
3. Rohsenow W.M and Choi H.Y.: Heat, Mass and momentum Transfer, Prentice-Hall, U.K, 1961.
4. McAdams, William Henry, Heat Transmission, Krieger Publication Company, 3rd edition, 1985.
5. Mathur. D.S, "Heat & Thermodynamics", S.Chand & Co., 2009.
6. Brijlal & Subramaniam, "Heat and Thermodynamics", S.Chand & Co, Delhi., 2010.
7. **Nag** P. K, Engineering Theromodynamics, Tata McGraw-Hill Education, 2005.
8. Bansal, R. K., A Textbook of Fluid Mechanics, Firewall Media, 2005.

OUTCOMES:

At the end of the course, the student will have the knowledge and skills on the following:

- Analyzing the problems associated with fluid mechanics.
- Computing the flow of fluid using various devices.
- Evaluating the performance of pumps, compressors involved in various systems.
- Assessing the various parameters in different equipment associated with heat transfer.
- Knowledge of mass transfer in various chemical process industries.
- Operating Ball Mill and Jaw Crushers.

SEMESTER III

		L	T	P	C
MAC 2181	**PARTIAL DIFFERENTIAL EQUATIONS AND TRANSFORMS**	**3**	**1**	**0**	**4**

OBJECTIVES:

The aims of this course are to

- familiarize in solving partial differential equation of first, second and higher orders.
- introduce basics and engineering applications of Fourier series, Laplace Transform, Fourier Transform and Z- Transform.

MODULE: I PARTIAL DIFFERENTIAL EQUATIONS 10

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solution of standard types of first order partial differential equations – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients.

MODULE: II FOURIER SERIES 10

Fourier Series and Dirichlet's conditions - General Fourier series - Half range Fourier series - Parseval's identity - Harmonic Analysis.

MODULE: III FOURIER TRANSFORMS 10

Fourier integral theorem (without proof) - Fourier transform pair - Fourier Inverse Transform – Properties - Convolution theorem - Parseval's identity.

MODULE: IV APPLICATIONS OF FOURIER SERIES AND FOURIER TRANSFORMS 10

Applications of Fourier series and Fourier Transform to solution of PDEs having constant coefficients with special reference to Heat & Wave equations, Discrete & point Spectrum and Single pulse.

MODULE: V Z – TRANSFORM 10

Introduction to Laplace transform - Existence of Laplace Transform - Properties of Laplace Transforms - Initial & Final Value Theorems - Inverse Laplace Transform - Convolution Theorem – Circuits to signal square wave: Integral equations with unrepeated complex factors – Damped forced vibrations: repeated complex factors –

Resonance - Solution of differential equations.

MODULE: VI REACTIONS OF POLYMERS 9

Introduction and Definition of Z-transform - Properties of Z- Transform - Convolution Theorem of Z-Transform - Inverse Z–transform - Convolution Theorem of Inverse Z-Transform - Formation of difference equations - Solving Difference Equations using Z-Transform.

L – 60; T – 0; Total Hours – 60

TEXT BOOKS:

1. Kreyszig .E., “Advanced Engineering Mathematics“, 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
2. Grewal B.S., “Higher Engineering Mathematics”, 42nd edition, Khanna Publishers, New Delhi, 2012.
3. Ramana, B.V, “Higher Engineering Mathematics” Tata Mc Graw Hill Publishing Co. New Delhi, 2006.

REFERENCES:

1. Veerarajan.T., “Engineering Mathematics“, 5th edition, Tata Mc Graw Hill Publishing Co. New Delhi, 2012.
2. Peter V. O'Neil, “Advanced Engineering Mathematics**”**, 7th edition, Cengage Learning, 2011.
3. Dennis G. Zill, Warren S. Wright, “Advanced Engineering Mathematics”, 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
4. Alan Jeffrey, “Advanced Engineering Mathematics”, Academic Press, USA, 2002.

OUTCOMES:

After completing the course, student will be able to

- solve the partial differential equations.
- derive a Fourier series of a given periodic function by evaluating Fourier coefficients.
- apply integral expressions for the forward and inverse Fourier transform to a range of non-periodic waveforms.
- solve wave equation and heat flow equation.
- solve ordinary differential equations using Laplace transform.
- solve difference equation using Z-transform.

ENC 2181	ORAL COMMUNICATION	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To help the students acquire efficiency in spoken English with due importance to stress, accent and pronunciation.
- To hone the listening skills and understand native accent.
- To enable them to make presentations effectively.
- To develop their ability to persuade and convince people to accept a point of view.
- To prepare them for placement interviews, group discussions.

MODULE: I PRESENTATION SKILLS 8

(i) Oral Communication – Implications in real life and work place situations

(ii) One–minute Presentations (JAM) on concrete and abstract topics that test their creative thinking

(iii) Prepared presentations and **extempore** presentations

(iv) Group project – presentation on any social issue. The group will have to research on the history of the problem, its cause, impact and outcome hoped for and then make a presentation

(v) Recording presentations and feedback - Peer and faculty evaluation

MODULE: II LISTENING 4

Listening to ESL Podcast – Viewing Multimedia – Listening to BBC News - Received Pronunciation (RP)/ VOA/ NDTV – exposure to paralinguistic features.

MODULE: III DEVELOPING PERSUASIVE SKILLS 6

Selling a product – marketing skills – the topics will be on advertising, convincing someone on social issues such as preservation of water, fuel, protection of environment, gender discrimination.

MODULE: IV DEBATES 9

Debates on pros and cons on topics of relevance like Nuclear Energy, Appropriate Technology, Internet, Social Media. This will be followed by Peer and Faculty feedback.

MODULE: V BRAINSTORMING 9

Think pair and share activity – Discussion etiquette – Assigning different roles in a GD (Note-taker, Manager, Leader and Reporter) Peer and faculty feedback.

MODULE: VI INTERVIEW SKILLS 9

- Assessing one's strengths and weaknesses, SWOC Analysis, Mock interview – Verbal and Non-verbal Communication – Types of Job Interview – Telephone Interview, Stress Interview.

L – 45; T – 0; Total Hours – 45

REFERENCES:

1. Hancock,Mark. "English Pronunciation in Use". Cambridge University Press, UK. 2005.
2. Anderson, Kenneth & et.al. "Study Speaking: A Course in Spoken English for Academic Purposes" (Second Edition). Cambridge University Press, UK. 2004.
3. Hurlock, B. Elizabeth. "Personality Development". Tata McGraw Hill, New York. 2004.
4.

OUTCOMES:

- On completion of the course, the students will have the ability to speak confidently and effectively in presentations and group discussions.

PEC 2101 CHEMISTRY OF MACROMOLECULES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the basic concepts of macromolecules.
- To develop an understanding of mechanisms of different polymerization reactions.
- To impart knowledge on characters governing the physical properties of polymers
- To develop an understanding on various reactions of polymers.
- To provide knowledge on chemical and degradation reactions of polymers.
- To introduce the basic concepts of macromolecules.

MODULE: I INTRODUCTION TO MACROMOLECULES 5

Basic concepts of monomers and macromolecules - definition – classification-nomenclature of polymers. Thermoplastics – thermosets – homopolymers – copolymers. Natural and synthetic polymers. Biopolymers and biodegradable polymers. Crystalline and amorphous state. Polymerization reactions – functionality – chain growth- step growth and copolymerization reactions.

MODULE: II CHAIN GROWTH POLYMERIZATION 9

Mechanism and kinetics of free radical- cationic and anionic polymerization. Initiation – propagation –termination - chain transfer. Coordination polymerization – mechanism and kinetics. Copolymerization – Mechanism and Kinetics of free radical – Ionic copolymerization – types of copolymers – Copolymer composition – Determination of Monomer reactivity ratios.

MODULE: III STEP – GROWTH POLYMERIZATION 8

Step growth polymerization – Mechanism and kinetic of step growth polymerization – Bi-functional systems – Poly functional systems. Mechanism and kinetics of ring opening polymerization. Atom transfer polymerization.

MODULE: IV POLYMERIZATION TECHNIQUES 5

Bulk (Mass) Polymerization - Solution Polymerization - Suspension Polymerization - Emulsion Polymerization – mini and micro emulsion polymerization - Precipitation Polymerization - Interfacial and solution polycondensation reactions.

MODULE: V MOLECULAR WEIGHT DETERMINATION 9

Molecular weight – Molecular weight averages – Molecular weight distribution – polydispersity, degree of polymerization - Molecular weight determination - Basic concepts of end group analysis, colligative properties, osmometry, light scattering, and gel permeation chromatography – Viscosity of polymers solutions.

MODULE: VI REACTIONS OF POLYMERS 9

Reactivity of macromolecules - addition reactions - rearrangement reactions - substitution reactions- cross-linking reactions. Graft copolymers - block copolymers. Polymer degradation - thermal degradation -hydrolytic degradation - oxidative degradation - photo-degradation -photo-oxidative degradations.

L – 45; T – 0; Total Hours – 45

TEXT BOOKS:

1. Andrew J. Peacock and Allison Calhoun, Polymer Chemistry: Properties and Application, Carl Hanser Verlag GmbH & Company, 2012.
2. Robert J. Young, Peter A. Lovell, Introduction to Polymers, Third Edition CRC Press, 2011.
3. A. Ravve, Principles of Polymer Chemistry, Springer-Verlag New York, 2012.
4. Joel R. Fried, “Polymer Science and Technology”, Prentice Hall, 2014.
5. Premamoy Ghosh ‘Polymer Science and Technology’ Tata Mc Graw – Hill, 2011.
6. Charles E. Carraher Jr. Introduction to Polymer Chemistry, Fourth Edition, CRC Press, 2017.
7. Fred W. BillMeyer ‘Textbook of Polymer Science’ John Wiley & Sons, 2008

REFERENCES:

1. Herman F. Mark, “Encyclopedia of Polymer Science and Technology”, Wiley-Interscience; 3rd Edition, 2004.
2. R.J.Samuels, “Structured Polymer Properties”, John Wiley & Sons, New York, 1974.

OUTCOMES:

At the end of the course, the students will have the

- Fundamental knowledge on polymers and polymerization reactions.
- Ability to demonstrate the knowledge on mechanism and kinetic of polymerization reactions.
- Ability to select suitable methods for the synthesis of polymers.

- Capability to apply knowledge in synthesizing copolymers.
- Ability to determine the molecular weight of polymers.
- Knowledge on reactions and degradation of polymers.

PEC 2102 PHYSICS OF MACROMOLECULES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide understanding of polymer chain conformation and configuration on its morphological behavior.
- To develop an understanding of the relationship between polymer structure and its properties.
- To introduce the basic principles of thermodynamic transitions in polymers
- .To impart the knowledge of mechanical, electrical, optical and chemical properties of polymers.
-

MODULE: I POLYMER CHAIN CONFORMATION AND CONFIGURATION **8**

Conformation of polymers – staggered and eclipsed states, configurations of polymers, Isomerism in polymers – structural and stereoisomerism.

Morphological aspects of polymers – polymer single crystals, lamellae, spherulites, fringed micelle model - degree of crystallinity, factors affecting crystallinity, Chain orientation – orientation in amorphous and crystalline polymers - properties of oriented polymers - birefringence.

MODULE: II POLYMER STRUCTURE AND PROPERTIES **7**

Structure of polymers – linear, branched, cross linked, and network polymers - homochain and hetero atomic chain polymers – copolymers - linear and cyclic arrangement of polymers - prediction of polymer properties – group contribution techniques, topological techniques , volumetric properties – molar volume, density, Van der Waals volume - coefficient of linear thermal expansion and volumetric thermal expansion - pressure volume temperature (PVT) relationship.

MODULE: III THERMODYNAMIC TRANSITIONS IN POLYMERS **7**

Thermodynamic and transition properties – transition temperature in polymers, glass transition (Tg),melting temperature (Tm), relationship between Tg and Tm - ß-transitions, upper and lower glass transition temperatures - prediction of Tg and Tm of polymers by group contributions. Calorimetric properties – heat capacity, specific heat, latent heat of crystallization and fusion - enthalpy and entropy - calculation of heat capacities of polymers.

MODULE: IV MECHANICAL PROPERTIES OF POLYMERS **8**

Electrical and optical properties – effect of polymer structure on dielectric constant, power factor, dissipation factor, and loss factor - effect of frequency of voltage and temperature on dielectric properties - prediction of molar polarization and effective dipole moment. Effect of additives on electrical properties of polymers - optical properties – effect of polymer structure on optical properties – clarity, transparency, haze, transmittance, reflectance, and gloss - prediction of refractive indices of polymers by group contributions.

MODULE: V ELECTRICAL AND OPTICAL PROPERTIES OF POLYMERS 7

Molecular weight – Molecular weight averages – Molecular weight distribution – polydispersity, degree of polymerization - Molecular weight determination - Basic concepts of end group analysis, colligative properties, osmometry, light scattering, and gel permeation chromatography – Viscosity of polymers solutions.

MODULE: VI CHEMICAL PROPERTIES OF POLYMERS 8

Chemical Properties – cohesive energy, cohesive energy density, solubility parameter, determination of solubility parameter of polymers – prediction of solubility parameter – effect of polymer structure on solubility in solvents and oils – influence of structure in prediction of flame retardancy, water repellency – chemical resistance of polymers – polymer toxicity.

L – 45; T – 0; Total Hours – 45

TEXT BOOKS:

1. E.L. Thomas, " Structure and Properties of Polymers" Wiley-VCH, December 2012. Robert J. Young, Peter A. Lovell, Introduction to Polymers, Third Edition CRC Press, 2011.
2. J.M.G Cowie, Valeria Arrighi, "Polymers: Chemistry and Physics of Modern materials, Third Edition, CRC Press,Taylor and Francis group, July 2007.
3. Yves Gnanou, Micheal Fontanille, " Organic and Physical Chemistry of Polymers, Wiley Interscience, March 2008.
4. Alfred Rudin , Phillip Choi Ph.D. P.Eng , The Elements of Polymer Science & Engineering, Third Edition, Academic Press; 3 edition December 28, 2012.
5. Hans - Henning Kausch, "Intrinsic Molecular Mobility and Toughness of Polymers II, Springer, Lausanne, September 2005.
6. S. F. Sun, Physical Chemistry of Macromolecules: Basic Principles and Issues, Wiley-Interscience; 2 edition, January 28, 2004.

7. Petr Munk , Tejraj M. Aminabhavi, Introduction to Macromolecular Science, Wiley-Interscience; 2 editions, March 5, 2002.
8. D.A.Seanor, ed., Electrical properties of polymers, Acadamic press, Newyork, 1982.
9. William Barford, Electronic and optical properties of conjugated polymers, Oxford University Press, USA, 2009.
10. Jozef.Bicerano, Prediction of Polymer Properties, Second Edition, Marcel Dekker Inc. Newyork, 1995.

REFERENCES:

3. Herman F. Mark, “Encyclopedia of Polymer Science and Technology”, Wiley-Interscience; 3rd Edition, 2004.
4. R.J.Samuels, “Structured Polymer Properties”, John Wiley & Sons, New York, 1974.
5. C.C.Ku & R.Liepins , “Electrical Properties of Polymers” , Hanser Publications, Munich, 1987.
6. Jwao Teraoka, “Polymer Solutions : An Introduction to Physical Properties”, Wiley Interscience, New York, 2002

OUTCOMES:

At the end of the course, the students will have the

- Understand the conformation and configuration of polymers.
- Demonstrate the knowledge on thermodynamic transition in polymers.
- Correlate the structure and properties of various polymers.
- Predict the properties of newly synthesized polymers.
- Analyse the properties with respect to polymer structure.
- Identify polymers with desired properties for specific applications.

PEC2103 PLASTIC MATERIALS TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES:

- To provide fundamental knowledge in the synthesis of monomers for different plastics.
- To impart knowledge in understanding the different polymerization methods involved in manufacturing of various plastic materials.
- To be familiar with the different polymers, their structure property relationship and applications.
- To impart knowledge in various industrial and high performance plastics, their properties and applications.

MODULE I POLYOLEFINS 8

Polyethylene - Introduction and historical background - monomer preparation - catalyst systems for olefin polymerization - production technology - Polymerization Processes - High-Pressure Processes - Ziegler processes - The Phillips process - The Standard Oil (Indiana) process - Metallocene processes - structure and properties of polyethylene - applications.

Polypropylene - types of PP - homopolymers - block copolymers - random copolymers - homopolymers and copolymers produced by metallocene catalysis - Preparation of Polypropylene - Structure and Properties of Polypropylene - additives for PP – applications.

MODULE II VINYL PLASTICS 8

Vinyl Chloride Polymers - monomer preparation - polymerisation - Structure and Properties of PVC - Compounding ingredients - properties of PVC compounds - applications - poly (vinylidene chloride).

Poly (vinyl acetate) - monomer preparation - polymerisation - structure, properties and applications.

Polyvinyl alcohol - polymerization and processing technologies - molecular structure - solid state properties - solution properties - applications.

MODULE III ACRYLIC AND STYRENIC PLASTICS 8

Poly(methy1 methacrylate) - preparation of monomer - polymerisation - structure, properties - commercial formulations and processing - Cast Sheet, PMMA Resin, beads - PMMA blends - applications.

Polyacrylonitrile - manufacture of acrylonitrile - polymerisation - structure and properties, thermoplastic blends, alloys, copolymers - applications.

Polystyrene - preparation of monomer - polymerisation - different grades of PS - structure and properties - modification of PS - HIPS, SAN, ABS - properties and applications.

MODULE IV POLYAMIDES 6

Aliphatic polyamides: polymerization of aliphatic polyamides - nylon 6- nylon 6, 6 and other types of nylons - structure and properties of aliphatic polyamides – applications.

Aromatic polyamides - monomer synthesis - polymerisation - properties - processing - spinning - wet and dry, casting - applications.

MODULE V OTHER ENGINEERING PLASTICS 8

Manufacturing processes, properties and applications of polyethylene terephthalate – polybutylene terephthalate – polyacetals – polycarbonates - fluoroplastics.

MODULE VI SPECIALITY PLASTICS 7

Manufacturing processes, properties and applications of - Poly(ether ether ketone) (PEEK) - Polyphenylene sulphides - polysulphones - liquid crystalline polymers - polyimides..

L – 45; T – 0; Total Hours – 45

TEXT BOOKS:

1. Marianne Gilbert, "Brydson's Plastics Materials", Elsevier Ltd, 2017.
2. Vikas Mittal, " High Performance Polymers and Engineering Plastics", Scrivener Publishing LLC, 2011.
3. Charles A. Harper, "Plastic Materials and Process encyclopedia", John Wiley & Sons, 2003.

REFERENCES:

1. Olagoke Olabisi, “Hand Book of Thermoplastics”, Second edition, Taylor & Francis Group LLC., 2016.
2. Irvin.I.Rubin, “Hand Book of Plastic Materials and Technology”, Wiley Interscience, NY, 1990.

OUTCOMES:

At the end of the course, the students will be able

- To demonstrate the synthesis of monomers for different plastics.

- To describe different polymerization methods involved in manufacturing of various plastic materials.
- To exhibit knowledge in different polymers, their structure property relationship and applications.
- To differentiate plastics based on structure property relationship.
- To identify / suggest plastics based on the application requirements.
- To explain industrial and high performance plastics, their properties and applications.

EEC 2181	INTRODUCTION TO ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C
		3	1	0	4

OBJECTIVES:

- Basic concepts of electrical circuits and their solutions
- Performance of Electrical machines, speed control and their use as drives.
- Basic knowledge on power system and various methods of power generation through renewable energy sources.
- The concepts of quantum theory of solids and semiconductor materials.

Basis of understanding the characteristics, operation and limitations of semiconductor devices.

MODULE I DC AND AC CIRCUITS 12

Circuit Parameters-Sources- Kirchhoff's laws-Solution of simple circuits AC quantities – Phasor representation – Power-Real, Reactive and Apparent Power – Solution of Simple circuits.

Superposition, Thevenin's, Norton's and Maximum power transfer theorem- Network solution by Mesh current and Node Voltage method

MODULE II ELECTRICAL MACHINES AND DRIVES 8

DC generator and Motor – Working Principle and Operating Characteristics – Starters for DC motors and speed control – applications.

Transformers - Single phase and three phase transformers- Working Principle – EMF equation - equivalent circuit and performance calculations.

Three phase and single phase induction motors - Working Principle – Torque-Slip characteristics – Starting and speed control – use of induction motor as industrial drives

MODULE III ELECTRIC POWER SYSTEMS 0

Structure of Power system – Transmission and Distribution schemes – Power Quality – Indian Electricity Rules and Regulations.

MODULE IV SEMICONDUCTORS 10

Energy band theory – intrinsic semiconductors- extrinsic semiconductors – Calculation of location of Fermi level and free electron and hole densities in extrinsic semiconductors – N and P type semiconductors- Mobility, drift current and conductivity – Diffusion current – Continuity equation – Hall effect – Calculation of electron and hole densities.

MODULE V PN JUNCTION AND SPECIAL DIODES 0

Band structure of PN Junction – Current Component in a PN Junction – Derivation of diode equation – switching characteristics of diode – Mechanism of avalanche and Zener breakdown – Zener diode & its applications –Diode as Clipper & Clamper – Varactor diode – Backward diode – Tunneling effect in thin barriers – Tunnel diode – Photo diode – Schottky diodes

MODULE VI TRANSISTORS AND AMPLIFIERS 0

Bipolar junction transistor – CB, CE, CC configuration and characteristics – Comparison – Field effect transistor – Configuration and characteristic – SCR, DIAC, TRIAC, UJT – Characteristics and simple applications – MOSFET:PMOS.NMOS – Structure and characteristics.

L – 60; Total Hours – 60

TEXT BOOKS:

1. William H. Hayt Jr, Jack E. Kemmerly, and Steven M. Durbin, “Engineering Circuit Analysis”, Tata McGraw Hill Publishing Co Ltd, New Delhi, 2002.
2. Vedam Subrahmanyam, "Electric Drives", McGraw-Hill Education (India) Pvt Limited, 2010.
3. Edward Hughes, “Electrical and Electronics Technology”, Pearson India, 9th Edition, 2007.
4. D.P.Kothari and I.J.Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill Publishing Co Ltd, 2nd Edition, 2002.
5. I.J .Nagrath and D.P.Kothari, ‘Power System Engineering’ , Tata McGraw Hill Publishing Co Ltd, 2nd Edition, 2007.

REFERENCES:

1. Ewald F.Fuchs and Mohammed A.S.Masoum, Elsevier Academic Press, 2008.
2. Indian Electricity Rules, 1956.
3. Jacob Millman & Christos C.Halkias, “Electronic Devices and Circuits” Tata McGraw–Hill, 1991.
4. Floyd, “Electronic Devices: Conventional Current Version, 7/E” Pearson Education India, 2008.
5. S. Salivahanan, N.Sureshkumar and A.Vallavaraj, “Electronic Devices and Circuits”, Tata McGraw Hill Publishing Co Ltd, 1998.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- The basics of electrical circuits and their solution methods.
- The working of machines and their drives.
- The structure of power system and importance of power quality.
- Various methods of power generation from renewable energy sources.
- Working of PN junction diodes and special purpose diodes.
  Characteristics of transistors both in ideal and non-ideal cases

PEC 2104	POLYMER SYNTHESIS LAB	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To impart practical skills in synthesizing various polymers using different polymerization techniques.
- To impart knowledge in identifying suitable method for polymerization of polymer.

LIST OF EXPERIMENTS :

1. Preparation of phenol – formaldehyde (Novolac) resin.
2. Preparation of phenol – formaldehyde (Resol) resin.
3. Preparation of urea formaldehyde resin.
4. Preparation of bisphenol – A epoxy resin.
5. Preparation of unsaturated polyester resin.
6. Preparation of polyester using diethylene glycol & adipic acid.
7. Bulk polymerization of styrene.
8. Emulsion polymerization of styrene.
9. Solution polymerization of acrylonitrile.
10. Solution polymerization of vinyl acetate.
11. Suspension polymerization of methyl methacrylate.
12. Copolymerization of styrene and methyl methacrylate

Total Hours – 45

REFERENCES:

1 Enrique Saldivar-Guerra “Handbook of Polymer Synthesis, Characterization, and Processing” Eduardo Vivaldo-Lima, 2013.

2 Dietrich Braun, Harald Cherdron, Matthias Rehahn,et al., “Polymer Synthesis: Theory and Practice: Fundamentals, Methods, Experiments”, springer ,5th edition, 2012.

3 Geofrey Boothroyd, “Fundamentals of Metal Machining and Machine Tools”, McGraw Hill, 2006.

4 Kalpakjian, “Manufacturing Engineering and Technology”, 4th edition, Addison Wesley Congmen Pvt. Ltd., Singapore, 2009.

OUTCOMES:

At the end of the course, the student will be able to

- Synthesize thermoplastics and thermosetting polymers.
- Develop new polymers and chemically modify the existing polymers based on specific property requirements.

EEC2182	ELECTRICAL AND ELECTRONICS ENGINEERING LAB	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To understand, simulate and verify Thevenin's and Norton's theorem.
- To understand and verify the characteristics of various electrical machines
- To understand the three phase power measurement in AC circuits**.**
- To verify practically, the fundamental characteristics of electron devices.

LIST OF EXPERIMENTS :

1. Verification of Thevenin's theorem and Norton's theorem using MATLAB
2. Open circuit characteristics and Load Characteristics of Self Excited DC Generator
3. Load Test on DC Shunt and DC Series Motor
4. Load Test on Single Phase Transformer
5. Load Test on Three Phase Induction Motor
6. Measurement of 3 phase power using 2 wattmeter method
7. PN Junction Diode characteristics.
8. Zener Diode characteristics.
9. Input and Output characteristics of BJT in CE configuration**.**
10. Characteristics of JFET.
11. SCR Characteristics.

Total Hours – 45

TEXT BOOKS:

1. William H. Hayt Jr, Jack E. Kemmerly, and Steven M. Durbin, "Engineering Circuit Analysis", Tata McGraw Hill Publishing Co Ltd, New Delhi, 2002.
2. Vedam Subrahmanyam, "Electric Drives", McGraw-Hill Education (India) Pvt Limited, 2010.
3. Edward Hughes, "Electrical and Electronics Technology", Pearson India, 9th Edition, 2007.
4. D.P.Kothari and I.J.Nagrath, "Basic Electrical Engineering", Tata McGraw Hill Publishing Co Ltd, 2nd Edition, 2002.
5. I.J .Nagrath and D.P.Kothari, 'Power System Engineering' , Tata McGraw Hill Publishing Co Ltd, 2nd Edition, 2007.

REFERENCES:

1. Ewald F.Fuchs and Mohammed A.S.Masoum, Elsevier Academic Press, 2008.
2. Indian Electricity Rules, 1956.

3. Jacob Millman & Christos C.Halkias, “Electronic Devices and Circuits” Tata McGraw–Hill, 1991.
4. Floyd, “Electronic Devices: Conventional Current Version, 7/E” Pearson Education India, 2008.
5. S. Salivahanan, N.Sureshkumar and A.Vallavaraj, “Electronic Devices and Circuits”, Tata McGraw Hill Publishing Co Ltd, 1998.

OUTCOMES:

At the end of the course, the student should be able to:

- Construct and simulate any given simple electric circuits and verify theorems using MATLAB.
- Study and understand the performance of Electrical Machines.
- Measure the three phase power.
  Experimentally understand the characteristics of diodes, BJT’s and FET’s and SCR.

PEC 2105 MACHINING PRACTICE LAB

L	T	P	C
0	0	2	1

OBJECTIVES:

- To demonstrate the knowledge of machining principles and safe working practices.
- To equip how to set the machining parameters in accordance of machining requirement.
- To impart practical skills in metal cutting processes.
- To provide understanding of machining operations in mould manufacturing.
- To impart knowledge of various process parameters affecting the machining operations in mould manufacturing.
- To equip with the fundamental knowledge of metrology and its applications in mould making processes.

LIST OF EXPERIMENTS:

1. Exercise on Shaping machine – making square rod from round rod and cutting V- groove.
2. Exercise on Plain Milling.
3. Exercise on Vertical Milling.
4. Exercise on Surface Grinding.
5. Exercise on Slotting Machine.
6. Grinding of Cutting tools.
7. Study of different types of Cutting tools.
8. Exercise on EDM.
9. Study of Micrometer, Vernier calipers, Height gauge and Slip gauge.
10. Measurement of angles and tapers.
11. Checking of straightness using auto collimeter.

Total Hours – 45

TEXT BOOKS:

- HMT – “Production Technology”, Tata McGraw-Hill, 2001.
- Hajra Choudhury, “Elements of Workshop Technology”, Vol. I and II, Media Promoters Pvt Ltd., Mumbai, 2007.
- P.C. Sharma, “A Text Book of Production Technology”, S. Chand and Company, 10th Edition, 2008.
- P.N. Rao, “Manufacturing Technology”, Tata McGraw-Hill Publishing Limited, II Edition, 2009.

- Jain.R.K, “Production Technology : Manufacturing Processes, Technology and Automation”, 17th Edition, Khanna Publishers, 2011.

REFERENCES:

- Chapman.W.A.J, “Workshop Technology Vol. I and II”, Arnold Publisher, New Delhi, 2001.
- Richerd R. Kibbe, John E. Neely, Roland O. Merges and Warren J. White, “Machine Tool Practices”, Prentice Hall of India, 2003.
- Geofrey Boothroyd, “Fundamentals of Metal Machining and Machine Tools”, McGraw Hill, 2006.
- Kalpakjian, “Manufacturing Engineering and Technology”, 4th edition, Addison Wesley Congmen Pvt. Ltd., Singapore, 2009.

OUTCOMES:

At the end of the course, the students will be able to

- Mount the tools and workpieces in accordance with industry practice, worksite procedures, and safety guidelines.
- Set various machining parameters in accordance with job specifications and machine operating procedures.
- Operate the shaping machines to make square rod from round rod and V groove.
- Manufacture various components by milling operations.
- Polish the machined surface by grinding operations.
- Identify and use the basic measuring instruments used in machine shop.
- Measure and confirm that they meet the specified tolerances in accordance with job specifications.

Semester - IV

ENC2282	WRITTEN COMMUNICATION	L	T	P	C
		0	0	2	1

OBJECTIVES:

To develop their creative thinking skills and write reviews.

- To train them with the nuances of corporate correspondence
- To train them in writing official letters, technical reports and proposals.
- To expose them to the writing of Statement of Purpose.

MODULE: I WRITTEN COMMUNICATION 8

Written Communication – Introduction - process of writing – ABC of academic and professional writing – Writing an article.

MODULE: II CREATIVE WRITING 9

Creative Writing - Writing stories based on visuals - Preparing an outline for a story - Writing critical reviews on an article / a paper.

MODULE: III CORPORATE CORRESPONDENCE 7

Corporate Correspondence – Tone in formal writing – e-mail writing, memo, fax, agenda and minutes writing.

Lab: viewing e-mail etiquette, format and conventions of writing memo.

MODULE: IV OFFICIAL LETTERS 7

Official Letters: Writing Statement of purpose, Letter of Application and Resume – Assessing one's strengths and weaknesses – peer evaluation.

Lab: Resume writing – Viewing different types – Functional, Chronological - Writing one's resume using wiki, Letter calling for interview and seeking promotion.

MODULE: V TECHNICAL WRITING 1 7

Describing an experiment, writing instructions and recommendations, Feasibility report and progress report, Synopsis – Group assignment – case study.

MODULE: VI TECHNICAL WRITING II 7

Writing a technical proposal – Format – cover page, executive summary, timeline chart, budget estimate, drafting, conclusion,.

L – 45; T – 0; Total Hours – 45

TEXT BOOKS:

1. Riordan & Pauley. 'Report Writing Today'. 9th Edition. Wadsworth Cengage Learning, USA. 2005.
2. Gerson, Sharon & Steven M. Gerson, 'Technical Writing: Process and Product' Pearson Education , New Delhi. 2004.

REFERENCES:

1. Riordan & Pauley. 'Report Writing Today'. 9th Edition. Wadsworth Cengage Learning, USA. 2005.
2. Gerson, Sharon & Steven M. Gerson, 'Technical Writing: Process and Product' Pearson Education , New Delhi. 2004.
3. *M* Ashraf Rizvi 'Effective Technical Communication'. Tata McGraw-Hill Education, 2005.
4. Sharma, R.C. & Krishna Mohan, "Business Correspondence and Report Writing". Tata MacGraw – Hill Publishing Company Limited, New Delhi. 2002.
5. Anderson, Durston & Pool. "Thesis and Assignment Writing". 4th Edition. John Wiley & Sons. Australia. 2002.

OUTCOMES:

On completion of the course, the students will have the ability to write all kinds of formal correspondence like letters, reports and proposals.

PEC2211 POLYMER RHEOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide understanding about the mechanical behavior of polymeric materials.
- To impart knowledge in rheological behavior of polymer melts.
- To equip with the knowledge about the function of various rheometers.
- To apply the fundamentals of polymer rheology in different processing applications.

MODULE: I MECHANICAL BEHAVIOUR OF POLYMERIC MATERIALS **8**

Introduction to Rheology – Types of mechanical deformation – Elastic materials – Viscous materials – Viscoelasticity – effect of rate of strain, temperature and time on mechanical behaviour of polymeric materials – creep – stress relaxation – Boltzman principle – time temperature super position principle – WLF equation.

MODULE: II MECHANICAL MODELS-VISCOELASTIC BEHAVIOUR **9**

Mechanical models – stress strain response of spring and dashpot – viscoelstic models – Maxwell element – Voight kelvin element – response to creep and stress relaxation – four-parameter model – dynamic mechanical properties – behavior of Maxwell element and relaxation spectra.

MODULE: III PARAMETERS INFLUENCING POLYMER RHEOLOGY **7**

Effect of pressure on viscosity, effect of temperature, activation energy effect of molecular weight and molecular weight distribution on viscosity, molecular at dependence of zero shear viscosity, effect of crosslinking, crystallinity branching, copolymerization, effect of fillers, fiber filled polymer melts, effect of plasticizers, shear rate dependence of viscosity.

Module: IV FLOW PROPERTIES OF POLYMER MELT **7**

Fluid flow – types of fluid flow –Newtonian and Non Newtonian fluids – laminar flow of Newtonian fluids - viscosity of polymer melts – shear thinning and shear thickening – zero-shear rate viscosity –— power law – general treatment of isothermal viscous flow in tubes – entrance and exit effects - elastic effects in polymer melt flow - die-swell and melt fracture – Weissenberg effect – normal stress difference – Elongational viscosity.

Module: V MEASUREMENT OF RHEOLOGICAL PROPERTIES 7

Measurements of rheological properties – capillary rheometers – melt flow index – cone and plate viscometrer – torque rheometers – Mooney viscometer – curemeters – Rheo – optical methods – birefringence

Module: VI APPLICATION OF POLYMER RHEOLOGY TO PROCESSING 7

Rheological behaviour of thermoplastics PE, PVC, PS, PP, nylons and PC – Applications of rheology to polymer processing - injection moulding, extrusion and blow moulding.

L – 45; T – 0; Total Hours – 45

TEXT BOOKS:

1. Montgomery T. Shaw, “Introduction to Polymer Rheology”, Wiley, Kindle Edition, 2012.Vikas Mittal, " High Performance Polymers and Engineering Plastics", Scrivener Publishing LLC, 2011.
2. Chang Dae Han, “Rheology and Processing of Polymeric Materials : Volume 2 : Polymer Processing”, Oxford University Press, USA, 2007.
3. Tim Osswald and Natalie Rudolph Madison, “Polymer Rheology Fundamentals and Applications”, Hanser Publishers, Munich, Cincinatti, USA, 2014.
4. Richard .G. Griskey, “Polymer Process Engineering ”, Springer Science and Business Media, 2012.
5. J.A Brydson, “Plastics Materials”, Butterworth-Heinemann; 8th Edition, UK, 2016

REFERENCES:

1. Herman F. Mark, “Encyclopedia of Polymer Science and Technology”, Wiley; 4rd Edition, 2014. I
2. Alexander Ya. Malkin, Avraam I. Isayev Rheology, “Concepts, Methods, and Applications”, ChemTech Publishing, 2nd Edition, 2012.

OUTCOMES:

At the end of the course, the students will be able

- Construct a model for the different combination of viscoelastic polymer melts.
- Demonstrate the rheological behavior of thermoplastic materials.
- Analyze the flow properties of polymer melts.
- Critique the influence of rheology on different properties of polymer.
- Explain the function of various rheological instruments and optimize its

parameters.

- Apply the theory of rheology in the applications of polymer processing.

PEC 2212	SCIENCE AND TECHNOLOGY OF RUBBERS	L	P	T	C
		3	0	0	3

OBJECTIVES:

- To impart knowledge in predicting and modifying the properties of rubber.
- To provide understanding on rubber compounding ingredients, their importance and technical classification of rubber mixes
- To make students conversant with the manufacture, properties and application of different rubbers.
- To enhance their skill in developing formulation for desired

MODULE: I SCIENCE OF RUBBERS 6

Physics of Rubber Elasticity – Thermodynamics of rubber – Classification of rubbers – Effect of structure on Tg – Effect of chemical structure on the performance properties of rubbers – Effect of structure on processing properties of elastomers.

MODULE: II COMPOUNDING AND MIXING 7

General principles of rubber compounding – Various compounding ingredients and their classification – Preparation, properties and uses of carbon black – Non-black fillers, plasticizers, accelerators, activators, cross linking agents – Special purpose additives– Rubber mixing mechanism– Mixing machinery – Two roll mill, Internal mixer.

MODULE: III MOLDING AND VULCANISATION 5

Compression, transfer and injection molding of rubbers – Curing characteristics - Mechanism of crosslinking by different crosslinking agents – Vulcanisation techniques.

MODULE: IV SPECIAL PURPOSE RUBBERS 9

Manufacture, Properties and Application: IIR– EPRs– NBR– CR– HNBR– ACM– EMA–EVA– CSM– CM– epichlorohydrin rubbers – polysulphide rubbers.

MODULE: V GENERAL PURPOSE RUBBERS 9

Natural rubber latex, tapping – Conversion to dry rubber – Properties, grading and specifications of NR – Chemically modified NR – SBR : preparation, types, properties and appliations– BR: polymerization , properties and applications – IR:

Manufacture, properties and appliations – poly alkenamers, poly norbornenes.

MODULE: VI HIGH PERFORMANCE AND THERMOPLASTIC ELASTOMERS **9**

Manufacture, Properties and Application: Silicone Elastomers– Fluorocarbon rubbers – Polyurethane Rubbers – Requirements for thermoplastic elastomeric behavior – Different methods of preparation – SBS and SIS Block copolymers – Thermoplastic Polyurethane elastomers – Thermoplastic – co – polyesters – Thermoplastic elastomers based on Plastics – Rubber Blends – Dynamic Vulcanization.

L – 45; T – 0; Total Hours – 45

TEXT BOOKS:

1 Maurice Morton, “Rubber Technology”, Third edition, Springer Science & Business Media, 2012.
2 J John M. Funt, “Mixing of Rubber”, First Edition, Smithers Rapra Technology, 2009.
3 Jean-Maurice Vergnaud, Iosif-Daniel Rosca, “Rubber Curing and Properties”, First Edition, CRC Press, 2016 .
4 James E. Mark, Burak Erman, Frederick R. Eirich , “Science and Technology of Rubber”, Second Edition, Academic Press, 2014.
5 Jim White, J. R. White, “Rubber Technologist's Handbook, Volume 2”, Second Edition, Smithers Rapra Technology, 2009.
6 Anil K. Bhowmick, “Current Topics in Elastomers Research”, First Edition, CRC Press, 2008.

REFERENCES:

1 John S. Dick , “Rubber Technology: Compounding and Testing for Performance”, Second Edition, Carl Hanser Verlag GmbH & Company KG, 2014.
2 R. B. Simpson, “Rubber Basics”, First Edition, iSmithers Rapra Publishing, 2002 .
3 Anil K. Bhowmick, Howard Stephens, “Handbook of Elastomers”, Second Edition, CRC Press, 2000.

COURSE OUTCOMES:

At the end of the course, the students will be able to

- Predict the properties of rubbers based on their chemical structure and modify it as per property requirement.
- Demonstrate skills to use rubber processing machineries and develop a high quality rubber compound.
- Select proper vulcanization mechanism for particular rubber compound to meet desired product performance.
- Select suitable grade of general purpose rubbers for desired application.
- Apply the knowledge of various rubbers and select an appropriate rubber for a given application.
- Design a suitable formulation for products requiring high performance properties.

PEC 2213	PLASTICS AND RUBBER COMPOUNDING TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To develop an understanding on the limitations aspect of polymeric materials during synthesis, manufacturing, service and emphasize the importance of various additives.
- To impart knowledge in selecting the various additives based on the performance and property requirements of the specific polymer.
- To provide knowledge on the chemistry and mechanism involved in incorporation of additives into polymeric materials.
- To impart skill in compounding of various thermoplastics, thermosets and rubbers to attain the desired performance.
- To develop a formulation for various polymeric products.
-

MODULE: I INTRODUCTION TO COMPOUNDING 5

Introduction – limitations of polymeric materials. Additives: additives for plastics – technological requirements of additives. Compounding of plastics and rubber

MODULE: II ADDITIVES FOR COMPOUNDING 9

Types, mechanism, advantages and limitations of antioxidants – lubricants – heat stabilizers – UV stabilizers – plasticisers – fillers – reinforcements - flame retardants – processing aids – blowing agents – toughening agents – colorants – anti static and anti slip agent.

MODULE: III COMPOUNDING OF THERMOPLASTICS 7

Compounding of poly(vinyl chloride) – formulations for rigid and flexible PVC products – design of formulations. Compounding of polyolefins – polyethylene, polypropylene.

MODULE: IV COMPOUNDING OF THERMOSETS 8

Compounding of thermosets - unsaturated polyester resins – epoxy resins – compounding of moulding powders – phenol formaldehyde – melamine formaldehyde.

MODULE: V COMPOUNDING OF RUBBERS 8

Vulcanizing agents - sulphur and peroxides – activators, accelerators, conventional

and efficient vulcanization systems – retarders, promoters, antioxidants, antiozonants, processing aids, fillers – non black and carbon black – chemical blowing agents.

MODULE: VI EQUIPMENT FOR COMPOUNDING 8

Single screw extruders – twin-screw extruders – internal and external mixers - high speed fluidized mixer and cooler - mixing machineries for rubbers – two roll mill – internal batch mixers – continuous mixers – banbury mixer - operations and maintenance of mixing equipments.

L – 45; T – 0; Total Hours – 45

TEXT BOOKS:

1. Natamai Subramanian Muralisrinivasan, “Introduction to Polymer Compounding: Raw Materials”, Volume 1, published by Smithers Rapra Technology Ltd, Volume 1, 2014.
2. Dr.Muralisrinivasan Natama Subramanian***, “I***ntroduction to Polymer Compounding: Raw Materials***”***, Volume 1***,*** 2014.
3. Michael Schiller “PVC Additives: Performance, Chemistry, Developments, and Sustainability” Carl Hanser Verlag GmbH & Company KG, 2015.
4. Brendan Rodgers, “Rubber Compounding: Chemistry and Applications”, Second Edition, edited by Taylor and Francis Group,2015.
5. Plastics Materials by J.A.Brydson, seventh edition, 2017.
6. John S.Dic, Annicelli.R.A. “Rubber Technology: Compounding and Testing for Performance” Hanser Gardner Publisication, 2001.
7. Plastics Additives, an A-Z reference, edited by Geoffrey Pritchard, 1998.
8. Chris Rauwendaal Polymer Mixing, A self-study Guide, Hanser Publisher, ed.1998.
9. Richard F.Grossman, The mixing of Rubbers, Chapman & Hall, 1997.
10. David B Todd, Plastic Compou Maurice Morton, Ed Rubber technology, Third Edition, Van Nostrand Reinhold, New York, 1987.
11. C.M.Blow and Hepburn, - Rubber Technology and Manufacture, 2nd edition, 1982.

REFERENCES:

1. Michael Bolgar, Jack Hubball, Joseph Groeger, Susan Meronek, “Handbook for the Chemical Analysis of Plastic and Polymer Additives”, Second edition, 2015.
2. J.M.Martin, W.K.Smith, “Handbook of Rubber Technology”, CBS Publishers &

Distributors, New Delhi, 2004.

OUTCOMES:

After completion of this course, students will be able to

- Suggest a suitable additive based on the performance and property requirement of the specific polymer.
- Apply knowledge in compounding of various thermoplastics, thermosets and rubbers to enhance proper dispersion and attain desired performance.
- Select suitable equipment for compounding specific thermoplastic, thermoset and rubber.

PEC 2214	POLYMER ANALYSIS AND CHARACTERIZATION	L	P	T	C
		3	0	0	3

OBJECTIVES:

- To impart the skill in identifying various polymers and validating their quality.
- To provide understanding on the usage of sophisticated instruments to analyze the morphology of polymers.
- To impart the knowledge of various techniques in characterizing the molecular structure of polymers.
- To impart the skills in handling various instruments and analyzing the test results.

MODULE: I ANALYSIS OF THERMOPLASTICS 5

Preliminary Identification of thermoplastics – Chemical Identification of thermoplastics– Raw materials characterization - melting point, density, viscosity, melt flow index, K-value.

MODULE: II ANALYSIS OF THERMOSETS AND RUBBERS 8

Preliminary and chemical Identification of thermosets and rubbers – Raw materials characterization of thermosets - moisture content, particle size, apparent density, flow test , gel time and peak exothermic temperature - acid value, hydroxyl value, isocyanate index, epoxy equivalent. Analysis of latex - viscosity, TSC, DRC, alkalinity, volatile matter, KOH number, mechanical stability.

MODULE: III SPECTROSCOPIC CHARACTERIZATION 8

Vibrational Spectroscopy- Principle – UV- Visible Spectrophotometer – IR – Raman – NMR – Mass Spectroscopy – Instrumentation – Fourier Transform Infrared Spectroscopy – Group frequencies and Finger Print Regions.

MODULE: IV THERMAL CHARACTERIZATION 8

Instrumentation, Analysis and Interpretation:Thermogravimetric analysis (TGA) – Differential scanning calorimetry (DSC) – Differential thermal analysis (DTA) – Dynamic mechanical analysis (DMA) – Thermomechanical analysis (TMA) – Dielectric thermal analysis (DETA).

MODULE: V MORPHOLOGICAL CHARACTERIZATION 8

X-RAY Diffraction – WAXD – SAXS – Crystal Structure – Birefringence – optical microscopy– scanning electron microscopy– transmission electron microscopy – Atomic Force Microscopy – Instrumentation, analysis and Interpretation of data.

MODULE: VI RHEOLOGICAL CHARACTERISATION AND PROCESSALBILITY 8

Characterization of Shear and Elongational flow – Capillary Rheometers – Rotational Rheometers – Parallel plate Rheometers– Rheological Characterization of filled and unfilled Polymers – Tests for processability parameters of rubbers – ODR, scorch time, cure time, cure rate index, plasticity, mooney viscosity.

L – 45; T – 0; Total Hours – 45

TEXT BOOKS:

1 Vishu Shah, “Handbook of plastics testing and failure analysis”, Third edition, John Wiley and Sons, 2007.
2 Roger Brown, “Physical test methods for elastomers”, First Edition, Springer, 2017.
3 John M. Chalmers, Robert J. Meier, “Molecular Characterization and Analysis of Polymers”, Volume 53 of Comprehensive Analytical Chemistry, Elsevier, 2008.
4 Edith Turi, “Thermal Characterization of Polymeric Materials”, First edition, Elsevier, 2012.
5 Richard A. Pethrick, “Polymer Structure Characterization: From Nano to Macro Organization in Small Molecules and Polymer”, First edition, Royal Society of Chemistry, 2013.
6 B.J. Hunt, M.I. James, “Polymer Characterisation”, Third Edition, Springer Science & Business Media, 2012.

REFERENCES:

1 Dan Campbell, Richard A. Pethrick, Jim R. White, “Polymer Characterization: Physical Techniques”, Second Edition, CRC Press, 2000.
2 Luigia Sabbatini, “Polymer Surface Characterization” , First edition, Walter de Gruyter GmbH & Co KG, 2014.
3 Linda C. Sawyer, “Polymer Microscopy”, First edition, Springer Science & Business Media 2012.
4 Wiley, “Characterization and Analysis of Polymers”, First edition, John Wiley & Sons, 2008.

OUTCOMES:

After completion of this course, students will be able to

- Analyse the various plastics and rubbers by simple physical & chemical methods.
- Analyze morphological characterisctics of polymers and interpret their occurrence.
- Select suitable characterization techniques to analyse the thermal and rheological characteristics of polymers.
- Interpret test results and create test reports.
- Analyse the quality of raw materials for suitable application and processing conditions.

PEC 2215	POLYMER CHARACTERIZATION LAB	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To provide skills in identification of plastics and rubbers by simple physical and chemical methods.
- To impart fundamental knowledge in analyzing various physical and chemical properties of the polymers.
- To equip with practical skill in analyzing the quality of natural rubber latex.

LIST OF EXPERIMENTS :

PART I

1. Identification of Plastics:
   PE, PP, PS, PVC, PVA, polyamides, Polyesters, PF, UF and MF.
2. Identification of Rubbers:
   NR, BR, SBR, CR, NBR and Silicone rubber.

PART II

4. Determination of molecular weight of polymers by viscosity method.
5. Determination of epoxy equivalent.
6. Determination of K – value of PVC resin.
7. Determination of moisture and water absorption in plastics.
8. Determination of gel time and peak exothermic temperature for thermosetting resins.
9. Determination of melt flow index of thermoplastic materials.
10. Determination of filler content in plastics / rubbers.
11. Determination of total solid, dry rubber content and total alkalinity of NR latex.

Total Hours – 45

TEXT BOOKS:

1 Sabu Thomas, Deepalekshmi Ponnamma, Ajesh K. Zachariah, “Polymer Processing and Characterization: 1 (Advances in Materials Science)”,Apple Academic Press; 1 edition ,January 31, 2013.

2 V.A. Bershtein , G.C. Berry, et al, “Polymer Analysis and Characterization (Advances in Polymer Science)”,2013.

3 T.R. Crompton, “Practical Polymer Analysis”, 2012.

4 Joseph D. Menczel , R. Bruce Prime, “Thermal Analysis of Polymers”, Fundamentals and Applications”, Wiley; 1 edition , April 20, 2009.

5 Characterization and Analysis of Polymers, by Wiley, 2008.

OUTCOMES:

At the end of the course, the student will be able to

- Identify the plastics and rubbers by simple physical and chemical methods.
- Analyze and determine the various physical and chemical properties of plastics and rubbers.
- Determine the cure characteristics of the thermosetting resins.
- Characterize the quality of latex.

SEMESTER – V

MSC 3182	**SOCIAL ENTREPRENEURSHIP**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

- To be able to understand the field of social entrepreneurship and Social problems
- To be able to describe and understand the traits of social entrepreneurs
- To recognize the social business opportunities
- To synthesize the resource mobilization ways for social entrepreneurship
- To understand the social entrepreneurship models
- To recognize the impact of social entrepreneurship on societies

MODULE I INTRODUCTION TO SOCIAL ENTREPRENEURSHIP 07

Introduction - Emergence and Development of Social Entrepreneurship. Social Problems in India: An Overview. Social Development: The Indian Scenario. Emergence of Social Entrepreneurs and Sustainable Solutions to Social Problem. Characteristics and Context of Social Entrepreneurship .The Role of Social Entrepreneurship in Societies & Economies.

MODULE II SOCIAL ENTREPRENEURSHIP: DRIVERS AND CHALLENGES 07

The Drivers of Social Entrepreneurship. Elements of the Social Entrepreneurial Personality. Challenges of financial constraints. Challenge to attract and cultivate talented workers. Challenge of evaluation of social entrepreneur impact. Challenge of scaling and its impact. Cases

MODULE III SOCIAL ENTREPRENEURSHIP: OPPORTUNITY RECOGNITION 07

Opportunity Recognition and Planning Process. Opportunities for Social Entrepreneurs. The Nature of Social Entrepreneurial Opportunities. Social Problems into Opportunities. Idea development and conceptualization of social problem. Cases

MODULE IV RESOURCE MOBILIZATION FOR SOCIAL VENTURE 08

Resources at Initial Stage. Social Network as a role of Social Capital. Team and Collective Efforts. Need and Determination of Important Resources. Resource of Knowledge, Skills and Abilities. overview of venture capital and angel investment. Cases

MODULE V BUSINESS MODELS AND BUSINESS PLAN FOR SOCIAL ENTERPRISES 08

Design Principles of Social Entrepreneurship Business Models , Evaluation of the Root Cause of a Societal Problem. Developing business plan for social ventures. Developing an investor presentation. Feasibility study and report. How to start a business - Procedures for registration of small scale industry

MODULE VI THE IMPACT OF SOCIAL ENTREPRENEURSHIP ON SOCIETY 08

Static Impact of Social Entrepreneurship. Impact of Charitable NGOs vs. Social Entrepreneurship, Impact of For-Profit Companies vs. Social Entrepreneurship. Social entrepreneurship report preparation by students.

Case Study of Social Entrepreneurs

L – 45; Total Hours – 45

REFERENCES:

1. “Social Entrepreneurship : New models of sustainable social change” . Alex Nicholls, Oxford University Press 2006
2. The Process of social value creation : A multiple case study on Social Entrepreneurship in India , Archana Singh Springer 2016
3. “Social Entrepreneurship and social business” Christine K Volkmann, Springer Gabler 2012
4. “Social Entrepreneurship” Manuel London ,Routlege, 2010

OUTCOMES:

The students can able to

- Conceptualize social entrepreneurship in terms of a theoretical framework between changing social values and institutions
- Think and communicate about social values
- Learn about practical models of social change to launch, lead, manage, and evaluate a social venture
- Analyze funding needs and sources for the social venture

- Experience the ideas can be critically and collaboratively examined prior to commitment.

ENC 3181	COMMUNICATION AND SOFT SKILLS - I CAREER CHOICE	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To create awareness of industrial trends and market demands.
- To encourage students to explore career opportunities in an industry and evaluate themselves in relation to industry preparedness

MODULE I **6**

Knowledge about specific industry-Discussion with industry experts --Self evaluating career prospects through survey questionnaire (based on his/her eligibility for taking up a job (industry preparedness)

MODULE II **6**

. Knowing case studies of industries(pertaining to students' choice of career)- Reading and discussing about job markets-goal setting, working on creativity.

MODULE III **4**

SWOC analysis and discussing outcomes--exploring mini projects or case studies of latest industries.

MODULE IV **6**

Writing statement of purpose pertaining to career choice---- Outcomes

MODULE V **8**

Project or case study presentations (Presentation in pairs) -mini project report or case study report.

Total Hours – 30

REFERENCES:

1. Brown,D.(2002). Career Choice and Development. Wiley,J. & Sons.USA
2. Lore,N.(1998). The Pathfinder: How to Choose or Change Your Career for a Lifetime of Satisfaction and Success. Simon & Schuster.USA.
3. Shell, G.R.(2013). *Springboard Launching your Personal Search for Success.Portfolio.USA.*

OUTCOMES:

After the completion of the course, students would be able to

- Speak about their career choice.
- Self evaluate their strengths and weaknesses and speak about it.
- Make effective presentations on case studies or relating to projects.
- Write the statement of purpose relating to their career choice.

PEC 3101	PLASTICS PROCESS ENGINEERING	L	P	T	C
		3	0	0	3

Objectives:

- To provide fundamental knowledge of the equipment and process of injection molding.
- To enhance the understanding of the significance of different molding process.
- To introduce extrusion and blow moulding machineries and process.
- To impart knowledge of advances in thermoforming and rotational moulding.

MODULE: I INJECTION MOLDING 8

Introduction – Theory of injection moulding – Moulding machine components – Clamp mechanism, hydraulic clamping, Injection unit – Feed system, screw and barrel, check valve and nozzle, screw design, Orientation in injection moulding and its effect, processing parameters and their effect on product quality, process control in injection molding – open loop, close loop and PID control of injection moulding machines. Trouble shooting in injection moulding

MODULE: II FUNDAMENTALS OF EXTRUSION MOLDING 8

Fundamentals of extrusion process–basic operation of single screw and twin screw extruders, analysis of flow through extruder, drag flow, pressure flow and total flow extruder design, extruder drives: types and selection, screw design– construction and operation, different type of screws, barrier screws. Process control variables, Viscoelastic properties and die swell, effect of process parameters on product.

MODULE: III EXTRUSION PROCESSES 7

Extrusion of Pipes, profile extrusion, extrusion line for cable industries, Film extrusion–blown film, cast film, flat film and sheet film extrusion process. Filament and fiber extrusion process, Coating and lamination, Co–extrusion, effects of machine and process variables on different processes. Process control of extrusion process, trouble shootings for extrusion processes

MODULE: IV COMPRESSION MOULDING 7

Types and procedure of compression molding, moulding materials, bulk factor, effect of preheating, number of cavities based on rate of production, basic principles of

compression mould design, advantages and disadvantages of compression moulding.

MODULE: V BLOW & TRANSFER MOULDING 7

X-RAY Diffraction – WAXD – SAXS – Crystal Structure – Birefringence – optical microscopy– scanning electron microscopy– transmission electron microscopy – Atomic Force Microscopy – Instrumentation, analysis and Interpretation of data.

MODULE: VI THERMOFORMING & ROTATIONAL MOLDING 8

Thermoforming – Types – Vacuum forming, pressure forming and mechanical forming processes, thermoforming machineries, hot strength, cooling and trimming the parts, trimming operations. Calendaring operations – types of calendar, calendaring faults and their origin.

Rotational moulding – Basic process, materials and products parameters, temperature, speed, cooling, effect on product quality, control system, rotational moulding equipment, drive, batch type and continuous type machines. Rotational moulding process analysis – mould temperature rise, heat and melt flow in rotational moulding, cycle time calculations.

L – 45; T – 0; Total Hours – 45

TEXT BOOKS:

1. M.L.Berins “Plastic Engineering Handbook”, Society of Plastic Industries, Chapman & Hall NY 1991.
2. D.V.Rosato,”Injection molding handbook”, Academic Publishers Boston 2nd edition 1995.
3. Stanley Middleman, “Fundamentals of Polymer Processing”, Mcgraw – Hill.1977
4. James F.Carley “Plastics Extrusion Technology Hand book”, Industrial Press Inc.1989.
5. Michaeli.W, “Extrusion Dies for Plastics and Rubbers”, 3rd edition, 2003.
6. Ottamer Baundu and William Andrew “Stretch Blow Molding”, 2nd edition, 2011.
7. M.N.Subramanian, “Basics of Troubleshooting in Plastics Processing: An Introductory Practical Guide”, Willey Scrivener, 1st edition, 2013.

REFERENCES:

1. Chris Rauwendaul, “Polymer Extrusion”, Hanser Publication, Munich,1987.
2. Mcklevy.J, “Polymer Processing”, John Willey, New York, 1962.

3. Lee.N, “Blow Molding Design Guide”, 2nd edition, Hanser Publication, 2008.

OUTCOMES:

After completion of this course, students will be able to

At the end of the course, the students will be able to

- Explain the process involved with injection, compression, blow molding processes.
- Demonstrate single and twin screw extruders and their working principle.
- Identify the various process parameters that influence plastic processing.
- Find solutions for various processing faults of plastic processing.

PEC 3102	STRENGTH OF MATERIALS	L	P	T	C
		3	0	0	3

OBJECTIVES:

- To provide a fundamental knowledge of stress induced in materials due to various loadings.
- To develop the ability to draw shear force and bending moment diagrams for beams.
- To provide understanding of stress analysis of thin and thick cylinders subjected to internal fluid pressure.
- To impart knowledge of deriving and solving problems on deflection of beams and columns

MODULE: I TENSION AND COMPRESSION 8

Elasticity: Stress and strain, compressive, tensile, shear and bearing stress – Stress – strain diagram, Hooks law, modulus of elasticity, modulus of rigidity, bulk modulus of rigidity, bulk modulus, Poisson's ratio. Relationship between elastic constants and temperature stresses, composite bars.

MODULE: II MOMENT OF INERTIA 8

Properties of section, calculation of areas, centroid, neutral axis, moment of inertia, modulus of section, radius of gyration with reference to structural shapes.

MODULE: III SHEAR FORCE AND BENDING MOMENT 8

Types of beams: Supports and loads, shear force and bending moment – relationship between load shearing forces and bending moment. Bending moment and shear force diagram for cantilever, simple supported and over hanging beams.

MODULE: IV STRESSES IN BEAMS AND SHAFTS 7

Bending and shear stresses. Torsion in solid and hollow shafts – combined bending and torsion.

MODULE: V THIN AND THICK CYLINDERS 7

Biaxial state of stresses – Thin cylinders and spheres and thick cylinders and spheres subjected to internal pressures.

MODULE: VI DEFLECTION OF BEAMS 7

Deflection – deflection of beams in simple cases column and struts – long and short columns – axial loading – effect of end conditions – equivalent length and slenderness ratio – Euler and Rankine formulae.

L – 45; T – 0; Total Hours – 45

TEXT BOOKS:

1. R.S. Khurmi, “Applied Mechanics and Strength of Materials”, S.Chand & Co., (6^{th} ed), New Delhi, 1987.
2. R. K. Bansal, “A Textbook of Strength of Materials” Laxmi Publications (P) Ltd, New Delhi, 2010.

REFERENCES:

1. Popov E.P, “Engineering Mechanics of Solids”, Prentice – Hall of India, New Delhi, 1997.
2. Beer F.P and Johnston R, “Mechanics of Materials”, McGraw – Hill Book Co, Third Edition, 2002

OUTCOMES:

At the end of the course, students will be able to

- Calculate the stresses induced in a material due to different loading conditions.
- Locate the centre of gravity and neutral axis of complicated structural shapes.
- Draws shear force and bending moment diagrams of beams with different loading situations.
- Find the critical load in columns of different end conditions and deflection in beams.

PEC 3103	PLASTIC AND RUBBER TESTING TECHNOLOGY	L	P	T	C
		3	0	0	3

Objectives:

- To introduce various methods for testing of polymers.
- To provide knowledge of incoming inspection of various raw materials to conform the test certificate.
- To impart knowledge on testing new products for predicting product performance and to analyze the failure modes.
- To impart skill in interpreting test results.

MODULE: I BASIC CONCPET IN TESTING 8

Specification and Standards – National and International Standards – Advancement in testing technology – preparation of test specimens – conditioning and test atmospheres.

MODULE: II MECHANICAL PROPERTIES 15

Basic understanding of stress–strain behavior of plastic materials. Short term mechanical properties – tensile strength – compressive properties – impact properties – shear strength – abrasion resistance – fatigue resistance – hardness. Long term mechanical properties – creep – stress relaxation – permanent set.

MODULE: III RHEOLOGICAL AND THERMAL PROPERTIES 12

Melt flow index, viscosity (Rotational viscometer, MPT, capillary rheometer and torque rheometer) Vicat softening temperature – heat distortion temperature – coefficient of expansion – thermal conductivity – brittleness temperature – flammability – transition temperature measurements

MODULE: IV ELECTRICAL AND OPTICAL PROPERTIES 12

Dielectric strength – dielectric constant – dissipation factor – volume and surface resistivity – arc resistance – electromagnetic interference (EMI) – radio frequency interface (RFI) shielding – conductivity measurements.

Refractive index – light transmittance and haze – photo elastic properties – color – gloss.

MODULE: V WEATHERING AND PERMEATION PROPERTIES **8**

Major environmental factors affecting plastics – accelerated weathering test – outdoor weathering of plastics – microbiological attack. Water absorption test – chemical resistance – environmental stress cracking resistance – gas permeability – moisture absorption – salt spray and staining resistance.

MODULE: VI TESTING OF PRODUCTS **5**

Plastic films & sheets – pipes – foams – containers – failure analysis – introduction to nondestructive testing of plastic products.

L – 45; T – 0; Total Hours – 45

TEXT BOOKS:

1. Vishu Shah, “Handbook of Plastics Testing and Failure Analysis” — 3rd edition. John Wiley, NY, 2007.
2. Roger.P.Brown, “Hand Book of Polymer Testing”, Marcel Dekker inc, New York, 1999

REFERENCES:

1. Nicholas P.Cheremisinoff, “Product Design and Testing of Polymeric Materials”, Marcel Dekker, inc, New York, 1990.
2. Roger P. Brown, “Physical Testing of Rubber”, Interscience, New York, 1966.

OUTCOMES:

At the end of the course, students will be able to

- Perform various tests for evaluating the properties of plastic materials.
- Identify the suitable test method for predicting product performance and to analyze the failures.
- Interpret test results for data generation.

PEC 3104	PLASTICS PROCESSING LAB	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To impart practical skills in operating hand, semi-automatic and fully automatic injection molding machines, extrusion and blow molding machines.
- To impart knowledge of various process parameters affecting the quality of the product and expose to process defects .
- To provide with skills in setting up and optimizing various molding operations.
- To equip with the fundamental knowledge of calculating the output and cycle time of various molding operations.

LIST OF EXPERIMENTS:

1. Hand operated Injection moulding Machine.
2. Semi – automatic injection moulding machine.
3. Automatic Injection moulding machine.
4. Compression moulding operation.
5. Blow moulding – hand operated.
6. Blow moulding semi – automatic.
7. Extrusion moulding processes.
8. Compounding of plastics.
9. Post processing operations.
10. Scrap grinding.

L – 0; P – 45; Total Hours – 45

OUTCOMES:

At the end of the course, the students will be able to

- Operate the plastics processing machineries
- Set the process parameters in moulding machines with respect to materials.
- Optimize the process based on the quality of the molded products.
- Calculate the process output and cycle time for different process.
- Identify the defects in the products and suggesting suitable remedial action.
- Compound plastics with an extrude

PEC 3105	RUBBER PROCESSING LAB	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To impart skills in developing recipes for rubber products.
- To impart knowledge of identifying the sequence of compounding cycle.
- To equip with the skill of processing rubber products by various molding techniques.
- To introduce the cure characteristics study by ODR

LIST OF EXPERIMENTS:

1. Compounding of rubbers
    - NR
    - SBR
    - NBR
2. Cure characteristics study by ODR
3. Compression molding of rubbers
4. Preparation of latex products
    - Straight dipping
    - Coagulant dipping
5. Compounding of TPE's
6. Rubber injection molding (TPE’s)

L – 0; P – 45; Total Hours – 45

OUTCOMES:

At the end of the course, the students will be able to

- operate hot and cold two roll mill
- operate compression press
- perform cure study in ODR
- develop compounding recipes based on applications.
- mould different elastomeric by compression moulding process.
- compound rubber with thermoplastics

SEMESTER VI

MSB 3181	**LEADERSHIP & CEO TRAINING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

The course aims at

- Bringing about positive transformation in students' attitude.
- Building unique leadership competencies that would ensure successful transition of students across all career stages.
- Sensitizing students to identify their strengths & weakness and training them to deal with it
- Assisting students in enhancing their expressive ability and inducing a high level of self confidence to manage both business and emotions
- Training students to become more adaptable and flexible to changing business environment

MODULE I INTRODUCTION TO LEADERSHIP 12

Leadership concept - meaning, definitions, importance of leadership, leadership traits. Leadership functions- general functions, listening, observing, managing and decision making. Components of leadership - leaders, followers and situation. Leadership theories – Trait theory, Skills theory, Style theory, Situational theory, Transformational theory, Transactional theory, Path Goal Theory and LMX. Assessing emotional intelligence and exploring the capabilities and inherent traits through psychometric tests - Multi factor leadership questionnaire and personal reflections

MODULE II LEADERSHIP STYLE AND COMMUNICATION 08

Leadership styles-visionary, Coaching, Affiliative, Democratic, Pacesetting Commanding, Transformational, Transactional. Autocratic, Participative, Laissez-Faire Leader versus Managers. Leadership communication - Rationale, tactic, assertive, formal, informal, communication in crisis- leadership and negotiations, Leadership Presentations-convincing and impressive style

MODULE III LEADERSHIP ROLES 08

Facets of leadership- Leader as an individual – personality and leadership, values, attitudes and ethics of a leader. **Leader as a relationship builder**- empowering people to meet higher order needs, initiating organization wide

motivational programs, involvement with all stakeholders- focusing on organization growth. **Leader as an inspirer**- motivation and leadership, recognizing and appreciating contributions, empowering others to lead **Leader as an innovator** –leader's role in shaping culture and values in an organization. **Leader as a Liaison- Leader as team player**

MODULE IV LEADERSHIP CHALLENGES AND STRATEGIES 09

Challenges in leadership: Perception of organization culture and values, interpreting the power dynamics in the organization, establishing work life balance. Bad leadership – Reasons and impact.-Case Study of Marissa Mayer-Yahoo.Inc Organizational transformation through efficient leaders-Case study of Apple Inc. Blue Ocean Leadership-Steps to Blue ocean Leadership-Four Pillars of Blue Ocean leadership-Blue Ocean leadership grid

MODULE V LEADERSHIP AND CEO TRAINING 08

Leader as a CEO: Traits of a successful CEO, Key responsibilities of a CEO, the path to be a CEO ,Training on Board Room Discussions, Meeting the CEO –Live sessions with industry CEO's. Requirements of Leadership: - Cognitive skills, Interpersonal skills, Business skills, Strategic skills. Role of Emotional Intelligence in taking up key-positions in the organization.

Teaching Pedagogy:

Nurturing – Based on the identified strengths and weaknesses, training will be given to enhance the strengths and overcome the weakness.

Assessment - Continuous evaluation will be effected through group discussions, oratory assignments and situational enactments. Pre-and post-training assessment through peer reviews and faculty feedback.

Sustained development – Training will be imparted for self-development and monitoring of leadership skills to ensure sustained applicability of the skills learnt.

L – 45; Total Hours – 45

REFERENCES:

1. Andrew J DuBrin. "Leadership: Research Findings, Practice, and Skills", 8th Edition, South-Western College Pub, 2015.
2. Yukl G , "Leadership in Organisations", 8th Edition, Pearson Education, 2013.
3. Richard L Daft , "Leadership", 5th Edition, South Western Cengage Learning 2012.

4. Stephen P. Robbins and Timothy A. Judge. “Organizational Behaviour”, 15th Edition, New Delhi: Pearson, 2013.
5. Fred Luthans, “Organizational Behavior, An Evidence Based Approach”, 12th Edition, New Delhi: McGraw Hill Education, 2013.
6. Emotional Intelligence, Why it can matter no more than IQ by Daniel Goleman (include a book) Publisher: Bloomsbury Publishing India Private Limited; Latest edition (2017)
7. Primal Leadership: Unleashing the Power of Emotional Intelligence by Prof Daniel Goleman , Richard Boyatzis and McKee ,Harvard Business Review Press

Recommended Readings:

1. Jim Collins, (2001). “Good To Great: Why Some Companies Make the Leap...And Others Don't”, Random House Publishers India Pvt.Ltd, New Delhi
2. George, B. with Sims, P. True North: Discover Your Authentic Leadership, The Times Group Books; First edition (1 October 2015)
3. Kim, W. C., & Mauborgne, R. A. (2014). Blue ocean strategy, expanded edition: How to create uncontested market space and make the competition irrelevant. Harvard business review Press.
4. Leadership Wisdom by Robin Sharma Jaico Publishing House;

OUTCOMES:

The students will be able to

- Explore through self-introspection one’s own leadership style, their strength and weakness
- Gain self confidence to lead a team in the organization
- Realize the role of leadership in making or breaking of an organization
- Acquire the practice of self introspection and development of leadership competencies thorough continuous efforts
- Manage their own emotions as well as other resulting in successful relationship building with all stakeholders

ENC 3281	COMMUNICATION AND SOFT SKILLS - II	L	T	P	C
	CONFIDENCE BUILDING	0	0	2	1

OBJECTIVES:

- To develop professional skills like work ethics, analytical skills, presentation skills etc.
- To train them in problem solving skills and leadership skills pertaining to industries.
- To train them in team building skills.
- To train in setting up career goals

MODULE I **6**

Brief about Multinational companies- Analysing work ethics of multinational companies and small industries- discussing as pairs-Knowledge about etiquette (different types)

MODULE II **6**

Visit to an Industry and prepare reports --Critically reading of industry specific journal articles and write ups-- preparing reports.

MODULE III **4**

Analysing problem solving situations in industries (relating to application of core subject to specific jobs) and discussing about them- working on a sample case

MODULE IV **6**

Developing Leadership in team projects-- debating about various aspects of leadership: for example, responsibility and reliability-time management

MODULE V **8**

Team building skills-- group discussions pertaining to industries-- presenting career goals. -- preparing for interviews- interpersonal skills

Total Hours – 30

REFERENCES:

1. Covey,S.R. (2004). The 7Habits of Highly Effective People: Powerful Lessons in Personal Change. Free Press.UK
2. Fine, P.M.& Alice Olins. (2016).Step up: Confidence, Success and Your Stellar Career in 10 Minutes a Day. Vermilion.UK
3. Pai, A. (1993).How to Develop Self-Confidence. Amazon.com
4. Wentz,F.H.(2012). Soft skills training: A Workbook to Develop Skills for Employment. Amazon.com

OUTCOMES:

After completing the course students would be able to

- Exhibit critical reading skills through review of industry specific articles.
- Provide solutions to problem based situations.
- Exhibit leadership qualities by debating over industry specific issues.
- Participate in group discussions confidently.
- Present their career goals.

PEC 3211	PLASTIC AND RUBBER PRODUCT DESIGN	L	P	T	C
		3	1	0	4

OBJECTIVES:

- To impart knowledge of different international standards used in product design.
- To develop the ability of selecting proper material for plastic products based on the end use.
- To equip with the knowledge of design calculations and optimization techniques in plastic product design.
- To provide understanding of finite element analysis in the design of plastic product design.

MODULE: I INTRODUCTION TO PRODUCT DESIGN 6

Introduction to product design, product design methodology, concurrent engineering, product life cycle, voice of customer, technical specification ,concept generation, design for X, FMEA.

MODULE: II PRODUCT FUNCTIONALITY & MATERIAL SELECTION 12

Limits, fits and tolerances – type of fits. Design of ribs and bosses. Design considerations for wall thickness – fillets – sharp corners. Molded threads and their types. Material selection for strength and rigidity – design for stiffness – processing limitations on polymer product design. Mould design for part requirement, stress-strain behavior of polymers, structural design of beams and other structural members. Steps in design, Mohrs circle, BIS standards, theories of failures of biaxial stress system and factor of safety.

MODULE: III PLASTIC GEAR & BEARING DESIGN 12

Fatigue loading – type of fatigue loading – S-N curve – simple problems by using fatigue equations – dynamic load response of polymers. Design for cylindrical and spherical pressure vessels by using simple equations. Materials for gears – types – basic terminologies – molded and cut gears – design for strength and durability. Bearings – types of bearings – design consideration – materials – self lubricated plastic materials – p-v rating of bearings.

MODULE: IV DESIGN OF SPRINGS & ELASTOMERIC PRODUCTS 10

Design of plastic springs – close coiled – Wahl's equation. Couplings – types. Design of seals and O-rings -flat belts and V-belts. Design of inserts – factors to be considered – mould strength – location of inserts in the part – cracking at the inserts. Design for undercuts – cored out sections in molded parts.

MODULE: V DESIGN FOR DAMPING & OPTIMIZATION TECHNIQUES 10

Vibration dampers: Basic vibration damping relations – octave rule for damped systems – under damping – over damping and critical damping, vibration isolation, vibration of single and two rotor systems. Introduction to optimum design – general principles of optimization – problem formulation and their classification.

MODULE: VI PRODUCT DESIGN VALIDATION 10

Check for functionality, finite element analysis – introduction – type of analysis – requirement of approximation – weight residual, Ritz and Galerkin method – model building, post processing – simple problems on 2D. Understanding of flow analysis, optimum gate locations, pressure drops across runner, fill analysis, shrinkage and warpage.

L – 60; T – 0; Total Hours – 60

TEXT BOOKS:

1. Miller.E, "Plastics Product Design Hand Book, Part A and B", Marcel Dekker, 1982.
2. Robert A. Malloy, "Plastic Part Design for Injection Moulding- An Introduction", Carl Hanser, 1994.
3. R.J.Crawford, Pergamon, "Plastics Extrusion Technology" Hanser, 1997.
4. Kazmer.D, "Injection Mold Design Engineering", Hanser, 2007.
3. James.C.Gerdeen, "Engineering Design with Polymers and Composites", CRC press, 2011.

REFERENCES:

1. M.L. Berins, "Plastics Engineering Handbook", Society of the Plastic Industries, Champman and Hall, NY 1991.
2. Charles A.Harper, "Modern Plastics Handbook", TataMcGraw-Hill, 1999.
3. Natti S. Rao, Günter Schumacher "Design Formula for Plastic Engineers", Cincinnati, 2nd.Edition,2004.

OUTCOMES:

At the end of the course, the students will be able to

- Select the plastic materials based on end use applications of products.
- Design plastic products for different working conditions with geometrical and financial considerations.
- Plan the dimensions of plastic gears, bearings and springs.
- Validate a plastic product design by finite element methods

PEC3212	PROCESS CONTROL AND INSTRUMENTATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To develop an understanding of control system
- To impart knowledge on flow and liquid level measurement.

MODULE I INTRODUCTION OF PROCESS CONTROL 8

Elements of measurement, functions and general classifications of measuring instruments Indicating and recording type of instruments. Elements of measuring instruments, static and dynamic characteristics of measuring instruments.

MODULE II LAPLACE TRANSFORMS 7

Definition, Transforms of simple functions, Ramp functions, Sine functions, Solutions of differential equations. Inversions of transform function by partial fractions, qualitative nature of solutions, Final value and initial value theorems, Translation of transforms, Transforms of unit impulse functions, Transforms of integral.

Principle of operation, construction and application of important industrial instruments for the measurement of temperature, flow, liquid level and composition.

MODULE III THE CONTROL SYSTEMS 8

Block diagram, Negative and positive feedback, Servo problem v/s regulator problems, Development of block diagrams, Process measuring element, Controller, Final control element. Closed Loop Transfer Functions: Standard block diagram symbols, Overall transfer function for single loop system, Overall transfer function for change in load, Overall transfer function for multi loop control system.Dynamic behavior of first order, second order and two or more first order systems in series.

MODULE IV TRANSIENT RESPONSE OF SIMPLE CONTROL SYSTEMS 07

Proportional control for Set point change (Servo Problem), Proportional control for load change (Regulator Problem), Proportional integral control for load change, Proportional Integral control for set point change, Proportional control for system with measurement lag. Block and physical diagrams of control system. Open and closed loop control systems.

Characteristics of measuring elements, controllers and final control elements Mods of control actions.

MODULE V FLOW MEASUREMENT 07

Head flow meter, Orifice plate, Flow nozzle, Venturi tube, pitot tube, Differential pressure meter, Electric type head flow meter, Bellows type meter, Rotameter, Piston type area meter, Positive displacement meter.

MODULE VI LIQUID LEVEL MEASUREMENT 08

Direct measurement, Float and tap, Float and shaft, Hydraulic remote transmission, Bubbler system, Diaphragm & air trap system, Differential pressure manometer, Float and spring pneumatic balance, Displacement float, Magnetic float gauge.

L – 45; Total Hours – 45

REFERENCES:

1. Stephenopolos, S., “Chemical process control”, Prentice Hall of India, New Delhi, 1984.
2. Luyben, W.L., “Process modelling, simulation, and control for Chemical Engineers”,McGrawHill, 1989.
3. Considine, D.M., “Process / Industrial Instruments and Controls Handbook”, McGraw Hill,1993.
4. Oggunaika B.A. and Ray W.H., “Process Dynamics, Modeling and control”. Oxford University Press, U.K. 1994.
5. Alciatore D.G. and Histand M.B., “Introduction to Mechatronics”, Tata McGraw Hill.Bolton W. “Mechatronics”, Pearson Education Singapore.

OUTCOMES:

The students will be able to

- Design a process control.
- Analyse and simulate data.
- Measure flow properties and optimize the process.

PEC 3213 POLYMER REACTION ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To teach the basic concepts of reaction engineering.
- To teach the students the fundamentals, applications of reaction engineering with related examples.
- To develop design principles in the reaction engineering.
- To develop the ability to analyse the processes and contribute to new designs.

MODULE I KINETICS OF REACTIONS 7

Elements of Chemical Reaction Engineering: Introduction to chemical kinetics. Representation of expression for reaction rate, rate constant. Temperature dependent and concentration dependent theory. Comparison of theories with Arrhenius law, Temperature dependency from thermodynamics.

MODULE II INTERPRETATION OF BATCH REACTOR DATA 8

Interpretation of batch reactor data for various types of reactions taking place in constant volume and variable volume batch reactors. Irreversible reactions in series, parallel. Differential method of analysis of data, Integrated rate equation for zero, first and second order reactions.

MODULE III DESIGN OF SINGLE IDEAL REACTORS 8

Size comparison of single reactors, Comparison of CSTR with PFR for first and second order reactions, Multiple reactor systems, PFR, CSTR-series and parallel, Recycle reactors, Autocatalytic reactions. Multiple Reactions-Reactions in Parallel, Quantitative treatment of product distribution and reactor size-batch, plug flow and mixed flow reactor.

MODULE IV SUSPENSION POLYMERIZATION 7

Introduction – Surface active agents, Mixing Phenomena, Bead and Powder Suspension Polymerization Process, Population balance modeling – Drop breakage and coalescence process, Numerical solution of PBE, Physical properties and phase equilibrium calculations – physical and transport properties, Effect of operating conditions on PSD, Scale-up of suspension polymerization reactors.

MODULE V EMULSION POLYMERISATION – REACTOR 7

ENGINEERING

Heterogeneous reacting systems-Catalyst, activity and specificity of catalyst, Pore diffusion resistance combined with surface kinetics, Heat effects during reaction, Performance equations for different type of reactors containing porous catalysts-Experimental methods for determining rates-application to design.

MODULE VI POLYMERIZATION REACTORS 8

Polymerization reactors – by free radical mechanism – characterization of mixtures of polymers – mechanism – rate equations – design of reactors for free radical polymerization – stepwise addition and condensation polymerization and copolymerization – analysis of rate equation – polymerization in batch reactors – flow reactors.

L – 45; Total Hours – 45

TEXT BOOKS:

1. Octave Levenspiel, “Chemical Reaction Engineering”, Wiley, 3rd edition 2006.
2. Miller Gt, “Chemical Reaction Engineering”, CBS Publisher, 2005
3. Asua J. M, “Polymer Reaction Engineering”, Blackwell Publishing Ltd, UK, 2007.
4. Smith J M, “Chemical Engineering Kinetics”, McGraw-Hill, 1981.
5. Mark E. Davis and Robert J.Davis, “Fundamental of Chemical Reaction Engineering”, Dover Publications, New York, 2012.

REFERENCES:

1. Scott Fogler H, “Elements of Chemical Reaction Engineering”, Prentice Hall International, 2016.
2. Tapio O. Salmi, Jyri-Pekka Mikkola and Johan P. Warna, “Chemical Reaction Engineering and Reactor Technology”, CRC Press,2010.
3. Martin Schmal, “Chemical Reaction Engineering: Essentials, Exercises and Examples”, CRC Press, 2014.
4. Anil Kumar and Gupta R P, “Fundamentals of Polymer Science and Engineering”, McGraw Hill, 1998.

OUTCOMES:

At the end of the course, the students will be able to

- Evaluate the kinetics and reaction rate.
- Identify the various types of reactors used in polymerization.

- Select a reactor, determine its size, conversion for a given application.
- Predict the optimization of performance of reactors.

PEC 3214 PLASTIC PRODUCT DESIGN USING CAD

L	T	P	C
0	0	2	1

OBJECTIVES:

- To impart skill with the codes and specifications of BIS.
- To introduce the concepts of limits, fits and tolerances in design.
- To develop skill of assembly drawings of various components using design software.

MODULE I DRAWING STANDARDS 5

Code of practice for engineering drawing, BIS specifications-Welding symbols, riveted joints, keys and fasteners-Reference to hand book for the selection of standard components like bolts, nuts, screws and keys. Limits, Fits-Tolerance of individual dimensions-Specification of Fits-Screw threads and threaded fasteners.

MODULE II ASSEMBLY DRAWING (USING MODELING PACKAGE PRO-E) 40

Parts drawing and preparation of assembled views given part details for components using a suitable drafting package. Joints-Cotter joints, Knuckle joints, hooks joints, shaft Couplings: rigid, flexible bearings-journal-foot step thrust or collar bearing, Plummer block. Machine tool components-machine vice, screw jack engine Parts-stuffing box, Connecting rod Valves- Safety valve, relief valve, non-return valve. Generation of part and assembly drawings given in actual polymeric products. Reading of art and assembly drawings.

OUTCOMES:

At the end of the course, the students will be able to

- Use international drawing standards in design.
- Read the part and assembly drawings.
- Develop a solid model which is to be used for stress analysis.
- Provide limits, fits and tolerances in product design.

PEC 3215	POLYMER TESTING LAB	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To emphasize the importance of testing mechanical and thermal characterization of polymers.
- To provide understanding of the working principle and specifications of the apparatus/equipments used for testing.
- To introduce test procedures of international standards.
- To equip with skill in determining various mechanical and thermal properties of polymers
- To impart skills in interpreting the test results.

LIST OF EXPERIMENTS

TESTING OF MECHANICAL PROPERTIES OF PLASTICS AND RUBBERS

1. Tensile strength.
2. Compression strength.
3. Flexural strength.
4. Tear strength.
5. Izod and Charpy impact strength.
6. Falling dart impact strength.
7. Hardness – Rockwell and Shore.
8. Abrasion resistance.
9. Rebound resilience.
10. Flex resistance.

TESTING OF THERMAL PROPERTIES of PLSTICS AND RUBBERS

1. Vicat softening point.
2. Heat distortion temperature.
3. Thermal aging property of rubbers

P – 45; Total Hours – 45

OUTCOMES:

At the end of the course, students will be able to

- Identify the test methods to evaluate the properties of a product/sample.
- Execute various tests to verify the quality of products.
- Interpret the data from the test results.

SEMESTER – VII

PEC 4101	**MOULD AND DIE DESIGN**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

OBJECTIVES:

- To impart knowledge of injection mold design calculation procedure.
- To provide understanding of compression and transfer mold design for making plastic products.
- To provide understanding of calculation and design procedure of blow mold and extrusion dies.
- To equip with the knowledge of recent developments in mould and die design.

MODULE I DESIGN OF FEEDING SYSTEM IN INJECTION MOLD 10

Classification of injection molds – number of cavities – selection of injection molding machine – layout of cavities in multi impression moulds. Feed systems – type of runners –design of runners – runner efficiency. Gates – sprue gate, tab gate, overlap gate, fan gate, diaphram gate, ring gate, pin gate, submarine gate, design rules – use of mold flow for gate design.

MODULE II DESIGN OF EJECTION SYSTEMS IN INJECTION MOLD 10

Ejection systems – constructional features of ejector grid, ejector grid lay out, type of ejector elements – pin ejector, valve ejector, D-P – pin ejector, stripper plate ejection techniques, calculation of ejector force, type of sprue pullers. Cooling systems – insert cooling systems, baffle cooling systems, bubbler cooling systems, heat rod and heat pipe systems, cooling time calculation and cooling channel layout.

MODULE III DESIGN OF TWO & THREE PLATE MOLDS 10

Design and construction features of two and three plate molds, mold materials. Actuation techniques – finger cam, dog leg cam, cam track actuation, split movement calculations, Type of locating rings, guide pillars, clamping tonnage and shot weight estimation. Calculation of number of cavities based on clamping tonnage and shot weight.

MODULE IV COMPRESSION & TRANSFER MOLD DESIGN 10

Classification of compression moulds – factors that influence thermo setting molding – design and construction features of compression molds – mold materials – design of mold cavity. Transfer molding – types, design of pot and plunger, feed system, economic determination of number of cavities, loading chamber design, heat and

energy requirement to heat the mold, advantages and disadvantages of compression and transfer molds.

MODULE V BLOW MOLD DESIGN 10

Blow mold design – material selection, mold cooling, mold venting, pinch-off, parison diameter calculation, wall thickness, blow ratio. Molds for blow molding, molds for injection stretch blow molding, molds for thermo forming and rotational molding. Design and constructional features of different type of parison dies. Design of Hot and Cold runner mold.

MODULE VI EXTRUSION DIE DESIGN 10

Extrusion die design: Basic consideration in die design, constructional features of rod die, cross head pipe die, offset pipe die, centre fed blown film die, spiral mandrel blown film die, flat film dies, sheet dies, fish tail die, coat hanger die and various type of profile dies.

L – 60; Total Hours – 60

TEXT BOOKS:

1. R.G.W.Pye, “Injection Mould Design”, SPE Publication, 1986.
2. Menges Mohren, “How to Make Injection Molds” Hanser Publication, New York, Second Edition, 1986.
3. M.V.Joshi, “Dies for Plastic Extrusion” Macmillan India Ltd. First Publication1984.
4. Laszlo Sors and Imre Balazs, “Design of Plastics Moulds and Dies”, Elsevier, 1989.

REFERENCES:

1. J.Harry Dubois, “Plastics Mold Engineering Handbook” Wayne.I.Pribble Publisher, Nergi Bossi.Spa, 1987.
2. Herbert Rees, “Mold Engineering” by Hanser Publishers, Munich Vienna, N.Y1995.
3. Gastrow, Unger.P, “Injection Molds for Engineers”, Hanser Publications, 2006.

OUTCOMES:

At the end of the course the students will be able to

- Select suitable material for making moulds and dies.
- Calculate the dimensions of various components in mould and die.
- Design injection moulds according to the plastic product.

- Design feed systems and ejection systems for any mould.
- Design blow moulds and dies based on product design specifications

PEC 4102 POLYMER COMPOSITE ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge of materials and matrix systems used in polymer composites.
- To develop understanding of processing, properties and applications of polymer composites.
- To provide knowledge in analyzing and characterizing the composite material for various applications.

MODULE I INTRODUCTION 7

Introduction – classification- theory of composites – macromolecular behaviour of laminates – stress strain relationships – other mechanical properties.

MODULE II MATERIALS FOR POLYMER COMPOSITES 8

Various matrix materials used in composites Glass fibres – forms or reinforcements – carbon and Kevlar fibres – inorganic fibres - polyester resins – epoxy resins – phenolic resins – other resins systems- curing of the resins – ingredients in FRP – carbon – carbon composites.

MODULE III PROCESSING METHODS 7

Hand lay up – spray up – resin injection moulding – bulk moulding compounds – compounding of polyester machines – machinery and equipment – SMC, BMC compression and injection moulding, filament winding – pultrusion – autoclave moulding, matched die moulding – injection moulding and forming of thermoplastic composites.

MODULE IV TESTING OF COMPOSITES - I 7

Analysis and testing of composites; stress-strain behavior and mechanical properties, durability, factors affecting strength of composites, fracture mechanics, debonding and delamination; thermal behavior, failure analysis.

MODULE V TESTING OF COMPOSITES - II 8

General test methods for tension, flexural, interlaminate shear stress, compression tests – impact strength -elevated temperature tests – shear modules- determination of void content, resin content and fibre content.

MODULE VI APPLICATIONS OF COMPOSITES 8

Application in aerospace, automotive industry, marine industry, civil engineering applications, electrical industry etc.

L – 45; Total Hours – 45

TEXT BOOKS:

1. G Lubin, Hand Book of Composites, 2nd Ed, Van Nostrand Reinhold, New York, 1982.
2. L.holloway Hand Book of Composites for Engineers, Technomic, Lancaster, Pa, 1994.
3. S.M. Lee, Dictionary of Composites Materials Technology, Technomic Lancaster, Pa, 1989.
4. G.Shook, Reinforced Plastic for Commercial Composites, Source Book, Asm, 1986.
5. Kevin Potter, An Introduction to Composites Products, Chapman And Hall Madras India 1997.
6. S.T.Peter, Hand Book of Composites, Chapman And Hall Chennai 1998.
7. Lin/Pearce, High Performance Thermosets, Hanser Publishers, Munich, New York, 1993.

REFERENCES:

1. Burns,R., “Polyester Moulding Compounds”, Marcel Dekker Inc., 1982.
2. Mathews F.L., and Rawlings, “Composite Material Engineering Science”, Chapman and Hall, London, 1994.

OUTCOMES:

At the end of the course, the student will have the

- Fundamental knowledge on various materials used in composites.
- Ability to analyze and characterize polymer composites.
- Knowledge in properties and applications of polymer composites

PEC 4103 POLYMER NANOCOMPOSITES L T P C
3 0 0 3

OBJECTIVES:

- To gain an understanding of materials commonly used in polymer nanocomposites such as nanoclays, carbon nanotubes, inorganic nanomaterials.
- To equip with the knowledge of processing, characterization methods, properties and industrial applications of nanocomposites.
- To study the various methods employed for the dispersion of nanomaterials in polymers.
- To understand the characterisation and properties and applications of polymer nanocomposites.

MODULE I INTRODUCTION TO POLYMER NANOCOMPOSITES 8

Introduction to polymer nanocomposites- layered silicates, carbon nanotubes-inorganic nanofillers. Polymer - filler interfaces-modification of interfaces. Ceramic/polymer nanocomposites, metal/polymer nanocomposites, natural nanobiocomposites, biomimetic nanocomposites, and biologically inspired nanocomposites.

MODULE II POLYMER - LAYERED SILICATE NANOCOMPOSITES 7

Polymer – layered silicate nanocomposites: types of nanoclays – thermoplastics and thermosets and elastomer matrices. Preparation of polymer layered silicate nanocomposites – solution, melt mixing, latex mixing methods – techniques for achieving dispersion of nanofillers- intercalation and exfoliation.

MODULE III POLYMER - CNT NANOCOMPOSITES 7

Carbon nanotube (CNT) -reinforced polymer nanocomposites: structure of carbon nanotubes, dispersion properties of CNT nanocomposites, interfacial bonding properties, mechanical properties and conductivity of nanotube–polymer nanocomposites.

MODULE IV PROPERTIES OF POLYMER NANOCOMPOSITES 8

Properties of polymer nanocomposites: influence of nanofilles on propertites of polymer nanocomposites. Mechanical properties – stress and strain and toughness. Electrical properties - conductivity, resistivity, permittivity and

breakdown strength. Thermal properties - thermal stability and flammability. Optical properties and gas barrier properties.

MODULE V NANOCOMPOSITE TECHNOLOGY 8

Plate-like nanofillers, Nanoparticle fillers, Carbon nanotubes- Inorganic filler – polymer interfaces – Modification of interfaces- Processing of polymer nanocomposites – Direct Mixing, Melt mixing Solution Mixing, In-Situ Polymerization, In-Situ Particle Processing, Ceramic/Polymer Composites Metal/Polymer Nanocomposites, Natural nanobiocomposites, Biomimetic nanocomposites, and Biologically inspired nanocomposites.

MODULE VI APPLICATIONS OF POLYMER NANOCOMPOSITES 7

Applications of polymer nanocomposites in: automobiles- aerospace -injection molded products- coatings and adhesives - fire-retardants - packaging materials- microelectronic packaging,-dielectrics- drug delivery- membranes -medical devices and consumer goods.

Total Hours – 45

TEXT BOOKS:

1. Lloyd M.Robeson, “Polymer Blends” Hanser gardner publications, U.S.A, 2007.
2. Leszek A. Utracki, “Polymer Alloys and Blends: Thermodynamics and Rheology” Hanser Gardner Publications, 1989
3. P. M. Ajayan, L. S. Schadler, P. V. Braun, “Nanocomposite Science and Technology”, WILEY-VCH Verlag GmbH, 2003.

REFERENCES:

1. C.B. Bucknall and D. R. Paul, “Polymer Blends: Volumes 1 and 2”, John Wiley and Sons, New York, 2000
2. D R. Paul and C.B. Newman, “Polymer Blends Vol. I & II”, Academic Press Inc, 1978.
3. Polymer Blends and Alloys, “Gabriel O. Shonaike and George P. Simon”, editors. Marcel Dekker, 1999.

OUTCOMES:

At the end of the course, students will be able to

- Explain the basic principles and types of polymer nanocomposites.
- Select the appropriate nanofillers for the synthesis of

nanocomposites with novel polymer nanocomposites to achieve synergistic properties.

- Select appropriate techniques for processing of polymer nanocomposites.
- Explain the properties and applications of polymer nanocomposites.

PEC 4104 MOULD DESIGN & FLOW SIMULATION LAB **L T P C 0 0 2 1**

OBJECTIVES:

- To impart basic knowledge and skill in using design software in mold design.
- To develop proficiency in computer aided design software for die design.
- To develop the ability to analyze the design of a mould.
- To impart skill in using mold flow software for mold design.

MODULE I INJECTION MOULD DESIGN BY USING PRO-E 8

Design Calculations; No. of cavities, Selection of injection moulding machine, Shot capacity, clamping force, Injection pressure and tool strength calculation for Two Plate and Three Plate moulds.

MODULE II COMPRESSION MOULD DESIGN BY USING PRO-E 8

Design calculations: Economic determination of number of cavities, design of mould cavity and loading chamber related to Open type and Semi-Positive type compression moulds.

MODULE III TRANSFER MOULD DESIGN BY USING PRO-E 7

Design Calculations: Pot calculation, runner and gate dimensions, bulk factor and shrinkage allowances for thermo set plastics related to Pot transfer and Plunger transfer mould.

MODULE IV BLOW MOULD DESIGN USING PRO-E 7

Design Calculations: Clamping force, Pinch-off, head die design and Parison diameter calculations related to blow moulds.

MODULE V EXTRUSION DIE DESIGN USING PRO-E 7

Design calculations for pipe and profile dies

MODULE VI MOULD FLOW ANALYSIS 8

Three dimension modeling using Mould Flow software – Flow analysis, Cooling analysis, Shrink/ Wrap analysis and Stress analysis.

Total Hours – 45

REFERENCES:

1. R.G.W.PYE, “Injection Mould Design”, SPE Publications, 2002.

OUTCOMES:

At the end of laboratory course the students will be able to

- Design molds and dies using Pro-E software.
- Identify the failures in mold and die design.
- Analyze flow, cooling provisions, shrinkage and stress level in plastic products using mold flow software.

PROGRAMME ELECTIVES
GROUP I (Materials)

PECX001	THERMOPLASTICS POLYESTERS	L	T	P	C
		1	0	0	1

OBJECTIVES:

- To provide fundamental knowledge in the synthesis of thermoplastic polyesters.
- To impart knowledge in polyester fiber manufacturing, properties, applications and recycling of PET products.

MODULE I POLYESTERS 8

Poly(ethyle terephthalate)- raw materials - polymerization process - properties and applications.

Poly(butylene terephthalate) - raw materials - polymerization process - properties and applications.

Highly aromatic linear polyesters -synthesis - properties and applications. Liquid Crystal Polyesters.

MODULE II POLYESTER FIBRES 7

Polyester Fibers - Fibre and yarn manufacturing-spinning process - chemical compositions, structure, property and processing - mechanical properties, chemical, optical of thermal properties.

Polyester films: Introduction –structure properties – manufacture – grades – commercial applications.

Recycling - Commercial significance of PET recycling - Types and sources of PET waste - Management of PET waste and recycling strategies - Recovery and use of textile waste - Physical recycling - Drying and extrusion of flakes or granules - Melt processing of flakes into products - PET recovery from photographic film waste.

L – 15; T – 0; Total Hours – 15

TEXT BOOKS:

8. Marianne Gilbert, "Brydson's Plastics Materials", Elsevier Ltd, 2017.

REFERENCES:

3. Sabu Thomas and Visakh P.M., "Handbook of Engineering and Specialty Thermoplastics", Volume 3, Scrivener Publishing LLC., 2011.

OUTCOMES:

At the end of the course, the students will be able

- To demonstrate the synthesis of thermoplastic polyesters like PET, PBT.
- To describe different polyester fiber manufacturing process, properties, application and recycling methods.

PECX 002	THERMOPLASTIC ELASTOMERS	L	P	T	C
		1	0	0	1

Objectives:

- To impart knowledge about the various approaches to develop, process and characterize thermoplastic elastomers.
- To provide understanding on recent developments and applications of thermoplastic elastomers.

MODULE: I DEVELOPMENT OF THERMOPLASTIC ELASTOMERS 8

Approaches to develop TPE – Classification of TPE – Processing of TPE – Characterization of TPE – Styrenic Block copolymers – Polyolefin based TPE – polyurethane based TPE – Polyamide based TPE –Polyester based TPE Miscellaneous TPE.

MODULE: II APPLICATIONS AND RECYCLING 7

Applications of Styrenic Thermoplastic Elastomers – Thermoplastic Vulcanizates – Thermoplastic Polyolefin elastomers – Melt-Processable Rubber –Thermoplastic Polyurethanes –Polyamide Thermoplastic Elastomers – Recycling of Thermoplastic Elastomers.

L – 15; T – 0; Total Hours – 15

TEXT BOOKS:

1 Jiri George Drobny, “Handbook of Thermoplastic Elastomers” Second Edition, Elsevier Science & Technology Books, 2014.
2 William Woishnis, Sina Ebnesajjad, “Chemical Resistance of Thermoplastics” First Edition, William Andrew, 2011
3 Stoyko Fakirov, “Handbook of Condensation Thermoplastic Elastomers” First Edition, John Wiley & Sons, 2006.
4 Hans R. Kricheldorf and Roderic P. Quirk, “Thermoplastic Elastomers” Third Edition, Hanser Publishers, 2004.

REFERENCES:

1 Anil K. Bhowmick , “Current Topics in Elastomers Research” First Edition, CRC Press, 2008.
2 P. W. Dufton, “Thermoplastic Elastomers”, First Edition, iSmithers Rapra

Publishing, 2001.

3 Geoffrey Holden, “Understanding Thermoplastic Elastomers” First Edition, Hanser, 2000

Course Outcomes:

On completion of this course students should be able

- Develop and process thermoplastic elastomers for suitable application.
- Analyze the morphology of thermoplastic elastomer and modify it as per requirement.

PECX 003	ELCTROACTIVE POLYMERS	L	P	T	C
		1	0	0	1

OBJECTIVES:

- To impart t knowledge of electrical conduction mechanism in electro-active polymers.
- To develop understanding of synthesis, properties and applications of conducting polymers.

MODULE: I SYNTHESIS TECHNIQUES 8

Synthesis of conducting polymers: Chemical synthesis – electrochemical synthesis – template synthesis – precursor synthesis – soluble polymers (colloids and dispersions) – advantages and disadvantages of various synthesis methods.

MODULE: II CHARACTERIZATION METHODS AND APPLICATIONS 7

Characterization methods: elemental analysis for dopants – IR – UV (electro chemical), measurement of conductivity- scanning electron microscopy (SEM).

Applications : rechargeable batteries, lights emitting diodes – gas sensors – bio sensors – photo voltaic energy devices – micro electronics (PCB fabrications.

L – 15; T – 0; Total Hours – 15

TEXT BOOKS:

1. R. G. Linford, “Electro Chemical Science and Technology of Polymers”, Elsevier applied sciences, London,1990.
2. M. Schlvxinger and M. Paunovic, “Modern Electro Plating”, John Wiley and sons Inc., New York, 2000.

REFERENCES:

1 Hari Singh Nalwa (ed.), “Handbook of Organic Conductive Molecules and Polymers”, John Wiley & sons, England, 1997.

OUTCOMES:

At the end of the course students will have the ability to

- Demonstrate knowledge of mechanism of electrical conduction in electroactive polymers.
- Analyse the properties of conducting polymers with respect to the structure
- Choose conducting polymers for specific applications

PECX 004	HEAT RESISTANT POLYMERS	L	P	T	C
		1	0	0	1

OBJECTIVES:

- To develop an understanding on the properties and applications of high temperature resistant speciality polymers.
- To provide an insight of the various applications of heat resistant polymers.
- To impart knowledge on process and application of polymer concrete.

MODULE: I HEAT RESISTANT POLYMERS 9

Introduction to heat resistant polymers -fluoropolymers, aromatic polymers,polysulphide, polysulphones, polyesters, polyamides, polyimides, polyketones, heterocyclic polysiloxanes, liquid crystalline polymers.

MODULE: II APPLICATIONS OF HEAT RESISTANT POLYMERS 6

Polymers in automobile, telecommunication and power transmission applications - polymers in aerospace application, coatings.

L – 15; T – 0; Total Hours – 15

TEXT BOOKS:

1 J.P Critchley, G.J. Knight , W.W. Wright, " Heat resistant Polymers: Technologically useful Materials, October 1983.
2 Sabu Thomas and Visakh P.M, " Handbook of Engineering and Speciality Thermoplastics, John Wiley & Sons, Massachusetts, 2011.
3 Manas Chanda, Salil.K.Roy, "Industrial Polymers, Specialty Polymers, and Their Applications (Plastics Engineering)", CRC Press, 2012.
4 Gennady E Zaikov, "Polymers for Advanced Technologies : Processing, Characterization and Applications", CRC Press, 2013.
5 R.W. Dyson, "Specialty Polymers", Chapman & Hall, 2nd edition, 1998.
6 D.Gerry Walters, "Polymer Concrete" , Volume 137, American Concrete Institute, November 2007.

REFERENCES:

1 Abbas Hamrang, Bob A Howell, Foundations of High Performance Polymers : Properties ,Performance and Applications, CRC Press, 2013.
2 H.F.Mark, (Ed), "Encyclopedia of Polymer Science & Engineering", John Wiley & Sons, New York, 1989.

3 J A Brydson, “Plastics Materials”, Butterworth-Heinemann, 1999.Munich, 1987.

Course Outcomes:

At the end of the course, the students will be able to

- Select suitable polymer for high temperature applications.
- Modify the structure of polymers for high temperature resistant properties.

PECX 005	BIODEGRDABLE PLASTICS	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To provide knowledge on biodegradable plastics.
- To develop understanding on mechanism of biodegradation of plastics.
- To impart knowledge on natural and synthetic biodegradable plastics.
- To equip with knowledge on biodegradation testing

MODULE: I INTRODUCTION 6

Biodegradable polymers and the environment - biodegradable plastics - naturally biodegradable polymers - synthetic biodegradable polymers - modified naturally biodegradable polymers. Mechanism of biodegradation - biological degradation of polymers- non-biological degradation. Abiotic degradation - biotic degradation, Commercially available biodegradable plastics.

MODULE: II NATURAL BIODEGRADABLE POLYMERS 7

Starch polymer - starch-filled plastics - thermoplastic starch – production methods- physical and chemical properties- applications. Synthesis, properties and applications of starch-based materials- cellulose and derivatives - chitin and chitosan - alginic acid - collagen- proteins- gelatin.

MODULE: III POLYHYDROXYALKANOATES & POLY(LACTIC ACID) 9

Various types of PHAs - mechanisms of biosynthesis of PHA - methods of production - mechanism of biodegradation– extracellular degradation - intracellular degradation- structure and properties - applications. Poly (lactic acid) - homopolymers - copolymers -functionalized polymers – structure and properties – mechanism of biodegradation - physical and chemical Properties – Applications.

MODULE: IV EVALUATION OF BIODEGRADABILITY 8

Test methods and standards for bio-degradable plastics – Criteria used in evaluation of biodegradable plastics – Description of current test methods – Scanning test for ready biodegradability – Test for inherent biodegradability – Test for simulation studies – Other methods for assessing polymer biodegradability.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Emo Chiellini, Roberto Solaro, 'Biodegradable Polymers and Plastics', Springer Science, 2002.
2. Joseph P. Greene, Sustainable Plastics, Wiley, 2014.
3. Jie Ren, 'Biodegradable Poly (Lactic Acid)', Springer, 2010.
4. Stoyko Fakirov, Biodegradable Polyesters, Wiley VCH Verlag GmbH & Co, 2015.
5. G,Griffin,'Chemistry and Technology of Biodegradable Polymers' Springer Netherlands, 2012.
6. Gary P. Felton, 'Biodegradable Polymers: Processing, Degradation and Applications' Nova Science Publishers, 2011.
7. Xiang Cheng Zhang, 'Science and Principles of Biodegradable and Bioresorbable Medical Polymers' Elsevier Ltd., 2017.
8. P. Halley, L. Averous , 'Starch Polymers: From Genetic Engineering to Green Applications' Elsevier 2014.
9. Ray Smith, 'Biodegradable polymers for industrial applications' CRC Press, 2005.

REFERENCES:

10. Sina Ebnesajjad 'Handbook of Biopolymers and Biodegradable Plastics' Elsevier, 2013
11. Catia Bastioli, 'Handbook of Biodegradable Polymers' Rapra Technology Limited, 2005

OUTCOMES:

At the end of the course, the students will have the

- Knowledge on biodegradable plastics and mechanism of biodegradation of plastics
- Knowledge on synthesis of biodegradable plastics
- Understanding of evaluation of biodegradability of plastics

PECX 006 BIOPLASTICS TECHNOLOGY L P T C
2 0 0 2

OBJECTIVES:

- To impart knowledge on the synthesis and properties of bioplastic materials
- To provide understanding of applications of biplastics

MODULE: I SYNTHESIS AND PROPERTIES OF BIOPLASTICS 7

Definition of Bio-Based Plastics - Direct Biosynthesis of Biopolymers - Modification of Renewable Feedstocks. Synthesis and properties of Cellulose Polymers, Cellulose Regenerates- Cellulose Ethers- Cellulose Esters- Polysaccharide Polymers . Synthesis and properties of Starch Polymers , Denatured Thermoplastic Starch (TPS)- Starch Acetate. Synthesis and properties of Vegetable Oil-Based Biopolymers Chitin- Chitosan - Casein Plastics - Gelatins, lignin.

MODULE: II APPLICATIONS OF BIOPLASTICS 8

Packaging - packaging materials - fibers and nets. Foams - biodegradable hot melt adhesive compositions. Food applications chewing gum medical applications - drug delivery – electrospinning - drug release from electrospun fibers - tissue engineering - scaffolds for tissue engineering – hydrogels – implants – stents - wound dressings. Personal care and sanitary goods - breathable biodegradable hot melt composition - sanitary goods - superabsorbent materials.

L – 15; T – 0; Total Hours –15

TEXT BOOKS:

1 Syed Ali Ashter, ‘Introduction to Bioplastics Engineering’ Elsevier, 2016.
2 Michael Niaounakis, ‘Biopolymers: Reuse, Recycling, and Disposal’ Elsevier, 2013.
3 David Plackett, ‘Biopolymers: New Materials for Sustainable Films and Coatings’Wiely, 2013.
4. Susheel Kalia, Luc Avérous, ‘Biopolymers: Biomedical and Environmental Applications’, John Wiley & Sons, 2011.

REFERENCES:

1. Srikanth Pilla, Handbook of Bioplastics and Biocomposites Engineering

Applications, Wiley 2011.

2. Stoyko Fakirov, **'**Handbook of Engineering Biopolymers: Homopolymers, Blends and Composites'Hanser, 2015.
3. Sanjay Kumar Sharma, Ackmez Mudhoo, A Handbook of Applied Biopolymer: Technology Synthesis, Degradation and Applications, Royal Society of Chemistry, 2011.

Course Outcomes:

At the end of the course the students will

- have the knowledge on synthesis and properties of bio-based plastic materials
- be able to identify bio-plastic materials for specific applications.

PECX007 MEDICAL POLYMERS L T P C
2 0 0 2

OBJECTIVES:

- To impart knowledge of biomaterials and their compatibility with the human body system.
- To introduce to the various biomaterials used for manufacturing implants and contact lenses.
- To be familiar with synthesis and processing of biomedical polymers.
- To equip with knowledge of biomaterials used in dental, orthopedics, vascular, urogenital and drug delivery systems.

MODULE I BIOMATERIALS AND BIOCOMPATIBILITY 10

Biomaterials, biocompatibility, blood and tissue compatibility - approaches for enhancing blood and tissue biocompatibility of the implants, biocompatibility testing - in-vitro testing, in-vivo testing for biocompatibility, clinical trials of biomedical implants, surface modifications for improving biocompatibility.

MODULE II POLYMERIC IMPLANTS 5

Implants - biological responses to implants, requirements of implants, implant design and applications. Types of biomaterials for implants - metals, ceramics, polymers, composites.

MODULE III BIOMEDICAL POLYMERS AND THEIR PROCESSING 10

Polymers used as biomaterials, properties, synthesis and their biomedical applications, processing of polymers for biomedical devices, fabrication of polymer films - solution casting, melt pressing, melt extrusion. Solvent-Based Processing of Biomaterials - wet spinning, melt spinning, electrospinning. Hollow Fiber Membranes, Porous Scaffolds, thermoforming, extrusion, injection moulding. Rapid prototyping - Stereolithography (SLA), Fused Deposition Modeling (FDM) .

MODULE IV POLYMERIC MATERIALS IN DENTAL APPLICATIONS 5

Dental Polymers - Features of Dental polymers , Function, Materials, Benefits, polymers used for Dental and Maxillofacial Surgery, dental sealants - Material Types.

L – 30; T – 0; Total Hours – 30

TEXT BOOKS:

1. A.K. Bajpai, Jaya Bajpai, "Smart biomaterial devices - Polymers in

Biomedical Sciences", CRC Press, 2017.
2. Vinod B. Damodaran, Divya Bhatnagar, N. Sanjeeva Murthy "Biomedical Polymers Synthesis and Processing", SpringerBriefs in Applied Sciences and Technology, 2016.
3. Munmaya K. Mishra, "Encyclopedia of Biomedical Polymers and Polymeric Biomaterials, 11 Volume Set", CRC Press, 2015.
4. C. M. Agrawal, "Introduction to biomaterials basic theory with engineering applications", Cambridge University Press, 2014.
5. Shalaby W. Shalaby, "Polymers for vascular and urogenital applications", CRC press, 2012.

REFERENCES:

4. Toyoichi Tanaka, “Experimental Methods in Polymer Science: Modern Methods in Polymer Research and Technology (Polymers, Interfaces and Biomaterials)”, Academic Press, 1999.

OUTCOMES:

At the end of the course, the students will be able

- define biomaterials and their compatibility with the human body system.
- describe the design, manufacture and requirements of various biomaterial implants.
- select suitable methods to synthesis and process polymers for biomedical applications.
- choose polymeric materials for dental applications.
- distinguish biomaterials used for contact lenses and drug delivery systems.

PECX 008 HIGH PERFORMANCE POLYMERS L P T C
2 0 0 2

Objectives:

- To develop an understanding of the properties and applications of high temperature resistant specialty polymers.
- To introduce the students with various methods for imparting conductivity in polymers.
- To provide an insight on to the various conducting and ionic polymers.
- To equip with the knowledge of various applications of conducting polymers.

MODULE: I HIGH PERFORMANCE AND IONIC POLYMERS 8

Introduction to high temperature resistant polymers, Ionic polymers - Synthesis, physical properties and applications, Ionomers based on poly styrene, polyethylene, PTFE and electrometric, ionomers with polyaromatic backbones, polyelectrolytes for ion exchange and based on carboxylates, polyelectroyte complexes.

MODULE: II ELECTRICALLY CONDUCTING POLYMERS 8

Conducting polymers, light sensitive -photo conducting polymers, polymers in non linear optics, polymers with piezoelectric, pyroelectric and ferroelectrics properties, photo resist for semiconductor fabrication, polymer coating in electronics.

MODULE: III CHARACTERISATION OF CONDUCTING POLYMERS 7

Electroanalytical techniques – cyclic voltammetry, linear sweep voltammetry, Impedance spectroscopy, chronoamperometry and chronocoulometry.

MODULE: IV APPLICATIONS OF CONDUCTING POLYMERS 7

Conducting polymers in microelectronics, EMI shielding, Light emitting diodes, rechargeable batteries, artificial muscles, electrochromic devices.

L – 30; T – 0; Total Hours – 30

TEXT BOOKS:

1 Charles A. Harper, Handbook of Plastics Technologies", Mc-Graw Hill Companies, USA, 2006.

2 Manas Chanda, Salil.K.Roy, “Industrial Polymers, Specialty Polymers, and Their Applications (Plastics Engineering)”, CRC Press, 2012.
Cotts, D.B.; Reyes, Z, “Electrically Conductive Organic Polymers for Advanced Applications” , William Andrew Publishing/Noyes,March 1986.
3 R.W. Dyson, “Specialty Polymers”, Chapman & Hall, 2nd edition, 1998.
4 Gordon G. Wallace, Peter R. Teasdale, Geoffrey M. Spinks Leon A. P. Kane-Maguire, “Conductive Electroactive Polymers: Intelligent Materials Systems”, Second Edition, CRC Press, 2002.
5 Manas Chanda, Salil.K.Roy, “Plastics Technology Handbook”, 2nd edition, Marcel Dekker, New York, 1993.
6 Zhiqun Lin, Yingkui Yang, Aiqing Zhang (eds.), “Polymer-Engineered Nanostructures for Advanced Energy Applications” Springer International Publication, July 2017.

REFERENCES:

1 Johannes Karl Fink, “High Performance Polymers”, Elsevier, 2014.
2 Abbas Hamrang, Bob A Howell, Foundations of High Performance Polymers : Properties ,Performance and Applications, CRC Press, 2013.
3 H.F.Mark, (Ed), “Encyclopedia of Polymer Science & Engineering”, John Wiley & Sons, New York, 1989.
4 J A Brydson, “Plastics Materials”, Butterworth-Heinemann, 1999.Munich, 1987.

OUTCOMES:

- Identify specific method to synthesize polymers for high temperature, electrical and electronic applications.
- Develop polyelectrolyte membranes for advance applications.
- Analyze electrical properties of conducting polymers.
- Interpret data based on electroanalytic techniques.
- Identify specific method to synthesize polymers for high temperature, electrical and electronic applications.

PECX 009	NANOTECHNOLOGY	L	P	T	C
		3	0	0	3

OBJECTIVES:

- To introduce the basic concepts of Nanoscience through quantum mechanical theories and solid state physics
- To provide knowledge about the various synthesis methods applicable to different nano materials
- To enrich the knowledge of students in various characterisation techniques and application in nano devices and sensors fabrication
- To provide knowledge on applications of poymer based nano materials in bio technology.

MODULE: I INTRODUCTION TO NANOSCIENCE & NANOTECHNOLOGY 7

Introduction to Nanoscience & Nanotechnology : Definition – overview-Quantum Mechanics: Review of classical mechanics- de Broglie's hypothesis-Heisenberg uncertainty principle- Pauli’s exclusion principle - Schrödinger's equation -Properties of the wave function -Application: quantum well, wire, dot -Quantum cryptography

MODULE: II SOLID STATE PHYSICS 8

Solid State Physics: Structure and bonding-Application: carbon nanotube -Electronic band structure-Electron statistics -Application: Optical transitions in solids.

MODULE: III NANOMATERIAL FABRICATION 8

Nanomaterial Fabrication: Bottom-up vs. top-down -Epitaxial growth -Self-assembly-nanoparticle synthesis -RF plasma, thermolysis, chemical induced, and pulse laser. The synthesis of carbon nanotubes- electrodeposition, gas atomization, preparation of quantum nanoparticles MEMS and NEMS -Fabrication -Modeling -Applications

MODULE: IV NANOMATERIAL CHARACTERIZATION 8

Nanomaterial Characterization:Structural characterization- X-Ray diffraction, electron microscopy-TEM, SEM, STM, Atomic Force Microscopy , Chemical characterization-Infrared Spectroscopy, Raman Spectroscopy- Optical characterization.

MODULE: V NANODEVICES & SENSORS 7

Single-Electron Devices, Nano scale MOSFET – Resonant Tunnelling Transistor –

Single Electron Transistors; Single-Electron Dynamics; Molecular nanowires-Organic LED, Organic FETs- CNT and Graphene FTE, SiNW FET - Micro and nano-sensors, Fundamentals of sensors, biosensor, micro fluids, MEMS and NEMS.

MODULE: VI NANO BIO TECHNOLOGY 7

Bioactive nanomaterials in bone grafting and tissue engineering. Inorganic /polymer nano composites for dental restoration and bone replacement applications. Polymers nanofibers and their applications in bioengineering – Functional polymers for bone tissue engineering - Self-assembling nanostructured injectable polymeric gels for drug delivery - Engineering surface erodable polyanhydrides with tailored microstructure for controlled drug and protein delivery.

L – 45; T – 0; Total Hours – 45

TEXT BOOKS:

1 Nanotechnology: Global Strategies, Industry Trends and Applications, Jurgen Schulte, Wiley 2005.
2 Understanding Nanotechnology, edited by editors in Scientific American, Scientific American, 2002.
3 Nanotechnology: basic science and emerging technologies, Mick Wilson, Kamali Kannangara, Geoff Smith, and Michelle Simmons, Chapman & Hall/CRC; I edition, 2002.
4 Nanotechnology: An introduction to nanostructuring techniques, Michael Köhler and Wolfgang Fritzsche, Wiley-VCH; 2Rev Ed edition, 2007.
5 Challa S.S.R. Kumar (Ed) Biological and pharmaceutical nanomaterials : Wiley - VCH Verlag GmbH& Co, KgaA..

REFERENCES:

1 Ninmeyer C.M, Mirkin C.A (Eds) 2005. Nanobiotechnology .
2 H.S. Nalwa (Ed) Handbook of Nanostructured Bioaterials and their applications in nanobiotechnology, American Scientific Publishers.2005.

OUTCOMES:

At the end of the course, students will be able to

- Apply the knowledge of theories of quantum mechanics and solid state physics to calculate the energy levels of nano sized and quantum dot materials.
- Synthesize nano particles with appropriate methods applicable to individual materials.

- Acquire the knowledge of various methods of characterization of nano materials.
- Fabricate advanced semiconductors and electro-optic devices and sensors with nano materials by the knowledge acquired on different methods.
- Acquire knowledge on various nano materials and their functional properties from performance of the devices.
- Apply the knowledge on properties of various polymer based nano materials in biotechnology.

PEC X010 NANO MATERIALS TECHNOLOGY

L	P	T	C
3	0	0	3

OBJECTIVES:

- To introduce the concept of nano sized particles and their importance in modern material technology.
- To impart the knowledge on process technologies for production
- To give a comprehensive account on critical characterization techniques of nano materials
- To introduce the diversity of applications of the nano particles for advanced, improved devices and smart materials.

MODULE: I BACKGROUND 6

Background to nanoscience and nanotechnology - scientific revolutions - nanosized effects –- surface to volume ratio– atomic structure – molecular and atomic size - quantum effects - molecules & phases - formation of nano sized particles – energy at the nanoscale.

MODULE: II PHYSICAL & MECHANICAL METHODS OF PREPARATION 7

Preparations of Nanomaterials by mechanical and physical methods : – High energy ball milling –severe plastic deformation – melt quenching and annealing – vapour deposition – Pulsed laser deposition – Laser ablation - Magnetron sputtering- – Microwave plasma evaporation. Control of grain size. Scale up process. Handling of nano particles - Health hazards – Precautions.

MODULE: III PREPARATION METHOD - CHEMICAL 8

Chemical Methods of Preparation : Sol-gel method –Gel combustion - Co-precipitaion hydrolysis – Sonochemical method-combustion- Electrodeposition-Electrospinning – Arc method for carbon nanotubes – Chemical methods with organic precursors for carbon nanotubes, nanofibres and rods – synthesis of Graphene- Scale up methods with precautions.

MODULE: IV CHARACTERISATION TECHNIQUES 8

Characterisation of Nanomaterials: SEM - FEG-SEM - TEM – AFM – Nano-Indentor – mechanical deformation in small scale - XRD – UV-VIS spectroscopy –FTIR, FT-Raman, Photoluminescence, NMR, ESR and Light Scattering methods - Dielectric characterization – Magnetic characterization – Chemical analysis.

MODULE: V PROPERTIES AND APPLICATIONS 9

Properties and application of nanomaterials – Optical - Mechanical – Electronic And Electrical - Quntum Dot (QD) Sensitized Solar Cells (QD-SSC) - Smart Coatings (Self Cleaning) - Superhyrophobic Coating For Drag Reduction – Application Of Polymer-Nanocomposites For Improvement In Properties - Smart Sensors .

MODULE: VI CARBON NANO MATERIALS & POLYMER NANOFIBRES 7

Applications of Carbon based nanomaterials (CNT, CNF, Graphene) - Polymers nanofibers and their applications in bioengineering – Functional polymers for bone tissue engineering applications – DNA- RNA- Nanoproducts.

L – 45; T – 0; Total Hours – 45

TEXT BOOKS:

1 Introduction to Nanoscience and Nanotechnology, Gabor .L et al,

2 A . Roth, Vacuum Technology North – Holland Pub.,II Edition (1982.)

REFERENCES:

1 Challa S.S.R. Kumar (Ed) Biological and pharmaceutical nanomaterials : Wiley - VCH Verlag GmbH& Co, KgaA..

2 H.S. Nalwa (Ed) Handbook of Nanostructured Bioaterials and their applications in nanobiotechnology, American Scientific Publishers.2005.

OUTCOMES:

At the end of the course, the students will be able to

- Acquire the knowledge of formation of nano sized particles and size dependency of material properties and their energy levels.
- Apply the knowledge on physical, mechanical and chemical methods of production of nano materials.
- Apply the knowledge of various critical and advanced techniques to characterize nano particles..
- Apply the knowledge gained in different types of nanomaterials for various engineering applications.
- Synthesize, characterize and apply the knowledge of the various nano carbons and polymer nano fibres in advanced material technologies and bio engineering.

PECX 011 POLYMERS FOR ELECTRONICS L P T C
1 0 0 1

Objectives:

- To introduce the students to the subject of polymeric materials having widely varying electrical, electronic, electro-optic, piezo and pyro-electric properties.
- To introduce the students to the application of various polymers and their desired properties for suitability in each electronic systems such as encapsulates, IC chips, PCBs, optical frequency modulators, optical wave guides, piezosensors and pyro sensors.

MODULE: I INTRODUCTION 7

Introduction of Polymer Classification: Insulators, Ionically conducting polymers - Electronically conducting polymers – Conductivity Ranges. Mechanism of electrical behavior: concept of band gaps, electron hopping- ion transport. Definitions of dielectric properties, pyroelectric & piezoelectric properties. Definition of Optoelectric and electromechanical properties. Examples in each type.

MODULE: II MATERIALS FOR VARIOUS APPLICATIONS 8

Chemistry of Interconnect polymers: Poyimides-advanced polyimides-Benzocyclobutane (BCB) , LCP – Alternate Polymers. Processing technology – Spin Coating _Curing –Etching. Characterisation: Electrical, mechanical, thermal, chemical resistance & moisture sensitivity. Adhesion – metal-polymer interface. Polymeric Materials for encapsulation and Inmold Electronics.

L – 15; T – 0; Total Hours – 15

OUTCOMES:

At the end of the course, the students will be able to

TEXT BOOKS:

1 Polymers for Electronic & Photonic Application : Edited by:C. P. Wong, ISBN: 978-0-12-762540-9.

2 Polymers for Electricity and Electronics: Materials, Properties, and Applications, Author(s): Jiri George Drobny, ISBN: 9780470455531, Online ISBN: 9781118160121, DOI: 10.1002/9781118160121. John Wiely & Sons, Inc.

REFERENCES:

1 Conducting Polymers – A new era in Electrochemistry – G. Inzelt, Ed. F. Scholz, Springer.

2 Handbook of Conducting Polymers – Second Edition, Terje A. Skotheim, CRC Press, 24-Nov-1997 - Technology & Engineering.

Course Outcomes:

At the end of the course, the students will be able to

- Apply the knowledge gained to differentiate the requirement of diverse properties of polymers for various applications in electronic and opto-electronic industry.
- Select, modify, design materials and apply acquired knowledge in processing technology to deliver the relevant item for electronic Industries.
- Develop new advanced technologies and materials for fast changing electronic field.

PECX 012	POLYMERS FOR ENERGY TECHNOLOGY	L	P	T	C
		2	0	0	2

OBJECTIVES:

- To impart knowledge to the students on the emerging technologies for harnessing energy by various methods of conversion.
- To give a comprehensive account of types of devices and systems using polymers for near future application in energy conversion techniques

MODULE: I ENERGY SOURCES 6

Introduction – various sources –non renewable sources – limitations – Renewable sources – types – advantage and disadvantages of each type – requirement of energy in near and far future – Indian scenario – options for India – smart grid development.

MODULE: II ELECTRICAL PROPERTIES OF POLYMERS 6

Electronically conducting Polymers – conduction mechanism – band gaps – synthesis – doping –properties - stability. Ionically conducting Polymers – polymer electrolyte membranes – polymer nanocomposite membranes – synthesis, characterization methods. Properties of Nafion, PBI, SPEEK and other membranes.

MODULE: III BATTERIES AND SUPERCAPACITORS 9

Lithium - Polymer batteries – Polymeric electrodes & Electrolytes – construction – cyclic voltametry for performance evaluation & characterization – comparison with Li-Ion Batteries. Supercapacitors – definition – aqueous & nonaqueous systems – use of conducting polymer-CNT composite as electrode- construction- characterization – stability studies.

MODULE: IV FUEL CELLS, PHOTOVOLTAICS AND WIND TURBINES 7

PEM Fuel Cells – construction – Role of PEM – emerging PEMs like Polybenzimidazole based, Sulphonated PEEK and PEKK based, performance – comparison of new PEMs with Nafion. Polymeric photovoltaic materials – processing of PV panels – energy conversion efficiency –comparison with conventional semiconductor PVs. Wind Turbine blades – material of construction – processing technology of blades - advanced thermosets for higher stiffness, lower

lateral vibrations and low creep – use of carbon nanoubes and graphenes.

L – 30; T – 0; Total Hours – 30

TEXT BOOKS:

1 Conducting Polymers – A new era in Electrochemistry – G. Inzelt, Ed. F. Scholz, Springer.
2 Handbook of Conducting Polymers – Second Edition, Terje A. Skotheim, CRC Press, 24-Nov-1997 - Technology & Engineering.
3 Polymer Membranes for Fuel Cells – Ed. S.M. Javaid Zaidi & Takeshi matsuura, Springer.
4 Organic-Inorganic Composite Polymer Electrolyte Membranes: Preparation, Properties, and Fuel Cell Applications, Dr Inamuddin, Ali Mohammad, Abdullah M. Asiri, Springer, 10-May-2017 - Technology & Engineering.
5 Polymer Photovoltaics: A Practical Approach, Frederik C. Krebs, Society of Photo Optical, 2008 - Technology & Engineering
6 Electrolytes for Electrochemical Supercapacitors, Cheng Zhong, Yida Deng, Wenbin Hu, Daoming Sun, Xiaopeng Han, Jinli Qiao, Jiujun Zhang, May 6, 2016 by CRC Press. ISBN 9781498747554 - CAT# K27050.

REFERENCES:

1 Supercapacitors: Materials, Systems and Applications, Francois Beguin, Elzbieta Frackowiak, John Wiley & Sons, 02-Apr-2013.
2 Advances in Wind Turbine Blade Design and Materials (Woodhead Publishing Series in Energy) 1st Edition, by Povl Brøndsted (Editor), Rogier P. L. Nijssen (Editor), ISBN-13: 978-0857094261, ISBN-10: 0857094262.

Course Outcomes:

At the end of the course, the students will be able to

- Acquire knowledge on various energy sources for conversion to electrical power and available resources in Indian scenario
- Apply the knowledge gained in selecting polymeric materials for appropriate energy storing/generating devices
- In principle design electrical energy source with the knowledge gained on polymer based components of power devices
- Innovate/modify material technology for energy systems with higher conversion efficiency.

GROUP II (PROCESS ENGINEERING)

PECX 014	NYLON TECHNOLOGY	L	P	T	C
		1	0	0	1

OBJECTIVES:

- To provide knowledge in manufacturing and properties of nylons
- To impart knowledge on fibre spinning process
- To equip with the knowledge of chemical modification and blending of nylons.

MODULE: I PHYSICAL STRUCTURE AND CHARACTERISATION 7

Structure properties relationship – crystallizing, melting temperature, Tg, solubility, molecular weight, melt viscosity, degradation and stabilization, Electrical and mechanical properties.

Characterisation: Identification, composition/moisture analysis, separation techniques, BGGmolecular mass and distribution, IR, NMR and X-ray diffraction.

MODULE: II MELT SPINNING AND FIBRE PROCESSING 8

Fundamentals of Melt Processing: Measurements of viscosity, PVT relationships, importance of moisture, effect of molecular mass, shear, temperature, additives and channel shape. Applications of Rheological data to flow situation.

Processing techniques of melt processing: Processing reagents, material handling and drying, injection moulding, extrusion, blow moulding and monomer processing.

Other processing Techniques: Powder coating, blending and solution coatings. Secondary Treatments: Assembly, Moisture conditioning, mechanical surface clearing, and decorating.

L – 15; T – 0; Total Hours – 15

TEXT BOOKS:

1 Malvin I. Kohan, “Nylon Plastics Hand Book”, Hanser publisher, 1995.

REFERENCES:

1 Nicholar P. Chermisinof, “Hand Book of Engineering Polymeric Materials”, Marcel Dekker inc. N.Y. 1997.

OUTCOMES:

At the end of the course, the students will have the ability to

- Identify the manufacturing process for the development of nylons for specific applications.
- Select nylon based on the properties for various applications.
- Compare the properties of various types of nylons.
- Analyse the various parameters employed in the fibre spinning process.

PECX 016	THERMOFORMING PROCESS	L	T	P	C
		1	0	0	1

OBJECTIVES:

- To provide advanced knowledge in the thermoforming process.
- To impart knowledge in machineries and moulds for thermoforming.
-

MODULE I THERMOFORMING - NEW DEVELOPMENTS 8

Theory of Forming Process - Forming Characteristics - Heating Technology, Trimming Technology, Thickness Reduction , Twin-Sheet Forming, Reinforced-Sheet Forming, Multilayer Sheet Forming. Machinery - Heavy and Light-Gauge Forming Process - Trouble shooting thermoforming process - Common Plastics for Thermoforming - Applications of thermoforming.

MODULE II MOLDS, MOLD DESIGN AND RECYCLING 7

Mold Materials - Prototype Mold Materials - Mold Design Elements - Mold Features - Molds for Matched Mold Forming and Twin-Sheet Forming. Primary, Secondary and Tertiary Recycling - Handling of Scrap - Contamination - Environmental Impact - The Economics of Recycling – Safety

L – 15; T – 0; Total Hours – 15

TEXT BOOKS:

1. Syed Ali Ashter, "Thermoforming of Single and Multilayer Laminates", Elsevier, 2014.
2.

REFERENCES:

1. James L. Throne, "Understanding Thermoforming", 2nd edition, Hanser, 2008.

OUTCOMES:

At the end of the course, the students will be able

- To demonstrate the synthesis of thermoplastic polyesters like PET, PBT.
- To describe different polyester fiber manufacturing process, properties, application and recycling methods.

PECX 017	INJECTION MOULDING TECHNOLOGY	L	P	T	C
		2	0	0	2

Objectives:

- To provide a fundamental knowledge on working principle of an injection molding machine.
- To impart knowledge on components of hydraulic circuit.
- To develop the understanding of hydraulic and electrical locking mechanisms.
- To introduce the advanced injection molding process and use of computer in injection molding operations

MODULE: I INJECTION MOLDING OPERATION & PLASTIC MATERIALS 8

Basics of injection molding-Basic principles of reciprocating machines, plunger type machines, single stage plunger machines, efficiency calculation for plunger machines, plunger-plunger machines, pre-plasticizing machines. Screw drives – hydraulic motor, electric motor, drive characteristics and speed reducers, comparison between hydraulic and electrical drives, horse power requirement. Clamping mechanisms -clamp force rating, toggle clamps, hydraulic clamps, operation of hydraulic clamp, comparison between hydraulic and toggle mechanisms, vertical and horizontal clamping. Machine specification. Molding conditions for PE, PP, PVC, Nylon, ABS, Polycarbonate etc.

MODULE: II HYDRAULIC MECHANISMS AND CIRCUITS 8

Hydraulic mechanisms – Pascal's law, principle hydraulic jack, fluid power symbols, advantages and disadvantages of hydraulic systems. Hydraulic oil requirement – lubricating properties, viscosity, effect of low viscosity, maintenance of hydraulic oil – filtration circuit, connectors – maintenance of connectors, water hammer, packing and seals, fluid power calculations. Hydraulic valves – Two way valves, three way valves, four way valves, check valves, control valves, pressure intensifiers, accumulators. Hydraulic circuits – clamp control, injection control circuits and reciprocating screw circuits

MODULE: III ELECTRICAL MECHANISMS AND CIRCUITS 7

Basic installation data for electric power, installation cost, rating, power factor. Protective devices – Fuses and circuit breakers. Control relays – Relay activation,

relay failure. Contactors – overload protectors for contactors. Electrical motors – motor failure, mechanical and electrical faults of motor, switch activation. Timers – Types (Mechanical, thermal, dashpot, electronic, solid state, electric motor drive). Electrical heating – Tubular heaters, catridge heaters, band type heaters, temperature controllers. Motor control circuits.

MODULE: IV INJECTION MOLD DESIGN AND OPERATION **7**

Mold types – flow of plastic melt – cold slug well, melt orientation. Cavity melt flow – Fill rate, melt temperature, mold temperature, packing pressure, mold geometry, number of cavities. Sprue, runner and gate systems. Mold components – Ejector mechanisms, ejector pin strength, sprue pullers, angle pins. Stripper plate ejection, cam actuation, sprue bushing, locating ring, top and bottom ejection, mold venting, cooling, under cuts, strength requirement for molds and deformation of molds.

L – 30; T – 0; Total Hours – 30

TEXT BOOKS:

1. M.L.Berins, “Plastic Engineering Handbook”, Society of Plastic Industries, Chapman & Hall NY, 1991.
2. D.V.Rosato,”Injection Molding Handbook”, Academic Publishers Boston 2nd edition, 1995.
3. Stanley Middleman, “Fundamentals of Polymer Processing”, Mcgraw-Hill, 1977.
8. J.Crawford “Plastics Engineering”, Butterworth-Heinemann,3rd edition ,2006.

REFERENCES:

1. Chris Rauwendaul, “Polymer Extrusion”, Hanser Publication, Munich, 1987.
4. James F.Carley, “Plastics Extrusion Technology Handbook”, Industrial Press Inc.1989.

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OUTCOMES:

At the end of the course the students will have the knowledge on

- Different types of injection molding machines.
- Working of clamping and ejector mechanism.
- Hydraulic and electrical mechanism and circuits.
- Material handling equipment in advanced injection moulding machine.

PECX 018 EXTRUSION MOULDING TECHNOLOGY L P T C
2 0 0 2

OBJECTIVES:

- To impart fundamental knowledge of single and twin screw extruder components and design criteria for dies.
- To provide an understanding of advances in blow molding operations and control systems.
- To develop the ability to use CAE in extrusion and blow molding operations.

MODULE: I EXTRUSION MACHINES AND LINE 15

Extruder type and construction, features of extruder and production line – single screw and twin screw extruder – extruder components, barrel and feed unit, drive system, auxiliary equipment, melt flow characteristics, melt flow and rheology screw design, barrel screw melting action, venting, processing performance, wear and screw inspection.

MODULE: II DIE DESIGN AND PERFORMANCE 15

Die land, manifold & die, die design, co-extrusion dies, special dies, construction materials, maintenance, trouble shooting, process control and computer: sensors, accuracy, intelligent processing, dies for flat film, blown film, sheet, wire and cable, pipe and tubes etc.

L – 30; T – 0; Total Hours – 30

TEXT BOOKS:

M.L.Berins, “Plastic Engineering Handbook”, Society of Plastic Industries, Chapman & Hall NY, 1991.

Stanley Middleman, “Fundamentals of Polymer Processing”, Mcgraw-Hill, 1977.

J.Crawford “Plastics Engineering”, Butterworth-Heinemann, 3rd edition, 2006.

REFERENCES:

1. Chris Rauwendaul, “Polymer Extrusion”, Hanser Publication, Munich, 1987.
2. James F.Carley, “Plastics Extrusion Technology Handbook”, Industrial Press Inc.1989.

OUTCOMES:

At the end of the course the students will be able to

- Describe the various types of extrusion machines and screw design.
- Plan the dies for flat film, blown film, pipe and tubes.
- Explain flow and cooling analysis of blow molded parts.
- State the requirement of auxiliary equipment for blow molding.

PECX 019 BLOW MOULDING TECHNOLOGY L P T C
2 0 0 2

OBJECTIVES:

- To impart fundamental knowledge of single and twin screw extruder components and design criteria for dies.
- To provide an understanding of advances in blow molding operations and control systems.
- To develop the ability to use CAE in extrusion and blow molding operations.

MODULE: I BLOW MOLDING OPERATION 8

Basics in blow molding – extrusion, Injection, Stretch blow molding, bi-axially oriented PET, PVC, Co-extrusion. Industrial blow molding, multi layer containers via coextrusion, coinjection, coating. Plastic molding material. Interfacing machine performance, start-up and shut down procedures. Blow molding presses – selection of blow molding presses. PET bottle specifications, how to mold heat resistant PET bottles, blow mold temperatures and PET bottle shrinkage, parison temperature, bottle weight, neck design.

MODULE: II CONTROLS FOR BLOW MOLDING 7

Plasticating screw process – metering screw, feed section, transition section, melting, shear rate, pressure holding. Mixing devices – dulmage mixer, mixing pins, union carbide mixer, pulser screw and barrier screw. Machine controls – temperature, placement of sensors, dual sensors, on/off control, proportional control, automatic reset. Type of sensors – thermocouple, resistance temperature detector, RPM speed regulator, process control – melt temperature control, melt pressure, melt pump, parison programming and length control. Weight and thickness control of blow molded products.

MODULE: III CAD/CAM/CAE FOR BLOWN PARTS 8

Basics of CAD/CAM/CAE in design, Basics of CAD/CAM modeling. Flow analysis, cooling analysis, economic plant operation analysis with CIM. Modeling methods – wire frame, surface and solid modeling. Fundamentals of cooling analysis – cooling the melt, conduction in the mold wall, convection cooling in the water line and combining the three.

MODULE: IV AUXILLIARY EQUIPMENT FOR BLOW MOLDING **7**

Need of material handling equipment, material handling, dryers, chillers, coolers, refrigerated compressed air dryers, heat pump chillers, mold dehumidification, granulation, blow molding automation, detecting leakage in containers, trouble shooting guidelines and troubleshooting guide lines for auxiliary equipment

L – 30; T – 0; Total Hours – 30

TEXT BOOKS:

1. M.L.Berins, “Plastic Engineering Handbook”, Society of Plastic Industries, Chapman & Hall NY, 1991.
2. Stanley Middleman, “Fundamentals of Polymer Processing”, Mcgraw-Hill, 1977.
3. J.Crawford “Plastics Engineering”, Butterworth-Heinemann, 3rd edition, 2006.

REFERENCES:

1. Chris Rauwendaul, “Polymer Extrusion”, Hanser Publication, Munich, 1987.
2. James F.Carley, “Plastics Extrusion Technology Handbook”, Industrial Press Inc.1989.

Course Outcomes:

At the end of the course the students will be able to

- Describe the various types of extrusion machines and screw design.
- Plan the dies for flat film, blown film, pipe and tubes.
- Explain flow and cooling analysis of blow molded parts.
- State the requirement of auxiliary equipment for blow molding.

PECX 020 POST PROCESSING OPERATIONS L P T C
2 0 0 1

OBJECTIVES:

- To provide understanding of post processing operations.
- To introduce different painting, printing and coating methods.
- To impart knowledge on assembly of plastic parts, plating and painting.

MODULE: I MACHINING AND FINISHING 8

Deflashing, smoothing and polishing, Routing, milling and turning, Filing grinding and sanding, sawing and cutting, drilling, taping and threading, cleaning and annealing.

MODULE: II ASSEMBLY OF PLASTIC PARTS 7

Mechanical fastening, Adhesive bonding, Thermal welding, Solvent cementing, Welding / Sealing: Hot gas, hot bar, high frequency dielectric, ultrasonic, rotations frictions, vibration, electromagnetic radiation, Microwave, infrared, orbital, friction stir, impulse, bond, hotwire, hot knife & contact – self fastening – press fit, snap fit – adhesive bonding.

L – 15; T – 0; Total Hours – 15

TEXT BOOKS:

1. Rodger Talbert, “Paint Technology Handbook”, CRC Press ,September 13, 2012.
2. Arthur A. Tracton ,”Coatings Materials and Surface Coatings”, CRC Press,2006.
3. Arthur A. Tracton,”Coatings Technology: Fundamentals, Testing, and Processing Techniques”, CRC Press, November 7, 2006.
4. Zeno W. Wicks Jr. , Frank N. Jones , S. Peter Pappas, Douglas A. Wicks, “Organic Coatings: Science and Technology”, Wiley-Interscience; 3rd edition,1993.
5. Charles A. Harper, “Modern Plastics Handbook”, McGraw-Hill, 1999.
6. Akira Kobayashi, **“**Machining of Plastics”, McGraw-Hill, 1990.

REFERENCES:

1. Modern Plastic World Encyclopedia – 2000, Modern Plastics International.
2. Walter Michaeli, “Plastic Processing, an Introduction”, Hanser publications – Munich, 2005.

OUTCOMES:

At the end of the course the students will be able to

- Identify machining and finishing operation for different plastic products.
- Select suitable printing and coating methods based on application.
- Design post processing method for polymer products.

PECX 021	RUBBER PRODUCT MANUFACTURING TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

To provide comprehensive knowledge in

- The techniques used for manufacturing various rubber products.
- Compound design and various vulcanization methods used to cure the rubber products.
- Trouble shooting during rubber products manufacturing.

MODULE I MANUFACTURING TECHNIQUES 7

Moulding of rubbers – blank preparation – compression molding – transfer molding – injection molding – extrusion molding – types of extruder – vulcanization methods – calendaring.

MODULE II LATEX PRODUCT MANUFACTING 7

Principle and types of dipping process – Manufacture of gloves, catheters, balloons – formulations – elastomeric tread production – latex sheeting – latex binders and carpet backing – latex fabric – principle and manufacture of foam by Dunlop and Talalay process – Compound design.

MODULE III FOOT WEAR MANUFACTURING 9

Types of foot wear – plimsolls – build up shoes – all rubber shoes – DVP shoes – dip shoes – plastic foot wear manufacturing by slush molding – injection molded PVC shoes – hand assembled and hand air vulcanized product – rubber boots manufacture by compression moulding – shoe sole / bottom manufacturing by direct molded process – injection molding of sole and heel units – expanded micro cellular soling – methods of manufacturing microcellular soling – trouble shooting.

MODULE IV BELT & HOSE MANUFACTURING 9

Conveyor belt – raw materials – belt construction – different grades of belts with their properties and applications – belt selection – manufacturing – vulcanization – belt joining process.

V-Belt – raw materials – processing of various components – rubber, cord, canvas – method of processing of various v-belts.

Hose design & construction – different types of hoses and their manufacturing process

MODULE V CABLES AND SPORTS GOODS MANUFACTURING 7

Elements of polymer insulated cables – designation of cables – cable design – compound design – manufacturing techniques – special purpose cables. Golf ball and tennis ball manufacturing.

MODULE VI RUBBER TO METAL BONDED COMPONENTS 6

Introduction to rubber to metal bonding – raw materials – manufacturing methods – moulding – use of various adhesives

L – 45; Total Hours – 45

TEXT BOOKS:

1. J.M.Martin, W.K.Smith, “Handbook of Rubber Technology”, CBS Publishers & Distributors, New Delhi, 2004.
2. A.K. Bhowmick, M.M. Hall and H.A. Benaney, “Rubber Products Manufacturing Technology”, Marcel Dekker Inc, New York, 1994.

REFERENCES:

1. Blow. C.M. and Hepburn C, “Rubber Technology and Manufacture”, Butterworths, 1982.
2. C.W. Evans, “Hose Technology”, Elsevier Applied Science Publishers, 1979.
3. D.C. Blackley, “High Polymer Latices, Vol I & II”, Applied Science Publishers, London, 1966.

OUTCOMES:

At the end of the course, students will be able to

- Describe the rubber product manufacturing process.
- Propose the compound design for various latex products.
  Identify appropriate molding method for rubber product manufacturing.

PECX 023	TYRE MANUFACTURING TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

To impart knowledge in

- Tyre compounds, tyre design criteria and manufacturing of tyres and tubes.
- Various deformation and failure mechanism encountered during rolling of tyres.
- Tyre retreading process.

MODULE: I TYRE COMPOUNDS 8

Introduction to tyre technology – tyre compound and fundamental properties – compound development – raw materials for rubber compounding – designing the compound matrix for the reinforced composite.

MODULE: II TYRE DESIGN 8

Function of pneumatic tyre – tyre application – tyre construction – classification of tyres – design feature of tyre – selection of materials – specification of number of plies – designing the cord – tyre shape – tread design.

MODULE: III TYRE MECHANICS 8

Mechanics of rubber – cord rubber composite and its properties, failure mechanism of cord reinforced rubbers composites. Inflation pressure – contact area, tyre deflections – design factors and principles. Rolling resistance, friction, mechanical loss on tyre behavior..

MODULE: IV TYRE MANUFACTURING 8

Tyre manufacturing – Tyre building – green tyre – curing methods – post curing inflation – finishing. Tubeless tyres, Aerotyres & ADV tyres, Cycle tyre. Retreading – criteria – methods of retreading..

MODULE: V TUBE MANUFACTURING 6

Tubes: Principles of tube design – manufacturing of tubes by extrusion, valve jamming, inflation & curing in presses, tube testing.

MODULE: VI TYRE TESTING 7

Tyre testing – tyre performance analysis – tyre durability, noise & vibration. Laboratory test – drum test, pulley wheel test – destructive & non-destructive testing.

L – 45; T – 0; Total Hours – 45

TEXT BOOKS:

1. J.M.Martin, W.K.Smith, “Hand book of Rbber Technology”, CBS Publishers & distributors, New Delhi, 2004.
2. Tom French, Tyre Technology, Bristol: Institute of Physics Publishers, 2002.

REFERENCES:

1. Anil K. Bhowmick, “Rubber Products Manufacturing Technology”, Marcel Dekker, 1994.
2. Rebecca Dolbey, “Advances in Tyre Mechanics”, Rapra Technologies Limited, 1997.
3. Franta, “Elastomers and Rubber Compounding Materials”, Elsevier, 2012

OUTCOMES:

At the end of the course, students will be able to,

- Critically analyze the compound design for tyre and tube manufacturing.
- Provide solutions for the defects occurred during moulding.
- Demonstrate the tyre retreading process.

PECX 024	PLASTICS RECYCLING	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To facilitate the students for selecting suitable recycling technique for polymer waste.
- To enable the students in designing simple techniques for conversion of plastic waste back to usable products.

MODULE: I IDENTIFICATION AND SEPERATION 8

Plastics production and consumption – Plastic wastes generation source and types – Plastic waste composition , quantities – Plastics identification methods physical , chemical and instrumental – sorting and separation technologies – disposal alternatives

MODULE: II METHODS OF RECYCLING 8

Size reduction of recycled plastics – cutting / shredding, densification, pulverization and chemical size reduction processes – municipal solid waste and composition – recycling of plastics from urban solid wastes – household waste.

MODULE: III DEGRADATION AND STABILIZATION OF RECYCLED POLYMER 7

Melt Filtration of Contamination in Recycled Polymers, degradation mechanisms, additives for closed loop recycling, stabilization mechanisms

MODULE: IV RECYCLING OF THERMOPLASTICS 7

Recycling of polyolefins – polyethylene films – Polypropylene battery recycling – Recycling of HDPE fuel tanks – PET recycling methods – PET film recycling – Applications of polyolefin and PET recycling – PVC recycling.Engineering thermoplastics and their major areas where engineering polymers are recycled – major recyclers of engineering plastics – GE/ Bayer/ MRC Polymers – PC, PBT, Nylon, PPO, ABS and polyacetals and their blends

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Michael Tolinski, “Plastics and Sustainability”, John Wiley & Sons, 2011.
2. Dr. Anandhan Srinivasan “Recycling of Polymer Wastes” VDM Publishing,

2010.
3. Güneri Akovali, “Frontiers in the Science and Technology of Polymer Recycling”, Springer Netherland.

REFERENCES:

1. Ann – Christine Albertson and Samuel J.Huang, “Degradable Polymers, Recycling and Plastic Waste Management”, Taylor & Francis, 1995.
2. Nabil Mustafa, “Plastics Waste Management”, Marcel Dekker, 1993.

OUTCOMES:

At the end of the course students will be able to

- Identify and analyse the various forms of plastic wastes.
- Select suitable recycling method for various polymer wastes.
- Demonstrate the knowledge of various recycling processes for plastics, thermoset and elastomeric wastes.

PECX 025	PLASTIC WASTE MANAGEMENT	L	T	P	C
		1	0	0	1

OBJECTIVES:

- To facilitate the students for selecting suitable recycling technique for polymer waste.
- To enable the students in designing simple techniques for conversion of plastic waste back to usable products.

MODULE: I RECYCLING OF THERMOSETS 8

Recycling of Polymer thermoset composites – regrind processes – SMC scrap – pyrolysis and energy recovery –Types of rubber products – rubber grinding methods – tyre grinding – rubber crumb applications – Reclaiming and de-vulcanization processes – tyre derived fuel and energy recovery – Pyrolysis of scrap tyres

MODULE: II RECYCLING OF ELASTOMERS 7

Rubber products Size Reduction, Ground Rubber Crumb Applications, Ground rubber tyre, recycling of rubber tyres, polymer composites, Reclaiming and Devulcanization, application of recycled rubber products – filler , ground rubber products, ribber crumb with thermoplastic binder.

L – 15; T – 0; Total Hours –15

TEXT BOOKS:

1. Michael Tolinski, “Plastics and Sustainability”, John Wiley & Sons, 2011.
2. Dr. Anandhan Srinivasan “Recycling of Polymer Wastes” VDM Publishing, 2010.
3. Güneri Akovali, “Frontiers in the Science and Technology of Polymer Recycling”, Springer Netherland.
4. Manas Chanda, “Plastics Fabrication and Recycling”, CRC Press, 2008.
5. John Scheirs, “Feedstock recycling and pyrolysis of waste plastics”, J. Wiley & Sons, 2006.

REFERENCES:

1. Ann – Christine Albertson and Samuel J.Huang, “Degradable Polymers, Recycling and Plastic Waste Management”, Taylor & Francis, 1995.
2. Nabil Mustafa, “Plastics Waste Management”, Marcel Dekker, 1993.
3.

OUTCOMES:

At the end of the course students will be able to

- Identify and analyse the various forms of plastic wastes.
- Select suitable recycling method for various polymer wastes.
- Demonstrate the knowledge of various recycling processes for plastics, thermoset and elastomeric wastes.

GROUP III (Product & Mould Design)

		L	T	P	C
PECX 028	**DESIGN OF COMPOSITE STRUCTURES**	**2**	**0**	**0**	**2**

OBJECTIVES:

- To introduce the various materials for composite structure.
- To equip with the knowledge of sandwich structure technology.
- To provide knowledge in fracture mechanics of composites.
- To impart knowledge in fatigue and damping capacity of composite materials.
- To provide understanding of various manufacturing/fabricating techniques for composite structures.

MODULE: I INTRODUCTION 8

Definition and classification – materials for composite structure – metals, ceramics, glasses, polymers, elastomers and composites

MODULE: II SANDWICH AND CORE STRUCTURE TECHNOLOGY 7

Applications – wind energy, oilfield, marine, transportation, corrosion, pressure vessels, aircraft, space technology, etc.

MODULE: III MECHANICAL PROPERTIES 8

Strength – tensile, impact, flexural – Hardness – Fatigue- toughness, damping capacity, creep – thermal shock resistance – wear- corrosion. Prediction of mechanical properties

MODULE: IV REINFORCEMENT 7

Reinforcement materials – type and nature – inorganic and organic – glass fiber, silicon carbide, rock fiber, aramid, boron fiber- matrix interface – metal matrix composites – ceramic matrix Composites – polymer matrix composites.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Robert Jones, ”Mechanics of Composite Materials”, McGraw Hill Company, 1998.
2. P.K.Mallick, “Fiber Reinforced Composite”, Marcel Deckar,1988
3. Autar K.Kaw, “Mechanics of Composite Materials”, CRC Press, 2005.
4. Bhagwan D. Agarwal, Lawrence J. Broutman, K. Chandrashekhara, “Analysis

and Performance of Fiber Composites,3rd edition, John Wiley & Sons,2006.

REFERENCES:

1. J. Barbero, “Introduction to Composite Materials Design, Second edition Taylor & Francis Group LLC, 2011.
2. Composites Materials: Engineering and Science by F.L. Mattews and R.D. Rawlings, Published by CRC Woodhead Publishing Limited, 2002.
3. Material Selection in Mechanical Design” by M.F. Ash, Pergamon Press, 1992

OUTCOMES:

At the end of the course, the students will be able to

- Select various materials for designing composite structures.
- Apply knowledge of fracture mechanics of composites during designing of composite structures.
- Analyze critically the damping capacity of composite materials.
- Correlate various manufacturing/fabricating techniques for composite structures based on design.

GROUP IV (Blends, Composites, Adhesives and Coatings)

		L	T	P	C
PECX 034	**MECHANICS OF COMPOSITES**	**2**	**0**	**0**	**2**

OBJECTIVES:

- To introduce the basics of macro and micromechanical behavior of a lamina.
- To impart knowledge about failure mechanism in composites.
- To enhance the knowledge in design and testing procedures of composites.

MODULE: I MACRO MECHANICAL BEHAVIOUR OF LAMINA 8

Stress-strain relations for anisotropic materials, stiffness, compliances and engineering constants for orthotropic materials, elastic constants of isotropic and orthotropic material, stress-strain relations for plane stress in an orthotropic material,

MODULE: II MICRO MECHANICAL BEHAVIOUR OF LAMINA 7

Mechanics of material approach to stiffness i.e. determination of engineering constants for the lamina, Halpin-Tsai equations, elasticity approach to stiffness, mechanics of materials approach to strength, tensile and compressive strength in fiber direction.

MODULE: III MACRO MECHANICAL BEHAVIOUR OF LAMINATE 8

Classical lamination theory, laminate code, symmetric laminates, theoretical and experimental angle – ply laminate stiffness, anti symmetric laminates, non symmetric laminates, balanced laminates, quasi-isotropic laminates.

MODULE: IV FAILURE THEORIES 7

Biaxial strength criteria for an orthotropic lamina; maximum stress failure criteria, maximum strain failure criteria, Tsai-Hill failure criteria,Hoffman Failure Criteria,Tsai-Wu tensor failure criteria, hygrothermal stresses and strains in unidirectional and angle lamina..

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Robert Jones, ”Mechanics of Composite Materials”, McGraw Hill Company, 1998.
2.P.K.Mallick, “Fiber Reinforced Composite”, Marcel Deckar,1988
3.Autar K.Kaw, “Mechanics of Composite Materials”, CRC Press, 2005.
4.Bhagwan D. Agarwal, Lawrence J. Broutman, K. Chandrashekhara, “Analysis and Performance of Fiber Composites,3rd edition, John Wiley & Sons, 2006.

REFERENCES:

1. M.Mukhopadhyay, “Mechanics of Composite Materials and Structures”, Universities Press, 2005
2.

OUTCOMES:

At the end of the course, students will be able to

- Analyze the stress - strain relationships of macro and micromechanical behavior of composites.
- Analyze and predict various failure modes of composites.
- Design composite structures based on different loading conditions

PECX 036	POLYMER BLENDS AND ALLOYS	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To provide understanding on the miscibility of polymers, phase morphology, characteristics of blends and mechanism of toughening.
- To impart knowledge on the properties and applications of polymer blends and alloys.

MODULE: I INTRODUCTION 8

Definition for blends, alloys and copolymers, Reason for blending, classification of polymer blends, and methods of blending, selection criteria of blending; Design of polymer blends.

MODULE: II POLYMER MISCIBILITY 7

Introduction, miscible blends and immiscible blends, difference between miscible and immiscible blends, properties of miscible and immiscible blends, Phase equilibria calculation, Huggins-Flory theory.

Factors affecting miscibility: Thermodynamics, compatibility, solubility parameter, interaction parameter, composition, molecular weight, transition temperature.

MODULE: III COMMERCIAL BLENDS AND ALLOYS 8

PC/PET, PC/PBT, PC/ABS; PPO/HIPS etc. study in detail along with properties and applications.

Interpenetrating Polymer Networks (IPNs): Introduction, classification, method of formation of IPNs, properties and uses, role of cross links, and their importance.

MODULE: IV MORPHOLOGY 7

Introduction, mechanism of phase separation (nucleation and growth and spinodal decomposition), semi-crystalline polymer blends, polymer crystallization, crystallization in miscible polymer blends, influence of liquid/liquid phase separation on the crystallization and morphology.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. 1. Lloyd M.Robeson, “Polymer Blends”, Hanser gardner publications, U.S.A, 2007.
2. Leszek A. Utracki, “Polymer Alloys and Blends: Thermodynamics and

Rheology", Hanser Gardner Publications, 1989.
3. M.J .Folkes and P.S.Hope,Blackiebn, "Polymer blends and alloys", Academic and Professional , Glasgow, 1993.

REFERENCES:

1. C.B. Bucknall and D. R. Paul, "Polymer Blends: Volumes 1 and 2", John Wiley and Sons, New York, 2000.
2. Gabriel O. Shonaike and George P. Simon, "Polymer Blends and Alloys", Marcel Dekker, 1999.

OUTCOMES:

At the end of the course students will have the

- Prospective to select the appropriate combination of polymers to have required synergistic property in the polymer blend.
- Ability to predict the suitable compatibilizer for enhancing the miscibility of immiscible blends.
- Understanding of phase morphology of miscible and immiscible blends.
- Knowledge of selecting right choice of equipment for thorough blending of polymers.

  Ability to analyse and characterize the morphological behavior of polymer blends

PECX 037	PAINT TECHNOLOGY	L	T	P	C
		1	0	0	1

OBJECTIVES:

- To facilitate the students for selecting suitable recycling technique for polymer waste.
- To enable the students in designing simple techniques for conversion of plastic waste back to usable products.

MODULE: I MANUFACTURE OF PAINTS 8

Introduction: Components of paints - paint preparation, formulation - factors affecting-pigment dispersion - preparation of pigment dispersion –manufacture – pigments-pigment properties, different types, selection - dispersion and color matching of pigments, extenders – solvents - solvent properties- oil, driers, resins, diluents, additives, factors affecting: viscosity interfacial tensions, chemical reaction, living micro-organisms.

MODULE: II PROPERTIES OF PAINT FILM 7

Light: reflection, refraction, diffraction, colour science, additive color mixing, subtractive color mixing, gloss, specular gloss, bloom gloss, surface uniformity, chromaticity diagrams for color measurement.

L – 15; T – 0; Total Hours –15

TEXT BOOKS:

1. Swaraj Paul, “Surface Coatings: Science and Technology”, Wiley – Interscience 1985.
2. R.Lambourne. “Paint and Surface Coatings – Theory and Practice”, Ellis Horwood Chichester 1987.

REFERENCES:

1. Arthur A. Tracton, Coating Technology Handbook, Third Edition, Taylor and Francis, 2005.

OUTCOMES:

At the end of the course students will be able to

- Demonstrate knowledge in manufacturing technology of paints.
- Identify various characterization methods to assess the quality of paints and coatings.

PECX 038	ADHESIVES TECHNOLOGY	L	T	P	C
		1	0	0	1

OBJECTIVES:

- To impart knowledge of various types of adhesives.
- To provide basic concepts of adhesive joint designs.
- To introduce the surface preparation methods for adhesive joints

MODULE: I **CONCEPTS AND TERMINOLOGY** **8**

Adhesives – concepts and terminology : functions of adhesives, advantages and disadvantages of adhesive bonding, theories of adhesion – mechanical theory, adsorption theory, electrostatic theory, diffusion theory, weak-boundary layer theory, Requirements for a good bond, criteria for selection of adhesives.

MODULE: II **ADHESIVES TYPES** **7**

Adhesives types: Structural adhesives, Urethane structured adhesives, Modified acrylic structural adhesives, phenolic adhesives and modifiers, anaerobic adhesives, cyanoacrylate adhesives, Hot melt adhesives, pressure sensitive adhesives, RTV Silicone adhesives, sealants, water based adhesives. Specialty adhesives, adhesives in aerospace, adhesive in automobile industry, conductive adhesives, adhesives in building construction, adhesive in electrical industry

L – 15; T – 0; Total Hours –15

TEXT BOOKS:

1. Gerald L. Schreberger, “Adhesive in manufacturing”, Marcel Dekker Inc., New York, 1983
2. W.C. Wake, “Adhesion and the formulation of adhesives” Applied Science Publishers, London, 1976.
3. Swaraj Paul, “Surface Coatings”, John Wiley & Sons, NY, 1985.

REFERENCES:

3. George Mathews, “Polymer Mixing Technology”, Applied Science Publishers. London, 1982.
2. Sheilds, “Hand book of adhesives”, Butterworth’s, 1984.

OUTCOMES:

At the end of the course students will be able to

At the end of the course, students will be able to

- Suggest suitable adhesives and joint design for specific applications
- Select appropriate coatings for specific applications
- Identify the defect in coatings and suggest suitable solutions

PECX 039	SURFACE COATING TECHNOLOGY	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To develop understanding of properties coatings.
- To introduce the surface preparation methods for adhesive joints.
- To introduce methods of characterizing coatings.

MODULE: I POLYMER BASED COATINGS 8

Types: classification based on polymeric resin, emulsion, oil and alkyd paints, acrylic paints, epoxy coatings, polyurethanes, silicones, formaldehyde based resins, chlorinated rubbers, acrylics, and hydrocarbon resins. Classification based on application. fluoropolymers, vinyl resins, appliance finishes, automotive finishes, coil coatings, can coatings, marine coatings, aircraft finishes.

MODULE: II SURFACE PREPARATION 7

Surface cleaning methods, chemical conversion treatments, paint application, brushing, dip coating, flow coating, roller coating, spray painting, electro deposition, chemiphoretic deposition.

MODULE: III SURFACE COATING METHODS 8

Different types of paints – classification based on polymeric resin, emulsion, oil and alkyd paints, acrylic paints, epoxy coatings, polyurethane, silicones, formaldehyde based resins, chlorinated rubbers, hydrocarbon resins. Classification based on application, fluropolymers, vinyl resins, appliance furnishes, automotive finishes, coil coatings, can coatings, marine coatings, aircraft coatings.

MODULE: IV CHARACTERISATION TECHNIQUES 7

Film preparation, barrier properties, mechanical properties and optical properties of coatings - color, gloss, hiding power, ageing properties -factors affecting viscosity of paints - effect of rheological behavior on paint performance. Adhesion properties of coatings - factors affecting adhesive bond - thermodynamics of adhesion - destructive methods - non destructive methods - properties such as floating, silking, cratering, foaming, skinning, flame retardancy, slip resistance and storage stability.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Swaraj Paul, “Surface Coatings: Science and Technology”, Wiley – Interscience 1985.

2.R.Lambourne. “Paint and Surface Coatings – Theory and Practice”, Ellis Horwood Chichester 1987.

3. Sheilds, “Hand book of adhesives”, Butterworth’s, 1984.

REFERENCES:

1. Arthur A. Tracton, Coating Technology Handbook, Third Edition, Taylor and Francis, 2005.

2. George Mathews, “Polymer Mixing Technology”, Applied Science Publishers. London, 1982.

OUTCOMES:

At the end of the course students will be able to

- Analyse appropriate coatings for specific applications.
- Identify relevant surface preparation method and application techniques based on the coatings.
- Identify various characterization methods to assess the quality of coatings.
- Select suitable type of coating methods for specific applications.

Physics Elective Courses
(To be offered in II Semester)

PHCX 01	FUNDAMENTALS OF ENGINEERING MATERIALS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To help students to acquire the properties and applications of conducting and semiconducting materials.
- To familiarize students with basic ideas about the properties of dielectric and magnetic materials and their applications.
- To familiarize students with basic knowledge of nanomaterials and its electrical, electronic, mechanical and magnetic properties.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I CONDUCTING AND SEMICONDUCTING MATERIALS 7

Conductors: properties, Fermi distribution function, Fermi energy in metals- density of states- conducting polymers-properties-applications, semiconductors: intrinsic and extrinsic semiconductors-carrier concentration, conductivity and energy band gap, semiconducting polymers- properties- applications.

MODULE II DIELECTRIC MATERIALS 8

Polarization- dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – Internal field - Clausius Mosotti relation - dielectric loss – dielectric breakdown – applications of dielectric materials (capacitors and transformers) – Pyroelectricity, Piezoelectricity, ferroelectricity and applications in Ferroelectric Random Access Memory (FeRAM) - multiferroic materials and its applications.

MODULE III MAGNETIC MATERIALS 7

Origin of magnetism-magnetic moment, susceptibility, permeability – Bohr magneton – Dia, Para and Ferro magnetism –Spontaneous magnetization- Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites and its application - Giant Magneto-resistance effect (GMR) - Magnetic resonance imaging(MRI).

MODULE IV NANOMATERIALS 8

Properties of nanomaterials – size effect on thermal, electrical, electronic, mechanical,

optical and magnetic properties – quantum confinement – classification of nanomaterials – quantum well, quantum wire, quantum dot - nanoporous materials - carbon nanotubes, graphene - nanocomposites – applications of nano materials.

PRACTICALS

1. Determination of energy band gap of a semiconductor.
2. Determination of resistivity of metals by four point probe method.
3. Determination of dielectric constant of dielectric material.
4. Determination of time constant of a capacitor using RC circuit.
5. Determination of paramagnetic susceptibility of given liquid.
6. Determination of hysteresis loss in a transformer using BH curve.
7. Analysis of size effect on the absorption spectrum of nanomaterials.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. William D. Callister, “Material Science and Engineering”, Wiley Publications, 2006.
2. Raghavan, V., “Materials Science and Engineering”, 5th edition, Printice Hall of India Pvt Ltd. New Delhi, 2004.
3. Wahab. M.A, “Solid State Physics: Structure and Properties of Materials”, Narosa Publishing House Pvt. Ltd., New Delhi , 2nd Edition, 2010.
4. Pillai, S.O., “Solid State Physics”, New Age International, New Delhi, 2005.
5. Charles P. Poole and Frank J. Owens, ”Introduction to nanotechnology”, Wiley (India), 2009.
6. Pradeep. T., “Textbook of Nanoscience and Nanotechnology”, McGraw Hill Education (India) Private Limited, New York, 2012.

OUTCOMES:

On completion of this course, the student will be able to

- apply the concepts of conducting and semiconducting materials for solid state devices.
- comprehend the significance of properties of dielectric magnetic materials and derive these properties from synthesized materials.
- differentiate between the properties of the nanomaterials compared to bulk materials.
- complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 02	HEAT AND THERMODYNAMICS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To familiarize students with basic concepts of heat.
- To help students acquire the fundamentals of heat conduction and radiation.
- To enable students acquaint with the basics of thermodynamic concepts.
- To make students understand the fundamentals of heat based experiments.

MODULE I CONCEPTS OF HEAT **10**

Definition of temperature, thermal and thermodynamic equilibrium - relationship between temperature and kinetic energy - definition of solid, liquid, gas - Introduction to phase transitions, critical and triple points- definition of heat capacity, mechanical equivalent of heat -Joule's calorimeter- latent heat- microscopic model of ideal gas - equation of state, internal energy, equipartition theorem- equation of state for non-ideal gases.

MODULE II CONDUCTION AND RADIATION **10**

Thermal conductivity – rectilinear flow of heat – thermal conductivity of a good conductor – Forbe’s method – thermal conductivity of a bad conductor – Lee’s disc method – conduction of heat through compound media - radiation – Planck’s law of blackbody radiation – Wien’s law – Stefan’s law – Newton’s law of cooling from Stefan’s law – Solar constant – Pyrometry.

MODULE III FUNDAMENTALS OF THERMODYNAMICS **10**

Thermodynamic equilibrium – zeroth law of thermodynamics – first law of thermodynamics – Reversible and irreversible processes – second law of thermodynamics - Heat engine – Carnot’s engine – Carnot’s theorem – Internal combustion engines – petrol and diesel engines (qualitative) – Entropy and available energy – temperature – entropy diagram for Carnot’s cycle - Third Law of thermodynamics (qualitative).

PRACTICALS

1. Determination of mechanical equivalent of heat by Joule’s calorimeter.
2. Relation between temperature of a body and time by plotting a cooling curve-Newton’s law of cooling.

3. Determination of specific heat capacity of liquid by cooling.
4. Determination of thermal conductivity of a good conductor-Forbe's method
5. Determination of thermal conductivity of a bad conductor-Lee's disc method

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Mathur. D.S, “Heat & Thermodynamics”, S.Chand & Co., 2009.
2. Brijlal & Subramaniam, “Heat and Thermodynamics”, S.Chand & Co, Delhi, 2010.
3. Gupta. A.B and Roy. H, “Thermal Physics”, Books and Allied Ltd., 2002.
4. Sharma. J.K and Sarkar. K.K, “Thermodynamics and statistical Physics”, Himalaya Publishing House, 1988.

OUTCOMES:

On completion of this course, the student will be able to

- understand the concepts of heat and its properties.
- comprehend the ideas governing the conduction and radiation processes.
- apply the knowledge of laws of thermodynamics in thermodynamic systems.
- perform heat based experiments and determine its various properties.

PHCX 03	INTRODUCTION TO NANOSCIENCE AND TECHNOLOGY	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To acquire basic knowledge about the nanomaterials and applications.
- To learn about the synthesis and imaging techniques of nanomaterials.
- To gain the basic concepts of fabrication techniques.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I NANOMATERIALS AND APPLICATIONS **10**

Properties of nanomaterials – size effect on thermal, electrical, electronic, mechanical, optical and magnetic properties – quantum confinement – classification of nanomaterials – quantum well, quantum wire, quantum dot - nanoporous materials - zeolite, mesoporous materials, carbon nanotubes, grapheme - nanocomposites - applications (qualitative): Molecular electronics-nanoelectronics – nanophotonics - single electron transistor-drug delivery.

MODULE II SYNTHESIS AND IMAGING TECHNIQUES **12**

Top-down and bottom up approaches – mechanical alloying and mechanical ball milling - sol-gel approach - hydrothermal method - precipitation method - spray pyrolysis - spin coating-self assembled monolayer (SAM) - Chemical vapour deposition method – Physical vapour deposition method: laser ablation method, sputtering method.

Optical microscopy – Phase contrast and interference microscopy – confocal microscopy - high resolution Scanning electron microscope (HRSEM) - high resolution Transmission electron microscope (HRTEM) - Atomic force microscope - Scanning Tunnelling microscope (STM).

MODULE III NANOFABRICATION **8**

Photolithgraphy - electron beam lithography - X-ray and Ion beam lithography - nanoimprint lithography - soft lithograpy - nanoelectromechnical systems (NEMS) - nanoindentation principles.

PRACTICALS

1. Synthesis of nanomaterials by sol-gel method.

2. Synthesis of nanomaterials by hydrothermal method.
3. Synthesis of nanomaterials by solid state reaction method.
4. Synthesis of nanomaterials by chemical bath deposition method.
5. Synthesis of nanomaterials by co-precipitation method.
6. Synthesis of nano thin films by spray pyrolysis method.
7. Synthesis of nano thin films by pulsed laser deposition (PLD) method.
8. Analysis of size effect on the absorption spectrum of nanomaterials.
9. SEM characterization of nanomaterials.
10. AFM characterization of nano thin films.
11. Phase confirmation by XRD.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Charles P.Poole and Frank J. Owens, ”Introduction to nanotechnology”, Wiley (India), 2009.
2. Cao. G., “Nanostructures & Nanomaterials: Synthesis, Properties & Applications”, Imperial College Press, 2004.
3. Gaddand. W., Brenner. D., Lysherski. S. and Infrate. G.J., “Handbook of NanoScience Engineering and Technology”, CRC Press, 2002.
4. Pradeep. T., “Textbook of Nanoscience and Nanotechnology”, McGraw Hill Education (India) Private Limited, New York, 2012.
5. Chris Mack, “Fundamental Principles of Optical Lithography: The Science of Microfabrication”, John Wiley & Sons, 2008.
6. Bandyopadhyay A.K., “Nano Materials”, New Age International Publishers, New Delhi, 2008.

OUTCOMES:

At the end of the course, the students will be able to

- understand the importance and basic concepts of the nanomaterials.
- comprehend the imaging techniques for nanomaterials.
- illustrate the various nanofabrication techniques.
- complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 04	LASERS AND THEIR APPLICATIONS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To recognize the fundamentals of laser and its characteristics.
- To comprehend and compare the different laser systems.
- To apply lasers in metrology and material processing.
- To understand the working of laser instrumentation.
- To correlate the experimental results for applications.

MODULE I LASER THEORY **8**

Spontaneous and stimulated emission - Population inversion – Einstein's A & B coefficients - Threshold condition – super-radiance Laser – Three level and four level laser systems -conditions for CW and pulsed laser action. Q-Switching - experimental methods - cavity dumping - Mode locking - experimental methods - Spatial and Temporal coherence.

MODULE II DIFFERENT LASER SYSTEMS **8**

Laser systems – General description - Laser structure - excitation mechanism - Different laser systems- He-Ne laser, Carbon-dioxide laser - Excimer laser – Free electron laser- Alexandrite laser - Ti-Sapphire laser – Semiconductor diode laser - Diode pumped solid state laser - Pulsed-CW dye laser- Fibre laser.

MODULE III METROLOGICAL AND MATERIAL PROCESSING APPLICATIONS **8**

CW and Pulsed laser beam characteristics and its measurements - Beam focusing effects - spot size - Power and Energy density Measurements - Distance measurement - Interferometric techniques - LIDARS - different experimental arrangements - Pollution monitoring by remote sensing - Laser gyroscope - Laser welding, drilling, machining and cutting - Laser surface treatment - Laser vapour deposition – Biophotonic applications.

MODULE IV LASER INSTRUMENTATION **7**

Laser for measurement of length, current and voltage – Laser Doppler Velocimetry - Holography and speckle in displacement and deformation measurements - Laser for communication with fiber optics as channel.

PRACTICALS

1. Tuning of Dye Laser using DFDL Arrangement
2. Determination of Brewster Angle using He-Ne laser
3. Study of transversely Pumped Dye Lasers
4. Study of longitudinally Pumped Dye Lasers
5. Determination of power and wavelength using Distributed Feedback Dye Laser (DFDL)
6. Determination of fibre optic losses using semiconductor laser.
7. Bandgap determination of a semiconductor diode.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. William T. Silfvast, “Laser Fundamentals”, Cambridge University Press, 2009.
2. Ghatak. A. & Thyagarajan. K. “Optical Electronics”, Cambridge University, 1994.
3. Laud.B.B., “Laser and Non-Linear Optics”, Second Edition, New Age International (p) Limited Publishers, 2011.
4. Nambiar. K.R., “Lasers Principle, Types and Applications”, New Age International (p) Ltd, 2004.
5. Wilson. J. & Hawkes. J.F.B., “Opto Electronics - An Introduction”, Prentice Hall, 1992.
6. William M.Steen, ”Laser Material Processing”, Springer-Verlag, Berlin, Third Edn., 2005.

OUTCOMES:

At the end of the course, the students will be able

- To complement the knowledge acquired in the theory class.
- To work with dye lasers for tunability of laser wavelength.
- To measure the loss of information involved in fibre optic communication.
- To correlate the results for application.

PHCX 05	MATERIALS SCIENCE	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To gain basic knowledge in conducting and semiconducting materials and their properties.
- To provide basic understanding of properties and applications of dielectric materials.
- To impart knowledge on magnetic and optical materials and their properties & applications.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I CONDUCTING AND SEMICONDUCTING MATERIALS 10

Quantum free electron theory of metals and its importance - Energy distribution of electrons in metals - Fermi distribution function - Density of energy states and carrier concentration in metals - Fermi energy – Classification of solids into conductors, semiconductors and insulators on the basis of Band theory – Introduction to Elemental and Compound semiconductors - Carrier concentration derivation for Intrinsic semiconductors - Density of electrons in conduction band & Density of holes in valence band- intrinsic carrier concentration - Fermi energy & Variation of Fermi energy level with temperature - Mobility and electrical conductivity - Band gap determination.

MODULE II DIELECTRIC MATERIALS 7

Introduction to dielectric materials & basic definitions – Electronic, Ionic, Orientation & Space charge polarizations - Total polarization – Frequency and temperature dependence of polarization - Internal field in a dielectric material - Deduction of Clausius - Mosotti's relation - dielectric loss & loss tangent – Different types of dielectric breakdown – Applications of dielectric materials : Capacitors and Transformers.

MODULE III MAGNETIC MATERIALS 6

Introduction to magnetic materials & origin of magnetic moment - Different types of

magnetic materials and their properties - Ferromagnetism & Domain theory of ferromagnetism - Hysteresis, Soft and Hard magnetic materials - Antiferromagnetic materials - Ferrites and its applications – Applications of magnetic materials : Data storage.

MODULE IV OPTICAL MATERIALS 7

Optical properties of semiconductors - Direct and Indirect bandgap semiconductors – Traps, recombination centre, color center and exciton – Luminescence : Fluorescence and Phosphorescence - Liquid crystal display : twisted nematic crystal display – Applications of Optical materials - Optical Sources : light emitting diode and laser diode - Photo detectors : PIN photodiode and Avalanche Photodiode - Pyroelectric devices - Electro optic effect : Kerr effect and Faraday effect.

PRACTICALS

1. Resistivity measurement of a semiconductor using four point probe method.
2. Determination of band gap of a semiconductor diode.
3. Determination of Hall coefficient of a given semiconductor material.
4. Determination of dielectric constant of a given non-polar liquid.
5. Determination of magnetic susceptibility of a given paramagnetic liquid using Quincke's method.
6. Determination of energy loss of a given transformer core using hysteresis method.
7. To study the I-V characteristics of a photodiode.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Palanisamy P.K., ''Physics II'', Material Science for ECE, Scitech Publications (India) Pvt. Ltd., 2006.
2. Kasap. S.O., ''Principles of Electronic materials and devices'', McGraw Hill Publishers, 3rd Edition, 2007.
3. Arumugam. M, "Physics II'', Material Science for ECE, Anuradha Publishers, 5th Edition, 2005.
4. Sze. S.M., ''Semiconductor Devices – Physics and Technology'', John Wiley, 2nd Edition. 2002.
5. Raghavan. V, ''Materials Science and Engineering'', Prentice Hall of India, 5th Edition, 2004.

OUTCOMES:

On the completion of this course, the students will be able to

- Gain knowledge about fundamentals of conducting and semiconducting materials.
- Understand concepts and applications of Dielectric and Magnetic materials.
- Familiarize Optical materials and their applications in Engineering and Medical fields.
- Complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 06	NON-DESTRUCTIVE TESTING	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To study the process and applications of ultrasonic inspection method.
- To understand the basic concepts of radiographic inspection method.
- To acquire the knowledge about the various surface Non-Destructive Testing (NDT) techniques.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I ULTRASONIC INSPECTION METHOD **10**

Ultrasonic Testing - Principle of operations - types of sound waves - types of Transducers - transmission and pulse-echo method - straight beam and angle beam, instrumentation - calibration methods - ultrasonic testing technique- data representation, A Scan, B-scan, C-scan. Phased Array Ultrasound, Time of Flight. Diffraction - thickness determination - advantages, disadvantages and applications.

MODULE II RADIOGRAPHIC INSPECTION METHOD **10**

Radiographic testing – Principle - Interaction of X-ray with matter - X-ray radiography - method of generation-industrial radiography inspection techniques – Equipment - Exposure charts - Types of films – Fluoroscopy - Xero-Radiography – Limitations - Gamma radiography - Equipment, radiation sources - method of generation - film processing - interpretations of radiography - safety in industrial radiography.

MODULE III SURFACE NDT TECHNIQUES **10**

Liquid Penetrant Testing – Principles, Characteristics and types of liquid penetrants – developers - advantages and disadvantages of various methods - Inspection Procedure and Interpretation of results. Applications of Liquid Penetrant testing.

Magnetic Particle Testing - Principle-magnetizing technique - procedure –equipment - Interpretation and evaluation of test indications - applications and limitations - demagnetization.

PRACTICALS

1. Inspection of welds using solvent removable visible dye penetrant.
2. Inspection of welds using solvent removable fluorescent dye penetrant.

3. Inspection on non magnetic materials by eddy current method.
4. Inspection on magnetic materials by eddy current method.
5. Inspection of welds by Eddy current Testing.
6. Inspection of welds by Magnetic Particle Testing - Dry method.
7. Inspection of welds by Magnetic Particle Testing - Wet method.
8. Ultrasonic flaw detector - Inspection of defects.
9. Demonstration of Radiographic inspection.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Baldev Raj., Jayakumar T.,Thavasimuthu., “Practical Non-Destructive Testing”, Narosa Publishing House, 2009.
2. Ravi Prakash., “Non-Destructive Testing Techniques”, 1st revised edition, New Age International Publishers, 2010.
3. ASM Metals Handbook of Non-Destructive Evaluation and Quality Control, American Society of Metals, Metals Park, Ohio, USA, Volume-17, 2000.
4. Paul E Mix,”Introduction to Non-destructive testing: a training guide”, Wiley, 2nd Edition New Jersey, 2005.
5. Charles J., Hellier, “Handbook of Nondestructive evaluation”, McGraw Hill, New York, 2001.

OUTCOMES:

Upon completion of this course, the students will be able to

- illustrate the ultrasonic inspection methods of NDT.
- understand the basic concept of radiographic inspection method.
- test the surfaces by the various surface NDT techniques.
- complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 07	PROPERTIES OF MATTER AND ACOUSTICS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To understand principles and properties of elasticity.
- To understand the basic concepts and application of viscosity.
- To analysis acoustic of building.
- To know about photoelasticity and its applications.

MODULE I ELASTICITY **8**

Stress and strain - Hooke's Law of elasticity - Elastic moduli - Stress-Strain Diagram - Poisson's Ratio - Relation between elastic constants - Work done in stretching and twisting a wire - Twisting couple on a cylinder- Expression for bending moment - Cantilever–Expression for depression - Uniform bending and Non-uniform bending of beams (theory & experiment) - I form Girders (qualitative treatment) and applications.

MODULE II VISCOSITY **8**

Viscosity- Newton’s formula for viscous flow - Streamline and turbulent motion - Reynolds number - Poiseuille's formula - Determination of coefficient of viscosity- factors affecting viscosity - capillary flow method - Stoke's formula- viscosity of highly viscous liquids – Stoke’s method - Lubricants and its applications –viscosity measurements - Viscometer - Variation of Viscosity with Temperature.

MODULE III ACOUSTICS OF BUILDING **7**

Basic requirement for the acoustically good halls - Reverberation and time of reverberation – Sabine’s formula for reverberation time - Absorption coefficient and its measurement -Transmission of sound and transmission loss - Factors affecting the architectural acoustics and their remedy-sound absorbing materials - vibration and noise control systems for buildings.

MODULE IV PHOTOELASTICITY **7**

Polarization - double refraction - Theory of Plane, Circularly and Elliptically polarized light - Quarter wave plate and half wave plate - photo elasticity - Theory of photo-elasticity - Stress optic relations - model materials - analysis techniques - Photo elastic bench - Three dimensional photo elasticity - Digital photo elasticity - Photo elastic

coatings.

PRACTICALS

1. Determination of viscosity of liquid by Poiseuille's method.
2. Determination of viscosity of liquid by Stoke's method.
3. Analysis of stress by photo elastic method.
4. Verification of Hooke's law by spring method.
5. Determination of Young's modulus of the cantilever beam.
6. Determination of rigidity modulus by static torsion method.
7. Visit to acoustically good auditorium and identifying the sound absorbing materials in the auditorium.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Mathur D.S., "Elements of Properties of Matter", S.Chand & Co, Delhi, 2009.
2. Gaur R.K., Gupta S.L.,"Engineering Physics", Dhanpat Rai Publishers, 2010.
3. Brijlal and Subramaniam.," Properties of Matter", Eurasia Publishing Co, New Delhi, 2002.
4. Smith C.J.," General Properties of Matter", Orient & Longman,1960.
5. Kenneth G. Budinski and Michel K., Budinski, "Engineering Materials Properties and Selection", Pearson, Singapore, 2002.

OUTCOMES:

Upon completion of this course, the students will be able to

- understand the basic concepts of the elasticity of materials.
- comprehend the concepts of viscosity of liquid and measurement.
- demonstrate the acoustical aspects of building and its importance in construction.
- apply the fundamental concept of photo elasticity for the stress analysis of the object.

PHCX 08	PROPERTIES OF MATTER AND NONDESTRUCTIVE TESTING	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To impart knowledge about the principles and properties of elasticity.
- To learn the laws governing the dynamic of rigid bodies.
- To acquire the knowledge of the various techniques of Non-Destructive Testing (NDT) of materials.
- To understand the principle and basic concept of low temperature applications.

MODULE I ELASTICITY **8**

Stress and strain - Hooke's Law of elasticity - Elastic moduli - Stress-Strain Diagram - Poisson's Ratio - Relation between elastic constants - Work done in stretching and twisting a wire - Twisting couple on a cylinder- Expression for bending moment- Cantilever–Expression for depression - Uniform Bending and Non-uniform bending of beams (theory & experiment) - I form Girders (qualitative treatment) and applications.

MODULE II DYNAMICS OF RIGID BODIES **8**

Rigid bodies - angular acceleration - Torque on a particle - angular momentum - law of conservation of angular momentum - moment of inertia and its significance - Theorem of parallel and perpendicular axis - moment of inertia of a thin uniform bar - moment of inertia of a rectangular lamina - moment of inertia of uniform circular disc - Moment of inertia of hollow and solid cylinders – flywheel
(qualitative) - kinetic energy of rotating body – Routh rule.

MODULE III NDT TECHNIQUES **6**

Ultrasonic Testing- types of Transducers-transmission and pulse-echo method- Radiographic testing- Principle-Interaction of X-ray with matter-X-ray radiography-method of generation-industrial radiography inspection techniques- Liquid Penetrant Testing**-** Inspection Procedure and Interpretation of results.

MODULE IV LOW TEMPERATURE PHYSICS **8**

Definition of Refrigeration and Air-Conditioning - Types of Refrigeration Systems-

Applications- Comfort Air Conditioning, Industrial Refrigeration, Food processing and food chain - **Cryogenic treatment - Low temperature properties of engineering materials: Mechanical properties, Thermal properties, Electrical properties.**

PRACTICALS

1. Verification of Hooke's law by spring method.
2. Determination of Young's modulus of the beam by bending method.
3. Inspection of welds using solvent removable visible dye penetrant.
   Inspection of welds using solvent removable fluorescence dye penetrant.
5. Inspection of welds by Magnetic Particle Testing.
6. Determination of moment of inertia of the disc by torsion pendulum method.
7. Determination of moment of inertia of the disc by static torsion method.
8. Demonstration of working of flywheel.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Mathur D.S.,"Elements of Properties of Matter", S.Chand & Co, Delhi, 2009.
2. Brijlal & Subramaniam," Properties of Matter", Eurasia Publishing Co, Delhi, 2002.
3. Gaur R.K., Gupta S.L., "Engineering Physics" Dhanpat Rai Publishers, 2010.
4. Baldev Raj.,Jayakumar T., Thavasimuthu M.,"Practical Non-Destructive testing", Narosa Publishing House, 2009.
5. Brijlal & Subrahmanyam., "Heat and Thermodynamics" S.Chand & Company Ltd, 2002.
6. Paul E Mix.," Introduction to Non-destructive testing: a training guide", Wiley, 2nd Edition, New Jersey, 2005.
7. Charles J., Hellier.," Handbook of Nondestructive evaluation", McGraw Hill, New York, 2001.

OUTCOMES:

Upon completion of this course, the students will be able to

- understand the basic of concept of elasticity of materials.
- comprehend the basic concepts of motion of rigid bodies and its applications.
- demonstrate the various NDT techniques and its importance.
- know the low temperature systems and its applications.

PHCX 09	SEMICONDUCTOR PHYSICS AND OPTOELECTRONICS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To understand the Physics of Semiconductor devices.
- To make the students learn the fundamentals of Photoluminous - semiconductors, Optoelectronic devices, Optical modulators/detectors.
- To make them understand the technology behind latest Display devices like LCD, Plasma and LED Panels.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I PHYSICS OF SEMICONDUCTORS **8**

Elemental and compound semiconductors – Drift and diffusion current - Intrinsic semiconductors – Carrier concentration (derivation) – Fermi energy – Variation of Fermi energy level with temperature – Mobility and electrical conductivity – Band gap determination – Extrinsic semiconductors – Carrier concentration in n-type and p-type semiconductor (derivation) – Variation of Fermi level with temperature and impurity concentration – Variation of Electrical conductivity with temperature – Hall effect – Experiment and applications of Hall effect.

MODULE II OPTOELECTRONIC DEVICES **7**

Light Emitting Diodes (LED) – power and efficiency - double hetero LED - LED structure - LED characteristics - White LED – Applications. Liquid crystal displays – Dynamic scattering and Twisted nematic display, Semiconductor Lasers, Homojunction and Heterojunction laser diodes - Optical processes in semiconductor lasers.

MODULE III OPTICAL MODULATORS **7**

Modulation of light – birefringence –Modulation Techniques - Electro optic effect – Electro optic materials –Types of Electro optic Modulators : Kerr and Pockel modulators –- Magneto optic effect - Magneto optic Modulators – Acousto Optic modulators.

MODULE IV OPTICAL DETECTORS **8**

Photo detectors - photodiodes - phototransistors - noise characteristics - PIN diode – Avalanche Photodiode (APD) characteristics - APD design of detector arrays – Charged Couple Device - Solar cells - Materials and design considerations, Thin film

solar cells, amorphous silicon solar cells.

PRACTICALS

1. Resistivity measurement of a semiconductor using four point probe method.
2. Determination of band gap of a semiconductor diode.
3. Determination of Hall coefficient of a given semiconductor material.
4. Determination of the wavelength of a given laser source using diffraction grating.
5. Determination of Planck's constant using LED.
6. To study the I-V characteristics of photodiode and phototransistor.
7. To study the characteristics of a solar cell.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Arumugam. M, "Physics II", Anuradha Publishers, 5th Edition, 2005.
2. Sze. S.M., "Semiconductor Devices – Physics and Technology", 2nd edn. John Wiley, 2002.
3. Wilson & J.F.B. Hawkes, "Optoelectronics – An Introduction", Prentice Hall, India, 1996.
4. Bhattacharya, "Semiconductor optoelectronic devices", Second Edn, Pearson Education, 2002.
5. Safa O. Kasap, "Optoelectronics & Photonics:Principles & Practices", Second Edn, Pearson Education,2013.
6. Palanisamy P.K., "Semiconductor physics and optoelectronics" Scitech Publications, 2003.

OUTCOMES:

On completion of this course, the student will be able to

- understand the principles of Physics behind semiconductor devices.
- choose the correct semiconductors for electronic devices and display.
- differentiate the working principle of LED and Diode Laser.
- apply the knowledge of modulation of light for different types of optical modulators.
- select suitable photodetectors for different types of applications.
- complement the knowledge acquired in the theory class and correlate the results for applications.

Chemistry Elective Courses
(To be offered II Semester)

CHCX01	ANALYTICAL INSTRUMENTATION	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make the student conversant with

- principles, instrumentation and applications of different electroanalytical techniques
- different chromatographic techniques
- principles, instrumentation and applications of various types of absorption and emission spectroscopy
- different thermal analytical methods and their applications

MODULE I ELECTROANALYTICAL TECHNIQUES **7**

Principle and applications: conductometric titrations – potentiometrIc titrations, ion-selective electrodes and pH-metry – coulometry – voltammetry - polarography, amperometric titrations.

MODULE II CHROMATOGRAPHY **8**

Basic concepts of chromatography – paper chromatography – column chromatography – thin layer chromatography – gas chromatography – high performance liquid chromatography – gel permeation chromatography.

MODULE III SPECTROSCOPY **8**

Absorption spectroscopy (principle, instrumentation and applications): Colorimetric analysis – UV-Visible spectroscopy – FTIR spectroscopy - Emission Spectroscopy (principle, instrumentation and applications): fluorescence, phosphorescence and chemiluminescence – Atomic absorption spectroscopy – flame emission spectroscopy.

MODULE IV THERMAL ANALYSIS **7**

Principle, instrumentation and applications: Thermo gravimetric analysis – Differential thermal analysis – Differential scanning calorimetry

PRACTICALS

1. Conductometric titrations: acid-base and precipitation titrations

2. Potentiometric titrations
3. Determination of pH of the unknown solution
4. Estimation of alkali metals using flame emission spectroscopy
5. Estimation of metal ions of coloured solutions using colorimetric analysis
6. Separation of compounds using gas chromatography
7. Separation of compounds using high performance liquid chromatography
8. Analysis of the given sample and interpretation of the data using IR, UV-Visible spectroscopy
9. Demonstration of TGA/DTA and DSC and interpretation of data.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Skoog D.A., West D.M., Holler F.J. and Crouch S.R., Fundamentals of Analytical Chemistry, 8th Edition, Thomson Brooks/Cole Publication., Singapore, 2004.
2. Willard H.H., Merritt L.L., Dean J.A. and Settle F.A., Instrumental Methods of Analysis, 7th Edition, CBS Publication, New Delhi Reprint, 2004.
3. A.I. Vogel, Vogel's Textbook of Practical Organic Chemistry, 5th Edition, Prentice Hall, London, 2008.
4. Christian G.D., Analytical Chemistry, 6th Edition, John Wiley, Singapore, 2003.
5. Fifield F.W. and Kealey D., Principles and Practice of Analytical Chemistry, 5th Edition, Blackwell Publication, London, 2000.
6. Settle F. (Editor), Handbook of Instrumental Techniques for Analytical Chemistry, Pearson Education, Singapore, 2004.

OUTCOMES:

The student will be able to

- state the principle and applications of various electro-analytical techniques
- identify the right separation method for a given sample using different chromatographic techniques
- explain the principle, instrumentation & applications of various spectroscopic methods and also to interpret the data
- elaborate the principle, instrumentation and applications of various thermal analytical techniques and interpret the data.

CHCX02	CORROSION AND ITS CONTROL	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students should be conversant with the

- Basic concepts, principles and factors affecting corrosion
- Types and mechanism of corrosion
- Control measures of corrosion by material selection, proper design and by applying organic coatings
- Control of corrosion by applying inorganic coating

MODULE I BASIC CONCEPTS OF CORROSION 8

Corrosion – causes and impacts of corrosion – mechanism of corrosion: Dry corrosion- oxidation corrosion - corrosion by other gases – Pilling-Bedworth rule- Corrosion by hydrogen: hydrogen blistering, hydrogen embritttlement, decarburization and hydrogen attack – corrosion of silver and copper by sulphur compounds – liquid metal corrosion (embritttlement or cracking) – Wet corrosion : hydrogen evolution – presence and absence of oxygen and absorption of oxygen – difference between dry and wet corrosion-factors influencing corrosion-polarization-passivity-emf series and galvanic series- corrosion current -rate of corrosion.

MODULE II FORMS OF CORROSION 7

Forms of corrosion-conditions for electrochemical corrosion –galvanic corrosion – differential aeration corrosion: pitting, water line, wire fencing, crevice and filiform corrosion – stress corrosion – Intergranular corrosion- erosion corrosion – soil corrosion – microbiological corrosion- fretting corrosion- corrosion in composites.

MODULE III CORROSION CONTROL AND ORGANIC COATINGS 8

Corrosion control – selection of materials and designing- cathodic protection – sacrificial anode and impressed current cathodic protection – corrosion inhibitors: anodic, cathodic and vapour phase inhibitors.

Organic protective coatings – paints: constituents – functions – varnishes : types-constituents – functions – lacquers : constituents – functions –enamels-constituents – functions – special paints : fire retardant, water repellant, heat resistant, temperature indicating and luminous paints.

MODULE IV INORGANIC COATINGS 7

Treatment of metal surface-inorganic coatings- classification- metallic coatings : anodic and cathodic coatings-hot dipping : galvanizing and tinning- electroplating—electroless plating – cementation (diffusion) : sherardizing, calorizing and chromizing – metal cladding-metal spraying – non metallic coatings (chemical conversion coatings) : phosphate, chromate, oxide coatings and anodizing – comparison of anodic and cathodic protection.

PRACTICALS

1. Determination and comparison of rate of corrosion of metals in the presence of acid, base and neutral medium by weight loss method.
2. Determination of rate of corrosion of iron in the presence of various acids by weight loss method.
3. Determination of rate of corrosion of iron in the presence and absence of anodic Inhibitor by weight loss method.
4. Determination of rate of corrosion of iron in the presence and absence of cathodic Inhibitor by weight loss method.
5. Electroplating of base metal with copper.
6. Electrolessplating of base metal with copper
7. Chemical conversion coatings such as chromate and phosphate coatings.
8. Demonstration on the study of rate of corrosion by using cyclic voltametry.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. P.C Jain & Monica Jain, Engineering Chemistry Dhanpatrai Publishing Company (P) Ltd., New Delhi (2013).
2. S S Umare & S S Dara, A text Book of Engineering Chemistry, S. Chand& Company Ltd, New Delhi, 2014.
3. M.G. Fontana and N.G. Green, Corrosion Engineering, McGraw Hill Book Company, NewYork, 1984.
4. S. Banerjee, A.K. Tyagi, Functional Materials- Preparation, Processing and Applications, ELSEVIER Publications, London ; Waltham, MA : 2011

OUTCOMES:

Students will be able to

- explain the mechanism, compare and enumerate the factors affecting

corrosion

- describe and identify the place and types for a given situation.
- choose and elaborate the suitable organic coating method for a given real time situation.
- apply a suitable metallic coating for a given situation

CHCX03	ELECTRICAL MATERIALS AND BATTERIES	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students should be conversant with

- preparation, properties and applications of plastics used in electrical and electronic applications
- properties and uses of electrical engineering materials
- classification and description of different types of batteries.
- classification and types of fuel cells

MODULE I POLYMERS FOR ELECTRICAL AND ELECTRONIC APPLICATIONS **8**

Preparation, properties and applications **:** polyethylene, polypropylene, EPDM, Nylon-6,6, PVC, PTFE, polycarbonates, ABS, phenol formaldehyde, urea formaldehyde, epoxy resins – polymer blends and alloys.

MODULE II ELECTRICAL ENGINEERING MATERIALS **7**

Conductors: Silver, Copper, Gold, Aluminum – Semiconductors: Germanium, Silicon, Gallium Arsenic – Insulating Materials: Rubbers, Mica, Plastics, Ceramics, Insulating papers – Magnetic Materials: ferromagnetic materials, paramagnetic materials, diamagnetic materials, antiferromagnetic materials, ferrites

MODULE III BATTERIES **7**

Electrochemical and electrolytic cell – batteries: types (primary, secondary and flow cell) – primary batteries: dry cells, alkaline batteries – secondary batteries: nickel-cadmium cell – lead acid storage cell, lithium battery: primary and secondary type – solar cell – dye sensitized solar cell.

MODULE IV FUEL CELLS **8**

Difference between batteries and fuel cells - chemistry of fuel cells - types of fuel cell (based on temperature and electrolyte) – principle, characteristic features, advantages, disadvantages and applications of polymer electrolyte membrane or proton exchange membrane fuel cell (PEMFC), direct methanol fuel cell (DMFC), alkaline fuel cell (AFC), phosphoric acid fuel cell (PAFC), molten carbonate fuel cell (MCFC) and solid oxide

fuel cells (SOFC).

PRACTICALS

1. Free radical polymerization of styrene.
2. Free radical polymerization of PMMA.
3. Preparation of phenol-formaldehyde.
4. Preparation of urea-formaldehyde.
5. Synthesis of epoxy resin.
6. Demonstration of mechanical properties of insulating materials using UTM
7. Demonstration of electrical properties of insulating materials
8. Construction of batteries using natural resources
9. Measurement of EMF for different batteries.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Jain P.C. and Renuka Jain, Engineering Chemistry, Dhanpat Rai Publication Co. (P) Ltd., New Delhi, 2013.
2. Michael L. Berins, Plastics Engineering Hand Book, 5th Edition, Chapman and Hall, New York, 1991.
3. H.F. Mark and N. Gaylord, Encyclopedia of Polymer Science and Technology, Vol. 1 to XIV Interscience, 2nd Ed. 1988.
4. Gowarikar V.R., Viswanathan N.V and Jayadev Sreedhar, Polymer Science, Wiley Eastern Limited, Madras, 1981.
5. R.K. Rajput,A Textbook of Electrical Engineering Materials, Firewall Media, 2004
6. Vladimir S. Bagotsky, Fuel Cells: Problems and Solutions, 2nd Edition, John Wiley and Sons, 2012.
7. B. Viswanathan and M. Aulice Scibioh, Fuel Cells: Principles and Applications, Taylor and Francis Group, 2007.

OUTCOMES:

The student will be able to

- summarise the preparation, properties and applications of plastics used in electrical and electronic applications
- enumerate the properties and uses of electrical engineering materials
- illustrate various types of batteries with the aid of a diagram
- classify the fuel cells and elaborate the different types of fuel cells.

CHCX04	ENGINEERING MATERIALS	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students should be conversant with

- properties and uses of different types of refractories and abrasives
- adhesives, cements and lime, setting of cements and their chemical behaviors.
- types, properties and uses of lubricants.
- various types of composite materials.

MODULE I REFRACTORIES AND ABRASIVES **8**

Introduction refractory: -classification - based on chemical nature- characteristic and selection of good refractory - general manufacture of refractory- preparation properties and uses of: silica refractory - magnesite refractory - zirconia refractory, properties of refractories: refractoriness - refractoriness under load - thermal spalling - porosity and dimensional stability, Cermets - super refractory.

Abrasives : introduction - Moh's scale - natural abrasives: diamond – corundum – emery - garnet and quartz, synthetic abrasives: preparation properties and uses: carborundum (silicon carbide)– alundum - boron (norbide) carbide

MODULE II ADHESIVES AND BINDING MATERIALS **7**

Introduction - classification of adhesives –advantage –limitation of adhesive bonding – development of adhesive- factors influencing adhesive action: chemical and physical, application techniques of adhesive – Lime: classification – manufacture - setting and hardening, Gypsum: -Manufacture and properties and uses - Cement : chemical composition- Manufacture – setting and hardening – concrete – weathering of cement and concrete and its prevention- special cements: high alumina cement - sorel cement - white portland cement – water proof cement.

MODULE III LUBRICANTS **7**

Introduction –functions of lubricant- mechanism of lubrication - classification of lubricant – liquid lubricant: vegetable and animal oils – mineral oils, semisolid: grease(calcium, lithium, aluminium) – petroleum jelly, solid lubricant: graphite - molybdenum disulphide, Properties of lubricant: viscosity - viscosity index - flash point and fire point - cloud point and pour point – oiliness - aniline point - carbon residue.

MODULE IV COMPOSITE MATERIALS 7

Introduction – advantageous characteristics of composites, applications of composites, main constituent of composites, types and applications of composites: RCC fibre-reinforced plastics (glass , carbon and aramid) - particulate composite - metal matrix composite - layered composites - failures in fibre-reinforced composites, ceramic matrix composites (CMC) – properties and applications.

PRACTICALS

1. Preparation of refractory bricks
2. Preparation of abrasive papers/cloth
3. Preparation of simple adhesives
4. Estimation of alkalinity in cements
5. Determination of cloud point and pour point
6. Determination of flash point and fire point
7. Preparation of fibre-reinforced composite

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. P.C Jain & Monica Jain, Engineering Chemistry Dhanpatrai Publishing Company (P) Ltd., New Delhi (2013).
2. B.Sivasnakar, “Engineering Chemistry”, Tata McGrow-Hill Publication Limited, New Delhi, second reprint 2008.
3. Engineering Chemistry, Wiley India Editorial Team, Willey India Publisher, New Delhi, 2011.
4. S S Umare & S S Dara, A text Book of Engineering Chemistry, S. Chand& Company Ltd, New Delhi, 2014.

OUTCOMES:

The student will be able to

- classify and describe the manufacture the refractories and enumerate the properties and uses of abrasive materials.
- elaborate the manufacture, properties and uses of various adhesives and binding materials.
- classify lubricants and describe the properties and uses of them
- enumerate the properties and uses of various composite materials.

CHCX05	FUELS AND COMBUSTION	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make the students conversant with the

- three types of fuels available and the different processes involved in it.
- analysis of fuel characteristics and manufacture of fuels
- calculations involved in calorific values and minimum air requirement for complete combustion.
- classification, functions, mechanism and properties of lubricants.

MODULE I SOLID FUELS **7**

Characteristics of good fuel. Solid fuel – Wood, Coal – Ranking of coal – selection of coal. Analysis of coal – Proximate analysis. Pulverized coal – Metallurgical coke – Carbonization of coal – types. Manufacture of metallurgical coke – Beehive oven and Otto Hoffman's by-product oven methods.

MODULE II LIQUID AND GASEOUS FUELS **8**

Liquid fuel: Petroleum: Refining of petroleum, Liquid fuels derived from petroleum – Cracking: Thermal (Liquid and Vapour phase) – Catalytic (fixed bed and moving bed cracking – Synthetic petrol: Fischer-Tropsch method– Knocking in petrol and diesel engine: octane number and antiknocking – cetane number and improvement of cetane number – biodiesel (trans-esterification) – Gaseous fuels: Compressed natural gas (CNG) – LPG – oil gas – producer gas – water (blue) gas – biogas.

MODULE III COMBUSTION **8**

Calorific value: Gross and net caloric value – Bomb Calorimeter, Gas calorimeter - Definition of combustion – calculation of minimum requirement of air (problems) – theoretical calculation of calorific values (Dulong's formula), Gross and net calorific values ((problems) – Analysis of flue gas: Orsat's gas analysis method, explosive range, Ignition temperature. Introduction to air pollution from IC (Internal combustion) engines, photochemical smog, primary and secondary pollutants.

MODULE IV LUBRICANTS **7**

Friction and wear – lubricants: definition, functions and mechanism of lubrication

(thick film and thin film) –classification: liquid lubricants: animal and vegetable origin, mineral oil, blended oils, lubricating emulsions and silicones – properties of lubricating oils: viscosity and viscosity index; Flash and fire-point, Cloud and pour point, oiliness, emulsification number, volatility, carbon residue, aniline point – semisolid lubricant: greases and waxes – solid lubricant: graphite and molybdenum disulphide –nanolubricants.

PRACTICALS

1. Testing of fuels - proximate analysis (moisture, volatile matter, ash content and fixed carbon present in coal, coke, charcoal etc)
2. Ash content and carbon residue test
3. Biodiesel synthesis by trans-esterification method (from coconut, groundnut, mustard oil, palm oil)
4. Determination of calorific value of a solid fuel using Bomb calorimeter (coal, charcoal, coke etc)
5. Determination of calorific value of a liquid fuel using Bomb calorimeter (petrol, diesel, biodiesel etc)
6. Determination of cloud point and pour point of a lubricant
7. Determination of flash and fire point of diesel.
8. Aniline Point of diesel
9. Viscosity Index of lubricants and Fuels by Viscometer
10. Flue gas analysis by Orsat's gas analysis method – Demonstration
11. Working of internal combustion engine – Demonstration

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai and Sons, New Delhi, 2001.
2. Engineering Chemistry, Wiley India Editorial Team, Willey India Publisher, New Delhi, 2011.
3. John Griswold, Fuels Combustion and Furnaces, Mc-Graw Hill Book Company Inc. University of Michigan, 1946.
4. J.B. Heywood, Internal Combustion Engine Fundamentals, McGraw Hill International Editions, 1989.
5. Bahl B.S., Tuli and Arun Bahl, Essentials of Physical Chemistry, S. Chand and Company Ltd., New Delhi, 2004.

OUTCOMES:

The students will be able to

- compare and contrast the solid, liquid and gaseous fuels and also describe the processes involved in liquid and gaseous fuels.
- analyse the fuel properties such as moisture, votalite matter, ash content, calorific value etc
- calculate minimum air required for complete combustion and calorific values of fuels.
- categorize different lubricants into three types, explain the preparation and determine their properties.

CHCX06	FUNDAMENTALS OF PHYSICAL CHEMISTRY	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students will be conversant with the

- various thermodynamic terms and relate the laws of thermodynamics in chemical processes
- molecularity and order of reaction and derive the rate constant for different order of reactions
- basics of adsorption of different materials and propose mechanisms and surface area measurement
- conditions for equilibrium and learn different components at equilibrium

MODULE I BASIC THERMODYNAMICS **8**

Introduction - Thermodynamic terms - Thermodynamic equilibrium and processes - 1st law of thermodynamics: internal energy, enthalpy, heat capacity, isothermal and adiabatic expansion, Joule-Thomson effect - Zeroth law of thermodynamics: absolute temperature - 2nd law of thermodynamics: - spontaneous and cyclic process, Entropy in isothermal, isobaric and isochoric processes, work and free energy function, Maxwell's relation - 3rd law of thermodynamics

MODULE II CHEMICAL KINETICS **8**

Rate of chemical reaction - order and molecularity of a reaction - Rate constant - kinetics of opposing, parallel and consecutive and chain reactions - isotope effects - effect of temperature on reaction rate - collision theory - absolute reaction rate theory - kinetics in enzyme catalysis

MODULE III SURFACE SCIENCE AND CATALYSIS **8**

Adsorption - adsorption isotherms - uni and bimolecular adsorption reactions - parahydrogen conversion - factors affecting adsorption – Langmuir adsorption isotherm - Hinshelwood mechanism and *Eley-Rideal* mechanism with example - adsorption of gases on solids and surface area measurement by BET method - Terms in catalysis - homogeneous and heterogeneous and enzyme catalysis with example

MODULE IV PHASE RULE **6**

Terms involved - Conditions for equilibrium - application of phase rule to water, lead-silver system, freezing mixtures, thermal analysis: cooling curves.

PRACTICALS

1. Determination of the heat capacity of benzoic acid, internal energy of combustion of camphor using Bomb calorimeter. Calculation of enthalpy of combustion and formation for camphor.
2. Determination of adsorption isotherm of (i) acetic acid on charcoal (ii) oxalic acid on charcoal.
3. *Kineticsoffirst and second order reactions.*
4. Phase rule experiments with organic compounds: (i) naphthalene and p-dichloro benzene (ii) naphthalene and diphenyl (iii) m-dinitrobenzenzene and p-nitro toluene.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Rajaram J. and Kuriacose J.C., Chemical Thermodynamics: Classical, Statistical and Irreversible, Pearson Education, India, 2013.
2. Samuel Glasstone, Thermodynamics for Chemists, Read Books, United Kingdom, 2007.
3. James E. House, Principles of Chemical Kinetics, 2nd Edition, Academic Press, United States of America, 2007.
4. Keith J. Laidler, Chemical Kinetics, Pearson Education, India, 1987.
5. Douglas M. Ruthven, Principles of Adsorption and Adsorption Processes, John Wiley & Sons, 1984.
6. Puri B.R., Sharma L.R. and Pathania M.S., Principles of Physical Chemistry, 47th Edition, Vishal Publishing Co. India, 2016.

OUTCOMES:

The student will be able to

- calculate entropy, enthalpy and free energy change for different chemical processes
- calculate the rate constant for any chemical and biochemical processes
- differentiate the adsorption processes and calculate the surface area and predict the suitability of catalysts for different chemical processes
- predict the equilibrium conditions for water, alloys, freezing mixtures and draw the thermal curves for phase transition

CHCX07	GREEN TECHNOLOGY	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make students conversant with the

- basic principles of green chemistry and green technology.
- wastes that causes hazards to human health
- chemicals that harms our environment
- need for green processes in various industries

MODULE I GREEN CHEMISTRY PROTOCOL **7**

Need – Significance – 12 Principles with examples – R4 model – Life cycle analysis – sustainable and cleaner production - Green Technology: definition, examples: CFC free refrigerants, green building, energy, 3D printers, nanotechnology – Awards for Green chemistry – organization promoting green chemistry.

MODULE II WASTE & WASTE MINIMISATION **8**

Source of wastes: domestic, industrial, medical, nuclear, e-waste; problems; prevention – economy of waste disposal – Waste minimization techniques: general waste treatment and recycling – alternate waste water treatment technologies: hybrid process – Green computing: goals, green cloud, green ICT - Pollution statistics from various industries (Industrial case studies).

MODULE III GREEN SYNTHESIS **7**

Introduction - Solvent free reactions - green reagents, green solvents in synthesis - microwave and ultrasound assisted reactions – supercritical fluid extraction – green oxidation and photochemical reactions – catalyst and biocatalysts.

MODULE IV GREEN INDUSTRIAL PROCESSES **8**

Polymer industry: biodegradable polymer - textile industry: greener approaches of dyeing, waste disposal – ecofriendly agrochemicals: biofertilizers, biopesticides – Pharmaceutical industry: atom economy, reduction of toxicity, use of biocatalyst, zero waste disposal – Leather industry: greener process in tanning, crusting, surface coating – ecofriendly batteries & fuel cells.

PRACTICALS

1. Synthesis of an ionic liquids (Ex: imidazolium) and testing the solubility of organic

chemicals.

2. Green bromination of stilbene (using pyridine hydrobromide).
3. Green synthesis: Photocatalytic reactions, solvent-free organic reaction – Aldol; green oxidation, green reduction.
4. Microwave assisted chemical reaction. (synthesis of aspirin, pinacol-pinacolone reaction, etc).
5. Comparison of conventional reaction with microwave assisted reactions (atom economy, solvent, etc) [Ex: aldehyde and ketones with hydrazines to give hydrazones].
6. Diels-Alder reaction in eucalyptus oil (green process).

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai and Sons, New Delhi. 2001.
2. V. K. Ahluwalia, Green Chemistry: Environmentally Benign Reactions, Ane Books India, New Delhi, 2006.
3. Paul Anastas, John C.Warner, John Warner Joint; Green Chemistry: Theory & Practice New Ed Edition; Oxford University press, USA, 2000.
4. Rashmi Sanghi, M. M. Srivastava, Green chemistry, Narosa publishers, New Delhi, 2003.

OUTCOMES:

The students will be able to

- outline the principles and implications of green chemistry.
- comprehend the potential risks of waste generated and analyse the threats to human and environment.
- integrate information into design of molecules to avoid/eliminate toxic solvents & reagents or reduce toxic products.
- identify various alternate greener technologies for various industries.

CHCX08	ORGANIC CHEMISTRY OF BIOMOLECULES	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make students conversant with the

- basic concepts in organic chemistry
- types and structure of carbohydrates and lipids
- formation of different structures of proteins from amino acid
- structure of nucleic acids

MODULE I BASIC CONCEPTS IN ORGANIC CHEMISTRY **8**

Classification and IUPAC nomenclature of organic compounds – stereochemistry – optical, stereo and geometrical isomerism – types of reagents: electrophiles and nucleophiles – types of reactions: addition, substitution, elimination and rearrangement reactions.

MODULE II CARBOHYDRATES, LIPIDS AND VITAMINS **7**

Structure and functions of carbohydrates: mono, di, oligo and polysaccharides – lipids: phospholipids, glycolipids, sphingolipids – cholesterol – steroids – Structure, functions and deficiency disorders of fat soluble vitamins: A, D, E & K - Water soluble vitamins B & C: Thiamine, riboflavin, pantothenic acid, niacin, pyridoxine, biotin, cobalamine, folic acid and ascorbic acid.

MODULE III AMINO ACIDS, PEPTIDES AND PROTEINS **7**

Aminoacids: classification, properties - peptides – polypeptides – proteins: primary, secondary, tertiary and quaternary structure – glycoproteins – lipoproteins – Enzymes: classification and functions

MODULE IV NUCLEIC ACIDS **8**

Nucleic acids – importance - structure of purines and pyrimidines – nucleotides – polynucleotides - RNA – types & structure - DNA – phosphodiester bonds – chemical, helical structure and functions – DNA replication – gene modification.

PRACTICALS

1. Qualitative tests to identify carbohydrates.

2. Quantitative estimation of carbohydrates.
3. Separation of sugars – TLC and/or paper chromatography.
4. Quantitative estimation of lipids.
5. Separation of amino acids – TLC and/or paper chromatography.
6. Quantitative estimation of proteins by Lowry's method.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. V. K. Ahluwalia, Organic Reaction Mechanism, Narosa Publishers, New Delhi, 2002.
2. Johnson Arthur T., Biology for Engineers, CRC Press, Finland, 2011.
3. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai and Sons, New Delhi. 2001.
4. David L. Nelson, Michael M. Cox, Lehninger Principles of biochemistry, Macmillan press, London, 2010

OUTCOMES:

The students will be able to

- classify organic compounds and explain the mechanism of various organic reactions.
- draw the structures and enumerate the functions of carbohydrate, lipids and vitamins.
- correlate the relationship among amino acids, peptides and proteins.
- recognize the role of nucleic acid in the formation of RNA & DNA and differentiate DNA & RNA using their structure and function.

CHCX09	POLYMER SCIENCE AND TECHNOLOGY	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make the student conversant with the

- basic concepts of polymers, classification, types of polymerization and molecular weight & its distribution
- preparation, properties and applications of thermoplastics and introduction to biodegradable polymers
- properties and applications of thermosets, elastomers and FRP
- different types of moulding techniques

MODULE I BASIC CONCEPTS OF POLYMERS **8**

Definitions: monomer, polymer, functionality, degree of polymerization – classification of polymers: source, structure, application, thermal processing behavior (thermoplastics and thermosets), composition and structure (addition and condensation), mechanism (chain growth and step-wise growth) – copolymer: types – Definition –nomenclature of polymers – tacticity – types of polymerization : free radical, cationic and anionic polymerization (concepts only) – average molecular weight of polymer: number, weight – molecular weight distribution (problems)

MODULE II THERMOPLASTICS AND BIODEGRADABLE POLYMERS **8**

Preparation, properties and applications : LDPE, HDPE, polypropylene, PVC, PTFE, PET, polyamides (Nylon-6 and Nylon 6,6) and polycarbonates – polymer blends and alloys – basics of biodegradable polymers.

MODULE III THERMOSET RESINS, ELASTOMERS AND FRP **7**

Thermoset resins : phenolic resins, amino resins (urea and melamine formaldehyde), epoxy resins, unsaturated polyesters – polyurethanes – elastomers : vulcanization of natural rubber, diene based elastomers –fibre reinforced plastics: glass, aramid and carbon.

MODULE IV MOULDING TECHNIQUES 7

Moulding constituents**:** functions – moulding techniques**:** compression, injection, extrusion (single screw), blow moulding, thermoforming, (mechanical and vacuum forming), lamination.

PRACTICALS

1. Determination of molecular weight and degree of polymerization using Oswald's viscometer.
2. Free radical polymerization of styrene.
3. Free radical polymerization of PMMA.
4. Preparation of phenol-formaldehyde.
5. Preparation of urea-formaldehyde.
6. Synthesis of epoxy resin.
7. Synthesis of unsaturated polyester.
8. Preparation of FRP laminates.
9. Demonstration of injection moulding, compression moulding and blow moulding.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Billmeyer F.N., Text Book of Polymer Science, 3rd Edition, John Wiley and Sons, New York, 1994.
2. George Odian, Principles of Polymerisation, 3rd Edition, McGraw Hill Book Company, New York, 1991.
3. Michael L. Berins, Plastics Engineering Hand Book, 5th Edition, Chapman and Hall, New York, 1991.
4. Jacqueline I., Kroschwitz, Concise Encyclopedia of Polymer Science and Engineering, John Wiley and Sons, New York, 1998.
5. Encyclopedia of Polymer Science and Technology, Vol. 1 to XIV, H.F. Mark and N. Gaylord, Interscience, 2nd Ed. 1988.
6. Gowarikar V.R., Viswanathan N.V and Jayadev Sreedhar, Polymer Science, Wiley Eastern Limited, Madras, 1981.

OUTCOMES:

The student will be able to

- classify various polymers, name the polymers and types of polymerization

reactions, calculate molecular weight of polymers,

- summarise preparation, properties and applications of thermoplastics and give examples of biodegradable polymers
- elaborate the properties and applications of thermosets, elastomers and FRP
- select the appropriate moulding technique for a given polymer, based on the application

Maths Elective Courses

(to be offered in IV

Semester)

MACX 01	**DISCRETE MATHEMATICS AND GRAPH THEORY**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

OBJECTIVES:

The aims of this course are to

- introduce Logical and Mathematical ability to deal with abstraction.
- familiarize the basic mathematical ideas and terminologies used in computer science.
- translate real life situations into diagrammatic representations.

MODULE I PROPOSITIONAL CALCULUS 8

Propositions – Logical connectives – Compound propositions – Conditional and biconditional propositions – Truth tables – Tautologies and contradictions – Contrapositive – Logical equivalences and implications – DeMorgan's Laws – Normal forms – Principal conjunctive and disjunctive normal forms – Rules of inference – Arguments – Validity of arguments.

MODULE II PREDICATE CALCULUS 7+3

Predicates – Statement function – Variables – Free and bound variables – Quantifiers – Universe of discourse – Logical equivalences and implications for quantified statements – Theory of inference – The rules of universal specification and generalization – Validity of arguments.

MODULE III FUNCTIONS 7+3

Functions – Classification of functions –– Composition of functions – Inverse functions – Binary and n–ary operations – Characteristic function of a set – Hashing functions – Recursive functions – Permutation functions.

MODULE IV ALGEBRAIC SYSTEMS 8+2

Groups, Cyclic Groups, Subgroups, Cosets, Lagrange's theorem, Normal subgroups – Codes and group codes – Basic notions of error correlation – Error recovery in group codes.

MODULE V GRAPH THEORY 7+3

Graphs – incidence and degree – subgraphs – isomorphism – complement of a graph – operations on graphs

MODULE VI PATH AND CIRCUIT 8+2

Walks, trails and paths – Eulerian graphs – Konigsburg bridge problem - Hamiltonian graphs

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1 Trembly J.P and Manohar R, “Discrete Mathematical Structures with Applications to Computer Science”, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, 30th Reprint 2011.

2 Kenneth H.Rosen, “Discrete Mathematics and its Applications:, 7th Edition, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, Special Indian Edition, 2011.

REFERENCES:

1 Ralph.P.Grimaldi, “Discrete and Combinatorial Mathematics: An Introduction”, 4th Edition, Pearson Education Asia, Delhi, 2007.

2 Thomas Koshy, “Discrete Mathematics with Applications”, Elsevier Publications, 2006.

3 C.L.Liu, D.P.Mohapatra, “Elements of Discrete Mathematics”, 4th Edition, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, 2012.

OUTCOMES:

At the end of the course, student will be able to

- use the concepts of propositional calculus.
- use the concepts of predicate calculus.
- identify types of functions and their importance.
- decode and encode the messages using group theory concepts.
- apply the basic concepts of graph theory.
- represent some real life situations into diagrammatic representation.

MACX 02 PROBABLITY AND STATISTICS L T P C
3 1 0 4

OBJECTIVES:

The aims of this course are to impart the

- knowledge of the theory of probability and random variables
- techniques to carry out probability calculations and identifying probability distributions
- application of statistical inference in practical data analysis

MODULE I BASICS OF PROBABILITY AND STATISTICS 8+2

Sample space, events- axioms of probability and interpretation – Addition, multiplication rules – conditional probability, Independent events - Total probability – Baye's theorem - Descriptive Statistics.

MODULE II ONE DIMENSIONAL RANDOM VARIABLE AND PROBABILITY DISTRIBUTION FUNCTIONS 7+3

Discrete random variable –continuous random variable – Expectation - probability distribution - Moment generating function – Binomial, Poisson, Geometric, Uniform (continuous), Exponential and Normal distributions.

MODULE III TWO DIMENSIONAL RANDOM VARIABLES 8+2

Joint, marginal, conditional probability distributions –covariance, correlation - transformation of random variables.

MODULE IV SAMPLING AND ESTIMATION 7+3

Sampling distributions – basic knowledge on Random , simple random , stratified and cluster samplings – Test of Hypotheses - concepts- Point estimation and Interval estimation.

MODULE V THEORY OF INFERENCE 8+2

Large sample tests – test for single and difference on proportions, single mean, difference of means, difference of variances – confidence intervals. Small sample tests – Student's t test, F test and Chi square test on theory of goodness of fit and analyses of independence of attributes.

MODULE VI DESIGN OF EXPERIMENTS 7+3

Analysis of variance – one way classification – two way classification – Completely

Randomised Block Designs – Randomised Block Design – Latin square designs - Interpretations - case studies.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. T.Veerarajan, “Probability and Statistics”, Tata McGraw-Hill Education, 2008.
2. Miller, I., Miller, M.,Freund, J. E., “Mathematical statistics”, 7th Edition, Prentice Hall International, 1999.
3. S.P.Gupta, “Applied Statistics”, Sultan Chand & Sons

REFERENCES:

1. S.M.Ross, “Introduction to Probability and Statistics for Engineers and Scientists” Fifth Edition, Elesvier.
2. S.C.Gupta and V.K.Kapoor, “Fundamentals of Mathematical Statistics” First edition, Sultan Chand and Sons.
3. Arora and Arora, “Comphrensive Statistical Methods”, S. Chand, 2007

OUTCOMES:

On completion of the course, students will be able to

- do basic problems on probability and descriptive statistics.
- derive the probability mass / density function of a random variable.
- calculate probabilities and derive the marginal and conditional distributions of bivariate random variables.
- calculate point and interval estimates.
- apply some large sample tests and small sample tests.
- carry out the data collection representation analysis and implications and the importance of inferences.

MACX 03	RANDOM PROCESSES	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aims of the course are to

- acquire the knowledge of the theory of probability and random variables
- study discrete and continuous probability distributions.
- demonstrate the techniques of two dimensional random variables and its distributions.
- introduce the random process, stationarity, Markov process and the study of correlation function and spectral analysis.

MODULE I Basics of Probability 7+3

Sample space, events- axioms of probability and interpretation – Addition, multiplication rules – conditional probability, Independent events - Total probability – Baye's theorem - Tchebychev's inequality.

MODULE II One dimensional Random variable and Probability Distribution functions 7+3

Discrete random variable –continuous random variable – Expectation - probability distribution - Moment generating function – Binomial, Poisson, Geometric, Uniform (continuous), Exponential and Normal distributions.

MODULE III Two dimensional random variables 7+3

Joint, marginal, conditional probability distributions - covariance, correlation and regression lines - transformation of random variables.

MODULE IV RANDOM PROCESSES 8+2

Classification of Random process - Stationary process - WSS and SSS processes - Poisson process – Markov Chain and transition probabilities.

MODULE V CORRELATION FUNCTIONS 8+2

Autocorrelation function and its properties - Cross Correlation function and its properties - Linear system with random inputs – Ergodicity.

MODULE VI SPECTRAL DENSITY 8+2

Power spectral Density Function - Properties - System in the form of convolution - Unit Impulse Response of the System – Weiner-Khinchine Theorem - Cross Power

Density Spectrum.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Veerarajan T., “Probability, Statistics and Random Processes”, Tata McGraw Hill,3rd edition, 2008.
2. Papoulis, “Probability, Random Variables and Stochastic Processes”, 4th Edition, Tata McGraw Hill Company, 2002.
3. S.M.Ross, “Introduction to Probability and Statistics for Engineers and Scientists” Fifth Edition, Elesvier

REFERENCES:

1. Scott L. Miller,Donald G. Childers, Probability and Random Processes, Academic Press,2009.
2. Trivedi K S, “ Probability and Statistics with reliability, Queueing and Computer Science Applications”,Prentice Hall of India,New Delhi,2nd revised edition, 2002

OUTCOMES:

On completion of the course, students will be able to

- do basic problems on probability.
- derive the probability mass / density function of a random variable.
- calculate probabilities and derive the marginal and conditional distributions of bivariate random variables.
- identify and study the different random processes.
- compute correlation functions and related identities.
- compute power spectral density functions and apply Weiner-Khinchine formula.

MACX 04 APPLIED NUMERICAL METHODS L T P C
3 1 0 4

OBJECTIVES:

The aims of the course are to

- introduce basic computational methods for analyzing problems that arise in engineering and physical sciences.
- acquire knowledge about approximation theory and convergence analysis associated with numerical computation.

MODULE I NUMERICAL SOLUTIONS OF EQUATIONS 7+3

Bisection method - Regula Falsi method – Secant method - Fixed point iteration method - Newton's Raphson method –Gauss Elimination method - Gauss-Jordon method – Gauss Jacobi method - Gauss-Seidel method.

MODULE II INTERPOLATION 8+2

Finite difference operators – Gregory Newton's forward and backward interpolations – Cubic spline interpolation - Lagrange interpolation - Newton's divided difference formula.

MODULE III NUMERICAL DIFFERENTIATION AND INTEGRATION 8+2

Numerical differentiation using Newton's forward and backward formulae – Numerical integration : Trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Gaussian Two Point and Three Point Quadrature formulae – Double integrals using Trapezoidal and Simpson's 1/3 rule.

MODULE IV INITIAL VALUE PROBLEMS FOR FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS 7+3

Numerical solutions by Taylor's Series method, Euler's method, Modified Euler's Method - Runge – Kutta Method of fourth order – Milne's and Adam's Bashforth Predictor and Corrector methods

MODULE V INITIAL AND BOUNDARY VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 8+2

Numerical solutions by Taylor's Series method - Runge – Kutta Method of fourth order of second order ODE. Finite difference methods.

MODULE VI BOUNDARY VALUE PROBLEMS FOR PARTIAL DIFFERENTIAL EQUATIONS **7+3**

Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace equation.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Grewal, B.S., “Numerical methods in Engineering and Science”, 7th edition, Khanna Publishers, 2007.
2. C.F.Gerald, P.O.Wheatley, “Applied Numerical Analysis” ,Pearson Education, New Delhi, 2002.

REFERENCES:

1. Chapra S.C, Canale R.P. “Numerical Methods for Engineers”, 5th Ed., McGraw Hill, 2006.
2. M.K.Jain, S.R.K.Iyengar, R.K.Jain, “Numerical methods for Scientific and Engineering Computation”, New Age International Publishers, New Delhi, 2003

OUTCOMES:

At the end of this course, students will be able to

- solve algebraic, transcendental and system of equations.
- apply interpolation techniques.
- carry out numerical differentiation and integration using different methods.
- solve first order ODE using single and multi step methods.
- solve second order ODE, initial and boundary value problems.
- solve the boundary value problems in PDE.

Maths Elective Courses
(To be offered in VI Semester)

MACX 05	MATHEMATICAL PROGRAMMING	L	T	P	C
		2	0	0	2

OBJECTIVES:

The aims of the course are to

- acquire knowledge and training in optimization techniques.
- obtain knowledge about optimization in utilization of resources.
- understand and apply operations research techniques to industrial operations.

MODULE I LINEAR PROGRAMMING PROBLEM 10

Linear programming – formulation of the problem - graphical interpretation of optimality - Simplex method – to obtain basic feasible solution – types of linear programming solution – complications and their resolution.

MODULE II ADVANCED LINEAR PROGRAMMING PROBLEMS 8

Artificial variable - Big M method – Two phase method – alternative optimal solution – unbounded solution - Duality – primal dual relationships.

MODULE III TRANSPORTATION PROBLEM 7

Transportation problems – Initial basic feasible solutions, MODI method, Unbalanced transportation problem, Degeneracy in transportation models,.

MODULE IV ASSIGNMENT PROBLEM 5

Assignment problem – Minimization and Maximization type of problems by Hungarian method.

Total Hours –30

TEXT BOOKS:

1. Hamdy A Taha, “Operations Research - An introduction”, 8th edition, Phil Pearson, 2007.
2. Winston.W.L., “Operations Research”, 4th edition, Thompson-Brooks/Cole, 2003.

REFERENCES:

1. Wayne.L. Winston, “Operations Research Applications and Algorithms”,

4th edition, Thomson learning, 2007.

2. Frederick. S. Hiller and Gerald J Lieberman, “Operations Research Concepts and Cases”, 8th edition (SIE), Tata McGraw – Hill Pub. Co. Ltd., New Delhi, 2006.
3. A. Ravindran, D. T. Phillips and J. J. Solberg, "Operations Research: Principles and Practice", 2nd edition, John Wiley & Sons, New York, 1992.
4. Robertazzi. T.G., “Computer networks and systems-Queuing theory and performance evaluation”, 3rd edition, Springer, 2002.

OUTCOMES:

At the end of the course, students will be able to

- formulate industrial problems as mathematical programming problems.
- solve linear programming problems by different methods.
- solve transportation problems by different methods.
- solve assignment problems by Hungarian method.

MACX 06	STATISTICAL METHODS FOR DATA ANALYSIS	L	T	P	C
		2	0	0	2

OBJECTIVES:

The aim of the course is to

- introduce statistical quality control tools.

MODULE I TESTS OF HYPOTHESES AND STATISTICAL INFERENCES 8

Small sample tests – Student's ' t ' test for single mean , difference of means, paired t test – F test for difference of variances – Chi square test on theory of goodness of fit and analyses of independence of attributes.

MODULE II DESIGN OF EXPERIMENTS 7

Analysis of variance – one way classification – two way classification – Completely Randomised Block Designs – Randomised Block Design – Latin square designs - Statistical analysis -Interpretations - case studies.

MODULE III STATISTICAL QUALITY CONTROL-I 8

Quality improvement and statistics –Statistical quality control- statistical process control – control charts – design of control charts –analysis of patterns on control charts - X bar chart, R chart and S chart.

MODULE IV STATISTICAL QUALITY CONTROL-II 7

Process and product control – attribute charts – P, np and C charts – control charts performance.

Total Hours –30

TEXT BOOKS:

1. Douglas C.Montgomery, George C. Runger "Applied Statistics and probability for Engineers" V Edition – John Wiley & Sons Inc.
2. Miller, I., Miller, M., Freund, J. E. "Mathematical statistics" 7th Edition. Prentice Hall International, 1999.

REFERENCES:

1. Dekking, F.M., Kraaikamp, C., Lopuhaä, H.P., Meester, L.E. "A Modern Introduction to Probability and Statistics" Springer, 2nd Edition.
2. Chin Long chiang "Statistical Methods of Analysis "World Scientific Books,

2003.
3. S.C.Gupta and V.K. Kapoor, “Mathematical Statistics” , Sultan Chand publications.
4. Veerarajan “Fundamentals of Mathematical Statistics” I Edition, Yes Dee Publishing Pvt. Ltd., 2017.

OUTCOMES:

On completion of the course, students will be able to

- develop and test hypothesis for different statistical tests
- design an experiment and case study the experiment with different data.
- analyze the industrial data using quality control design tools statistically.
- analyze the industrial data using process and product control tools statistically.

MACX 07 NUMERICAL METHODS FOR INTEGRATION AND DIFFERENTIAL EQUATIONS

L	T	P	C
2	0	0	2

OBJECTIVES:

- This course aims to solve numerically integral and differential equations.

MODULE I NUMERICAL INTEGRATION **8**

Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Two Point and Three point Gaussian quadrature formulae.

MODULE II NUMERICAL DOUBLE INTEGRATION **6**

Double integrals using trapezoidal and Simpson's 1/3 rules

MODULE III NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS **8**

Milne's Predictor and Corrector Method – Adam's Predictor-Corrector Method - Finite difference methods for two – point Boundary Value problems for Ordinary Differential Equations.

MODULE IV BOUNDARY VALUE PROBLEMS FOR PARTIAL DIFFERENTIAL EQUATIONS **8**

Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace and Poisson equations

Total Hours –30

TEXT BOOKS:

1. M.K.Jain, S.R.K.Iyengar, R.K.Jain, "Numerical methods for Scientific and Engineering Computation", New Age International Publishers, New Delhi, 2003.
2. Grewal, B.S., "Numerical methods in Engineering and Science" 7th edition, Khanna Publishers, 2007

REFERENCES:

1. C.F.Gerald, P.O.Wheatley, "Applied Numerical Analysis" Pearson Education, New Delhi 2002.
2. P.Dechaumphai, N. Wansophark, "Numerical Methods in Engineering", Narosa Publications, 2012.

OUTCOMES:

At the end of the course students will be able to

- solve the integration by numerical methods.
- solve the double integration by numerical methods
- find numerical solution of ordinary differential equations in engineering problems.
- find numerical solution of partial differential equations in engineering problems.

MACX 08 MATHEMATICAL MODELLING

L	T	P	C
3	0	0	3

OBJECTIVES:

The aims of the course are to

- provide basic idea of formation and use of Mathematical models for different purposes.
- determine the extent to which models are able to replicate real-world phenomena under different conditions

MODULE I PRINCIPLES OF MATHEMATICAL MODELING 7

Mathematics as a modelling language - Classification of models - Building, studying, testing and using models - Black and white box models – Difference equations

MODULE II PHENOMENOLOGICAL MODELS 7

Linear, Multiple linear and nonlinear regression - Neural networks - Fuzzy model - Stability and higher dimensional systems

MODULE III MECHANISTIC MODELS –I 8

Setting up ODE models – Initial and Boundary value problems - Numerical solutions - Fitting ODE to data - Applications

L	T	P	C
2	0	0	2

MODULE IV MECHANISTIC MODELS –II 8

Linear and nonlinear equations - Elliptic, parabolic and hyperbolic equations - Closed form solutions - Finite difference and finite element methods

Total Hours –30

TEXT BOOKS:

1. G . Ledder , “Calculus, modelling , probability and dynamic systems”, Springer 2013
2. Kei Velten, “Mathematical modelling and simulation”, J. Wiley and sons,2009

REFERENCES:

1. Michael D Alder, “An introduction to Mathematical modelling”, Heaven for Books.com
2. Alfio Quarteroni, “Mathematical models in science and engineering”, Notices of AMS
3. J.N. Kapur, “Mathematical models in Biology and Medicine”, Affiliated East-

West Press Private Limited, New Delhi, 1992.

OUTCOMES:

On completion of the course, the students will be able to

- identify the relationship between real world and mathematical models
- Classify the data and choose the appropriate model
- Distinguish between linear and nonlinear models
- identify the relationship between empirical and mechanistic models

MACX 09 **GRAPH THEORY** **L T P C**

3 0 0 3

OBJECTIVES:

The aims of this course are to

- represent the real life situations diagrammatically.
- appraise different methods to find solutions to graph theory problems.

MODULE I INTRODUCTION TO GRAPH THEORY 8

Graphs - finite and infinite graphs - Incident and degree-isolated vertex, pendent vertex and null vertex.

MODULE II PATH AND CIRCUIT 8

Isomorphism – sub graphs-walks, paths and circuits – connected and disconnected graphs- Euler graphs – operation on a graph.

MODULE III TREES AND FUNDAMENTAL CIRCUITS 7

Trees- some properties of trees- pendent vertices in a tree – rooted binary tree-spanning trees-fundamental circuits.

MODULE IV CUT SETS AND CUT VERTICES

Cut sets – some properties of cut sets- fundamental circuits and cut sets-network flows.

Total Hours –30

TEXT BOOKS:

1. NARSINGH DEO, Graph theory with applications to Engineering and Computer Science, Prentice Hall INC, New Delhi,
2. J.A. Pondy and U.S.R. Murthy, North Holland, Oxford, New York Graph theory with applications

REFERENCES:

1. Trembly J.P and Manohar R, “Discrete Mathematical Structures with Applications to Computer Science”, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, 30th Reprint 2011
2. Kenneth H.Rosen, “Discrete Mathematics and its Applications”, 7th Edition, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, Special Indian Edition, 2011

3. Md. Saidur Rahman, “Basic graph theory”, Springer, 2017

OUTCOMES:

At the end of the course, students will be able to

- demonstrate the basic concepts of Graph theory.
- explore connected and disconnected graphs.
- identify the real life problems with trees and circuits.
- bring out the cut set properties and network flows properties.

Humanities Elective I

(To be offered in III Semester)

SSCXO1	**FUNDAMENTALS OF ECONOMICS**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**2**

OBJECTIVES:

- To identify and present the basic concepts of demand, supply and equilibrium.
- To explain and discuss the types and concepts of national income and inflation.
- To illustrate the fundamental concepts of money, banking and public finance.
- To apprise the students about Indian economy and the role of engineers in economic development.

MODULE I DEMAND AND SUPPLY ANALYSIS 8

Classification of economy – open and closed economy, Demand - Types of demand - Determinants of demand – Law of Demand - Demand elasticity - Supply - Determinants of Supply – Law of Supply - Supply elasticity - Pricing strategies.

MODULE II NATIONAL INCOME AND INFLATION 7

Concepts of National income and measurement – Importance and difficulties of estimating National Income in India - Aggregate demand and aggregate supply, Macroeconomic equilibrium – meaning of inflation- types - causes and preventive measures

MODULE III MONEY, BANKING AND PUBLIC FINANCE 9

Money – Meaning, types, functions, importance - Commercial Banks - Central Bank - Monetary policy – meaning, objectives, Methods of Credit Control By RBI, Government Budget – Government revenue and Expenditures – Fiscal policy - Its objectives, instruments and limitations - Deficit Financing - The Fiscal Responsibility and Budget Management Act, 2003 (FRBMA) .

MODULE IV INDIAN ECONOMY AND THE ROLE OF ENGINEERS 6

Economic reforms – Liberalization, Privatization and Globalization - challenges and opportunities, Engineers – Engineers' contributions to the economic growth.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Dutt and Sundharam (2013), *Indian Economy*, S. Chand & Company Pvt. Ltd, New Delhi.
2. Hussain, Moon Moon (2015), *Economics for Engineers*, Himalaya Publishing House, New Delhi.

REFERENCES:

1. Cleaver Tony (2004), "*Economics: The Basics*", Routledge, London.
2. Mell Andrew and Walker Oliver (2014), "*The Rough Guide to Economics*", Rough Guide Ltd.

OUTCOMES:

On successful completion of this course,

- Students will have had exposure to the basic concepts of demand, supply and various pricing strategies.
- Students will have understood the macroeconomic concepts of national income and inflation.
- Students will be able to apply the knowledge of money, banking and public finance in their real life situations.
- Students will have an overview of the economic reforms introduced in Indian economy.

SSCXO2 PRINCIPLES OF SOCIOLOGY.

L	T	P	C
2	0	0	2

OBJECTIVES:

- To acquaint the students with Concepts and perspectives of Sociology
- To explain the reflection of society in Individuals and vice versa
- To describe the hierarchical arrangement of individuals and groups in society
- To explicate the dimensions, forms and factors of Social change.
- To examine the context, impact and agencies of Globalization

MODULE I THE FOUNDATIONAL CANON 8

Sociology-Definition, scope and importance; Major theoretical perspectives- Functionalism, Conflict Theorising and Interactionism; Elements of social formation- Society, Community, Groups and Association; Associative Social Process- Co-operation, Accommodation and Assimilation; Dissociative Social Process- Competition and Conflict.

MODULE II INDIVIDUAL AND SOCIETY 7

Culture-definition, characteristics, functions, types, cultural lag and civilization, Socialization – definition, process, stages, agencies and anticipatory socialization; Social Control- definition, characteristics, importance, types & agencies.

MODULE III SOCIAL INEQUALITY AND STRATIFICATION 7

Concepts- inequality, hierarchy, differentiation, Social Exclusion, and Social Stratification. Forms of Social Stratification- Caste, Class and Estate. Gender and Social Stratification- sex and gender, patriarchy, factors perpetuating gender stratification; Globalization and gender inequality

MODULE IV SOCIAL CHANGE AND GLOBALIZATION 8

Social Change-definition, nature, direction; Forms- evolution, development, progress and transformation; Factors of social change- demography, economy, technology, polity and culture. Globalization- definition, characteristics, historical and social context and Impact, agencies of globalization- IGOs, INGOs, Nation-State, MNEs and Media

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Giddens A. 1989. “Sociology” Cambridge: Polity Press.

2. Heald Haralambos, R.M(2014) . ‘‘Sociology Themes and Perspectives”, Oxford, New Delhi-92
3. Bhushan Vidya and D.R. Sachdeva (2012). ‘‘Fundamental of Sociology”, Pearson, Delhi.

REFERENCES:

1. Das Gupta, Samir and Paulomi Saha (2012), ‘‘An Introduction to Sociology”, Pearson, Delhi
2. Bottomore, T.B. 1972. *Sociology- A Guide to Literature and Problems*, New Delhi,

OUTCOMES:

On successful completion of this course,

- Students will have exposure to the fundamentals tenets of Sociology.
- Students will be trained to understand social reality with sociological perspective.
- Students will be oriented to constructively analyze human interactions, social relationship and social issues
- Students will gain exposure to the dynamics of human society with special reference to the contemporary trends of globalization.

SSCXO3	SOCIOLOGY OF INDIAN SOCIETY.	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To present a portrayal of the components of the Indian Social structure
- To describe the nature and contemporary structure of Indian social Institutions.
- To examine the causality and magnitude of social problem facing the contemporary India.
- To elucidate the processes forms and impact of change and development in Indian society

MODULE I INDIAN SOCIAL STRUCTURE 7

Unity and Diversity; Concepts of unity and diversity- racial, religious, ethnic and linguistic composition of India. Types of communities-rural, urban and tribal; Social backwardness- OBC, SC and ST; Indian minorities- religious, ethnic, linguistic and LGBT

MODULE II INDIAN SOCIAL INSTITUTIONS 7

Family- definition, types, characteristics, functions of family; Joint Family- definition features, utility, changes; Marriage- definition, characteristics, marriage as sacrament or contract. Caste- definition, principles, contemporary changes, dominant caste, caste -class interface.

MODULE III SOCIAL PROBLEMS IN INDIA 8

Social Problem-definition, nature, social disorganization; Population explosion-causes, effects, relationship with development; Child Labour- causes, magnitude and consequences; Unemployment-nature , types, causes and effects; Gender issues-social status of women, violence against women and women in work place; Contemporary issues- communalism, terrorism and corruption.

MODULE IV SOCIAL CHANGE AND DEVELOPMENT IN INDIA 8

Socio-cultural Change- Sanskritization, Westernization, Secularization, Modernization; Processes of Social change- Industrialization, Urbanization, Globalization; Development- definition, elements, role of government, industry and corporate sector. Technology and change- invention and innovation, impact of technology on social institutions, technology and development.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Sharma,K.L.2008. *Indian Social Structure and Change*. Jaipur: Rawat Publications,.
2. Shah, A.M. 1998. *The Family in India: Critical Essays*. New Delhi: Orient Longman,
3. Ahuja Ram. 1999. *Social problems in India*, Rawat Publication: New Delhi.
4. Ahuja Ram. 2014. *Society in India,*, Rawat Publication: New Delhi.

REFERENCES:

1. Jayapalan, N.(2001), **"**Indian Society and Social Institutions" Atlantic Publishers & Distri,
2. Atal, yogesh (2006), "Changing Indian Society" Rawat Publications, Jaipur

OUTCOMES:

On successful completion of this course,

- Students will gain an in-depth understanding of the social structure and social institutions that constitute society in India.
- Students will be sensitized to the various categories ,Inequalities and their challenges
- Students will be exposed to the social problems encountered in contemporary India.
- Students will gain knowledge about the various forms and trends of the social change.
- Students will become aware about the challenges in the path of progress of Indian society and realize relevance of their role in bringing about development

Humanities Elective II

(To be offered in IV Semester)

		L	T	P	C
SSCXO4	**ECONOMICS OF SUSTAINABLE DEVELOPMENT**	**2**	**0**	**0**	**2**

OBJECTIVES:

- To have an increased awareness on the concept and components of sustainable development.
- To develop the ability to demonstrate the need of sustainable development and international responses to environmental challenges.
- To have an insight into global environmental issues and sustainable globalization.
- To establish a clear understanding of the policy instruments of sustainable development.

MODULE I CONCEPT OF SUSTAINABLE DEVELOPMENT 7

Evolution of the Concept – Rio Summit and sustainable development - various definitions of sustainable development - Components of sustainable development: Social, environmental and economic components.

MODULE II NEED FOR SUSTAINABLE DEVELOPMENT 8

Need for sustainability – Global environmental challenges: population growth, resource depletion, pollution, energy use, climate change, pollution, growing water scarcity, other urban problems, loss of biodiversity, hazardous wastes disposal.International responses to environmental challenges - Global policy such as Kyoto Protocol, Montreal Protocol, Basel Convention.

MODULE III GLOBALIZATION AND ENVIRONMENT SUSTAINABILITY 8

Impact of Globalization on sustainable development, Co - existence of globalization and Environment sustainability, Globalization and Global Governance.Green economy - Renewable energy, sustainable transport, sustainable construction, land and water management, waste management.

MODULE IV POLICIES FOR ACHIEVING SUSTAINABLE DEVELOPMENT 7

Principles of environmental policy for achieving sustainable development: precautionary principle and polluter pays principle – Business Charter for Sustainable Development.Policy instruments for sustainable development: direct regulation – market based pollution control instruments such as pollution tax, subsidy, pollution permits.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Anderson, David A (2010), "*Environmental Economics and Natural Resource Management*", Routledge, 3rd edition.
2. Karpagam M (1999), "*Environmental Economics: A Textbook*", Sterling Publishers Pvt. Ltd, New Delhi.

REFERENCES:

1. Karpagam M and Jaikumar Geetha (2010), "*Green Management Theory and Applications*", Ane Books Pvt. Ltd, New Delhi.
2. Sengupta Ramprasad (2004), "*Ecology and Economics: An Approach to Sustainable Development*", Oxford University Press, New Delhi.

OUTCOMES:

On successful completion of this course,

- The students will have understood the concepts and components of sustainable development.
- The students will have a holistic overview on the challenges of sustainable development and International responses to environmental challenges.
- The students will have gained knowledge on the global environment issues and demonstrate responsible globalization through global governance.
- The students will have developed awareness of the ethical, economic, social and political dimensions that influence sustainable development.

SSCXO5 INDUSTRIAL SOCIOLOGY

L	T	P	C
2	0	0	2

OBJECTIVES:

- To introduce sociological approaches and perspectives to understand the social relationship in manufacturing industries and corporate sector.
- To explain the structure and functions of industrial organizations.
- To elucidate the dynamics of organizational behavior, leadership and communication.
- To inculcate professional ethics and values to equip students to work in organizational settings.

MODULE I INTRODUCTION 8

Industrial Sociology- definition, scope and importance; Theoretical approaches- scientific management, human relations approach, theory of bureaucracy, Fordism and post-fordism; Production system- concept and characteristics of factory system, automation and rationalization; Industrial conflict- strike , lockout and trade unions.

MODULE II INDUSTRIAL ORGANIZATION 7

Formal organization- definition, features, utility; Informal organization- definition, characteristics, types and relevance; Structure of industrial organization- features and functions of line organization, characteristics and roles of staff organization, distinction;

Industrial hierarchy-white collar, blue collar, supervisors and managers.

MODULE III DYNAMICS OF INDUSTRIAL RELATIONS 8

Group dynamics- Definition, Group behaviour model, Group decision making process, group cohesiveness; Leadership- definitions, style and effective supervision; Communication- concepts, types, model barriers; Job satisfaction- nature, employee compensation and job satisfaction.

MODULE IV PROFESSIONAL ETHICS AND VALUES 7

Concepts- values- morals, and ethics, Integrity, work ethics , service learning - Civic Virtue - caring - Sharing - Honesty - Courage - Valuing Time - Co-operation - commitment - empathy - Self-Confidence - Environmental Ethics, Cyber issues - computer ethics, cyber crimes, plagiarism Ethical living-concept of harmony in life.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Narender Singh, Industrial Sociology, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2012.
2. Gisbert Pascal, Fundamentals of Industrial Sociology, Tata Mc. Graw Hill Publishing Co., New Delhi, 1972
3. Schneider Engeno. V, Industrial Sociology 2nd Edition, Mc. Graw Hill Publishing Co., New Delhi, 1979.

REFERENCES:

1. Robbins, Stephen, Organizational Behaviour , Prentice Hall of India PVT ltd new Delhi, 1985
2. Devis Keith , Human Behaviour at work place, Mc. Graw Hill Publishing Co., New Delhi,1984

OUTCOMES:

On successful completion of this course,

- Students will have acclimatized with sociological perspectives for dealing with social relationships in production and service organizations.
- Students will be familiar with structure of authority, roles and responsibility in organizational settings.
- Students will imbibe leadership, communication and behavioral acumen to govern organization
- Students will be sensitized to standards of desirable behavior to engage in industrial and corporate sector.

SSCXO6 LAW FOR ENGINEERS

L	T	P	C
2	0	0	2

OBJECTIVES:

- To understand the Constitution and Governance of our country.
- To apprise the students of human rights - local and international and redressal mechanism.
- To have an insight into the industrial, corporate and labour laws of our country.
- To establish a clear understanding about the importance of intellectual property related laws.

MODULE I INDIAN CONSTITUTION AND GOVERNANCE 8

Constitution – salient features, Preamble, Citizenship, Fundamental rights, Fundamental duties, Directive principles, Union executive, Legislature – Union – State and union territories – Election Commission – Election for parliament and state legislature, Judiciary- basic functioning of the Supreme Court and High Courts, Right to information Act 2005 – evolution – concept – practice.

MODULE II HUMAN RIGHTS 7

Human rights – meaning and significance, Covenant on civil and political rights, Covenant on Economic, Social and Cultural rights, UN mechanism and agencies, The Protection of Human Rights Act, 1993 – watch on human rights and enforcement.

MODULE III INDUSTRIAL, CORPORATE AND LABOUR LAWS 8

Corporate laws – meaning and scope, Companies Act 1956 – Indian Contract Act 1872 - Principles of Arbitration - Industrial Employment (Standing Orders) Act 1946 - Industrial Disputes Act 1947 - Workmen's Compensation Act 1923 - The Factories Act, 1948.

MODULE IV LAWS RELATED TO IPR 7

IPR – meaning and scope, International organization – WIPO – TRIPS, Major Indian IPR Acts – Copyright laws, Patent and Design Act, Trademarks Act, Trade Secret Act, Geographical Indicator.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. M.P. Jain (2005) *Indian Constitutional Law*, Wadhwa & Co.

2. H. D, Agarwal (2008), *International Law and Human Rights,* Central Law Publications,
3. Rao, Meena (2006), *Fundamental Concepts in Law of Contract*, 3rd edn., Professional offset.
4. Ramappa (2010), *Intellectual Property Rights Law in India*, Asia Law House.
5. Singh, Avtar (2007), *Company Law*, Eastern Book Co.
6. R.F, Rustamji (1967)*, Introduction to the Law of Industrial Disputes*, Asia Publishing House.

REFERENCES:

1. Acts: Right to Information Act, Industrial Employees (standing order) Act, Factories Act, Workmen Compensate Act.

OUTCOMES:

On successful completion of this course,

- Students will `be able to apply the basic concepts of Indian Constitution, Governance and power in their real life situation.
- Students will have gained knowledge in human rights, cultural, social and political rights.
- Students will have synthesized knowledge about industrial, corporate and labour laws of our country.
- Students will have an overview of IPRs and laws related to Intellectual Property Rights.

General Elective Courses

Group I courses

(To be offered in V Semester)

		L	T	P	C
GECX101	**DISASTER MANAGEMENT**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To give an exposure to various environmental hazards and disasters: and various concepts and principles to manage disaster.
- To give exposure to various environmental policies & programs in India for disaster management

MODULE I ENVIRONMENTAL HAZARDS 7

Environmental hazards, Environmental Disasters and Environmental stress-Meaning and concepts. Vulnerability and disaster preparedness.

MODULE II NATURAL DISASTERS 7

Natural hazards and Disasters - Volcanic Eruption, Earthquakes, Tsunamis, Landslides, Cyclones, Lightning, Hailstorms, Floods, Droughts, Cold waves, Heat waves and Fire.

MODULE III MAN-MADE DISASTERS 7

Man induced hazards & Disasters - Soil Erosion, Chemical hazards, Population Explosion

MODULE IV DISASTER MANAGEMENT 8

Emerging approaches in Disaster Management- Preparing hazard zonation maps, Predictability / forecasting & warning, Preparing disaster preparedness plan, Land use zoning, Communication. Disaster resistant house construction, Population reduction in vulnerable areas, Awareness - Rescue training for search & operation at national & regional level - Immediate relief, Assessment surveys, Political, Administrative, Social, Economic, Environmental Aspects.

MODULE V NATURAL DISASTER REDUCTION & MANAGEMENT 8

Provision of Immediate relief measures to disaster affected people, Prediction of Hazards & Disasters, Measures of adjustment to natural hazards

MODULE VI ENVIRONMENTAL POLICIES & PROGRAMMES IN INDIA **8**

Regional survey of Land Subsidence, Coastal Disaster, Cyclonic Disaster & Disaster in Hills with particular reference to India. Ecological planning for sustainability & sustainable development in India, Sustainable rural development: A Remedy to Disasters, Role of Panchayats in Disaster mitigations, Environmental policies & programmes in India- Institutions & National Centers for Natural Disaster reduction, Environmental Legislations in India, Awareness, Conservation Movement, Education & training.

L – 45; Total Hours –45

REFERENCES:

1. Satender, “Disaster Management in Hills”, Concept Publishing Co., New Delhi, 2003.
2. Singh, R.B. (Ed.), “Environmental Geography”, Heritage Publishers, New Delhi,1990.
3. Savinder Singh, “Environmental Geography”, Prayag Pustak Bhawan,1997.
4. Kates, B.I. and White, G.F., “The Environment as Hazards”, Oxford University Press, New York, 1978.
5. Gupta, H.K., (Ed), “Disaster Management”, University Press, India, 2003.
6. Singh, R.B.,“Space Technology for Disaster Mitigation in India (INCED)”, University of Tokyo, 1994.
7. Bhandani, R.K., “An overview on Natural & Manmade Disaster & their Reduction”, IIPA Publication, CSIR, New Delhi, 1994.
8. Gupta, M.C., “Manuals on Natural Disaster management in India”, National Centre for Disaster Management, IIPA Publication, New Delhi, 2001.

OUTCOMES:

At the end of the course, the students will

- achieve sufficient knowledge on the disaster prevention strategy, early warning system, disaster preparedness, response and human resource development.
- be familiar with the National Policy on Disaster Management.

GECX102 TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

- To understand the various principles, practices of TQM to achieve quality.
- To get acquainted with the various statistical tools and approaches for quality control and continuous improvement.
- To get aware of the importance of ISO and Quality Systems.

MODULE I INTRODUCTION 8

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

MODULE II TQM PRINCIPLES 7

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits.

MODULE III TQM IMPROVEMENT PROCESS 8

Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

MODULE IV STATISTICAL PROCESS CONTROL (SPC) 8

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

MODULE V TQM TOOLS 7

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

MODULE VI QUALITY SYSTEMS 7

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System– Elements, Implementation of Quality System, Documentation, Quality Auditing, TS 16949, ISO 14000 – Concept, Requirements and Benefits

L – 45; Total Hours –45

TEXT BOOKS:

1. Dale H.Besterfiled, et al., “Total Quality Management”, Pearson Education, Inc. 2003.

REFERENCES:

1. James R.Evans & William M.Lidsay, “The Management and Control of Quality”, 5th Edition, South-Western (Thomson Learning), 2002.
2. Feigenbaum.A.V., “Total Quality Management”, McGraw-Hill, 1991.
3. Oakland.J.S., “Total Quality Management”, Butterworth Hcinemann Ltd., Oxford, 1989.
4. Narayana V. and Sreenivasan. N.S., “Quality Management – Concepts and Tasks”, New Age International, 1996.
5. Zeiri, “Total Quality Management for Engineers”, Wood Head Publishers, 1991.

OUTCOMES:

The student should be able to

- apply the various statistical tools and approaches for Quality control.
- achieve continuous process improvement through TQM.

GECX103 ENERGY STUDIES L T P C
3 0 0 3

OBJECTIVES:

- To learn the growing demand, supply of energy on global and national levels and the need for renewable energy promotion.
- To understand the basic need for energy conservation and waste heat recovery.
- To learn the important aspects of energy audit and management.
- To get acquainted with the global environmental issues and carbon credits.

MODULE I GLOBAL AND NATIONAL ENERGY SCENARIO 7

Role of energy in economic development, various energy resources - overall energy demand and availability- Energy consumption in various sectors and its changing pattern - Exponential increase in energy consumption and projected future demands. Need for renewable energy.

MODULE II SOLAR ENERGY 8

Solar Radiation – Measurements of Solar Radiation - Flat Plate and Concentrating Collectors – Solar direct Thermal Applications – Solar thermal Power Generation - Fundamentals of Solar Photo Voltaic Conversion – Solar Cells – Solar PV Power Generation – Solar PV Applications.

MODULE III OTHER RENEWABLE ENERGY SOURCES 8

Power from wind – wind turbine working and types, solar thermal power plants – low medium and high power generation, power from wave , tidal, geothermal sources, OTEC system. MHD power plants – working, types, merits and demerits. Energy from biomass.

MODULE IV COGENERATION, WASTE HEAT RECOVERY AND COMBINED CYCLE PLANTS 8

Cogeneration principles- topping and bottoming cycles, role in process industries. Energy from wastes- waste heat recovery- heat recovery from industrial processes. Heat exchange systems – recuperative and regenerative heat exchangers – commercially available waste heat recovery devices. Combined cycle plants – concept, need and

advantages, different combinations and practical scope.

MODULE V ENERGY CONSERVATION AND MANAGEMENT 7

Need for energy conservation – use of energy efficient equipment. Energy conservation opportunities - in educational institutions, residential, transport, municipal, industrial and commercial sectors – concept of green building. Energy audit in industries – need, principle and advantages. Case studies.

MODULE VI GLOBAL ENERGY ISSUES AND CARBON CREDITS 7

Energy crisis, fossil consumption and its impact on environmental climate change. Energy treaties – Montreal and Kyoto protocols - Transition from carbon rich and nuclear to carbon free technologies, carbon foot print – credits – clean development mechanism.

L – 45; Total Hours –45

TEXT BOOKS:

1. S.S. Rao and B.B. Parulekar, “Energy Technology”, 3rd Edition, Khanna Publishers, New Delhi, 2011.
2. O. Callaghn. P.W., “Design and Management for Energy Conservation”, Pergamon Press, Oxford, 1981.

REFERENCES:

1. G.D. Rai, “Non Conventional Energy Sources”, Khanna Publishers, New Delhi, 2011.
2. Archie, W Culp. “Principles of Energy Conservation”, McGraw Hill, 1991.
3. D Patrick and S W Fardo, “Energy Management and Conservation”, PHI,1990
4. P. O’Callaghan: “Energy Management”, McGraw - Hill Book Company, 1993.
5. Kenney, W. F., “Energy Conservation in Process Industries”, Academic Press, 1983.

OUTCOMES:

The student should be able to

- Realize the global and national energy status and need to switch over to renewable energy technology.
- Energy audit and suggest methodologies for energy savings.
- Utilize the available resources in an optimal way.
- Concern about the global environmental issues & promote carbon credits.

GECX104 ROBOTICS

L	T	P	C
3	0	0	3

OBJECTIVES:

To learn about the robots, various components, of Robots, programming and their applications.

MODULE I **8**

Definition- Need - Application, Types of robots – Classifications – Configuration, work volume, control loops, controls and intelligence- basic parts - functions – specifications. of robot, degrees of freedoms, end effectors – types, selection

MODULE II ROBOT DRIVES AND CONTROL **8**

Controlling the Robot motion – Position and velocity sensing devices – Design of drive systems – Hydraulic and Pneumatic drives – Linear and rotary actuators and control valves – Electro hydraulic servo valves, electric drives – Motors – Designing of end effectors – Vacuum, magnetic and air operated grippers.

MODULE III ROBOT SENSORS **8**

Transducers and Sensors – Tactile sensor – Proximity and range sensors – Sensing joint forces – Robotic vision system – Image Representation - Image Grabbing –Image processing and analysis – Edge Enhancement – Contrast Stretching – Band Rationing - Image segmentation – Pattern recognition – Training of vision system.

MODULE IV ROBOT PROGRAMMING & AI TECHNIQUES **7**

Types of Programming – Teach pendant programming – Basic concepts in AI techniques – Concept of knowledge representations – Expert system and its components.

MODULE V ROBOTIC WORK CELLS AND APPLICATIONS OF ROBOTS **7**

Robotic cell layouts – Inter locks – Humanoid robots – Micro robots – Application of robots in surgery, Manufacturing industries, space and underwater.

MODULE VI ROBOT KINEMATICS AND DYNAMICS 7

Forward and inverse Kinematic equations, Denvit – Hartenbers representations Fundamental problems with D-H representation, differential motion and velocity
of frames - Dynamic equations for sing, double and multiple DOF robots – static force analysis of robots.

L – 45; Total Hours –45

REFERENCES:

1. Yoram Koren," Robotics for Engineers", Mc Graw-Hill, 1987.
2. Kozyrey, Yu, "Industrial Robots", MIR Publishers Moscow, 1985.
3. Richard. D, Klafter, Thomas, A, Chmielewski, Michael Negin, "Robotics Engineering – An Integrated Approach", Prentice-Hall of India Pvt. Ltd., 1984.
4. Deb, S.R. "Robotics Technology and Flexible Automation", Tata Mc Graw-Hill, 1994.
5. Mikell, P. Groover, Mitchell Weis, Roger, N. Nagel, Nicholas G. Odrey, "Industrial Robotics Technology, Programming and Applications", Mc Graw- Hill, Int. 1986.
6. Timothy Jordanides et al,"Expert Systems and Robotics", Springer – Verlag, New York, May 1991.

OUTCOMES:

Students would be able to

- Understand about the robots, its various components.
- Design Robots for industrial applications.
- Do programming for robots and apply them in real time applications.

GECX105 TRANSPORT MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the transport fleet and their related activities for minimizing operational cost.
- To understand the need of maintenance and its importance.
- To understand the functions and applications of various types of transport system.

MODULE I INTRODUCTION 7

Personnel management; objectives and functions of personnel management, psychology, sociology and their relevance to organization, personality problems. Selection process: job description, employment tests, interviewing, introduction to training objectives, advantages, methods of training, training procedure, psychological tests.

MODULE II ORGANISATION AND MANAGEMENT 7

Forms of Ownership – principle of Transport Management – Staff administration – Recruitment and Training – welfare – health and safety. Basic principles of supervising. Organizing time and people. Driver and mechanic hiring - Driver checklist - Lists for driver and mechanic - Trip leasing - Vehicle operation and types of operations.

MODULE III TRANSPORT SYSTEMS 9

Introduction to various transport systems. Advantages of motor transport. Principal function of administrative, traffic, secretarial and engineering divisions. chain of responsibility, forms of ownership by state, municipality, public body and private undertakings.

MODULE IV SCHEDULING AND FARE STRUCTURE 8

Principal features of operating costs for transport vehicles with examples of estimating the costs. Fare structure and method of drawing up of a fare table. Various types of fare collecting methods. Basic factors of bus scheduling. Problems on bus scheduling.

MODULE V MOTOR VEHICLE ACT 7

Traffic signs, fitness certificate, registration requirements, permit insurance, constructional regulations, description of vehicle-tankers, tippers, delivery vans, recovery vans, Power wagons and fire fighting vehicles. Spread over, running time, test for competence to drive.

MODULE VI MAINTENANCE 7

Preventive maintenance system in transport industry, tyre maintenance procedures. Causes for uneven tyre wear; remedies, maintenance procedure for better fuel economy, Design of bus depot layout.

L – 45; Total Hours –45

TEXT BOOKS:

1. John Duke, "Fleet Management", McGraw-Hill Co, USA, 1984.
2. Kitchin.L.D., "Bus Operation", III edition, Illiffee and Sons Co., London, 1992

REFERENCES:

1. Government Motor Vehicle Act, Publication on latest act to be used as on date.

OUTCOMES:

Upon completion of the course, students will

- Know about different aspects related to transport system and management.
- Features of scheduling, fixing the fares
- Know about the motor vehicle act and maintenance aspects of transport.

GECX106 CONTROL SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the system modeling and to derive their transfer function.
- To provide adequate knowledge of time response of systems and steady state error analysis.
- To accord basic knowledge in obtaining the open loop and closed–loop frequency responses of Control systems.

MODULE I BASIC CONCEPTS AND SYSTEM REPRESENTATION **8**

Control System - Basic elements in control systems – Open and closed loop systems – Electrical analogy of mechanical and thermal systems – Transfer function – Block diagram reduction techniques – Signal flow graphs.

MODULE II TIME RESPONSE ANALYSIS AND DESIGN **8**

Time response – Time domain specifications – Types of test input – First and Second order system - Type I and Type II System – Response - Error coefficients – Generalized error series – Steady state error – P, PI, PID modes of feedback control.

MODULE III FREQUENCY RESPONSE ANALYSIS AND DESIGN **7**

Performance specifications - correlation to time domain specifications - bode plots and polar plots – gain and phase margin – constant M and N circles and Nichols chart – all pass and non-minimum phase systems.

MODULE IV STABILITY **8**

Characteristics equation – Location of roots in s plane for stability – Routh Hurwitz criterion – Root locus construction – Effect of pole, zero addition – Gain margin and phase margin – Nyquist stability criterion.

MODULE V COMPENSATOR DESIGN **8**

Performance criteria – Lag, lead and lag-lead networks – Compensator design using bode plots and root locus technique.

MODULE VI CONTROL SYSTEM COMPONENTS AND APPLICATION OF CONTROL SYSTEMS **6**

Synchros – AC servomotors - DC Servo motors - Stepper motors - AC

Tacho generator - DC Tacho generator - Typical applications of control system in industry.

L – 45; Total Hours –45

REFERENCES:

1. K. Ogata, “Modern Control Engineering”, 4th Edition, Pearson Education, New Delhi, 2003.
2. I.J. Nagrath & M. Gopal, “Control Systems Engineering”, New Age International Publishers, 2003.
3. C.J.Chesmond, “Basic Control System Technology”, Viva student edition, 1998.
4. I.J.Nagarath and M.Gopal, “Control System Engineering”, Wiley Eastern Ltd., Reprint, 1995.
5. R.C.Dorf and R.H.Bishop, “Modern Control Systems”, Addison-Wesley (MATLAB Reference), 1995.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Proper understanding of basics of Control Systems.
- Ability and skill to carry-out time domain and frequency domain analysis.
- Capable of determining stability of the system using Routh Hurwitz criterion, Root locus and Nyquist criterion.
- Ability to design lag, lead and lag lead compensator networks.

GECX107 INTRODUCTION TO VLSI DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- Basic concepts of HDL.
- Verilog language and its syntax constructs.
- Programmable Logic Devices and FPGAs
- MOS devices theory
- CMOS based combinational and sequential circuits

PREREQUISITES:

Fundamentals of Electronics

Basics knowledge in Digital Electronics.

MODULE I REVIEW OF BASIC DIGITAL SYSTEMS 7

Boolean algebra, Building blocks of combinational logic design-Adders, multiplexer, encoder, decoder, comparator, Latches & flip-flops, counters, shift registers.

MODULE II LOGIC DESIGN USING VERILOG HDL 8

Overview of Digital Design with Verilog HDL, Levels of Design Description, Concurrency, Hierarchical Modeling Concepts, Modules and Ports, Component instantiation Data flow and RTL, structural, gate level, switch level modeling and Behavioral Modeling.

MODULE III LANGUAGE CONSTRUCTS OF VERILOG HDL 7

Identifiers- gate primitives, gate delays, operators, timing controls, procedural assignments, conditional statements Variable types, arrays and tables, Tasks and functions, Test bench.

MODULE IV BUILDING BLOCKS OF DIGITAL VLSI SYSTEMS 8

HDL Design -Data Path Operations-Addition/Subtraction, Parity Generators, Comparators, Zero/One Detectors, Binary Counters, ALUs, Multiplication, Shifters, Memory Elements. Programmable logic elements and AND-OR arrays, FPGAs programming methods.

MODULE V TRANSISTOR THEORY 7

Introduction to MOS Transistors-NMOS & PMOS Characteristics, Current Equations, Complementary CMOS Inverter-DC Characteristics, Static Load MOS Inverters.

MODULE VI BASICS OF DIGITAL CMOS DESIGN 8

NMOS & PMOS Logic Gate, CMOS Logic Gate, Basic layout design of simple gate-stick diagram, CMOS Logic Structures-full adder, multiplexers.

Total Hours –45

TEXT BOOKS:

1. M.Morris Mano "Digital Design", 3rd Edition, Prentice Hall of India Pvt. Ltd New Delhi, 2003

REFERENCES:

1. Michael D. Ciletti“Advanced Digital Design with the Verilog HDL" (2nd Edition) Hardcover – January 31, 2010
2. J.Bhasker: Verilog HDL primer, BS publication, 2001.
3. J. P. Uyemura, "Introduction to VLSI Circuits and System", Wiley, 2002
4. Neil Weste and K. Eshragian, “Principles of CMOS VLSI Design: A System Perspective,” 2nd edition, Pearson Education (Asia) Pvt.Ltd., 2000
5. Douglas A Pucknell& Kamran Eshragian , “Basic VLSI Design” PHI 3rd Edition (original edition – 1994)

OUTCOMES:

At the end of the course the students will be able to

- Create basic Register Transfer Level (RTL) models for combinational circuits & Sequential circuits using Verilog HDL.
- Create basic behavioral models for combinational circuits & Sequential circuits using Verilog HDL.
- Describe the usage of Programmable Logic Devices and FPGAs.
- Describe MOS devices theory and inverter circuit DC characteristics
- Design the basic digital building blocks using MOS circuit.
- Apply VLSI design concepts based on the requirements to conduct experiments or projects

GECX108 PLANT ENGINEERING L T P C

3 0 0 4

OBJECTIVES:

- To provide in depth knowledge on Plant Engineering
- To introduce detail engineering and P&ID
- To learn about the support to Instrumentation from other disciplines
- To study about the Installation and commissioning

MODULE I INTRODUCTION OF PLANTS 7

General Project Cycle – Feed – Sales - Plant Description, Component / Areas of Plant, Plant Layout, Plant Interfaces, Plant Location

MODULE II ELEMENTS OF PLANT 8

Main Elements of a Plant, Process Flow Scheme (PFD – Process Flow Diagram) P&ID's, Plant Legend Finalization.

MODULE III DETAIL ENGINEERING 10

P& ID Development with PFD's, Major Discipline Involvement & Inter discipline Interaction, Major Instrumentation & Control Systems - Development Phase – Instrument List , I/O Count, Specification Sheets, Instrument Installation (Hook ups) , Control Philosophy – Detail Engineering.

MODULE IV SUPPORT FROM OTHER DISCIPLINE 8

Other Discipline Supports to Instrumentation – Plot Plan, Piping / Equipment Plan, Electrical Area Classification, Fire Hazardous Classification Telecommunication Systems - Control Network architecture.

MODULE V INSTALLATION AND COMMISSIONING 7

Plant Construction - Key Drawings for Construction Support Construction Activities, System Testing, Startup / Commissioning, Production.

MODULE VI CASE STUDIES 5

Case studies of Water Treatment Plant - Paper Industry – Power Plant etc

L – 45; Total Hours –45

REFERENCES:

1. Duncan C Richardson, Plant Equipment and Maintenance Engineering Handbook, McGraw-Hill Education: New York, Chicago, San Francisco, Athens, London, Madrid, Mexico City, Milan, New Delhi, Singapore, Sydney, Toronto, 2014 McGraw-Hill Education
2. Gabriel Salvendy, Handbook of Industrial Engineering – Technology and operations Management, John Wiley & Sons, 2001.
3. Robert C Rosaler , Standard Handbook of Plant Engineering, Mc Graw Hill third Edition, 2004
4. R. Keith Mobley, Plant Engineer's Handbook, Technology and Engineering, 2001.

OUTCOMES:

At the end of the course, the student will be able to

- Review and correct P&IDs
- Do installation and commissioning of new plants
- Apply plant engineering in design and maintenance of water treatment plant / power plant etc

GECX109	NETWORK SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

The students should be able to

- Discuss the basic concepts of computer security, model and attacks
- Examine the major types of threats and the associated attacks
- Identify the encryption techniques in real time applications
- Understand the special requirements for wireless security and how authentication is implemented in wireless systems
- Understand the functions of Network Security Device Firewall and its types
- Interpret the various network intrusion such as computer viruses, network worms etc

MODULE I INTRODUCTION 6

Computer Security Concepts - The OSI Security Architecture - Security Attacks - Security Services - Security Mechanisms - A Model for Network Security - Standards – classical encryption techniques.

MODULE II SYMMETRIC ENCRYPTION AND MESSAGE CONFIDENTIALITY 7

Symmetric Encryption Principles - Symmetric Block Encryption Algorithms - Random and Pseudorandom Numbers - Stream Ciphers and RC4 - Cipher Block Modes of Operation

MODULE III PUBLIC KEY CRYPTOGRAPHY AND MESSAGE AUTHENTICATION 8

Approaches to Message Authentication - Secure Hash Functions - Message Authentication Codes - Public-Key Cryptography Principles - Public-Key Cryptography Algorithms - Digital Signatures

MODULE IV KEY DISTRIBUTION ,USER AUTHENTICATION AND TRANSPORT-LEVEL SECURITY 8

Symmetric Key Distribution Using Symmetric Encryption - Kerberos - Key Distribution Using Asymmetric Encryption - X.509 Certificates - Public-Key Infrastructure -Federated Identity Management - Web Security Considerations -

Secure Socket Layer and Transport Layer Security - Transport Layer Security

MODULE V WIRELESS NETWORK SECURITY, ELECTRONIC MAIL SECURITY AND IP SECURITY **8**

IEEE 802.11 Wireless LAN Overview -IEEE 802.11i Wireless LAN Security - Wireless Application Protocol Overview - Wireless Transport Layer Security - WAP End-to-End Security - Pretty Good Privacy - S/MIME – Domain Keys Identified Mail- IP Security Overview -IP Security Policy - Encapsulating Security Payload - Combining Security Associations - Internet Key Exchange - Cryptographic Suites

MODULE VI SYSTEM SECURITY **8**

Intruders -Intrusion Detection -Password Management - Types of Malicious Software - Viruses Virus Countermeasures – Worms - Distributed Denial of Service Attacks- The Need for Firewalls - Firewall Characteristics - Types of Firewalls - Firewall Basing - Firewall Location and Configurations

L – 45; Total Hours –45

REFERENCES:

1. William Stallings,"Network security Essentials:Applications and standards", Prentice Hall, Fifth Edition , ISBN-13: 978-0134527338, 2013
2. William Stallings, "Cryptography and Network Security: Principles and Practice", Pearson, ISBN-13:978-0-273-79335-9,2013
3. Behrouz Forouzan, Debdeep Mukhopadhyay,Cryptography and network security (sie) 2nd edition, ISBN-13: 978-0070702080, 2016
4. Wikipedia, "Network Security and Management" , https://en.wikipedia.org/wiki/Book:Network Security and Management, 2014.
5. Nitesh Dhanjani, Justin Clarke, "Network Security Tools", O'Reilly Media, ISBN-13: 9780596007942, 2005.

OUTCOMES:

Students who complete this course will be able to

- Recognize the computer security concepts, architecture attacks and model
- Distinguish the symmetric and asymmetric encryption techniques
- Apply the cryptographic algorithms in different applications
- Express the network security designs using available secure solutions

such as PGP,SSL, IPSec, etc.

- Describe the firewalls principles and different types of firewalls applied in organization
- Identify abnormalities within the network caused by worms, viruses and Network related security treats**.**

GECX110	KNOWLEDGE MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course

- Focuses on positioning knowledge as a valuable commodity, embedded in products and in the tacit knowledge of highly mobile individual employees.
- Presents KM as a deliberate and systematic approach to cultivating and sharing an organization's knowledge base.
- Brings out the paradigm in terms of information technology and intellectual capital.

MODULE I KNOWLEDGE MANAGEMENT 6

KM Myths – KM Life Cycle – Understanding Knowledge – Knowledge, intelligence – Experience – Common Sense – Cognition and KM – Types of Knowledge – History of Knowledge Management - From Physical assets to Knowledge Assets – Expert knowledge – Human Thinking and Learning.

MODULE II KNOWLEDGE MANAGEMENT SYSTEMS AND MODELS 9

Challenges in Building KM Systems – Conventional Vs KM System Life Cycle (KMSLS) – Knowledge Creation and Knowledge Architecture – KM cycle - Different variants of KM cycle - KM models - Implications and practical implementations.

MODULE III CAPTURING KNOWLEDGE AND SHARING 9

Tacit knowledge capture - Explicit knowledge codification – Knowledge taxonomies - Knowledge sharing - Communities - Obstacles to knowledge capture and sharing.

MODULE IV KNOWLEDGE MANAGEMENT TOOLS 9

KM System tools – Neural Network – Association Rules – Classification Trees – Data Mining and Business Intelligence – Knowledge capture and creation tools - Content creation tools - Data mining and knowledge discovery – Content management tools - Knowledge sharing and dissemination tools – Group ware

and Collaboration tools - Intelligent filtering tools.

MODULE V KNOWLEDGE APPLICATION 6

KM at individual level - Knowledge workers - Task analysis and modeling - Knowledge application at group and organizational levels – Knowledge repositories - Knowledge reuse -Case study: e-learning.

MODULE VI VALUE OF KNOWLEDGE MANAGEMENT 6

KM return on investment and metrics - Benchmarking method – Balanced scorecard method - House of quality method - Results based assessment method - Measuring success - Future challenges for KM.

L – 45; Total Hours –45

TEXT BOOKS:

1. Elias M. Awad, Hassan M. Ghaziri, “Knowledge Management”, Prentice Hall, 2nd Edition, 2010.
2. Jay Liebowitz, “Handbooks on Knowledge Management”, 2nd Edition, 2012.
3. Irma Becerra-Fernandez, Rajiv Sabherwal, ”Knowledge Management: Systems and Processes”, 2010.

OUTCOMES:

Students who complete this course will be able to

- Describe the fundamental concepts in the study of knowledge and its creation, acquisition, representation, dissemination, use and re-use, and management.
- Explains the core concepts, methods, techniques, and tools for computer support of knowledge management.
- Critically evaluate current trends in knowledge management and apply it for e-learning

GECX111 CYBER SECURITY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the basics of Cyber Security Standards and Policies.
- To know the legal, ethical and professional issues in Cyber security.
- To understand Cyber Frauds and Abuse and its Security Measures.
- To know the technological aspects of Cyber Security.

MODULE I FUNDAMENTALS OF CYBER SECURITY 7

Security problem in computing – Cryptography Basics – History of Encryption – Modern Methods – Legitimate versus Fraudulent Encryption methods – Encryption used in Internet.

MODULE II CYBERCRIME AND CYBEROFFENSES 8

Cybercrime and Information Security – Cybercriminals – Classifications of Cybercrimes – Email Spoofing – Spamming – Cyber defamation – Internet Time Theft – Forgery – Web jacking – Hacking – Online Frauds – Software Piracy – Mail Bombs – Password Sniffing – Cyberoffenses – Categories – Planning the attacks – Cyberstalking – Cybercafe and Cybercrimes – Botnets.

MODULE III CYBERCRIME: MOBILE AND WIRELESS DEVICES 8

Proliferation of Mobile and Wireless Devices – Trends in Mobility – Credit card frauds in Mobile and Wireless Computing – Security Challenges – Authentication Service Security – Attacks on Mobile Phones.

MODULE IV TOOLS AND METHODS USED IN CYBERCRIME 8

Proxy Servers and Anonymizers – Phishing – Password Cracking – Keyloggers and Spywares – Virus and Worms – Trojan Horses and Backdoors – Steganography – DoS and DDoS Attacks.

MODULE V SECURITY POLICIES 7

Introduction - Defining User Policies – Passwords – Internet Use – Email Usage – Installing/ Uninstalling Software – Instant Messaging – Defining System Administrative Policies – Defining Access Control Developmental Policies Standards, Guidelines and Procedures – Basics of assessing a system

MODULE VI COMPUTER FORENSICS 7

General Guidelines – Finding Evidence on the PC - Finding Evidence in System Logs – Windows Logs – Linux Logs – Getting Back Deleted Files – Operating System Utilities – The Windows Registry.

L – 45; Total Hours –45

TEXT BOOKS:

1. Nina Godbole, Sunit Belapure, “Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Wiley, 2011.

2. Chuck Easttom, “Computer Security Fundamentals”, 2nd Edition, Pearson Education, 2012.

REFERENCES:

1. Charles B. Pfleeger, Shari Lawrence Pfleeger, “Security in Computing”, 3rd Edition, Pearson Education, 2003.
2. William Stallings, “Cryptography and Network Security – Principles and Practices”, 3rd Edition, Pearson Education, 2003.
3. Atul Kahate, “Cryptography and Network Security”, Tata McGraw Hill, 2000.

OUTCOMES:

Upon completion of this course, students will be able to

- Explain the general security issues.
- Discuss various cybercrimes and offenses.
- Outline the occurrence of Cybercrime in mobile and wireless environment.
- Use relevant tools and methods in cybercrime
- Apply security policies in cyber forensics.
- Outline the strategies adopted in computer forensics.

GECX112 GENETIC ENGINEERING L T P C
4 0 0 4

OBJECTIVES:

The course aims to provide an advanced understanding of the core principles and topics of Cell and Organism reproduction and the Principles of heredity and their experimental basis, and to enable students to be able to apply these principles in assessment of pedigrees to identify genotypes and predict the mating outcomes.

MODULE I GENETICS AND ORGANISM 10

Genetics and human affairs, Genetics and Biology, Genes and Environment, Techniques of genetic analysis, The chromosome theory of heredity, Sex chromosomes, Sex linkage, The parallel behaviour of autosomal genes and chromosomes.

MODULE II MENDELISM AND LINKAGE 12

Mendel's laws of inheritance, Interaction of genes, Variations on dominance, Multiple alleles, Lethal alleles, Several genes affecting the same character, Penetrance and expressivity, Linkage- Basic eukaryotic chromosome mapping, The discovery of linkage, Recombination linkage symbolism, Linkage of genes on X chromosomes, Linkage maps, Examples of linkage maps.

MODULE III FINE STRUCTURE OF GENES 10

The concept of promoter, Coding sequence, Terminator, Induction of gene for expression. The concept of extranuclear genome in higher plants and animals, Overview of mitochondrial genome, Chloroplast genome.

MODULE IV RECOMBINATION IN BACTERIA AND VIRUSES 10

Conjugation recombination and mapping the E.coli chromosomes, Transformation, Transduction, Chromosome mapping. Population genetics: Darwin's revolution, Variation and its modulation, The effect of sexual reproduction on variation, The sources of variation, Selection quantitative genetics

MODULE V PRINCIPLES OF PLANT BREEDING 9

Objectives, Selfing and crossing techniques, Male sterility,Incompatability, Hybrid vigour.

MODULE VI HUMAN GENOME PROJECT **9**

Genetic diseases in humans, Genetics and society

L – 45; T – 15; Total Hours –60

REFERENCES:

1. In Introduction to genetic analysis, Griffiths, Miller, Suzuki, Lewontin and Gelbart, Freeman and Company.
2. Genetics, A.V.S.S. Sambamurty, Narosa Publishing House.
3. Concepts of Genetics, Klug & Cummings, Prientice Hall.
4. Molecular Cloning, Moniatisetal, Cold Spring Harbor Laboratory.

OUTCOMES:

At the end of the course students will be able to

- Describe the structure, function and replication of DNA as the genetic material
- Describe gene structure, expression and regulation
- Describe the chromosomal basis of inheritance and how alterations in chromosome number or structure may arise during mitosis and meiosis

GECX113	FUNDAMENTALS OF PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The students would gain knowledge on

- Technicalities attached to Project Management and Significance of Quality Consideration
- Project management methodologies – tools and techniques, supplemented with examples from case studies
- The importance of Efficient HR team and role of Communication in executing Projects.
- Managing Risks in Project Management

MODULE I INTRODUCTION TO PROJECT MANAGEMENT 9

Introduction to Project and Project Management-Project Management as a Career-Project Management Skill Sets-Project Scope Management: Project Charter, Scope Creep, Scope Validation, Scope Change Control-Type of Organization: Organization Structure-Influence of Organization Structure on Project, Project Stakeholders and Organizational Productivity.

MODULE II PROJECT MANAGEMENT PROCESS, TOOLS AND TECHNIQUES 8

Project life cycle-Initiation, Planning, Execution, Monitoring and Closing Phase; - Link between project management process, process groups and knowledge areas; Project management tools and techniques- Project Stakeholders description and mapping - Stakeholder Management Process

MODULE III PROJECT QUALITY, COST AND SCHEDULE MANAGEMENT 10

Triple constraints of project-quality, cost and schedule-Quality Planning, Quality Assurance and Quality Control, Process Control, Cost of Quality, Seven Tools of Quality Control- Cost Management: Cost Estimating Methods, Estimating Completion Cost, Earned Value Management, Budgeting, Life-Cycle Cost analysis- Project Time Management: Duration Estimation Method, FS/FF/SS/ SF Relations, Lead/Lag, Arrow Diagram Method and Precedence Diagram Method for Scheduling-Resource Allocation

MODULE IV PROJECT HR MANAGEMENT 5

Organizational Goals- (MBO/MBE/MBP)-Responsibility Assignment Matrix (RAM)-Types of Powers- Manage or Lead-Conflict management Techniques-Performance Evaluation Process-Motivation Theories and its Application for execution of Projects-Leadership Styles-Project Team Building-Project Staffing Constraints/Policies

MODULE V COMMUNICATION MANAGEMENT 5

Communication Management: Understanding Body languages of Project Personnel-Effective Communications- Interpersonal Skills for project Managers-PMIS-Communicating with the Customer-Communicating with Management- Formal vs. Informal Communications-Written, Verbal and Non-Verbal Communications.

MODULE VI PROJECT PROCUREMENT & RISK MANAGEMENT 8

Introduction to Project Procure Management: Soliciting RFQ/RFP-Contract Proposals-Contract Negotiation-Contract Closure-Risk Management: Defining risks-Risk management process-Risk identification-Qualitative and Quantitative Risk-Probability and Decision trees-Risk Response strategies / methods-Expected monetary value-Risk vs. life cycle phases

L – 45; Total Hours –45

REFERENCES:

1. Jack. R. Meredith, Samuel. J. Mantel & Scott. M. Shafer, Project Management in Practice, Fifth Edition, Bangalore: Wiley, 2015
2. Bob Hughes, Mike Cotterrel “Software Project Management”, Tata McGraw-Hill, 2009

OUTCOMES:

- Learners will be able to identify the Key Knowledge Areas and apply PM process in hypothetical project assignments given as continuous assessment.
- They would be able to suitably recognize tools and techniques required for various phases included in a project.
- They would also be able to manage scope, time, cost and other major components that would help them to execute the project efficiently.

GECX114 OPERATIONS RESEARCH L T P C
3 0 0 3

OBJECTIVES:

- To acquire knowledge and training in optimization techniques.
- To get knowledge about optimization in utilization of resources.
- To understand and apply operations research techniques to industrial operations

MODULE I LINEAR PROGRAMMING PROBLEM 8

Linear programming – formulation of the problem - graphical interpretation of optimality - Simplex method – to obtain basic feasible solution – types of linear programming solution – complications and their resolution.

MODULE II ARTIFICIAL VARIABLE AND TWO PHASE METHOD, DUALITY 6

Artificial variable - Big M method – Two phase method – alternative optimal solution – unbounded solution - Duality – primal dual relationships - rules of constructing the dual from primal.

MODULE III TRANSPORTATION PROBLEM & ASSIGNMENT PROBLE 8

Transportation problems – Initial basic feasible solutions, MODI method, Unbalance in transportation, Degeneracy in transportation models, Assignment problem – Minimization and Maximization type of problems by Hungarian method.

MODULE IV NETWORK AND SEQUENCING PROBLEMS 8

PERT and CPM – Network diagram – Fulkerson's rule - CPM Probability of achieving completion date – Crash time – Cost analysis. Sequencing N jobs through 2 machines and 3 machines.

MODULE V QUEUING THEORY & SIMULATION 7

Poisson arrivals and exponential service times – characteristics of Queuing models – single channel – Introduction to multi channel models – Random number generation – Monte Carlo Simulation.

MODULE VI INVENTORY CONTROL, REPLACEMENT MODELS AND GAME THEORY 8

Types of inventory- Inventory cost - EOQ - Deterministic inventory problems – Introduction to probabilistic models & system level inventory control - Replacement models – Replacement of items that deteriorate with time – value of money changing with time – not changing with time – Individual and group replacement policy - Game theory – simple games.

L – 45; Total Hours –45

TEXT BOOKS:

3. Hamdy ATaha, “Operations Research an introduction”, 8th edition, Phil Pearson, 2007.
4. Winston.W.L., “Operations Research”, 4th edition, Thompson-Brooks/Cole, 2003.

REFERENCES:

1. Wayne.L. Winston, “Operations Research applications and algorithms”, 4th edition, Thomson learning, 2007.
2. Frederick. S. Hiller and Gerald.J.Lieberman, “Operations Research concepts and cases”, 8th edition (SIE), Tata McGraw – Hill Pub. Co. Ltd., New Delhi, 2006.
3. A. Ravindran, D. T. Phillips and J. J. Solberg, "Operations Research:Principles and Practice", 2nd edition, John Wiley & Sons, New York, 1992.
4. Robertazzi. T.G., “Computer networks and systems-Queuing theory and performance evaluation”, 3rd edition, Springer, 2002.

OUTCOMES:

At the end of the course students will be able to

- solve linear programming problems
- solve transportation and assignment problems.
- solve network and sequencing problems.
- apply the operations research techniques to solve industrial problems.

GECX115	NANO TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the basic concepts of Nanoscience relevant to the field of engineering.
- To provide an exposure about the importance of various synthesis method.
- To enrich the knowledge of students in various characterisation techniques.

MODULE I INTRODUCTION & CLASSIFICATION OF NANOMATERIALS 9

Definition - Origin of nanotechnology - Difference between bulk and nanomaterials- Top-down and bottom-up processes - Size dependent properties (magnetic, electronic,transport and optical), Classification based on dimensional property - 0D, 1D, 2D and 3D nanostructures – Kubo gap.

MODULE II TYPES OF NANOMATERIALS 9

Metal oxides and metal nano particles - Ceramic nano particles - Semi conducting quantum dots - Core-shell quantum dots - Nanocomposites - Micellar nanoparticles.

MODULE III PRODUCTION OF NANOPARTICLES 7

Sol-gel, hydrothermal, solvothermal, Plasma Arcing, Electro deposition, RF sputtering, Pulsed laser deposition, Chemical vapour, deposition.

MODULE IV CARBON BASED NANOMATERIALS 6

Carbon nanotubes: Single wall nanotubes (SWNT), Multiwall nanotubes (MWNT) - structures-carbon nanofibre, Fullerenes-Application of carbon nanotubes and Fullerenes.

MODULE V NANOPHOTONICS 7

Light and nanotechnology, Interaction of light and nanotechnology, Nanoholes and photons, nanoparticles and nanostructures; Nanostructured polymers, Photonic Crystals, Solar cells.

MODULE VI CHARACTERISATION TECHNIQUES 7

Basic principles of scanning Electron Microscopy (SEM), Atomic force microscopy (AFM), Scanning tunneling microscopy (STM), Scanning probe

microscopy (SPM) and Transmission electron microscopy (TEM), Particle size analyzer, Luminescence techniques.

L – 45; Total Hours –45

TEXT BOOKS:

1. Hari Singh Nalwa, “Handbook of Nanostructured Materials and Nanotechnology”, Academic Press, 2000.
2. Guozhong Cao, “Nanostructures and Nano materials-Synthesis, Properties and Applications”, Imperial College Press (2011).
3. Zhong Lin Wang, “Handbook of Nanophase and Nanomaterials (Vol 1 and II)”, Springer, 2002.
4. Mick Wilson, Kamali Kannangara, Geoff smith, “Nanotechnology: Basic Science and Emerging Technologies”, Overseas press, 2005.

REFERENCES:

1. A. Nabok, “Organic and Inorganic Nanostructures”, Artech House, 2005.
2. C.Dupas, P.Houdy, M.Lahmani, Nanoscience: “Nanotechnologies and Nanophysics”, Springer-Verlag Berlin Heidelberg, 2007.
3. Mick Wilson, Kamali Kannangara, Michells Simmons and Burkhard Raguse, “Nano Technology – Basic Science and Emerging Technologies”, 1st Edition, Overseas Press, New Delhi,2005.
4. M.S. Ramachandra Rao, Shubra SinghH, “Nanoscience and Nanotechnology: Fundamentals to Frontiers”, Wiley, 2013.

OUTCOMES:

At the end of this course, the students will be able to:

- Apply the knowledge of different types of nanomaterials for various engineering applications.
- Acquire the knowledge of various methods of production of nanomaterials.
- Familiarize with various characterization techniques.

GECX116	VEHICLE MAINTENANCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To know about the various methods of maintaining procedure, vehicle insurance and basic problems in a vehicle.
- The student able to impart knowledge in maintaining of engine components and subsystems.
- The student able to impart knowledge in maintaining of transmission, driveline, steering, suspension, braking and wheels.
- The student able to impart **carefully maintaining their vehicle and can increase driving safety.**

MODULE I MAINTENANCE, WORKSHOP PRACTICES, SAFETY AND TOOLS **7**

Maintenance – Need, importance, primary and secondary functions, policies - classification of maintenance work - vehicle insurance - basic problem diagnosis. Automotive service procedures – workshop operations – workshop manual - vehicle identification. Safety – Personnel, machines and equipment, vehicles, fire safety - First aid. Basic tools – special service tools – measuring instruments – condition checking of seals, gaskets and sealants. Scheduled maintenance services – service intervals - Towing and recovering.

MODULE II ENGINE AND ENGINE SUBSYSTEM MAINTENANCE **8**

General Engine service- Dismantling of Engine components- Engine repair- working on the underside, front, top, ancillaries- Service of basic engine parts, cooling and lubricating system, fuel system, Intake and Exhaust system, electrical system - Electronic fuel injection and engine management service - fault diagnosis- servicing emission controls.

MODULE III TRANSMISSION AND DRIVELINE MAINTENANCE **8**

Clutch- general checks, adjustment and service- Dismantling, identifying, checking and reassembling transmission, transaxle- road testing- Removing and replacing propeller shaft, servicing of cross and yoke joint and constant velocity joints- Rear axle service points- removing axle shaft and bearings- servicing differential assemblies- fault diagnosis.

MODULE IV STEERING AND SUSPENSION MAINTENANCE 7

Maintenance and Service of Mc person strut, coil spring, leaf spring, shock absorbers. Dismantling and assembly procedures. Inspection, Maintenance and Service of steering linkage, steering column, Rack and pinion steering, Recirculating ball steering service- Worm type steering, and power steering system.

MODULE V BRAKE AND WHEEL MAINTENANCE 7

Inspection, Maintenance and Service of Hydraulic brake, Drum brake, Disc brake, parking brake. Bleeding of brakes. Wheel alignment and balance, removing and fitting of tyres, tyre wear and tyre rotation.

MODULE VI AUTO ELECTRICAL AND AIR CONDITIOING MAINTENANCE 8

Maintenance of batteries, starting system, charging system and body electrical -Fault diagnosis using Scan tools. Maintenance of air conditioning parts like compressor, condenser, expansion valve, evaporator - Replacement of hoses- Leak detection- AC Charging- Fault diagnosis Vehicle body repair like panel beating, tinkering, soldering, polishing, painting.

L – 45; Total Hours –45

TEXT BOOKS:

1. Ed May, "Automotive Mechanics Volume One" , Mc Graw Hill Publications, 2003
2. Ed May, "Automotive Mechanics Volume Two" , Mc Graw Hill Publications, 2003
3. Vehicle Service Manuals of reputed manufacturers
4. Vehicle maintenance and garage practice by Jigar A.Doshi Dhru U.Panchal,Jayesh P.Maniar. 2014
5. A Practical Approach to Motor Vehicle Engineering and Maintenance 3rd Edition by Allan Bonnick.

REFERENCES:

1. Bosch Automotive Handbook, Sixth Edition, 2004.
2. Advanced Automotive Fault Diagnosis by Tom Denton 2011.
3. Nissan Patrol Automotive Repair Manual: 1998-2014 by Haynes Manuals Inc.
4. Automobile electrical manual a comprehensive guide by Haynes manual car repair.

OUTCOMES:

On completion of the course student should be able to

- Prepare maintenance schedules and procedures with appropriate tools.
- Demonstrate the procedure and methods to repair and calibrate the engine.
- **Analyze the causes and remedies for fault in transmission and drive line systems.**
- **Analyze the causes and remedies of steering and suspension systems.**
- **Analyze the causes and remedies of brake system.**
- **Demonstrate the procedure for wheel alignment and wheel balanced.**

GECX117	FUNDAMENTALS OF DIGITAL IMAGE PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Describe and explain basic principles of digital image processing
- Design and implement algorithms that perform basic image processing
- Design and implement algorithms for advanced image analysis
- Assess the performance of image processing algorithms and systems

PRE-REQUISITES:

- Basic knowledge of transforms in Mathematics

MODULE I DIGITAL IMAGE FUNDAMENTALS 8

Elements of Image Processing System, Fundamentals steps in Digital Image Processing, Image Sampling & Quantization, Spatial and Gray Level Resolution.

MODULE II COLOR IMAGE PROCESSING 8

Fundamental of color image processing, color models- RGB, CMY, HIS, Pseudo color image processing

MODULE III IMAGE ENHANCEMENT 7

Basic gray level Transformations, Histogram Processing, Spatial Filtering

MODULE IV IMAGE TRANSFORMS 7

2D-DFT, DCT, Haar Transform, Fundamentals of 2D-wavelet transform, sub-band coding

MODULE V IMAGE SEGMENTATION AND RESTORATION 8

Point, line and edge detection methods ,Image Segmentation and its types, Restoration: Noise model, Inverse filter and Wiener filter.

MODULE VI IMAGE COMPRESSION 7

Fundamentals of redundancies, Basic Compression Methods: Huffman coding, Arithmetic coding, JPEG and MPEG Compression standards.

TOTAL HOURS 45

TEXT BOOKS

1. Gonzalez and Woods, "Digital Image Processing", 3rd Edition, Pearson Education, 2016.
2. Anil. K. Jain, "Fundamentals of Digital Image Processing"; 4th Edition, PHI, 2007

REFERENCES

1. Pratt William, "Digital Image Processing", John Wiley & Sons, 2007.
2. Arthur Weeks Jr., "Fundamentals of Digital Image Processing", PHI, 2006.

OUTCOMES:

On completion of the course, students will be able to

- Explain the fundamental concepts of digital image processing.
- Discuss about color image processing
- Recognize & apply various image enhancement techniques.
- Apply various transforms for image processing.
- Apply various techniques for image segmentation and restoration.
- Identify and use appropriate image compression techniques

Group II courses

(To be offered in VII Semester)

GECX201	GREEN DESIGN AND SUSTAINABILITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart knowledge to face challenges, the technology poses for water, energy, and climate change by implementing sustainable design.

MODULE I CONCEPTS OF SUSTAINABLE DEVELOPMENT 7

Objectives of Sustainable Development - Need for sustainable development-Environment and development linkages - Globalisation and environment-Population, poverty and pollution- global, regional and local environment issues-Green house gases and climate change.

MODULE II SUSTAINABLE DEVELOPMENT OF SOCIO ECONOMIC SYSTEMS 8

Demographic dynamics of sustainability- Policies for socio economic development- Sustainable Development through trade- Economic growth- Action Plan for implementing sustainable development- Sustainable Energy and Agriculture.

MODULE III FRAME WORK FOR ACHIEVING SUSTAINBAILITY 7

Sustainability indicators- Hurdles to sustainability- Business and Industry – Science and Technology for Sustainable Development- Performance indicators of sustainability and assessment mechanism- Constraints and barriers of Sustainable Development.

MODULE IV GREEN BUILDINGS 8

Introduction to Green Building- Energy- Water- Materials and Resources - Sustainable Sites and Land Use - Indoor Environmental Quality- Life Cycle Assessment- Energy, water and materials efficiency.

MODULE V ENERGY CONSERVATION AND EFFICIENCY 7

Energy savings- Energy Audit- Requirements- Benefits of Energy conservation-Energy conservation measures for buildings- Energy wastage- impact to the environment.

MODULE VI GREEN BUILDINGS DESIGN 8

Elements of Green Buildings Design- Foundation, Electrical, Plumbing, flooring, Decking, roofing, insulation, wall coverings, windows, siding, doors and finishing, LEED certification for Green Buildings, Green Buildings for sustainability.

L – 45; Total Hours –45

TEXT BOOKS:

1. Kirby, J., Okeefe, P., and Timber lake, “Sustainable Development”, Earthscan Publication, London, 1995.

REFERENCES:

1. Charles Kibert, J., “Sustainable Construction: Green Building Design and Delivery”, 2nd Edition, John Wiley and sons, 2007.

OUTCOMES:

At the end of the course, the students will be able to

- Explain the relationship between sustainability and emergence of green building practices.
- Address the economic, environmental, and social concerns.

GECX202 APPROPRIATE TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES:

- To impart students knowledge about the basics and applications of various appropriate technologies in the field of civil engineering.

MODULE I BASICS CONCEPTS 7

Back ground, Tools, Choices and Implications, Appropriate Technology Movement (an overview) - Basic design process, basic financial analysis-discounted cash flow, and energy fundamentals.

MODULE II APPROPRIATE TECHNOLOGY WITH REFERENCE TO BUILDING DESIGN 7

Appropriate Building Materials, Appropriate Energy Saving Techniques, Water Conservation (Indoor), Rain Water Harvesting.

MODULE III WATER, HEALTH AND SANITATION MANAGEMENT 7

Water Storage: Designing Dams and Pipelines, Appropriate Selection for Sanitation Technique, Sewerage, Communal Health and Waste Water Recycling.

MODULE IV WASTE MANAGEMENT 8

Types of Waste - Sources - Collections and On-Site Processing -Transferring Stations - Disposal Systems - Recycling.

MODULE V ENERGY EFFICIENT TECHNIQUES 8

Green building concepts-renewable energy sources- Solar – Steam and wind-Biofuels - Biogas – Electricity.

MODULE VI TECHNOLOGY POLICY 8

Government Policies- Energy Policy-Appropriate technology Development Centre-its function and responsibilities-Building policies-Case Studies.

L – 45; Total Hours –45

TEXT BOOKS:

1. Barrett Hazeltine and Christopher Bull, “Appropriate Technology: Tools Choices and Implications”, Academic Press, Orlando, USA, 1998.
2. Ken Darrow and Mike Saxenian, “Appropriate Technology Source Book : A Guide to Practical Books for Village and Small Community Technology”, Stanford, 1986.

REFERENCES:

1. Richard Heeks, “Technology and Developing Countries: Practical Applications Theoretical Issues”, 1995.
2. John Pickford, “The Worth of Water : Technical Briefs on Health, Water and Sanitation”, Intermediate Technology Publications, 1998.

OUTCOMES:

- At the end of the course, the students will be able to use suitable technologies for various conditions for sustainable development.

GECX203 ENGINEERING SYSTEM MODELLING AND SIMULATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn the concepts, techniques, tools for modeling and simulation systems and environments through the use of computers.
- To study the various aspects of discrete dynamic, stochastic systems modeling and conducting experiments with those models on a computer.

MODULE I INTRODUCTION 6

Systems – Modelling – types – systems components – Steps in model building- Simulation Algorithms and Heuristics; Simulation Languages.

MODULE II RANDOM NUMBERS / VARIATES 7

Random numbers – methods of generation – random variates for standard distributions like uniform, exponential, Poisson, binomial, normal etc. – Testing of Random variates – Monte Carlo Simulation.

MODULE III MODELLING PROCESS 7

Primitive Models : Establishing relationships via physical laws; Establishing relationships via curve fitting; Parameters estimation problems; Elementary state transition models.

MODULE IV DESIGN OF SIMULATION EXPERIMENTS 9

Steps on Design of Simulation Experiments – Development of models using of Highlevel language for systems like Queuing, Inventory, Replacement, Production etc., – Model validation and verification, Output analysis.

MODULE V SIMULATION LANGUAGES 10

Need for simulation Languages – Comparisons & Selection of Languages – GPSSARENA- EXTEND – Study of any one of the languages.

MODULE VI CASE STUDIES USING SIMULATION LANGUAGES 6

Case Study using simulation languages

L – 45; Total Hours –45

REFERENCES:

1. Law, A.M., & W.D. Kelton, “Simulation Modelling and Analysis”, McGraw

Hill, Singapore, 2000.
2. Harrel, C.R., et. al., “System Improvement Using Simulation”, 3rd Edition, JMI Consulting Group and ProModel Corporation, 1995.
3. Harrel, C.R. & T. Kerim, “Simulation Made Easy, A Manager’s Guide”, IIE Press, 1995.
4. Geoffrey Gordon, “Systems Simulation”, Prentice Hall, 2002.
5. David Kelton, Rondall P Sadowski, David T Sturrock, “Simulation with Arena”, Mc Graw Hill, 2004.

OUTCOMES:

The student should be able to

- Model and simulate systems and environments through the use of computers.
- Conduct experiments with discrete dynamic, stochastic system models on a computer.

GECX204 VALUE ANALYSIS AND ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To get acquainted with value analysis and engineering tool for productivity improvement.
- To understand and analyze the theory and methodology of Value Engineering.

MODULE I VALUE ENGINEERING BASICS 8

Origin of Value Engineering, Meaning of value, Definition of Value Engineering and Value analysis, Difference between Value analysis and Value Engineering, Types of Value, function - Basic and Secondary functions, concept of cost and worth, creativity In Value Engineering.

MODULE II VALUE ENGINEERING JOB PLAN AND PROCESS 6

Seven phases of job plan, FAST Diagram as Value Engineering Tool, Behavioural and organizational aspects of Value Engineering, Ten principles of Value analysis, Benefits of Value Engineering.

MODULE III ORIENTATION AND INFORMATION PHASES 8

Launching Value Engineering project work - Objectives and Targets - VE Project work: a time-bound programme - Projects and Teams - Time Schedule - Co-ordination - Consultant. Technical data - Marketing related information - Competition profile - Cost data - Materials Management related information - Quality related information - Manufacturing data.

MODULE IV FUNCTION ANALYSIS AND CREATIVE PHASES 9

Objectives - Function definition - Classification of functions - Higher level functions – Function – Cost – Function – Worth - Value Gap - Value index - How to carry out Function Analysis? – Fast Diagraming - Cost Modelling.

Creativity - How to improve creativity of an individual? – How to promote creativity in the organisation? - Obstacles to Creativity - Mental road blocks - Creativity killer phrases. Positive thinking - Ideas stimulators - Creativity techniques - Brainstorming.

MODULE V EVALUATION, INVESTIGATION AND RECOMMENDATION 6

Paired comparison and Evaluation Matrix techniques - Criteria for selection of

VE solutions. Design – Materials – Quality – Marketing – Manufacturing - Preview session. The report - presentation.

MODULE VI IMPLEMENTATION PHASE AND CASE STUDIES 8

Design department - Materials department - Production Planning & Control - Quality Control – Manufacturing – Marketing - Need for co-ordinated teams - The Action Plan. Value Engineering case studies.

L – 45; Total Hours –45

TEXT BOOKS:

1. Mudge, Arthur E. “Value Engineering- A systematic approach”, McGraw Hill, New York, 2000.
2. Kumar S, Singh R K and Jha J K (Ed), “Value Engineering”, Narosa Publishing House, 2005.

REFERENCES:

1. Park RJ, “Value Engineering: A Plan for Invention”, St.Lucie Press, New York, 1999.
2. Lawrence, D.M., “Techniques of Value Analysis and Engineering”, McGraw Hill 1988.
3. George, E.D., “Engineering Design: a Material and Processing Approach”, McGraw Hill, 1991.
4. Heller, D.E., “Value Management, Value Engineering and Cost Reduction”, Addison Wesley, 1988.

OUTCOMES:

- The student will be able to realize the value of products, processes and implement value analysis to achieve productivity improvement.

GECX205 INDUSTRIAL SAFETY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the various safety measures to be taken in different industrial environments.

MODULE I SAFETY MANAGEMENT **7**

Evolution of modern safety concept- Safety policy - Safety Organization - line and staff functions for safety- Safety Committee- budgeting for safety. safety education and training.

MODULE II SAFETY IN MANUFACTURING **7**

Safety in metal working-Machine guarding -Safety in welding and gas cutting - Safety in cold forming and hot working of metals -Safety in finishing, inspection and testing -Regulation.

MODULE III SAFETY IN CONSTRUCTION **8**

General safety consideration in Excavation, foundation and utilities – Cordoning – Demolition – Dismantling –Clearing debris – Types of foundations – Open footings.

Safety in Erection and closing operation - Safety in typical civil structures – Dams-bridges-water Tanks-Retaining walls-Critical factors for failure-Regular Inspection and monitoring.

MODULE IV ELECTRICAL SAFETY **8**

Electrical Hazards – Energy leakage – Clearance and insulation – Excess energy – Current surges – Electrical causes of fire and explosion – National electrical Safety code.

Selection of Environment, Protection and Interlock – Discharge rods and earthing device – Safety in the use of portable tools - Preventive maintenance.

MODULE V SAFETY IN MATERIAL HANDLING **8**

General safety consideration in material handling devices - Ropes, Chains, Sling, Hoops, Clamps, Arresting gears – Prime movers.

Ergonomic consideration in material handling, design, installation, operation and

maintenance of Conveying equipments, hoisting, traveling and slewing mechanisms.

Storage and Retrieval of common goods of shapes and sizes in a general store of a big industry.

MODULE VI SAFETY EDUCATION AND TRAINING 7

Importance of training-identification of training needs-training methods – programme, seminars, conferences, competitions – method of promoting safe practice - motivation – communication - role of government agencies and private consulting agencies in safety training – creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign – Domestic Safety and Training.

L – 45; Total Hours –45

REFERENCES:

1. Krishnan N.V, “Safety Management in Industry”, Jaico Publishing House, Bombay, 1997.
2. Blake R.B., “Industrial Safety”, Prentice Hall, Inc., New Jersey, 1973.
3. Fulman J.B., “Construction Safety, Security, and Loss Prevention”, John Wiley and Sons, 1979.
4. Fordham Cooper W., “Electrical Safety Engineering”, Butterworths, London, 1986.
5. Alexandrov M.P., “Material Handling Equipment”, Mir Publishers, Moscow, 1981.

OUTCOMES:

Students would be able to

- Acquire knowledge on various safety Hazards.
- Carry out safety measures for different industrial environments.

GECX206 ADVANCED OPTIMIZATION TECHNIQUES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the various advanced optimization tools.
- To provide an understanding to deal with ill identified and fuzzy problems.

MODULE I INTRODUCTION **7**

Review of conventional optimization techniques - limitations - limitation of exhaustive search - need for artificial intelligence - bio mimicking methods

MODULE II HEURISTICS METHODS **8**

Introduction – Advanced methods of algorithm design: Greedy method, Backtracking method, Divide and Conquer method – Dynamic programming – Heuristics exploration algorithms – Greedy search - Local search – Hill climbing – Tabu search – Gradient search – Beam search – Simulated Annealing.

MODULE III GENETIC ALGORITHM **7**

Introduction - Basics of GA – Population – Reproduction – Cross over – Mutation -genetic algorithms in search, optimization and machine learning-practical genetic algorithms.

MODULE IV ANT COLONY OPTIMIZATION **8**

Introduction: Ant Colony Optimization – Meta-heuristic Optimization – History – The ACO Meta-heuristic – ACO Algorithms: Main ACO – Ant system – Ant colony system – Max-Min Ant system – Applications: Routing in telecommunication networks – Travelling salesmen – Graph Coloring – Advantages & Disadvantages

MODULE V FUZZY LOGIC AND ANN **8**

Fuzzy logic, knowledge representation and inference mechanism – Fuzzy and expert control – standard Takagi-Sugeno mathematical characterizations – Design example – Biological foundations to intelligent systems: Artificial neural networks, Back-propagation networks, Radial basis function networks, and recurrent networks.

MODULE VI IMPLEMENTATIONS & APPLICATIONS 7

Reduction of size of an optimization problem – multilevel optimization – parallel processing – multi objective optimization – Job shop scheduling – Vehicle scheduling – Line balancing – Sensor integration.

L – 45; Total Hours –45

REFERENCES:

1. Singiresu S. Rao, “Engineering optimization – Theory and practices”, John Wiley and Sons, 1996.
2. Ravindran – Phillips –Solberg, “Operations Research – Principles and Practice, John Wiley and Sons, 1987.
3. Fredrick S.Hillier and G.J.Liberman, “Introduction to Operations Research”, McGraw Hill Inc. 1995.
4. Kalymanoy Deb, “Optimization for Engineering Design”, PHI, 2003
5. Christos H. Papadimitriou, Kenneth Steiglitz, Combinatorial Optimization, PHI 2006

OUTCOMES:

At the end of the course student will be able to

1. Formulate a real life situation as an optimization the problem.
2. Identify the appropriate solution methodology and provide a solution

GECX207 MATLAB SIMULINK

L	T	P	C
3	0	0	3

OBJECTIVES:

- Teach students how to mathematically model engineering systems
- Teach students how to use computer tools to solve the resulting mathematical models. The computer tool used is MATLAB and the focus will be on developing and solving models of problems encountered in engineering fields

MODULE I INTRODUCTION MATLAB DATA PRESENTATION 7

Vectors, Matrices -Vector/Matrix Operations & Manipulation- Functions vs scripts- Making clear and compelling plots-Solving systems of linear equations numerically and symbolically- Least squares regression -Curve fitting.

MODULE II MATLAB PLOT FUNCTION 7

Introduction- Plot Function – Animation- 3D Plots-Customizing Plots – Plot Applications- Saving &Painting Plots.

MODULE III ROOT FINDING AND COMPUTER REPRESENTATION OF NUMBERS 7

Linearization and solving non-linear systems of equations- The Newton-Rapson method- Integers and rational numbers in different bases- Floating point numbers- Round off and errors in basic arithmetic-Significant digits when reporting results

MODULE IV ORDINARY DIFFERENTIAL EQUATIONS 8

Numerical integration and solving 1^{st} order, ordinary differential equations (Euler's method and Runge-Kutta)- Use of ODE function in MATLAB

MODULE V NON-LINEAR DIFFERENTIAL EQUATIONS 8

Converting 2^{nd} order and higher ODEs to systems of 1^{st} order ODEs- Solving systems of ODEs via Euler's method and Runge-Kutta)- Solving single and systems of non-linear differential equations by linearization-Use of the function ODE in MATLAB to solve differential equations

MODULE VI INTRODUCTION OF SIMULINK 8

Simulink & its relations to MATLAB – Modeling a Electrical Circuit- Modeling a fourth order differential equations- Modeling the solution of three equations with three unknowns- Representing a model as a subsystem-Simulink demos.

L – 45; Total Hours –45

REFERENCES:

1. Griffiths D V and Smith I M, Numerical Methods for Engineers, Blackwell, 1991.
2. Laurene Fausett, Applied Numerical Analysis Using MATLAB, Pearson 2008.
3. Moin P, Fundamentals of Engineering Numerical Analysis, Cambridge University Press, 2001.
4. Wilson HB, Turcotte LH, Advanced mathematics and mechanics applications using MATLAB. CRC Press, 1997
5. Ke Chen, Peter Giblin and Alan Irving , Mathematical Exploration with MATLAB, Cambridge University Press, 1999.

OUTCOMES:

At the end of this unit students will be able to:

1. Use Matlab as a convenient tool for solving a broad range of practical problems in engineering from simple models to real examples.
2. Write programs using first principles without automatic use of built-in ones.
3. Write programs for solving linear and nonlinear systems, including those arising from boundary value problems and integral equations, and for root-finding and interpolation, including piecewise approximations.
4. Be fluent in exploring Matlab's capabilities, such as using matrices as the fundamental data-storage unit, array manipulation, control flow, script and function m-files, function handles, graphical output.
5. Make use of Maltab visual capabilities for all engineering applications.
6. An ability to identify, formulate, and solve engineering problems. This will be accomplished by using MATLAB to simulate the solution to various problems in engineering fields

GECX208	EMBEDDED SYSTEMS AND ITS APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide a detailed overview of embedded system.
- To equip students with the software development skills necessary for practitioners in the embedded systems field.
- To understand entire software development lifecycle and examine the various issues involved in developing software for embedded systems.

MODULE I EMBEDDED SYSTEMS OVERVIEW 8

Introduction –Embedded Systems vs. General computing systems- Fundamental Components of embedded systems- Characteristics- Challenges-Examples- Embedded System design process.

MODULE II EMBEDDED COMPUTING PLATFORM 8

Overview of Processors and hardware units in an embedded system-CPU buses – Memory devices –Memory types- I/O devices – Designing with computing platforms- Consumer electronics architecture-Design example: Alarm clock.

MODULE III REAL TIME EMBEDDED SYSTEMS 8

Programming embedded systems in assembly and C – Real time systems – Hard and Soft real time systems- Need for RTOS in Embedded Systems- Multiple tasks and processes –Context switching-Scheduling policies- Interprocess communication and synchronization.

MODULE IV EMBEDDED SOFTWARE DEVELOPMENT PROCESS and TOOLS 8

Development process of an embedded system-software modules and tools for implementation of an embedded system- Integrated development environment- Host and target machines-cross compiler-cross assembler-Choosing right platform.

MODULE V PROGRAM MODELING IN EMBEDDED SYSTEMS 8

Program Models – Data Flow Graph model-control DFG model-Synchronous DFG model- Finite state machines- UML modeling – UML Diagrams.

MODULE VI EMBEDDED SYSTEMS APPLICATION 5

Application specific embedded system – case study: digital camera hardware and software architecture, embedded systems in automobile, embedded system for a smart card.

Total Hours –45

TEXT BOOKS:

1. Marilyn Wolf , "Computers as components", Elsevier 2012.
2. Shibu. K.V, “Introduction to Embedded Systems”, Tata Mcgraw Hill,2009.
3. Rajkamal, "Embedded Systems Architecture, Programming and Design",1st Reprint,Tata McGraw-Hill, 2003
4. Frank Vahid and Tony Gwargie, "Embedded System Design", John Wiley & sons, 2002.

REFERENCES:

1. Sriram V Iyer and PankajGupta ,”Embedded Realtime Systems Programming ”Tata McGraw-Hill,2008
2. Qing Li and Carolyn Yao," Real-Time Concepts for Embedded Systems", CMPBooks, 2003
3. David E.Simon, "An Embedded Software Primer", Pearson Education, 2003

OUTCOMES:

On completion of this course, the students will be able to

- Identify the suitable processor and peripherals in embedded applications
- Develop embedded programs in assembly and c
- Choose the right platform for designing an embedded system
- Explore different scheduling mechanism in rtos
- Design the program model for embedded applications.
- Analyze different domain specific applications in embedded systems.

GECX209 USABILITY ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

The objective of this course is

- To understand the emerging concept of usability, requirements gathering and analysis.
- To learn about human computer interaction with the help of interfaces that has high usability.

MODULE I INTRODUCTION 6

Cost Savings – Usability Now – Usability Slogans – Discount Usability Engineering – Usability – Definition – Example – Trade-offs – Categories – Interaction Design – Understanding & Conceptualizing Interaction – Cognitive Aspects.

MODULE II USER INTERFACES 8

Generation of User Interfaces – Batch Systems, Line Oriented Interfaces, Full Screen Interfaces, Graphical User Interfaces, Next Generation Interfaces, Long Term Trends – Usability Engineering Life Cycle – Interfaces – Data Gathering – Data Analysis Interpretation and Presentation.

MODULE III INTERACTION DESIGN 8

Process of Interaction Design - Establishing Requirements – Design,Prototyping and Construction - Evaluation and Framework.

MODULE IV USABILITY TESTING 8

Usability Heuristics – Simple and Natural Dialogue, Users' Language, Memory Load, Consistency, Feedback, Clearly Marked Exits, Shortcuts, Error Messages, Prevent Errors, Documentation, Heuristic Evaluation – Usability Testing - Test Goals and Test Plans, Getting Test Users, Choosing Experimenters, Ethical Aspects, Test Tasks, Stages of a Test, Performance Measurement, Thinking Aloud, Usability Laboratories.

MODULE V USABILITY ASSESSMENT METHODS 8

Observation, Questionnaires and Interviews, Focus Groups, Logging Actual Use, User Feedback, Usability Methods – Interface Standards - National, International and Vendor Standards, Producing Usable In-House Standards.

MODULE VI USER INTERFACES 7

International Graphical Interfaces, International Usability Engineering, Guidelines for Internationalization, Resource Separation, Multilocale Interfaces – Future Developments – Case Study.

L – 45; Total Hours –45

TEXT BOOKS:

1. Yvonne Rogers, Helen Sharp, Jenny Preece, “Interaction Design: Beyond Human - Computer Interaction”, John Wiley & Sons, 3rd Edition, 2011 (Module I, II, III).
2. Jakob Nielsen, “Usability Engineering”, Morgan Kaufmann Academic Press, 1994. (Module I – VI).

REFERENCES:

1. Ben Shneiderman, Plaisant, Cohen, Jacobs, “Designing the User Interface: Strategies for Effective Human Interaction”, Pearson Education, 5th Edition, 2010.
2. Laura M. Leventhal, Julie A. Barnes, “Usability Engineering: Process, Products, and Examples”, Pearson/Prentice Hall, 2008

OUTCOMES:

Students who complete this course will be able to

- build effective, flexible and robust user interfaces.
- translate system requirements into appropriate human/computer interaction sequences.
- choose mode, media and device for the application requirements.

GECX210 SUPPLY CHAIN MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the various decision phases in a supply chain
- To be aware of the Supply Chain and its drivers
- To design Supply Chain Network
- To build a aggregate plan in supply chain
- To understand Sourcing Decisions in Supply Chain
- To comprehend the influence of Information technology in Supply Chain

MODULE I INTRODUCTION TO SUPPLY CHAIN 7

Understanding Supply Chain - Decision phases - Supply chain performance - Competitive and supply chain strategies - Achieving strategic fit - Expanding strategic scope

MODULE II SUPPLY CHAIN DRIVERS AND DESIGN 7

Drivers of supply chain performance – Designing distribution network - Network Design in the Supply Chain - Network design in Uncertain Environment

MODULE III AGGREGATE PLANNING AND MANAGING SUPPLY, DEMAND AND INVENTORY 8

Aggregate Planning in a Supply chain: role - Managing Supply - Managing Demand in Supply Chain – Cycle and Safety inventory in supply chain – Level of product availability.

MODULE IV MANAGING INVENTORY IN SUPPLY CHAIN 8

Managing Economies of Scale in a Supply Chain : Cycle Inventory- Managing uncertainty in a Supply Chain Safety Inventory- Determining optimal level of Product Availability

MODULE V SOURCING AND TRANSPORTATION 8

Sourcing decision in supply chain - Third and Fourth – Party Logistics providers - Supplier scoring and assessment - Transportation in a Supply Chain – Risk and Trade-offs in transportation design.

MODULE VI INFORMATION TECHNOLOGY IN A SUPPLY CHAIN 7

Information technology in a supply chain – CRM, ISCM, SRM in supply chain -

Over view of recent trends in Supply Chain: e-SRM, e-LRM, e-SCM.

L – 45; Total Hours –45

REFERENCES:

1. Sunil Chopra and Peter Meindl, “Supply Chain Management-Strategy Planning and Operation”, Pearson Education, 5th Indian Reprint, 2013.
2. Jananth Shah “Supply Chain Management – Text and Cases“ Pearson Education, 2008.
3. Altekar Rahul V, “Supply Chain Management-Concept and Cases”, Prentice Hall India, 2005.
4. Monczka et al., “Purchasing and Supply Chain Management”, Thomson Learning, 2nd Edition, 2nd Reprint, 2002.

OUTCOMES:

- After taking up the course the student will be able to brighten his prospects of taking up a career on supply chain management.
- The student decision making capability specific to supply chain issues in an industry is improved.
- The student can plan a well defined execution of supply chain strategy in companies.
- The student will be able to design a optimal distribution network as per the demands of the industry.
- The student can also determine the most favorable transportation plan for a company.
- The student will also be able to bring in company from paper environment to paperless environment.

GECX211 SYSTEMS ANALYSIS AND DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To describe the phases of the systems development life cycle
- To teach the automated tools for system development
- To develop and evaluate system requirements.
- To explain the organizational issues in system implementation
- To teach the usability testing and electronic data interchange
- To elucidate the importance of System analysis and design in electronic commerce.

MODULE I FUNDAMENTALS OF SYSTEM DEVELOPMENT 8

System Concept – Characteristics – Elements of System – Types of System – Modern Approach to System Analysis and Design – System Development Life Cycle – Approaches to Improving Development – Tools for System Development – Succeeding as a System Analyst – Skills – Managing the Project.

MODULE II AUTOMATED TOOLS FOR SYSTEMS DEVELOPMENT 7

What is requirements determination? Fact finding techniques, Tools for documenting procedure and decision-CASE Tools-Need for CASE tools-Reverse engineering and reengineering- phases of the software life cycle-Ranking projects-Value Chain Analysis- Corporate Strategic Planning vs. Information Systems Planning.

MODULE III SYSTEM ANALYSIS 8

Determining System Requirements – Traditional Methods - Modern Methods – Radical Methods – Structuring System Requirements – Process Modeling – Data Flow Diagramming – Logic Modeling – Conceptual Data Modeling – E-R Modeling.

MODULE IV SYSTEM DESIGN 8

System Implementation – Software Application Testing – Installation – Documentation – Training and Support – Organizational Issues in Systems Implementation – Maintaining Information System – Conducting System Maintenance.

MODULE V USABILITY AND MEASURING USER SATISFACTION **7**

Usability Testing-User satisfaction test- A tool for analyzing user satisfaction – Unified Modeling Language(UML)- Case study: System Design: Application in Human Resource-Financial Applications

MODULE VI SAD IN E-COMMERCE **7**

Systems analysis and design in the era of electronic commerce: B2B, B2C and C2C e-commerce -advantages and disadvantages of e-commerce. E-commerce system architecture – physical networks, logical network, World Wide Web, web-services - HTML, XML - case studies-El electronic data interchange: EDI standards - virtual private networks - XML and EDI

L – 45; Total Hours –45

REFERENCES:

1. Jeffrey A. Hoffer, Joey F. George, Joseph S. Valacich, “Modern Systems Analysis and Design”,Fifth Edition, Prentice Hall,March 2007.

2.Ned Kock, “Systems Analysis & Design Fundamentals” Sage South Asia, May 2008.

3. Joseph S. Valacich, Jeffrey A. Hoffer, Joey F. George, “Essentials Of System Analysis And Design” Prentice Hall , August 2005.

4. Rumbaugh et al, “Succeeding with Booch and Rambaugh Methods”, Addisson Wesley, second Edition, 1998.

5.Larman, C.,” Applying UML and Patterns. An introduction to Object-Oriented Analysis and Design”. Prentice-Hall PTR, 2002.

OUTCOMES:

- List the characteristics of the system and specify the approaches in the development of the system.
- Summarize the phases of the software life cycle
- Differentiate Corporate Strategic Planning and Information Systems Planning.
- Illustrate the system requirements through various modeling diagrams.
- Use tools and techniques for process and data modeling.
- Solve realistic systems analysis problems and perform user satisfaction test.

GECX212 ADVANCED MATERIALS

L	T	P	C
3	0	0	3

OBJECTIVES:

To make the student conversant with

- Dielectric materials
- Magnetic materials
- Energy materials
- Nano materials
- Semi conductors
- Smart materials

MODULE I **8**

Dielectric Materials- Polarization and Mechanism-Internal or local field-Clausius-Mossotti relation- Dielectric loss- Temperature and Frequency effect-Measurement of Dielectric constant and loss using Scherring bridge- electric break down- ferro, piezo, pyroelectric materials and its application.

MODULE II **8**

Magnetic Materials- Terminology and classification of magnetic materials (Dia, Para, Ferro & Ferri) – Magnetic moments due to electrospin – Domain theory of Hysteresis – Heisenberg theory of Exchange Interaction (without derivation)- Structure and properties of Ferrites- Properties of Soft and Hard Magnetic Materials- Application: floppy disk, CD ROM, Magneto optical recording.

MODULE III **8**

Energy Materials (Nuclear) - Introduction to nuclear materials- Materials for nuclear fuel in fission and fusion reactors, Fissile and fertile materials- Control & Construction Materials for Nuclear reactors, Moderators, Heat Exchangers- Radiation proof materials- Brief discussion of safety and radioactive waste disposal.

MODULE IV **7**

Nano Materials- The nanosize range- classification of nanomaterials- processing of nanomaterials-properties of nanomaterials- mechanical, electrical, magnetic properties- other properties- carbon based nanomaterials- other nanomaterials and its application.

MODULE V **7**

Semiconductors- The energy gap in solids-Extrinsic Semiconductors- Intrinsic Semiconductors- Hall Effect in semiconductors- Application of Hall Effect- Basic ideas of compound semiconductors -Semiconductor materials- Fabrication of Integrated Circuits- Some semiconductor Devices

MODULE VI **7**

Smart materials- aerospace materials Ni and Co based super alloys, Special steels, Titanium alloys, Intermetallics, ceramics and their composites, New High strength material, Properties of Materials, Materials in Medical Applications, Stainless steel alloys,Cobalt based alloys, titanium based alloys, polymers

L – 45; Total Hours –45

REFERENCES:

1. Materials science and Engineering: A first course by V. RAGHAVAN, 6th ed., Eastern Economy edition,Prentice Hall of India,2015
2. Materials science and Engineering: An Introduction by William D. Callister Jr., 7th ed. John Wiley & Sons Inc. 2007
3. Material science by Dr.M.Arumugam, Anurasha agencies ,third revised edition ,2002

OUTCOMES:

Students will be able to know

- significance of dielectric materials
- types and applications of magnetic materials
- applications of nuclear materials for energy harvesting
- applications of nano materials
- significance of semi conductor devices
- applications of smart materials

GECX213	NATIONAL SERVICE SCHEME	L	T	P	C
		2	0	0	2

OBJECTIVES:

Primary Objective: Personality development through community service.
To achieve the above objective, the following should be adhered:

1. To provide an understanding about the aims, structure and programmes and activities of National Service scheme in terms of Nation Building
2. To develop certain basic skills for personality development through community development.
3. Understand the community in which they work and their relation
4. Identify the needs and problems of the community and involve them in problem-solving and
5. Practice national integration and social harmony.

MODULE I INTRODUCTION TO NSS 8

Orientation and structure of NSS,-Aims and Objectives of National Service Scheme- The history of NSS- Symbol and meaning- NSS hierarchy from national to college level – Role and responsibilities of various NSS functionaries

MODULE II PERSONALITY AND COMMUNITY DEVELOPMENT SKILLS 8

Importance of youth Leadership, Traits of Good Leadership and Personality Development. Role of youth in creating awareness through NSS Programmes on Health & Hygiene; Environmental Conservation and Enrichment for Sustainable Development; Sanitation and Swachh Bharat.

MODULE III UNDERSTANDING YOUTH 7

Definition and Profiles of youth categories, Youth Issues, Challenges and Opportunities for Youth, Youth as agent of social change & Community Mobilization .Role of Youth in Nation Building. National Youth Policy.

MODULE IV SOCIAL HARMONY AND NATIONAL INTEGRATION 7

National Integration, Various obstacles in the way of National Integration; such as caste, religion, language and provisional problems etc. Role of youth in Peace building and conflict resolution- Globalization and its Economic Social Political and

Cultural impacts.

L – 30; Total Hours –30

TEXT BOOKS:

1. National Service Scheme – A Youth Volunteers Programme for Under Graduate students as per UGC guidelines J.D.S.Panwar et al. Astral International. New Delhi.
2. National Service Scheme Revised Manual, 2006.Govt. of India. Ministry of Youth Affairs & Sports. New Delhi.
3. Social Problems in India, *Ram Ahuja.*

REFERENCES:

1. National Youth Policy-2014. Ministry of Youth Affairs & Sports. .Govt. of India

OUTCOMES:

On successful completion of this course-

- Students will have exposure to the the aims, structure and programmes and activities of National Service scheme in terms of Nation Building
- Students will be trained to skills for personality development through community development.
- Students will gain knowledge about national integration and social harmony.
- Students will be exposed to the role of youths in Nation building Students will gain

GECX214	AUTOMOTIVE POLLUTION AND CONTROL	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To have a fair knowledge in automotive pollution control.
- To understand the concept of formation and control techniques of pollutants like UBHC, CO, NOx, particulate matter and smoke for both SI and CI engine will be taught to the students.
- To know about the instruments for measurement of pollutants
- To get introduced about emission standards

MODULE I EMISSION FROM AUTOMOBILES 8

Sources of Air Pollution. Various emissions from Automobiles — Formation — Effects of ollutants on environment and human beings. Emission control techniques – Modification of fuel, after treatment devices. Emission standards. Automotive waste management, old vehicle disposal, recycling, tyre recycling

MODULE II SI ENGINE EMISSIONS AND CONTROL 9

Emission formation in SI Engines- Carbon monoxide & Carbon di oxide - Unburned hydrocarbon, NOx, Smoke —Effects of design and operating variables on emission formation – controlling of pollutants - Catalytic converters, Charcoal Canister, Positive Crank case ventilation system, Secondary air injection, thermal reactor

MODULE III CI ENGINE EMISSION AND CONTROL 8

Formation of White, Blue, and Black Smokes, NOx, soot, Effect of Operating variables on Emission formation — Fumigation, Split injection, Catalytic Coating, EGR, Particulate Traps, SCR, Fuel additives — Cetane number Effect.

MODULE IV NOISE POLLUTION FROM AUTOMOBILES 8

Sources of Noise — Engine Noise, Transmission Noise, vehicle structural Noise, aerodynamics noise, Exhaust Noise. Noise reduction in Automobiles — Encapsulation technique for noise reduction —Silencer Design.

MODULE V TEST PROCEDURES 6

Constant Volume Sampling I and 3 (CVSI &CVS3) Systems- Sampling Procedures — Chassis dynamometers - Seven mode and thirteen mode cycles for Emission Sampling.

MODULE VI EMISSION MEASUREMENTS 6

Emission analysers —NDIR, FID, Chemiluminesecent, Smoke meters, Dilution Tunnel, SHED Test, Sound level meters.

L – 45; Total Hours –45

TEXT BOOKS:

1. V.Ganesan, 'Internal combustion Engines', Tata McGraw Hill Book Co, Eighth Reprint, 2005.
2. Crouse and Anglin, 'Automotive Emission Control', McGraw Hill company., Newyork 1993.

REFERENCES:

1. G.P.Springer ad D.J.Patterson, Engine Emissions, Pollutant formation, Plenum Press, New York. 1986.
2. D.J.Patterson and N.A.Henin, 'Emission from Combustion Engine and their control', Anna Arbor Science Publication,1985.
3. L.Lberanek, 'Noise Reduction', Mcgrawhill Company., Newyork1993.
4. C.Duerson, 'Noise Abatment', Butterworths ltd., London1990.
5. A.Alexander, J.P.Barde, C.lomure and F.J. Langdan, 'Road traffic noise', Applied science publisher ltd., London,1987.

OUTCOMES:

On completion of the course student should be able to

- Identify the sources of emission from vehicles.
- Analyse the causes and effects of emissions.
- Analyse causes and effects of noise pollution
- Bring out solutions for control of emissions.
- Demonstrate the test procedures and emission norms.
- Select suitable instruments for measurement of emissions.

GECX215	MOTOR VEHICLE ACT, INSURANCE & POLICY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn about basic act and regulation followed for road vehicle
- To learn about systematic steps involved to get licence and registration of motor vehicle
- To learn arbour various types of motor vehicle polices and insurances

MODULE I BASIC RULES FOR ROAD VEHICLE 8

Display and Use of Number Plates- Attachment of number plates- Number plates in horizontal position- Removal of number plates on transfer- Hours prescribed for lighted lamps- Mounting of lamps and reflectors- Multiple beam headlamps- Daytime running lamps- Auxiliary driving lamps- Parking lamps- Brakes- Stopping distances- Emergency or parking brakes- Horn- Muffler- Mirrors- Inspection of motor vehicles- Standards of safety and repair

MODULE II LICENSING OF DRIVERS OF MOTOR VEHICLES 8

Necessity of driving licence- Age limit in connection with driving of motor vehicle-Responsibility of owners of motor vehicles-Restriction on the holding of driving licence-Grant of learner's licence-Grant of driving licence-Addition to driving licence- Renewal of driving licence-Revocation of driving licence on grounds of disease or disability-Driving licence to drive motor vehicle belonging to the central government- power of court to disqualify- suspension of driving licence in certain cases- suspension or cancellation of driving licence on convection- Endorsement.

MODULE III REGISTRATION OF MOTOR VEHICLE 7

Necessity for registration – Registration Where and how to be made- Special provision for registration of motor vehicle of diplomatic officers-Temporary registration- Production of vehicle at the time of registration- Refusal of registration- renewal of certificate of registration- effectiveness in India of registration- Change of residence or place of business-transfer of ownership-Suspension of registration – cancellation of registration suspended under section 53- certificate of fitness of transport vehicle-cancellation of registration.

MODULE IV INSURANCE OF MOTOR VEHICLE 8

Necessity for insurance against third party – Requirements of policies and limits of liability- - Duty of insurers to satisfy judgements and awards against person insured in respect of third party risks-Duty to give information as to insurance-Settlement between insurers and insured persons- transfer of certificate of insurance-production of certain certificates, licences and permit in certain cases-Special provisions as to compensation in case of hit and run motor accident – Types of motor polices

MODULE V CONTROL OF TRANSPORT VEHICLES 7

Power to State Government to control road transport- Transport authorities-General provision as to applications for permits- Application for stage carriage permit- Procedure of Regional Transport Authority in considering application for stage carriage permit- Scheme for renting of motor cabs- Application for private service vehicle permit- Procedure in applying for and granting permits- Duration and renewal of permits- Transfer of permit- Replacement of vehicles-Temporary permits

MODULE VI OFFENCES AND PUNISHMENT 7

Driving without holding an effective driving licence- Driving by an under-aged person (Minor driving vehicle)- Holding of a driving licence permitting it to be used by other person.- Driving a vehicle at an excessive speed- Driving or permitting to drive a vehicle carrying excess load- Driving dangerously / its Abetment Driving an uninsured vehicle

Rider and pillion rider failing to wear protective head gear (Helmet) -Violation of Mandatory Signs -.e-challan and spot challan

L – 45; Total Hours –45

TEXT BOOKS:

1. The motor vehicle act 1988, Universal law publishing co.cpvt ltd. Newdelhi 2011
2. A Commentary On The Motor Vehicles Act, 1988 by SUKHDEV AGGARWAL The Bright Law House, New Delhi

REFERENCES:

1. The Motor Vehicles Act, 1988 Along with Latest Case Law, Notifications

& Table of Offences and Punishments Asia Law House; 15th edition (2014)

2. Assessment of Compensation in Accidents under Motor Vehicles Act by Karkara Delhi Law House (2013)

OUTCOMES:

On completion of the course students should be able to

- Explain the analysis of rules and regulations for road vehicles
- Analyze the procedure for getting driving license for vehicles at national and international level
- Analyze the procedure for registration of vehicles.
- Analyze the procedure for Insurance of vehicles and claims.
- Analyze the procedure for obtaining Government Permits and renewal
- Analyze the consequences of not following the rules and regulations

GECX216	PRINCIPLES OF COMMUNICATION SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

To introduce the analog and digital modulation techniques.
To elaborate the working of communication receivers in the presence of noise.
To give an overview of various communication systems.

MODULE I LINEAR MODULATION 8

Baseband signals, Amplitude Modulation – Modulation Index, Power Transmitted, Double Side Band and Single Side Band AM, AM Modulators and AM Receivers, AM Radio systems, Frequency Division Multiplexing.

MODULE II ANGLE MODULATION 8

Frequency Modulation and Phase Modulation, Frequency deviation and modulation index, Bandwidth of FM, FM Modulators and FM receivers, FM Radio and FM Stereo Systems

MODULE III SAMPLING AND PULSE MODULATION 7

Sampling, Nyquist's Sampling Theorem, Pulse Modulations - PAM, PPM and PWM, Time Division Multiplexing, Bandwidth of TDM systems.

MODULE IV DIGITAL COMMUNICATION 7

Digital baseband data, Digital Modulations – ASK, FSK, PSK and QPSK. Digital Communication Transmitters and Receivers.

MODULE V NOISE 8

Sources of Noise, Thermal Noise, shot noise, White noise, Narrow band Noise, Effect of noise in communication, SNR, Receiver Noise Temperature and Noise Equivalent Bandwidth.

MODULE VI COMMUNICATION SYSTEMS & NETWORK 7

FM Radio Systems, Cellular Mobile network, Satellite Communications, Optical Fiber Communication.

L – 45; T – 0; Total Hours – 45

TEXT BOOKS:

1. A. Bruce Carlson, Paul B. Crilly, "Communication Systems", 5th Edition,

McGraw Hill Int., 2011.
2. B.P. Lathi, Zhi Ding, Hari M. Gupta, “Modern Digital and Analog Communication Systems”, 4th Edition, Oxford University Press, 2017.

REFERENCES:

1. Herbert Taub, Donald L. Schilling, Goutam Saha, “Principles of Communication Systems” 4th Edition, McGraw Hill Int. 2013.
2. Simon Haykin, “An Introduction To Analog And Digital Communications”, 1st Edition, Wiley India, 2010.
3. Simon Haykin , “Communications Systems” 4th Edition, Wiley India, 2006.
4. Hwei P. Hsu, “Analog and Digital Communications” 3rd Edition,

OUTCOMES:

On completion of the course students will be able to

1. Identify various communication systems and the corresponding modulation schemes.
2. Predict the characteristics of various analog and digital modulation schemes.
3. Interpret the effect of noise and bandwidth in a communication systems
4. Apply the Nyquist criteria for a given baseband signals.
5. Evaluate the performance of communication receivers.
6. Demonstrate the applications of common communication systems.

GECX217 **LEAN MANAGEMENT** **L T P C**

3 1 0 4

OBJECTIVES:

The objective of the Course to make the student know about

- the basics of lean production management,
- how Lean principles are applied to the Construction industry to improve the operation management and product development.

MODULE I **8**

lean production? – Introduction, background, and lean thinking. Importance of philosophy, strategy, culture, alignment, focus and systems view. Discussion of Toyota Production System.

MODULE II **8**

Manufacturing systems – an overview of manufacturing strategies. Job shops, batch flow, and flexible manufacturing systems Flow production and lean production systems

MODULE III **7**

Value stream mapping in process design and product development Waste reduction - lead time reduction

Process cycle time and value-added vs. non-value added activities Optimum lot sizing

MODULE IV **8**

Lean production processes, approaches and techniques.—Importance of focusing upon flow. Tools -. Workplace organization – 5S. - Stability. - Just-In-Time – One piece flow – Pull. - . Cellular systems. - . Quick change and set-up reduction methods. f. Total productive maintenance. -. Poka-Yoke – mistake proofing, quality improvement. Standards. - . Leveling. - . Visual management. Just-in-time techniques – SMED and Takt Times - Standard work processes and line balancing Poka-yoke and pull systems material handling reduction and facilities planning

MODULE V **8**

Managing change in the lean organization Human resource management and the lean enterprise Employee involvement – Teams – Training – Supporting and encouraging involvement – Involving people in the change process -- communication -- Importance of culture. Startup of lean processes and examples of applications.

Sustaining improvement and change, auditing, follow-up actions.

7

MODULE VI

The lean enterprise and supply chain management Costs and risks of lean initiatives - Measuring lean initiatives

L – 45; Total Hours –45

TEXT BOOKS:

1. The Toyota Way Fieldbook, Jeffrey Liker and David Meier, McGraw-Hill, 2006. Lean Production Simplified, Pascal Dennis, Productivity Press, 2007.
2. Womack, James P., and Daniel T. Jones. Lean Thinking. New York, NY: Simon and Schuster, 2003. ISBN: 0743249275.
3. Murman, Earll. Lean Enterprise Value. New York, NY: Palgrave Macmillan, 2002. ISBN: 0333976975.

REFERENCES:

1. Readings at http://www.leanconstruction.org/readings.htm
2. Hopp, W. J., and Spearman, M. L. (2011). Factory Physics, Third Edition, Waveland Press, Long Grove, Il. 720 pp.

OUTCOMES:

The student will be able to

- Describe the manufacturing approaches employed and the background and philosophy of lean production.
- Illustrate the concept of waste reduction
- Apply evaluation techniques that can be used in preparation for and use in learn production activities.
- Select the tools that can be used implementing lean production in production operations.
- Discuss the importance of workplace organization, pull production, cellular arrangement and employee involvement, need for employee creativity
- Describe about the Methods for promoting success in implementing lean transformations

GECX218 GEOSPATIAL MODELING & ANALYSIS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To equip the students with fundamental representation and analysis of geospatial phenomena and provides foundations in methods and algorithms used in GIS analysis.
- To focus is on terrain modeling, geomorphometry, watershed analysis and introductory GIS-based modeling of landscape processes (water, sediment). The course includes analysis from lidar data, coastal change assessment and 3D visualization.

MODULE I INTRODUCTION TO GEOSPATIAL DATA 7

Mapping natural phenomena –Concept of continuous fields and discrete sampling – Units, projections, coordinate transformation – Georeferencing, geospatial formats, conversions, geospatial data abstraction library – Raster and vector representation, raster and vector conversions and resampling.

MODULE II DATA DISPLAY AND VISUALIZATION 7

Display of continuous and discrete data, use of color, shading, symbols, to extract the spatial pattern and relationships – 3D visualization: multiple surfaces and volumes, 3D vector objects – visualization for data analysis (lighting, scaling, transparency, cutting planes, animations) – view/create maps/post your data on-line (Google Earth/Maps, GPS visualizer)

MODULE III GEOSPATIAL ANALYSIS 7

Foundations for analysis of continuous and discrete phenomena – neighborhood operations and buffers – analysis and modeling with map algebra – cost surfaces and least cost path – spatial interpolation and approximation (gridding)

MODULE IV TERRAIN MODELING AND ANALYSIS 9

terrain and bathymetry mapping – mathematical and digital representations (point clouds, contour, raster, TIN) – DEM and DSM, working with multiple return lidar data – spatial interpolation of elevation data and topographic analysis, line of sight, view shed analysis – solar irradiation, photovoltaic energy potential, time series of elevation data, analysis of coastal change.

MODULE V FLOW TRACING, WATERSHED ANALYSIS AND LANDFORMS **8**

Methods for flow routing and flow accumulation – Extraction of stream networks – Extraction of watershed boundaries and building watershed hierarchies – feature extraction, types of landforms.

MODULE VI MODELING OF GEOSPATIAL PROCESSES **7**

Model formulation, input data processing – introduction to GIS-based hydrologic, erosion and environmental modeling – Geocomputational methods, including agent-based modeling, artificial neural networks and evolutionary computing.

L – 45; T – 0; Total Hours –45

TEXT BOOKS:

1. Hassan A, Karimi (2017), *Geospatial Data Science Techniques and Applications*, CRS Press & Co.
2. Sudipto Banerjee, Bradley P, Carlin, Alan E. Gelfand (2014), *Hierarchical Modeling and Analysis for Spatial Data*, CRS Press & Co.

REFERENCES:

1. Maguire, D., M. Batty, and M. Goodchild. 2015. GIS, Spatial analysis, and modeling. ESRI Press (G70.212 .G584 2005)
2. Zeiler, M. 2010. Modeling Our World: The ESRI Guide to Geodatabase Design. Second Ed. ESRI Press, Redlands, California

OUTCOMES:

On successful completion of this course,

- Students will be able to apply the basic concepts of Conceptualize models as representations of real life systems with inputs, outputs, and processes.
- Students will have gained knowledge in spatial tools to make simulations and predictions of real life phenomena.
- Students will have synthesized knowledge about Apply, integrate, and develop models with geospatial data through a GIS.
- Students will have an overview of Evaluate models in terms of accuracy, sensitivity, and uncertainty.
- Students will have Use of a system-based approach for problem solving, with an emphasis on sustainability.

B.S. Abdur Rahman Crescent Institute of Science & Technology
Deemed to be University u/s 3 of the UGC Act, 1956

REGULATIONS 2017

CURRICULUM AND SYLLABI

B.Tech.

INFORMATION TECHNOLOGY

DEPARTMENT OF INFORMATION TECHNOLOGY

VISION AND MISSION

VISION

- To be a leader in providing quality education and training in the field of Information Technology at Undergraduate and Postgraduate levels and undertake Research activities thereby contributing to the progress of the country.

MISSION

- To impart quality education and inculcate professionalism to suit the needs of the industries and society.
- To involve graduates in undertaking need based Research activities and disseminate the knowledge to develop entrepreneurial skills.
- To improve the professionalism through extension activities, industrial visits and in-plant training.
- To improve communicate effectively both in documentation and presentation.
- To create awareness of social,economic responsibilities ethically.

PROGRAMME EDUCATIONAL OBJECTIVES

- To provide students with core competence in mathematics, science and engineering concepts essential to formulate, analyze and solve hardware / software engineering problems.
- To impart students with good breadth of knowledge in the core areas of information technology and related engineering so as to comprehend engineering trade-offs, analyze, design and synthesize data and technical concepts to create novel products and solutions for the real time problems.
- To train students in the use of tools and techniques for software development in different application domains and to grow as an entrepreneur.
- To prepare students to apply their knowledge and multifaceted skills to get immediate employment and excel in IT professional careers or awareness of the lifelong learning needed to continue their education in IT or related post graduate programmes to perform excellence, leadership and demonstrate good citizenship.
- To inculcate in students to maintain high professionalism and ethical standards, effective oral and written communication skills, to work as part of teams on multidisciplinary projects and diverse professional environments, and relate engineering issues to the society, global economy and to emerging technologies.

PROGRAMME OUTCOMES

On successful completion of the programme, the graduates will

- Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- Identify, formulate, research literature, and analyses complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- Use research –based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.

- Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
- To impart broad spectrum of knowledge and skill in the analysis, design, implementation and testing of software systems.
- To focus on need based research in different domains relevant to Information Technology and carry out research projects of national and social relevance.
- To provide problem solving capability through IT tools and techniques with adequate hands on experience to meet industry/ societal needs.
- To develop communication, problem solving, team spirit and leadership skills for a successful professional career.

B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE AND TECHNOLOGY

B.TECH. INFORMATION & TECHNOLOGY

CURRICULUM & SYLLABUS, REGULATIONS 2017

SEMESTER I

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	BS	MAC 1181	Differential Calculus and Geometry	3	1	0	4	
2.	HS	ENC 1181/ ISC 1181/ LNC 1181/ LNC 1182 / LNC 1183	English / Arabic / Mandarin / German / Japanese	3	0	0	3	
3.	BS	PHC 1181	Physics	3	0	2	4	
4.	BS	CHC 1181	Chemistry	3	0	2	4	
5.	ESF	GEC 1101	Engineering Graphics	2	0	2	3	
6.	ESF	GEC 1102	Engineering Design	2	0	0	2	
7.	ESF	GEC 1103	Basic Engineering Practices Laboratory	0	0	2	1	
8.	ESF	GEC 1104	Computer Programming I	1	0	2	2	**23**

SEMESTER II

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	BS	MAC 1281	Advanced Calculus	3	1	0	4
2.	BS	-	Physics Elective	2	0	2	3
3.	BS	-	Chemistry Elective	2	0	2	3
4.	ESF	GEC 1211	Basic Engineering Mechanics	3	1	0	4
5.	BS	GEC 1212	Environmental Studies	2	0	0	2
6.	ESF	GEC 1213	Computer Programming II	1	0	2	2

7.	EC	ITC 1201	Digital Principles and Applications	2	0	2	3	
8.	EC	ITC1202	Programming in Python	2	0	2	3	**24**

SEMESTER III

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	BS	MAC 2181	Partial Differential Equations and Transforms	3	1	0	4	
2.	HS	-	Humanities Elective I	2	0	0	2	
3.	HS	ENC 2181	Oral Communication	0	0	2	1	
4.	EC	ITC 2101	Data Structures	3	0	2	4	
5.	EC	ITC 2102	Computer Architecture	3	0	0	3	
6.	EC	ITC 2103	Computer Networks	3	0	0	3	
7.	EC	ITC 2104	Advanced Java & Internet Programming	3	0	0	3	
8.	EC	EEC2181	Fundamentals of Digital Signal Processing	1	0	0	1	
9.	EC	ITC 2106	Network Configuration Lab	0	0	3	1	
10.	EC	ITC 2107	Advanced Java & Internet Programming Lab	0	0	3	1	**23**

SEMESTER IV

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	BS	-	Mathematics Elective I	3	1	0	4
2.	HS	-	Humanities Elective II	2	0	0	2
3.	HS	ENC2282	Written Communication	0	0	2	1
4.	EC	ITC2211	Unix and Shell Programming	2	0	2	3
5.	EC	ITC2212	Database Management System	3	0	0	3
6.	EC	ITC2213	Operating Systems	3	0	2	4
7.	EC	ITC2214	Software Engineering	3	0	0	3

8.	EC	ITC2215	DBMS Lab	0	0	3	1	
9.	PE		Programme Elective - I				3	**24**

SEMESTER V

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	MS	MSC 3181/ MSC 3182	Leadership and CEO Training/ Social Entrepreneurship	3	0	0	3	
2.	GE	-	General Elective I	3	0	0	3	
3.	HS	ENC3181	Communication and soft skill I – Career Choice	0	0	2	1	
4.	EC	ITC3101	Object Oriented Analysis and Design	3	0	0	3	
5.	EC	ITC3102	Fundamentals of Web Designing	2	0	2	3	
6.	EC	ITC3103	Microprocessor and Microcontrollers	3	0	2	4	
7.	EC	ITC3104	Case Tools Lab	0	0	3	1	
8.	PE	-	Programme Elective - II				6	**24**

SEMESTER VI

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	MS	MSC 3181 MSC 3182	Leadership and CEO Training/ Social Entrepreneurship	3	0	0	3
2.	BS	-	Mathematics Elective II	2	0	0	2
3.	HS	ENC3281	Communication and soft skill II Confidence Building	0	0	2	1
4.	EC	ITC3211	Software Testing	3	0	0	3
5.	EC	ITC3212	Cloud Computing Technologies	3	0	0	3
6.	EC	ITC3213	Distributed Computing	3	0	0	3
7.	EC	ITC3214	Open Source Technologies	1	0	2	2

8.	EC	ITC3215	Software Development Lab	0	0	3	1	
9.	PE	-	Programme Elective - III				6	**24**

SEMESTER VII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	GE	-	General Elective II	3	0	0	3	
2.	EC	ITC4101	Internet of Things	3	0	2	4	
3.	EC	ITC4102	Information Security	3	0	0	3	
4.	EC	ITC4103	Wireless Networks	3	0	0	3	
5.	EC	ITC4104	Programming in Hadoop	0	0	2	1	
6.	PE	-	Programme Elective - IV	0	0	0	9	
7.	EC	ITC4105	Internship				1*	**24**

SEMESTER VIII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	EC	ITC4211	Project Work	0	0	24	12	**12**

Total credits – 178

* Industrial training will be undertaken during Third year summer vacation for 15 days. The credit will be awarded in the 7th Semester.

PROGRAMME ELECTIVES

IV SEMESTER ELECTIVES – I (3 CREDITS)

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	ITCX201	Android Application Development	1	0	2	2
2.	PE	ITCX202	Nextgen Technologies	3	0	0	3
3.	PE	ITCX203	Multimedia Tools & Techniques	0	0	2	1
4.	PE	ITCX204	System Software	3	0	0	3
5.	PE	ITCX205	Principles of Communication	3	0	0	3
6.	PE	ITCX206	Principles of Compiler Design	3	0	0	3
7.	PE	ITCX207	User Interface Design	2	0	0	2
8.	PE	ITCX208	Semantic Web	2	0	0	2

V SEMESTER ELECTIVES – II (6 CREDITS)

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	ITCX101	iOS Application Development	1	0	2	2
2.	PE	ITCX102	Oracle Database Programming	0	0	2	1
3.	PE	ITCX103	Natural Language Processing	3	0	0	3
4.	PE	ITCX104	Game Theory	3	0	0	3
5.	PE	ITCX105	Soft Computing	3	0	0	3
6.	PE	ITCX106	Machine Learning Algorithms	3	0	0	3
7.	PE	ITCX107	C# and .NET Framework	3	0	2	4
8.	PE	ITCX108	Artificial Intelligence	3	0	0	3
9.	PE	ITCX109	Grid Computing	3	0	0	3

10	PE	ITCX110	Information Coding Techniques	3	0	0	3
11	PE	ITCX111	Mobile AdHoc Networks	3	0	0	3

VI SEMESTER ELECTIVES – III (6 CREDITS)

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	ITCX212	Hybrid Application Development	1	0	2	2
2.	PE	ITCX213	Data Warehousing, Data Mining and Data Mining Tools	3	0	2	4
3.	PE	ITCX214	Cyber Security	3	0	0	3
4.	PE	ITCX215	Software Requirements Management & Software Project Management	3	0	0	3
5.	PE	ITCX216	Business and Data Analytics	3	0	0	3
6.	PE	ITCX217	Web Services	3	0	0	3
7.	PE	ITCX218	Image Processing	3	0	0	3
8.	PE	ITCX219	Expert Systems	3	0	0	3
9.	PE	ITCX220	Service Oriented Architecture	3	0	0	3
10.	PE	ITCX221	Pervasive Computing	3	0	0	3
11.	PE	ITCX222	Knowledge Based Decision Support System	3	0	0	3
12.	PE	ITCX223	Electronics Commerce	3	0	0	3

VII SEMESTER ELECTIVES – IV (9 CREDITS)

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	ITCX117	Cloud Middleware Tools	1	0	2	2
2.	PE	ITCX118	Big Data Tools & Technologies	1	0	2	2
3.	PE	ITCX119	Forensic Tool Kits	0	0	2	1
4.	PE	ITCX120	MongoDB for Java developers	0	0	2	1

5.	PE	ITCX121	Green Computing	0	0	2	1
6.	PE	ITCX122	XML Technologies	0	0	2	1
7.	PE	ITCX123	Big Data Analytics	3	0	0	3
8.	PE	ITCX124	Programming in Scala	0	0	2	1
9.	PE	ITCX125	R Programming	1	0	2	2
10.	PE	ITCX126	Virtual Reality	2	0	2	3
11.	PE	ITCX127	Software Quality Management	3	0	0	3
12.	PE	ITCX128	Cloud Forensics	3	0	0	3
13.	PE	ITCX129	Networking Simulators	0	0	2	1
14.	PE	ITCX130	Enterprise Resource Planning	3	0	0	3
15.	PE	ITCX131	Embedded System	3	0	0	3

Physics Elective Courses

(To be offered in II Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	PHCX 01	Fundamentals of Engineering Materials	2	0	2	3
2.	PHCX 02	Heat and Thermodynamics	2	0	2	3
3.	PHCX 03	Introduction to Nanoscience and Technology	2	0	2	3
4.	PHCX 04	Lasers and their applications	2	0	2	3
5.	PHCX 05	Materials Science	2	0	2	3
6.	PHCX 06	Non-Destructive Testing	2	0	2	3
7.	PHCX 07	Properties of Matter and Acoustics	2	0	2	3
8.	PHCX 08	Properties of Matter and Nondestructive Testing	2	0	2	3
9.	PHCX 09	Semiconductor Physics and Optoelectronics	2	0	2	3

Chemistry Elective Courses

(To be offered in II Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	CHCX01	Analytical Instrumentation	2	0	2	3
2.	CHCX02	Corrosion and its Control	2	0	2	3
3.	CHCX03	Electrical Materials and Batteries	2	0	2	3
4.	CHCX04	Engineering Materials	2	0	2	3
5.	CHCX05	Fuels and Combustion	2	0	2	3
6.	CHCX06	Fundamentals of Physical Chemistry	2	0	2	3
7.	CHCX07	Green Technology	2	0	2	3
8.	CHCX08	Organic Chemistry of Biomolecules	2	0	2	3
9.	CHCX09	Polymer Science and Technology	2	0	2	3

Maths Elective Courses

(To be offered in IV Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	MACX 01	Discrete Mathematics And Graph Theory	3	1	0	4
2.	MACX 02	Probability And Statistics	3	1	0	4
3.	MACX 03	Random Processes	3	1	0	4
4.	MACX 04	Applied Numerical Methods	3	1	0	4

Maths Elective Courses

(To be offered in VI Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	MACX 05	Mathematical Programming	2	0	0	2
2.	MACX 06	Statistical Methods for Data Analysis	2	0	0	2
3.	MACX 07	Numerical Methods for Integral and Differential Equations	2	0	0	2
4.	MACX 08	Mathematical Modelling	2	0	0	2
5.	MACX 09	Graph Theory	2	0	0	2

Humanities Elective I

(To be offered in III Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	SSCX01	Fundamentals of Economics	2	0	0	2
2.	SSCX02	Principles of Sociology	2	0	0	2
3.	SSCX03	Sociology of Indian Society	2	0	0	2

Humanities Elective II

(To be offered in IV Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	SSCX04	Economics of Sustainable Development	2	0	0	2
2.	SSCX05	Industrial Sociology	2	0	0	2
3.	SSCX06	Law for Engineers	2	0	0	2

General Elective

Group I Courses

(To be offered in V semester)

Sl. No.	Course Code	Course Title	Offering Department
1.	GECX101	Disaster Management	Civil
2.	GECX102	Total Quality Management	Mechanical
3.	GECX103	Energy Studies	Mechanical
4.	GECX104	Robotics	Mechanical
5.	GECX105	Transport Management	Automobile
6.	GECX106	Control Systems	EEE
7.	GECX107	Introduction to VLSI Design	ECE
8.	GECX108	Plant Engineering	EIE
9.	GECX109	Network Security	CSE
10.	GECX110	Knowledge management	CSE
11.	GECX111	Cyber security	IT
12.	GECX112	Genetic Engineering	LS
13.	GECX113	Fundamentals of Project Management	CBS
14.	GECX114	Operations Research	Mathematics
15.	GECX115	Nano Technology	Physics / Chemistry
16.	GECX116	Vehicle Maintenance	Automobile
17.	GECX117	Fundamentals of Digital Image Processing	ECE

Group II Courses

(To be offered in VII semester)

Sl. No.	Course Code	Course Title	Offering Department
1.	GECX201	Green Design and Sustainability	Civil
2.	GECX202	Appropriate Technology	Civil / Mechanical
3.	GECX203	Engineering System Modelling and Simulation	Mechanical
4.	GECX204	Value Analysis and Engineering	Mechanical
5.	GECX205	Industrial Safety	Mechanical
6.	GECX206	Advanced Optimization Techniques	Mechanical
7.	GECX207	Mat Lab Simulation	EEE
8.	GECX208	Embedded Systemsand its Applications	ECE
9.	GECX209	Usability Engineering	CSE
10.	GECX210	Supply Chain Management	CBS
11.	GECX211	System Analysis and Design	CA
12.	GECX212	Advanced Materials	Physics & Chemistry
13.	GECX213	National Service Scheme	School of Humanities
14.	GECX214	Automotive Pollution and Control	Automobile
15.	GECX215	Motor Vehicle Act, Insurance and Policy	Automobile
16.	GECX216	Principles of Communication Systems	ECE
17.	GECX217	Lean Management	Civil
18.	GECX218	Spatial Data Modeling & Analysis	Civil

SEMESTER I

MAC 1181	DIFFERENTIAL CALCULUS AND GEOMETRY	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aims of this course are to

- introduce eigen values and eigenvectors of matrix algebra.
- make the student knowledgeable in the area of Three Dimensional Analytical Geometry.
- demonstrate the application of Differential Calculus.
- familiarize the student with the functions of several variables.
- develop the use of ODE solvable techniques necessary for engineering applications.
- motivate the students with some basic engineering application problems in ODE.

MODULE I **MATRICES** **8+2**

Characteristic Equation- Eigenvalues and Eigenvectors of a real matrix –Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton Theorem (without proof) – Orthogonal matrices – orthogonal transformations of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation.

MODULE II **THREE DIMENSIONAL ANALYTICAL GEOMETRY** **7+3**

Direction cosines and ratios – angle between two lines – equations of a plane – equations of a straight line, coplanar lines - shortest distance between skew lines - sphere – tangent plane – plane section of a sphere – orthogonal spheres.

MODULE III **DIFFERENTIAL GEOMETRY** **7+3**

Curvature – Cartesian and polar coordinates – centre and radius of curvature – circle of curvature – involutes and evolutes – envelopes.

MODULE IV **DIFFERENTIAL CALCULUS OF SEVERAL VARIABLES** **8+2**

Functions of two variables – partial derivatives – total differential – Implicit Functions – Jacobian - Taylor’s series expansion – Optima of two variables – Lagrange’s multiplier method.

MODULE V **ORDINARY DIFFERENTIAL EQUATIONS** **8+2**

Linear equations of second order with constant and variable coefficients – Simultaneous first order linear equations with constant coefficients – homogeneous equations of Euler's type – method of undetermined coefficients, method of variation of parameters

MODULE VI **APPLICATIONS OF ORDINARY DIFFERENTIAL EQUATIONS** **7+3**

Solution of Ordinary Differential Equation Related to Electric Circuits – Bending of Beams- Motion of a Particle in a resisting medium – Simple harmonic motion.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Ramana, B.V, "Higher Engineering Mathematics" Tata McGraw Hill Publishing Co. New Delhi, 2006.
2. Grewal B.S., "Higher Engineering Mathematics" (43rd edition), Khanna Publishers, New Delhi, 2012.
3. John W. Cell "Engineering Problems Illustrating Mathematics" Mc Graw Hill Publishing Co., New York 1943.

REFERENCES:

1. Veerarajan.T., "Engineering Mathematics" (5th edition) Tata Mc Graw Hill Publishing Co. New Delhi, 2012
2. Kreyszig, E., "Advanced Engineering Mathematics", 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
3. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th edition, Cengage Learning, 2011.
4. Dennis G. Zill, Warren S. Wright, "Advanced Engineering Mathematics", 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
5. Alan Jeffrey, "Advanced Engineering Mathematics", Academic Press, USA, 2002.
6. Venkataraman, M.K., "Engineering Mathematics", Volume I, 2nd edition, National Publishing Co., Chennai, 2003.
7. James Stewart ".Calculus" (7th edition),Brooks/Cole cengage learning,UK

OUTCOMES:

After completing the course, student will be able to

- Understand the matrix techniques and compute eigen values and eigenvectors of a given matrix.
- Do the problems based on three dimensional analytic geometry.
- Apply differential calculus in engineering problems.
- Differentiate more than one variable and their applications.
- Solve the differential equations with constant coefficient and variable coefficient.
- Form and solve differential equations.

ENC 1181	ENGLISH	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To train students to use appropriate vocabulary in academic and technical contexts.
- To facilitate students to speak effectively while exchanging ideas and making presentations.
- To develop students' listening skill for comprehending and analyzing information.
- To develop their reading skill through sub skills like skimming , scanning and critical reading of a text.
- To sharpen their academic writing skills.
- To expose them to the correct usage of language and help them to apply that knowledge appropriately.

MODULE I **8**

L: Listening for general information

S : Self Introduction, Introducing one another.

R: Predicting the content

W: Paragraph Writing

Language Focus: Affixes, Simple Present tense , Connective & Prepositions.

MODULE II **8**

L: Listening for specific information (from dialogues)

S:Exchanging opinion.

R: Skimming technical Passages

W: Argumentative Writing (using the concept of Flipped Learning), Letter to the Editor.

Language Focus: Idioms, use of Modals, Simple Past tense & use of "Wh" and question tags.

MODULE III **7**

L: Learning the ways of describing images and presenting specific information (focusing on note making)

S: Making Presentations using visuals.

R : Scanning short texts for gist of information

W: Letter of Invitation, Expository Writing

Language Focus: Homophones, Homographs, Simple Future & Collocations.

MODULE IV **7**

L: Understanding prepared presentation techniques through videos

S: Short Presentations.

R: Reading for coherence and cohesion

W: Letter seeking permission for Industrial Visit

Language Focus: S-V agreement, Euphemism

MODULE V **8**

L : Understanding Non- Verbal Communications while listening to narration of incidents.

S: Narrating an expereince

R: Inferential Reading

W: Process Description – Transcoding a Flow chart.

Language Focus: Interchange of Active & passive voice, Impersonal Passive voice.

MODULE VI **7**

L: Learning Story telling techniques (stories & visuals) through audio files

S: Discussion in groups

R: Reading for critical appreciation

W: Developing an idea, Slogan writing, Interpreting a Bar Chart.

Language Focus: If clause and phrasal verbs.

TOTAL HOURS :45

REFERENCES:

1. Carol Rosenblun perry(2011). The Fine Art of Technical Writing. Create Space Independent Publishing Platform, New Delhi.
2. Dutt, P.K. Rajeevan. G and Prakash , C.L.N. (2007) A course in Communication Skills. Cambridge Univesity Press, India.
3. Kala, Abdul & Arun Tiwari (2004). Wings of Fire: An Autobiography (Simplified and A bridged by Mukul Chowdhri). Hyderabad Univeristy Press.
4. Sen, Leena. (2004) Communication Skills. Prentice Hall, New Delhi.

5. Matt Firth, Chris Sowton et.al. (2012). Academic English: An Integrated Skills Course for EAP. Cambridge University Press, Cambridge.

OUTCOMES:

After completion of the course, students will have the ability to

- Demonstrate their range of vocabulary in academic and technical contexts
- Exchange ideas and make presentations
- Comprehend and respond appropriately to listening tasks.
- Read a text efficiently and process information.
- Create and draft different kinds of academic documents
- Communicate effectively using grammatically correct expressions.

ISC1181	ARABIC	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To read and write in Arabic language.
- To learn vocabulary of different fields
- To develop situational communication skills.

MODULE I PREPARATORY ARABIC **7**

Introducing Arabic Alphabets.
Listening and Reading.
Audio & Video aided listening, Tajweed listening,
Writing Arabic Alphabets (connected & unconnected).
Introducing words.
Reading simple sentences.
Learning names of the things in and around the class room.
Exercises.

MODULE II FUNCTIONAL ARABIC **7**

Listening Arabic texts, stories and action verbs
Communicating Simple sentences.
Jumla' Ismiyya and Jumla' Fi'liyya
Situational Conversation:
Greetings, Introduction.
Classroom, College, Picnic.
Dining and Kitchen.
Reading skills.
Exercises

MODULE III FUNCTIONAL ARABIC **8**

Implication of effective listening.
Audio aids.
Writing Simple sentences.
Communicating ordinal and cardinal numbers.
Situational communication:

Playground, library.
Forms of plural – Sample sentences.
Introduction to tenses.
Exercises.

MODULE IV FUNCTIONAL ARABIC 8

Communication:
Family, travel
Market, Prayer hall
Writing skills:
Note making.
Sequencing of sentences.
Developing answers from the questions.
Exercises.

MODULE V TECHNICAL ARABIC 8

Importance of technical communication.
Reading and writing skills.
Audio & Video aided listening.
Introduction to Arabic terms related to administration.
Situation communication:
Air travel, Office administration, passport, visa.
Exercises

MODULE VI TECHNICAL ARABIC 7

Situation communication:
Contractual work, machineries and equipments..
Computer, internet browsing.
Banking,
Exercises.

TOTAL HOURS :45

TEXT BOOKS:

1. Arabic for professionals and employees, Kilakarai Bukhari Aalim Arabic College, Chennai, India, 2013.

REFERENCES:

1. Arabic Reader for Non Arabs (Ummul Qura University, Makkah), Kilakarai Bukhari Aalim Arabic College, 2005.

OUTCOMES:

On successful completion of the course, the student will be able to:

- Write correct sentences in Arabic.
- Communicate in Arabic at primary level in working situations in the fields of engineering and administration.

LNC1181	MANDARIN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To improve the proficiency of students in Mandarin language.
- To develop their knowledge of vocabulary.
- To train them in using appropriate grammatical forms during communications.
- To empower them for successful communication in social and academic contexts.
- To make them appreciate the language usage in real life situations.

MODULE I **8**

· General Introduction to Chinese • Pinyin and Tones • Introduction to the Writing System: basic strokes and stroke order · Numbers 1-100, song · Days of the Week · Months of the Year

MODULE II **8**

· Chinese names and related culture · Chinese family structures and values · Greetings · Introducing Yourself · Family members · Occupations

MODULE III **7**

· Languages and Nationalities · Daily Routine · Chinese breakfast · Negative Sentences and Interrogative Sentences · Asking for Personal Information · The Verb *shi* and Basic Sentence Structures

MODULE IV **7**

· Answering an Affirmative-negative Question · Food and drinks · Transportation · Likes and dislikes · Adverbs *bu*, *jiu* and *dou* · Verb-absent Sentences

MODULE V **8**

·*Jisui* and *duoda* Questions · S+V+O Construction · Routines and Daily Activities ·*Haishi* Questions · Modal Verbs · Hobbies and Habits

MODULE VI **7**

· Making Suggestions with *haoma* ·Colors · Clothing · Body parts · Talking about Likes and Dislikes · Measurement Words in Chinese

TOTAL HOURS :45

TEXT BOOKS:

1.Ma, Yanmin, and Li, Xinying. *Easy Steps to Chinese, Vol*. *1 Textbook*. Beijing: Beijing Language and Culture University Press, 2006. Print.

2. Ma, Yanmin, and Li, Xinying. *Easy Steps to Chinese, Vol. 1 Workbook*. Beijing: Beijing Language and Culture University Press, 2006. Print.

OUTCOMES:

On completion of the course, students will be able to

- Exhibit proficiency in Chinese Language.
- Use vocabulary in appropriate contexts.
- Use appropriate grammatical forms effectively.
- Use the language in social and academic contexts.
- Appreciate the use of language forms.

LNC1182	GERMAN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To improve the proficiency of students in German language.
- To create awareness of using vocabulary among students.
- To expose them to correct grammatical forms of the language.
- To empower them for successful communication in social and academic contexts.

MODULE I **8**

Introduction to German alphabets, phonetics and pronunciation- Introducing themselves and others using simple sentences and answer to some basic personal questions-: Introduction to different types of articles and verbs, Nouns

MODULE II **8**

Understanding and responding to everyday queries like instruction, questions, - number & gender, pronouns, present and past tense.

MODULE III **7**

Short telephone messages, requests etc., if spoken slowly and clearly-- Detailed overview of articles, adjectives with/without articles, Prepositions

MODULE IV **7**

Ask and giving directions using simple prepositions- Ability to fill basic information on forms while registering for courses / classes.

MODULE V **8**

Ability to extract and understand relevant information in a public announcement, broadcast, newspaper, radio etc-- dative & accusative

MODULE VI **7**

Ability to describe about people, work, immediate environment, education and other topics related to personal needs in a concise manner-- Understanding of matters that are familiar and are encountered regularly like instances at school, work, at public places, places of leisure etc.

TOTAL HOURS :45

TEXT BOOKS:

1. Course book : Tangram aktuell 1 – Lektion 1–4 (Kursbuch + Arbeitsbuch mit Audio-CD zum Arbeitsbuch), Rosa-Maria Dallapiazza, Eduard von Jan, Til Schönherr, Hueber Publisher, ISBN 978-3-19-001801-7

2. Practice book: Tangram aktuell 1 – Lektion 1–4 (Kursbuch + Arbeitsbuch mit Audio-CD zum Arbeitsbuch), Rosa-Maria Dallapiazza, Eduard von Jan, Til Schönherr, Hueber Publisher, ISBN 978-3-19-001801-7.

REFERENCES:

1. NETZWERK A1 TEXTBOOK, Deutsch als Fremdsprache,Stefanie Dengler,Paul Rusch, Helen Schmitz, Tanja Sieber, Langenscheidt and Klett, ISBN : 9788183076968

2. STUDIO D A1 (SET OF 3 BOOKS + CD), Hermann Funk. Cornelsen, ISBN: 9788183073509

3. Willkommen! Beginner's course. Paul Coggle, Heiner Schenke. 2nd edition. (chapter 1 - 6) ISBN: 9781444165159 –

4. Willkommen! Beginner's course. Paul Coggle, Heiner Schenke. ISBN: 978-1-444-16518-0

5. An Introduction to the German Language and Culture for Communication, Updated Edition Lovik, Thomas A., J. Douglas Guy & Monika Chavez. Vorsprung -. New York, Houghton Mifflin Company, 1997/2002. ISBN 0-618-14249-5.

OUTCOMES:

On completion of the course, students will be able to

- Show their proficiency in German Language.
- Use appropriate vocabulary in real life contexts.
- Use appropriate grammatical forms while communicating with people.
- Effectively use the language in social and academic contexts.

LNC1183	JAPANESE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To train students to use appropriate vocabulary in academic and technical contexts.
- To facilitate students to speak effectively while exchanging ideas and making presentations.
- To develop their reading skill through sub skills like skimming, scanning and critical reading of a text.
- To sharpen their academic writing skills.
- To expose them to the correct usage of language and help them to apply that knowledge appropriately.

MODULE I **7**

Introduction of the Japanese writing system, i.e. *Hiragana*, *Katakana* and *Kanji*, word-building, writing foreign names and loan words in Katakana.

MODULE II **8**

Oral practice of pronunciation and intonation of Japanese sounds, Japanese greetings, self introduction, identifying things, time of the day, calendar; counting using Japanese numerical classifiers; describing things;

MODULE III **7**

Making comparisons; talking of daily activities, kinship terms used for address and reference, seasons, giving and receiving, shopping; making requests, talking of one's likes and dislikes.

MODULE IV **8**

Extensive practice of basic patterns at the lower intermediate level through drills and exercises.

MODULE V **7**

Comprehension of passages in simple Japanese and writing of composition in Japanese applying lower intermediate grammatical patterns.

MODULE VI **8**

Diverse texts based on Japanese culture, customs, history, food habits, and science etc, for the development of communicative competence of students; skimming, scanning of texts with emphasis on advanced sentence patterns, grammatical structures and idiomatic phrases, reading and writing of approximately

TOTAL HOURS :45

REFERENCES:

1. Nihongo I, Kokusaigakuyukai, and other supplementary material
2. Exersice book 1of Nihongo 1, and other supplementary material
3. Nippon, the Land and its People & Encyclopedia of Contemporary Japanese
4. Japani: Japanese Conversation for Improving Spoken Proficiency, By P.A. George, Inoue Yoriko and Itsuko Nandi, Books Plus.
5. Chukyu Nihongo, Tokyo Gaikokugo Daigaku; Nihongo II, Kokusaigakuyukai, and other supplementary material.

OUTCOMES:

After completion of the course, students will have the ability to

- Demonstrate their range of vocabulary in academic and technical contexts
- Exchange ideas and make presentations
- Comprehend and respond appropriately to listening tasks.
- Read a text efficiently and process information.
- Create and draft different kinds of academic documents
- Communicate effectively using grammatically correct expressions.

PHC 1181	PHYSICS	L	T	P	C
		3	0	2	4

OBJECTIVES:

To make students conversant with the

- basic concepts of crystal physics and its structures
- production and applications of ultrasonic waves
- study of thermal conductivities of good and bad conductors
- phenomenon of wave optics and its applications
- principle of fibre optic communication and its applications to sensors
- wave mechanics principle and its applications in electron microscopy
- green energy physics and its environmental impacts to society

MODULE I CRYSTAL PHYSICS **8**

Crystalline and amorphous solids – Unit Cell – Seven Crystal Systems – Bravais Lattice – Miller Indices – Interplanar Spacing – Characteristics of Unit Cell - Calculation of Number of atoms per unit cell, Atomic Radius, Coordination Number and Packing Factor for SC, BCC, FCC and HCP and Diamond structures –Defects in crystals-Point defects –Edge and screw dislocations and their significance - Surface Defects.

MODULE II ULTRASONICS AND THERMAL PHYSICS **8**

Introduction to Ultrasonics - Properties - Production methods - Magnetostriction Oscillator method- Piezoelectric Oscillator method – Detection of Ultrasonics – Thermal method – Piezoelectric method – Kundt's tube method – Applications of Ultrasonics – Acoustic Grating – SONAR – Depth of sea – Velocity of blood flow, Ultrasonic Flaw detector (qualitative).

Transmission of heat – Conduction, Convection and Radiation – Thermal Conductivity of good Conductor – Forbe's method- Thermal Conductivity of bad Conductor – Lee's Disc method.

MODULE III APPLIED OPTICS **8**

Interference – Air Wedge – Michelson's Interferometer – Determination of wavelength of light and thickness of thin transparent sheet.

Introduction to Laser – Characteristics of Laser – Spontaneous and Stimulated Emissions – Einstein's Coefficients - Population inversion – Pumping Mechanism – Laser Action – Types of Laser: He-Ne laser, CO2 laser and Nd:YAG laser - Applications : Laser Materials

Processing .

MODULE IV FIBRE OPTICS 7

Optical fibre – Principle and propagation of light in optical fibre – Numerical aperture and acceptance angle – Types of optical fibres – Attenuation – Absorption, Scattering losses, Bending losses and Dispersion in Optical fibres – Fiber Connectors and Couplers - Applications – Fibre optic communication system (block diagram only)- Fibre optic sensors - displacement and pressure sensors (qualitative) - Medical endoscope.

MODULE V QUANTUM MECHANICS 7

Black body radiation – Planck's theory of radiation – Deduction of Wien's displacement law and Rayleigh – Jean's law from Planck's theory –Dual nature of matter – de Broglie's wavelength- Physical significance of wave function – Schrodinger wave equation – Time independent and time dependent wave equation – Particle in one dimensional box – Harmonic oscillator(qualitative).

MODULE VI RENEWABLE ENERGY SOURCES 7

Present Energy sources and sustainability - Solar energy - Solar photovoltaics - Solar cells – Bioenergy - Biomass – production of liquid fuels from biomass – Wind energy – Wind turbines – energy and power from wind turbines - Geothermal energy - Ocean energy: Wave energy – Wave energy conversion devices – Tidal energy – Tidal power basics – power generation –Tidal energy potential – Environmental benefits and impacts of renewable energy sources

PRACTICALS

1. Determination of Velocity of Ultrasonic waves in a given liquid using Ultrasonic Interferometer.
2. Determination of wavelength of ultrasonic waves using Kundt's tube method.
3. Determination of thickness of a thin wire using Air Wedge method.
4. Determination of wavelength of light using spectrometer diffraction grating.
5. Determination of angle of divergence of a laser beam using He-Ne laser.
6. Determination of particle size of lycopodium powder using semiconductor laser.
7. Determination of wavelength of laser light using semiconductor laser diffraction.
8. Determination of Acceptance angle and Numerical Aperture using fiber optic cable.
9. Determination of thermal conductivity of a good conductor by Forbe's method.
10. Determination of thermal conductivity of a bad conductor by Lee's disc method.
11. Determination of solar cell characteristics.

L – 45; P – 30; TOTAL HOURS – 75

REFERENCES :

1. Gaur R.K. and Gupta S.L., “Engineering Physics’’, 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2013.
2. Palanisamy P.K., Physics for Engineers, Vol1 & Vol2, 2nd Edition, Scitech Publications, 2003.
3. Serway R.A. and Jewett, J.W. “Physics for Scientists and Engineers with Modern Physics”. Brooks/cole Publishing Co., 2010.
4. Tipler P.A. and Mosca, G.P., “Physics for Scientists and Engineers with Modern Physics”, W.H. Freeman, 2007.
5. Markert J.T., Ohanian. H. and Ohanian, M. “Physics for Engineers and Scientists”. W.W. Norton & Co. 2007.
6. Godfrey Boyle, “Renewable Energy: Power for sustainable future”, 2nd edition, Oxford University Press, UK, 2009.

OUTCOMES:

At the end of the course, students will be able to

- understand the different types of crystal structures
- apply the concept of ultrasonic principle in engineering and medical field
- calculate thermal conductivities of good and bad conductors
- differentiate the various laser systems and its applications in engineering and medical field
- apply the principle of fibre optics for communication and sensor applications
- formulate wave mechanics principle for applications in electron microscopy
- Correlate the different renewable energy sources for societal needs.
- To complement the knowledge acquired in the theory class.
- To correlate the experimental results for application.

CHC1181	CHEMISTRY	L	T	P	C
		3	0	2	4

OBJECTIVES:

The students should be conversant with

- the basic problems like hardness, alkalinity, dissolved oxygen associated with the water used for domestic and industrial purpose and treatment process involved.
- the synthesis, properties and applications of nanomaterials.
- the importance of renewable energy sources like solar, wind, biogas, biomass, geothermal, ocean and their limitations.
- the basic analytical techniques like UV-Visible, FT-IR, NMR, AAS, AES, Circular Dichroism and XRD etc.
- photochemistry concepts related to physical processes and chemical reactions induced by photon absorption and their applications.
- basic principles of electrochemistry, cell construction and evaluation and to understand general methodologies for construction & design of electrochemical cell

MODULE I WATER TECHNOLOGY 9

Impurities present in water, hardness : types of hardness, demerits of hard water in boilers, estimation of hardness by EDTA method (problems) – alkalinity : estimation of alkalinity (problems) – dissolved oxygen: estimation of dissolved oxygen – conditioning methods : external treatment method: – lime soda and zeolite process (principle only), Ion exchange process – Internal treatment : colloidal, carbonate, phosphate and calgon methods – drinking water: standards (BIS), treatment of domestic water {screening, sedimentation, coagulation, filtration, disinfection }– desalination: electrodialysis, reverse osmosis.

MODULE II NANOCHEMISTRY 6

Introduction – distinction between molecules, bulk materials and nanoparticles – classification based on dimension with examples – synthesis (top-down and bottom-up approach} : sol-gel, thermolysis (hydrothermal and solvothermal), electrodeposition, chemical vapour deposition, laser ablation – properties and applications (electronic, magnetic and catalytic) – risk factors and future perspectives.

MODULE III ENERGY SOURCES 8

Energy: past, today, and future – a brief history of energy consumption – present energy scenario of conventional and renewable energy sources – renewable energy : needs of renewable energy, advantages and limitations of renewable energy – solar energy: basics, solar energy in the past , photovoltaic, advantages and disadvantages – bioenergy: conversion, bio degradation, biogas generation, biomass gasifier, factors affecting biogas generation, advantages and disadvantages – geothermal energy: geothermal resources (hot dry rock and magma resources, natural and artificial), advantages and disadvantages – wind energy: wind resources, wind turbines, advantages and disadvantages – ocean energy: wave energy, wave energy conversion devices, ocean thermal energy, advantages and disadvantages.

MODULE IV PHOTOCHEMISTRY 7

Introduction: absorption and emission, chromophores, auxochromes – laws of photochemistry : Grotthus-Draper law, Stark Einstein law – quantum yield (problems) –photo physical processes : fluorescence and phosphorescence - Jablonski diagram (electronic states and transitions) – quenching, annihilation – photosensitization: principle and applications – chemiluminescence, bioluminescence.

MODULE V ANALYTICAL TECHNIQUES 7

Spectroscopy: electromagnetic radiation and spectrum – types of transitions – types of spectra (atomic and molecular with their chemical usefulness) – Beer-Lamberts law (problems) – principles, instrumentation and applications of: Colourimetry – UV-Vis spectrophotometer – atomic absorption spectroscopy – atomic emission spectroscopy – principles and applications of: IR, NMR, mass and X-ray diffraction analysis.

MODULE VI ELECTROCHEMISTRY 8

Electrochemistry - types of electrodes (principle and working) : gas (SHE), metal/metal ion electrode, metal-metal insoluble salt (calomel electrode), ion-selective (glass electrode and fluoride ion selective electrode) – Electrolytic and galvanic cells, construction of cell, EMF measurement and applications (problems), standard cell (Weston-cadmium), reversible and irreversible cell, concentration cell. Determination of fluoride ion using fluoride ion selective electrode – Chemically modified electrodes (CMEs) : concept, approaches and applications.

PRACTICALS

1. Estimation of hardness in given water sample.
2. Estimation of the alkalinity of the given water sample.
3. Estimation of strong acid by conductometry.
4. Estimation of Fe^{2+} present in the given sample by potentiometry.
5. Verification of Beer-Lamberts law and estimation of Cu^{2+} present in unknown sample.
6. Estimation of sodium and potassium present in the given sample by flame photometry.
7. Determination of molecular weight and degree of polymerisation of a polymer by viscosity method.
8. Synthesis of thermosetting polymer.

L – 45; P – 30; TOTAL HOURS – 75

REFERENCES:

1. S. Vairam, P. Kalyani and Suba Ramesh, “Engineering Chemistry”, Wiley India Ltd., New Delhi, 2011.
2. G.A. Ozin and A.C. Arsenault, “Nanochemistry: A Chemical Approach to Nanomaterials”, RSC Publishing, Thomas Graham House, Cambridge, 2005.
3. P.C Jain & Monica Jain, Engineering Chemistry Dhanpatrai Publishing Company (P) Ltd., New Delhi (2013).
4. S S Umare & S S Dara, A text Book of Engineering Chemistry, S. Chand& Company Ltd, New Delhi, 2014.
5. G.D.Rai, “Non conventional energy sources,” Khanna Publishers, New Delhi, 2011.
6. John Twidell and Tony Weir, “Renewable Energy Resources, Taylor & Francis Ltd, London, United Kingdom, 2005
7. Principles of molecular photochemistry: An introduction, Nicholas J. Turro, V.Ramamurthy and Juan C. Scaiano, University Science Books, Sausalito, CA, 2009.

OUTCOMES:

The students will be able to

- solve problems related to hardness, alkalinity, dissolved oxygen associated with the water and describe the treatment processes.
- classify nanomaterials and apply the nanochemistry approach to synthesize the

nanomaterials.

- explain the principle and enumerate the advantages and disadvantages of various renewable energy sources.
- state the principle and illustrate the instrumentation of various analytical techniques.
- apply the concepts of photochemistry to elaborate various photo-physical and photochemical reactions.
- construct a electrochemical cell and describe the various types of electrodes and determine the fluoride content.

GEC 1101	ENGINEERING GRAPHICS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To introduce the students of all engineering programs, the basic concepts of engineering drawing, which is the basic communication medium for all engineers
- To provide practical exposure on important aspects like drawing analytic curves, orthographic projections, section of solids, development of surfaces, isometric projection, perspective projection and free hand drawing.
- To introduce computerized drafting.

MODULE I BASICS AND ENGINEERING CURVES **10**

Drawing instruments, dimensioning, BIS conventions, types of lines, simple geometric constructions.

Conic sections: ellipse, parabola, hyperbola.

Special curves: cycloid, epicycloid, hypocycloid and involutes.

MODULE II ORTHOGRAPHIC PROJECTION **8**

Orthographic projection – first angle, second angle, third angle and fourth angle projections –setup - assumptions, principle. Free hand sketching of orthographic views of simple machine parts as per first angle projection. Orthographic projection of points in all quadrants. Some commands and demonstration of drafting packages.

MODULE III PROJECTION OF STRAIGHT LINES AND PLANES **10**

Projection of straight lines in first quadrant – true length and true inclinations – Rotating line and trapezoidal methods –traces of straight line.

Projection of plane lamina in first quadrant and its traces

MODULE IV PROJECTION OF SOLIDS **10**

Projection of solids in first quadrant: Axis inclined to one reference plane only- prism, pyramid, cone, cylinder – change of position and auxiliary projection methods.

MODULE V SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES **12**

Section of solids: prism, pyramid, cone, cylinder, and sphere – sectional view – true shape of section Solids in simple position and cutting plane inclined to one reference

plane only.

Development of surface of truncated solids: prism, pyramid, cone cylinder – frustum of cone, pyramid and simple sheet metal parts.

MODULE VI PICTORIAL PROJECTIONS 10

Isometric projection: Isometric scale – isometric axes- iso sheet - Isometric projection and view of prism, pyramid, cylinder, cone, frustums, truncated solids and simple products

Perspective projection: station point – vanishing point – Perspective projection and views of prism, pyramid, cylinder and frustums by Visual ray method.

L – 30; P – 30; TOTAL HOURS – 60

TEXT BOOKS:

1. N.D. Bhatt, 'Engineering Drawing' Charotar Publishing house, 53rd Edtion, (2014)

REFERENCES:

1. K.V. Natarajan, 'A text book of Engineering Graphics', Dhanalakshmi publishers, Chennai. (2009)
2. Venugopal. K, and V. Prabhu Raja, Engineering Graphics, New Age International (P) Ltd., Publication, Chennai. (2011)

OUTCOMES:

- Students should be able to read the specifications and standards of technical drawing and able to draw conic sections and special curves.
- Students should be able to understand the insight of orthographic projection and to draw the various views of orthographic projection of a point and various components.
- Students should be able to draw the orthographic views of straight lines and plane figures.
- Students should be able to draw the orthographic views of simple solids.
- Students should be able to draw the sections of solids and development of solid surfaces.
- Students should be able to draw the isometric and perspective projection of simple solids and components.

GEC 1102	ENGINEERING DESIGN	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To understand the role of design in Engineering
- To understand the basic design concepts
- To understand the role of innovation in design

MODULE I DESIGN AS A CENTRAL ACTIVITY IN ENGINEERING 08

Product design – products and processes – product design methodology Design of systems; Software design

MODULE II NEED ANALYSIS AND CONCEPT DEVELOPMENT 07

Voice of customers – product specification - need analysis Bench marking Product architecture – concept generation and evaluation;

MODULE III CASE STUDIES IN ENGINEERING DESIGN 08

Product design – process design; system design; software design -Ergonomics – usability

MODULE IV INNOVATION AND DESIGN 07

Role of innovation in Engineering – incremental changes and systemic changes; scientific approach to driving innovation – case studies.

TOTAL HOURS – 30

REFERENCES:

1. Clive L. Dym and David C. Brown,“Engineering Design: Representation and Reasoning”, 2nd Edition, Cambridge University Press, New Delhi, 2011.
2. Daniel G. Dorner, G. E. Gorman and Philip J. Calvert, “Information Needs Analysis: Principles and practice in information organizations”, Published by Faced Publishing, London. 2015.
3. Cliff Matthews, “Case Studies in Engineering Design”, John Wiley & Sons Pvt. Ltd, New York, 1998.
4. Bengt-Arne Vedin, “The Design-Inspired Innovation Workbook”, World Scientific, 2011.
5. Navi Radjou, Jaideep Prabhu and Simone Ahuja, “Jugaad Innovation”, Published

by Random House India, 2012.

OUTCOMES:

The students will be able to

- Apply the basic knowledge of design in engineering products / process / service.
- Analyse the problems and give innovative solutions.
- Correlate the basic knowledge of design in the real world problems.
- Apply innovative approaches to engineering design.

GEC1103	BASIC ENGINEERING PRACTICES LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To provide a practical exposure to basic engineering practices like carpentry, fitting, plumbing, welding and making of simple electrical and electronic circuits
- To have an understanding on the use of various tools, instruments and methods
- To enable the students to appreciate the practical difficulties and safety issues

CIVIL ENGINEERING PRACTICE

1. Study of plumbing in general household and industrial systems
2. Making a small window frame with Lap and Mortise & Tenon Joints
3. Introduction to power tools

MECHANICAL ENGINEERING PRACTICE

1. Fabrication of a small Table frame with Butt, Lap and Fillet Joints
2. Machining of a simple component like a table weight using lathe
3. Mold preparation for simple component

ELECTRICAL ENGINEERING PRACTICE

1. Comparison of incandescent, Fluorescent, CFL and LED lamps.
2. Study of Protection Circuits (small relay, fuse, MCB, HRC, MCCB, ECCB).
3. Familiarization of households Electrical Gadgets (Iron Box, Wet Grinder).
4. Understanding of Domestic and Industrial wiring.
5. Earthing and its significance.
6. Troubleshooting in Electrical Circuits.
7. Study of inverter fed UPS/Emergency lamp

ELECTRONICS ENGINEERING PRACTICE

1. Identifications symbolic representation of active and passive electronic components
2. Soldering and tracing of electronic circuits and checking its continuity
3. Assembling of A.C. to D.C, D.C to A.C. Circuits in bread Board and Mini project.

TOTAL HOURS – 30

OUTCOMES:

Upon the completion of the course, students should be able to

- Appreciate the practical skills needed even in making of simple objects, assemblies and circuits
- Attend minor defects especially in items used in day to day life
- Aware of the safety aspects involved in using tools and instruments

GEC 1104	COMPUTER PROGRAMMING I	L	T	P	C
		1	0	2	2

OBJECTIVES:

- To identify the hardware and software components of the computer.
- To know the basic concept of operating system and get knowledge about different operating systems.
- To learn various database concepts and operations
- To develop efficient algorithms for solving a problem.
- To implement the algorithms in C language.
- To use arrays in solving problems.

MODULE I COMPUTER FUNDAMENTALS **7**

Introduction -. Number System - Planning the computer program - Computer Software - Basic operating system concepts - Database Operations

MODULE II PROGRAMMING IN C **8**

Introduction to C Programming Language – Operators - Control statements -Iterative statements - Arrays.

LIST OF EXPERIMENTS:

1. Computer organization –Hardware in a typical computer Identification – Booting- error messages and what it means
2. Types of Operating systems – Windows and Linux
3. Structure of a basic program - Hello world program – Debugging it
4. Data types: Type conversions
5. Input / Output: Formatted functions – Unformatted functions – Library functions
6. Properties of operators – Priority of operators – Arithmetic relational logical and bitwise operators
7. If – if else- nested if else- goto- switch case – nested switch case – for loops – nested for loops – while loop – do-while loop – break and continue statement
8. Arrays – Operation with arrays
9. Sorting and searching.

L – 15; P – 30; TOTAL HOURS – 45

REFERENCES:

1. Ashok N Kamthane, “Computer Programming”, Pearson Education, 2nd Edition, ISBN 13: 9788131704370, 2012
2. Paul J. Deitel, Deitel & Associates, “C How to Program”, Pearson Education, 7th Edition, ISBN-13: 978-0132990448, 2012

OUTCOMES:

Students who complete this course will be able to

- Recognize Modular design, logic flow, data abstraction
- Analyze the working of the programming constructs, functions, and I/O.
- Write down programs for sorting and searching algorithms
- Write down programs developing cycle for different applications
- Debug the programs and solve some practical problems in programming
- Develop programs using arrays.

SEMESTER II

MAC 1281	ADVANCED CALCULUS	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aims of this course are to

- train the students in solving problems using multiple integration.
- provide knowledge in using special functions to find out the area and volume of a region.
- acquire knowledge in tangent and normal vectors.
- gain knowledge in finding the areas of a curve and surface using vector integration.
- learn about the analytic functions and their properties along with bilinear transformation.
- know complex integration using Cauchy's theorems.

MODULE I MULTIPLE INTEGRATION AND ITS APPLICATIONS 8+2

Multiple integrals– Cartesian and Polar coordinates – change of order of integration – Multiple integral to compute area and volume.

MODULE II TRANSFORMATION OF COORDINATES AND SPECIAL FUNCTIONS 7+3

Change of variables between Cartesian, polar, cylindrical and spherical coordinates - Beta and Gamma functions – Properties and applications.

MODULE III VECTOR DIFFERENTIATION 7+3

Operations on vectors – Scalar Product, Vector Product, Projection of Vectors - Angle between two vectors - Gradient, divergence and curl

MODULE IV VECTOR INTEGRATION 8+2

Line, surface and volume integrals – Green's Theorem, Gauss Divergence Theorem and Stokes Theorem (statement only) – verification and evaluation of integrals.

MODULE V

ANALYTIC FUNCTION 8+2

Analytic function - Necessary and Sufficient condition (statement only) – Cauchy-Riemann equations in polar coordinates - properties of analytic function – determination of analytic function – conformal mapping (w = z+a, az and 1/z) and bilinear transformation.

MODULE VI COMPLEX INTEGRATION **7+3**

Statement and application of Cauchy's integral theorem – Cauchy's integral formula – Taylor's series and Laurent's series expansion – singularities - classification – residues - Cauchy's residue theorem – contour integration – Unit circle and semi circular contours (excluding poles on the real axis).

L – 45; T – 15; TOTAL HOURS – 60

TEXT BOOKS:

1. Veerarajan.T., "Engineering Mathematics "(5th edition) Tata Mc Graw Hill Publishing Co. New Delhi, 2012
2. Grewal B.S., "Higher Engineering Mathematics" (43rd edition), Khanna Publishers, New Delhi, 2012.
3. John W. Cell "Engineering Problems Illustrating Mathematics" Mc Graw Hill Publishing Co., New York 1943

REFERENCES:

1. Kreyszig, E., "Advanced Engineering Mathematics", 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
2. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th edition, Cengage Learning, 2011.
3. Dennis G. Zill, Warren S. Wright, "Advanced Engineering Mathematics", 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
4. Alan Jeffrey, "Advanced Engineering Mathematics", Academic Press, USA, 2002.
5. Ramana, B.V., "Higher Engineering Mathematics" Tata Mc Graw Hill Publishing Co. New Delhi, 2006.
6. Venkataraman, M.K., "Engineering Mathematics", Volume 2, 2nd edition, National Publishing Co., Chennai, 2003.
7. James Stewart ".Calculus" (7th edition),Brooks/Cole cengage learning,UK.

OUTCOMES:

After completing the course, student will be able to

- compute the area and volume using multiple integrals.

- apply special functions to solve integration problems.
- apply differentiation in scalar and vector fields.
- find area and volume of a region using vector integration.
- verify analyticity, conformity and bilinearity of complex functions.
- evaluate complex integrals.

GEC 1211	BASIC ENGINEERING MECHANICS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To impart knowledge about the basic laws of statics and dynamics and their applications in problem solving
- To acquaint both with scalar and vector approaches for representing forces and moments acting on particles and rigid bodies and their equilibrium
- To give on exposure on inertial properties of surfaces and solids
- To provide an understanding on the concept of work energy principle, friction, kinematics of motion and their relationship

MODULE I VECTOR APPROACH TO MECHANICS **07**

Introduction - Units and Dimensions- Vectors – Vectorial representation of forces and moments –Vector Algebra and its Physical relevance in Mechanics - Laws of Mechanics – Parallelogram and triangular Law of forces -Lame's theorem, Coplanar Forces – Resolution and Composition of forces- Equilibrium of a particle.

MODULE II EQUILIBRIUM OF PARTICLE **06**

Forces in space - Equilibrium of a particle in space - Equivalent systems of forces – Principle of transmissibility – Single equivalent force

MODULE III EQUILIBRIUM OF RIGID BODY **06**

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis –Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem - Equilibrium of Rigid bodies in two dimensions -Examples

MODULE IV PROPERTIES OF SURFACES **08**

Determination of Areas – First moment of area and the Centroid of sections – Rectangle, circle, triangle from integration – T section, I section, Angle section, Hollow section by using standard formula – second and product moments of plane area – Physical relevance - Rectangle, triangle, circle from integration - T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia- Mass moment of Area

MODULE V FRICTION **08**

Introduction to friction- types of friction- Laws of Coloumb friction- Frictional force – simple

contact friction – Rolling resistance –ladder friction

MODULE VI LAWS OF MOTION 10

Review of laws of motion – Newton's law – Work Energy Equation of particles– Impulse and Momentum – Impact of elastic bodies.

L – 45; T – 15; TOTAL HOURS – 60

REFERENCES:

1. Beer, F.P and Johnston Jr. E.R, "Vector Mechanics for Engineers, Dynamics & Statics", Third SI Metric Edition, Tata McGraw-Hill International Edition, 2001.
2. Hibbeller, R.C., Engineering Mechanics, Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., 2000.
3. Irving H. Shames, Engineering Mechanics – Statics and Dynamics, IV Edition Pearson Education Asia Pvt. Ltd., 2003.

OUTCOMES:

On completion of this course students should be able

- Analyse and resolve forces, moments and solve problems using various principles and laws of Mechanics
- Apply the concept of equilibrium to particles and solve problems
- Apply the concept of equilibrium to rigid bodies and solve problems
- Analyse and determine the properties of surfaces
- Analyse and evaluate the fractional forces between the bodies
- Apply the laws of motion in solving dynamics problems

GEC 1212	ENVIRONMENTAL STUDIES	L	T	P	C
		2	0	0	2

OBJECTIVES:

The student will be conversant with the

- various natural resources, availability, utilisation and its current scenario
- different ecosystems, energy transfer, values, threats and conservation of biodiversity
- levels of different pollutants and its impact and the causes and effects of natural disasters
- impacts of human population, impact assessment, human rights and environmental acts and sustainable development

MODULE I NATURAL RESOURCES 8

Land resources: land degradation, soil erosion and desertification - Forest resources: use and over-exploitation, deforestation - Water resources: use and over-utilisation of surface and ground water, conflicts over water (inter-state and international), dams (benefits and problems), water conservation (rainwater harvesting and watershed management) - Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources, mining - Food resources: world food problems, changes in land use by agriculture and overgrazing, modern agriculture and its effects, fertilizer and pesticide problems, water logging and salinity - Energy resources: increasing energy needs, renewable and non-renewable, use of alternate energy sources.

MODULE II ECOSYSTEM AND BIODIVERSITY 8

Ecosystem- energy flow in the ecosystem - food chains, food webs and ecological pyramids - characteristics, structure and function of (a) Terrestrial ecosystems (forest, grassland, desert) and (b) Aquatic fresh water ecosystems (pond, lake, river) (c) Aquatic salt water ecosystems (ocean, estuary) - ecological succession.

Biodiversity - genetic, species and ecosystem diversity – hot-spots of biodiversity – biogeographic classification of India - endangered, endemic, extinct and invasive species of India - red data book - values of biodiversity: consumptive, productive, social, ethical, aesthetic and option values - threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts - conservation of biodiversity: in-situ and ex-situ conservation of biodiversity

MODULE III ENVIRONMENTAL POLLUTION AND NATURAL DISASTER **8**

Definition, cause, effects and control measures of (a) air pollution (b) water pollution (c) soil pollution (d) marine pollution (e) noise pollution (f) thermal pollution (g) nuclear hazards - ill-effects of fireworks and upkeep of clean environment - solid waste management: types (urban, industrial, biomedical and electronic wastes), collection, processing and disposal (incineration, composting and land-fill) - natural disaster and management: flood, cyclone, drought, landslide, avalanche, volcanic eruptions, earthquake and tsunami.

MODULE IV HUMAN POPULATION, HEALTH AND SOCIAL ISSUES **6**

Population and population growth, population variation among nations, population explosion, family welfare programme.

Human health: air-borne, water borne diseases, infectious diseases, risks due to chemicals in food and environment.

Sustainable development - environmental legislation and laws: water act, air act, wildlife protection act, forest conservation act, environment protection act - environmental impact assessment, steps in EIA - human rights - women and child welfare.

Case studies related to current situation

TOTAL HOURS – 30

TEXT BOOKS:

1. Erach Bharucha, Textbook for Environmental Studies For Undergraduate Courses of all Branches of Higher Education for University Grants Commission, Orient Blackswan Pvt Ltd, Hyderabad, India, 2013.
2. Benny Joseph, Environmental Studies, Tata McGraw-Hill Education, India, 2009.
3. Ravikrishnan A, Environmental Science and Engineering, Sri Krishna Publications, Tamil Nadu, India, 2015.
4. Raman Sivakumar, Introduction to Environmental Science and Engineering, McGraw Hill Education, India, 2009.
5. Venugopala Rao P, Principles of Environmental Science and Engineering, Prentice Hall India Learning Private Limited; India, 2006.
6. Anubha Kaushik and Kaushik C.P., Environmental Science and Engineering,

New Age International Pvt Ltd., New Delhi, India, 2009.

REFERENCES:

1. Masters G.M., Introduction to Environmental Engineering and Science, Prentice Hall, New Delhi, 1997.
2. Henry J.G. and Heike G.W., Environmental Science and Engineering, Prentice Hall International Inc., New Jersy, 1996.
3. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co. Boston, USA, 2016.

OUTCOMES:

The student will be able to

- predict the scenario of various natural resources and suggest remedies to curb the exploitation of these resources.
- identify food chain and web and its role in various ecosystems, assess the impacts on biodiversity and provide solutions to conserve it.
- analyse the impacts of pollutants in the environment and propose suitable method to alleviate the pollutants and the natural disasters.
- assess on the impact of human population and the health related issues and the ethics to be followed for sustainable life.

GEC 1213	COMPUTER PROGRAMMING II	L	T	P	C
		1	0	2	2

OBJECTIVES:

- To provide knowledge about the benefits of Object Oriented Programming over Procedure oriented programming.
- To learn various File operations
- To expose fundamental concepts of object-oriented programming in classes, invoking methods and functions.
- To prepare students to get full use of code reusability using object oriented programming.
- To implement the basic concepts of object oriented programming using C++concepts.
- To focus on solving problems based on analyzing, designing and implementing programs in C and C++.

MODULE I PROGRAMMING IN C 7

Functions - Storage Classes - Structures and Unions – Pointers -Self Referential Structures and Linked Lists - File Processing.

MODULE II PROGRAMMING IN C++ 8

Programming in C++ - Overview of OOP in C – Inheritance - Polymorphism - Type Casting – Exceptions.

LIST OF EXPERIMENTS:

1. Functions
2. One dimensional arrays, Pointers
3. Recursion
4. Multi dimensional arrays, Linked lists.
5. Operating on Files.
6. Simple C++ program with Control statements.
7. Getting input from user console.
8. Classes, Object and Constructors.
9. Method overloading.
10. Inheritance

L – 15; P – 30; TOTAL HOURS – 45

REFERENCES:

1. Bjarne Stroustrup," The C++ Programming Language", Addison Wesley, 4th edition, ISBN-13: 978-0321563842, 2013.
2. Brian W. Kernighan and Dennis M. Ritchie, " The C Programming Language", Prentice Hall, ISBN 0-13-110362-8, 2015.
3. Bjarne Stroustrup, " Programming: Principles and Practice Using C++ ", Addison Wesley, 2nd edition, ISBN-13: 978-0321992789, 2014.
4. Brian W. Kernighan and Dennis M. Ritchie, " The C Programming Language (Ansi C Version)", Prentice Hall India Learning Private Limited, 2nd edition, ISBN-13: 978-8120305960, 1990.

OUTCOMES:

Students who complete this course will be able to

- Develop efficient algorithms for solving problems
- Handle files in C
- Use simple data structures like arrays and linked lists in solving problems.
- Write simple programs using concepts of object oriented programming.
- Implement algorithms in C++ Language.
- Demonstrate the Object Oriented Programming concepts applied in networking, web development and Database applications.

ITC 1201	DIGITAL PRINCIPLES AND APPLICATIONS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To acquire the knowledge of various numbering systems and their applications.
- To understand the different methods for simplification of Boolean Algebra
- To design and implement combinational logic circuits.
- To design and implement sequential logic circuits.

MODULE I NUMBER SYSTEMS, CODES AND DIGITAL LOGIC 7

Binary Number System – Binary to Decimal Conversion – Decimal to Binary Conversion – Octal Numbers – Hexadecimal Numbers – The ASCII Code – The Excess-3-Code – The Gray Code – Digital Logic – The Basic Gates – NOT,OR,AND – Universal Logic Gates – NOR, NAND, AND-OR-Invert Gates – Boolean Laws and Theorems

MODULE II MAPPING AND TABULATION METHODS 7

Sum-of-Products Method –Truth Table to Karnaugh Map – Pairs, Quads, and Octets – Karnaugh Simplifications – Don't-care Conditions – Product-of-sums Method – Products-of-sums Simplifications – Simplification by Quine-McClusky Method.

MODULE III COMBINATIONAL LOGIC CIRCUITS 8

Multiplexers – De-multiplexers – Decoders –Encoders – Code converters - Parity Generators and Checkers – Magnitude Comparator –- Read-only-Memory – Programmable Array Logic – Programmable Logic Arrays – Binary Adder and Subtractor.

MODULE IV SEQUENTIAL LOGIC CIRCUITS 8

Flip-flops: RS Flip-flops, D Flip-flops, JK Flip-flops, T Flip-flops – Registers: Serial-In-Serial-Out, Serial-In-Parallel-Out, Parallel-In-Parallel-Out, Universal Shift Registers– Counters: Asynchronous counters, Synchronous counters –

Design of sequential circuits: State Transition diagram, State Synthesis Table, Design Equations and Circuit Diagrams, State Reduction Technique.

LIST OF EXPERIMENTS

1. Study of logic gates – AND,OR, NOT, NOR and NAND.
2. Simplification of Boolean functions and implementation with logic gates.
3. Design and implementation of multiplexers.
4. Design and implementation of demultiplexers.
5. Design and implementation of decoders.
6. Design and implementation of encoders
7. Design and implementation of code converters.
8. Design and implementation magnitude comparators.
9. Design and implementation of adders and subtractors.
10. Design and implementation of parity generator and checker.
11. Study of flip-flops- RS,D,JK and T
12. Design and implementation of Registers with flip-flops.

L – 30; P – 30; TOTAL HOURS – 60

TEXT BOOKS:

1. Donald P.Leach, Albert Paul Malvino and Goutam Saha, 'Digital Principles an Applications', Tata McGraw Hill Education Private Limited, Seventh Edition, 2011.

REFERENCES:

1. M. Morris R. Mano and Michael D. Ciletti, 'Digital Design' , Pearson, Fourth Edition, 2011
2. John F.Wakerly , 'Digital Design – Principles and practices', Pearson Fourth Edition, 2014.

OUTCOMES:

On completion of the course students will be able to:

- Know the fundamental concepts and techniques used in digital electronics.
- Understand and examine the structure of various number systems and codes.
- Apply the principles of Boolean algebra to manipulate and minimize logic

expressions.

- Apply the mapping and tabulation method to minimize and optimize logic functions of any level.
- Design and implement various combinational logic circuits.
- Design and implement various sequential logic circuits built with different flip-flops.

ITC1202	PROGRAMMING IN PYTHON	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To install and execute python program.
- To provide a complete knowledge about python programming language.
- To develop application using python language.

MODULE I FUNDAMENTALS **7**

Python basics – objects – sequences – strings – lists – tuples.

MODULE II FILES INPUT AND OUTPUT **7**

Mapping and set types – conditionals and loops – files input and output

MODULE III PYTHON IN OTHER PARADIGMS **8**

Errors and exceptions-function programming-object oriented programming-execution environment.

MODULE IV ADVANCED TOPICS **8**

Network programming-internet client programming-GUI programming.

LIST OF EXPERIMENTS

1. Download and install Python.
2. Write a Python program to print "Hello, World!" and save this in a file named ***helloworld.py***. Make this program executable and run it like: ***./helloworld.py***
3. Write a Python program (*swap.py*) to swap values of two variables.
4. Write a program that asks for two numbers. If the sum of the numbers is greater than 100, print "That is a big number."
5. Write a python program to have a separate function for the area of a square, the area of a rectangle and the area of a circle (3.14 * radius ** 2).
6. Write a python program that prints result based on user input from the random integer between 0 and 99. If the user input is above the range print ”Too High”, below range print “Too Low”, within the range print “That’s right”.
7. Write a program using a while loop that asks the user for a number, and prints a

countdown from that number to zero. Include a condition in your program if the user inputs a negative number.

8. Write a method fact that takes a number from the user and prints its factorial.
9. Write a function roots that computes the roots of a quadratic equation. Check for complex roots and print an error message saying that the roots are complex**.**
10. Draw a Digital Clock by creating a class called Digital Clock that has attributes hour, minute, second, pos and draw method. The attributes store the time in the position - the upper left corner of the rectangle face. Add extra methods to help you draw the clock, e.g. a method for drawing the face, a method for drawing the text, a method returning the time as string.

L – 30; P – 30; TOTAL HOURS – 60

TEXT BOOKS:

1. Wesley J Chun, “Core Python Programming”, Second Edition, Prentice hall, 2006.

REFERENCES:

1. Richard L.Halterman, “Learning to program with python”, 2011.

OUTCOMES:

Upon Completion of this course the student will be able to

- Download and install python compiler.
- Write and test python programs.
- Develop applications using python.

SEMESTER III

		L	T	P	C
MAC 2181	**PARTIAL DIFFERENTIAL EQUATIONS AND TRANSFORMS**	**3**	**1**	**0**	**4**

OBJECTIVES:

The aims of this course are to

- familiarize in solving partial differential equation of first, second and higher orders.
- introduce basics and engineering applications of Fourier series, Laplace Transform, Fourier Transform and Z- Transform.

MODULE I PARTIAL DIFFERENTIAL EQUATIONS 8 + 2

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solution of standard types of first order partial differential equations – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients..

MODULE II FOURIER SERIES 8 + 2

Fourier Series and Dirichlet's conditions - General Fourier series - Half range Fourier series - Parseval's identity - Harmonic Analysis.

MODULE III FOURIER TRANSFORMS 7 + 3

Fourier integral theorem (without proof) - Fourier transform pair - Fourier Inverse Transform – Properties - Convolution theorem - Parseval's identity.

MODULE IV APPLICATIONS OF FOURIER SERIES AND FOURIER TRANSFORMS 7 + 3

Applications of Fourier series and Fourier Transform to solution of PDEs having constant coefficients with special reference to Heat & Wave equations, Discrete & point Spectrum and Single pulse.

MODULE V LAPLACE TRANSFORM 8 + 2

Introduction to Laplace transform - Existence of Laplace Transform - Properties of Laplace Transforms - Initial & Final Value Theorems - Inverse Laplace Transform - Convolution Theorem – Circuits to signal square wave: Integral equations with unrepeated complex factors – Damped forced vibrations: repeated complex factors – Resonance - Solution of differential equations

MODULE VI Z – TRANSFORM 7 + 3

Introduction and Definition of Z-transform - Properties of Z- Transform - Convolution Theorem of Z-Transform - Inverse Z–transform - Convolution Theorem of Inverse Z-Transform - Formation of difference equations - Solving Difference Equations using Z-Transform.

L – 45; T – 15; Total – 60

TEXT BOOKS

1. Kreyszig .E., “Advanced Engineering Mathematics“, 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
2. Grewal B.S., “Higher Engineering Mathematics”, 42nd edition, Khanna Publishers, New Delhi, 2012.
3. Ramana, B.V, “Higher Engineering Mathematics” Tata Mc Graw Hill Publishing Co. New Delhi, 2006.

REFERENCES

1. Veerarajan.T., “Engineering Mathematics“, 5th edition, Tata Mc Graw Hill Publishing Co. New Delhi, 2012.
2. Peter V. O'Neil, “Advanced Engineering Mathematics**”**, 7th edition, Cengage Learning, 2011.
3. Dennis G. Zill, Warren S. Wright, “Advanced Engineering Mathematics”, 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
4. Alan Jeffrey, “Advanced Engineering Mathematics”, Academic Press, USA, 2002.

OUTCOMES:

After completing the course, student will be able to

- solve the partial differential equations.
- derive a Fourier series of a given periodic function by evaluating Fourier coefficients.
- apply integral expressions for the forward and inverse Fourier transform to a range of non-periodic waveforms.
- solve wave equation and heat flow equation.
- solve ordinary differential equations using Laplace transform.
- solve difference equation using Z-transform.

ENC 2181	ORAL COMMUNICATION	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To expose students to a range of professional contexts through podcasts for learning appropriate expressions.
- To train them in making poster presentations.
- To enable them to make effective business presentations.
- To help them learn persuasive and negotiation skills.
- To train them to debate on issues of current relevance
- To train them to participate in group discussions on current affairs

MODULE I **4**

Orientation to the Importance of Oral Communication -– Verbal and non-verbal communication -Paralinguistic features.

One-minute presentations (using Audacity/Voicethread) – Just a minute (JAM) on random topics

MODULE II **4**

Negotiating and persuading through effective arguments – to arrive at a conclusion (pair-work)

Understanding Negotiation, persuasion and marketing skills through Podcasts

Listening to short conversations and monologues for understanding real life conversations

MODULE III **4**

Making Poster presentations on current issues

Understanding nuances of making effective presentations (TED Videos)

MODULE IV **6**

Deliberation on social and scientific issues – Debates (focus on rebuttal skills and deconstructing arguments)

Viewing videos on debates (NDTV Discussions)

MODULE V **6**

Discussing social issues or current affairs in groups

Viewing group discussions and listening for specific information

MODULE VI **6**

Making full length presentation (through Voicethread) with the focus on one's career plans and prospects (discipline specific)

Listening to interviews for understanding speakers' perception (on industry related issues)

P – 30; Total Hours –30

REFERENCES:

1. Hancock, Mark (2012). *English Pronunciation in Use*. Cambridge University Press, UK.
2. Anderson, Kenneth & et.al (2007). *Study Speaking: A Course in Spoken English for Academic Purposes* (Second Edition). Cambridge University Press, UK.
3. Hurlock, B.Elizabeth (2011). *Personality Development*. Tata McGraw Hill, New York.
4. Dhanavel,S.P (2015). *English and Soft Skills*. Orient Blackswan, Chennai.
5. Whitby, Norman (2014). *Business Benchmark: Pre-Intermediate to Intermediate.* Cambridge University Press, UK.

OUTCOMES:

On completion of the course, students will be able to

- Listen to business conversations and do related tasks.
- Deliver effective poster presentations.
- Make effective business presentations.
- Use persuasive and negotiating skills for justifying arguments.
- Participate effectively in debates.
- Speak English intelligibly, fluently and accurately in group discussions.

ITC2101	DATA STRUCTURES	L	T	P	C
		3	0	2	4

OBJECTIVES:

To enable the students to

- depict the different problem solving techniques and the need for data structures.
- be aware of the various abstract data types and their applications.
- know the tree ADT and their applications.
- understand and implement searching and sorting algorithms.
- recognize graphical representation and apply algorithms for path finding.
- apply the knowledge of data structures in practical applications.

Prerequisite: Computer Fundamentals

MODULE I PROBLEM SOLVING AND ABSTRACT DATA TYPES 7

Problem solving - Top-down Design – Efficiency- Analysis - Sample algorithms – Introduction to data structures – Data structure types – Abstract Data Types – Arrays – Structures – Unions – Pointers.

MODULE II LISTS, STACKS AND QUEUES 8

List ADT – Stack ADT – Queue ADT – Circular Queue – Double Ended Queue - Priority Queue – Array implementation of Stack and Queue – Singly Linked List – Doubly Linked Lists – Stack and Queue using Linked List.

MODULE III TREES AND HASHING 8

Preliminaries - Binary Trees - The Search Tree ADT - Binary Search Trees - AVL Trees - Tree Traversals – Binary Heap - Hashing - General Idea - Hash Function - Separate Chaining - Open Addressing - Linear Probing.

MODULE IV SEARCHING AND SORTING 7

Linear Search – Binary Search - Preliminaries - Insertion Sort - Selection Sort- Shell Sort - Heap sort - Merge sort - Quick sort.

MODULE V GRAPHS 8

Definitions - Topological Sort - Shortest-Path Algorithms - Unweighted Shortest Paths – Dijkstra’s Algorithm - Minimum Spanning Tree – Prim’s Algorithm -

Applications of Depth-First Search - Undirected Graphs.

MODULE VI APPLICATIONS **7**

Linked List - Maintaining an inventory -- Stack - conversion of infix to postfix expression, evaluation of arithmetic expression - Queue - scheduler in OS - Tree - Priority queue - Graph - Traveling Salesman Problem.

Total : 45 Hours

LIST OF EXERCISES:

1. Implementation of linear search and binary search
2. Array implementation of List ADT, STACK ADT, Queue ADT.
3. Implementation of Singly linked list (addition, deletion. Insertion in all positions)
4. Implementation of Doubly linked list (addition, deletion. Insertion in all positions)
5. Implementation of Stack and Queues using linked list.
6. Implementation of binary search tree.
7. Program for tree traversal (inorder, postorder, preorder)
8. Implementation of Quick sort, Merge sort, Shell sort.
9. Implementation of Dijkstra”s algorithms.
10. Implementation of Depth First search.
11. Implementation of Linked List, Stack and Queue in real world.

Practical: 20 Hours

L – 45; P – 20; TOTAL HOURS – 65

TEXT BOOK:

1. R. G. Dromey, "How to Solve it by Computer", Prentice-Hall of India, 2009.

2. M. A. Weiss, "Data Structures and Algorithm Analysis in C++", 3rd Edition, Pearson Education, 2007.

REFERENCES:

1. Ashok Kamthane, "Introduction to Data Structures in C", 2nd edition, Wiley Publishers, 2011.

2. Narasimha Karumanchi, “Data Structures and Algorithms Made Easy”, 2nd Edition, CareerMonk Publications, 2011.

3. S.K. Srivastava & Deepali Srivastava," Data Structures Through C in Depth" 2nd Edition, 2011, BPB Publications.

4. A.K.Sharma, “Data Structures using C”, Pearson Education, 2013.

OUTCOMES:

On successful completion of the course, the students will be able to:

- Analyze the performance of algorithms.
- Describe how arrays, structures, unions and pointers are represented in memory.
- Exhibit an understanding of the abstract properties of various data structures such as lists, stacks and queues.
- Demonstrate the different methods for traversing trees and outline the concepts of hashing.
- Explain the various searching and sorting algorithms.
- Discuss about graph traversal algorithms.
- Choose an appropriate data structure and algorithm design method for a specified application.

ITC2102 COMPUTER ARCHITECTURE L T P C
3 0 0 3

OBJECTIVES:

To enable the students to

- have a thorough understanding of the basic structure and operation of a digital computer.
- explore the instruction set and addressing modes of a computer.
- study about the different types of pipelining and processors
- discuss in detail implementation of fixed-point and floating-point addition, subtraction, multiplication & division.
- explore the different ways of communicating with I/O devices and standard I/O interfaces.
- study the hierarchical memory system including cache memories and virtual memory.

MODULE I BASIC COMPUTER ORGANIZATION 7

Instruction codes – Computer Registers – Computer Instructions – Timing and Control – Instruction Cycle – Memory Reference Instructions – Input – output and Interrupt – Complete Computer Description – Design of Basic Computer – Design of accumulator Logic – Micro programmed Control – Control Memory – Address sequencing.

MODULE II CENTRAL PROCESSING UNIT 8

General Register Organization – Stack Organization –Instruction Formats – Addressing Modes – Data Transfer and Manipulation – Program Control – Reduced Instruction Set Computers.

MODULE III PIPELINE AND VECTOR PROCESSING 8

Parallel Processing – Pipelining – Arithmetic Pipeline – Instruction Pipeline – RISC Pipeline – Vector Processing – Array Processors.

MODULE IV COMPUTER ARITHMETIC 8

Addition and Subtraction Algorithms – Multiplication Algorithms – Division Algorithms – Floating Point Arithmetic Operations – Decimal Arithmetic Unit – Decimal Arithmetic Operations.

MODULE V I/O ORGANIZATION **7**

Peripheral Devices – Input-Output Interface –Asynchronous Data Transfer – Modes of Transfer – Priority Interrupt- Direct Memory Access – Input/ Output Processor – Serial Communication.

MODULE VI MEMORY ORGANIZATION **7**

Memory Hierarchy – Main Memory – Auxiliary Memory – Associative Memory – Cache Memory – Virtual Memory – Memory Management Hardware - CASE study.

Total : 45 Hours

TEXT BOOK:

1. M. Morris Mano, “Computer System Architecture” Revised Third Edition, Pearson

Education, 2017.

REFERENCES:

1. Smruthi Ranjan Sarangi, “Computer Organization and Architecture”, McGraw Hill Education (India) Pvt.Ltd., 2015.

2. William Stallings, “Computer Organization and Architecture – Designing for Performance”, 9th edition, Pearson, 2013.

3. Hohl, William, “ARM Assembly Language: fundamentals and techniques “ , 2nd edition, CRC Press, 2014.

4. David A. Patterson and John L.Hennesey, “Computer Organization and Design- The Hardware / Software Interface”, 5th edition, Morgan Kauffman / Elsevier , 2014.

5. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, "Computer Organization", 5th Edition, McGraw-Hill, 2011

OUTCOMES:

On successful completion of the course, the students will be able to

- Discuss the central ideas in computer organization and show the relationship between hardware and software of a computer.
- Describe various operations and operands of computer hardware and representation of instructions.
- Explain the importance of Pipelining and parallel processing.
- Explain how a computer performs arithmetic operations and decimal arithmetic operations.
- Outline the I/O Organization, interrupts and interfaces.
- Compile the concepts of memory organization.

ITC2103 COMPUTER NETWORKS L T P C

3 0 0 3

OBJECTIVES:

To enable the students to

- understand the computer networking basics and the functions of different layers in OSI Model and TCP-IP Model.
- acquire the knowledge about the different error detection and correction methods and how the data flow is controlled in data communication.
- learn the internetworking protocols and how to apply the sub netting scheme to efficiently use the IP addresses by reducing the wastage of addresses.
- be conversant with the various transmission control protocols and congestion control mechanisms.
- be familiar with various application layer protocols .
- learn about cryptographic techniques and algorithms for network security.

Prerequisite: Computer Fundamentals

MODULE I INTRODUCTION TO COMPUTER NETWORKS 7

Data communication: components, data representation, data flow – Networks: Network criteria, Physical Topology, Categories of Networks - Protocols and standards – Network Models: OSI and TCP/IP Model – Data Transmission: Transmission Impairments, line coding – Transmission Media: Guided and Unguided media.

MODULE II DATA LINK LAYER 8

Error detection and correction: CRC, Hamming code - Flow and Error control Protocols: Stop and Wait, Go back-N ARQ, Selective Repeat ARQ - HDLC – LAN: Ethernet, IEEE 802.3, IEEE 802.11 - Switches - Virtual LAN.

MODULE III INTERNET AND ROUTING PROTOCOLS 8

Logical Addressing – IPv4: Classfull Addressing, Classless Addressing , CIDR, NAT, Sub netting , Super netting, VLSM – IPv6: Structure, Address space, Advantages -- Routers – Routing Protocols - Distance Vector Routing - Link State Routing.

MODULE IV TRANSMISSION AND CONGESTION CONTROL MECHANISMS 8

Transmission control: Process to Process Delivery, Transmission Control Protocols: UDP, TCP and SCTP - Congestion control: Open loop and closed loop congestion control methods, Congestion control examples in TCP and Frame Relay - Quality of Service.

MODULE V NETWORK SERVICES AND SECURITY 7

Domain Name System – Electronic Mail – Remote Connection – File Transfer – Hyper Text Transfer – Cryptography - Symmetric Key Cryptography - Asymmetric Key Cryptography – RSA Algorithm.

MODULE VI SOFTWARE DEFINED NETWORKS 7

Need for SDN : Evolution of switches and control panel, SDN Implications for Research and Innovation, Data Center Innovation, Data Center Needs – Genesis of SDN: The Evolution of Networking Technology, Forerunners of SDN, Open Source Contributions to SDN – Working Principles of SDN: Fundamental Characteristics of SDN, SDN operation, SDN Devices, SDN Controller and SDN applications.

Total : 45 Hours

TEXT BOOK:

1. Behrouz A. Forouzan, "Data Communication and Networking", 4th Edition, Tata McGraw- Hill, 2017.

REFERENCES:

1. James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", Fifth Edition, Pearson Education, 2017.

2. Andrew S. Tanenbaum, David.J.Wetherall "Computer Networks", Fifth Edition, Pearson Education, 2013.

3. William Stallings, "Data and Computer Communication", Tenth Edition, Pearson Education, 2017.

4. Paul Goransson, Chuck Black, and Timothy Culver **"**Software Defined Networks:

A Comprehensive Approach", Second Edition, Pearson Education, 2016.

OUTCOMES:

On successful completion of the course, the students will be able to

- discuss the terminology and concepts of the OSI reference model & TCP-IP model and the various technologies & standards related networks.
- apply the error detection & correction methods and compare various flow control mechanisms in data communication.
- design and apply appropriate subnetting scheme upon analyzing the requirements of the organization networking structure.
- illustrate the role of various transmission control protocols , how congestion in the networks can be controlled .
- explain the various services provided by network and apply cryptographic techniques and algorithms for network security.
- discuss the need for software defined networks and their working principles and characteristics.

ITC2104 ADVANCED JAVA AND INTERNET PROGRAMMING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To install and setup Java environment and to learn Java basics
- To develop Java application using swing and AWT
- To explore advanced Java concepts
- To have hands on experience in Internet Programming.

MODULE I JAVA BASICS **8**

Introduction to Java – evolution – variables and data types - arrays- operators-control structures- methods- implementation of object oriented concepts – exception handling.

MODULE II MULTI THREADING AND I / O STREAMS **7**

Multithread programming, thread creation, inter process communication, synchronization-i/o basics- generic programming – string handling-collections.

MODULE III INTRODUCTION TO GUI PROGRAMMING **8**

AWT – using AWT Controls - Event Handling -SWING - Applets and Applications- JavaFX Programming.

MODULE IV JAVA OPEN DB AND RICH INTERNET APPLICATIONS **7**

Introduction to databases – SQL-MySQL-Java DB / Apache Derby – Java API with XML-AJAX-Rich Internet Applications with XML and JSON.

MODULE V INTERNET PROGRAMMING FUNDAMENTALS **7**

Introduction to HTML5 - cascading Style Sheets -Java Script- functions-arrays – objects-DOM- event handling.

MODULE VI INTERNET PROGRAMMING FRAMEWORKS **8**

Java Beans- Servlets – JSP– Session Management – Cookies – Java Web Start – Java Plug-Ins – Deployment, Plug-In And Web Start Tools –– Installing And Configuring Apache Tomcat Server- Jboss Server.

Total Hours : 45

TEXT BOOKS:

1. Herbert Schildt, “Java 2 – The Complete Reference”, Nineth Edition, Tata McGraw Hill, 2014.

2. Deitel and Deitel and Nieto “Internet and World Wide Web-How to Program”, Prentice Hall, 6th Edition, 2012.

OUTCOMES:

Upon Completion of course the students will be able to :

- become familiar with the Java environment
- develop Java application using Swings and Middleware technology
- develop Applet and AWT based Java Applications
- apply java concepts to develop frontend and backend applications
- use client side and server side scripting
- explore internet application frameworks

ECC2105	FUNDAMENTALS OF DIGITAL SIGNAL PROCESSING	L	T	P	C
		1	0	0	1

OBJECTIVES:

- To introduce signals, systems, time and frequency domain concepts and the associated fundamental mathematical tools to all DSP techniques.
- To impart knowledge about the digital filters
- To excel in fields such as speech processing, image processing and audio signal processing

MODULE I SIGNALS AND SYSTEMS 06

Basic elements of DSP, Sampling theorem, Discrete time signals, Discrete time systems , Analysis of discrete time LTI systems , Z transform, convolution (linear and circular) , Discrete Fourier Transform, Fast Fourier Transform.

MODULE II INTRODUCTION TO FILTERS & DSP APPLICATIONS 09

IIR filter design, FIR filter design, DSP applications- audio processing, speech processing, digital image processing.

TOTAL HOURS: 15

TEXT BOOKS

1. John G. Proakis& Dimitris G.Manolakis, “Digital Signal Processing – Principles, Algorithms and Applications”, Pearson education / Prentice Hall, Fourth edition, 2007.
2. Mitra, Sanjit K, Digital Signal Processing : A Computer Based Approach, 4th Edition, McGraw-Hill, 2011.

REFERENCES

1. Kuo Sen M, Lee Bob H andTianWenshun, Real-Time Digital Signal Processing: Implementations and Applications, 2nd Edition, John Wiley, c2006.
2. Alan V. Oppenheim, Ronald W. Jchafer&Hohn. R.Back, “Discrete Time Signal Processing”, Pearson Education, Second Edition, 2001
3. Emmanuel C.Ifeachor, &Barrie.W.Jervis, “Digital Signal Processing”, Pearson Education / Prentice Hall, Second edition, 2002.

OUTCOMES:

On completion of the course, students will be able to

1. To understand the key theoretical principles of DSP.
2. Differentiate between continuous & discrete time signals.
3. Understand the implications of the sampling theorem and the consequences of aliasing and quantization distortion.
4. Represent real world signals in digital format and understand transform-domain (Fourier and z-transforms) representation of the signals.
5. Describe about digital filters.
6. To apply signal processing concepts in speech processing, image processing and audio signal processing.

ITC2106	NETWORK CONFIGURATION LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

To enable the students to

- study the tools and commands for constructing and maintaining networks.
- configure the IP addresses in the Network devices.
- configure the various routing protocols and enable the different networks to communicate with each other.
- configure the Access control lists in a network topology.
- configure VLANs on the switches in a network topology.

LIST OF EXERCISES:

1. Using Network Tools to verify the various addresses associated with network, connectivity between nodes in a network.
2. Basic configuration of Routers and Switches and Configuration of IP addresses in a computer and in the interfaces of a Router.
3. Creating simple peer to peer network.
4. Creating a Wide Area Network (WAN) with various classes of IP address and configured with RIP protocol.
5. Creating a WAN with subnetted IP addresses and configured with IGRP protocol.
6. Creating a WAN with variable length subnetted IP addresses and configured with RIP Ver 2 Protocol.
7. Creating a WAN with variable length subnetted IP addresses and configured with EIGRP protocol.
8. Creating a WAN with variable length subnetted IP addresses and configured with OSPF protocol.
9. Creating an Access controlled WAN with variable length subnetted IP addresses and configured with any one of the routing protocol.
10. Configuration of Virtual LAN on the switches in a network topology

Total : 30 Hours

OUTCOMES:

On completion of the course students will be able to:

- Design and implement a WAN with a distance vectored routing protocol.

- Design and implement a WAN with a link-state routing protocol.
- Design and implement a WAN with VLSM and appropriate classless inter-domain
  Routing protocol
- Design and implement a WAN with VLAN configured switches.
- Design and implement a WAN with communication restricted through ACLs.

ITC2107 ADVANCED JAVA AND INTERNET PROGRAMMING LAB

L	T	P	C
0	0	3	1

OBJECTIVES:

To enable the students to

- acquire practical experience on core java programming.
- have hands on experience in advanced concepts of java programming.
- gain hands on experience in Internet Programming.

EXPERIMENTS:

1. Java program using AWT GUI components.
2. Java programs for layout manager.
3. Java program to create applets with the specific features like color palette, background, image insertion, radio buttons, and checkbox group etc.
4. Programs to implement Java swing components.
5. Java programs to implement thread, thread priority, multi thread concepts.
6. Java programs for database connectivity using JDBC-ODBC connectivity.
7. Installation and working of webserver like Apache Tomcat and application servers glassfish.
8. *Java programs to create three-tier applications using servlets and JSP.*
9. Create a web page using HTML (i.e include map,hotspots).
10. Create a web page with various kind of style sheets.
11. Demonstration of Java Script, JQuery, and Ajax.
12. XML and Java API for XML web services.

Total Hours : 30

OUTCOMES:

Upon Completion of course the students will be able to :

- become familiar with the Java environment.
- develop Applet , AWT, and Swing based Java Applications.
- practice advanced Java concepts.
- practice Markup languages and programming.
- work in the Internet frameworks.

SEMESTER IV

ENC 2282	WRITTEN COMMUNICATION	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To help students identify content specific vocabulary and learn its usage.
- To expose them to reading for specific purposes, especially in professional contexts.
- To expose them to the process of different kinds of formal writing.
- To help them learn corporate correspondence for different purposes.
- To train them in preparing effective applications with résumé
- To make them write different types of reports.

MODULE I **4**

Introduction - process of writing – Fundamentals of academic and professional writing – Understanding short, real world notices, messages, etc.

MODULE II **4**

Reading industry related texts (ex. Manufacturing, textile, hospitality sector etc.) for specific information.

Writing Instructions and recommendations

MODULE III **6**

Understanding format and conventions of writing email, memo, fax, agenda and minutes of the meeting.

Writing email, memo, fax, agenda and minutes of the meeting for various purposes (industry specific)

MODULE IV **6**

Viewing letter of application and Résumé, letter calling for an interview, letter of inquiry and Promotional letter

Writing Functional résumé and letter of application using Edmodo,

MODULE V **6**

Viewing a Video and reading a case study (industry specific) – collaborative writing using Edmodo –reading and information transfer

Writing reports- Survey, feasibility and progress – exposure to discipline specific reports

MODULE VI **4**

Writing Statement of purpose (Higher Education)-- Justifying and writing about one's preparedness for job (Statement of Purpose highlighting strengths and weaknesses) – Peer evaluation skills through Edmodo.

P – 30; Total Hours –30

REFERENCES:

1. Riordan,D (2013). *Technical Report Writing Today*. Cengage Learning, 10th edition. USA.
2. Oliu, W. E., Brusaw, C.T., & Alred, G.J.(2012). *Writing that Works: Communicating Effectively on the Job* . Bedford/St. Martin's. Eleventh Edition.
3. Garner, B.A. (2013). *HBR Guide to Better Business Writing (HBR Guide Series)*. Harvard Business Review Press. USA.
4. Sharma, R.C. & Krishna M. (2002). *Business Correspondence and Report Writing*. Tata MacGraw – Hill Publishing Company Limited, New Delhi.
5. Macknish, C. (2010). *Academic and Professional Writing for Teachers*. McGraw-Hill Education. USA.
6. Whitby, Norman (2014). *Business Benchmark: Pre-Intermediate to Intermediate.* Cambridge University Press, UK.

OUTCOMES:

On completion of the course, the students will have the ability to

- Identify content specific vocabulary and also use them in appropriate contexts.
- Demonstrate reading skills with reference to business related texts.
- Draft professional documents by using the three stages of writing.
- Create different types of documents for various corporate correspondences.
- Write effective letter of applications, résumé and statement of purpose.
- Write business related reports efficiently.

ITC2211 UNIX AND SHELL PROGRAMMING

L	T	P	C
2	0	2	3

OBJECTIVES:

To enable the students to

- learn the structure of unix and file system
- use unix shells and commands
- write shell and C programming in unix

Prerequisite: Fundamentals of Computer and operating systems

MODULE I INTRODUCTION **7**

Introduction to Unix:- Architecture- Features -Commands-Unix Utilities:- file system-file handling utilities- security by file permissions.

MODULE II UNIX UTILITIES **7**

Utilities-process utilities- disk utilities- networking commands-Text processing utilities and backup utilities- Introduction to Shells- Unix Session- Standard Streams- Pipes-filters.

MODULE III GREP , SED AND AWK PROGRAMMING **8**

Grep -Operation- grep Family- Searching for File Content-Sed -Scripts- Operation-Addresses- commands- Applications- Awk-Execution- Fields and Records- Scripts-Operations- String Functions- Mathematical Functions.

MODULE IV SHELL PROGRAMMING **8**

Interactive Korn Shell-Korn Shell Features- Interactive C Shell-C shell features -Special Files- Variables- Output/ Input-Environmental Variables- Startup Scripts-Debugging Scripts- Script Examples

Total : 30 Hours

LIST OF EXERCISES:

1. Basic unix commands and vi editor.
2. Unix utilities-file system, permissions, process, networking, grep and sed.
3. Programming with shell scripts- basic shell program, streams, control statements, test condions and Loop setup.
4. Korn shell and awk programming.

5. Process management – Fork, Exec and job control.

6. Inter-process communication between related processes using pipes and filters.

7. Interactive C shell programming on unix – pointer arithmetic, statements for program control, functions, manipulating files.

L – 30; P – 30; TOTAL HOURS – 60

TEXT BOOKS :

1. Behrouz A. Forouzan, Richard F. Gilberg.Thomson," Unix and shell Programming ", Brooks/Cole-Thomson Learning, 2003.

2. Sumitabha Das,"Your Unix the ultimate guide", 2nd Edition, Tata McGraw-Hill, 2006.

REFERENCES :

1. Kernighan and Pike,"Unix programming environment", PHI. / Pearson Education.

2. Graham Glass, King Ables,"Unix for programmers and users", 3rd edition, Pearson Education.

3. Rosen, Host, Klee, Farber, Rosinski,"The Complete Reference Unix", Second Edition, TMH.

OUTCOMES:

On successful completion of the course, the students will be able to

- Describe the structure of unix system
- Use unix commands to manage file systems
- Discuss file structure and system calls
- Write shell and awk programming
- Write C program for inter process communication, memory allocation and file handling.

ITC2212 DATABASE MANAGEMENT SYSTEM

L	T	P	C
3	0	0	3

OBJECTIVES:

- To describe essential features of database management systems and its use.
- Familiar to identify about the procedural and non-procedural language.
- Mastering the design principles of databases, as well as in the normalization approach.
- To provide the description of physical file structures and access methods
- Master the advanced topics and current trends.

MODULE I BASIC CONCEPTS 7

General Introduction to database and Transactions -Traditional file system and database - Database system three-tier architecture - various components of database- Data models - Modeling using ER model – UML – OLTP Vs OLAP

MODULE II RELATIONAL ALGEBRA AND SQL LANGUAGE 8

Unary Operations: Select and Project - Relational Set operations - Binary Relational operators. SQL: Data definition Language, Data Manipulation Language, Data Control Language in SQL - Basic constraints in SQL - Basic Queries in SQL- Joins, Aggregate & SORT functions -SQL Views and Privileges.

MODULE III DATABASE DESIGN AND DATA STORAGE 8

Importance of good schema design - Problems due to bad design schema- Functional dependencies: Definition-Inference rules for FD-minimal sets of FD- Normal forms up to BCNF- Dependency preserving and Lossless decomposition. Storage File organization: Memory Hierarchies - Secondary Storage devices - Magnetic tape storage device. Files - Fixed length and Variable length records. Operations on files: Sorted Files - Heap Files-Hashing and overflow handling techniques.

MODULE IV INDEXING AND TRANSACTION PROCESSING 8

What is Indexing? Advantages of Indexing; Indexing structure for files: Different type of single-level ordered index- Multi level index-Dynamic multilevel indexing using B tree and B+ trees: Create Index using SQL; Introduction to transaction processing: single-user verses multiuser - Need for Concurrency and recovery - Transaction states - ACID properties and Logs - Schedules based on Serializability:

Conflict and View serializability - testing for serializability. Characterizing schedules based on Recoverability: Recoverable - Non-recoverable schedules - cascading rollback and cascade less schedule. – What is SQL Tuning?

MODULE V CONCURRENCY AND RECOVERY TECHNIQUES 8

Concurrency control techniques: Locking, Lock compatibility matrix, Basic Two-phase locking (2PL) protocol, and various 2PL protocol, Timestamp-ordering based protocol. Deadlock prevention, Deadlock detection and Deadlock recovery - Database recovery techniques: Immediate update, deferred update, Shadow paging, and Checkpoint.

MODULE VI ENHANCED DATA MODELS 6

Overview of object oriented concepts - Temporal databases - Introduction to multimedia and spatial databases - Distributed databases and issues - Types of distributed database systems - XML documents and XML Querying - Data mining concepts – Introduction to NoSQL & Columnar databases

Total Hours : 45

TEXT BOOKS:

1. Silberschatz, A., Korth, H. F., & Sudarshan, “Database system concepts” McGraw-Hill. ,(International Edition) (6th ed.). New York, 2011.
2. Elmasri, R., & Navathe, S. B. “Fundamentals of database systems” (6th ed.) Pearson Education, 2011.

REFERENCE BOOKS:

1. Raghu Ramakrishnan, “Database Management System”,3rd Edition, Tata McGraw-Hill Publishing Company, 2003.
2. Peter Rob and Corlos Coronel- “Database System, Design, Implementation and Management”, 5th edition, 2003.
3. C J Date, “An Introduction to Database System”, 8th Edition, 2004.
4. Hector Garcia–Molina, Jeffrey D.Ullman and Jennifer Widom- “Database System Implementation”, Pearson Education, 2000.

OUTCOMES:

On successful completion of the course, the students will be able to

- Summarize the vital concepts and architecture associated with DBMS
- Describe relational database using SQL.

- Apply normalization techniques in database design.
- Use the transaction processing and concurrency control for application software.
- Utilize the query evaluation techniques and query optimization.
- Apply the knowledge in current trends of database system.

ITC2213 OPERATING SYSTEMS L T P C

3 0 2 4

OBJECTIVES:

To enable the students to

- Study about different types of system software and operating systems.
- understand the concepts of process scheduling and compare the various scheduling algorithms.
- acquire the knowledge about critical section problem and how the solution is provided
- explain conditions that lead to deadlock and the different methods to handle the deadlock.
- understand the concepts of various memory management schemes.
- learn about the file and disk management.

Prerequisite: Computer Programming and Computer Architecture

MODULE I INTRODUCTION TO SYSTEM SOFTWARE AND OPERATING SYSTEM 8

Introduction to system software-Editor, Assembler, Loader, Linker, Compiler & Interpreter, Macro-processors and Emulator, Operating System: Goals – Operating System Types: Multiprogramming, Timesharing, Distributed, Real-Time System, Multimedia, Open Source, Android – Computing Environments – System Components – Operating System Design & Implementation – Operating System Structure

MODULE II PROCESS SCHEDULING 7

Overview of Process, Memory, File and Disk Management-Process Management-Process Concepts – Schedulers – Process Scheduling: Algorithms, Multiple-Processor & Real-Time Scheduling – Threads: Overview, Threading Issues, Thread Scheduling.

MODULE III PROCESS SYNCHRONIZATION 7

Operations on Processes – Inter-Process Communication – Process Synchronization: Critical-Section Problem, Semaphores, Classic Problems of Synchronization, Critical Region-Monitors.

MODULE IV DEADLOCKS AND SYSTEM PROTECTION 7

Deadlocks: System Model– Deadlock Prevention-Deadlock Avoidance: Banker's Algorithm - Deadlock Detection -Deadlock Recovery- System Protection: Goals, Principles- System and Network Threats: Firewall-Port Scanner.

MODULE V MEMORY MANAGEMENT 8

Main Memory Address Space–Swapping – Contiguous Memory Allocation: Fragmentation, Paging, Segmentation – Virtual Memory: Demand Paging, Page Replacement Algorithms, Allocation of Frames, Thrashing, Virtualization: Memory Virtualization, Virtual Machine.

MODULE VI FILE AND DISK MANAGEMENT 8

File Concepts – Access Methods – Directory Structure– File System Structure – File System Implementation– Virtual File System: Network File System – Distributed File System – File System Mounting – File Sharing & Protection: File Locking- Disk Structure – Disk Scheduling– Disk Management, Case study- UNIX Operating System.

Lecture : 45 Hours

LIST OF EXPERIMENTS

1. Study of UNIX commands
2. Study of Shell Programming
3. Creation of process using system call.
4. Implementation of Producer-Consumer problem using shared-memory API.
5. Development of multi-threaded program.
6. Implementation of Semaphore.
7. Implementation of Scheduling algorithms (FIFO, SJF, Priority & Round-robin)
8. Implementation of Banker's algorithm for Deadlock avoidance.
9. Implementation of Port Scanner.
10. Implementation of First-fit, Best-fit and Worst-fit memory allocation strategies.
11. Implementation of page replacement algorithms.
12. Creation of Virtual Machines
13. Implementation of File-locking concept.
14. Implementation of disk scheduling algorithms (SCAN, C-SCAN & LOOK)

Lecture: 45 Hours, Practical: 30 Hours Total: 75 Hours

TEXT BOOK:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, 'Operating System Concepts', Ninth Edition, John Wiley & Sons (ASIA) Pvt. Ltd, 2013.

REFERENCES:

1. Leland L. Beck, "System Software - An Introduction to Systems Programming", 3rd Edition, Pearson Education Asia, 2000.
2. Harvey M. Deitel, 'Operating Systems', Second Edition, Pearson Education Pvt. Ltd, 2002.
3. Andrew S. Tanenbaum, 'Modern Operating Systems', Prentice Hall of India Pvt. Ltd, 2003.
4. William Stallings, 'Operating System', Prentice Hall of India, 4th Edition, 2003.
5. Pramod Chandra P. Bhatt – 'An Introduction to Operating Systems, Concepts and Practice', PHI, 2003.

OUTCOMES:

On successful completion of the course, the students will be able to

- discuss the different types of system software and operating systems
- analyze the different CPU scheduling algorithms
- use appropriate schemes for providing process synchronization
- discuss how the deadlock can be managed / avoided.
- illustrate the various memory management schemes.
- explain the concepts of file and disk management

ITC2214 SOFTWARE ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

To enable the students to

- understand various software process models.
- acquire the knowledge about software requirements engineering.
- Understand the fundamental concepts of software design.
- learn software design techniques.
- comprehend software testing techniques.
- understand software project management concepts.

Prerequisite: Computer Programming

MODULE I SOFTWARE PROCESS MODELS 8

The Software Process - Software Engineering Practice - Software Development Myths - Software Process Structure - Process Models - Agile Process Models - Agile Teams.

MODULE II SOFTWARE REQUIREMENTS 8

Requirements Engineering - Establishing The Groundwork - Eliciting Requirements - Developing Use Cases - Building The Analysis Model - Scenario-Based Modeling: Requirements Analysis - Scenario-Based Modeling - Class-Based Methods: - Requirements Modeling for Web And Mobile Apps.

MODULE III SOFTWARE DESIGN FUNDAMENTALS 7

The Design Process - Design Concepts - The Design Model - Software Architecture - Architectural Styles - Component-Level Design: - Designing Class-Based Components - Component-Level Design for Webapps - Component-Level Design for Mobile Apps.

MODULE IV SOFTWARE DESIGN 7

User Interface Design: The Golden Rules - Interface Design Steps - Webapp And Mobile Interface Design - Design Evaluation - Pattern-Based Software Design.

MODULE V SOFTWARE TESTING 8

Test Strategies For Conventional Software - Test Strategies For Object-Oriented

Software - Test Strategies For Webapps - Test Strategies For Mobileapps - Validation Testing - System Testing - The Art Of Debugging - White-Box Testing Techniques - Black-Box Testing Techniques - Testing Object-Oriented Applications - Testing Concepts For Webapps - Testing Web Applications - Testing Mobileapps.

MODULE VI MANAGING SOFTWARE PROJECTS 7

Introduction To Software Configuration Management - Project Management Concepts - Empirical Estimation Models - Estimation For Object-Oriented Projects - The CMMI -

Total : 45 Hours

TEXT BOOK:

1. Roger S. Pressman, "Software Engineering - A Practitioners Approach", 8th Edition, McGraw Hill Publication, 2015.

REFERENCES:

1. Sommerville, "Software Engineering", 10th Edition, Addison-Wesley, 2015.
2. Jordan Hudgens, “Skill Up: A Software Developer's Guide to Life and Career”, Packt Publishing, 2017.
3. John Sonmez , “The Complete Software Developer's Career Guide: How to Learn Programming Languages Quickly, Ace Your Programming Interview, and Land Your Software Developer Dream Job”, Simple Programmer, 2017.

OUTCOMES:

On successful completion of the course, the students will be able to

- select the suitable software process model to develop the software successfully.
- prepare requirements specification document and analyze the requirements.
- explain software design concepts.
- design a software for given requirements to develop a quality software.
- develop test case specification and to test the software using both white-box and black-box testing techniques.
- explain about the software project management concepts.

ITC2215	DBMS LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

To enable the students to

- know how to create a database and query it using SQL.
- understand the importance of Referential and Integrity constraints.
- know how to work with PL/SQL.
- be aware of database connectivity for developing an application.

LIST OF EXERCISES:

1. Creation of Data Definition Language (DDL) to perform table creation, Alter, modify and drop commands in RDBMS.
2. Integrity and referential Constraints.
3. Data Manipulation Language Basic Queries in SQL, Joined tables in SQL, Aggregate functions in SQL, Group By and Having clause.
4. Working with Views.
5. Basic programs in Procedural Language using SQL (PL/SQL).
6. No_Data_Found, Too_Many_Rows Exception program using PL/SQL.
7. Programs using Cursors.
8. Programs using Functions and Procedures.
9. Triggers.
10. Database connectivity using MySQL.
11. Design and implementation of any application using database.

OUTCOMES:

On successful completion of the course, the students will be able to

- Apply SQL DML/DDL commands for creating a database.
- Demonstrate PL/SQL programming.
- Develop small-scale database oriented applications.

SEMESTER V

MSB 3181	**LEADERSHIP & CEO TRAINING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

The course aims at

- Bringing about positive transformation in students' attitude.
- Building unique leadership competencies that would ensure successful transition of students across all career stages.
- Sensitizing students to identify their strengths & weakness and training them to deal with it
- Assisting students in enhancing their expressive ability and inducing a high level of self confidence to manage both business and emotions
- Training students to become more adaptable and flexible to changing business environment

MODULE I INTRODUCTION TO LEADERSHIP 12

Leadership concept - meaning, definitions, importance of leadership, leadership traits. Leadership functions- general functions, listening, observing, managing and decision making. Components of leadership - leaders, followers and situation. Leadership theories – Trait theory, Skills theory, Style theory, Situational theory, Transformational theory, Transactional theory, Path Goal Theory and LMX. Assessing emotional intelligence and exploring the capabilities and inherent traits through psychometric tests - Multi factor leadership questionnaire and personal reflections

MODULE II LEADERSHIP STYLE AND COMMUNICATION 08

Leadership styles-visionary, Coaching, Affiliative, Democratic, Pacesetting Commanding, Transformational, Transactional. Autocratic, Participative, Laissez-Faire Leader versus Managers. Leadership communication - Rationale, tactic, assertive, formal, informal, communication in crisis- leadership and negotiations, Leadership Presentations-convincing and impressive style

MODULE III LEADERSHIP ROLES 08

Facets of leadership- Leader as an individual – personality and leadership, values, attitudes and ethics of a leader. **Leader as a relationship builder**- empowering people to meet higher order needs, initiating organization wide

motivational programs, involvement with all stakeholders- focusing on organization growth. **Leader as an inspirer**- motivation and leadership, recognizing and appreciating contributions, empowering others to lead **Leader as an innovator** –leader's role in shaping culture and values in an organization. **Leader as a Liaison- Leader as team player**

MODULE IV LEADERSHIP CHALLENGES AND STRATEGIES 09

Challenges in leadership: Perception of organization culture and values, interpreting the power dynamics in the organization, establishing work life balance. Bad leadership – Reasons and impact.-Case Study of Marissa Mayer-Yahoo.Inc Organizational transformation through efficient leaders-Case study of Apple Inc. Blue Ocean Leadership-Steps to Blue ocean Leadership-Four Pillars of Blue Ocean leadership-Blue Ocean leadership grid

MODULE V LEADERSHIP AND CEO TRAINING 08

Leader as a CEO: Traits of a successful CEO, Key responsibilities of a CEO, the path to be a CEO ,Training on Board Room Discussions, Meeting the CEO –Live sessions with industry CEO's. Requirements of Leadership: - Cognitive skills, Interpersonal skills, Business skills, Strategic skills. Role of Emotional Intelligence in taking up key-positions in the organization.

Teaching Pedagogy:

Nurturing – Based on the identified strengths and weaknesses, training will be given to enhance the strengths and overcome the weakness.

Assessment - Continuous evaluation will be effected through group discussions, oratory assignments and situational enactments. Pre-and post-training assessment through peer reviews and faculty feedback.

Sustained development – Training will be imparted for self-development and monitoring of leadership skills to ensure sustained applicability of the skills learnt.

L – 45; Total Hours – 45

REFERENCES:

1. Andrew J DuBrin. "Leadership: Research Findings, Practice, and Skills", 8th Edition, South-Western College Pub, 2015.
2. Yukl G , "Leadership in Organisations", 8th Edition, Pearson Education, 2013.
3. Richard L Daft , "Leadership", 5th Edition, South Western Cengage Learning 2012.

4. Stephen P. Robbins and Timothy A. Judge. “Organizational Behaviour”, 15th Edition, New Delhi: Pearson, 2013.
5. Fred Luthans, “Organizational Behavior, An Evidence Based Approach”, 12th Edition, New Delhi: McGraw Hill Education, 2013.
6. Emotional Intelligence, Why it can matter no more than IQ by Daniel Goleman (include a book) Publisher: Bloomsbury Publishing India Private Limited; Latest edition (2017)
7. Primal Leadership: Unleashing the Power of Emotional Intelligence by Prof Daniel Goleman , Richard Boyatzis and McKee ,Harvard Business Review Press

Recommended Readings:

1. Jim Collins, (2001). “Good To Great: Why Some Companies Make the Leap...And Others Don't”, Random House Publishers India Pvt.Ltd, New Delhi
2. George, B. with Sims, P. True North: Discover Your Authentic Leadership, The Times Group Books; First edition (1 October 2015)
3. Kim, W. C., & Mauborgne, R. A. (2014). Blue ocean strategy, expanded edition: How to create uncontested market space and make the competition irrelevant. Harvard business review Press.
4. Leadership Wisdom by Robin Sharma Jaico Publishing House;

OUTCOMES:

The students will be able to

- Explore through self-introspection one’s own leadership style, their strength and weakness
- Gain self confidence to lead a team in the organization
- Realize the role of leadership in making or breaking of an organization
- Acquire the practice of self introspection and development of leadership competencies thorough continuous efforts
- Manage their own emotions as well as other resulting in successful relationship building with all stakeholders

MSB 3182 SOCIAL ENTREPRENEURSHIP L T P C
3 0 0 3

OBJECTIVES:

- To be able to understand the field of social entrepreneurship and Social problems
- To be able to describe and understand the traits of social entrepreneurs
- To recognize the social business opportunities
- To synthesize the resource mobilization ways for social entrepreneurship
- To understand the social entrepreneurship models
- To recognize the impact of social entrepreneurship on societies

MODULE I INTRODUCTION TO SOCIAL ENTREPRENEURSHIP 07

Introduction - Emergence and Development of Social Entrepreneurship. Social Problems in India: An Overview. Social Development: The Indian Scenario. Emergence of Social Entrepreneurs and Sustainable Solutions to Social Problem. Characteristics and Context of Social Entrepreneurship .The Role of Social Entrepreneurship in Societies & Economies.

MODULE II SOCIAL ENTREPRENEURSHIP: DRIVERS AND CHALLENGES 07

The Drivers of Social Entrepreneurship. Elements of the Social Entrepreneurial Personality. Challenges of financial constraints. Challenge to attract and cultivate talented workers. Challenge of evaluation of social entrepreneur impact. Challenge of scaling and its impact. Cases

MODULE III SOCIAL ENTREPRENEURSHIP: OPPORTUNITY RECOGNITION 07

Opportunity Recognition and Planning Process. Opportunities for Social Entrepreneurs. The Nature of Social Entrepreneurial Opportunities. Social Problems into Opportunities. Idea development and conceptualization of social problem. Cases

MODULE IV RESOURCE MOBILIZATION FOR SOCIAL VENTURE 08

Resources at Initial Stage. Social Network as a role of Social Capital. Team and Collective Efforts. Need and Determination of Important Resources. Resource of Knowledge, Skills and Abilities. overview of venture capital and angel investment. Cases

MODULE V **BUSINESS MODELS AND BUSINESS PLAN FOR SOCIAL ENTERPRISES** **08**

Design Principles of Social Entrepreneurship Business Models , Evaluation of the Root Cause of a Societal Problem. Developing business plan for social ventures. Developing an investor presentation. Feasibility study and report. How to start a business - Procedures for registration of small scale industry

MODULE VI **THE IMPACT OF SOCIAL ENTREPRENEURSHIP ON SOCIETY** **08**

Static Impact of Social Entrepreneurship. Impact of Charitable NGOs vs. Social Entrepreneurship, Impact of For-Profit Companies vs. Social Entrepreneurship. Social entrepreneurship report preparation by students.

Case Study of Social Entrepreneurs

L – 45; Total Hours – 45

REFERENCES:

1. “Social Entrepreneurship : New models of sustainable social change” . Alex Nicholls, Oxford University Press 2006
2. The Process of social value creation : A multiple case study on Social Entrepreneurship in India , Archana Singh Springer 2016
3. “Social Entrepreneurship and social business” Christine K Volkmann, Springer Gabler 2012
4. “Social Entrepreneurship” Manuel London ,Routlege, 2010

OUTCOMES:

The students can able to

- Conceptualize social entrepreneurship in terms of a theoretical framework between changing social values and institutions
- Think and communicate about social values
- Learn about practical models of social change to launch, lead, manage, and evaluate a social venture
- Analyze funding needs and sources for the social venture
- Experience the ideas can be critically and collaboratively examined prior to commitment.

ENC 3181	COMMUNICATION AND SOFT SKILLS - I CAREER CHOICE	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To create awareness of industrial trends and market demands.
- To encourage students to explore career opportunities in an industry and evaluate themselves in relation to industry preparedness

MODULE I **6**

Knowledge about specific industry-Discussion with industry experts --Self evaluating career prospects through survey questionnaire (based on his/her eligibility for taking up a job (industry preparedness)

MODULE II **6**

. Knowing case studies of industries(pertaining to students' choice of career)- Reading and discussing about job markets-goal setting, working on creativity.

MODULE III **4**

SWOC analysis and discussing outcomes--exploring mini projects or case studies of latest industries.

MODULE IV **6**

Writing statement of purpose pertaining to career choice---- Outcomes

MODULE V **8**

Project or case study presentations (Presentation in pairs) -mini project report or case study report.

Total Hours – 30

REFERENCES:

1. Brown,D.(2002). Career Choice and Development. Wiley,J. & Sons.USA
2. Lore,N.(1998). The Pathfinder: How to Choose or Change Your Career for a Lifetime of Satisfaction and Success. Simon & Schuster.USA.
3. Shell, G.R.(2013). Springboard Launching your Personal Search for Success.Portfolio.USA.

OUTCOMES:

After the completion of the course, students would be able to

- Speak about their career choice.

- Self evaluate their strengths and weaknesses and speak about it.
- Make effective presentations on case studies or relating to projects.
- Write the statement of purpose relating to their career choice.

ITC3101 OBJECT ORIENTED ANALYSIS AND DESIGN L T P C
3 0 0 3

OBJECTIVES:

- To understand the object oriented life cycle.
- To know how to identify objects, relationships, services and attributes through UML.
- To provide knowledge in Object Oriented Design process.
- To analyze about software quality and usability.

MODULE I INTRODUCTION 7

An Overview of Object Oriented Systems Development - Object Basics - Object Oriented Systems Development Life Cycle.

MODULE II OBJECT ORIENTED METHODOLOGIES 8

Unified Approach - Development Process - Unified Modeling Language – Use case - Class diagram: The Essential - Advanced Concepts – Interactive Diagram - Package Diagram - Collaboration Diagram - State Diagram – Activity Diagram - Communication Diagrams - Composite Structure - Timing Diagrams.

MODULE III OBJECT ORIENTED ANALYSIS 8

Identifying use cases - Object Analysis: Classification - Identifying Object relationships, Attributes, and Methods.

MODULE IV OBJECT ORIENTED DESIGN - I 7

Design axioms - Designing Classes

MODULE V OBJECT ORIENTED DESIGN - II 8

Access Layer: Object Storage and Object Interoperability, View Layer: Designing Interface Objects.

MODULE VI SOFTWARE QUALITY AND USABILITY 7

Designing Interface Objects - Software Quality Assurance - System Usability - Measuring User Satisfaction

Total Hours : 45

TEXT BOOKS:

1. Ali Bahrami, "Object Oriented Systems Development", Tata McGraw-Hill, 1999.
2. Martin Fowler, "UML Distilled", 3rd edition, Pearson Education, 2007.

REFERENCES:

1. John Deacon, "Object Oriented Analysis and Design", Pearson Education, 2009.
2. Bennett, Farmer, Steve McRobb, "Object-oriented Systems Analysis and Design: Using UML", McGraw-Hill Higher Education, 2010.
3. Grady Booch, "Object Oriented Analysis and Design with Applications", 3rd edition, Pearson, 2010.

OUTCOMES:

On completion of the programme students will be able to:

- Outline the basics of object oriented system development life cycle.
- Explain the various UML diagrams.
- Analyze software requirements to identify objects, attributes and methods.
- Prepare design for software using UML diagrams.
- Outline how to identify requirements, analyze requirements and prepare design for application and real-time software.
- Explain how to develop user friendly software.

ITC3102 FUNDAMENTALS OF WEB DESIGNING

L	T	P	C
2	0	2	3

OBJECTIVES:

- To introduce the basics of web designing
- To discuss methods and techniques to create simple to complex websites.
- To explore prevailing vocabulary in web development in creating social media websites.
- To focus on client side and server side scripting languages.
- To discuss about software's and services that are easily incorporated in a website.

MODULE I INTRODUCTION 8

Introduction to web design environment, role of web designers, basics of scripting and programming, need of multimedia, tools and equipment's assisting web designing, working of web, browser server communication, web page address, anatomy of a web page, Multitude of devices in web, standards in web, responsive web design.

MODULE II STRUCTURE OF WEB PAGE AUTHORING 7

Introduction – First XHTML Example, Headers, Linking, Images, Special Characters, Unordered Lists, Nested and Ordered Lists, Basic XHTML Tables, Basic HTML Forms. Internal Linking, Meta Elements, Framesets, Forms and creation of Forms.

MODULE III PROGRAMMING WITH JAVASCRIPT 8

Introduction to scripting, simple program, memory concepts, arithmetic, decision making statements, control structures, JavaScript functions, objects, dynamic html event model.

MODULE IV STYLING WITH CSS 7

Introduction, Inline styles, embedded style sheets, conflicting styles, linking external style sheets, W3C CSS validation services, positioning elements, Backgrounds, element dimensions, text flow and box model, user style sheets, internal style sheets.

Total Hours : 30

REFERENCES:

1.The Internet of Things in the Cloud: A Middleware Perspective - Honbo Zhou – CRC Press – 2012.

2. Architecting the Internet of Things - Dieter Uckelmann; Mark Harrison; Florian Michahelles- (Eds.) – Springer – 2011.

3. Designing internet of things –Adrian McEwen & Hakim Cassimally – Jhon Wiley and

sons – 2014.
4. Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Key applications and Protocols”, Wiley, 2012.

OUTCOMES:

Upon Completion of course the students will be able to :

- Create local HTML pages and move them to a remote web server.
- Design and develop basic web pages using HTML and CSS.
- Use graphics and tables in Web pages.
- Link pages so that they create a Web site.

ITC3103 MICROPROCESSORS AND MICROCONTROLLER

L	T	P	C
3	0	2	4

OBJECTIVES:

- To study the architecture and Instruction set of 8086
- To develop assembly language programs in 8086.
- To understand and design multiprocessor configurations.
- To study different peripheral devices and their interfacing to 8086.
- To study the architecture and programming of 8051 microcontroller.

MODULE I 8086 ARCHITECTURE **8**

Introduction to 8086 Microprocessor, Minimum and Maximum Mode Signals, Architecture, Memory Organization, Interrupt structure of 8086, Introduction to Advanced Microprocessors.

MODULE II INSTRUCTION SET AND ASSEMBLY LANGUAGE PROGRAMMING OF 8086 **8**

Instruction formats, addressing modes, Instruction Set of 8086, String Manipulations, assembler directives, Procedures and Macros, Assembly Language Programming.

MODULE III I/O INTERFACING **7**

Memory Interfacing, I/O Interfacing, Parallel Communication Interface, 8255 PPI Architecture and Interfacing, Serial Communication Interface, 8251 USART Architecture and Interfacing, Real Time Applications.

MODULE IV INTERFACING WITH ADVANCED DEVICES **7**

Interrupt service routine, Programmable Interrupt controller 8259 Architecture and Interfacing, Introduction to Timer/ Counter Controller 8253, Keyboard/Display Controller 8279 and DMA Controller 8257, Simple Applications.

MODULE V 8051 MICROCONTROLLER **7**

Introduction, Signals of 8051, Architecture, Memory Organization, Interrupt Structure, Serial & Timer control.

MODULE VI 8051 REAL TIME CONTROL **8**

Addressing Modes and Instruction set of 8051, Programming Timer interrupts, external hardware interrupts and serial communication interrupts, Real Time Applications using 8051, Introduction to Embedded System.

Total Hours : 45

TEXT BOOKS:

1. A. K. Ray and K.M. Bhurchandani, "Advanced Microprocessors and Peripherals- TMH", 2nd edition, 2006.

2. Subrata Ghoshal, "8051 Microcontroller Internals, Instructions, Programming and Interfacing", Pearson Education, 2010.

REFERENCES:

1. K.Uma Rao, Andhe Pallavi, "The 8051 Microcontrollers, Architecture and programming and Applications", Pearson Education, Sixth Edition, 2013.

2. D. V. Hall, "Micro processors and Interfacing",1st edition, 2006.

3. Kenneth. J. Ayala , "The 8051 microcontroller", 3rd edition, Cengage learning, 2010.

OUTCOMES:

- Explain the internal architecture of 8086 Microprocessor.
- Develop assembly language programs using 8086 instructions.
- Design and demonstrate I/O interfacing concepts and programming techniques using 8255 and 8251 for simple applications.
- Explain the internal architecture of 8051 Microcontroller.
- Develop simple programs using 8051 instructions.
- Develop and demonstrate real time control applications using 8051 instructions.

ITC3104 **CASE TOOLS LAB** **L T P C**
0 0 3 1

OBJECTIVES:

- Define the process of object-oriented analysis and design to software development.
- Pointing out the importance and function of each UML model throughout the process of object-oriented analysis and design and explaining the notation of various elements in these models.
- Providing students with the necessary knowledge and skills in using object oriented CASE tools.

Prepare the following documents for two or three of the experiments listed below and develop the software using software engineering methodology.

1. Feasibility Study and Project Planning.
   Thorough study of the problem - Identify project scope, Objectives, Infrastructure.
2. Software Requirements Analysis.
   Develop Scenario-based Model, Class-based Model, and Behavioral Model.
3. Data Modelling.
   Use work products -use case diagrams and activity diagrams, class diagrams, sequence diagrams and add interface to class diagrams.
4. Software development and debugging.
5. Study of software testing tools.

LIST OF EXERCISES:

1. Student Marks Analyzing System.
2. Gas Booking System.
3. Online Flight Ticket Reservation System.
4. Employee Payroll Management System.
5. Course Registration System.
6. Hostel Room Allocation System.
7. Health Insurance Management System.
8. Online Mobile Recharging System.
10. Vacation Management System
11. Satellite Navigation System

Total Hours : 45

OUTCOMES:

Students on successful completion of the course should have gained the following skills

- Show the importance of systems analysis and design in solving complex problems.
- Show how the object-oriented approach differs from the traditional approach to systems analysis and design.

SEMESTER VI

MSB 3181	**LEADERSHIP & CEO TRAINING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

The course aims at

- Bringing about positive transformation in students' attitude.
- Building unique leadership competencies that would ensure successful transition of students across all career stages.
- Sensitizing students to identify their strengths & weakness and training them to deal with it
- Assisting students in enhancing their expressive ability and inducing a high level of self confidence to manage both business and emotions
- Training students to become more adaptable and flexible to changing business environment

MODULE I INTRODUCTION TO LEADERSHIP 12

Leadership concept - meaning, definitions, importance of leadership, leadership traits. Leadership functions- general functions, listening, observing, managing and decision making. Components of leadership - leaders, followers and situation. Leadership theories – Trait theory, Skills theory, Style theory, Situational theory, Transformational theory, Transactional theory, Path Goal Theory and LMX. Assessing emotional intelligence and exploring the capabilities and inherent traits through psychometric tests - Multi factor leadership questionnaire and personal reflections

MODULE II LEADERSHIP STYLE AND COMMUNICATION 08

Leadership styles-visionary, Coaching, Affiliative, Democratic, Pacesetting Commanding, Transformational, Transactional. Autocratic, Participative, Laissez-Faire Leader versus Managers. Leadership communication - Rationale, tactic, assertive, formal, informal, communication in crisis- leadership and negotiations, Leadership Presentations-convincing and impressive style

MODULE III LEADERSHIP ROLES 08

Facets of leadership- Leader as an individual – personality and leadership, values, attitudes and ethics of a leader. **Leader as a relationship builder**- empowering people to meet higher order needs, initiating organization wide

motivational programs, involvement with all stakeholders- focusing on organization growth. **Leader as an inspirer**- motivation and leadership, recognizing and appreciating contributions, empowering others to lead **Leader as an innovator** –leader's role in shaping culture and values in an organization. **Leader as a Liaison- Leader as team player**

MODULE IV LEADERSHIP CHALLENGES AND STRATEGIES 09

Challenges in leadership: Perception of organization culture and values, interpreting the power dynamics in the organization, establishing work life balance. Bad leadership – Reasons and impact.-Case Study of Marissa Mayer-Yahoo.Inc Organizational transformation through efficient leaders-Case study of Apple Inc. Blue Ocean Leadership-Steps to Blue ocean Leadership-Four Pillars of Blue Ocean leadership-Blue Ocean leadership grid

MODULE V LEADERSHIP AND CEO TRAINING 08

Leader as a CEO: Traits of a successful CEO, Key responsibilities of a CEO, the path to be a CEO ,Training on Board Room Discussions, Meeting the CEO –Live sessions with industry CEO's. Requirements of Leadership: - Cognitive skills, Interpersonal skills, Business skills, Strategic skills. Role of Emotional Intelligence in taking up key-positions in the organization.

Teaching Pedagogy:

Nurturing – Based on the identified strengths and weaknesses, training will be given to enhance the strengths and overcome the weakness.

Assessment - Continuous evaluation will be effected through group discussions, oratory assignments and situational enactments. Pre-and post-training assessment through peer reviews and faculty feedback.

Sustained development – Training will be imparted for self-development and monitoring of leadership skills to ensure sustained applicability of the skills learnt.

L – 45; Total Hours – 45

REFERENCES:

8. Andrew J DuBrin. "Leadership: Research Findings, Practice, and Skills", 8th Edition, South-Western College Pub, 2015.
9. Yukl G , "Leadership in Organisations", 8th Edition, Pearson Education, 2013.
10. Richard L Daft , "Leadership", 5th Edition, South Western Cengage Learning 2012.

11. Stephen P. Robbins and Timothy A. Judge. “Organizational Behaviour”, 15th Edition, New Delhi: Pearson, 2013.
12. Fred Luthans, “Organizational Behavior, An Evidence Based Approach”, 12th Edition, New Delhi: McGraw Hill Education, 2013.
13. Emotional Intelligence, Why it can matter no more than IQ by Daniel Goleman (include a book) Publisher: Bloomsbury Publishing India Private Limited; Latest edition (2017)
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OUTCOMES:

The students will be able to

- Explore through self-introspection one’s own leadership style, their strength and weakness
- Gain self confidence to lead a team in the organization
- Realize the role of leadership in making or breaking of an organization
- Acquire the practice of self introspection and development of leadership competencies thorough continuous efforts
- Manage their own emotions as well as other resulting in successful relationship building with all stakeholders

MSB 3182 SOCIAL ENTREPRENEURSHIP L T P C
3 0 0 3

OBJECTIVES:

- To be able to understand the field of social entrepreneurship and Social problems
- To be able to describe and understand the traits of social entrepreneurs
- To recognize the social business opportunities
- To synthesize the resource mobilization ways for social entrepreneurship
- To understand the social entrepreneurship models
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MODULE I INTRODUCTION TO SOCIAL ENTREPRENEURSHIP 07

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MODULE II SOCIAL ENTREPRENEURSHIP: DRIVERS AND CHALLENGES 07

The Drivers of Social Entrepreneurship. Elements of the Social Entrepreneurial Personality. Challenges of financial constraints. Challenge to attract and cultivate talented workers. Challenge of evaluation of social entrepreneur impact. Challenge of scaling and its impact. Cases

MODULE III SOCIAL ENTREPRENEURSHIP: OPPORTUNITY RECOGNITION 07

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MODULE IV RESOURCE MOBILIZATION FOR SOCIAL VENTURE 08

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MODULE V **BUSINESS MODELS AND BUSINESS PLAN FOR SOCIAL ENTERPRISES** **08**

Design Principles of Social Entrepreneurship Business Models , Evaluation of the Root Cause of a Societal Problem. Developing business plan for social ventures. Developing an investor presentation. Feasibility study and report. How to start a business - Procedures for registration of small scale industry

MODULE VI **THE IMPACT OF SOCIAL ENTREPRENEURSHIP ON SOCIETY** **08**

Static Impact of Social Entrepreneurship. Impact of Charitable NGOs vs. Social Entrepreneurship, Impact of For-Profit Companies vs. Social Entrepreneurship. Social entrepreneurship report preparation by students.

Case Study of Social Entrepreneurs

L – 45; Total Hours – 45

REFERENCES:

5. “Social Entrepreneurship : New models of sustainable social change” . Alex Nicholls, Oxford University Press 2006
6. The Process of social value creation : A multiple case study on Social Entrepreneurship in India , Archana Singh Springer 2016
7. “Social Entrepreneurship and social business” Christine K Volkmann, Springer Gabler 2012
8. “Social Entrepreneurship” Manuel London ,Routlege, 2010

OUTCOMES:

The students can able to

- Conceptualize social entrepreneurship in terms of a theoretical framework between changing social values and institutions
- Think and communicate about social values
- Learn about practical models of social change to launch, lead, manage, and evaluate a social venture
- Analyze funding needs and sources for the social venture
- Experience the ideas can be critically and collaboratively examined prior to commitment.

ENC 3281	COMMUNICATION AND SOFT SKILLS - II	L	T	P	C
	CONFIDENCE BUILDING	0	0	2	1

OBJECTIVES:

- To develop professional skills like work ethics, analytical skills, presentation skills etc.
- To train them in problem solving skills and leadership skills pertaining to industries.
- To train them in team building skills.
- To train in setting up career goals

MODULE I **6**

Brief about Multinational companies- Analysing work ethics of multinational companies and small industries- discussing as pairs-Knowledge about etiquette (different types)

MODULE II **6**

Visit to an Industry and prepare reports --Critically reading of industry specific journal articles and write ups-- preparing reports.

MODULE III **4**

Analysing problem solving situations in industries (relating to application of core subject to specific jobs) and discussing about them- working on a sample case

MODULE IV **6**

Developing Leadership in team projects-- debating about various aspects of leadership: for example, responsibility and reliability-time management

MODULE V **8**

Team building skills-- group discussions pertaining to industries-- presenting career goals. -- preparing for interviews- interpersonal skills

Total Hours – 30

REFERENCES:

1. Covey,S.R. (2004). The 7Habits of Highly Effective People: Powerful Lessons in Personal Change. Free Press.UK
2. Fine, P.M.& Alice Olins. (2016).Step up: Confidence, Success and Your Stellar Career in 10 Minutes a Day. Vermilion.UK
3. Pai, A. (1993).How to Develop Self-Confidence. Amazon.com
4. Wentz,F.H.(2012). Soft skills training: A Workbook to Develop Skills for Employment. Amazon.com

OUTCOMES:

After completing the course students would be able to

- Exhibit critical reading skills through review of industry specific articles.
- Provide solutions to problem based situations.
- Exhibit leadership qualities by debating over industry specific issues.
- Participate in group discussions confidently.
- Present their career goals.

ITC3211 SOFTWARE TESTING

L	T	P	C
3	0	0	3

OBJECTIVES:

The objective of this course is to enable the students:

- To discuss the distinctions between different levels of testing.
- To describe the principles of software testing and maturity levels.
- To describe strategies for generating system test cases.
- To understand the essential characteristics of tool used for test automation.
- Demonstrate the ability to apply multiple methods to develop reliability estimates for a software system.

MODULE I SOFTWARE TESTING-INTRODUCTION 8

Testing as an Engineering Activity - Role of Process in Software Quality - Testing as a Process - Basic Definitions, Testing Concepts and Definitions – TMM levels- Software Testing Principles - The Tester"s Role in a Software Development Organization - Origins of Defects - Defect Classes - The Defect Repository and Test Design- Defect Examples - Developer/Tester Support for developing a defect Repository.

MODULE II STRATEGIES AND METHODS FOR TEST CASE DESIGN 8

Introduction to Testing Design Strategies - The Smarter Tester -Test Case Design Strategies - Using Black Box Approach to Test Case Design – Random Testing - Equivalence Class Partitioning - Boundary Value Analysis –Using White-Box Approach to Test design - Test Adequacy Criteria - Coverage and Control Flow Graphs - Covering Code Logic - Paths - White-box Based Test Design - Additional White Box Test design approaches - Evaluating Test Adequacy Criteria.

MODULE III LEVELS OF TESTING AND TESTING GOALS, PLANS AND POLICIE 8

The Need for Levels of Testing - MODULE Testing -Integration testing-System Testing - types of system testing - Acceptance Testing-types of acceptance test - testing OO systems - usability and accessibility testing-Testing and debugging Goals and policies-Test plan components-The role of three groups in Test Planning and Policy Development.

MODULE IV CONTROLLING & MONITORING 7

Introducing the test specialist - Skills needed by a test specialist - Building a Testing

Group-Structure of the testing group- Measurements and milestones for controlling and monitoring-Criteria for test completion- software configuration management-Controlling and Monitoring: Three critical views.

MODULE V TEST MEASUREMENTS 7

Reviews as a testing activity-Types of Reviews-Developing a Review Program-Measurement program to support product and process Quality-Review of Quality concepts-Quality costs-An approach to usability Testing.

MODULE VI TESTERS WORKBENCH 7

Defect analysis and prevention-Defect casual Analysis-Evaluating Testing Tools for the workbench-Tool categories-process reuse-Approach to model development-TMM structure-TMM Assessment model components.

Total Hours : 45

TEXT BOOKS:

1. Abu Sayed Mahfuz, “Software Quality Assurance: Integrating Testing, Security, and Audit, CRC Press, 2016.
2. Srinivasan Desikan and Gopalaswamy Ramesh, "Software Testing - Principles and Practices", Pearson education, 2006.
3. Ilene Burnstein, "Practical Software Testing", Springer, 2003.

REFERENCES:

1. Limaye L G, "Software Testing - Principles, Techniques and Tools", Tata Mc-Graw Hill Education Pvt. Ltd., New Delhi, 2009.
2. Aditya P.Mathur, "Foundations of Software Testing", Pearson Education, 2008.
3. Boris Beizer, "Software Testing Techniques", 2nd Edition, Dreamtech, 2003.

OUTCOMES:

Students who have completed this course would have learned

- Various test processes and continuous quality improvement
- Types of testing techniques and developing test case design
- Writing proper test plan for an application
- Build a test group and how to control and monitoring the testing process.
- Various test measurement techniques and review techniques
- The use of various test tools

ITC3212 CLOUD COMPUTING TECHNOLOGIES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn about cloud computing basics.
- To know the various technologies available for cloud platforms.
- To understand the cloud storage service and standards to access cloud service providers.
- To learn virtualization technology over various open source cloud tools to monitor the cloud performance.
- To understand security and challenges in cloud.

MODULE I CLOUD COMPUTING BASICS 8

Introduction to Cloud Computing - Essential Characteristics - Architectural Overview – Cloud Delivery Models - Service Models – Deployment models – Cloud computing vendors – Benefits of cloud computing – Limitations.

MODULE II CLOUD COMPUTING TECHNOLOGY 7

Hardware and Infrastructure – Thick and thin clients – Cloud providers and consumers – Cloud services - Accessing the cloud – Cloud Platforms and Frameworks – Web Applications – Web API"s – Web Browsers – Google App Engine.

MODULE III CLOUD STORAGE AND STANDARDS 8

Storage as a Service – Cloud Storage Providers - Cloud File Systems - GFS and HDFS – Big Table, HBase and Dynamo DB – Cloud Data Store – Simple Storage Service.

MODULE IV VIRTUALIZATION TECHNOLOGY 7

Virtualization Technology - Overview - Virtual Machines Provisioning and Manageability - Virtual Machine Migration Services - VM Provisioning and Migration in Action - VM Life Cycle and VM Monitoring - Amazon Elastic Compute Cloud.

MODULE V DATA CENTER TECHNOLOGY 7

Virtualization – Automation – Remote Operation and Management – Computing Hardware – Storage Hardware – Network Hardware – Carrier and External Network Interconnection – Web Tier Load Balancing and Acceleration.

MODULE VI CLOUD SECURITY 8

Cloud Security Fundamentals- Terms and Concepts- Threat Agents – Anonymous Attacker - Malicious Service Agent - Trusted Attacker - Malicious Insider -Cloud

Security Threats - Traffic Eavesdropping- Malicious Intermediary -Denial of Service - Insufficient Authorization - Virtualization Attack - Overlapping Trust Boundaries – Case Study example for IaaS, PaaS, SaaS.

Total Hours : 45

TEXT BOOKS:

1. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, “Cloud Computing: A Practical Approach”, McGraw-Hill, 2010.
2. Thomas Erl , Ricardo Puttini , Zaigham Mahmood, “Cloud Computing: Concepts, Technology & Architecture”, Prentice –Hall, 2013
3. Rajkumar Buyya, James Broberg, Andrzej Goscinski, “Cloud Computing Principles and Paradigms”, John Wiley & Sons, Inc Publications, 2011

REFERENCES:

1. Kai Hwang, Fox and Dongarra, Morgan Kaufmann, “Distributed and Cloud Computing”, 1st Edition, Elseiver, 2012.
2. Scott Granneman, “Google Apps Deciphered: Compute in the cloud to streamline your desktop”, Pearson Education, 2009.
3. Tim Malhar, S.Kumaraswammy, S.Latif, “Cloud Security & Privacy”, SPD, O”REILLY 2009.

OUTCOMES:

- Discuss the core concepts of cloud computing paradigm.
- Analyze services, systems, platforms, frameworks to support cloud computing.
- Illustrate the concepts of cloud storage system services.
- Assess virtualization technology services in open source cloud computing environment.
- Understand data center technology from industry centric perspective.
- Identify cloud security issues to demonstrate real time applications.

ITC3213 DISTRIBUTED COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the components and types of distributed systems.
- To give insight into the basic principles of how distributed computer systems are working.
- To provide knowledge and skills in design and development of distributed computing systems.

MODULE I TYPES OF DISTRIBUTED SYSTEMS 8

Introduction - Goals - hardware concepts - bus based multiprocessor - switched multiprocessor - bus based multicomputer - switched multicomputer - software concepts - network operating systems - Multiprocessor time sharing system- True distributed system- Design issues.

MODULE II COMMUNICATIONS 7

Communication-Layered Protocols-Issues in communications-Client server model - remote procedure call - group communication.

MODULE III S Y N C H R O N I Z A T I O N 8

Synchronization-Clock Synchronization - Mutual Exclusion - Election Algorithms - Atomic transactions.

MODULE IV S C H E D U L I N G 7

Deadlock - System models - Processor Allocation – Scheduling.

MODULE V DISTRIBUTED FILE SYSTEMS 8

Introduction to Distributed file systems- Distributed file system design – implementation – file models – fault tolerance – file replication .

MODULE VI DISTRIBUTED SHARED MEMORY 7

Consistency models – page based distributed shared memory - shared variable distributed shared memory – Case studies.

Total Hours : 45

TEXT BOOK:

1. Andrew S.Tanenbaum, “Distributed Operating Systems”, Pearson Education Asia, 2001.

REFERENCES:

1. Mukesh singhal and Niranjan G.Shivaratri, “Advanced concepts in Operating System”, Tata McGraw Hill, 2001.
2. Pradeep.K and Sinha, “Distributed operating systems”, PHI, 2001.

OUTCOMES:

The students completing the course are expected to possess the following skills and abilities:

- Understand and be familiar with hardware and software concepts of the distributed operating systems.
- Describe the models and solve the issues associated with the design of distributed systems.
- Implement efficient algorithms for distributed computing application.
- Design and implement scheduling algorithms in distributed application.
- Gain the understanding of distributed file system
- Discuss the different types of shared memory distributed systems

ITC3214 OPEN SOURCE TECHNOLOGIES

L	T	P	C
1	0	2	2

OBJECTIVES:

- To help demystify the tools in Open source technologies.
- To explain the impact of open source technology in programming.
- To expose students to open source environment and introduce them to use open source Packages.
- To develop GUI processing using Python and PHP.
- To create back end server using MySQL.

LIST OF EXERCISES:

1. Case study: Proprietary Vs Open Source tools
2. Deploy a LAMP stack in Linux
3. Create an application that uses all the LAMP stack components
4. OPEN SOURCE TOOLS AND TECHNOLOGIES:WEB SERVER: Apache Web server –Working with Web server –Configuring and using Apache Web services – Execution Environment
5. Open Source Software tools and processors –Eclipse IDE platform –Compilers.
6. Creation of Simple application using GIMP tool.
7. Demonstration of GitHub.
8. OPEN SOURCE PROGRAMMING LANGUAGES: PHP: Introduction-Programming in Web Environment and SQL database.
9. OPEN SOURCE PROGRAMMING LANGUAGES: PYTHON: Python objects-Numbers-Sequences-Strings-Lists and Tuples -Dictionaries-Conditionals and loops
10. OPEN SOURCE DATABASE: MySQL: Introduction-Setting up account-Starting, terminating and writing your own SQL programs ,MySQL and Web.

Total Hours : 45

OUTCOMES:

Students who complete this course will be able to:

- Analyze the difference between the open source model and commercial proprietary model.
- Expertise on using a variety of open source software.
- Develop and deploy a project based purely on open source tools.

ITC3215 SOFTWARE DEVELOPMENT LAB

L	T	P	C
0	0	3	1

OBJECTIVES:

- Create a project team and appoint a project leader.
- Assume the role of client .discuss, evaluate and propose the requirements for a real world problem.
- Discuss the software requirement with team lead.
- Use the template to write requirements.
- To take part in ongoing project development process such as requirement analysis, design, implementation and testing.
- Learn where and how to make improvements in the software development process through developing projects.

LIST OF EXERCISES

Note: List of exercises will be framed based on the professional elective chosen.

The project should be carried out with the following supporting documents

a) Requirement Analysis
b) Software Requirement Specification
c) Design
d) Implementation
e) Testing

Any one of the projects listed below should be carried out in detail

1. Software for a Game
2. Digital Classroom (Smart Class)
3. Course Scheduler
4. Stock Management
5. Photography Studio
6. Buy Big Mobile App
7. Online Quiz System
8. Entrance Exam System
9. Micro Social University Web App
10. Internal Assessment
11. Tourist Management System
12. Airline Reservation System
13. Payroll processing System

Total Hours : 45

OUTCOMES:

- Discuss, evaluate and propose the requirements to solve real world problem with team members.
- Analyze software requirements and prepare software design using common template.
- Implement and test software module in coordination with other team members.

SEMESTER VII

		L	T	P	C
ITC4101	**INTERNET OF THINGS**	**3**	**0**	**2**	**4**

OBJECTIVES:

- To introduce the basics of Internet of things.
- Utilize IoT features and create applications based on IoT protocols.
- To discuss the features of cloud of things and web of things.
- Outline the embedded prototyping and design and apply the use of Devices in IoT Technology.
- To explain Real World IoT Design and compile the same.

MODULE I INTRODUCTION **8**

Definitions and Functional Requirements –Motivation – Architecture - Web 3.0 View of IoT– Ubiquitous IoT Applications – Four Pillars of IoT – DNA of IoT – The Toolkit Approach for End-user Participation in the Internet of Things. Middleware for IoT: Overview – Communication middleware for IoT.

MODULE II IOT PROTOCOLS **8**

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus – KNX – ZigBee Architecture – Network layer – APS layer.

MODULE III WEB OF THINGS **8**

Web of Things – Web of Things versus Internet of Things – Two Pillars of the Web – Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence.

MODULE IV DESIGN PRINCIPLES OF CONNECTED DEVICES **7**

Technology for design – Privacy in storing data – Internet principles for connected devices-Prototypes and production – Changing embedded platform – Open source versus closed source.

MODULE V PROTOTYPING EMBEDDED DEVICES **7**

Prototyping embedded devices – Electronics- Sensors – Actuators – Arduino – Raspberry PI – Beagle Bone Black – Electric Imp.

MODULE VI PROTOTYPING ONLINE COMPONENTS AND EMBEDDED CODING 8

Sketch – Iterate and Explore – Preparation of physical prototype – Getting started with API – Writing New API – Writing New API – Real Time Reactions – Other Protocols – Techniques for Writing Embedded code –Memory Management – Performance and Battery Life – Libraries and Debugging.

Total Hours : 45

LAB COMPONENT - LIST OF EXERCISES

1. Integration of Sensors and Actuators with Arduino-Traffic Control System
2. Working of Basic IoT Kit with Python Programming Networking
3. Implementation of IoT with Raspberry Pi - Raspbian OS – Blinking LED
4. Home Automation – Controlling lights using ESP8266
5. Sending Gmail notification when the door is opened or closed-sensed using Magnetic door sensor
6. Sensing the room temperature and monitoring it – using temperature sensor in ZigBee kit
7. Calculating distance using ultrasonic sensor
8. Program on RESTFUL API and XMAPP
9. IP based lighting control through Data Acquisition Card
10. Study on Industrial IoT

Practical: 30 Hours

T: 45, P: 30, Total: 75 Hours

REFERENCES:

1. Honbo Zhou , “The Internet of Things in the Cloud: A Middleware Perspective”, CRC Press, 2012.
2. Dieter Uckelmann; Mark Harrison; Florian Michahelles , Architecting the Internet of Things, Springer, 2011.
3. Adrian McEwen & Hakim Cassimally , “Designing internet of things”, Jhon Wiley and sons, 2014.
4. Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Key applications and Protocols”, Wiley, 2012.

OUTCOMES:

Upon Completion of course the students will be able to :

- Identify and design the new models for market strategic interaction
- Analyze various protocols for IoT
- Analyze and compare Cloud of things and Web of things

- Design a middleware for IoT
- Identify the prototyping with various embedded devices
- Analyze and design different models for embedded devices and API techniques

ITC4102 INFORMATION SECURITY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the basics of cryptography techniques.
- To explore the technological aspects of program and web security.
- To know the security mechanism given by operating system.
- To discover the network level security.
- To study the critical need for ensuring Information Security in database.
- To know the legal, ethical and professional issues in Information Security.

MODULE I CRYPTOGRAPHY 9

Introduction - Computer Security – Threats - Harm – Vulnerabilities – Controls - Authentication - Access Control – Cryptography – Symmetric key & Asymmetric key encryption – Digital signatures.

MODULE II PROGRAM & WEB SECURITY 7

Unintentional (Nonmalicious) Programming errors – Malicious code – Malware - Viruses, Trojan Horses, and Worms – Countermeasures - The Web - Browser Attacks - Web Attacks Targeting Users - Email Attacks.

MODULE III OPERATING SYSTEM SECURITY 7

Memory and Address Protection - File Protection Mechanisms - User Authentication - Trusted Operating Systems - Designing Trusted Operating Systems- Assurance in Trusted Operating Systems

MODULE IV NETWORK SECURITY 8

Network Security Attacks - Threats to Network Communications - Wireless Network Security - Denial of Service - Security Countermeasures - Cryptography in Network Security – Firewalls - Intrusion Detection and Prevention Systems

MODULE V DATABASE SECURITY 7

Introduction - Security Requirements of Databases - Reliability and Integrity - Database Disclosure - Data Mining and Big Data

MODULE VI ADMINSTERING SECURITY AND ETHICAL ISSUES 7

Security Planning - Risk Analysis - Organizational Security Policies - Physical Security - Protecting Programs and Data - Information and the Law - Computer Crime

- Ethical Issues.

Total Hours : 45

TEXT BOOK:

1. Charles B. Pfleeger, Shari Lawrence Pfleeger, "Security in Computing", 5th Edition, Pearson Education, 2015.

REFERENCES:

1. William Stallings, "Cryptography and Network Security - Principles and Practices", 3rd Edition, Pearson Education, 2003.
2. Atul Kahate, "Cryptography and Network Security", Tata McGraw Hill, 2003.

OUTCOMES:

- Analyze the various cryptographic techniques in Information Security.
- Identify program level malicious code and provide control measures.
- Discuss operating system level security to assess trusted operating systems.
- Explain threats in network level scenarios.
- Outline database security requirements in multilevel databases.
- Discuss organizational security policies and ethical issues.

ITC4103 WIRELESS NETWORKS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn the fundamental concepts of wireless, mobile and personal telecommunication system.
- To understand the wireless network topologies, cellular concepts and its operational characteristics.
- To explain the evolution of WLAN and the channel access mechanisms.
- To gain knowledge about the different routing protocols in adhoc wireless networks.
- To understand WPAN and geo-location systems.

MODULE I PHYSICAL LAYER ALTERNATIVES FOR WIRELESS NETWORKS 8

Applied Wireless Transmission Techniques. Short Distance Baseband Transmission. Pulse Transmission. Carrier Modulated Transmission. Traditional Digital Cellular Transmission. Broadband Modems for Higher Speeds. Spread Spectrum Transmissions. High-Speed Modems for Spread Spectrum Technology. Diversity and Smart Receiving Techniques. Comparison of Modulation Schemes. Coding Techniques for Wireless Communications

MODULE II PRINCIPLES OF WIRELESS NETWORK OPERATION 8

Wireless networks topologies, cellular topology, cell fundamentals signal to interference ratio calculation, capacity expansion techniques, cell splitting, use of directional antennas for cell sectoring, micro cell method, overload cells, channels allocation techniques and capacity expansion FCA, channel borrowing techniques, DCA, mobility management, radio resources and power management securities in wireless networks.

MODULE III GSM, CDMA AND TDMA TECHNOLOGY 8

Mechanism to support a mobile environment, communication in the infrastructure, IS-95 CDMA forward channel, IS - 95 CDMA reverse channel, pallet and frame formats in IS - 95; forward channel in W-CDMA and CDMA 2000, reverse channels in W-CDMA and CDMA 2000.

MODULE IV LOCAL BROADBAND NETWORKS 7

Historical overviews of the LAN industry, evolution of the WLAN industry, wireless home

networking, IEEE 802.11,Physical Layer, Basic MAC Layer Mechanisms, CSMA/CA Mechanisms, other MAC Layers functionalities.

MODULE V AD HOC NETWORKS 7

Overviews of Ad hoc networks,, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classifications of Routing Protocols, Proactive, Reactive and Hybrid routing protocols - DSDV, AODV, DSR, ABR, TORA, ZRP.

MODULE VI WPAN AND GEOLOCATION SYSTEMS 7

IEEE 802.15 WPAN, Home RF, Bluetooth, interface between Bluetooth and 802.11, wireless geo location technologies for wireless geo location, geo location standards for E.911 service.

Total Hours : 45

TEXT BOOK:

1. Kaveh Pahlavan, Prashant Krishnamoorthy, "Principles of Wireless Networks- A united approach", Pearson Education, 2008.

REFERENCES:

1. Jochen Schiller, "Mobile Communications", 2nd Edition, Pearson Education, 2003.
2. X.Wang and H.V.Poor, "Wireless Communication Systems", Pearson education, 2004.
3. M.Mallick, "Mobile and Wireless design essentials", Wiley Publishing Inc. 2003.
4. P.Nicopolitidis, M.S.Obaidat, G.I. papadimitria, A.S. Pomportsis, "Wireless Networks", John Wiley & Sons, 2003.
5.

OUTCOMES:

- Explain the various wireless transmission and coding techniques.
- Discuss the principle of operation of wireless networks and its issues.
- Analyze the IEEE 802.11, ITU, and IS-X standards for multiple access wireless networks.
- Discuss about the application of wireless technology in real world applications.
- Compare the different routing protocols for adhoc networks.
- Analyze the available commercial implementations of several wireless technologies.

ITC4104 **PROGRAMMING IN HADOOP** **L T P C**

0 0 3 1

OBJECTIVES:

- To make the students familiar with Hadoop distributed file system and can learn how to configure Hadoop.
- To create single node and multinode using Hadoop and to learn programming using Map Reduce paradigm.
- To provide a complete knowledge about Hadoop echo system with key components like Pig, Hive and Sqoop.
- To Install Apache Spark and explore the components in it

List of exercises:

1. Introduction to HDFS and Hadoop Ecosystem. Configuration and Installation of Hadoop 1.0 Single node with Name node and Data node.
2. Configuration of Hadoop 1.0 with SSH key for security for Name and Data Node with Demo of Pseudo distributed Node and Case Study of Multinode set up.
3. Study of Map reduce Java API. Simple programs in Map Reduce paradigm with java concepts.
4. Working on Input functions, mapper & reducer functions. Simple program for text extraction and title extraction.
5. Program for searching key word and extract it from the given text paragraph.
6. Program for extracting link from a HTML page using Map and Reduce.
7. Implementation of Pig using Hadoop Ecosystem for processing structured Data.
8. Implementation of Sqoop for transferring schema format to NOSQL format.
9. Implementation and configuration of Hive in Hadoop ecosystem for querying.
10. Apache Spark Installation and implementation of simple programs in it.

Total Hours : 45

OUTCOMES:

Upon Completion of this course the student will be able to

- Demonstrate single node and multinode Hadoop 1.0 with installation and configuration.
- Compute simple programs in Hadoop using Map reduce Paradigm.
- Analyze Hadoop Ecosystem using simple components like Pig, Hive and Sqoop.
- Exploring Apache Spark and analyzing the components in it.

III Semester Electives
Programme Elective - I

ITCX201	ANDROID APPLICATION DEVELOPMENT	L	T	P	C
		1	0	2	2

OBJECTIVES:

- To know the importance of mobile applications.
- To learn the fundamentals of Android application development.
- To develop simple mobile applications using Android.

THEORETICAL STUDY

ANDROID APPLICATION DEVELOPMENT **15**

Android Basics - Android Architecture - Application Framework - The Manifest file - Libraries – Developing - Managing Virtual Devices - Building and Running – Debugging – Testing - Building Blocks - Application Components - Content Providers - Broadcast Receiver - Processes and Threads - Data storage - SQLite Databases - Localization - User Interface.

LABORATORY PRACTICE **30**

- Developing Simple Android Applications (4 exercises)
- Mobile application development in Android. (Students can select their own problem to develop an Application)

  Sample applications
  - Scientific calculator
  - Online shopping
  - Student attendance and marks maintenance
  - Bus route management
  - Games

Total Hours : 45

REFERENCES:

1. Dawn Griffiths, David Griffiths, “Head First Android Development: A Brain-Friendly Guide”, O'Reilly Media, 2015.

2. John Horton, “Android Programming for Beginners”, Packt Publishing, 2015.
3. Herbert Shieldt , “Java: A Beginner's Guide”, 7th Edition, Oracle Press, 2017.

OUTCOMES:

On completion of the course students will be able to:

- Describe the limitations and challenges of working in a mobile and wireless environment as well as the commercial and research opportunities presented by these technologies.
- Apply the different types of application models/architectures used to develop mobile software applications.
- Describe the components and structure of a mobile development frameworks (Android SDK and Eclipse Android Development Tools (ADT)) and learn how and when to apply the different components to develop a working system.
- Work within the capabilities and limitations of a range of mobile computing devices.
- Design, implement and deploy mobile applications using an appropriate software development environment.

ITCX202 NEXTGEN TECHNOLOGIES L T P C

3 0 0 3

OBJECTIVES:

- To understand the concepts of Next Generation Technologies like Cloud, Big Data, IoT and Social Media and Mobility, Machine learning, Artificial Intelligence and their impact on the industry.
- To study the concepts of cloud architecture and various services, technologies offered in Cloud, Big Data (Hadoop), Data Sciences, Data analyzing techniques, Structured data, Unstructured data.
- To learn the concepts of social media and how social Media is used for business
- To understand the development of various mobile platforms, mobile apps and their operating systems.
- To discuss IoT, IPV6, and future of IoT and its uses across various industries.
- To acquire knowledge of AI – Machine Learning Algorithms and uses of AI in the various industries.

Prerequisites: Programming in Python, Java Programming, Computer Programming

MODULE I INTRODUCTION TO NEXT GENERATION TECHNOLOGIES 7

Introduction – Next-Generation Sequencing Technology – Computing Technology - Cloud Computing, Data Science Technology - Big Data, Internet of Things (IoT), Social Media and Mobility, Machine Learning-Artificial Intelligence (AI) – Diverse applications.

MODULE II CLOUD & BIG DATA 8

Cloud architectural overview – Cloud deployment models – Cloud service models – Cloud platforms – Managing data in the cloud – Computing in the cloud – Data Analytics in the cloud – Amazon Elastic Compute Cloud – Privacy and Security in Cloud – Data Visualization - Big data value for the enterprise – Structured and Unstructured data - Hadoop components – HDFS – Map reduce.

MODULE III SOCIAL MEDIA 7

Digital Social Media – Microblogging – Customer Personas - Social Networks – Social Bookmarking – Social Media Marketing – Social Media Profiling - Video Sharing and Podcasts – Live Streaming – REALLY Framework – Strategy

Development – Gamification.

MODULE IV MOBILE APP DEVELOPMENT 7

Introduction – Mobile Platforms - Andriod Development Environment – XCode, Eclipse, VS2012, PhoneGAP - Multichannel and Multimodel UIs – App store, Google Play, Windows Store - Mobile device application programming interfaces – Android/iOS/Win 8 Survial and basic apps – Impact on business cases.

MODULE V INTERNET OF THINGS (IOT) 8

Introduction to IoT and Web of Things (WoT) – Business aspects of IoT – Industry domains - Making Things Smart – M2M to IoT - Cloud Computing for IoT - IoT Communication Protocols – IoT services or attributes - Electronics- Sensors – Actuators – Arduino – Raspberry PI – Beagle Bone Black – Electric Imp.

MODULE VI ARTIFICIAL INTELLIGENCE & MACHINE LEARNING 8

Foundations of AI & Machine Learning – Knowledge representation – Advanced search – Types of learning – Supervised – Unsupervised – Dimensionality Reduction – Machine Learning System Design – Linear model – Distance based model – Tree and Rule models – Support Vector Machines – Neural networks – Robotic Process Automation – Machine learning tools – Octave/Matlab tutorial – A case study – Photo OCR – Game playing – Speech recognition

Total Hours : 45

TEXT BOOKS:

1. Ian Foster, Dennis B.Gannon, “Cloud Computing for Science and Engineering”, MIT Press, September 2017.
2. Rajkumar Buyya, James Broberg, Andrzej Goscinski, “Cloud Computing Principles and Paradigms”, John Wiley & Sons, Inc., Publications, 2011.
3. Michael Minelli, Michele Chambers, Ambiga Dhiraj., “Big Data, Big Analytics, Emerging Business Intelligence and Analytic Trends for Today's Businesses”, First Edition, Wiley Publications, 2013.
4. Luttrell, Regina, “Social Media: How to Engage, Share, and Connect”, Rowman & Littlefield Publishers, 2016.
5. Jeff McWherter, Scott Gowell, “Professional Mobile Application Development”, 2012.
6. Honbo Zhou, “The Internet of Things in the Cloud: A Middleware Perspective”, CRC Press, 2012.

7. K. P. Murphy, “Machine Learning: A probabilistic perspective”, MIT Press, 2012.

REFERENCE BOOKS:

1. Reto Meier, “Professional Android 4 Development”, John Wiley and Sons, 2012.
2. Matt Neuburg, “Programming iOS 5”, O'Reilly Media, Inc., 2012.
3. Adrian McEwen & Hakim Cassimally, “Designing internet of things”, John Wiley and Sons, 2014.
4. P. Flach, “Machine Learning: The art and science of algorithms that make sense of data”, Cambridge University Press, 2012.

OUTCOMES:

- Describe the concepts of Next Generation Technologies.
- Understand cloud services, Big Data, Data science, Hadoop, and their impact on industry.
- Analyze social media and impact of social media on the business.
- Understand any of the mobile platforms, and mobile programming language.
- Develop skills on IoT technologies and their contact on industry.
- Implement AI & machine learning algorithms for an application and analyze the results.

ITCX203 MULTIMEDIA TOOLS AND TECHNIQUES

L	T	P	C
0	0	2	1

OBJECTIVES:

To enable the students to

- understand and gain knowledge about the various multimedia tools.
- learn to do Image Editing using Adobe Photoshop.
- design animation using Adobe Flash, Write Action script.
- edit text, image, audio and video

LIST OF EXERCISES **30**

1. Create an image and demonstrate basic image editing using photoshop
2. Demonstrate rasterization and filtering of layers, blending effects, text effects using photoshop
3. Design logo using adobe illustrator
4. Create animated text effects and transition using flash.
5. Create an advertisement using guide layer, masking, morphing, and onion skin in flash
6. Generate frame by frame animation using multimedia flash
7. Create 2D/3D Animation using Flash/ Director
8. Create 3D Animation using 3dsmax/Maya
9. Editing Audio and Video

Total Hours : 30

OUTCOMES:

After successful completion of this course, the students should be able to

- design and implement an animation for various themes.
- create multimedia advertisement.
- edit audio and video using multimedia tools.

ITCX204 **SYSTEM SOFTWARE** **L T P C**

3 0 0 3

OBJECTIVES:

To enable the students to

- study about assemblers and macroprocessor.
- analyze about linkers and loaders.
- demonstrate the concept about emulators.
- learn about the tools used for system software.

Prerequisite: To understand about assembly language programming.

MODULE I INTRODUCTION **8**

Simplified Instructional Computer (SIC)- -Modes of addressing - instruction sets,instruction formats - I/O instructions-Device Driver, Role of Device Drivers, Classes of Devices, Security issues, Design issues.

MODULE II ASSEMBLERS **8**

Definition- Machine dependent features –Types of addressing modes and types of instruction formats - Program relocation – Assembler machine independent features – Literal pool- Statements defining symbols - Expressions – Types of assemblers – example of a assembler.

MODULE III LOADERS AND LINKERS **8**

Absolute Loader - Features of Loader- Machine dependent and machine independent - Program relocation ,linking- Tables used during Linking – Standard Library Search - Design of Loader - Linkage Editors – Dynamic program Linking – Types of Loaders - MSDOS linker.

MODULE IV MACRO PROCESSORS AND EMULATORS **8**

Functions of a macro processor - Macro Definition and Expansion – Tables generated- machine-independent features - Example - MASM Macro Processor - Introduction of virtual machine (VM)-Emulation –Basic interpretation-Threaded interpretation.-Binary Transalation.

MODULE V COMPILER AND INTERPRETERS **8**

Basic concepts of Compiler-Phases of Compiler -Interpreters-Benefits of Interpreters- Overview of Interpretation-A Toy Interpreter-Pure and Impure

Interpreters.

MODULE VI TEXT EDITOR **5**

Features of a Text editors - Editing tasks - Editor Structure- Debugging systems- Debugging tasks - User-Interface Criteria. Android operating system: Android Architecture, Linux Kernel, Android Architecture Libraries, Android Architecture Application Framework, Applications, Security features and Permission.

Total : 45 Hours

TEXT BOOK:

1. Leland L. Beck, "System Software - An Introduction to Systems Programming", 3rd Edition, Pearson Education Asia, 2000.

REFERENCES:

1. D. M. Dhamdhere, "Systems Programming and Operating Systems", 2nd Edition, Tata McGraw-Hill, 1999.
2. John J. Donovan, "Systems Programming", Tata McGraw-Hill, 1972.
3. Neil Smith , ”Android studio development essentials”, Second edition .

OUTCOMES:

On successful completion of the course, the students will be able to

- Outline the architecture of hypothetical computers.
- Summarize the functions of assembler.
- Discuss about the various loaders and linkers.
- Compare the different types of macroprocessors.
- Outline about compilers and interpreters.
- Design a text editor and analyze its features.

ITCX205 PRINCIPLES OF COMMUNICATION L T P C

3 0 0 3

OBJECTIVES:

- To understand the basics of electronic communication.
- To gain experience about the modulation and demodulation techniques.
- To teach the importance of digital communication.
- To understand the various satellite communication systems.

MODULE I FUNDAMENTALS OF ELECTRONIC COMMUNICATION 8

The Significance of Human Communication - Communication Systems - Types of communication – Modulation and Multiplexing - EM spectrum - Optical spectrum – Bandwidth **and** Gain – Attenuation and Decibels - Tuned Circuits- Filters - Application.

MODULE II AMPLITUDE MODULATOR AND DEMODULATOR CIRCUITS 8

Amplitude modulation concept – Modulation index and percent modulation – sidebands and the Frequency domain – Frequency domain representation of AM - AM power – Single sideband modulation - Signal power consideration - AM modulators - low level AM modulator - high level AM modulator – Amplitude demodulators.

MODULE III FREQUENCY MODULATION TECHNIQUE 8

Basic Principles - Frequency Modulation - Phase Modulation - Modulation Index - Sidebands – Noise Suppression – FM Versus AM - Frequency Modulators - Phase Modulators - Frequency Demodulators - Signal reproduction – Receivers - Transceivers.

MODULE IV DIGITAL MODULATION TECHNIQUES 7

Introduction – Types of modulation - ASK – FSK – PSK - QAM - Bandwidth Efficiency - Carrier Recovery - Clock Recovery - DPSK - Trellis Code Modulation - Error -Probability -Bit Error Rate - Performance.

MODULE V SPREAD SPECTRUM TECHNIQUES 7

Introduction, Pseudo noise, properties, model-spread spectrum- performance of DSSS, FHSS - frequency hopping- access techniques–Comparison, Coding of speech for wireless.

MODULE VI SATELLITE COMMUNICATION 7

Satellite systems - Satellite Orbits – Spectrum usage – Satellite sub systems -

Communication sub system – Power–Antenna – Receiver– Transmitter – Ground station - Satellite application – Global navigation.

Total Hours : 45

TEXT BOOKS:

1. Wayne Tomasi, “Advanced Electronic Communication Systems”, 6th edition Pearson Education, 2014.
2. Louis E. Frenzel Jr., “Principles of Electronic Communication Systems”, 4th Edition McGraw-Hill Education, 2016.

REFERENCES:

1. Simon Haykin and Michael Moher “Communication Systems”, 5th Edition, John Wiley & Sons, 2010.
2. George Kennedy and Bernard Davis, “Electronic Communication Systems”, 4th Edition, McGraw-Hill Education, 2009.

OUTCOMES:

- On completion of the course students will be able to:
- Outline the basics of electronic communication.
- Analyze the basic concepts of Frequency Modulation and Phase Modulation.
- Discuss the various Digital modulation techniques.
- Apply suitable modulation schemes and coding for various applications.
- Analyze the various spread spectrum transmission techniques.
- Identify and describe different satellite communication techniques.

ITCX206 PRINICPLES OF COMPILER DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

To enable the students to

- enrich the knowledge in various phases of compiler.
- design and construct a lexical analyzer.
- expand the knowledge of parser by parsing.
- construct the syntax-directed tress
- concise and design optimization of codes.
- design a compiler for a simple programming language.

Prerequisite: Programming concepts and Data structures

MODULE I INTRODUCTION **7**

Language processor - Structure of a Compiler - Applications of Compiler Technology - Programming language basics - Syntax Definition - Syntax-Directed translation - parsing - Lexical Analysis - symbol tables - intermediate code generation.

MODULE II LEXICAL ANALYSIS **9**

The role of lexical analyzer - Input Buffering - Specification of Tokens - Recognition of Tokens - Lexical Analyzers generator Lex, Finite Automata - From a Regular Expression to automata - Design of a Lexical Analyzer Generator

MODULE III SYNTAX ANALYSIS **8**

Introduction - Context Free Grammars -Top Down parsing - Bottom-up Parsing - Introduction to LR parsing - Construction of SLR Parsing table - Introduction to LALR Parser- Parser Generators.

MODULE IV SYNTAX - DIRECTED TRANSLATION **7**

Syntax-Directed Definitions - Construction of Syntax Trees - Syntax-Directed Translation schemes - Implementing L-Attributed SDD’s.

MODULE V INTERMEDIATE CODE GENERATION **7**

Variants of syntax trees - Three-address code - Types and declarations - Translation of Expressions - Type checking - Type Conversions - Control Flow.

MODULE VI CODE OPTIMIZATION AND CODE GENERATION 7

Issues in design of a code generator - The target language - Addresses in the target code - Flow graphs - Optimization of basic blocks - a simple code generator algorithm - Peephole Optimization - Register Allocation and Assignment - Optimal code generation.

Total : 45 Hours

TEXT BOOK:

1. Alfred V.Aho, Monica S.Lam, Ravi Sethi and Jeffrey D.Ullman, "Compilers – Principles, Techniques and Tools", Second edition, Pearson Education, New Delhi, 2013.

REFERENCES:

1. Raghavan V, “Principles of Compiler Design”, Tata Mc-Graw Hill Education Pvt. Ltd., New Delhi, 2009.
2. Dick Grone, Henri E Bal, Ceriel J H Jacobs and Koen G Langendoen, “Modern Compiler Design”, John Wiley, New Delhi, 2016.
3. Randy Allen, Ken Kennedy, “Optimizing Compilers for Modern Architectures: A Dependence-based Approach”, Morgan Kaufmann Publishers, 2015.
4. Dhamdhere D M, "Compiler Construction Principles and Practice", second edition, Macmillan India Ltd., New Delhi, 2002.
5. Jean Paul Tremblay, Paul G Serenson, "The Theory and Practice of Compiler Writing", McGraw Hill, New Delhi, 2005.

OUTCOMES:

On successful completion of the course, the students will be able to

- obtains the knowledge of modern compiler & its features.
- analyze the given program using lexical analyzer
- discuss various parsing techniques.
- evaluate the syntax directed translation.
- design and conduct experiments for intermediate code generation.
- demonstrate the compilation of a program in a regular high level language.

ITCX207 **USER INTERFACE DESIGN** **L T P C**
3 0 0 3

OBJECTIVES:

To enable the students to

- gain knowledge on the user interface design process.
- learn business functions and to understand the user interface design principles.
- Be familiar on menus and windows.
- Understand hoe to use messages and controls.
- acquire the knowledge about icons and images.
- learn about android.

Prerequisite: Computer Fundamentals

MODULE I DESIGN PROCESS **8**

The Importance of Good Design, The Benefits of Good Design, Characteristics of the Graphical User Interface, Characteristics of a Web Interface, Principles of User Interface Design, The User Interface Design Process

MODULE II BUSINESS FUNCTIONS AND PRINCIPLES **7**

Know Your User or Client - Understand the Business Function - Understand the Principles of Good Interface and Screen Design

MODULE III MENUS AND WINDOWS **8**

Develop System Menus and Navigation Schemes - Select the Proper Kinds of Windows -

MODULE IV CONTROLS AND MESSAGES **7**

Screen-Based Controls - Text and Messages - Effective Feedback and Guidance and Assistance - Internationalization and Accessibility -

MODULE V VISUAL OBJECTS & TESTING **7**

Meaningful Graphics, Icons, and Images - Proper Colors - Test, Test, and Retest

MODULE VI ANDROID USER INTERFACE DESIGN **8**

Android UI and Material Design - Understanding Views—The UI Building Blocks -

Creating Full Layouts With View Groups and Fragments - Adding App Graphics and Resources - Prototyping and Developing the App

Total : 45 Hours

TEXT BOOK:

1. Wilbert O. Galitz, “The Essential Guide to User Interface Design: An Introduction to GUI Design Principles and Techniques”, 3rd Revised edition, John Wiley & Sons, 2007
2. Ian G. Clifton, “Android User Interface Design: Implementing Material Design for Developers “, Second Edition, Addison Wesley, 2017

REFERENCES:

1. Alon Cooper, “About Face: The Essentials of Interface Design, Fourth Edition, WILEY, 2016
2. Laura Klein, “UX for Lean Startups”, Shroff, 2013
3. Jeff Gothelf, “Lean UX: Designing Great Products with Agile Teams”, Second Edition, Shroff/O'Reilly, 2016.
4. Patricia Harris, “What Is User Interface Design?”, Powerkids Press, 2017

OUTCOMES:

On successful completion of the course, the students will be able to

- explain the design process.
- apply the design principles to develop a good user interface design.
- design a software with suitable types of menus and windows.
- develop appropriate message windows and text messages.
- choose meaningful icons and colors.
- Develop android applications.

ITCX208	SEMANTIC WEB	L	T	P	C
		2	0	0	2

OBJECTIVES:

To enable the students to

- To understand the evolution and significance of semantic web.
- To identify and explore tools and methods to construct and implement ontologies.
- To build and implement a micro level ontology that is semantically descriptive of chosen problem domain.
- To develop and implement applications and tools based on ontology.

Prerequisite: Web Technology, Internet Technology Fundamentals.

MODULE I INTRODUCTION TO SEMANTIC WEB 9

Overview of semantic web – source of semantic web– examining semantic web and examples-semantic wikis-twine-FOAF project-sources of semantic data-RDF-architecture of semantic web-role of ontology in sematic web-semantic web data-Compare and Contrast semantic technologies with traditional technologies-Semantic framework-web based issues and solutions.

MODULE II ONTOLOGY & WEB RESOURCES 12

Ontologies – Taxonomies –Topic Maps – Classifying Ontologies - Kind of Ontology resources -construction of ontology instances – Classifications and methods for building ontology -Ontology Development Life Cycle & process – Ontology-Evolution – Versioning-Structured Web Documents - XML ,JSON– Building page structures – Namespaces – Labeling – Query parsers for ontology–RDF – RDF based models– Formats - RDF grammar– fundamentals.

MODULE III SEMANTIC WEB TOOLS AND APPLICATIONS 9

Tools for construction and designing ontology and reasoning logics for semantic web– Apache Jena Framework, Protégé – SPARQL – Alchemy API – Word Net based Applications -Case studies and Applications using Python and NLTK based Libraries.

Total : 30 Hours

TEXT BOOK:

1. Liyang Yu, A Developer's Guide to the Semantic Web, Springer; 3rd Edition, 2015.

REFERENCES:

1. John Hebeler, Matthew Fisher, Ryan Blace and Andrew Perez-Lopez, Semantic Web
2. Programming, Wiley; 1 edition, 2009.
3. Grigoris Antoniou, Frank van Harmelen, A Semantic Web Primer, Second Edition
   (Cooperative Information Systems) (Hardcover), MIT Press, 2008
4. Dean Allemang and James Hendler, Semantic Web for the Working Ontologist: Effective Modeling in RDFS and OWL, Morgan Kaufmann; 2 edition, 2011.

OUTCOMES:

On successful completion of the course, the students will be able to

- Explore fundamentals of semantic web, models and tools.
- Understand semantic tools and techniques for representing ontology as XML and RDF files.
- Have hands on experience on various popular Semantic NLP tools and libraries.

Programme Elective – II (6 Credits)

		L	T	P	C
ITCX101	**iOS APPLICATION DEVELOPMENT**	**1**	**0**	**2**	**2**

OBJECTIVES:

- To know the importance of mobile applications.
- To learn the fundamentals of iOS application development.
- To develop simple mobile applications using iOS.

THEORETICAL STUDY

iOS APPLICATION DEVELOPMENT **15**

iOS Basics - iOS Architecture - Integrated development Tools - Objective C - Frame work and Libraries - Project templates - Resource & Application Settings - Views & Controls - Debugging & Running - Building Block Approach - Application Life cycle - MVC – Pattern - View - Data Management - Core Data - Application Storage - External Storage - Memory Management - UI Design - Design Tools - Interface Builders - Story board - View Controllers - Drawing model – Windows - Event Handling - View data Source and delegates.

LABORATORY PRACTICE **30**

- Developing Simple iOS Applications (4 exercises)
- Mobile application development in iOS. (Students can select their own problem to develop an Application)

  Sample applications
  - Scientific calculator
  - Home Automation
  - Live Chat
  - Currency converter
  - To do list
  - Games

Total Hours : 45

REFERENCES:

1. Rob Napier, Mugunth kumar, “iOS 7 Programming”, Wiley, 2014.
2. Erica Sadun, “The iOS 5 Developer’s Cookbook”, Pearson, Third Edition, 2012.

OUTCOMES:

On completion of the course students will be able to :

- Describe the limitations and challenges of working in a mobile and wireless environment as well as the commercial and research opportunities presented by these technologies.
- Apply the different types of application models/architectures used to develop mobile software applications.
- Describe the components and structure of a integrated development environment (XCode) and learn how and when to apply the different components to develop a working system.
- Work within the capabilities and limitations of a range of mobile computing devices.
- Design, implement and deploy mobile applications using an appropriate software development environment.

ITCX102 ORACLE DATABASE PROGRAMMING

L	T	P	C
0	0	2	1

OBJECTIVES:

- To design and implement effective SQL queries within database applications and manipulate database data effectively.
- To demonstrate a database solution for a business or organization using Oracle Application Express (APEX).
- To implement database-driven web site with database programming with PL/SQL.
- To develop, execute and manage PL/SQL database program like procedures, functions, and database triggers.

LIST OF EXERCISES:

1. Design of database with SQL using DDL, DML, and TCL commands.
2. Implementation of Single Row Functions, JOINs, Group Functions.
3. Implementation of Constraints, Views, Sequences, Privileges and Regular Expressions.
4. SQL Functions, Triggers and Procedures.
5. Database and Websheet application creation in Oracle Application Express (APEX) using Application Builder.
6. Working on SQL Commands in Oracle Application Express - SQL Command Processor.
7. Transferring Schema and Data in APEX.
8. Database Programming with PL/SQL
    - Retrieving & Manipulating Data in PL/SQL
    - Using Explicit & Multiple Cursors
    - Program Structures to Control Execution Flow
    - Creating procedures and Passing parameters
    - Using dynamic SQL
    - Database Event Triggers
9. Design and Implement a basic database using the Oracle Database Management and Java Programming.
10. Creating and Presenting Database Projects.

Total Hours : 30

OUTCOMES:

1. Understand the use and application of the relational database model.
2. Enhance skills in Oracle database programming.
3. Implement database applications using Java programming.
4. Design database and websheet application creation using Application Builder.
5. Expertise in relational database data management.

ITCX103 NATURAL LANGUAGE PROCESSING

L	T	P	C
3	0	0	3

OBJECTIVES:

The student should be made to:

- Learn the techniques in natural language processing.
- Be familiar with the natural language generation.
- Be exposed to machine translation.
- Understand the information retrieval techniques.

MODULE I OVERVIEW AND LANGUAGE MODELING 7

Overview: Origins and challenges of NLP-Language and Grammar-Processing Indian Languages- NLP Applications-Information Retrieval. Language Modeling: Various Grammar- based Language Models-Statistical Language Model.

MODULE II WORD LEVEL AND SYNTACTIC ANALYSIS 7

Word Level Analysis: Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging.

MODULE III SYNTACTIC ANALYSIS AND SEMANTIC ANALYSIS 8

Syntactic Analysis: Context-free Grammar-Constituency- Parsing-Probabilistic Parsing. Semantic Analysis: Meaning Representation-Lexical Semantics-Ambiguity-Word Sense Disambiguation.

MODULE IV DISCOURSE PROCESSING AND NATURAL LANGUAGE GENERATION 8

Discourse Processing: cohesion-Reference Resolution- Discourse Coherence and Structure. Natural Language Generation: Architecture of NLG Systems-Generation Tasks and Representations- Application of NLG.

MODULE V MACHINE TRANSLATION AND INFORMATION RETRIEVAL 8

Machine Translation: Problems in Machine Translation- Characteristics of Indian Languages- Machine Translation Approaches-Translation involving Indian Languages.

MODULE VI LEXICAL RESOURCES AND APPLICATIONS 7

Information Retrieval: Design features of Information Retrieval Systems-Classical,

Non-classical, Alternative Models of Information Retrieval – valuation Lexical Resources: World Net-Frame Net- Stemmers-POS Tagger- Research Corpora - Applications.

Total Hours : 45

REFERENCES:

1. Tanveer Siddiqui, U.S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.
2. Daniel Jurafsky and James H Martin, “Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition”, 2 nd Edition, Prentice Hall, 2008.
3. James Allen, “Natural Language Understanding”, 2nd edition, Benjamin /Cummings publishing company, 1995.

OUTCOMES:

Upon completion of the course, the student should be able to:

- Discuss the major trends and systems in Natural Language Processing.
- Explain context free grammars and the use of parsers.
- Outline the syntax of grammars and analyze the feature-based semantic systems.
- Apply statistical techniques to natural language analysis.
- Do machine translation.
- Apply information retrieval techniques.

ITCX104 GAME THEORY L T P C

3 0 0 3

OBJECTIVES:

- To introduce the student to the notion of a game, its solutions concepts, and other basic notions and tools of game theory.
- Appraise theoretical predictions obtained from Game Theory analyses against real world conflicts.
- To formalize the notion of strategic thinking and rational choice by using the tools of game theory, and to provide insights into using game theory in modeling applications;
- Integrate increasing analytical skills into increasingly complex conflicts.
- To draw the connections between game theory, computer science, and economics, especially emphasizing the computational issues.
- To introduce contemporary topics in the intersection of game theory, computer science, and economics.

MODULE I INTRODUCTION 7

Introduction - Making rational choices: basics of Games - strategy - preferences - payoffs -

Mathematical basics - Game theory - Rational Choice - Basic solution concepts-non-cooperative versus cooperative games - Basic computational issues - finding equilibrium and learning in games - Typical application areas for game theory (e.g. Google's sponsored search, eBay auctions, electricity trading markets).

MODULE II GAME DESIGN & GAME PROGRAMMING 8

Game Design - Game Writing - Narrative Theory - Story and Character Development - Game play - Creating the Game World - Level Design - Human - Computer Interface design - Game Programming Fundamentals - C++ - Java - Scripting Languages.

MODULE III GAMES WITH PERFECT & IMPERFECT INFORMATION 8

Games with Perfect Information - Strategic games - prisoner's dilemma, matching pennies - Nash equilibrium- mixed strategy equilibrium - zero-sum games - Games with Imperfect Information – Bayesian Games - Extensive Games with Imperfect - Information - Strategies - Beliefs and sequential equilibrium - Illustrations - Repeated Games – The Prisoner's Dilemma – Bargaining.

MODULE IV NON-COOPERATIVE GAME THEORY 7

Non-cooperative Game Theory - Self-interested agents- Games in normal form -

Analyzing games: from optimality to equilibrium - Computing Solution Concepts of Normal - Form Games - Computing Nash equilibrium of two-player, zero-sum games - Computing Nash equilibrium of two-player, general-sum games - Identifying dominated strategies.

MODULE V MECHANISM DESIGN 8

Aggregating Preferences-Social Choice - Formal Model- Voting - Existence of social functions - Ranking systems - Protocols for Strategic Agents: Mechanism Design - Mechanism design with unrestricted preferences- Efficient mechanisms - Vickrey and VCG mechanisms (shortest paths) - profit maximization Computational applications of mechanism design - applications in Computer Science - Google's sponsored search - eBay auctions.

MODULE VI GAME PRODUCTION AND BUSINESS OF GAMES 7

Game production - Project management - Game industry roles - Economics - Publisher-Developer relationship - Marketing - Intellectual Property rights - Content regulation.

Total Hours : 45

REFERENCES:

1. M. J. Osborne, “An Introduction to Game Theory”. Oxford University Press, 2004.
2. N. Nisan, T. Roughgarden, E. Tardos, and V. V. Vazirani, “Algorithmic Game Theory”, Cambridge University Press, 2007.
3. M. J. Osborne and A. Rubinstein, “A Course in Game Theory”, MIT Press, 1994.
4. A.Dixit and S. Skeath, “Games of Strategy”, Second Edition. W W Norton & Co Inc, 2004.
5. Yoav Shoham, Kevin Leyton-Brown, “Multiagent Systems: Algorithmic, Game-Theoretic, and Logical Foundations”, Cambridge University Press 2008
6. Jeannie Novak, "Game Development Essentials - An Introduction", 3rd Edition, Delmar Cengage Learning, 2011.

OUTCOMES:

- Discuss the notion of a strategic game and equilibrium, and identify the characteristics of main applications of these concepts.
- Communicate game-theoretic ideas and concepts to non-specialist audiences in a language which is accessible and comprehensible.
- Discuss the game with perfect and imperfect information with the use of Nash

Equilibrium for other problems.

- Model competitive real world phenomena using concepts from non-cooperative game theory.
- Identify key strategic aspects and based on these be able to connect them to appropriate game theoretic concepts given a real world situation.
- Implement a typical Virtual Business scenario using Game theory applications.

ITCX105 SOFT COMPUTING L T P C

3 0 0 3

OBJECTIVES:

- Understand the basic concepts of soft computing
- To become familiar with AI and neural networks that can learn from available examples and generalize to form appropriate rules for inferencing systems.
- Provide the mathematical background for carrying out the optimization associated with neural network learning.
- Familiarize with genetic algorithms and other random search procedures useful while seeking global optimum in self-learning situations.
- Introducing the ideas of hybrid soft computing techniques and applications and use of heuristics based on human experience.
- Develop the case studies utilizing the above and illustrate the intelligent behavior of programs based on soft computing.

MODULE I INTRODUCTION 8

Introduction of soft computing, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing. Artificial Intelligence : Introduction to searching: breadth first search, depth first search techniques, other Search Techniques like hill Climbing, A* algorithm, AO* Algorithms and various types of control strategies. Knowledge representation issues, Prepositional and predicate logic, monotonic and non monotonic reasoning, forward Reasoning, backward reasoning.

MODULE II INTRODUCTION TO NEURAL NETWORK 8

Structure and Function of a single neuron: Biological neuron, artificial neuron, definition of ANN, Taxonomy of neural net, Difference between ANN and human brain, characteristics and applications of ANN, single layer network, Perceptron training algorithm, Linear separability, Widrow & Hebb"s learning rule/Delta rule, ADALINE, MADALINE, AI v/s ANN.

MODULE III MLP 7

Introduction of MLP, different activation functions, Error back propagation algorithm, derivation of BBPA, momentum, limitation, characteristics and application of EBPA. Counter propagation network, architecture, functioning & characteristics of counter Propagation network, Hopfield/ Recurrent network, associative memory, and characteristics, limitations and applications.

MODULE IV FUZZY LOGIC **8**

Membership functions: features, fuzzification, methods of membership value assignments- Defuzzification: lambda cuts – methods – fuzzy arithmetic and fuzzy measures: fuzzy arithmetic – extension principle -fuzzy integrals – fuzzy rule base and approximate reasoning : truth values and tables, fuzzy propositions, formation of rules-decomposition of rules, aggregation of fuzzy rules, fuzzy reasoning-fuzzy inference systems-overview of fuzzy expert system-fuzzy decision making.

MODULE V GENETIC ALGORITHM **7**

Fundamentals, basic concepts, working principle, encoding, fitness function, Genetic modeling: Inheritance operator, cross over, inversion & deletion, mutation operator, Bitwise operator, constraints ,Generational Cycle, Real Applications & advances in GA, Differences & similarities between GA & other traditional methods.

MODULE VI HYBRID SOFT COMPUTING TECHNIQUES & APPLICATIONS **7**

Neuro-fuzzy hybrid systems – genetic neuro hybrid systems – genetic fuzzy hybrid and fuzzy genetic hybrid systems – Applications: A fusion approach of multispectral images with SAR and soft computing based hybrid fuzzy controllers.

Total Hours : 45

TEXT BOOKS:

1. S.Rajasekaran & G.A. Vijayalakshmi Pai, “Neural Networks, Fuzzy Logic & Genetic Algorithms, Synthesis & applications”, PHI Publication, 2002.
2. S.N.Sivanandam and S.N.Deepa, “Principles of Soft Computing”, Wiley India Pvt Ltd, 2011.
3. J.S.R.Jang, C.T. Sun and E.Mizutani, “Neuro-Fuzzy and Soft Computing”, PHI / Pearson Education 2004.

REFERENCES:

1. Timothy J.Ross, “Fuzzy Logic with Engineering Applications”, McGraw-Hill, 1997.
2. N.K.Bose, “Neural Network Fundamentals with Graphs, Algorithms, and Applications” TMH, 1996.
3. Kosko: “Neural Network & Fuzzy System”, PHI Publication, 1992.
4. Rich E and Knight K, “Artificial Intelligence”, TMH, 1991.

OUTCOMES:

- Learn about soft computing techniques and their applications
- Analyze various neural network architectures
- Understand perceptrons and counter propagation networks.
- Define the fuzzy systems
- Analyze the genetic algorithms and their applications
- Familiar with the techniques of soft computing and adaptive neuro-fuzzy inferencing systems which differ from conventional AI and computing in terms of its tolerance to imprecision and uncertainty.

ITCX106 MACHINE LEARNING ALGORITHMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To study the components, models of machine learning.
- To discuss the various concepts related to supervised and unsupervised learning.
- To recognize the different types of machine learning models and how to use them.
- To learn the theoretical and practical aspects of tree and graph models.
- To acquire the knowledge of reinforcement learning.
- To discuss various applications in machine learning.

MODULE I INTRODUCTION TO MACHINE LEARNING 7

Introduction - Component of learning - examples of machine learning applications - Types of machine learning - Mathematical foundations of machine learning - Learning models - Probabilistic models - Logic models - Parametric Models - Non-Parametric Models - Theory of learning - Theory of generalization.

MODULE II SUPERVISED LEARNING 8

Linear classification - Linear Models for Regression – Univariate linear regression Multivariate linear regression - Bayesian Linear Regression – Linear algebra review - Linear Models for Classification - Discriminant Functions - Probabilistic Generative Models -Probabilistic Discriminative Models. Learning Artificial Neural Networks - Feed-forward Network Functions - Back Propagation Network - Bayesian Neural Network - support vector machines - Ensemble methods.

MODULE III UNSUPERVISED LEARNING 8

Nearest neighbor models – Clustering - K-means - hierarchical clustering - k-d trees - EM Algorithm- Mixtures of Gaussians - Dimensionality Reduction - Factor analysis - Principal Component Analysis (PCA) - Probabilistic PCA - Independent components analysis (ICA) - Singular Value Decomposition - meta learning.

MODULE IV TREE AND GRAPHICAL MODELS 8

Decision trees - learning decision trees - regression trees - clustering trees - descriptive rule learning - association rule mining - Graphical Models - Undirected graphical models - Markov Random Fields - Directed Graphical Models - Bayesian Networks - Inference - Learning - Generalization - Hidden Markov Models.

MODULE V REINFORCEMENT LEARNING 7

Passive reinforcement learning - direct utility estimation - adaptive dynamic programming - temporal-difference learning - active reinforcement learning - exploration - learning an action-utility function - Generalization in reinforcement learning - policy search - applications in game playing - applications in robot control.

MODULE VI APPLICATIONS 7

Ranking: Priority Inbox - Ordering Email Messages by Priority - Writing a Priority Inbox - Spam Filtering - Analyzing Social Graphs - Social Network Analysis - Hacking Twitter Social Graph Data - Analyzing Twitter Networks - Case Study - Octave/Matlab.

Total Hours : 45

TEXT BOOKS:

1. Ethem Alpaydin, “Introduction to Machine Learning”, Third Edition, MIT Press, 2014.
2. Alex Smola and S.V.N Vishwanathan, “Introduction to Machine Learning”, Second Edition Cambridge University Press, 2010.

REFERENCES:

1. K. P. Murphy, “Machine Learning: A probabilistic perspective”, MIT Press, 2012.
2. Flach, “Machine Learning: The art and science of algorithms that make sense of data”, Cambridge University Press, 2012.
3. Ian H. Witten, Eibe Frank, Mark A. Hall, “Data Mining: Practical Machine Learning Tools and Techniques”, Third Edition, Morgan Kaufmann, 2011.
4. T. M. Mitchell, “Machine Learning”, McGraw Hill, 1997.

OUTCOMES:

- Describe the concepts, components and models of machine learning.
- Understand and design algorithms for supervised and unsupervised learning.
- Develop skills by using unsupervised learning techniques.
- Analyze the efficient tree and graphical models for solving real world problems.
- Implement reinforcement learning algorithms for an application and analyze the results.
- Apply the appropriate techniques in social network analysis and web security.

ITCX107 C# AND .NET FRAMEWORK L T P C
3 0 2 4

OBJECTIVES:

The student should be made to:

- Understand the foundations of CLR execution.
- Know the object oriented aspects of C#.
- Learn the technologies of the .NET framework.
- Be aware of application development in .NET.
- Learn web based applications on .NET (ASP.NET).

MODULE I INTRODUCTION TO C# 8

Review of OOP Concepts - Overview of .NET Framework - Basic Elements of C# -
Program Structure and simple Input and Output Operations – Operators and Expressions – Statements – Arrays and Structures.

MODULE II OBJECT ORIENTED ASPECTS OF C# 8

Inheritance - Namespace – Polymorphism – Interface and Overloading – Multiple
Inheritance – Property – Indexes – Delegates – Publish/Subscribe Design Patterns-
Operator Overloading-Method Overloading

MODULE III C# CONCEPTS FOR FILES AND THREADS 8

C# Concepts for creating Data Structures - File Operation – File Management systems–
Stream Oriented Operations- Multitasking – Multithreading – Thread Operation – Synchronization.

MODULE IV XML and .NET 7

Working with XML – Techniques for Reading and Writing XML Data - Using XPath and
Search XML - ADO.NET Architecture – ADO.NET Connected and Disconnected Models
– XML and ADO.NET – Simple and Complex Data Binding– Data Grid View Class.

MODULE V APPLICATION DEVELOPMENT ON .NET 7

Application Domains – Remoting – Leasing and Sponsorship - .NET Coding Design

Guidelines –Assemblies – Security – Application Development

MODULE VI WEB SERVICES 7

Web Services -Building an XML Web Service - Web Service Client – WSDL and SOAP – Web Service with Complex Data Types – Web Service Performance.

Total Hours : 45

REFERENCES:

1. S. Thamarai Selvi and R. Murugesan “A Textbook on C# “, Pearson Education,2003.
2. Stephen C. Perry “Core C# and .NET”, Pearson Education,2006.
3. Jesse Liberty, “Programming C#”, Second Edition, O’Reilly Press, 2002.
4. Robinson et al, “Professional C#”, Fifth Edition, Wrox Press, 2002.
5. Herbert Schildt, “The Complete Reference: C#”, Tata McGraw Hill, 2004.
6. Andrew Troelsen, “C# and the .NET Platform”, A! Press, 2003.
7. Thuan Thai and Hoang Q. Lam, “. NET Framework Essentials”, Second Edition, O’Reilly, 2002.

OUTCOMES:

After completing this course, the student will be able to:

- List the major elements of the .NET frame work and discuss CLR.
- Explain how C# fits into the .NET platform.
- Analyze the basic structure of a C# application
- Debug, compile, and run a simple application.
- Develop programs using C# on .NET
- Design and develop Web based applications on .NET

ITCX108 ARTIFICIAL INTELLIGENCE L T P C

3 0 0 3

OBJECTIVES:

- To become familiar with AI and neural networks that can learn from available examples and generalize to form appropriate rules for inferencing systems.
- To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience.
- To provide the mathematical background for carrying out the optimization associated with neural network learning.
- To familiarize with genetic algorithms and other random search procedures useful while seeking global optimum in self-learning situations.
- To introduce case studies utilizing the above and illustrate the intelligent behavior of programs based on soft computing

MODULE I INTRODUCTION 5

Computerized reasoning - Artificial Intelligence (AI) - characteristics of an AI problem - Problem representation in AI - State space representation - problem reduction.

MODULE II SEARCH PROCESS 10

AI and search process - Brute force search techniques, Depth first, Breadth first search techniques, Hill climbing, Best first search, AND/OR graphs, A* algorithm - Constraint satisfaction.

MODULE III AI AND GAME PLAYING 6

Major components of a game playing program - plausible move generator - static evaluation - function generator - Minimal strategy - Alpha - Beta techniques - problems in computer game playing programs.

MODULE IV KNOWLEDGE REPRESENTATION 9

Logic, Propositional logic - Tautology - Contradiction - Normal forms - Predicate logic - Rules of inference - Resolution - Unification algorithm - Production rules - Semantic networks - Frames – Scripts - Conceptual dependency.

MODULE V KNOWLEDGE ENGINEERING 7

Design and architecture of expert systems - Expert system life cycle - Knowledge acquisition – difficulties - strategies - major applications areas - Qualitative study of expert systems, DENDRAL, MYCIN.

MODULE VI MACHINE LEARNING 5

Frame work for learning – Inductive learning –Supervised, Unsupervised learning – Parallel distributed processing – Genetic Algorithms .

Total Hours : 45

REFERENCES:

1. Stuart Russel and Peter Norvig, " Artificial Intelligence – a modern approach", Prentice Hall, 2003.
2. Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill, 2003.
3. Patrick Henry Winston, "Artificial Intelligence", Addison Wesley, 2000.
4. Luger George F and Stubblefield William A, "Artificial Intelligence : Structures and Strategies for Complex Problem Solving", Pearson Education, 2002.

OUTCOMES:

Upon successful completion of this course, the student shall be able to:

- Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.
- Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.
- Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
- Demonstrate proficiency developing applications in an 'AI language', expert system shell, or data mining tool.
- Ability to apply knowledge representation, reasoning, and machine learning techniques to real-world problems.
- Know various AI search algorithms (uninformed, informed, heuristic, constraint satisfaction, genetic algorithms).

ITCX109 **GRID COMPUTING** **L T P C**

3 0 0 3

OBJECTIVES:

- To provide an overview of the basic concepts of Grid Computing.
- To highlight the advantages of deploying Grid Computing.
- To illustrate the practical adoption of a Grid deployment through real life case studies.

MODULE I CONCEPTS AND ARCHITECTURE **8**

Introduction-Parallel and Distributed Computing- Cluster Computing-Grid Computing- Virtual Organization and the Grid Standards -Anatomy and Physiology of Grid- Web and Grid Services.

MODULE II STANDARDIZATION OF GRID TECHNOLOGY **8**

Service Oriented Grid Architecture – web Services- Open Grid Services Infrastructure-OGSA Services and Schema- OGSA implementations.

MODULE III GRID SECURITY **6**

Grid Security-A Brief Security Primer-PKI-X 509 Certificates-Grid Security Requirement -WS security.

MODULE IV RESOURCE MANAGEMENT **8**

Grid Scheduling and Resource Management, Gridway and Gridbus Broker- principles of Local Schedulers- Overview of Condor, SGE, PBS, LSF-Grid Scheduling with QoS.

MODULE V KNOWLEDGE ORIENTED GRIDS **7**

Knowledge for Grid applications- Metadata, Knowledge and Semantics-Architectures for Knowledge Oriented Grids- Representing Knowledge-Case study.

MODULE VI GRID MIDDLEWARE **8**

List of globally available Middlewares – Case Studies-Recent version of Globus Toolkit and gLite - Architecture, Components and Features. Features of Next generation grid.

Total Hours : 45

TEXT BOOKS:

1. Ian Foster, Carl Kesselman, "The Grid 2: Blueprint for a New Computing Infrastructure", Elsevier Series, 2004.
2. Parvin Asadzadeh, Rajkumar Buyya, Chun Ling Kei, Deepa Nayar, and Srikumar Venugopal, "Global Grids and Software Toolkits: A Study of Four Grid Middleware Technologies, High Performance Computing: Paradigm and Infrastructure", Laurence Yang and Minyi Guo (editors), Wiley Press, New Jersey, 2005.

REFERENCES:

1. Jarek Nabrzyski, Jennifer M. Schopf, Jan Weglarz, "Grid Resource Management: State of the Art and Future Trends", (International Series in Operations Research & Management Science), 1st Edition, Springer, 2003.
2. "Designing a Resource Broker for Heterogeneous Grids, Software: Practice and Experience", Wiley Press, New York, USA, 2008.
3. Fran Berman, Geoffrey Fox, Anthony J.G. Hey, "Grid Computing: Making The Global Infrastructure a Reality", Wiley, 2003.

OUTCOMES:

- Outline the basic concepts of Grid Computing.
- Discuss the components of OGSA frame work.
- Design suitable methods for grid security.
- Compare the local and global grid scheduling mechanisms.
- Prepare a case study on knowledge oriented grid.
- Develop an application using any grid middleware.

ITCX110 INFORMATION CODING TECHNIQUES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn the concept of information and entropy of Information.
- To understand the basic Modulation and its types.
- To familiarize with text compression techniques.
- To know about video compression, H.261 and MPEG standard.

MODULE I INFORMATION ENTROPY FUNDAMENTALS 8

Uncertainty, Information and Entropy – Source coding Theorem – Huffman coding – Shannon-fano coding – Discrete Memory less channels – channel capacity – channel coding theorem – Channel capacity theorem.

MODULE II DATA AND VOICE CODING 8

Differential Pulse Code Modulation – Adaptive Differential Pulse code Modulation – Adaptive subband coding – Delta Modulation – Adaptive Delta Modulation – Coding of speech signal at low bit rates (Vocoders, LPC).

MODULE III BLOCK CODES 7

Definitions and Principles: Hamming weight - Hamming distance - Minimum distance decoding - Single parity codes - Hamming codes - Repetition codes - Linear block codes - Cyclic codes - Syndrome calculation - Encoder and decoder – CRC.

MODULE IV ERROR CONTROL CODING 7

Generator polynomial – Parity check polynomial – Convolutional codes – code tree trellis, state diagram - Encoding – Decoding: Sequential search and Viterbi algorithm – Principle of Turbo coding.

MODULE V COMPRESSION TECHNIQUES 8

Principles of text compression – static Huffman coding – dynamic huffman coding – arithmetic coding – image compression – graphics interchange format – tagged image file format – digitized documents – introduction to JPEG standards.

MODULE VI AUDIO AND VIDEO CODING 7

Linear predictive coding – code excited LPC – perceptual coding - MPEG audio coders – Dolby audio coders – video compression – H.261 and MPEG video standards.

Total Hours : 45

TEXT BOOKS:

1. Simon Haykin, 'Communication Systems', John Wiley and Sons, 4th Edition 2001.

2. Fred Halsall, "Multidedia Communications: Applications, Networks, Protocols and Standards", Perason Education Asia, 2002

REFERENCES:

1. Mark Nelson, "Data Compression Book", BPB, 1992.

2. Watkinson J, "Compression in Video and Audio", Focal Press, London, 1995.

OUTCOMES:

On completion of the course students will be able to:

- Explain the different information coding theorems.
- Discuss the various modulation methods to encode data and voice.
- Apply the block codes and cyclic codes to detect errors.
- Discuss how error control coding techniques are applied in communication systems.
- Demonstrate the various text and image compression techniques.
- Demonstrate the various audio and video compression techniques.

ITCX111 MOBILE ADHOC NETWORKS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To know the difference between wired and adhoc networks.
- To gain the knowledge about the applications of adhoc networks.
- To learn about the proactive and reactive protocols.
- To understand the concepts of reactive protocols in less mobile environment.
- To explain the concepts of reactive protocols in high mobile environment.
- To realize the importance of hybrid and hierarchical protocols

MODULE I INTRODUCTION **8**

Model of Operation. symmetric Links. Layer-2 Ad Hoc Solutions. Proactive versus Reactive Protocols. Multicast. Commercial Applications of Ad Hoc Networking. Conferencing. Home Networking. Emergency Services. Personal Area Networks and Bluetooth. Embedded Computing Applications. Technical and Market Factors Affecting Ad Hoc Networks. Scalability. Power Budget versus Latency. Protocol Deployment and Incompatible Standards.

MODULE II CHANNEL ALLOCATION **8**

Channel allocation methods –802.11 WLAN – MACA – MACAW – MACABI – CSMA – TSMA.

MODULE III DESTINATION SEQUENCED DISTANCE VECTOR PROTOCOL **7**

Introduction. Overview of Routing Methods. Link-State. Distance-Vector. Destination-Sequenced Distance Vector Protocol. Protocol Overview. Route Advertisements. Route Table Entry Structure. Responding to Topology Changes. Route Selection Criteria. Operating DSDV at Layer 2. Extending Base Station Coverage. Performance evaluation using simulators.

MODULE IV DYNAMIC SOURCE ROUTING PROTOCOL FOR MULTI HOP WIRELESS **7**

Ad Hoc Networks Assumptions. DSR Protocol Description — Overview and

Important Properties. DSR Route Discovery. DSR Route Maintenance. Additional Route Discovery Features. Additional Route Maintenance Features. Support for Heterogeneous Networks and Mobile IP. Multicast Routing with DSR. Location of DSR Functions in the ISO Network Reference Model.Performance evaluation using simulators.

MODULE V AD HOC ON-DEMAND DISTANCE-VECTOR PROTOCOL **7**

AODV Properties. Unicast Route Establishment. Route Discovery. Expanding Ring Search. Forward Path Setup. Route Maintenance. Local Connectivity Management. Multicast Route Establishment. Route Discovery. Forward Path Setup. Multicast Route Activation/Deactivation. Multicast Tree Maintenance. Performance evaluation using simulators.

MODULE VI HYBRID AND HIERARCHICAL ROUTING PROTOCOLS **8**

ZRP: A Hybrid Framework for Routing in Ad Hoc Networks. The Zone Routing Protocol. ZRP – Formal Description. Hiearchical based Routing – Hierarchical State Routing Protocol, Fisheye Routing Protocol.

Total Hours : 45

TEXT BOOKS:

1. Charles E. Perkins, “Ad Hoc Networking”, Addison Wesley, December 2000.
2. C. Siva Ram Murthy, B.S. Manoj, “Adhoc Wireless Networks”, Prentice Hall, 2004.

REFERENCES:

1. C.K. Toh, “Adhoc Mobile Wireless Networks: Protocols and Systems”, Pearson Education, 2009.
2. Elizabeth M.Royer and C.K.Toh, “A Review of Current Routing Protocols for Mobile Adhoc Networks”, IEEE Personal Communications, April 1999.

OUTCOMES:

- Acquaint the basic knowledge of adhoc networks.
- Analyze the various channel allocation algorithms used in MAC layer.
- Explain the DSDV, DSR and AODV protocols.
- Compare the performance of DSDV, DSR and AODV protocols and

implement any one protocol using simulator.

- Identify the difference between the protocols & practical issues.
- Evaluate the ZRP and Fisheye Routing Protocol.

Program Electives – III

ITCX212	HYBRID APPLICATION DEVELOPMENT	L	T	P	C
		1	0	2	2

OBJECTIVES:

- To know the importance of hybrid applications.
- To learn the fundamentals of hybrid application development.
- To develop simple hybrid applications using AngularJS.

THEORETICAL STUDY

HYBRID APPLICATION DEVELOPMENT **15**

Introduction - Computing eras & current mobile wave - Platforms, Frameworks & Tools - Hybrid frameworks, web tech, web APIs (backend) - The stack – HTML5/CSS3/AngularJS - Ionic – AngularJS and native-like – Phonegap.

JS Basics - JS Frameworks - AngularJS Intro - Ionic Framework, Why Ionic? - Ionic 1 / 2 - NodeJS / NPM - Data Binding & Filters - Module, Controller & Views – Directives – Services – Routing - Angular JS 2 changes – Components – Typescript - Working with Angular code.

Project Structure - Application Logic - Screen Templates - Ionic components - Navigation Stack - Application structure and screens - Integrating the screens - Component customization - Working with Web APIs - Integrating Device Features.

LABORATORY PRACTICE **30**

- Developing Simple Hybrid Applications using AngularJS (4 exercises)
- Hybrid application development in AngularJS. (Students can select their own problem to develop an Application)

  Sample applications
  - Simple Conversion Apps
  - ToDo App
  - Employee Directory
  - Tourism App
  - Games

Total Hours : 45

OUTCOMES:

On completion of the course students will be able to :

- Create mobile apps with HTML, JavaScript, and CSS.
- Describe the components and structure of a hybrid application development frameworks (Ionic, phonegap, etc.) and learn how and when to apply the different components to develop a working system.
- Design complex interfaces with Ionic's UI controls.
- Build once and deploy for both iOS and Android.
- Design, implement and deploy hybrid applications using an appropriate software development environment.

REFERENCES:

1. Asep Edi Kurniawan, "Mobile App Development with Angularjs and Ionic", Leanpub 2015.

2. Jeremy Wilken, "Ionic in Action: Hybrid Mobile Apps with Ionic and AngularJS", Manning Publication 2015.

3. Vinci Rufus, "AngularJS Web Application Development Blueprints", Packt Publishing 2014.

ITCX213 DATA WAREHOUSING AND DATA MINING TOOLS

L	T	P	C
3	0	2	4

OBJECTIVES:

- To introduce the concept of data mining with a detail coverage of basic tasks, metrics, issues and implication.
- To explain core topics like classification, clustering and association rules are exhaustively dealt with.
- To introduce the concept of data warehousing with special emphasis on architecture and design.

MODULE I INTRODUCTION TO DATA WAREHOUSING **7**

Need for Data warehousing - Operational database systems vs Data warehouses - Data warehouse architecture – Data warehousing components - A Multidimensional data model - Need for OLAP- OLAP Operations – Types of OLAP servers.

MODULE II DATA MINING **6**

Motivation and Importance of Data mining – Evolution of Database systems – Data mining functionalities – Steps in KDD process- Architecture of a typical data mining system - Classification of data mining systems – Data mining task primitives - Major issues in data mining.

MODULE III DATA PREPARATION AND CONCEPT DESCRIPTION **7**

Different forms of Preprocessing - Data Cleaning - Data Integration and Transformation - Concept hierarchy - Data generalization - Attribute oriented induction for data generalization and data characterization.

MODULE IV ASSOCIATION ANALYSIS **6**

Market Basket Analysis – Frequent Itemsets- Closed Itemsets - Frequent Pattern mining - The Apriori algorithm – Generating association rules- Improving the efficiency of Apriori - Correlation analysis.

MODULE V CLASSIFICATION AND PREDICTION **8**

Issues – Decision tree induction – Attribute selection measures – Overfitting and pruning- Bayesian Classification – Bayesian Belief Networks - Prediction.

MODULE VI CLUSTER ANALYSIS & APPLICATIONS **11**

Types of data in Cluster Analysis – Categorization of clustering methods – Partitioning methods - Classical partitioning methods- Hierarchical methods -

Agglomerative and Divisive - BIRCH- Outlier analysis. Trends and social impacts of data mining – privacy concerns– Web mining - Social network analysis - Biological data analysis. Introduction to WEKA tool.

Total Hours : 45 + 30

TEXT BOOKS:

1. Alex Berson, Stephen J. Smith, “Data Warehousing, Data Mining and OLAP”, Tata McGraw- Hill, New Delhi, 2008.
2. Jiawei Han and Micheline Kamber,” Data Mining Concepts and Techniques”, Elsevier Science India Pvt Ltd., New Delhi,2007

REFERENCES:

1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, “Introduction to Data Mining”, Pearson Education,New Delhi, 2007.
2. Margaret Dunham, “Data Mining: Introductory and Advanced Topics”, Pearson Education, New Delhi, 2007.
3. Gupta K, “Introduction to Data Mining with Case Studies”, PHI Learning Private Ltd, New Delhi, 2011.
4. Jamie MacLenna, Zhaohui Tang, Bogdan Crivat, “Data Mining with Microsoft SQL Server 2008”, Wiley publications, USA, 2008.
5. Daniel T.Larose, “Data Mining Methods and Models”, Wile-Interscience, 2006.
6. Sam Anahory, Dennis Murry, “Data Warehousing in the real world”, Pearson Education, 2003.
7. David Hand, Heikki Manila, Padhraic Symth, “Principles of Data mining”, PHI, 2004.
8. Sam Anahory, Dennis Murry, “Data Warehousing in the real world”, Pearson Education, 2003.
9. W.H.Inmon, “Building the Data Warehouse”, 3rd Edition, Wiley, 2003.
10. Alex Bezon, Stephen J.Smith, “Data Warehousing, Data Mining & OLAP”, McGraw Hill Edition, 2001.
11. Paulraj Ponniah, “Data Warehousing Fundamentals”, Wiley-Interscience Publication, 2003.

ITCX214 **CYBER SECURITY** **L T P C**

3 0 0 3

OBJECTIVES:

- To understand the basics of Cryptography.
- To know the impact of various cybercrimes and cyber offenses.
- To understand cybercrimes in mobile devices.
- To know the tools and techniques used to secure from cybercrimes.
- To understand the basics of Cyber Security Standards and Policies.
- To learn about the basics of cyber forensics.

MODULE I FUNDAMENTALS OF CRYPTOGRAPHY 7

Security problem in computing – Cryptography Basics – History of Encryption – Modern Methods – Legitimate versus Fraudulent Encryption methods – Encryption used in Internet.

MODULE II CYBERCRIME AND CYBER OFFENSES 8

Cybercrime and Information Security – Cybercriminals – Classifications of Cybercrimes – Email Spoofing – Spamming – Cyber defamation – Internet Time Theft – Forgery – Web jacking – Hacking – Online Frauds – Software Piracy – Mail Bombs – Password Sniffing – Cyberoffenses – Categories – Planning the attacks – Cyberstalking – Cybercafe and Cybercrimes – Botnets.

MODULE III CYBERCRIME: MOBILE AND WIRELESS DEVICES 8

Proliferation of Mobile and Wireless Devices – Trends in Mobility – Credit card frauds in Mobile and Wireless Computing – Security Challenges – Authentication Service Security – Attacks on Mobile Phones.

MODULE IV TOOLS AND METHODS USED IN CYBERCRIME 8

Proxy Servers and Anonymizers – Phishing – Password Cracking – Keyloggers and Spywares – Virus and Worms – Trojan Horses and Backdoors – Steganography – DoS and DDoS Attacks.

MODULE V SECURITY POLICIES 7

Introduction - Defining User Policies – Passwords – Internet Use – Email Usage – Installing/ Uninstalling Software – Instant Messaging – Defining System Administrative Policies – Defining Access Control – Developmental Policies – Standards, Guidelines and Procedures – Basics of Assessing a System.

MODULE VI COMPUTER FORENSICS **7**

General Guidelines – Finding Evidence on the PC - Finding Evidence in System Logs – Windows Logs – Linux Logs – Getting Back Deleted Files – Operating System Utilities – The Windows Registry.

Total Hours : 45

TEXT BOOK:

1. Nina Godbole, Sunit Belapure, “Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Wiley, 2011.
2. Chuck Easttom, “Computer Security Fundamentals”, 2nd Edition, Pearson Education, 2012.

REFERENCES:

1. Charles B. Pfleeger, Shari Lawrence Pfleeger, “Security in Computing”, 3rd Edition, Pearson Education, 2003.
2. William Stallings, “Cryptography and Network Security – Principles andPractices”, 3rd Edition, Pearson Education, 2003.
3. Atul Kahate, “Cryptography and Network Security”, Tata McGraw Hill, 2000.

OUTCOMES:

- Explain the general security issues.
- Discuss various cybercrimes and offenses.
- Cybercrime in mobile and wireless environment.
- Use relevant tools and methods in cybercrime
- Apply security policies in cyber forensics.
- Outline the strategies adopted in computer forensics.

ITCX215 SOFTWARE REQUIREMENTS AND SOFTWARE PROJECT MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn the basic concepts of software requirements.
- To learn the software requirements management concepts.
- To learn the basic concepts of software project management and software estimation methods.
- To know the software product estimation techniques.
- To learn how to manage risks and allocate resources for software projects.

MODULE I INDTRODUCTION TO SOFTWARE REQUIREMENTS 7

The essential software requirement - Good practices for requirements engineering - The business analyst role - Requirements elicitation - Documenting the requirements

MODULE II SOFTWARE REQUIREMENTS MANAGEMENT 8

Requirements management practices: Requirements management process - The requirements baseline - Requirements version control - Requirement attributes - Tracking requirements status - Resolving requirements issues - Measuring requirements effort - Managing requirements on agile projects - Why manage requirements? - Change happens - Tools for requirements engineering

MODULE III PROJECT MANAGEMENT CONCEPT 9 RISK MANAGEMENT 8

Introduction to software project Management - Project evaluation and programme Management - An overview of project planning

MODULE IV SOFTWARE ESTIMATION & COSTING 8

Selection of an appropriate project Approach - Software effort estimation - Activity planning

MODULE V RISK MANAGEMENT 7

Risk management - Resource allocation - Monitoring and control - Managing contracts

MODULE VI PEOPLE MANAGEMENT 7

Managing people in software Environments - Working in teams - Software quality

Total Hours : 45

REFERENCES:

1. McConnell, S. “Software Requirements”, 3rd edition, Microsoft Press, 2013.
2. Bob Hughes and Mike Cotterell, “Software Project management”, 5th edition, Mc Graw Hill, 2009.

OUTCOMES:

- Students will explain the concepts of software requirements elicitation.
- They will be able to explain how to change and control the requirements.
- Students will know the software project management and software estimation methods.
- They will have capability to prepare project plan.
- Students will be ready to identify and analyze risks.
- They will express how to manage people.

ITCX216 BUSINESS AND DATA ANALYTICS L T P C

3 0 2 4

OBJECTIVES:

- To gain an understanding business analytics to formulate and solve business problems and to support managerial decision making.
- To become familiar with data analysis techniques to develop, report, and analyze business data.
- To learn to use advanced analytics and model evaluation to solve business problems.

MODULE I INTRODUCTION 7

Introduction to Business Analytics, data mining, Big Data and data science, steps in data mining, preliminary steps.

MODULE II BUSINESS ANALYTICS LIFE CYCLE 8

Business Analytics Process, CRISP-DM, predictive power and over fitting, using JMP, automated data mining solutions.

MODULE III DATA EXPLORATION AND DIMENSION REDUCTION 8

Uses of data visualization, basic charts, multidimensional visualization, curse of dimensionality, practical considerations, correlation analysis, principal component analysis, dimension reduction using regression models, classification and regression trees.

MODULE IV PERFORMANCE EVALUATION 7

Evaluating Predictive performance, judging classifier performance, judging ranking performance, and oversampling.

MODULE V ADVANCED ANALYTICS 8

Multiple linear regression, k-nearest neighbors, classification and regression trees, logic regression, neural nets, discriminative analysis.

MODULE VI MODEL EVALUATION TECHNIQUES 7

Model Evaluation Techniques for the Description Task **,**Model Evaluation Techniques for the Estimation and Prediction Tasks **,**Model Evaluation Techniques for the Classification Task, Error Rate, False Positives, and False Negatives, Misclassification Cost Adjustment to Reflect Real-World Concerns ,Decision Cost/Benefit Analysis **,** Lift

Charts and Gains Charts, Interweaving Model Evaluation with Model Building , Confluence of Results: Applying a Suite of Models.

Total Hours : 45
Practical Hours:15

TEXT BOOKS:

1. Galit Shmueli ,Peter C. Bruce,Mia L. Stepiiens, Nitin R. Patel, “Data Mining For Business Analytics Concepts, Techniques, and Applications with JMP Pro”, John Wiley & sons, 2017.
2. Daniel T. Larose & Chantal D. Larose, “Discovering Knowledge in Data: An Introduction to Data Mining”, Wiley, Second Edition.

REFERENCES:

1. Ron Klimberg and B. D. McCullough, “Fundamentals of Predictive Analytics with JMP”, SAS Institute.
2. Marc J. Schniederjans, Dara G. Schniederjans , Christopher M. Starkey, “Business analytics principles, concepts and applications what, why and how”, Pearson.
3. Saxena, Rahul, Srinivasan, Anand, “Business Analytics A Practitioner’s Guide”, Springer.
4. Hastie, Trevor, et al. The elements of statistical learning. Vol. 2. No. 1. New York: springer, 2009.
5. Montgomery, Douglas C., and George C. Runger. Applied statistics and probability for engineers. John Wiley & Sons, 2010.

OUTCOMES:

- Explain the business analytics and data mining concepts
- Understand the life cycle of business analytics
- Apply data visualization and dimension reduction techniques
- Evaluate the performance of prediction methods
- Apply the knowledge of advanced analytic techniques
- Discuss on various model evaluation techniques

ITCX217 **WEB SERVICES** **L T P C**

3 0 0 3

OBJECTIVES:

- To learn the XML based standards for creating XML application.
- To understand the architecture of web services and its underlying infrastructure.
- To gain knowledge about SOAP, WSDL and UDDI.
- To explore HTTP, from the request/response cycle to its verbs, headers, and cookies
- To choose the service that works best for an application.

MODULE I XML TECHNOLOGY FAMILY **8**

XML – benefits – Advantages of XML over HTML, Databases – XML based standards – Structuring with schemas - DTD – XML Schemas – XML processing DOM – SAX – presentation technologies – XSL – XFORMS – XHTML – Transformation – XSLT –XPATH – XQuery

MODULE II MOTIVATIONS FOR WEB SERVICES **7**

Business motivations for web services – B2B – B2C – Technical motivations- limitations of CORBA and DCOM – Service-oriented Architecture (SOA).

MODULE III ARCHITECTING WEB SERVICES **7**

Architecting web services – Implementation view – web services technology stack – logical view – composition of web services – deployment view – from application server to peer to peer – process view – life in the runtime.

MODULE IV WEB SERVICES BUILDING BLOCKS **7**

Transport protocols for web services – messaging with web services – protocols - SOAP - describing web services – WSDL – Anatomy of WSDL – manipulating WSDL – web service policy – Discovering web services – UDDI – Anatomy of UDDI – Web service inspection – Ad-Hoc Discovery - Securing web services.

MODULE V HTTP VERBS AND HEADERS **8**

HTTP – Clients and Servers – Making HTTP requests - HTTP Verbs - Serving GET request- Making GET request – Handling POST request – Making

POST request- Headers –request response headers – identify clients with user agents – Headers for content negotiation – Securing headers with authorization headers – caching headers – custom headers.

MODULE VI BUILDING API 8

Cookies- Cookies Mechanics – reading and writing cookies – making request with cookies- cookies and APIs – JSON- Handling JSON with PHP – Consuming JSON APIs – XML in PHP – Consuming XML APIs – Sample API application.

Total Hours : 45

TEXT BOOKS:

1. Ron Schmelzer et al., “XML and Web Services”, Pearson Education, 2008.
2. Sandeep Chatterjee and James Webber, “Developing Enterprise Web Services:An Architect’s Guide”, Pearson Education, 2004.
3. Lorna Jane Mitchell,“PHP Web Services – APIs for the Modern Web” 2nd edition, O’reilly , 2016.

REFERENCES:

1. Keith Ballinger, “.NET Web Services Architecture and Implementation”, Pearson Education, 2003.
2. David Chappell, “Understanding .NET ATutorial and Analysis”, Addison Wesley,2002.
3. Kennard Scibner and Mark C.Stiver, “Understanding SOAP”, SAMS publishing.
4. Alexander Nakhimovsky and Tom Myers, “XML Programming: Web Applications and Web Services with JSP and ASP”, Apress, 2002.

OUTCOMES:

- Create, validate and parse XML documents.
- Analyze the B2B and B2C real world applications.
- Explain the logical and deployment view of web service technology stack.
- Use SOAP, WSDL and UDDI for creation of a web service.
- Learn to work with JSON and XML technologies.
- Use the best service for a given application and make it robust.

ITCX218 IMAGE PROCESSING L T P C
3 0 0 3

OBJECTIVES:

The course aims to provide understanding of

- The basic principles and concepts in digital image processing
- The application of digital image analysis moving towards image interpretation.
- The techniques and tools for digital image processing, and finally also introduce image analysis techniques in the form of image segmentation.
- To study the image fundamentals and mathematical transforms necessary for image processing.

MODULE I DIGITAL IMAGE FUNDAMENTALS 7

Digital image fundamentals - Digital Image through scanner, digital camera. Concept of gray levels. Imaging Geometry – Image sampling and quantization Basic relationship between pixels.

MODULE II DIGITAL IMAGE TRANSFORMS 8

Basic geometric transformations-Introduction to Fourier Transform and DFT , Properties of 2D Fourier Transform , FFT , Separable Image Transforms, Walsh, Hadamard, Discrete Cosine Transform, Haar, Slant – Karhunen – Loeve transforms.

MODULE III IMAGE ENHANCEMENT TECHNIQUES 7

Spatial Domain methods: Basic grey level transformation, Histogram equalization, Image subtraction, Image averaging, Spatial filtering: Smoothing, sharpening filters, Laplacian filters , Frequency domain filters : Smoothing, Sharpening filters.

MODULE IV IMAGE RESTORATION 7

Model of Image Degradation/restoration process, Noise models , Inverse filtering, Least mean square filtering , Constrained least mean square filtering, Blind image Restoration, Pseudo inverse , Singular value decomposition.

MODULE V IMAGE COMPRESSION 8

Need for data compression, Lossless compression: Variable length coding, LZW coding, Bit plane coding, predictive coding-DPCM. Lossy Compression: Transform coding, Wavelet coding, Basics of Image compression standards: JPEG, MPEG, Basics of Vector quantization.

MODULE VI IMAGE SEGMENTATION AND REPRESENTATION 8

Edge detection , Thresholding, Region Based segmentation , Boundary representation: chair codes- Polygonal approximation , Boundary segments, boundary descriptors: Simple descriptors-Fourier descriptors, Regional descriptors, Simple descriptors.

Total Hours: 45

REFERENCES:

1. Rafael C Gonzalez, Richard E Woods, “Digital Image Processing”, 2nd Edition, Pearson Education, 2003.
2. William K Pratt, “Digital Image Processing”, John Willey, 2001.
3. Millman Sonka, Vaclav hlavac, Roger Boyle, Broos/colic, “Image Processing Analysis and Machine Vision”, 1999.
4. A.K. Jain, PHI, “Fundamentals of Digital Image Processing”, New Delhi ,1995.
5. Chanda Dutta Magundar , “Digital Image Processing and Applications”, PrenticeHall of India, 2000.

OUTCOMES:

- Explain the basic elements and applications of image processing.
- Create Gray level transformations for Image enhancement .
- Design and implement two-dimensional spatial filters for image enhancement.
- Select Wiener filtering for de-blurring and noise removal .
- Analyze the techniques for image compression and segmentation.
- Apply digital image analysis techniques and Enhance their critical thinking skills in digital color images.

ITCX219 EXPERT SYSTEMS L T P C

3 0 0 3

OBJECTIVES:

- To study the basic concepts of expert systems.
- To know the languages and tools for building expert systems.
- To study about representing knowledge& knowledge acquisition.
- To study the various heuristics for building expert systems.

MODULE I INTRODUCTION TO EXPERT SYSTEMS 7

Definition, Features of an expert system, Organization, Characteristics, Uses, Basic activities of expert systems, Prospector, Knowledge Representation in expert system, an overview of Artificial Intelligence.

MODULE II RULE-BASED EXPERT SYSTEM 8

Introduction to Rule-based systems – Canonical systems, production systems for problem solving, the syntax of rules, working memory, controlling behavior of the interpreter, conflict resolution, forward and backward chaining, rules and meta-rules.

MODULE III LANGUAGES TO BUILD AN EXPERT SYSTEM 8

Symbolic computation-Symbolic representation, Physical symbols systems, Introduction to LISP, LISP data structures, LISP programs, List processing, pattern matching. Logic Programming- Formal languages, propositional calculus, the predicate calculus, the PROLOG language, PROLOG and MBASE, PROLOG's search rules, Object-oriented analysis and design for expert systems.

MODULE IV EXPERT SYSTEMS TOOLS 7

Overview of expert systems tools, expert system shells, high-level programming languages, constraints of production rule languages, evaluating object-oriented approaches, logic programming for expert systems, multiple-paradigm programming environments, potential implementation problems, More maxims on expert system development, Building an Expert System-MYCIN, EMYCIN.

MODULE V KNOWLEDGE ACQUISITION 8

Theoretical analysis of knowledge acquisition, Stages of knowledge

acquisition, Ontology analysis, Expert system shells, Knowledge acquisition methods, Knowledge-based knowledge acquisition, Introduction to Machine Learning.

MODULE VI CLASSIFICATIONS OF EXPERT SYSTEM TASKS 7

Classification of expert system tasks, heuristic matching, classification, The generality of heuristic classification, Classification versus construction, mapping tools to tasks, knowledge acquisition strategies, Managing complexity, classification problem solving.

Total Hours : 45

TEXT BOOKS:

1. Peter Jackson, “Introduction to Expert Systems”, Third Edition, Pearson Education, 2003.
2. Donald A. Waterman, “A Guide to Expert Systems”, Addison Wesley, 1999.

REFERENCES:

1. W. Patterson, ‘Introduction to Artificial Intelligence and Expert Systems’, Prentice Hall of India, 2003.
2. Elain Rich and Kevin Knight, ‘Artificial Intelligence’, Second Edition, Tata McGraw Hill, 1995.

OUTCOMES:

- Explain the concepts of expert systems.
- Write the rules for designing expert system
- Develop programs using LISP and PROLOG
- Analyze the knowledge acquisition in expert system
- Develop programs using machine learning concepts
- Build a new expert system using various tools

ITCX220 SERVICE ORIENTED ARCHITECTURE L T P C

3 0 0 3

OBJECTIVES:

- To gain understanding of the basic principles of service orientation.
- To understand web services and service abstraction.
- To learn service oriented analysis and coordination techniques.
- To use the concepts of SOAP and WSDL for designing applications.
- To learn technologies underlying the design of xml based web services.
- To know about various WS-* specification standards, web service security and service transaction.
-

MODULE I SOA FUNDAMENTALS 8

Roots of SOA – Characteristics of SOA - Comparing SOA to client-server and distributed internet architectures – Anatomy of SOA- How components in an SOA interrelate -Principles of service orientation.

MODULE II WEB SERVICES & SERVICE ABSTRACTION 8

Web services – Service descriptions – Messaging with SOAP –Message exchange Patterns – Coordination –Atomic Transactions – Business activities – Orchestration –Choreography - Service layer abstraction – Application Service Layer – Business Service Layer – Orchestration Service Layer.

MODULE III SERVICE-ORIENTED ANALYSIS & DESIGN 8

Service oriented analysis – Business-centric SOA – Deriving business services- service modeling - Service Oriented Design – WSDL basics – SOAP basics – SOA composition guidelines – Entity-centric business service design– Application service design – Task centric business service design.

MODULE IV XML BASED WEB SERVICES 9

SOA platform basics – SOA support in J2EE – Java API for XML-based web services (JAX-WS) - Java architecture for XML binding (JAXB) – Java API for XML Registries (JAXR) - Java API for XML based RPC (JAX-RPC)- Web Services Interoperability Technologies (WSIT) - SOA support in .NET – Common Language Runtime - ASP.NET web forms – ASP.NET web services
– Web Services Enhancements (WSE).

MODULE V SERVICE COORDINATION AND WEB SERVICES SECURITY 6

WS-BPEL basics – WS-Coordination overview - WS-Choreography, WS- Policy, WSSecurity.

MODULE VI SOA TRANSACTION & PROTOCOL COORDINATION 6

Transaction processing – paradigm – protocols and coordination – transaction specifications – SOA in mobile – research issues.

Total Hours : 45

REFERENCES:

1. Thomas Erl, "Service-Oriented Architecture: Concepts, Technology, and Design", Pearson Education, 2005.
2. Newcomer, Lomow, "Understanding SOA with Web Services", Pearson Education, 2005.
3. Sandeep Chatterjee, James Webber, "Developing Enterprise Web Services- An Architect"s Guide", Pearson Education, 2005.
4. Dan Woods and Thomas Mattern, "Enterprise SOA Designing IT for Business Innovation", 1st Edition, O'Reilly, 2006.
5. Shankar Kambhampaly, "Service–Oriented Architecture for Enterprise Applications", Wiley India Pvt Ltd, 2008.
6. Mark O'Neill, et al. , "Web Services Security", Tata McGraw-Hill , 2003.

OUTCOMES:

- Compare service oriented architecture with other internet architectures.
- Analysis about web services and service abstraction.
- Discuss about service-oriented analysis and design,
- Design a web service using SOAP and WSDL to support SOA based applications.
- Identify research issues in service coordination, web services security and choreography in service layers.
- Explain the various WS-* specification standards and research issues in SOA.

ITCX221 PERVASIVE COMPUTING L T P C

3 0 0 3

OBJECTIVES:

- To know about the applications of pervasive computing.
- To understand the use of pervasive computing on web applications.
- To gain knowledge about PDA"s using pervasive computing.
- To learn the user interface issues in pervasive computing.

MODULE I INTRODUCTION 7

Pervasive Computing Application - Pervasive Computing devices and Interfaces Device technology trends, Connecting issues and protocols. Pervasive Computing Market -m-Business – Application examples: Retail, Airline -check- in and booking – Health care – Car information system – E-mail access via WAP and voice.

MODULE II WEB APPLICATION CONCEPTS 8

Pervasive Computing and web based Applications - XML and its role in Pervasive Computing - Wireless Application Protocol (WAP) Architecture and Security - Wireless Mark-Up language (WML) – Introduction.

MODULE III VOICE TECHNOLOGY 7

Voice Enabling Pervasive Computing - Voice Standards - Speech Applications in Pervasive Computing and security –java for pervasive devices, Biometrics.

MODULE IV PERSONAL DIGITAL ASSISTANTS 8

PDA in Pervasive Computing – Introduction - PDA software Components, Standards, emerging trends - PDA Device characteristics - PDA Based Access Architecture.PDA browsers

MODULE V USER INTERFACE ISSUES 7

User Interface Issues in Pervasive Computing, Architecture - Smart Card- based Authentication Mechanisms - Wearable computing Architecture.Case study- Wearable computing / Cyber physical system

MODULE VI PERVASIVE WEB APPLICATION ARCHITECTURE 8

Introduction - scalability and availability - Development of Pervasive computing Web Applications - Pervasive application architecture. Example application – User interface overview – Architecture – Implementation.

Total Hours : 45

TEXT BOOKS:

1. Jochen Burkhardt, Horst Henn, Stefan Hepper, Thomas Schaec & Klaus Rindtorff. "Pervasive Computing Technology and Architecture of Mobile Internet Applications", Addision Wesley, Reading, 2002.
2. Uwe Hansman, Lothat Merk, Martin S Nicklous & Thomas Stober, "Principles of Mobile Computing", 2nd Edition, Springer- Verlag, New Delhi, 2003.

REFERENCES:

1. Rahul Banerjee, "Internetworking Technologies: An Engineering Perspective", Prentice –Hall of India, New Delhi, 2003. (ISBN 81-203-2185-5).
2. Rahul Banerjee, "Lecture Notes in Pervasive Computing", Outline Notes, BITS-Pilani, 2003.

OUTCOMES:

On completion of the programme students will be able to:

- Outline the basics of pervasive computing device technologies.
- Identify the protocols used in pervasive computing.
- Assess the voice standards and applications in pervasive computing.
- Compile the characteristics of PDA devices.
- Discuss various user interface issues in pervasive computing.
- Develop a Pervasive computing Web Application.

ITCX222 KNOWLEDGE BASED DECISION SUPPORT SYSTEM

L	T	P	C
3	0	0	3

OBJECTIVES:

- To become familiar with the theoretical perspectives of knowledge creation, knowledge transfer, knowledge sharing, and knowledge leadership roles and skills.
- To understand how the study of communication relates to knowledge development and knowledge sharing in organizations.
- To read about and discuss the relationship between knowledge management and a learning organization, Development of support system Methods of managing knowledge Intelligent decision system development.

MODULE I INTRODUCTION **7**

Decision making, Systems, Modeling, and support - Introduction and Definition - Systems - Models - Modeling process - Decision making: The intelligence phase - The design phase - The choice phase - Evaluation: The implementation phase -Alternative Decision - Making models - Decision support systems - Decision makers - Case applications.

MODULE II DECISION SUPPORT SYSTEM DEVELOPMENT **8**

Decision Support System Development: Introduction - Life cycle - Methodologies - prototype - Technology Levels and Tools - Development platforms - Tool selection - Developing DSS. Enterprise systems: Concepts and Definition - Evolution of information systems - Information needs - Characteristics and capabilities – Comparing and Integrating EIS and DSS - EIS data access, Data Warehouse, OLAP, Multidimensional analysis, Presentation and the web - Including soft information enterprise on systems- Organizational DSS - supply and value chains and decision support - supply chain problems and solutions - computerized systems MRP, ERP, SCM - frontline decision support systems.

MODULE III KNOWLEDGE MANAGEMENT **8**

Introduction - Organizational learning and memory - Knowledge management - Development -methods, Technologies, and Tools - success -Knowledge management and Artificial intelligence - Electronic document management.

Knowledge acquisition and validation: Knowledge engineering - Scope - Acquisition methods - Interviews - Tracking methods - Observation and other methods - Grid analysis - Machine Learning: Rule induction, case-based reasoning - Neural computing - Intelligent agents - Selection of an appropriate knowledge acquisition methods - Multiple experts - Validation and verification of the knowledge base - Analysis, coding, documenting, and diagramming - Numeric and documented knowledge acquisition - Knowledge acquisition and the Internet/Intranets.

MODULE IV KNOWLEDGE REPRESENTATION AND INFERENCE TECHNIQUES 8

Knowledge representation: Introduction - Representation in logic and other schemas - Semantic networks - Production rules - Frames - Multiple knowledge representation - Experimental knowledge representations - Representing uncertainty.Inference Techniques: Reasoning in artificial intelligence - Inference with rules: The Inference tree - Inference with frames- Model-based and case-based reasoning - Explanation and Meta knowledge- Inference with uncertainty - Representing uncertainty - Probabilities and related approaches - Theory of certainty - Approximate reasoning using fuzzy logic.

MODULE V INTELLIGENT SYSTEM DEVELOPMENT 7

Intelligent Systems Development: Prototyping: Project Initialization – System analysis and design - Software classification: Building expert systems with tools - Shells and environments - Software selection - Hardware -Rapid prototyping and a demonstration prototype - System development - Implementation - Post implementation.

MODULE VI MANAGEMENT SUPPORT SYSTEMS 7

Implementing and integrating management support systems - Implementation: The major issues - Strategies - System integration – Generic models MSS, DSS, ES - Integrating EIS, DSS and ES, and global integration Intelligent DSS - Intelligent modeling and model management – Examples of integrated systems - Problems and issues in integration. Impacts of Management Support Systems - Introduction - overview - Organizational structure and related areas - MSS support to business process reengineering

Personnel management issues - Impact on individuals - Productivity, quality, and competitiveness - decision making and the manager manager"s job - Issues of legality, privacy, and ethics - Intelligent systems and employment levels - Internet communication - other societal impacts - managerial implications and social responsibilities.

Total Hours : 45

TEXT BOOK:

1. Efrain Turban, Jay Aaronson, "Decision Support Systems and Intelligent Systems", 6th Edition, Pearson Education, 2001.

REFERENCES:

1. Ganesh Natarajan, Sandhya Shekhar, "Knowledge management – Enabling Business Growth", Tata McGraw Hill, 2002.
2. George M.Marakas, "Decision Support System", Prentice Hall, India, 2003.
3. Efrem A.Mallach, "Decision Support and Data Warehouse Systems", Tata McGraw-Hill, 2002.

OUTCOMES:

- Outline the relationship between business information needs and decision making
- Explain the development of decision support systems.
- Discuss the role of knowledge management.
- Identify the various knowledge representation and inference techniques.
- Analyze the working of an intelligent system development.
- Evaluate the function of management support systems.

ITCX223 ELECTRONICS COMMERCE L T P C

3 0 0 3

OBJECTIVES:

- To have an awareness about security and legal issues in ecommerce to investigate the strategic implications of e-commerce with emphasis on existing companies
- To navigate positioning strategies available within the e-commerce landscape
- To develop the ability to quickly and effectively research Internet companies and strategies
- To learn to distinguish between temporary tremors and seismic shifts in the unstable e-commerce landscape

MODULE I INTRODUCTION 8

Introduction – Electronic Commerce Framework – The Anatomy of E-Commerce Applications- The Network Infrastructure for E-Commerce-The Internet as a Network Infrastructure - World of Blogs.

MODULE II ELECTRONIC COMMERCE AND EDI 8

Electronic Payment Systems- Interorganizational Commerce and EDI - EDI Implementation - MIME and Value added Networks- ecommerce security and fraud detection.

MODULE III ADVERTISING AND MARKETING 8

Advertising and Marketing on the Internet- Computer Based Education and Training - Technological Components of Education on-Demand- Digital Copy rights and Electronic Commerce -Software Agent - Website Design Issues- Factors that Make People Return to Your Site- Strategies for Website Development.

MODULE IV CORPORATE DIGITAL LIBRARY 8

The Corporate Digital Library – Dimensions of Internal Electronics Commerce Systems - Making a Business case for a document Library - Types of Digital documents - Issues behind document Infrastructure- Corporate data warehouses- Documents Active / Compound document architecture.

MODULE V DOCUMENT TYPES 8

Structured Documents-Structured Document Fundamentals-Document Interchange Representations-Separating Logical Structure from Physical Structure - Document Markup- Document Markup Languages.

MODULE VI MULTIMEDIA AND ECOMMERCE 5

Multimedia and Digital Video – Broad band Telecommunications – Mobile and Wireless Computing Fundamentals-Social networks and online communities- Online auctions including ebay-Ecommerce portals-mobile commerce.

Total Hours : 45

TEXT BOOK:

1. Kalakota & Whinston, “Frontiers of Electronic Commerce”, Pearson Education, 2002.

REFERENCES:

1. Kamalesh K. Bajaj, “E-Commerce: The Cutting Edge & Business”, Tata McGraw-Hill, 2003.
2. Brenda Kennan, “Managing your E-Commerce Business”, Prentice Hall of India, 2001.
3. Elias M. Awad, “Electronic Commerce from Vision to Fulfillment”, Prentice Hall of India, 2003.
4. Bharat Bhaskar, “Electronic Commerce – Framework, Technology andApplication”, TMH, 2003.
5. Effy Oz, “Foundations of E-Commerce”, Prentice Hall of India, 2001.
6. Jim A Carter, “Developing E-Commerce Systems”, Prentice Hall of India, 2001.

OUTCOMES:

On completion of the programme students will be able to:

- Demonstrate an understanding of the foundations and importance of eCommerce
- Demonstrate an understanding of the impact of eCommerce on business models and strategy
- Describe Internet trading relationships including Business to Consumer, Business-to-Business, Intra-organizational.
- Describe the infrastructure for eCommerce
- Demonstrate an understanding of eCommerce related programming, database, and networking issues.

- Recognize legal, global, privacy, security and risk management issues in eCommerce

Professional Electives IV (9 Credits)

ITCX117	CLOUD MIDDLEWARE TOOLS	L	T	P	C
		1	0	2	2

OBJECTIVES:

- To understand the datacenter resources in cloud middleware environment.
- To implement creation of virtual machines and accessing cloud services.
- To create virtual machines with different operating systems using open source middleware technologies.
- To design and access private, public and hybrid clouds.
- To analyze various cloud middleware tools and their functionalities.

THEORY COMPONENT

MODULE I INTRODUCTION 7

Introduction to Physical and Viirtual Machine resources – Viirtualization – Hypervisor - Data Center - Cloud Services - IaaS, PaaS, SaaS, Operating systems - Virtual Appliances – vApps & AppV

MODULE II PRIVATE, PUBLIC AND HYBRID CLOUD 8

Private Cloud Tools - VMware workstation, VirtualBox, VMware vCenter Convertor, vApps, Open Source Cloud Middleware Tools & Technologies - Eucalpytus, OpenNebula, and Openstack Cloud IaaS, Public Cloud - Amazon EC2, Hybrid Cloud, Oracle Fussion

LAB COMPONENT - LIST OF EXERCISES

1. Study of Physical Machine & virtual machines resources
2. Creation of Virtual Machines using VMware workstation, VirtualBox, VMware vCenter Convertor
3. Virtual Appliances
4. Creating Windows and Ubuntu virtual data centers using Eucalpytus and OpenNebula-Open Source Middleware technology.
5. Cloud service provisioning - IaaS, PaaS, SaaS
6. Openstack Cloud IaaS solution-nova, neutron, cinder, glance, swift
7. Amazon EC2
8. Hybrid cloud
9. Cloud Middleware Integration Consulting - .NET/JAVA—SOAP/REST
10. Database Middleware Automation
11. Oracle Fussion Middleware

Total Hours : 45

OUTCOMES:

Analyze physical and virtual machines management in remote cloud servers.

- Design virtual machines using various hypervisors and cloud middleware products.
- Demonstrate Windows and Ubuntu virtual machines using open source middleware technologies.
- Identify and evaluate private, public and hybrid clouds and IaaS, PaaS, SaaS service provisioning.
- Build cloud platform for digital business.

ITCX118 BIG DATA TOOLS AND TECHNOLGIES

L	T	P	C
0	0	3	1

OBJECTIVES:

- To make the students familiar with Hadoop distributed file system and can learn how to configure Hadoop.
- To install and configure various tools in hadoop ecosystem.
- To provide a complete knowledge about Hadoop echo system with key components like Pig, Hive and Sqoop.
- To Install Apache Spark and explore the components in it.

List of exercises:

1. Introduction to HDFS and Hadoop Ecosystem. Configuration and Installation of Hadoop 1.0 Single node with Name node and Data node.
2. Implementation and configuration of Hive in Hadoop ecosystem for querying.
3. Implementation of Pig using Hadoop Ecosystem for processing structured Data.
4. Implementation of Sqoop for transferring schema format to NOSQL format.
5. Configure Flume and Working flume for logdata.
6. Install HDFS 2.0 and explore YARN for scheduling.
7. Apache Spark Installation and implementation of simple programs in it.
8. Connect MongoDB with Hadoop as store data from MongoDB to HDFS.
9. Connect MYSQL with Hadoop and store data form MYSQL to HDFS
10. Work With RANGER and configure Hadoop for security features.
11. Install IBM BigInsights, hortonworks HDP on virtual machines
12. Working with AWS nodes. Creation of Virtual machines in AWS and Amazon S3.

Total Hours : 45

OUTCOMES:

Upon Completion of this course the student will be able to

- Demonstrate single node and multinode Hadoop 1.0 and 2.0 with installation and configuration.
- Compute the dataset with different tools in hadoop ecosystem.
- Analyze Hadoop Ecosystem using simple components like Pig, Hive and Sqoop.
- Exploring Apache Spark and analyzing the components in it.

ITCX119	FORENSIC TOOL KITS	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To understand Cyber Forensics, Digital evidence and Investigation process.
- To become familiar with Computer forensics toolkits (FTK).
- To analyze the components of the Encase forensic software environment, evidence and configuration files.
- To explore methods of data storage and forensic recovery using Access Data Software.

MODULE I **7**

LIST OF EXERCISES:

1. Study of computer forensic toolkits like CyberCheck Suite (C-DAC), FTK, Helix, The Coroner's Toolkit (TCT), ProDiscover.
2. Working in Windows and Linux Environment: Study of various commands in Linux like Encryption and Decryption, message digest etc.
3. Exploring Encase software.
4. Email Forensics - Tracing E–mail–Finding senders IP Address of received e–mail, tracing route of e–mail received using tools available on internet using Visual Trace Route.
5. Locate a deleted mail using Forensic Tool Kit.
6. Storage media forensics.
7. Image Analysis & Steganography using tools like Merge Streams, Image Hide, Stealth Files, Blindside, Stools.
8. Network Forensics Analysis – Capture and analyze network traffic using network traffic/data capturing/monitoring tools like NetWitness, Windump, Network Flight Recorder.
9. Digital evidence imaging using R-Drive Imag, Drive Image Pro.

Total Hours : 45

OUTCOMES:

- To do the cross validation of computer forensic case data using Encase Access Data and computer forensic tools.
- Analyze the storage media forensics and email forensics.
- The ability to quantitatively assess and measure threats and forensic challenges to information assets.
- Analyze network forensic analysis using capturing and monitoring tools.
- To protect data assets against attacks from the Internet and investigate and mitigate data risk.

ITCX120	MONGODB FOR JAVA DEVELOPERS	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To explore NoSQL database and learn installation of MongoDB.
- To practice hands-on session on Mongo Shell
- To learn the CURD operations in MongoDB.
- To acquire knowledge in sharding and replication.

List of exercises:

Introduction and Overview

Overview, Design Goals, the Mongo Shell, JSON Intro, Installing Tools, Overview of Blog Project. Maven, Spark and Free marker Intro.

Creating, Reading and Updating Data (CRUD)

Mongo Shell, Query Operators, Update Operators and a Few Commands

Schema Design

Patterns, Case Studies & Tradeoffs

Performance

Using Indexes, Monitoring and Understanding Performance. Performance in Sharded Environments/.

Aggregation Framework

Goals, the Use of the Pipeline, Comparison with SQL Facilities.

Application Engineering

Drivers, Impact of Replication and Sharding on Design and Development.

Case Studies

Total Hours : 45

OUTCOMES:

At the end of this MongoDB course you will be able to:

- Develop an expertise in writing Java applications using MongoDB
- Perform installation, configuration and maintenance of MongoDB environment
- Get hands-on experience in creating and managing different types of indexes in MongoDB for query execution
- Develop skillsets in processing huge amounts of data using MongoDB tools
- Proficiently store unstructured data in MongoDB
- Acquire in-depth understanding of managing DB Nodes, replica set & Master-Slave concepts.

ITCX121	GREEN COMPUTING	L	T	P	C
		2	0	0	1

OBJECTIVES:

- To acquire knowledge to adopt green computing practices to minimize negative impacts on the environment.
- To learn to minimize energy consumption.
- To examine technology that can reduce paper and other consumables usage.

MODULE I GREEN COMPUTING FUNDAMENTALS, ASSETS & MODELING **7**

Green IT Fundamentals: Business, IT, Environment - Green IT Strategies: Drivers, Dimensions, Goals - Green Assets: Buildings, Data Centers, Networks, and Devices - Green Business Process Management: Modeling, Optimization, and Collaboration – Green Enterprise Architecture - Green Information Systems: Design and Development Models.

MODULE II GREEN IT FRAMEWORK & GREEN COMPLIANCE **8**

Virtualizing of IT systems – Role of electric utilities, Telecommuting, Teleconferencing and

Teleporting – Going paperless - Materials recycling – Green Data center – Green Grid framework – Green Compliance: Protocols, Standards, and Audits – Emergent Carbon Issues: Technologies and Future.

Total Hours : 15

TEXT BOOKS:

1. Bud E. Smith,"Green Computing Tools and Techniques for Saving Energy, Money, and Resources", Taylor & Francis Group, CRC Press, ISBN-13: 978-1-4665-0340-3, 2014.
2. Jason Harris, "Green Computing and Green IT Best Practices, On Regulations and Industry Initiatives, Virtualization and power management, materials recycling and Tele commuting , Emereo Publishing .ISBN-13: 978-1-9215-2344-1,2014.

REFERENCES:

1. Ishfaq Ahmed & Sanjay Ranka, "Handbook of Energy Aware and Green Computing", CRC Press, ISBN: 978-1-4665-0116-4, 2013.
2. Greg Schulz, "The Green and Virtual Data Center", CRC Press, ISBN-13:978-

1-4200-8666-9, 2009.

3. Marty Poniatowski, “Foundation of Green IT: Consolidation, Virtualization, Efficiency, and ROI in the Data Center”, Printice Hall, ISBN: 9780-1-3704-375-0, 2009.

OUTCOMES:

- Discuss Green Computing concepts, assets and business process management.
- Outline Green IT data center framework, Green compliance in IT systems.

ITCX122 **XML TECHNOLOGIES** **L T P C**
0 0 2 1

OBJECTIVES:

- To become familiar with various aspects of XML.
- Able to develop complex XML applications

LIST OF EXERCISES:

1. XML Document Creation.
2. Creating Inline Cascading Style Sheets, Embedded Cascading Style Sheets and External Cascading Style Sheets.
3. Render XML document with HTML in JavaScript.
4. Internal and External DTD Creation.
5. Importing and Exporting XML document in Database.
6. XSL Transformation- Displaying data with XSLT using XPath functions
7. Demonstrate X Query, X Link and XML Namespaces
8. XML Schema Creation- Working with simple types &Working with complex types
9. Parsing XML Document using SAX/DOM Parser.
10. Fetching data from XML using Java Applications.

Total Hours : 15

OUTCOMES:

On completing this course students will

- Analyse the different scripting languages and learn to apply the same in different context in web technology
- Implement dynamic applications and apply it for real time problems.

ITCX123 BIG DATA ANALYTICS L T P C

3 0 2 4

OBJECTIVES:

- Understand big data analytics
- Discuss data analytic methods
- To learn technology and tools for analytics

MODULE I INTRODUCTION TO BIG DATA ANALYTICS 7

Data structures –state of practice in data analytics-key roles-examples-data analytics life cycle-discovery-data preparation-model planning-model building-communicate result-operationalize.

MODULE II DATA ANALYTIC METHOD 8

Introduction to R-exploratory data analysis-statistical methods for evaluation-clustering-k means-association rules.

MODULE III ADVANCED ANALYTICS 8

Regression-linear regression-logistic regression-classification-decision trees-naives bayes-diagnostics of classifiers-text analytics.

MODULE IV TECHNOLOGY AND TOOLS 7

Analytics of unstructured data-use cases-map reduce-hadoop- echo system-pig-hive-hbase-mahout-NoSql.

MODULE V IN-DATABASE ANALYTICS 8

Sql essentials-joins-set operation-grouping extensions-text analysis-advanced sql-window function-ordered aggregates-MADlib.

MODULE VI ANALYTIC PROJECTS 7

Communicating and operationalize analytic projects-final deliverables-data visualization.

Theory : 45

Practical session:

1. Set up a pseudo-distributed, single-node Hadoop cluster backed by the Hadoop Distributed File System, running on Ubuntu Linux.
2. After successful installation on one node, configuration of a multi-node Hadoop cluster (one master and multiple slaves).
3. Map Reduce application for word counting on Hadoop cluster

4. Unstructured data into NoSQL data and do all operations such as NoSQL query with API.
5. K-means clustering using map reduce.

Practical : 15

Total Hours : 60

TEXT BOOKS:

1. Data Science & Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", John Wiley & Sons, Inc., Indianapolis, Indiana, 2015.

REFERENCES:

1. Big data analytics with R and Hadoop, Vignesh Prajapati, packet publishing, 2013.
2. Big data, big analytics, Michael Minelli, Michele Chambers and Ambiga Dhiraj, John Wiley & Sons, Inc,2013.
3. Real-time big data analytics-emerging architecture by mike barlow, O'Reilly Media, First Edition,2013.
4. Big data governance: Modern Data Management Principles for Hadoop, NoSQL & Big Data Analytics by Peter K. Ghavami, PhD, 2016.

OUTCOMES:

- Discuss the basics of big data analytics
- To understand the methods of analytics
- To discuss the advanced analytics methods
- To setup environment using technology and tools for analytics
- To understand in-database analytics
- To carry out the analytic projects

ITCX124 **PROGRAMMING IN SCALA** **L T P C**

0 0 3 1

OBJECTIVES:

- To explore a multiparadigm programming language equivalent to java.
- To install and set up environment to execute the scala programs.
- To develop simple scala programs and implement in the scala environment.
- To demonstrate the scala based web frameworks.

List of exercises:

1. Overview of Scala and environmental setup.
2. Creation of simple programs with basic syntax, variables and data types.
3. Implementation of class and extension of class and objects.
4. Implementation of classes using access modifiers and operators.
5. Implementation of looping statements and branching statements.
6. Implementation of programs in Arrays and Collections.
7. Implementation of strings, traits, pattern matching.
8. Implementation of pattern matching with extractors.
9. Program with regular expressions and exceptional handling.
10. Case study of different web frameworks with Scala.

Total Hours : 45

OUTCOMES:

Upon Completion of this course the student will be able to

- Install and set environment to run scala programs.
- Develop and implement scala programs with arrays, classes and objects.
- Implement pattern matching based programs
- Explore scale based web frameworks

ITCX125	R PROGRAMMING	L	T	P	C
		1	0	1	2

OBJECTIVES:

- To understand the fundamentals of R programming.
- To analyze the data and draw graph

MODULE I INTRODUCTION TO R PROGRAMMING 7

Introduction – R Programming Structures - Doing Math and Simulations in R

MODULE II DATA ANALYSIS AND GRAPHICS 8

Input/ Output – Graphics - Interface R to Other Languages

LIST OF EXERCISE:

1. Store data in textual and binary format.
2. Subsetting R objects
3. Vectorized Matrix Operation
4. Apply select, filter and arrange, group_by function.
5. Control structures

Total Hours : 45

Text Book:

Norman Matloff, “The Art of R Programming: A Tour of Statistical Software Design, “, No Starch Press, 2011.

OUTCOMES:

On completion of the programme students will be able to:

- Develop a simulation model in R programming.
- Analyze the data and draw various graphs.

ITCX126 **VIRTUAL REALITY** **L T P C**

3 0 0 3

OBJECTIVES:

- To make students know the basic concept and framework of virtual reality.
- To study of virtual reality systems, transformations, graphical rendering, human vision.
- To discuss interface design, human factors, developer recommendations, and technological issues of virtual reality.
- To provide the technology for managing large scale VR environment in real time.
- To discuss VR system framework and development tools.
- To design a virtual environment and compelling virtual reality experience.
-

MODULE I INTRODUCTION TO VIRTUAL REALITY 7

Introduction – Goals and VR definitions – Transforming models – Matrix algebra and 2D rotations – 3D rotations – Axis-angle representations – Converting and multiplying rotations – Homogeneous transforms – Eye transforms – Canonical view transform – Viewport transform.

MODULE II VISUAL PHYSIOLOGY AND VISUAL PERCEPTION 8

Photoreceptors – Sufficient resolution for VR – Light intensity – Eye movements - Eye movements issues for VR – Neuroscience of vision – Depth perception – Motion perception – Frame rates and displays.

MODULE III VI: TRACKING SYSTEMS 8

Orientation tracking – Tilt drift correction – Yaw drift correction – Tracking with a camera – Perspective n-point problem – Filtering – Lighthouse approach.

MODULE IV VISUAL RENDERING & AUDIO 8

Visual rendering – Shading models – Rasterization – Pixel shading – VR-specific problems – Distortion shading – Post-rendering image warp – Audio – Auditory localization – Rendering – Spatialization and display – Combining other senses.

MODULE V VR INTERFACES & ANIMATING VIRTUAL ENVIRONMENT 7

Interfaces – Overview – Locomotion – Manipulation – System control – Social

interaction – Evaluation of VR Systems – Interactive techniques in VR – Body track – Hand gesture – Animation of objects – Shape and object inbetweening – Free-from deformation – Particle systems.

MODULE VI VR DEVELOPMENT TOOLS AND FRAMEWORKS 7

Frameworks of Software Development Tools in VR – X3D standard – Vega – MultigEN – VR toolkits – VRML Programming – Augmented reality system - VR technology in Film & TV production – VR technology in physical exercises and games – Demonstration of Digital Entertainment by VR – Emerging Virtual Reality Applications.

Total Hours : 45

REFERENCES:

1. John Vince, “Virtual Reality Systems”, Pearson Education, First edition, 2007.
2. Burdea, G.C. and P. Coiffet, “Virtual Reality Technology”, Second edition, Wiley-IEEE Press, 2003.
3. Sherman, W.R. & A. Craig, “Understanding Virtual Reality: Interface, Application, and Design”, Morgan Kaufmann, San Francisco, CA, 2003.
4. George Mather, “Foundations of Sensation and Perception”, Psychology Press; Second edition, 2009.
5. Peter Shirley, Michael Ashikhmin, and Steve Marschner, “Fundamentals of Computer Graphics”, A K Peters/CRC Press; Third edition, 2009.

OUTCOMES:

- Provides students the fundamental knowledge of virtual reality required for their professional career in this field, and applied to various applications such as digital entertainment.
- Apply knowledge of computing and mathematics to solve complex computing problems in computer science discipline.
- Describe current techniques, skills, and tools necessary for computing practice
- Apply visual rendering and audio in VR systems in real time standards.
- Design of VR interfaces using interactive techniques.
- Analyze frameworks of Software Development & modeling Tools in VR.

ITCX127 SOFTWARE QUALITY MANAGEMENT L T P C

3 0 0 3

OBJECTIVES:

The objective of this course is to enable the students:

- To understand the fundamental concepts of quality management.
- To acquire the knowledge of understanding the "widely-used" quality analysis tools and techniques.
- To have the exposure about software quality assurance, quality measures, and quality control.
- To introduce philosophies and strategies to quality related issues.

MODULE I SOFTWARE QUALITY ASSURANCE 7

Quality Concepts and Perspectives - Assuring Software Quality Assurance – Software Quality Assurance Planning.

MODULE II SOFTWARE QUALITY MEASUREMENTS 7

Fundamentals Of Measurement Theory – Software Quality Metrics Overview – Applying The Seven Basic Quality Tools In Software Development – Selecting Quality Goals And Measures – Principles Of Measurement – Measures And Metrics – Quality Function Deployment – Measuring And Analyzing Customer Satisfaction.

MODULE III SOFTWARE QUALITY MANAGEMENT MODELS 8

Quality Management Systems – A Historical Perspective, A QMS For Software – Quality Management Systems – The ISO 9000 Series Of Quality Management Standards – Models And Standards For Process Improvement – Dos And Don”ts Of Software Process Improvement.

MODULE IV SOFTWARE QUALITY METRICS 8

Product Quality Metrics: Defect Density-Customer Problems Metric-CustomerSatisfaction Metrics-Function Points- In-Process Quality Metrics: Defect Arrival Pattern-Phase-Based Defect Removal Pattern- Defect Removal Effectiveness-Metrics for Software Maintenance: Backlog Management Index- Fix Response Time- Fix Quality-Software Quality Indicators.

MODULE V SOFTWARE MANAGEMENT PROCESS FRAMEWORK & DISCIPLINE 8

Life Cycle Process – Model Based Software Architectures – Workflow of The Process – Checkpoint of The Process – Iterative Process Planning – Project Organizations And Responsibilities – Process Automation.

MODULE VI SOFTWARE RELIABILITY AND PROCESS IMPROVEMENT 7

Definition and Measurement – Measurement based Assurance – Software Process Improvement and Capability Determination.

Total Hours : 45

TEXT BOOK:

1. Abu Sayed Mahfuz, “Software Quality Assurance: Integrating Testing, Security, and Audit, CRC Press, 2016.

REFERENCES:

1. Gordon G Schulmeyer, “Handbook of Software Quality Assurance”, 4th Edition, Artech House Publishers, 2008.

2. Stephen H. Kan, “Metrics and Models in Software Quality Engineering”, 2nd Edition, Pearson Edition, India, 2004.

3. Alan C. Gillies, “Software Quality Theory and Management”, 2nd Edition, Thomson Press, 2003.

OUTCOMES:

Upon completion of the course, the student should be able to

- Describe software quality assurance.
- Understand the measurement theory concept
- Choose the suitable software quality model for the given software project.
- Identify various software quality metrics
- Understand management problems, general solutions, technologies and standards.
- Describe software process improvement

ITCX128 CLOUD FORENSICS L T P C

3 0 0 3

OBJECTIVES:

- Gain knowledge on fundamental concepts of cloud forensics
- Apply appropriate skills and knowledge in solving cloud forensics investigation.
- Apply theoretical and practical knowledge in forensic computing into the future.
- Familiarize the basics of Digital Forensics.
- Analyze the legal, ethical and professional issues in Cyber Crime.
- Know the technological aspects of Incident Response.

MODULE I INTRODUCTION TO CLOUD FORENSICS 9

History of Forensics – Cloud Forensic Flaws and Risks – Rules of Cloud Forensics – Legal issues – Digital Forensic Principles – Digital Environments – Digital Forensic Methodologies - Forensics Software and Hardware tools.

MODULE II AN OVERVIEW OF CLOUD FORENSICS INVESTIGATION 8

Router Forensics and Network Forensics – An overview of Routers – Hacking Routers – Investigating Routers – Investigating Wireless Attacks – Basics of wireless – Wireless Penetration Testing – Direct Connections to Wireless Access Point – Wireless Connect to a Wireless Access Point

MODULE III DIGITAL FORENSICS 9

Introduction – Evidential potential of digital devices: closed vs. open systems, evaluating digital evidence potential- Device handling: seizure issues, device identification, networked devices and contamination - Seven element security model-developmental model of digital systems- audit and logs- Evidence interpretation: Data content and context.

MODULE IV NETWORK FORENSICS 6

Collecting Network Based Evidence - Investigating Routers - Network Protocols - Email Tracing - Internet Fraud.

MODULE V SYSTEMS INVESTIGATION AND ETHICAL ISSUES 6

Data Analysis Techniques - Investigating Live Systems (Windows &Unix) - Investigating Hacker Tools - Ethical Issues – Cybercrime.

MODULE VI INCIDENT AND INCIDENT RESPONSE 7

Introduction to Incident - Incident Response Methodology – Steps - Activities in Initial Response Phase after detection of an incident.

Total Hours : 45

REFERENCES:

1. Anthony Reyes, Jack Wiles, “Cybercrime and Digital Forenscis”, Elseiver Publications, 2007.
2.John Sammons, “The Basics of Digital Forensics”, Elesvier 2012
3. Linda Volonins, Reynalds Anzaldua, “Computer Forensics for dummies”, Wiley Publishing 2008.
4.Norbert Zaenglein, “Disk Detective: Secret You Must Know to Recover Information From a Computer”, Paladin Press, 2000.
5.Bill Nelson,Amelia Philips and Christopher Steuart, “Guide to computer forensics and investigations”, course technology, Cengage Learning; 4thedition, ISBN: 1- 435-49883-6, 2009.
6.Kevin Mandia, Chris Prosise, “Incident Response and computer forensics”,Tata McGrawHill, 2006.

OUTCOMES:

1. Have a fundamental understanding of Cloud Forensics and how resultant evidence can be applied within legal cases.
2. Distinguish various types of Cloud crime, and use cloud forensic techniques to identify the digital fingerprints associated with criminal activities.
3. Understand why Digital forensics is important for any modern organization. Gained theoretical knowledge in digital forensic investigations.
4. Know how to apply forensic analysis tools to recover important evidence for identifying cloud crime
5. Identify and apply current practices for data discovery recovery and acquisition.
6. Understand financial and accounting forensics, and explain their role in preventing various forms of fraud.

ITCX129 NETWORK SIMULATOR LAB

L	T	P	C
0	0	3	1

OBJECTIVES:

- Introduce various wireless systems and standards and their basic operation cases.
- Learn to simulate wireless networks and analyze the simulation results.

LIST OF EXERCISES: (Experiments using NS2/matlab/Qualnet/Routers/Switches, etc.,)

1. Wireless Access Point - configuring and enabling security
2. Wi-Fi based Data Acquisition
3. Routing protocols for IP network using routers
4. Configuration of VLAN using switches
5. PDA mobility analysis using layer 3 switches
6. Hidden and exposed terminal problem
7. Signaling in wireless networks (RTS, CTS, DATA andACK)
8. AODV/DSR
9. RTP protocol of VoIP
10. Implementation of network security algorithms
11. Network performance analysis using packet sniffer

Total Hours : 45

OUTCOMES:

On completion of the course students will be able to:

- Create wireless network environment and configure virtual LAN.
- Develop various wireless network applications.
- Demonstrate different wireless network protocols.
- Identify a suitable network security algorithms for a given scenario.
- Assess the performance of wireless network using packet sniffer.

ITCX130 ENTERPRISE RESOURCE PLANNING L T P C
3 0 0 3

OBJECTIVES:

- Knowing the real time information about business field strategies and business process of an enterprise.
- Understand and how to access information and provide services through an intuitive and integrated interface, and ultimately aims to: Improve Service Experience, Enhance Competitiveness, Modernize Business Processes and Systems, Automate Business Solutions, Increase Operating Efficiency and Provide Access to Standardized College Data.
- To understand the key implementation issues.
- To know the business modules and appreciate the current and future trends.
- To be aware of some popular products available in market.
- Familiar the current and future emerging trends in erp developments.

MODULE I ERP AND TECHNOLOGY 9

ERP: An Overview, Enterprise – An Overview, Benefits of ERP, ERP and Related Technologies, Business Process Reengineering (BPR), Data Warehousing, Data Mining, OLAP, SCM, CRM and Product life Cycle management.

MODULE II ERP IMPLEMENTATION 9

ERP Implementation Challenges - Lifecycle, Implementation Methodology, Package selection , Requirements Definition – Methodologies -Vendors, Consultants and Users, Contracts with Vendors, Consultants and Employees, Data Migration, Project Management and Monitoring.

MODULE III ERP IN ACTION 6

Operation and Maintenance of the ERP System, Measuring the Performance of the ERP System, Maximizing the ERP System.

MODULE IV THE BUSINESS MODULES 7

Business modules in an ERP Package, Finance, Manufacturing, Human Resources, Materials Management, Marketing, Total Quality Management, Sales, Distribution and Service.

MODULE V THE ERP MARKET **8**

Marketplace – Dynamics – SAP AG – Oracle – PeopleSoft – JD Edwards – QAD Inc –SSA Global – Lawson Software.

MODULE VI ERP – PRESENT AND FUTURE **6**

Turbo Charge the ERP System, EIA, ERP and e-Commerce, ERP II , ERP and Internet, Future Directions and Trends in ERP.

Total Hours : 45

TEXT BOOKS:

1. Alexis Leon, “ERP Demystified”, Tata McGraw Hill, New Delhi, 2000.
2. Mary Sumner, “Enterprise Resource Planning”, Pearson Education, 2007.

REFERENCES:

1. Vinod Kumar Garg and Venkitakrishnan N K, “Enterprise Resource Planning – Concepts and Practice”, PHI, New Delhi, 2003.
2. Joseph A Brady, Ellen F Monk, Bret Wagner, “Concepts in Enterprise Resource Planning”,Thompson Course Technology, USA, 2001.

OUTCOMES:

- Understand how business processes are mapped (translated) into enterprise system software and how managerial decisions integrate across disciplines.
- Understand and be able to articulate the life cycle stages of any ERP implementation. Develop working knowledge of enterprise system modules to enable efficient navigation and information access for management.
- Differentiate enterprise system transactions, queries, and reports within a manager’s role and develop competence in transforming raw data into management information.
- Know and be able to apply key technical terminology in enterprise information systems as they apply in different ERP products and development methods.
- Understand key differences between the major ERP applications (such as SAP AG, and Oracle/PeopleSoft) and issues specific to these applications their configuration and management.
- Synthesize prior theoretical and experiential knowledge in IT development and project management with the current literature on Enterprise System development.

ITCX131 EMBEDDED SYSTEMS L T P C

3 0 0 3

OBJECTIVES:

- This course will introduce students to embedded systems by providing a detailed overview of the important topics in the field.
- This course will equip students with the software development skills necessary for practitioners in the embedded systems field.
- Entire software development lifecycle and examine the various issues involved in developing software for embedded systems.

MODULE I EMBEDDED COMPUTING PLATFORM 7

Embedded computing - characteristics and challenges - embedded system design process-- Overview of Processors and hardware units in an embedded system.

MODULE II COMPUTING PLATFORM AND DESIGN ANALYSIS 9

CPU buses - Memory devices - I/O devices - Component interfacing - Design with microprocessors - Development and Debugging - Program design - Model of programs - Assembly and Linking - Basic compilation techniques - Analysis and optimization of execution time, power, energy, program size - Program validation and testing.

MODULE III REAL TIME OPERATING SYSTEMS (RTOS) 7

Overview of Operating Systems (OS) concepts - Real time systems - Types- Need for RTOS in Embedded Systems -Compare OS and RTOS - RTOS Tasks - Task States - Multitasking -Context Switching - Scheduling Algorithms- IPC mechanisms .

MODULE IV DISTRIBUTED EMBEDDED SYSTEMS 8

Communication buses - Shared memory communication - accelerated design- networks for emb

edded systems - networks based design - Internet enabled systems.

MODULE V EMBEDDED SOFTWARE DEVELOPMENT TOOLS 7

Host and target machines - Linkers / Locators for Embedded Software - Debugging techniques - Instruction set simulators Laboratory tools - Practical example - Source code.

MODULE VI SOFTWARE TECHNOLOGY FOR EMBEDDED SYSTEMS 7

Programming in assembly language (ALP) vs. High Level Language - C Program Elements, Macros and functions -Use of Pointers - NULL Pointers - C" Program compilers - Cross compiler - Optimization of memory codes.

Total Hours:45

TEXT BOOKS:

1. Marilyn Wolf, "Computers as components ", Elsevier, 2012.
2. Qing Li and Carolyn Yao, "Real-Time Concepts for Embedded Systems", CMP Books, 2003.
3. Michael Bass, "Programming Embedded Systems in C and C++", Oreilly, 2003.

REFERENCES:

1. David E.Simon, "An Embedded Software Primer", Pearson Education, 2003.
2. Rajkamal, "Embedded Systems Architecture, Programming and Design", Tata McGraw-Hill, First reprint Oct. 2003.
3. Steve Heath, "Embedded System Design", 2nd Edition, Elsevier, 2004.
4. Frank Vahid and Tony Gwargie, "Embedded System Design", John Wiley & sons, 2002.

OUTCOMES:

On completion of this course the student will be able to

- Develop Embedded Programs in C and C++.
- Apply various code minimization techniques.

Physics Elective Courses
(To be offered in II Semester)

PHCX 01	FUNDAMENTALS OF ENGINEERING MATERIALS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To help students to acquire the properties and applications of conducting and semiconducting materials.
- To familiarize students with basic ideas about the properties of dielectric and magnetic materials and their applications.
- To familiarize students with basic knowledge of nanomaterials and its electrical, electronic, mechanical and magnetic properties.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I CONDUCTING AND SEMICONDUCTING MATERIALS 7

Conductors: properties, Fermi distribution function, Fermi energy in metals- density of states- conducting polymers-properties-applications, semiconductors: intrinsic and extrinsic semiconductors-carrier concentration, conductivity and energy band gap, semiconducting polymers- properties- applications.

MODULE II DIELECTRIC MATERIALS 8

Polarization- dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – Internal field - Clausius Mosotti relation - dielectric loss – dielectric breakdown – applications of dielectric materials (capacitors and transformers) – Pyroelectricity, Piezoelectricity, ferroelectricity and applications in Ferroelectric Random Access Memory (FeRAM) - multiferroic materials and its applications.

MODULE III MAGNETIC MATERIALS 7

Origin of magnetism-magnetic moment, susceptibility, permeability – Bohr magneton – Dia, Para and Ferro magnetism –Spontaneous magnetization- Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites and its application - Giant Magneto-resistance effect (GMR) - Magnetic resonance imaging(MRI).

MODULE IV NANOMATERIALS 8

Properties of nanomaterials – size effect on thermal, electrical, electronic, mechanical,

optical and magnetic properties – quantum confinement – classification of nanomaterials – quantum well, quantum wire, quantum dot - nanoporous materials - carbon nanotubes, graphene - nanocomposites – applications of nano materials.

PRACTICALS

1. Determination of energy band gap of a semiconductor.
2. Determination of resistivity of metals by four point probe method.
3. Determination of dielectric constant of dielectric material.
4. Determination of time constant of a capacitor using RC circuit.
5. Determination of paramagnetic susceptibility of given liquid.
6. Determination of hysteresis loss in a transformer using BH curve.
7. Analysis of size effect on the absorption spectrum of nanomaterials.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. William D. Callister, “Material Science and Engineering”, Wiley Publications, 2006.
2. Raghavan, V., “Materials Science and Engineering”, 5th edition, Printice Hall of India Pvt Ltd. New Delhi, 2004.
3. Wahab. M.A, “Solid State Physics: Structure and Properties of Materials”, Narosa Publishing House Pvt. Ltd., New Delhi , 2nd Edition, 2010.
4. Pillai, S.O., “Solid State Physics”, New Age International, New Delhi, 2005.
5. Charles P. Poole and Frank J. Owens, ”Introduction to nanotechnology”, Wiley (India), 2009.
6. Pradeep. T., “Textbook of Nanoscience and Nanotechnology”, McGraw Hill Education (India) Private Limited, New York, 2012.

OUTCOMES:

On completion of this course, the student will be able to

- apply the concepts of conducting and semiconducting materials for solid state devices.
- comprehend the significance of properties of dielectric magnetic materials and derive these properties from synthesized materials.
- differentiate between the properties of the nanomaterials compared to bulk materials.
- complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 02	HEAT AND THERMODYNAMICS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To familiarize students with basic concepts of heat.
- To help students acquire the fundamentals of heat conduction and radiation.
- To enable students acquaint with the basics of thermodynamic concepts.
- To make students understand the fundamentals of heat based experiments.

MODULE I CONCEPTS OF HEAT **10**

Definition of temperature, thermal and thermodynamic equilibrium - relationship between temperature and kinetic energy - definition of solid, liquid, gas - Introduction to phase transitions, critical and triple points- definition of heat capacity, mechanical equivalent of heat -Joule's calorimeter- latent heat- microscopic model of ideal gas - equation of state, internal energy, equipartition theorem- equation of state for non-ideal gases.

MODULE II CONDUCTION AND RADIATION **10**

Thermal conductivity – rectilinear flow of heat – thermal conductivity of a good conductor – Forbe’s method – thermal conductivity of a bad conductor – Lee’s disc method – conduction of heat through compound media - radiation – Planck’s law of blackbody radiation – Wien’s law – Stefan’s law – Newton’s law of cooling from Stefan’s law – Solar constant – Pyrometry.

MODULE III FUNDAMENTALS OF THERMODYNAMICS **10**

Thermodynamic equilibrium – zeroth law of thermodynamics – first law of thermodynamics – Reversible and irreversible processes – second law of thermodynamics - Heat engine – Carnot’s engine – Carnot’s theorem – Internal combustion engines – petrol and diesel engines (qualitative) – Entropy and available energy – temperature – entropy diagram for Carnot’s cycle - Third Law of thermodynamics (qualitative).

PRACTICALS

1. Determination of mechanical equivalent of heat by Joule’s calorimeter.
2. Relation between temperature of a body and time by plotting a cooling curve-Newton’s law of cooling.

3. Determination of specific heat capacity of liquid by cooling.
4. Determination of thermal conductivity of a good conductor-Forbe's method
5. Determination of thermal conductivity of a bad conductor-Lee's disc method

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Mathur. D.S, “Heat & Thermodynamics”, S.Chand & Co., 2009.
2. Brijlal & Subramaniam, “Heat and Thermodynamics”, S.Chand & Co, Delhi, 2010.
3. Gupta. A.B and Roy. H, “Thermal Physics”, Books and Allied Ltd., 2002.
4. Sharma. J.K and Sarkar. K.K, “Thermodynamics and statistical Physics”, Himalaya Publishing House, 1988.

OUTCOMES:

On completion of this course, the student will be able to

- understand the concepts of heat and its properties.
- comprehend the ideas governing the conduction and radiation processes.
- apply the knowledge of laws of thermodynamics in thermodynamic systems.
- perform heat based experiments and determine its various properties.

PHCX 03	INTRODUCTION TO NANOSCIENCE AND TECHNOLOGY	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To acquire basic knowledge about the nanomaterials and applications.
- To learn about the synthesis and imaging techniques of nanomaterials.
- To gain the basic concepts of fabrication techniques.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I NANOMATERIALS AND APPLICATIONS **10**

Properties of nanomaterials – size effect on thermal, electrical, electronic, mechanical, optical and magnetic properties – quantum confinement – classification of nanomaterials – quantum well, quantum wire, quantum dot - nanoporous materials - zeolite, mesoporous materials, carbon nanotubes, grapheme - nanocomposites - applications (qualitative): Molecular electronics-nanoelectronics – nanophotonics - single electron transistor-drug delivery.

MODULE II SYNTHESIS AND IMAGING TECHNIQUES **12**

Top-down and bottom up approaches – mechanical alloying and mechanical ball milling - sol-gel approach - hydrothermal method - precipitation method - spray pyrolysis - spin coating-self assembled monolayer (SAM) - Chemical vapour deposition method – Physical vapour deposition method: laser ablation method, sputtering method.

Optical microscopy – Phase contrast and interference microscopy – confocal microscopy - high resolution Scanning electron microscope (HRSEM) - high resolution Transmission electron microscope (HRTEM) - Atomic force microscope - Scanning Tunnelling microscope (STM).

MODULE III NANOFABRICATION **8**

Photolithgraphy - electron beam lithography - X-ray and Ion beam lithography - nanoimprint lithography - soft lithograpy - nanoelectromechnical systems (NEMS) - nanoindentation principles.

PRACTICALS

1. Synthesis of nanomaterials by sol-gel method.

2. Synthesis of nanomaterials by hydrothermal method.
3. Synthesis of nanomaterials by solid state reaction method.
4. Synthesis of nanomaterials by chemical bath deposition method.
5. Synthesis of nanomaterials by co-precipitation method.
6. Synthesis of nano thin films by spray pyrolysis method.
7. Synthesis of nano thin films by pulsed laser deposition (PLD) method.
8. Analysis of size effect on the absorption spectrum of nanomaterials.
9. SEM characterization of nanomaterials.
10. AFM characterization of nano thin films.
11. Phase confirmation by XRD.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Charles P.Poole and Frank J. Owens, ”Introduction to nanotechnology”, Wiley (India), 2009.
2. Cao. G., “Nanostructures & Nanomaterials: Synthesis, Properties & Applications”, Imperial College Press, 2004.
3. Gaddand. W., Brenner. D., Lysherski. S. and Infrate. G.J., “Handbook of NanoScience Engineering and Technology”, CRC Press, 2002.
4. Pradeep. T., “Textbook of Nanoscience and Nanotechnology”, McGraw Hill Education (India) Private Limited, New York, 2012.
5. Chris Mack, “Fundamental Principles of Optical Lithography: The Science of Microfabrication”, John Wiley & Sons, 2008.
6. Bandyopadhyay A.K., “Nano Materials”, New Age International Publishers, New Delhi, 2008.

OUTCOMES:

At the end of the course, the students will be able to

- understand the importance and basic concepts of the nanomaterials.
- comprehend the imaging techniques for nanomaterials.
- illustrate the various nanofabrication techniques.
- complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 04	LASERS AND THEIR APPLICATIONS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To recognize the fundamentals of laser and its characteristics.
- To comprehend and compare the different laser systems.
- To apply lasers in metrology and material processing.
- To understand the working of laser instrumentation.
- To correlate the experimental results for applications.

MODULE I LASER THEORY **8**

Spontaneous and stimulated emission - Population inversion – Einstein's A & B coefficients - Threshold condition – super-radiance Laser – Three level and four level laser systems -conditions for CW and pulsed laser action. Q-Switching - experimental methods - cavity dumping - Mode locking - experimental methods - Spatial and Temporal coherence.

MODULE II DIFFERENT LASER SYSTEMS **8**

Laser systems – General description - Laser structure - excitation mechanism - Different laser systems- He-Ne laser, Carbon-dioxide laser - Excimer laser – Free electron laser- Alexandrite laser - Ti-Sapphire laser – Semiconductor diode laser - Diode pumped solid state laser - Pulsed-CW dye laser- Fibre laser.

MODULE III METROLOGICAL AND MATERIAL PROCESSING APPLICATIONS **8**

CW and Pulsed laser beam characteristics and its measurements - Beam focusing effects - spot size - Power and Energy density Measurements - Distance measurement - Interferometric techniques - LIDARS - different experimental arrangements - Pollution monitoring by remote sensing - Laser gyroscope - Laser welding, drilling, machining and cutting - Laser surface treatment - Laser vapour deposition – Biophotonic applications.

MODULE IV LASER INSTRUMENTATION **7**

Laser for measurement of length, current and voltage – Laser Doppler Velocimetry - Holography and speckle in displacement and deformation measurements - Laser for communication with fiber optics as channel.

PRACTICALS

1. Tuning of Dye Laser using DFDL Arrangement
2. Determination of Brewster Angle using He-Ne laser
3. Study of transversely Pumped Dye Lasers
4. Study of longitudinally Pumped Dye Lasers
5. Determination of power and wavelength using Distributed Feedback Dye Laser (DFDL)
6. Determination of fibre optic losses using semiconductor laser.
7. Bandgap determination of a semiconductor diode.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. William T. Silfvast, “Laser Fundamentals”, Cambridge University Press, 2009.
2. Ghatak. A. & Thyagarajan. K. “Optical Electronics”, Cambridge University, 1994.
3. Laud.B.B., “Laser and Non-Linear Optics”, Second Edition, New Age International (p) Limited Publishers, 2011.
4. Nambiar. K.R., “Lasers Principle, Types and Applications”, New Age International (p) Ltd, 2004.
5. Wilson. J. & Hawkes. J.F.B., “Opto Electronics - An Introduction”, Prentice Hall, 1992.
6. William M.Steen, ”Laser Material Processing”, Springer-Verlag, Berlin, Third Edn., 2005.

OUTCOMES:

At the end of the course, the students will be able

- To complement the knowledge acquired in the theory class.
- To work with dye lasers for tunability of laser wavelength.
- To measure the loss of information involved in fibre optic communication.
- To correlate the results for application.

PHCX 05	MATERIALS SCIENCE	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To gain basic knowledge in conducting and semiconducting materials and their properties.
- To provide basic understanding of properties and applications of dielectric materials.
- To impart knowledge on magnetic and optical materials and their properties & applications.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I CONDUCTING AND SEMICONDUCTING MATERIALS 10

Quantum free electron theory of metals and its importance - Energy distribution of electrons in metals - Fermi distribution function - Density of energy states and carrier concentration in metals - Fermi energy – Classification of solids into conductors, semiconductors and insulators on the basis of Band theory – Introduction to Elemental and Compound semiconductors - Carrier concentration derivation for Intrinsic semiconductors - Density of electrons in conduction band & Density of holes in valence band- intrinsic carrier concentration - Fermi energy & Variation of Fermi energy level with temperature - Mobility and electrical conductivity - Band gap determination.

MODULE II DIELECTRIC MATERIALS 7

Introduction to dielectric materials & basic definitions – Electronic, Ionic, Orientation & Space charge polarizations - Total polarization – Frequency and temperature dependence of polarization - Internal field in a dielectric material - Deduction of Clausius - Mosotti's relation - dielectric loss & loss tangent – Different types of dielectric breakdown – Applications of dielectric materials : Capacitors and Transformers.

MODULE III MAGNETIC MATERIALS 6

Introduction to magnetic materials & origin of magnetic moment - Different types of

magnetic materials and their properties - Ferromagnetism & Domain theory of ferromagnetism - Hysteresis, Soft and Hard magnetic materials - Antiferromagnetic materials - Ferrites and its applications – Applications of magnetic materials : Data storage.

MODULE IV OPTICAL MATERIALS 7

Optical properties of semiconductors - Direct and Indirect bandgap semiconductors – Traps, recombination centre, color center and exciton – Luminescence : Fluorescence and Phosphorescence - Liquid crystal display : twisted nematic crystal display – Applications of Optical materials - Optical Sources : light emitting diode and laser diode - Photo detectors : PIN photodiode and Avalanche Photodiode - Pyroelectric devices - Electro optic effect : Kerr effect and Faraday effect.

PRACTICALS

1. Resistivity measurement of a semiconductor using four point probe method.
2. Determination of band gap of a semiconductor diode.
3. Determination of Hall coefficient of a given semiconductor material.
4. Determination of dielectric constant of a given non-polar liquid.
5. Determination of magnetic susceptibility of a given paramagnetic liquid using Quincke's method.
6. Determination of energy loss of a given transformer core using hysteresis method.
7. To study the I-V characteristics of a photodiode.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Palanisamy P.K., ''Physics II'', Material Science for ECE, Scitech Publications (India) Pvt. Ltd., 2006.
2. Kasap. S.O., ''Principles of Electronic materials and devices'', McGraw Hill Publishers, 3rd Edition, 2007.
3. Arumugam. M, "Physics II'', Material Science for ECE, Anuradha Publishers, 5th Edition, 2005.
4. Sze. S.M., ''Semiconductor Devices – Physics and Technology'', John Wiley, 2nd Edition. 2002.
5. Raghavan. V, ''Materials Science and Engineering'', Prentice Hall of India, 5th Edition, 2004.

OUTCOMES:

On the completion of this course, the students will be able to

- Gain knowledge about fundamentals of conducting and semiconducting materials.
- Understand concepts and applications of Dielectric and Magnetic materials.
- Familiarize Optical materials and their applications in Engineering and Medical fields.
- Complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 06	NON-DESTRUCTIVE TESTING	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To study the process and applications of ultrasonic inspection method.
- To understand the basic concepts of radiographic inspection method.
- To acquire the knowledge about the various surface Non-Destructive Testing (NDT) techniques.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I ULTRASONIC INSPECTION METHOD **10**

Ultrasonic Testing - Principle of operations - types of sound waves - types of Transducers - transmission and pulse-echo method - straight beam and angle beam, instrumentation - calibration methods - ultrasonic testing technique- data representation, A Scan, B-scan, C-scan. Phased Array Ultrasound, Time of Flight. Diffraction - thickness determination - advantages, disadvantages and applications.

MODULE II RADIOGRAPHIC INSPECTION METHOD **10**

Radiographic testing – Principle - Interaction of X-ray with matter - X-ray radiography - method of generation-industrial radiography inspection techniques – Equipment - Exposure charts - Types of films – Fluoroscopy - Xero-Radiography – Limitations - Gamma radiography - Equipment, radiation sources - method of generation - film processing - interpretations of radiography - safety in industrial radiography.

MODULE III SURFACE NDT TECHNIQUES **10**

Liquid Penetrant Testing – Principles, Characteristics and types of liquid penetrants – developers - advantages and disadvantages of various methods - Inspection Procedure and Interpretation of results. Applications of Liquid Penetrant testing.

Magnetic Particle Testing - Principle-magnetizing technique - procedure –equipment - Interpretation and evaluation of test indications - applications and limitations - demagnetization.

PRACTICALS

1. Inspection of welds using solvent removable visible dye penetrant.
2. Inspection of welds using solvent removable fluorescent dye penetrant.

3. Inspection on non magnetic materials by eddy current method.
4. Inspection on magnetic materials by eddy current method.
5. Inspection of welds by Eddy current Testing.
6. Inspection of welds by Magnetic Particle Testing - Dry method.
7. Inspection of welds by Magnetic Particle Testing - Wet method.
8. Ultrasonic flaw detector - Inspection of defects.
9. Demonstration of Radiographic inspection.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Baldev Raj., Jayakumar T.,Thavasimuthu., “Practical Non-Destructive Testing”, Narosa Publishing House, 2009.
2. Ravi Prakash., “Non-Destructive Testing Techniques”, 1st revised edition, New Age International Publishers, 2010.
3. ASM Metals Handbook of Non-Destructive Evaluation and Quality Control, American Society of Metals, Metals Park, Ohio, USA, Volume-17, 2000.
4. Paul E Mix,”Introduction to Non-destructive testing: a training guide”, Wiley, 2nd Edition New Jersey, 2005.
5. Charles J., Hellier, “Handbook of Nondestructive evaluation”, McGraw Hill, New York, 2001.

OUTCOMES:

Upon completion of this course, the students will be able to

- illustrate the ultrasonic inspection methods of NDT.
- understand the basic concept of radiographic inspection method.
- test the surfaces by the various surface NDT techniques.
- complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 07	PROPERTIES OF MATTER AND ACOUSTICS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To understand principles and properties of elasticity.
- To understand the basic concepts and application of viscosity.
- To analysis acoustic of building.
- To know about photoelasticity and its applications.

MODULE I ELASTICITY **8**

Stress and strain - Hooke's Law of elasticity - Elastic moduli - Stress-Strain Diagram - Poisson's Ratio - Relation between elastic constants - Work done in stretching and twisting a wire - Twisting couple on a cylinder- Expression for bending moment - Cantilever–Expression for depression - Uniform bending and Non-uniform bending of beams (theory & experiment) - I form Girders (qualitative treatment) and applications.

MODULE II VISCOSITY **8**

Viscosity- Newton’s formula for viscous flow - Streamline and turbulent motion - Reynolds number - Poiseuille's formula - Determination of coefficient of viscosity- factors affecting viscosity - capillary flow method - Stoke's formula- viscosity of highly viscous liquids – Stoke’s method - Lubricants and its applications –viscosity measurements - Viscometer - Variation of Viscosity with Temperature.

MODULE III ACOUSTICS OF BUILDING **7**

Basic requirement for the acoustically good halls - Reverberation and time of reverberation – Sabine’s formula for reverberation time - Absorption coefficient and its measurement -Transmission of sound and transmission loss - Factors affecting the architectural acoustics and their remedy-sound absorbing materials - vibration and noise control systems for buildings.

MODULE IV PHOTOELASTICITY **7**

Polarization - double refraction - Theory of Plane, Circularly and Elliptically polarized light - Quarter wave plate and half wave plate - photo elasticity - Theory of photo-elasticity - Stress optic relations - model materials - analysis techniques - Photo elastic bench - Three dimensional photo elasticity - Digital photo elasticity - Photo elastic

coatings.

PRACTICALS

1. Determination of viscosity of liquid by Poiseuille's method.
2. Determination of viscosity of liquid by Stoke's method.
3. Analysis of stress by photo elastic method.
4. Verification of Hooke's law by spring method.
5. Determination of Young's modulus of the cantilever beam.
6. Determination of rigidity modulus by static torsion method.
7. Visit to acoustically good auditorium and identifying the sound absorbing materials in the auditorium.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Mathur D.S., "Elements of Properties of Matter", S.Chand & Co, Delhi, 2009.
2. Gaur R.K., Gupta S.L.,"Engineering Physics", Dhanpat Rai Publishers, 2010.
3. Brijlal and Subramaniam.," Properties of Matter", Eurasia Publishing Co, New Delhi, 2002.
4. Smith C.J.," General Properties of Matter", Orient & Longman,1960.
5. Kenneth G. Budinski and Michel K., Budinski, "Engineering Materials Properties and Selection", Pearson, Singapore, 2002.

OUTCOMES:

Upon completion of this course, the students will be able to

- understand the basic concepts of the elasticity of materials.
- comprehend the concepts of viscosity of liquid and measurement.
- demonstrate the acoustical aspects of building and its importance in construction.
- apply the fundamental concept of photo elasticity for the stress analysis of the object.

PHCX 08	PROPERTIES OF MATTER AND NONDESTRUCTIVE TESTING	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To impart knowledge about the principles and properties of elasticity.
- To learn the laws governing the dynamic of rigid bodies.
- To acquire the knowledge of the various techniques of Non-Destructive Testing (NDT) of materials.
- To understand the principle and basic concept of low temperature applications.

MODULE I ELASTICITY **8**

Stress and strain - Hooke's Law of elasticity - Elastic moduli - Stress-Strain Diagram - Poisson's Ratio - Relation between elastic constants - Work done in stretching and twisting a wire - Twisting couple on a cylinder- Expression for bending moment- Cantilever–Expression for depression - Uniform Bending and Non-uniform bending of beams (theory & experiment) - I form Girders (qualitative treatment) and applications.

MODULE II DYNAMICS OF RIGID BODIES **8**

Rigid bodies - angular acceleration - Torque on a particle - angular momentum - law of conservation of angular momentum - moment of inertia and its significance - Theorem of parallel and perpendicular axis - moment of inertia of a thin uniform bar - moment of inertia of a rectangular lamina - moment of inertia of uniform circular disc - Moment of inertia of hollow and solid cylinders – flywheel
(qualitative) - kinetic energy of rotating body – Routh rule.

MODULE III NDT TECHNIQUES **6**

Ultrasonic Testing- types of Transducers-transmission and pulse-echo method- Radiographic testing- Principle-Interaction of X-ray with matter-X-ray radiography-method of generation-industrial radiography inspection techniques- Liquid Penetrant Testing**-** Inspection Procedure and Interpretation of results.

MODULE IV LOW TEMPERATURE PHYSICS **8**

Definition of Refrigeration and Air-Conditioning - Types of **Refrigeration Systems-**

Applications- Comfort Air Conditioning, Industrial Refrigeration, Food processing and food chain - **Cryogenic treatment - Low temperature properties of engineering materials: Mechanical properties, Thermal properties, Electrical properties.**

PRACTICALS

1. Verification of Hooke's law by spring method.
2. Determination of Young's modulus of the beam by bending method.
3. Inspection of welds using solvent removable visible dye penetrant.
   Inspection of welds using solvent removable fluorescence dye penetrant.
5. Inspection of welds by Magnetic Particle Testing.
6. Determination of moment of inertia of the disc by torsion pendulum method.
7. Determination of moment of inertia of the disc by static torsion method.
8. Demonstration of working of flywheel.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Mathur D.S.,"Elements of Properties of Matter", S.Chand & Co, Delhi, 2009.
2. Brijlal & Subramaniam," Properties of Matter", Eurasia Publishing Co, Delhi, 2002.
3. Gaur R.K., Gupta S.L., "Engineering Physics" Dhanpat Rai Publishers, 2010.
4. Baldev Raj.,Jayakumar T., Thavasimuthu M.,"Practical Non-Destructive testing", Narosa Publishing House, 2009.
5. Brijlal & Subrahmanyam., "Heat and Thermodynamics" S.Chand & Company Ltd, 2002.
6. Paul E Mix.," Introduction to Non-destructive testing: a training guide", Wiley, 2nd Edition, New Jersey, 2005.
7. Charles J., Hellier.," Handbook of Nondestructive evaluation", McGraw Hill, New York, 2001.

OUTCOMES:

Upon completion of this course, the students will be able to

- understand the basic of concept of elasticity of materials.
- comprehend the basic concepts of motion of rigid bodies and its applications.
- demonstrate the various NDT techniques and its importance.
- know the low temperature systems and its applications.

PHCX 09	SEMICONDUCTOR PHYSICS AND OPTOELECTRONICS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To understand the Physics of Semiconductor devices.
- To make the students learn the fundamentals of Photoluminous - semiconductors, Optoelectronic devices, Optical modulators/detectors.
- To make them understand the technology behind latest Display devices like LCD, Plasma and LED Panels.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I PHYSICS OF SEMICONDUCTORS **8**

Elemental and compound semiconductors – Drift and diffusion current - Intrinsic semiconductors – Carrier concentration (derivation) – Fermi energy – Variation of Fermi energy level with temperature – Mobility and electrical conductivity – Band gap determination – Extrinsic semiconductors – Carrier concentration in n-type and p-type semiconductor (derivation) – Variation of Fermi level with temperature and impurity concentration – Variation of Electrical conductivity with temperature – Hall effect – Experiment and applications of Hall effect.

MODULE II OPTOELECTRONIC DEVICES **7**

Light Emitting Diodes (LED) – power and efficiency - double hetero LED - LED structure - LED characteristics - White LED – Applications. Liquid crystal displays – Dynamic scattering and Twisted nematic display, Semiconductor Lasers, Homojunction and Heterojunction laser diodes - Optical processes in semiconductor lasers.

MODULE III OPTICAL MODULATORS **7**

Modulation of light – birefringence –Modulation Techniques - Electro optic effect – Electro optic materials –Types of Electro optic Modulators : Kerr and Pockel modulators –- Magneto optic effect - Magneto optic Modulators – Acousto Optic modulators.

MODULE IV OPTICAL DETECTORS **8**

Photo detectors - photodiodes - phototransistors - noise characteristics - PIN diode – Avalanche Photodiode (APD) characteristics - APD design of detector arrays – Charged Couple Device - Solar cells - Materials and design considerations, Thin film

solar cells, amorphous silicon solar cells.

PRACTICALS

1. Resistivity measurement of a semiconductor using four point probe method.
2. Determination of band gap of a semiconductor diode.
3. Determination of Hall coefficient of a given semiconductor material.
4. Determination of the wavelength of a given laser source using diffraction grating.
5. Determination of Planck's constant using LED.
6. To study the I-V characteristics of photodiode and phototransistor.
7. To study the characteristics of a solar cell.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Arumugam. M, "Physics II", Anuradha Publishers, 5th Edition, 2005.
2. Sze. S.M., "Semiconductor Devices – Physics and Technology", 2nd edn. John Wiley, 2002.
3. Wilson & J.F.B. Hawkes, "Optoelectronics – An Introduction", Prentice Hall, India, 1996.
4. Bhattacharya, "Semiconductor optoelectronic devices", Second Edn, Pearson Education, 2002.
5. Safa O. Kasap, "Optoelectronics & Photonics:Principles & Practices", Second Edn, Pearson Education,2013.
6. Palanisamy P.K., "Semiconductor physics and optoelectronics" Scitech Publications, 2003.

OUTCOMES:

On completion of this course, the student will be able to

- understand the principles of Physics behind semiconductor devices.
- choose the correct semiconductors for electronic devices and display.
- differentiate the working principle of LED and Diode Laser.
- apply the knowledge of modulation of light for different types of optical modulators.
- select suitable photodetectors for different types of applications.
- complement the knowledge acquired in the theory class and correlate the results for applications.

Chemistry Elective Courses
(To be offered II Semester)

CHCX01	ANALYTICAL INSTRUMENTATION	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make the student conversant with

- principles, instrumentation and applications of different electroanalytical techniques
- different chromatographic techniques
- principles, instrumentation and applications of various types of absorption and emission spectroscopy
- different thermal analytical methods and their applications

MODULE I ELECTROANALYTICAL TECHNIQUES **7**

Principle and applications: conductometric titrations – potentiometrIc titrations, ion-selective electrodes and pH-metry – coulometry – voltammetry - polarography, amperometric titrations.

MODULE II CHROMATOGRAPHY **8**

Basic concepts of chromatography – paper chromatography – column chromatography – thin layer chromatography – gas chromatography – high performance liquid chromatography – gel permeation chromatography.

MODULE III SPECTROSCOPY **8**

Absorption spectroscopy (principle, instrumentation and applications): Colorimetric analysis – UV-Visible spectroscopy – FTIR spectroscopy - Emission Spectroscopy (principle, instrumentation and applications): fluorescence, phosphorescence and chemiluminescence – Atomic absorption spectroscopy – flame emission spectroscopy.

MODULE IV THERMAL ANALYSIS **7**

Principle, instrumentation and applications: Thermo gravimetric analysis – Differential thermal analysis – Differential scanning calorimetry

PRACTICALS

1. Conductometric titrations: acid-base and precipitation titrations

2. Potentiometric titrations
3. Determination of pH of the unknown solution
4. Estimation of alkali metals using flame emission spectroscopy
5. Estimation of metal ions of coloured solutions using colorimetric analysis
6. Separation of compounds using gas chromatography
7. Separation of compounds using high performance liquid chromatography
8. Analysis of the given sample and interpretation of the data using IR, UV-Visible spectroscopy
9. Demonstration of TGA/DTA and DSC and interpretation of data.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Skoog D.A., West D.M., Holler F.J. and Crouch S.R., Fundamentals of Analytical Chemistry, 8th Edition, Thomson Brooks/Cole Publication., Singapore, 2004.
2. Willard H.H., Merritt L.L., Dean J.A. and Settle F.A., Instrumental Methods of Analysis, 7th Edition, CBS Publication, New Delhi Reprint, 2004.
3. A.I. Vogel, Vogel's Textbook of Practical Organic Chemistry, 5th Edition, Prentice Hall, London, 2008.
4. Christian G.D., Analytical Chemistry, 6th Edition, John Wiley, Singapore, 2003.
5. Fifield F.W. and Kealey D., Principles and Practice of Analytical Chemistry, 5th Edition, Blackwell Publication, London, 2000.
6. Settle F. (Editor), Handbook of Instrumental Techniques for Analytical Chemistry, Pearson Education, Singapore, 2004.

OUTCOMES:

The student will be able to

- state the principle and applications of various electro-analytical techniques
- identify the right separation method for a given sample using different chromatographic techniques
- explain the principle, instrumentation & applications of various spectroscopic methods and also to interpret the data
- elaborate the principle, instrumentation and applications of various thermal analytical techniques and interpret the data.

CHCX02	CORROSION AND ITS CONTROL	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students should be conversant with the

- Basic concepts, principles and factors affecting corrosion
- Types and mechanism of corrosion
- Control measures of corrosion by material selection, proper design and by applying organic coatings
- Control of corrosion by applying inorganic coating

MODULE I BASIC CONCEPTS OF CORROSION 8

Corrosion – causes and impacts of corrosion – mechanism of corrosion: Dry corrosion- oxidation corrosion - corrosion by other gases – Pilling-Bedworth rule- Corrosion by hydrogen: hydrogen blistering, hydrogen embritttlement, decarburization and hydrogen attack – corrosion of silver and copper by sulphur compounds – liquid metal corrosion (embritttlement or cracking) – Wet corrosion : hydrogen evolution – presence and absence of oxygen and absorption of oxygen – difference between dry and wet corrosion-factors influencing corrosion-polarization-passivity-emf series and galvanic series- corrosion current -rate of corrosion.

MODULE II FORMS OF CORROSION 7

Forms of corrosion-conditions for electrochemical corrosion –galvanic corrosion – differential aeration corrosion: pitting, water line, wire fencing, crevice and filiform corrosion – stress corrosion – Intergranular corrosion- erosion corrosion – soil corrosion – microbiological corrosion- fretting corrosion- corrosion in composites.

MODULE III CORROSION CONTROL AND ORGANIC COATINGS 8

Corrosion control – selection of materials and designing- cathodic protection – sacrificial anode and impressed current cathodic protection – corrosion inhibitors: anodic, cathodic and vapour phase inhibitors.

Organic protective coatings – paints: constituents – functions – varnishes : types-constituents – functions – lacquers : constituents – functions –enamels-constituents – functions – special paints : fire retardant, water repellant, heat resistant, temperature indicating and luminous paints.

MODULE IV INORGANIC COATINGS 7

Treatment of metal surface-inorganic coatings- classification- metallic coatings : anodic and cathodic coatings-hot dipping : galvanizing and tinning- electroplating—electroless plating – cementation (diffusion) : sherardizing, calorizing and chromizing – metal cladding-metal spraying – non metallic coatings (chemical conversion coatings) : phosphate, chromate, oxide coatings and anodizing – comparison of anodic and cathodic protection.

PRACTICALS

1. Determination and comparison of rate of corrosion of metals in the presence of acid, base and neutral medium by weight loss method.
2. Determination of rate of corrosion of iron in the presence of various acids by weight loss method.
3. Determination of rate of corrosion of iron in the presence and absence of anodic Inhibitor by weight loss method.
4. Determination of rate of corrosion of iron in the presence and absence of cathodic Inhibitor by weight loss method.
5. Electroplating of base metal with copper.
6. Electrolessplating of base metal with copper
7. Chemical conversion coatings such as chromate and phosphate coatings.
8. Demonstration on the study of rate of corrosion by using cyclic voltametry.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. P.C Jain & Monica Jain, Engineering Chemistry Dhanpatrai Publishing Company (P) Ltd., New Delhi (2013).
2. S S Umare & S S Dara, A text Book of Engineering Chemistry, S. Chand& Company Ltd, New Delhi, 2014.
3. M.G. Fontana and N.G. Green, Corrosion Engineering, McGraw Hill Book Company, NewYork, 1984.
4. S. Banerjee, A.K. Tyagi, Functional Materials- Preparation, Processing and Applications, ELSEVIER Publications, London ; Waltham, MA : 2011

OUTCOMES:

Students will be able to

- explain the mechanism, compare and enumerate the factors affecting

corrosion

- describe and identify the place and types for a given situation.
- choose and elaborate the suitable organic coating method for a given real time situation.
- apply a suitable metallic coating for a given situation

CHCX03	ELECTRICAL MATERIALS AND BATTERIES	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students should be conversant with

- preparation, properties and applications of plastics used in electrical and electronic applications
- properties and uses of electrical engineering materials
- classification and description of different types of batteries.
- classification and types of fuel cells

MODULE I POLYMERS FOR ELECTRICAL AND ELECTRONIC APPLICATIONS **8**

Preparation, properties and applications **:** polyethylene, polypropylene, EPDM, Nylon-6,6, PVC, PTFE, polycarbonates, ABS, phenol formaldehyde, urea formaldehyde, epoxy resins – polymer blends and alloys.

MODULE II ELECTRICAL ENGINEERING MATERIALS **7**

Conductors: Silver, Copper, Gold, Aluminum – Semiconductors: Germanium, Silicon, Gallium Arsenic – Insulating Materials: Rubbers, Mica, Plastics, Ceramics, Insulating papers – Magnetic Materials: ferromagnetic materials, paramagnetic materials, diamagnetic materials, antiferromagnetic materials, ferrites

MODULE III BATTERIES **7**

Electrochemical and electrolytic cell – batteries: types (primary, secondary and flow cell) – primary batteries: dry cells, alkaline batteries – secondary batteries: nickel-cadmium cell – lead acid storage cell, lithium battery: primary and secondary type – solar cell – dye sensitized solar cell.

MODULE IV FUEL CELLS **8**

Difference between batteries and fuel cells - chemistry of fuel cells - types of fuel cell (based on temperature and electrolyte) – principle, characteristic features, advantages, disadvantages and applications of polymer electrolyte membrane or proton exchange membrane fuel cell (PEMFC), direct methanol fuel cell (DMFC), alkaline fuel cell (AFC), phosphoric acid fuel cell (PAFC), molten carbonate fuel cell (MCFC) and solid oxide

fuel cells (SOFC).

PRACTICALS

1. Free radical polymerization of styrene.
2. Free radical polymerization of PMMA.
3. Preparation of phenol-formaldehyde.
4. Preparation of urea-formaldehyde.
5. Synthesis of epoxy resin.
6. Demonstration of mechanical properties of insulating materials using UTM
7. Demonstration of electrical properties of insulating materials
8. Construction of batteries using natural resources
9. Measurement of EMF for different batteries.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Jain P.C. and Renuka Jain, Engineering Chemistry, Dhanpat Rai Publication Co. (P) Ltd., New Delhi, 2013.
2. Michael L. Berins, Plastics Engineering Hand Book, 5th Edition, Chapman and Hall, New York, 1991.
3. H.F. Mark and N. Gaylord, Encyclopedia of Polymer Science and Technology, Vol. 1 to XIV Interscience, 2nd Ed. 1988.
4. Gowarikar V.R., Viswanathan N.V and Jayadev Sreedhar, Polymer Science, Wiley Eastern Limited, Madras, 1981.
5. R.K. Rajput,A Textbook of Electrical Engineering Materials, Firewall Media, 2004
6. Vladimir S. Bagotsky, Fuel Cells: Problems and Solutions, 2nd Edition, John Wiley and Sons, 2012.
7. B. Viswanathan and M. Aulice Scibioh, Fuel Cells: Principles and Applications, Taylor and Francis Group, 2007.

OUTCOMES:

The student will be able to

- summarise the preparation, properties and applications of plastics used in electrical and electronic applications
- enumerate the properties and uses of electrical engineering materials
- illustrate various types of batteries with the aid of a diagram
- classify the fuel cells and elaborate the different types of fuel cells.

CHCX04	ENGINEERING MATERIALS	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students should be conversant with

- properties and uses of different types of refractories and abrasives
- adhesives, cements and lime, setting of cements and their chemical behaviors.
- types, properties and uses of lubricants.
- various types of composite materials.

MODULE I REFRACTORIES AND ABRASIVES **8**

Introduction refractory: -classification - based on chemical nature- characteristic and selection of good refractory - general manufacture of refractory- preparation properties and uses of: silica refractory - magnesite refractory - zirconia refractory, properties of refractories: refractoriness - refractoriness under load - thermal spalling - porosity and dimensional stability, Cermets - super refractory.

Abrasives : introduction - Moh's scale - natural abrasives: diamond – corundum – emery - garnet and quartz, synthetic abrasives: preparation properties and uses: carborundum (silicon carbide)– alundum - boron (norbide) carbide

MODULE II ADHESIVES AND BINDING MATERIALS **7**

Introduction - classification of adhesives –advantage –limitation of adhesive bonding – development of adhesive- factors influencing adhesive action: chemical and physical, application techniques of adhesive – Lime: classification – manufacture - setting and hardening, Gypsum: -Manufacture and properties and uses - Cement : chemical composition- Manufacture – setting and hardening – concrete – weathering of cement and concrete and its prevention- special cements: high alumina cement - sorel cement - white portland cement – water proof cement.

MODULE III LUBRICANTS **7**

Introduction –functions of lubricant- mechanism of lubrication - classification of lubricant – liquid lubricant: vegetable and animal oils – mineral oils, semisolid: grease(calcium, lithium, aluminium) – petroleum jelly, solid lubricant: graphite - molybdenum disulphide, Properties of lubricant: viscosity - viscosity index - flash point and fire point - cloud point and pour point – oiliness - aniline point - carbon residue.

MODULE IV COMPOSITE MATERIALS 7

Introduction – advantageous characteristics of composites, applications of composites, main constituent of composites, types and applications of composites: RCC fibre-reinforced plastics (glass , carbon and aramid) - particulate composite - metal matrix composite - layered composites - failures in fibre-reinforced composites, ceramic matrix composites (CMC) – properties and applications.

PRACTICALS

1. Preparation of refractory bricks
2. Preparation of abrasive papers/cloth
3. Preparation of simple adhesives
4. Estimation of alkalinity in cements
5. Determination of cloud point and pour point
6. Determination of flash point and fire point
7. Preparation of fibre-reinforced composite

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. P.C Jain & Monica Jain, Engineering Chemistry Dhanpatrai Publishing Company (P) Ltd., New Delhi (2013).
2. B.Sivasnakar, “Engineering Chemistry”, Tata McGrow-Hill Publication Limited, New Delhi, second reprint 2008.
3. Engineering Chemistry, Wiley India Editorial Team, Willey India Publisher, New Delhi, 2011.
4. S S Umare & S S Dara, A text Book of Engineering Chemistry, S. Chand& Company Ltd, New Delhi, 2014.

OUTCOMES:

The student will be able to

- classify and describe the manufacture the refractories and enumerate the properties and uses of abrasive materials.
- elaborate the manufacture, properties and uses of various adhesives and binding materials.
- classify lubricants and describe the properties and uses of them
- enumerate the properties and uses of various composite materials.

CHCX05	FUELS AND COMBUSTION	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make the students conversant with the

- three types of fuels available and the different processes involved in it.
- analysis of fuel characteristics and manufacture of fuels
- calculations involved in calorific values and minimum air requirement for complete combustion.
- classification, functions, mechanism and properties of lubricants.

MODULE I SOLID FUELS **7**

Characteristics of good fuel. Solid fuel – Wood, Coal – Ranking of coal – selection of coal. Analysis of coal – Proximate analysis. Pulverized coal – Metallurgical coke – Carbonization of coal – types. Manufacture of metallurgical coke – Beehive oven and Otto Hoffman's by-product oven methods.

MODULE II LIQUID AND GASEOUS FUELS **8**

Liquid fuel: Petroleum: Refining of petroleum, Liquid fuels derived from petroleum – Cracking: Thermal (Liquid and Vapour phase) – Catalytic (fixed bed and moving bed cracking – Synthetic petrol: Fischer-Tropsch method– Knocking in petrol and diesel engine: octane number and antiknocking – cetane number and improvement of cetane number – biodiesel (trans-esterification) – Gaseous fuels: Compressed natural gas (CNG) – LPG – oil gas – producer gas – water (blue) gas – biogas.

MODULE III COMBUSTION **8**

Calorific value: Gross and net caloric value – Bomb Calorimeter, Gas calorimeter - Definition of combustion – calculation of minimum requirement of air (problems) – theoretical calculation of calorific values (Dulong's formula), Gross and net calorific values ((problems) – Analysis of flue gas: Orsat's gas analysis method, explosive range, Ignition temperature. Introduction to air pollution from IC (Internal combustion) engines, photochemical smog, primary and secondary pollutants.

MODULE IV LUBRICANTS **7**

Friction and wear – lubricants: definition, functions and mechanism of lubrication

(thick film and thin film) –classification: liquid lubricants: animal and vegetable origin, mineral oil, blended oils, lubricating emulsions and silicones – properties of lubricating oils: viscosity and viscosity index; Flash and fire-point, Cloud and pour point, oiliness, emulsification number, volatility, carbon residue, aniline point – semisolid lubricant: greases and waxes – solid lubricant: graphite and molybdenum disulphide –nanolubricants.

PRACTICALS

1. Testing of fuels - proximate analysis (moisture, volatile matter, ash content and fixed carbon present in coal, coke, charcoal etc)
2. Ash content and carbon residue test
3. Biodiesel synthesis by trans-esterification method (from coconut, groundnut, mustard oil, palm oil)
4. Determination of calorific value of a solid fuel using Bomb calorimeter (coal, charcoal, coke etc)
5. Determination of calorific value of a liquid fuel using Bomb calorimeter (petrol, diesel, biodiesel etc)
6. Determination of cloud point and pour point of a lubricant
7. Determination of flash and fire point of diesel.
8. Aniline Point of diesel
9. Viscosity Index of lubricants and Fuels by Viscometer
10. Flue gas analysis by Orsat's gas analysis method – Demonstration
11. Working of internal combustion engine – Demonstration

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai and Sons, New Delhi, 2001.
2. Engineering Chemistry, Wiley India Editorial Team, Willey India Publisher, New Delhi, 2011.
3. John Griswold, Fuels Combustion and Furnaces, Mc-Graw Hill Book Company Inc. University of Michigan, 1946.
4. J.B. Heywood, Internal Combustion Engine Fundamentals, McGraw Hill International Editions, 1989.
5. Bahl B.S., Tuli and Arun Bahl, Essentials of Physical Chemistry, S. Chand and Company Ltd., New Delhi, 2004.

OUTCOMES:

The students will be able to

- compare and contrast the solid, liquid and gaseous fuels and also describe the processes involved in liquid and gaseous fuels.
- analyse the fuel properties such as moisture, votalite matter, ash content, calorific value etc
- calculate minimum air required for complete combustion and calorific values of fuels.
- categorize different lubricants into three types, explain the preparation and determine their properties.

CHCX06	FUNDAMENTALS OF PHYSICAL CHEMISTRY	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students will be conversant with the

- various thermodynamic terms and relate the laws of thermodynamics in chemical processes
- molecularity and order of reaction and derive the rate constant for different order of reactions
- basics of adsorption of different materials and propose mechanisms and surface area measurement
- conditions for equilibrium and learn different components at equilibrium

MODULE I BASIC THERMODYNAMICS **8**

Introduction - Thermodynamic terms - Thermodynamic equilibrium and processes - 1st law of thermodynamics: internal energy, enthalpy, heat capacity, isothermal and adiabatic expansion, Joule-Thomson effect - Zeroth law of thermodynamics: absolute temperature - 2nd law of thermodynamics: - spontaneous and cyclic process, Entropy in isothermal, isobaric and isochoric processes, work and free energy function, Maxwell's relation - 3rd law of thermodynamics

MODULE II CHEMICAL KINETICS **8**

Rate of chemical reaction - order and molecularity of a reaction - Rate constant - kinetics of opposing, parallel and consecutive and chain reactions - isotope effects - effect of temperature on reaction rate - collision theory - absolute reaction rate theory - kinetics in enzyme catalysis

MODULE III SURFACE SCIENCE AND CATALYSIS **8**

Adsorption - adsorption isotherms - uni and bimolecular adsorption reactions - parahydrogen conversion - factors affecting adsorption – Langmuir adsorption isotherm - Hinshelwood mechanism and *Eley-Rideal* mechanism with example - adsorption of gases on solids and surface area measurement by BET method - Terms in catalysis - homogeneous and heterogeneous and enzyme catalysis with example

MODULE IV PHASE RULE **6**

Terms involved - Conditions for equilibrium - application of phase rule to water, lead-silver system, freezing mixtures, thermal analysis: cooling curves.

PRACTICALS

1. Determination of the heat capacity of benzoic acid, internal energy of combustion of camphor using Bomb calorimeter. Calculation of enthalpy of combustion and formation for camphor.
2. Determination of adsorption isotherm of (i) acetic acid on charcoal (ii) oxalic acid on charcoal.
3. *Kineticsoffirst and second order reactions.*
4. Phase rule experiments with organic compounds: (i) naphthalene and p-dichloro benzene (ii) naphthalene and diphenyl (iii) m-dinitrobenzenzene and p-nitro toluene.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Rajaram J. and Kuriacose J.C., Chemical Thermodynamics: Classical, Statistical and Irreversible, Pearson Education, India, 2013.
2. Samuel Glasstone, Thermodynamics for Chemists, Read Books, United Kingdom, 2007.
3. James E. House, Principles of Chemical Kinetics, 2nd Edition, Academic Press, United States of America, 2007.
4. Keith J. Laidler, Chemical Kinetics, Pearson Education, India, 1987.
5. Douglas M. Ruthven, Principles of Adsorption and Adsorption Processes, John Wiley & Sons, 1984.
6. Puri B.R., Sharma L.R. and Pathania M.S., Principles of Physical Chemistry, 47th Edition, Vishal Publishing Co. India, 2016.

OUTCOMES:

The student will be able to

- calculate entropy, enthalpy and free energy change for different chemical processes
- calculate the rate constant for any chemical and biochemical processes
- differentiate the adsorption processes and calculate the surface area and predict the suitability of catalysts for different chemical processes
- predict the equilibrium conditions for water, alloys, freezing mixtures and draw the thermal curves for phase transition

CHCX07	GREEN TECHNOLOGY	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make students conversant with the

- basic principles of green chemistry and green technology.
- wastes that causes hazards to human health
- chemicals that harms our environment
- need for green processes in various industries

MODULE I GREEN CHEMISTRY PROTOCOL **7**

Need – Significance – 12 Principles with examples – R4 model – Life cycle analysis – sustainable and cleaner production - Green Technology: definition, examples: CFC free refrigerants, green building, energy, 3D printers, nanotechnology – Awards for Green chemistry – organization promoting green chemistry.

MODULE II WASTE & WASTE MINIMISATION **8**

Source of wastes: domestic, industrial, medical, nuclear, e-waste; problems; prevention – economy of waste disposal – Waste minimization techniques: general waste treatment and recycling – alternate waste water treatment technologies: hybrid process – Green computing: goals, green cloud, green ICT - Pollution statistics from various industries (Industrial case studies).

MODULE III GREEN SYNTHESIS **7**

Introduction - Solvent free reactions - green reagents, green solvents in synthesis - microwave and ultrasound assisted reactions – supercritical fluid extraction – green oxidation and photochemical reactions – catalyst and biocatalysts.

MODULE IV GREEN INDUSTRIAL PROCESSES **8**

Polymer industry: biodegradable polymer - textile industry: greener approaches of dyeing, waste disposal – ecofriendly agrochemicals: biofertilizers, biopesticides – Pharmaceutical industry: atom economy, reduction of toxicity, use of biocatalyst, zero waste disposal – Leather industry: greener process in tanning, crusting, surface coating – ecofriendly batteries & fuel cells.

PRACTICALS

1. Synthesis of an ionic liquids (Ex: imidazolium) and testing the solubility of organic

chemicals.

2. Green bromination of stilbene (using pyridine hydrobromide).
3. Green synthesis: Photocatalytic reactions, solvent-free organic reaction – Aldol; green oxidation, green reduction.
4. Microwave assisted chemical reaction. (synthesis of aspirin, pinacol-pinacolone reaction, etc).
5. Comparison of conventional reaction with microwave assisted reactions (atom economy, solvent, etc) [Ex: aldehyde and ketones with hydrazines to give hydrazones].
6. Diels-Alder reaction in eucalyptus oil (green process).

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai and Sons, New Delhi. 2001.
2. V. K. Ahluwalia, Green Chemistry: Environmentally Benign Reactions, Ane Books India, New Delhi, 2006.
3. Paul Anastas, John C.Warner, John Warner Joint; Green Chemistry: Theory & Practice New Ed Edition; Oxford University press, USA, 2000.
4. Rashmi Sanghi, M. M. Srivastava, Green chemistry, Narosa publishers, New Delhi, 2003.

OUTCOMES:

The students will be able to

- outline the principles and implications of green chemistry.
- comprehend the potential risks of waste generated and analyse the threats to human and environment.
- integrate information into design of molecules to avoid/eliminate toxic solvents & reagents or reduce toxic products.
- identify various alternate greener technologies for various industries.

CHCX08	ORGANIC CHEMISTRY OF BIOMOLECULES	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make students conversant with the

- basic concepts in organic chemistry
- types and structure of carbohydrates and lipids
- formation of different structures of proteins from amino acid
- structure of nucleic acids

MODULE I BASIC CONCEPTS IN ORGANIC CHEMISTRY **8**

Classification and IUPAC nomenclature of organic compounds – stereochemistry – optical, stereo and geometrical isomerism – types of reagents: electrophiles and nucleophiles – types of reactions: addition, substitution, elimination and rearrangement reactions.

MODULE II CARBOHYDRATES, LIPIDS AND VITAMINS **7**

Structure and functions of carbohydrates: mono, di, oligo and polysaccharides – lipids: phospholipids, glycolipids, sphingolipids – cholesterol – steroids – Structure, functions and deficiency disorders of fat soluble vitamins: A, D, E & K - Water soluble vitamins B & C: Thiamine, riboflavin, pantothenic acid, niacin, pyridoxine, biotin, cobalamine, folic acid and ascorbic acid.

MODULE III AMINO ACIDS, PEPTIDES AND PROTEINS **7**

Aminoacids: classification, properties - peptides – polypeptides – proteins: primary, secondary, tertiary and quaternary structure – glycoproteins – lipoproteins – Enzymes: classification and functions

MODULE IV NUCLEIC ACIDS **8**

Nucleic acids – importance - structure of purines and pyrimidines – nucleotides – polynucleotides - RNA – types & structure - DNA – phosphodiester bonds – chemical, helical structure and functions – DNA replication – gene modification.

PRACTICALS

1. Qualitative tests to identify carbohydrates.

2. Quantitative estimation of carbohydrates.
3. Separation of sugars – TLC and/or paper chromatography.
4. Quantitative estimation of lipids.
5. Separation of amino acids – TLC and/or paper chromatography.
6. Quantitative estimation of proteins by Lowry's method.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. V. K. Ahluwalia, Organic Reaction Mechanism, Narosa Publishers, New Delhi, 2002.
2. Johnson Arthur T., Biology for Engineers, CRC Press, Finland, 2011.
3. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai and Sons, New Delhi. 2001.
4. David L. Nelson, Michael M. Cox, Lehninger Principles of biochemistry, Macmillan press, London, 2010

OUTCOMES:

The students will be able to

- classify organic compounds and explain the mechanism of various organic reactions.
- draw the structures and enumerate the functions of carbohydrate, lipids and vitamins.
- correlate the relationship among amino acids, peptides and proteins.
- recognize the role of nucleic acid in the formation of RNA & DNA and differentiate DNA & RNA using their structure and function.

CHCX09	POLYMER SCIENCE AND TECHNOLOGY	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make the student conversant with the

- basic concepts of polymers, classification, types of polymerization and molecular weight & its distribution
- preparation, properties and applications of thermoplastics and introduction to biodegradable polymers
- properties and applications of thermosets, elastomers and FRP
- different types of moulding techniques

MODULE I BASIC CONCEPTS OF POLYMERS **8**

Definitions: monomer, polymer, functionality, degree of polymerization – classification of polymers: source, structure, application, thermal processing behavior (thermoplastics and thermosets), composition and structure (addition and condensation), mechanism (chain growth and step-wise growth) – copolymer: types – Definition –nomenclature of polymers – tacticity – types of polymerization : free radical, cationic and anionic polymerization (concepts only) – average molecular weight of polymer: number, weight – molecular weight distribution (problems)

MODULE II THERMOPLASTICS AND BIODEGRADABLE POLYMERS **8**

Preparation, properties and applications : LDPE, HDPE, polypropylene, PVC, PTFE, PET, polyamides (Nylon-6 and Nylon 6,6) and polycarbonates – polymer blends and alloys – basics of biodegradable polymers.

MODULE III THERMOSET RESINS, ELASTOMERS AND FRP **7**

Thermoset resins : phenolic resins, amino resins (urea and melamine formaldehyde), epoxy resins, unsaturated polyesters – polyurethanes – elastomers : vulcanization of natural rubber, diene based elastomers –fibre reinforced plastics: glass, aramid and carbon.

MODULE IV MOULDING TECHNIQUES 7

Moulding constituents**:** functions – moulding techniques**:** compression, injection, extrusion (single screw), blow moulding, thermoforming, (mechanical and vacuum forming), lamination.

PRACTICALS

1. Determination of molecular weight and degree of polymerization using Oswald's viscometer.
2. Free radical polymerization of styrene.
3. Free radical polymerization of PMMA.
4. Preparation of phenol-formaldehyde.
5. Preparation of urea-formaldehyde.
6. Synthesis of epoxy resin.
7. Synthesis of unsaturated polyester.
8. Preparation of FRP laminates.
9. Demonstration of injection moulding, compression moulding and blow moulding.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Billmeyer F.N., Text Book of Polymer Science, 3rd Edition, John Wiley and Sons, New York, 1994.
2. George Odian, Principles of Polymerisation, 3rd Edition, McGraw Hill Book Company, New York, 1991.
3. Michael L. Berins, Plastics Engineering Hand Book, 5th Edition, Chapman and Hall, New York, 1991.
4. Jacqueline I., Kroschwitz, Concise Encyclopedia of Polymer Science and Engineering, John Wiley and Sons, New York, 1998.
5. Encyclopedia of Polymer Science and Technology, Vol. 1 to XIV, H.F. Mark and N. Gaylord, Interscience, 2nd Ed. 1988.
6. Gowarikar V.R., Viswanathan N.V and Jayadev Sreedhar, Polymer Science, Wiley Eastern Limited, Madras, 1981.

OUTCOMES:

The student will be able to

- classify various polymers, name the polymers and types of polymerization

reactions, calculate molecular weight of polymers,

- summarise preparation, properties and applications of thermoplastics and give examples of biodegradable polymers
- elaborate the properties and applications of thermosets, elastomers and FRP
- select the appropriate moulding technique for a given polymer, based on the application

Maths Elective Courses

(to be offered in IV

Semester)

MACX 01	**DISCRETE MATHEMATICS AND GRAPH THEORY**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

OBJECTIVES:

The aims of this course are to

- introduce Logical and Mathematical ability to deal with abstraction.
- familiarize the basic mathematical ideas and terminologies used in computer science.
- translate real life situations into diagrammatic representations.

MODULE I PROPOSITIONAL CALCULUS 8

Propositions – Logical connectives – Compound propositions – Conditional and biconditional propositions – Truth tables – Tautologies and contradictions – Contrapositive – Logical equivalences and implications – DeMorgan's Laws – Normal forms – Principal conjunctive and disjunctive normal forms – Rules of inference – Arguments – Validity of arguments.

MODULE II PREDICATE CALCULUS 7+3

Predicates – Statement function – Variables – Free and bound variables – Quantifiers – Universe of discourse – Logical equivalences and implications for quantified statements – Theory of inference – The rules of universal specification and generalization – Validity of arguments.

MODULE III FUNCTIONS 7+3

Functions – Classification of functions –– Composition of functions – Inverse functions – Binary and n–ary operations – Characteristic function of a set – Hashing functions – Recursive functions – Permutation functions.

MODULE IV ALGEBRAIC SYSTEMS 8+2

Groups, Cyclic Groups, Subgroups, Cosets, Lagrange's theorem, Normal subgroups – Codes and group codes – Basic notions of error correlation – Error recovery in group codes.

MODULE V GRAPH THEORY 7+3

Graphs – incidence and degree – subgraphs – isomorphism – complement of a graph – operations on graphs

MODULE VI PATH AND CIRCUIT 8+2

Walks, trails and paths – Eulerian graphs – Konigsburg bridge problem - Hamiltonian graphs

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1 Trembly J.P and Manohar R, “Discrete Mathematical Structures with Applications to Computer Science”, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, 30th Reprint 2011.

2 Kenneth H.Rosen, “Discrete Mathematics and its Applications:, 7th Edition, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, Special Indian Edition, 2011.

REFERENCES:

1 Ralph.P.Grimaldi, “Discrete and Combinatorial Mathematics: An Introduction”, 4th Edition, Pearson Education Asia, Delhi, 2007.

2 Thomas Koshy, “Discrete Mathematics with Applications”, Elsevier Publications, 2006.

3 C.L.Liu, D.P.Mohapatra, “Elements of Discrete Mathematics”, 4th Edition, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, 2012.

OUTCOMES:

At the end of the course, student will be able to

- use the concepts of propositional calculus.
- use the concepts of predicate calculus.
- identify types of functions and their importance.
- decode and encode the messages using group theory concepts.
- apply the basic concepts of graph theory.
- represent some real life situations into diagrammatic representation.

MACX 02 PROBABLITY AND STATISTICS L T P C
3 1 0 4

OBJECTIVES:

The aims of this course are to impart the

- knowledge of the theory of probability and random variables
- techniques to carry out probability calculations and identifying probability distributions
- application of statistical inference in practical data analysis

MODULE I BASICS OF PROBABILITY AND STATISTICS 8+2

Sample space, events- axioms of probability and interpretation – Addition, multiplication rules – conditional probability, Independent events - Total probability – Baye's theorem - Descriptive Statistics.

MODULE II ONE DIMENSIONAL RANDOM VARIABLE AND PROBABILITY DISTRIBUTION FUNCTIONS 7+3

Discrete random variable –continuous random variable – Expectation - probability distribution - Moment generating function – Binomial, Poisson, Geometric, Uniform (continuous), Exponential and Normal distributions.

MODULE III TWO DIMENSIONAL RANDOM VARIABLES 8+2

Joint, marginal, conditional probability distributions –covariance, correlation - transformation of random variables.

MODULE IV SAMPLING AND ESTIMATION 7+3

Sampling distributions – basic knowledge on Random , simple random , stratified and cluster samplings – Test of Hypotheses - concepts- Point estimation and Interval estimation.

MODULE V THEORY OF INFERENCE 8+2

Large sample tests – test for single and difference on proportions, single mean, difference of means, difference of variances – confidence intervals. Small sample tests – Student's t test, F test and Chi square test on theory of goodness of fit and analyses of independence of attributes.

MODULE VI DESIGN OF EXPERIMENTS 7+3

Analysis of variance – one way classification – two way classification – Completely

Randomised Block Designs – Randomised Block Design – Latin square designs - Interpretations - case studies.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. T.Veerarajan, “Probability and Statistics”, Tata McGraw-Hill Education, 2008.
2. Miller, I., Miller, M.,Freund, J. E., “Mathematical statistics”, 7th Edition, Prentice Hall International, 1999.
3. S.P.Gupta, “Applied Statistics”, Sultan Chand & Sons

REFERENCES:

1. S.M.Ross, “Introduction to Probability and Statistics for Engineers and Scientists” Fifth Edition, Elesvier.
2. S.C.Gupta and V.K.Kapoor, “Fundamentals of Mathematical Statistics” First edition, Sultan Chand and Sons.
3. Arora and Arora, “Comphrensive Statistical Methods”, S. Chand, 2007

OUTCOMES:

On completion of the course, students will be able to

- do basic problems on probability and descriptive statistics.
- derive the probability mass / density function of a random variable.
- calculate probabilities and derive the marginal and conditional distributions of bivariate random variables.
- calculate point and interval estimates.
- apply some large sample tests and small sample tests.
- carry out the data collection representation analysis and implications and the importance of inferences.

MACX 03	RANDOM PROCESSES	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aims of the course are to

- acquire the knowledge of the theory of probability and random variables
- study discrete and continuous probability distributions.
- demonstrate the techniques of two dimensional random variables and its distributions.
- introduce the random process, stationarity, Markov process and the study of correlation function and spectral analysis.

MODULE I Basics of Probability 7+3

Sample space, events- axioms of probability and interpretation – Addition, multiplication rules – conditional probability, Independent events - Total probability – Baye's theorem - Tchebychev's inequality.

MODULE II One dimensional Random variable and Probability Distribution functions 7+3

Discrete random variable –continuous random variable – Expectation - probability distribution - Moment generating function – Binomial, Poisson, Geometric, Uniform (continuous), Exponential and Normal distributions.

MODULE III Two dimensional random variables 7+3

Joint, marginal, conditional probability distributions - covariance, correlation and regression lines - transformation of random variables.

MODULE IV RANDOM PROCESSES 8+2

Classification of Random process - Stationary process - WSS and SSS processes - Poisson process – Markov Chain and transition probabilities.

MODULE V CORRELATION FUNCTIONS 8+2

Autocorrelation function and its properties - Cross Correlation function and its properties - Linear system with random inputs – Ergodicity.

MODULE VI SPECTRAL DENSITY 8+2

Power spectral Density Function - Properties - System in the form of convolution - Unit Impulse Response of the System – Weiner-Khinchine Theorem - Cross Power

Density Spectrum.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Veerarajan T., “Probability, Statistics and Random Processes”, Tata McGraw Hill,3rd edition, 2008.
2. Papoulis, “Probability, Random Variables and Stochastic Processes”, 4th Edition, Tata McGraw Hill Company, 2002.
3. S.M.Ross, “Introduction to Probability and Statistics for Engineers and Scientists” Fifth Edition, Elesvier

REFERENCES:

1. Scott L. Miller,Donald G. Childers, Probability and Random Processes, Academic Press,2009.
2. Trivedi K S, “ Probability and Statistics with reliability, Queueing and Computer Science Applications”,Prentice Hall of India,New Delhi,2nd revised edition, 2002

OUTCOMES:

On completion of the course, students will be able to

- do basic problems on probability.
- derive the probability mass / density function of a random variable.
- calculate probabilities and derive the marginal and conditional distributions of bivariate random variables.
- identify and study the different random processes.
- compute correlation functions and related identities.
- compute power spectral density functions and apply Weiner-Khinchine formula.

MACX 04 APPLIED NUMERICAL METHODS L T P C
3 1 0 4

OBJECTIVES:

The aims of the course are to

- introduce basic computational methods for analyzing problems that arise in engineering and physical sciences.
- acquire knowledge about approximation theory and convergence analysis associated with numerical computation.

MODULE I NUMERICAL SOLUTIONS OF EQUATIONS 7+3

Bisection method - Regula Falsi method – Secant method - Fixed point iteration method - Newton's Raphson method –Gauss Elimination method - Gauss-Jordon method – Gauss Jacobi method - Gauss-Seidel method.

MODULE II INTERPOLATION 8+2

Finite difference operators – Gregory Newton's forward and backward interpolations – Cubic spline interpolation - Lagrange interpolation - Newton's divided difference formula.

MODULE III NUMERICAL DIFFERENTIATION AND INTEGRATION 8+2

Numerical differentiation using Newton's forward and backward formulae – Numerical integration : Trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Gaussian Two Point and Three Point Quadrature formulae – Double integrals using Trapezoidal and Simpson's 1/3 rule.

MODULE IV INITIAL VALUE PROBLEMS FOR FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS 7+3

Numerical solutions by Taylor's Series method, Euler's method, Modified Euler's Method - Runge – Kutta Method of fourth order – Milne's and Adam's Bashforth Predictor and Corrector methods

MODULE V INITIAL AND BOUNDARY VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 8+2

Numerical solutions by Taylor's Series method - Runge – Kutta Method of fourth order of second order ODE. Finite difference methods.

MODULE VI BOUNDARY VALUE PROBLEMS FOR PARTIAL 7+3

DIFFERENTIAL EQUATIONS

Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace equation.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Grewal, B.S., “Numerical methods in Engineering and Science”, 7th edition, Khanna
   Publishers, 2007.
2. C.F.Gerald, P.O.Wheatley, “Applied Numerical Analysis” ,Pearson Education, New Delhi, 2002.

REFERENCES:

1. Chapra S.C, Canale R.P. “Numerical Methods for Engineers”, 5th Ed., McGraw Hill, 2006.
2. M.K.Jain, S.R.K.Iyengar, R.K.Jain, “Numerical methods for Scientific and Engineering Computation”, New Age International Publishers, New Delhi, 2003

OUTCOMES:

At the end of this course, students will be able to

- solve algebraic, transcendental and system of equations.
- apply interpolation techniques.
- carry out numerical differentiation and integration using different methods.
- solve first order ODE using single and multi step methods.
- solve second order ODE, initial and boundary value problems.
- solve the boundary value problems in PDE.

Maths Elective Courses
(To be offered in VI Semester)

MACX 05	MATHEMATICAL PROGRAMMING	L	T	P	C
		2	0	0	2

OBJECTIVES:

The aims of the course are to

- acquire knowledge and training in optimization techniques.
- obtain knowledge about optimization in utilization of resources.
- understand and apply operations research techniques to industrial operations.

MODULE I LINEAR PROGRAMMING PROBLEM 10

Linear programming – formulation of the problem - graphical interpretation of optimality - Simplex method – to obtain basic feasible solution – types of linear programming solution – complications and their resolution.

MODULE II ADVANCED LINEAR PROGRAMMING PROBLEMS 8

Artificial variable - Big M method – Two phase method – alternative optimal solution – unbounded solution - Duality – primal dual relationships.

MODULE III TRANSPORTATION PROBLEM 7

Transportation problems – Initial basic feasible solutions, MODI method, Unbalanced transportation problem, Degeneracy in transportation models,.

MODULE IV ASSIGNMENT PROBLEM 5

Assignment problem – Minimization and Maximization type of problems by Hungarian method.

Total Hours –30

TEXT BOOKS:

1. Hamdy A Taha, “Operations Research - An introduction”, 8th edition, Phil Pearson, 2007.
2. Winston.W.L., “Operations Research”, 4th edition, Thompson-Brooks/Cole, 2003.

REFERENCES:

1. Wayne.L. Winston, “Operations Research Applications and Algorithms”,

4th edition, Thomson learning, 2007.

2. Frederick. S. Hiller and Gerald J Lieberman, “Operations Research Concepts and Cases”, 8th edition (SIE), Tata McGraw – Hill Pub. Co. Ltd., New Delhi, 2006.
3. A. Ravindran, D. T. Phillips and J. J. Solberg, "Operations Research: Principles and Practice", 2nd edition, John Wiley & Sons, New York, 1992.
4. Robertazzi. T.G., “Computer networks and systems-Queuing theory and performance evaluation”, 3rd edition, Springer, 2002.

OUTCOMES:

At the end of the course, students will be able to

- formulate industrial problems as mathematical programming problems.
- solve linear programming problems by different methods.
- solve transportation problems by different methods.
- solve assignment problems by Hungarian method.

MACX 06	STATISTICAL METHODS FOR DATA ANALYSIS	L	T	P	C
		2	0	0	2

OBJECTIVES:

The aim of the course is to

- introduce statistical quality control tools.

MODULE I TESTS OF HYPOTHESES AND STATISTICAL INFERENCES 8

Small sample tests – Student's ' t ' test for single mean , difference of means, paired t test – F test for difference of variances – Chi square test on theory of goodness of fit and analyses of independence of attributes.

MODULE II DESIGN OF EXPERIMENTS 7

Analysis of variance – one way classification – two way classification – Completely Randomised Block Designs – Randomised Block Design – Latin square designs - Statistical analysis -Interpretations - case studies.

MODULE III STATISTICAL QUALITY CONTROL-I 8

Quality improvement and statistics –Statistical quality control- statistical process control – control charts – design of control charts –analysis of patterns on control charts - X bar chart, R chart and S chart.

MODULE IV STATISTICAL QUALITY CONTROL-II 7

Process and product control – attribute charts – P, np and C charts – control charts performance.

Total Hours –30

TEXT BOOKS:

1. Douglas C.Montgomery, George C. Runger "Applied Statistics and probability for Engineers" V Edition – John Wiley & Sons Inc.
2. Miller, I., Miller, M., Freund, J. E. "Mathematical statistics" 7th Edition. Prentice Hall International, 1999.

REFERENCES:

1. Dekking, F.M., Kraaikamp, C., Lopuhaä, H.P., Meester, L.E. "A Modern Introduction to Probability and Statistics" Springer, 2nd Edition.
2. Chin Long chiang "Statistical Methods of Analysis "World Scientific Books,

2003.
3. S.C.Gupta and V.K. Kapoor, “Mathematical Statistics” , Sultan Chand publications.
4. Veerarajan “Fundamentals of Mathematical Statistics” I Edition, Yes Dee Publishing Pvt. Ltd., 2017.

OUTCOMES:

On completion of the course, students will be able to

- develop and test hypothesis for different statistical tests
- design an experiment and case study the experiment with different data.
- analyze the industrial data using quality control design tools statistically.
- analyze the industrial data using process and product control tools statistically.

MACX 07 NUMERICAL METHODS FOR INTEGRATION AND DIFFERENTIAL EQUATIONS

L	T	P	C
2	0	0	2

OBJECTIVES:

- This course aims to solve numerically integral and differential equations.

MODULE I NUMERICAL INTEGRATION **8**

Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Two Point and Three point Gaussian quadrature formulae.

MODULE II NUMERICAL DOUBLE INTEGRATION **6**

Double integrals using trapezoidal and Simpson's 1/3 rules

MODULE III NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS **8**

Milne's Predictor and Corrector Method – Adam's Predictor-Corrector Method - Finite difference methods for two – point Boundary Value problems for Ordinary Differential Equations.

MODULE IV BOUNDARY VALUE PROBLEMS FOR PARTIAL DIFFERENTIAL EQUATIONS **8**

Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace and Poisson equations

Total Hours –30

TEXT BOOKS:

1. M.K.Jain, S.R.K.Iyengar, R.K.Jain, "Numerical methods for Scientific and Engineering Computation", New Age International Publishers, New Delhi, 2003.
2. Grewal, B.S., "Numerical methods in Engineering and Science" 7th edition, Khanna Publishers, 2007

REFERENCES:

1. C.F.Gerald, P.O.Wheatley, "Applied Numerical Analysis" Pearson Education, New Delhi 2002.
2. P.Dechaumphai, N. Wansophark, "Numerical Methods in Engineering", Narosa Publications, 2012.

OUTCOMES:

At the end of the course students will be able to

- solve the integration by numerical methods.
- solve the double integration by numerical methods
- find numerical solution of ordinary differential equations in engineering problems.
- find numerical solution of partial differential equations in engineering problems.

MACX 08 MATHEMATICAL MODELLING

L	T	P	C
3	0	0	3

OBJECTIVES:

The aims of the course are to

- provide basic idea of formation and use of Mathematical models for different purposes.
- determine the extent to which models are able to replicate real-world phenomena under different conditions

MODULE I PRINCIPLES OF MATHEMATICAL MODELING 7

Mathematics as a modelling language - Classification of models - Building, studying, testing and using models - Black and white box models – Difference equations

MODULE II PHENOMENOLOGICAL MODELS 7

Linear, Multiple linear and nonlinear regression - Neural networks - Fuzzy model - Stability and higher dimensional systems

MODULE III MECHANISTIC MODELS –I 8

Setting up ODE models – Initial and Boundary value problems - Numerical solutions - Fitting ODE to data - Applications

L	T	P	C
2	0	0	2

MODULE IV MECHANISTIC MODELS –II 8

Linear and nonlinear equations - Elliptic, parabolic and hyperbolic equations - Closed form solutions - Finite difference and finite element methods

Total Hours –30

TEXT BOOKS:

1. G . Ledder , “Calculus, modelling , probability and dynamic systems”, Springer 2013
2. Kei Velten, “Mathematical modelling and simulation”, J. Wiley and sons,2009

REFERENCES:

1. Michael D Alder, “An introduction to Mathematical modelling”, Heaven for Books.com
2. Alfio Quarteroni, “Mathematical models in science and engineering”, Notices of AMS
3. J.N. Kapur, “Mathematical models in Biology and Medicine”, Affiliated East-

West Press Private Limited, New Delhi, 1992.

OUTCOMES:

On completion of the course, the students will be able to

- identify the relationship between real world and mathematical models
- Classify the data and choose the appropriate model
- Distinguish between linear and nonlinear models
- identify the relationship between empirical and mechanistic models

MACX 09 **GRAPH THEORY** **L T P C**

3 0 0 3

OBJECTIVES:

The aims of this course are to

- represent the real life situations diagrammatically.
- appraise different methods to find solutions to graph theory problems.

MODULE I INTRODUCTION TO GRAPH THEORY **8**

Graphs - finite and infinite graphs - Incident and degree-isolated vertex, pendent vertex and null vertex.

MODULE II PATH AND CIRCUIT **8**

Isomorphism – sub graphs-walks, paths and circuits – connected and disconnected graphs- Euler graphs – operation on a graph.

MODULE III TREES AND FUNDAMENTAL CIRCUITS **7**

Trees- some properties of trees- pendent vertices in a tree – rooted binary tree-spanning trees-fundamental circuits.

MODULE IV CUT SETS AND CUT VERTICES

Cut sets – some properties of cut sets- fundamental circuits and cut sets-network flows.

Total Hours –30

TEXT BOOKS:

1. NARSINGH DEO, Graph theory with applications to Engineering and Computer Science, Prentice Hall INC, New Delhi,
2. J.A. Pondy and U.S.R. Murthy, North Holland, Oxford, New York Graph theory with applications

REFERENCES:

1. Trembly J.P and Manohar R, “Discrete Mathematical Structures with Applications to Computer Science”, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, 30th Reprint 2011
2. Kenneth H.Rosen, “Discrete Mathematics and its Applications”, 7th Edition, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, Special Indian Edition, 2011

3. Md. Saidur Rahman, “Basic graph theory”, Springer, 2017

OUTCOMES:

At the end of the course, students will be able to

- demonstrate the basic concepts of Graph theory.
- explore connected and disconnected graphs.
- identify the real life problems with trees and circuits.
- bring out the cut set properties and network flows properties.

Humanities Elective I

(To be offered in III Semester)

		L	T	P	C
SSCXO1	**FUNDAMENTALS OF ECONOMICS**	**2**	**0**	**0**	**2**

OBJECTIVES:

- To identify and present the basic concepts of demand, supply and equilibrium.
- To explain and discuss the types and concepts of national income and inflation.
- To illustrate the fundamental concepts of money, banking and public finance.
- To apprise the students about Indian economy and the role of engineers in economic development.

MODULE I DEMAND AND SUPPLY ANALYSIS 8

Classification of economy – open and closed economy, Demand - Types of demand - Determinants of demand – Law of Demand - Demand elasticity - Supply - Determinants of Supply – Law of Supply - Supply elasticity - Pricing strategies.

MODULE II NATIONAL INCOME AND INFLATION 7

Concepts of National income and measurement – Importance and difficulties of estimating National Income in India - Aggregate demand and aggregate supply, Macroeconomic equilibrium – meaning of inflation- types - causes and preventive measures

MODULE III MONEY, BANKING AND PUBLIC FINANCE 9

Money – Meaning, types, functions, importance - Commercial Banks - Central Bank - Monetary policy – meaning, objectives, Methods of Credit Control By RBI, Government Budget – Government revenue and Expenditures – Fiscal policy - Its objectives, instruments and limitations - Deficit Financing - The Fiscal Responsibility and Budget Management Act, 2003 (FRBMA) .

MODULE IV INDIAN ECONOMY AND THE ROLE OF ENGINEERS 6

Economic reforms – Liberalization, Privatization and Globalization - challenges and opportunities, Engineers – Engineers' contributions to the economic growth.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Dutt and Sundharam (2013), *Indian Economy*, S. Chand & Company Pvt. Ltd, New Delhi.
2. Hussain, Moon Moon (2015), *Economics for Engineers*, Himalaya Publishing House, New Delhi.

REFERENCES:

1. Cleaver Tony (2004), "*Economics: The Basics*", Routledge, London.
2. Mell Andrew and Walker Oliver (2014), "*The Rough Guide to Economics*", Rough Guide Ltd.

OUTCOMES:

On successful completion of this course,

- Students will have had exposure to the basic concepts of demand, supply and various pricing strategies.
- Students will have understood the macroeconomic concepts of national income and inflation.
- Students will be able to apply the knowledge of money, banking and public finance in their real life situations.
- Students will have an overview of the economic reforms introduced in Indian economy.

SSCXO2 PRINCIPLES OF SOCIOLOGY.

L	T	P	C
2	0	0	2

OBJECTIVES:

- To acquaint the students with Concepts and perspectives of Sociology
- To explain the reflection of society in Individuals and vice versa
- To describe the hierarchical arrangement of individuals and groups in society
- To explicate the dimensions, forms and factors of Social change.
- To examine the context, impact and agencies of Globalization

MODULE I THE FOUNDATIONAL CANON 8

Sociology-Definition, scope and importance; Major theoretical perspectives- Functionalism, Conflict Theorising and Interactionism; Elements of social formation- Society, Community, Groups and Association; Associative Social Process- Co-operation, Accommodation and Assimilation; Dissociative Social Process- Competition and Conflict.

MODULE II INDIVIDUAL AND SOCIETY 7

Culture-definition, characteristics, functions, types, cultural lag and civilization, Socialization – definition, process, stages, agencies and anticipatory socialization; Social Control- definition, characteristics, importance, types & agencies.

MODULE III SOCIAL INEQUALITY AND STRATIFICATION 7

Concepts- inequality, hierarchy, differentiation, Social Exclusion, and Social Stratification. Forms of Social Stratification- Caste, Class and Estate. Gender and Social Stratification- sex and gender, patriarchy, factors perpetuating gender stratification; Globalization and gender inequality

MODULE IV SOCIAL CHANGE AND GLOBALIZATION 8

Social Change-definition, nature, direction; Forms- evolution, development, progress and transformation; Factors of social change- demography, economy, technology, polity and culture. Globalization- definition, characteristics, historical and social context and Impact, agencies of globalization- IGOs, INGOs, Nation-State, MNEs and Media

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Giddens A. 1989. “Sociology” Cambridge: Polity Press.

2. Heald Haralambos, R.M(2014) . ‘‘Sociology Themes and Perspectives”, Oxford, New Delhi-92
3. Bhushan Vidya and D.R. Sachdeva (2012). ‘‘Fundamental of Sociology”, Pearson, Delhi.

REFERENCES:

1. Das Gupta, Samir and Paulomi Saha (2012), ‘‘An Introduction to Sociology”, Pearson, Delhi
2. Bottomore, T.B. 1972. *Sociology- A Guide to Literature and Problems*, New Delhi,

OUTCOMES:

On successful completion of this course,

- Students will have exposure to the fundamentals tenets of Sociology.
- Students will be trained to understand social reality with sociological perspective.
- Students will be oriented to constructively analyze human interactions, social relationship and social issues
- Students will gain exposure to the dynamics of human society with special reference to the contemporary trends of globalization.

SSCXO3	SOCIOLOGY OF INDIAN SOCIETY.	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To present a portrayal of the components of the Indian Social structure
- To describe the nature and contemporary structure of Indian social Institutions.
- To examine the causality and magnitude of social problem facing the contemporary India.
- To elucidate the processes forms and impact of change and development in Indian society

MODULE I INDIAN SOCIAL STRUCTURE 7

Unity and Diversity; Concepts of unity and diversity- racial, religious, ethnic and linguistic composition of India. Types of communities-rural, urban and tribal; Social backwardness- OBC, SC and ST; Indian minorities- religious, ethnic, linguistic and LGBT

MODULE II INDIAN SOCIAL INSTITUTIONS 7

Family- definition, types, characteristics, functions of family; Joint Family- definition features, utility, changes; Marriage- definition, characteristics, marriage as sacrament or contract. Caste- definition, principles, contemporary changes, dominant caste, caste -class interface.

MODULE III SOCIAL PROBLEMS IN INDIA 8

Social Problem-definition, nature, social disorganization; Population explosion-causes, effects, relationship with development; Child Labour- causes, magnitude and consequences; Unemployment-nature , types, causes and effects; Gender issues-social status of women, violence against women and women in work place; Contemporary issues- communalism, terrorism and corruption.

MODULE IV SOCIAL CHANGE AND DEVELOPMENT IN INDIA 8

Socio-cultural Change- Sanskritization, Westernization, Secularization, Modernization; Processes of Social change- Industrialization, Urbanization, Globalization; Development- definition, elements, role of government, industry and corporate sector. Technology and change- invention and innovation, impact of technology on social institutions, technology and development.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Sharma,K.L.2008. *Indian Social Structure and Change*. Jaipur: Rawat Publications,.
2. Shah, A.M. 1998. *The Family in India: Critical Essays*. New Delhi: Orient Longman,
3. Ahuja Ram. 1999. *Social problems in India*, Rawat Publication: New Delhi.
4. Ahuja Ram. 2014. *Society in India,*, Rawat Publication: New Delhi.

REFERENCES:

1. Jayapalan, N.(2001), **"**Indian Society and Social Institutions" Atlantic Publishers & Distri,
2. Atal, yogesh (2006), "Changing Indian Society" Rawat Publications, Jaipur

OUTCOMES:

On successful completion of this course,

- Students will gain an in-depth understanding of the social structure and social institutions that constitute society in India.
- Students will be sensitized to the various categories ,Inequalities and their challenges
- Students will be exposed to the social problems encountered in contemporary India.
- Students will gain knowledge about the various forms and trends of the social change.
- Students will become aware about the challenges in the path of progress of Indian society and realize relevance of their role in bringing about development

Humanities Elective II

(To be offered in IV Semester)

		L	T	P	C
SSCXO4	**ECONOMICS OF SUSTAINABLE DEVELOPMENT**	**2**	**0**	**0**	**2**

OBJECTIVES:

- To have an increased awareness on the concept and components of sustainable development.
- To develop the ability to demonstrate the need of sustainable development and international responses to environmental challenges.
- To have an insight into global environmental issues and sustainable globalization.
- To establish a clear understanding of the policy instruments of sustainable development.

MODULE I CONCEPT OF SUSTAINABLE DEVELOPMENT 7

Evolution of the Concept – Rio Summit and sustainable development - various definitions of sustainable development - Components of sustainable development: Social, environmental and economic components.

MODULE II NEED FOR SUSTAINABLE DEVELOPMENT 8

Need for sustainability – Global environmental challenges: population growth, resource depletion, pollution, energy use, climate change, pollution, growing water scarcity, other urban problems, loss of biodiversity, hazardous wastes disposal.International responses to environmental challenges - Global policy such as Kyoto Protocol, Montreal Protocol, Basel Convention.

MODULE III GLOBALIZATION AND ENVIRONMENT SUSTAINABILITY 8

Impact of Globalization on sustainable development, Co - existence of globalization and Environment sustainability, Globalization and Global Governance.Green economy - Renewable energy, sustainable transport, sustainable construction, land and water management, waste management.

MODULE IV POLICIES FOR ACHIEVING SUSTAINABLE DEVELOPMENT 7

Principles of environmental policy for achieving sustainable development: precautionary principle and polluter pays principle – Business Charter for Sustainable Development.Policy instruments for sustainable development: direct regulation – market based pollution control instruments such as pollution tax, subsidy, pollution permits.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Anderson, David A (2010), "*Environmental Economics and Natural Resource Management*", Routledge, 3rd edition.
2. Karpagam M (1999), "*Environmental Economics: A Textbook*", Sterling Publishers Pvt. Ltd, New Delhi.

REFERENCES:

1. Karpagam M and Jaikumar Geetha (2010), "*Green Management Theory and Applications*", Ane Books Pvt. Ltd, New Delhi.
2. Sengupta Ramprasad (2004), "*Ecology and Economics: An Approach to Sustainable Development*", Oxford University Press, New Delhi.

OUTCOMES:

On successful completion of this course,

- The students will have understood the concepts and components of sustainable development.
- The students will have a holistic overview on the challenges of sustainable development and International responses to environmental challenges.
- The students will have gained knowledge on the global environment issues and demonstrate responsible globalization through global governance.
- The students will have developed awareness of the ethical, economic, social and political dimensions that influence sustainable development.

SSCXO5 INDUSTRIAL SOCIOLOGY

L	T	P	C
2	0	0	2

OBJECTIVES:

- To introduce sociological approaches and perspectives to understand the social relationship in manufacturing industries and corporate sector.
- To explain the structure and functions of industrial organizations.
- To elucidate the dynamics of organizational behavior, leadership and communication.
- To inculcate professional ethics and values to equip students to work in organizational settings.

MODULE I INTRODUCTION 8

Industrial Sociology- definition, scope and importance; Theoretical approaches- scientific management, human relations approach, theory of bureaucracy, Fordism and post-fordism; Production system- concept and characteristics of factory system, automation and rationalization; Industrial conflict- strike , lockout and trade unions.

MODULE II INDUSTRIAL ORGANIZATION 7

Formal organization- definition, features, utility; Informal organization- definition, characteristics, types and relevance; Structure of industrial organization- features and functions of line organization, characteristics and roles of staff organization, distinction;

Industrial hierarchy-white collar, blue collar, supervisors and managers.

MODULE III DYNAMICS OF INDUSTRIAL RELATIONS 8

Group dynamics- Definition, Group behaviour model, Group decision making process, group cohesiveness; Leadership- definitions, style and effective supervision; Communication- concepts, types, model barriers; Job satisfaction- nature, employee compensation and job satisfaction.

MODULE IV PROFESSIONAL ETHICS AND VALUES 7

Concepts- values- morals, and ethics, Integrity, work ethics , service learning - Civic Virtue - caring - Sharing - Honesty - Courage - Valuing Time - Co-operation - commitment - empathy - Self-Confidence - Environmental Ethics, Cyber issues - computer ethics, cyber crimes, plagiarism Ethical living-concept of harmony in life.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Narender Singh, Industrial Sociology, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2012.
2. Gisbert Pascal, Fundamentals of Industrial Sociology, Tata Mc. Graw Hill Publishing Co., New Delhi, 1972
3. Schneider Engeno. V, Industrial Sociology 2nd Edition, Mc. Graw Hill Publishing Co., New Delhi, 1979.

REFERENCES:

1. Robbins, Stephen, Organizational Behaviour , Prentice Hall of India PVT ltd new Delhi, 1985
2. Devis Keith , Human Behaviour at work place, Mc. Graw Hill Publishing Co., New Delhi,1984

OUTCOMES:

On successful completion of this course,

- Students will have acclimatized with sociological perspectives for dealing with social relationships in production and service organizations.
- Students will be familiar with structure of authority, roles and responsibility in organizational settings.
- Students will imbibe leadership, communication and behavioral acumen to govern organization
- Students will be sensitized to standards of desirable behavior to engage in industrial and corporate sector.

SSCXO6	LAW FOR ENGINEERS	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To understand the Constitution and Governance of our country.
- To apprise the students of human rights - local and international and redressal mechanism.
- To have an insight into the industrial, corporate and labour laws of our country.
- To establish a clear understanding about the importance of intellectual property related laws.

MODULE I INDIAN CONSTITUTION AND GOVERNANCE 8

Constitution – salient features, Preamble, Citizenship, Fundamental rights, Fundamental duties, Directive principles, Union executive, Legislature – Union – State and union territories – Election Commission – Election for parliament and state legislature, Judiciary- basic functioning of the Supreme Court and High Courts, Right to information Act 2005 – evolution – concept – practice.

MODULE II HUMAN RIGHTS 7

Human rights – meaning and significance, Covenant on civil and political rights, Covenant on Economic, Social and Cultural rights, UN mechanism and agencies, The Protection of Human Rights Act, 1993 – watch on human rights and enforcement.

MODULE III INDUSTRIAL, CORPORATE AND LABOUR LAWS 8

Corporate laws – meaning and scope, Companies Act 1956 – Indian Contract Act 1872 - Principles of Arbitration - Industrial Employment (Standing Orders) Act 1946 - Industrial Disputes Act 1947 - Workmen's Compensation Act 1923 - The Factories Act, 1948.

MODULE IV LAWS RELATED TO IPR 7

IPR – meaning and scope, International organization – WIPO – TRIPS, Major Indian IPR Acts – Copyright laws, Patent and Design Act, Trademarks Act, Trade Secret Act, Geographical Indicator.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. M.P. Jain (2005) *Indian Constitutional Law*, Wadhwa & Co.

2. H. D, Agarwal (2008), *International Law and Human Rights,* Central Law Publications,
3. Rao, Meena (2006), *Fundamental Concepts in Law of Contract*, 3rd edn., Professional offset.
4. Ramappa (2010), *Intellectual Property Rights Law in India*, Asia Law House.
5. Singh, Avtar (2007), *Company Law*, Eastern Book Co.
6. R.F, Rustamji (1967)*, Introduction to the Law of Industrial Disputes*, Asia Publishing House.

REFERENCES:

1. Acts: Right to Information Act, Industrial Employees (standing order) Act, Factories Act, Workmen Compensate Act.

OUTCOMES:

On successful completion of this course,

- Students will `be able to apply the basic concepts of Indian Constitution, Governance and power in their real life situation.
- Students will have gained knowledge in human rights, cultural, social and political rights.
- Students will have synthesized knowledge about industrial, corporate and labour laws of our country.
- Students will have an overview of IPRs and laws related to Intellectual Property Rights.

B.S. Abdur Rahman Crescent Institute of Science & Technology

Deemed to be University u/s 3 of the UGC Act, 1956

REGULATIONS 2017

CURRICULUM AND SYLLABI

B.TECH.

AERONAUTICAL ENGINEERING

DEPARTMENT OF AEROSPACE ENGINEERING
VISION AND MISSION

VISION

Department of Aerospace Engineering aspires to be a center of excellence in Aerospace Engineering Education, Training and Research and contribute for the development of Aerospace Technology.

MISSION

- To provide quality education and training in Aerospace Engineering to bring out motivated and capable aerospace engineers and scientists.
- To create stimulating environment and supportive infrastructure for research and scholarly development in Aerospace and related areas.
- To undertake collaborative research with Aerospace and related industries to solve problems of interest.
- To provide analytical skills, leadership quality and team sprit through balanced curriculum and a judicial mix of co-curricular, extra-curricular and professional society activities.

PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES
B.TECH. (AERONAUTICAL)

PROGRAMME EDUCATIONAL OBJECTIVES

- To provide fundamental knowledge in science, engineering and technology relating to Aeronautical/Aerospace Engineering.
- To impart adequate knowledge and skills required for aircraft/aerospace industry, research organization and advance their careers and achieve positions of increasing responsibility, and/ or pursue entrepreneurial endeavors.
- To develop the technical expertise in design, analysis, manufacturing and maintenance management of flight vehicles and their components.
- To provide exposure to the advancements in aeronautical science and engineering and related fields.
- To inculcate a sense of commitment to the profession through involvement with the community and professional organization.

PROGRAMME OUTCOMES

The graduates will be able to

- Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- Identify, formulate, research literature, and analyses complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- Use research –based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.

- Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- Recognize the need for, and have the preparation and ability to engage• in independent and life-long learning in the broadest context of technological
- Formulate and solve problems in Aeronautical Engineering using the knowledge acquired in core areas of aerodynamics, aircraft structures, propulsion, materials, flight dynamics and avionics.
- Design aircraft systems, components and processes to meet desired needs within realistic constraints.

B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE AND TECHNOLOGY

B.TECH. AERONAUTICAL ENGINEERING

CURRICULUM & SYLLABUS, REGULATIONS 2017

SEMESTER I

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	BS	MAC 1181	Differential Calculus and Geometry	3	1	0	4	
2.	HS	ENC 1181/ ISC 1181/ LNC 1181/ LNC 1182 / LNC 1183	English / Arabic / Mandarin / German / Japanese	3	0	0	3	
3.	BS	PHC 1181	Physics	3	0	2	4	
4.	BS	CHC 1181	Chemistry	3	0	2	4	
5.	ESF	GEC 1101	Engineering Graphics	2	0	2	3	
6.	ESF	GEC 1102	Engineering Design	2	0	0	2	
7.	ESF	GEC 1103	Basic Engineering Practices Laboratory	0	0	2	1	
8.	ESF	GEC 1104	Computer Programming I	1	0	2	2	**23**

SEMESTER II

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	BS	MAC 1281	Advanced Calculus	3	1	0	4
2.	BS	-	Physics Elective	2	0	2	3
3.	BS	-	Chemistry Elective	2	0	2	3
4.	ESF	GEC 1211	Basic Engineering Mechanics	3	1	0	4
5.	BS	GEC 1212	Environmental Studies	2	0	0	2
6.	ESF	GEC 1213	Computer Programming II	1	0	2	2

7.	EC	AEC 1211	Introduction to Aeronautical Engineering	3	0	0	3	
8.	EC	AEC 1212	Aircraft Component Modeling & Drafting Lab	0	0	3	1	
9.	EC	AEC 1213	Aircraft Structure Repair Lab	0	0	3	1	**23**

SEMESTER III

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	BS	MAC 2181	Partial Differential Equations and Transforms	3	1	0	4	
2.	HS	-	Humanities Elective I	2	0	0	2	
3.	HS	ENC 2181	Oral Communication	0	0	3	1	
4.	EC	AEC2101	Solid Mechanics	3	0	0	3	
5.	EC	AEC2102	Thermodynamics	3	1	0	4	
6.	EC	AEC2103	Fluid Mechanics	3	0	0	3	
7.	EC	EIC2181	Basic Electrical & Electronics Engg	3	0	0	3	
8.	EC	AEC2104	Thermodynamics Lab	0	0	3	1	
9.	EC	AEC2105	Fluid Mechanics Lab	0	0	3	1	
10.	EC	EIC2182	Electrical & Electronics Engg Lab	0	0	3	1	**23**

SEMESTER IV

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	BS	-	Mathematics Elective I	3	1	0	4
2.	HS	-	Humanities Elective II	2	0	0	2
3.	HS	ENC 2282	Written Communication	0	0	3	1
4.	EC	AEC2211	Low Speed Aerodynamics	3	0	0	3
5.	EC	AEC2212	Aircraft Structural Mechanics	3	1	0	4

6.	EC	AEC2213	Air Breathing Propulsion	3	0	0	3	
7.	EC	AEC2214	Aircraft Systems & Instruments	3	0	0	3	
8.	EC	AEC2215	Solid Mechanics Lab	0	0	3	1	
9.	EC	AEC2216	Aircraft Systems & Instruments Lab	0	0	3	1	
10.	EC	AEC2217	Propulsion Lab	0	0	3	1	**23**

SEMESTER V

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	MS	MSC 3181/ MSC 3182	Leadership & CEO training / Social Entrepreneurship	3	0	0	3	
2.	GE	-	General Elective I	3	0	0	3	
3.	HS	ENC3181	Communication & Soft Skill I Career Choice	0	0	3	1	
4.	EC	AEC3101	Design of Compressors & Turbines	2	0	0	2	
5.	EC	AEC3102	Aircraft Structural Analysis	3	1	0	4	
6.	EC	AEC3103	High Speed Aerodynamics	3	0	0	3	
7.	EC	-	Electives	6	0	0	6	
8.	EC	AEC3104	Aerodynamics Lab	0	0	3	1	
9.	EC	AEC3105	Aircraft Structural Analysis Lab	0	0	3	1	**24**

SEMESTER VI

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	MS	MSC 3181/ MSC 3182	Leadership & CEO training / Social Entrepreneurship	3	0	0	3
2.	BS	-	Mathematics Elective II	2	0	0	2

3.	HS	ENC3281	Communication and Soft skill II Confidence Building	0	0	3	1	
4.	EC	AEC3211	Rocket Propulsion	3	0	0	3	
5.	EC	AEC3212	Flight Dynamics	3	0	0	3	
6.	EC	AEC3213	Aircraft Materials	3	0	0	3	
7.	EC	-	Electives	6	0	0	6	
8.	EC	AEC3214	Aircraft Design Project - I	1	0	3	2	**23**

SEMESTER VII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	GE	-	General Elective II	3	0	0	3	
2.	EC	AEC4101	Avionics (Lab Integrated)	3	0	3	4	
3.	EC	AEC4102	Finite Element Method	3	0	0	3	
4.	EC	AEC4103	UAV/MAV Systems	1	0	3	2	
5.	EC	-	Electives	7	0	0	7	
6.	EC	AEC4104	Aircraft Design Project – II	1	0	3	2	
7.	EC	AEC4105	CFD-Structural Analysis Lab	0	0	3	1	
8.	EC	AEC4106	Internship	0	0	*	1**	**23**

SEMESTER VIII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	EC	AEC4211	Project Work	0	0	24	12	**12**

Total credits – 174

* 15 days

** Industrial training will be undertaken during third year summer vacation.
The credit will be awarded in the 7th Semester.

PROGRAMME ELECTIVES

ODD SEMESTER ELECTIVES

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	AECX01	Flow Diagnostics	2	0	0	2
2.	PE	AECX02	Hypersonic Aerodynamics	3	0	0	3
3.	PE	AECX03	Industrial Aerodynamics	3	0	0	3
4.	PE	AECX04	Grid Generation	2	0	0	2
5.	PE	AECX05	Wind Tunnel Model Design	1	0	0	1
6.	PE	AECX06	Theory of Elasticity	3	0	0	3
7.	PE	AECX07	Fatigue and Fracture	3	0	0	3
8.	PE	AECX08	Structural Analysis Tools (NASTRAN and PATRAN)	2	0	0	2
9.	PE	AECX09	Smart Structures	1	0	0	1
10	PE	AECX10	Aircraft Structural Testing and Qualification	1	0	0	1
11	PE	AECX11	Measurement Systems	2	0	0	2
12	PE	AECX12	NDT techniques for Aircraft Structures	1	0	0	1
13	PE	AECX13	Airframe Repair & Maintenance	3	0	0	3
14	PE	AECX14	Behavior of Materials at High Temperatures	3	0	0	3
15	PE	AECX15	Heat Transfer	3	0	0	3
16	PE	AECX16	Advanced Propulsion Systems	3	0	0	3
17	PE	AECX17	Micro Propulsion	1	0	0	1
18	PE	AECX18	Cryogenics	2	0	0	2
19	PE	AECX19	Air Traffic Control and Aerodrome Design	3	0	0	3

2(	PE	AECX20	Aviation Rules and Regulation	3	0	0	3

EVEN SEMESTER ELECTIVES

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	AECX21	Experimental Aerodynamics	3	0	0	3
2.	PE	AECX22	Introduction to CFD	3	0	0	3
3.	PE	AECX23	Viscous Flows	3	0	0	3
4.	PE	AECX24	Aero-acoustics	1	0	0	1
5.	PE	AECX25	Wind Engineering	3	0	0	3
6.	PE	AECX26	Composite Materials and Structures	3	0	0	3
7.	PE	AECX27	Experimental Stress Analysis	3	0	0	3
8.	PE	AECX28	Theory of Vibration	3	0	0	3
9.	PE	AECX29	Hyper Mesh	2	0	0	2
1(	PE	AECX30	Aviation Fuels and Combustion	3	0	0	3
1:	PE	AECX31	Rockets and Missiles	3	0	0	3
1:	PE	AECX32	Design of Power Plants for Aircrafts	3	0	0	3
1:	PE	AECX33	Aircraft Cooling Systems	1	0	0	1
1-	PE	AECX34	Aircraft General Engineering Maintenance	2	0	0	2
1:	PE	AECX35	Product Development and 3D Printing Technologies	2	0	0	2
1(	PE	AECX36	Advanced Manufacturing Technologies	2	0	0	2
1:	PE	AECX37	Aircraft Navigation & Guidance	3	0	0	3
1:	PE	AECX38	Control Engineering	3	0	0	3
1:	PE	AECX39	Microprocessor & Microcontroller for Aircraft	2	0	0	2

			Systems				
2(	PE	AECX40	Mathematical Modeling & Simulation (MATLAB)	2	0	0	2

Physics Elective Courses

(To be offered in II Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	PHCX 01	Fundamentals of Engineering Materials	2	0	2	3
2.	PHCX 02	Heat and Thermodynamics	2	0	2	3
3.	PHCX 03	Introduction to Nanoscience and Technology	2	0	2	3
4.	PHCX 04	Lasers and their applications	2	0	2	3
5.	PHCX 05	Materials Science	2	0	2	3
6.	PHCX 06	Non-Destructive Testing	2	0	2	3
7.	PHCX 07	Properties of Matter and Acoustics	2	0	2	3
8.	PHCX 08	Properties of Matter and Nondestructive Testing	2	0	2	3
9.	PHCX 09	Semiconductor Physics and Optoelectronics	2	0	2	3

Chemistry Elective Courses

(To be offered in II Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	CHCX01	Analytical Instrumentation	2	0	2	3
2.	CHCX02	Corrosion and its Control	2	0	2	3
3.	CHCX03	Electrical Materials and Batteries	2	0	2	3
4.	CHCX04	Engineering Materials	2	0	2	3
5.	CHCX05	Fuels and Combustion	2	0	2	3
6.	CHCX06	Fundamentals of Physical Chemistry	2	0	2	3
7.	CHCX07	Green Technology	2	0	2	3
8.	CHCX08	Organic Chemistry of Biomolecules	2	0	2	3
9.	CHCX09	Polymer Science and Technology	2	0	2	3

Maths Elective Courses

(To be offered in IV Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	MACX 01	Discrete Mathematics And Graph Theory	3	1	0	4
2.	MACX 02	Probability And Statistics	3	1	0	4
3.	MACX 03	Random Processes	3	1	0	4
4.	MACX 04	Applied Numerical Methods	3	1	0	4

Maths Elective Courses

(To be offered in VI Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	MACX 05	Mathematical Programming	2	0	0	2
2.	MACX 06	Statistical Methods for Data Analysis	2	0	0	2
3.	MACX 07	Numerical Methods for Integral and Differential Equations	2	0	0	2
4.	MACX 08	Mathematical Modelling	2	0	0	2
5.	MACX 09	Graph Theory	2	0	0	2

Humanities Elective I

(To be offered in III Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	SSCX01	Fundamentals of Economics	2	0	0	2
2.	SSCX02	Principles of Sociology	2	0	0	2
3.	SSCX03	Sociology of Indian Society	2	0	0	2

Humanities Elective II

(To be offered in IV Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	SSCX04	Economics of Sustainable Development	2	0	0	2
2.	SSCX05	Industrial Sociology	2	0	0	2
3.	SSCX06	Law for Engineers	2	0	0	2

General Elective

Group I Courses

(To be offered in V semester)

Sl. No.	Course Code	Course Title	Offering Department
1.	GECX101	Disaster Management	Civil
2.	GECX102	Total Quality Management	Mechanical
3.	GECX103	Energy Studies	Mechanical
4.	GECX104	Robotics	Mechanical
5.	GECX105	Transport Management	Automobile
6.	GECX106	Control Systems	EEE
7.	GECX107	Introduction to VLSI Design	ECE
8.	GECX108	Plant Engineering	EIE
9.	GECX109	Network Security	CSE
10.	GECX110	Knowledge management	CSE
11.	GECX111	Cyber security	IT
12.	GECX112	Genetic Engineering	LS
13.	GECX113	Fundamentals of Project Management	CBS
14.	GECX114	Operations Research	Mathematics
15.	GECX115	Nano Technology	Physics / Chemistry
16.	GECX116	Vehicle Maintenance	Automobile
17.	GECX117	Fundamentals of Digital Image Processing	ECE

Group II Courses

(To be offered in VII semester)

Sl. No.	Course Code	Course Title	Offering Department
1.	GECX201	Green Design and Sustainability	Civil
2.	GECX202	Appropriate Technology	Civil / Mechanical
3.	GECX203	Engineering System Modelling and Simulation	Mechanical
4.	GECX204	Value Analysis and Engineering	Mechanical
5.	GECX205	Industrial Safety	Mechanical
6.	GECX206	Advanced Optimization Techniques	Mechanical
7.	GECX207	Mat Lab Simulation	EEE
8.	GECX208	Embedded Systemsand its Applications	ECE
9.	GECX209	Usability Engineering	CSE
10.	GECX210	Supply Chain Management	CBS
11.	GECX211	System Analysis and Design	CA
12.	GECX212	Advanced Materials	Physics & Chemistry
13.	GECX213	National Service Scheme	School of Humanities
14.	GECX214	Automotive Pollution and Control	Automobile
15.	GECX215	Motor Vehicle Act, Insurance and Policy	Automobile
16.	GECX216	Principles of Communication Systems	ECE
17.	GECX217	Lean Management	Civil
18.	GECX218	Spatial Data Modeling & Analysis	Civil

SEMESTER I

SEMESTER I

		L	T	P	C
MAC 1181	**DIFFERENTIAL CALCULUS AND GEOMETRY**	**3**	**1**	**0**	**4**

OBJECTIVES:

The aims of this course are to

- introduce eigen values and eigenvectors of matrix algebra.
- make the student knowledgeable in the area of Three Dimensional Analytical Geometry.
- demonstrate the application of Differential Calculus.
- familiarize the student with the functions of several variables.
- develop the use of ODE solvable techniques necessary for engineering applications.
- motivate the students with some basic engineering application problems in ODE.

MODULE I **MATRICES** **8+2**

Characteristic Equation- Eigenvalues and Eigenvectors of a real matrix –Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton Theorem (without proof) – Orthogonal matrices – orthogonal transformations of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation.

MODULE II **THREE DIMENSIONAL ANALYTICAL GEOMETRY** **7+3**

Direction cosines and ratios – angle between two lines – equations of a plane – equations of a straight line, coplanar lines - shortest distance between skew lines - sphere – tangent plane – plane section of a sphere – orthogonal spheres.

MODULE III **DIFFERENTIAL GEOMETRY** **7+3**

Curvature – Cartesian and polar coordinates – centre and radius of curvature – circle of curvature – involutes and evolutes – envelopes.

MODULE IV **DIFFERENTIAL CALCULUS OF SEVERAL VARIABLES** **8+2**

Functions of two variables – partial derivatives – total differential – Implicit Functions – Jacobian - Taylor’s series expansion – Optima of two variables – Lagrange’s

multiplier method.

MODULE V **ORDINARY DIFFERENTIAL EQUATIONS** **8+2**

Linear equations of second order with constant and variable coefficients – Simultaneous first order linear equations with constant coefficients – homogeneous equations of Euler's type – method of undetermined coefficients, method of variation of parameters

MODULE VI **APPLICATIONS OF ORDINARY DIFFERENTIAL EQUATIONS** **7+3**

Solution of Ordinary Differential Equation Related to Electric Circuits – Bending of Beams- Motion of a Particle in a resisting medium – Simple harmonic motion.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Ramana, B.V, "Higher Engineering Mathematics" Tata McGraw Hill Publishing Co. New Delhi, 2006.
2. Grewal B.S., "Higher Engineering Mathematics" (43rd edition), Khanna Publishers, New Delhi, 2012.
3. John W. Cell "Engineering Problems Illustrating Mathematics" Mc Graw Hill Publishing Co., New York 1943.

REFERENCES:

1. Veerarajan.T., "Engineering Mathematics" (5th edition) Tata Mc Graw Hill Publishing Co. New Delhi, 2012
2. Kreyszig, E., "Advanced Engineering Mathematics", 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
3. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th edition, Cengage Learning, 2011.
4. Dennis G. Zill, Warren S. Wright, "Advanced Engineering Mathematics", 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
5. Alan Jeffrey, "Advanced Engineering Mathematics", Academic Press, USA, 2002.
6. Venkataraman, M.K., "Engineering Mathematics", Volume I, 2nd edition, National Publishing Co., Chennai, 2003.

7. James Stewart ".Calculus" (7th edition),Brooks/Cole cengage learning,UK

OUTCOMES:

After completing the course, student will be able to

- Understand the matrix techniques and compute eigen values and eigenvectors of a given matrix.
- Do the problems based on three dimensional analytic geometry.
- Apply differential calculus in engineering problems.
- Differentiate more than one variable and their applications.
- Solve the differential equations with constant coefficient and variable coefficient.
- Form and solve differential equations.

ENC 1181	ENGLISH	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To train students to use appropriate vocabulary in academic and technical contexts.
- To facilitate students to speak effectively while exchanging ideas and making presentations.
- To develop students' listening skill for comprehending and analyzing information.
- To develop their reading skill through sub skills like skimming , scanning and critical reading of a text.
- To sharpen their academic writing skills.
- To expose them to the correct usage of language and help them to apply that knowledge appropriately.

MODULE I **8**

L: Listening for general information

S : Self Introduction, Introducing one another.

R: Predicting the content

W: Paragraph Writing

Language Focus: Affixes, Simple Present tense , Connective & Prepositions.

MODULE II **8**

L: Listening for specific information (from dialogues)

S:Exchanging opinion.

R: Skimming technical Passages

W: Argumentative Writing (using the concept of Flipped Learning), Letter to the Editor.

Language Focus: Idioms, use of Modals, Simple Past tense & use of "Wh" and question tags.

MODULE III **7**

L: Learning the ways of describing images and presenting specific information (focusing on note making)

S: Making Presentations using visuals.

R : Scanning short texts for gist of information

W: Letter of Invitation, Expository Writing

Language Focus: Homophones, Homographs, Simple Future & Collocations.

MODULE IV **7**

L: Understanding prepared presentation techniques through videos

S: Short Presentations.

R: Reading for coherence and cohesion

W: Letter seeking permission for Industrial Visit

Language Focus: S-V agreement, Euphemism

MODULE V **8**

L : Understanding Non- Verbal Communications while listening to narration of incidents.

S: Narrating an expereince

R: Inferential Reading

W: Process Description – Transcoding a Flow chart.

Language Focus: Interchange of Active & passive voice, Impersonal Passive voice.

MODULE VI **7**

L: Learning Story telling techniques (stories & visuals) through audio files

S: Discussion in groups

R: Reading for critical appreciation

W: Developing an idea, Slogan writing, Interpreting a Bar Chart.

Language Focus: If clause and phrasal verbs.

TOTAL HOURS :45

REFERENCES:

1. Carol Rosenblun perry(2011). The Fine Art of Technical Writing. Create Space Independent Publishing Platform, New Delhi.
2. Dutt, P.K. Rajeevan. G and Prakash , C.L.N. (2007) A course in Communication Skills. Cambridge Univesity Press, India.
3. Kala, Abdul & Arun Tiwari (2004). Wings of Fire: An Autobiography (Simplified and A bridged by Mukul Chowdhri). Hyderabad Univeristy Press.
4. Sen, Leena. (2004) Communication Skills. Prentice Hall, New Delhi.

5. Matt Firth, Chris Sowton et.al. (2012). Academic English: An Integrated Skills Course for EAP. Cambridge University Press, Cambridge.

OUTCOMES:

After completion of the course, students will have the ability to

- Demonstrate their range of vocabulary in academic and technical contexts
- Exchange ideas and make presentations
- Comprehend and respond appropriately to listening tasks.
- Read a text efficiently and process information.
- Create and draft different kinds of academic documents
- Communicate effectively using grammatically correct expressions.

ISC1181	ARABIC	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To read and write in Arabic language.
- To learn vocabulary of different fields
- To develop situational communication skills.

MODULE I PREPARATORY ARABIC 7

Introducing Arabic Alphabets.
Listening and Reading.
Audio & Video aided listening, Tajweed listening,
Writing Arabic Alphabets (connected & unconnected).
Introducing words.
Reading simple sentences.
Learning names of the things in and around the class room.
Exercises.

MODULE II FUNCTIONAL ARABIC 7

Listening Arabic texts, stories and action verbs
Communicating Simple sentences.
Jumla' Ismiyya and Jumla' Fi'liyya
Situational Conversation:
Greetings, Introduction.
Classroom, College, Picnic.
Dining and Kitchen.
Reading skills.
Exercises

MODULE III FUNCTIONAL ARABIC 8

Implication of effective listening.
Audio aids.
Writing Simple sentences.
Communicating ordinal and cardinal numbers.
Situational communication:

Playground, library.
Forms of plural – Sample sentences.
Introduction to tenses.
Exercises.

MODULE IV FUNCTIONAL ARABIC 8

Communication:
Family, travel
Market, Prayer hall
Writing skills:
Note making.
Sequencing of sentences.
Developing answers from the questions.
Exercises.

MODULE V TECHNICAL ARABIC 8

Importance of technical communication.
Reading and writing skills.
Audio & Video aided listening.
Introduction to Arabic terms related to administration.
Situation communication:
Air travel, Office administration, passport, visa.
Exercises

MODULE VI TECHNICAL ARABIC 7

Situation communication:
Contractual work, machineries and equipments..
Computer, internet browsing.
Banking,
Exercises.

TOTAL HOURS :45

TEXT BOOKS:

1. Arabic for professionals and employees, Kilakarai Bukhari Aalim Arabic College, Chennai, India, 2013.

REFERENCES:

1. Arabic Reader for Non Arabs (Ummul Qura University, Makkah), Kilakarai Bukhari Aalim Arabic College, 2005.

OUTCOMES:

On successful completion of the course, the student will be able to:

- Write correct sentences in Arabic.
- Communicate in Arabic at primary level in working situations in the fields of engineering and administration.

LNC1181	MANDARIN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To improve the proficiency of students in Mandarin language.
- To develop their knowledge of vocabulary.
- To train them in using appropriate grammatical forms during communications.
- To empower them for successful communication in social and academic contexts.
- To make them appreciate the language usage in real life situations.

MODULE I **8**

· General Introduction to Chinese • Pinyin and Tones • Introduction to the Writing System: basic strokes and stroke order · Numbers 1-100, song · Days of the Week · Months of the Year

MODULE II **8**

· Chinese names and related culture · Chinese family structures and values · Greetings · Introducing Yourself · Family members · Occupations

MODULE III **7**

· Languages and Nationalities · Daily Routine · Chinese breakfast · Negative Sentences and Interrogative Sentences · Asking for Personal Information · The Verb *shi* and Basic Sentence Structures

MODULE IV **7**

· Answering an Affirmative-negative Question · Food and drinks · Transportation · Likes and dislikes · Adverbs *bu*, *jiu* and *dou* · Verb-absent Sentences

MODULE V **8**

·*Jisui* and *duoda* Questions · S+V+O Construction · Routines and Daily Activities ·*Haishi* Questions · Modal Verbs · Hobbies and Habits

MODULE VI **7**

· Making Suggestions with *haoma* ·Colors · Clothing · Body parts · Talking about Likes and Dislikes · Measurement Words in Chinese

TOTAL HOURS :45

TEXT BOOKS:

1.Ma, Yanmin, and Li, Xinying. *Easy Steps to Chinese, Vol*. *1 Textbook*. Beijing: Beijing Language and Culture University Press, 2006. Print.

2. Ma, Yanmin, and Li, Xinying. *Easy Steps to Chinese, Vol. 1 Workbook*. Beijing: Beijing Language and Culture University Press, 2006. Print.

OUTCOMES:

On completion of the course, students will be able to

- Exhibit proficiency in Chinese Language.
- Use vocabulary in appropriate contexts.
- Use appropriate grammatical forms effectively.
- Use the language in social and academic contexts.
- Appreciate the use of language forms.

LNC1182	GERMAN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To improve the proficiency of students in German language.
- To create awareness of using vocabulary among students.
- To expose them to correct grammatical forms of the language.
- To empower them for successful communication in social and academic contexts.
-

MODULE I **8**

Introduction to German alphabets, phonetics and pronunciation- Introducing themselves and others using simple sentences and answer to some basic personal questions-: Introduction to different types of articles and verbs, Nouns

MODULE II **8**

Understanding and responding to everyday queries like instruction, questions, - number & gender, pronouns, present and past tense.

MODULE III **7**

Short telephone messages, requests etc., if spoken slowly and clearly-- Detailed overview of articles, adjectives with/without articles, Prepositions

MODULE IV **7**

Ask and giving directions using simple prepositions- Ability to fill basic information on forms while registering for courses / classes.

MODULE V **8**

Ability to extract and understand relevant information in a public announcement, broadcast, newspaper, radio etc-- dative & accusative

MODULE VI **7**

Ability to describe about people, work, immediate environment, education and other topics related to personal needs in a concise manner-- Understanding of matters that are familiar and are encountered regularly like instances at school, work, at public

places, places of leisure etc.

TOTAL HOURS :45

TEXT BOOKS:

1. Course book : Tangram aktuell 1 – Lektion 1–4 (Kursbuch + Arbeitsbuch mit Audio-CD zum Arbeitsbuch), Rosa-Maria Dallapiazza, Eduard von Jan, Til Schönherr, Hueber Publisher, ISBN 978-3-19-001801-7
2. Practice book: Tangram aktuell 1 – Lektion 1–4 (Kursbuch + Arbeitsbuch mit Audio-CD zum Arbeitsbuch), Rosa-Maria Dallapiazza, Eduard von Jan, Til Schönherr, Hueber Publisher, ISBN 978-3-19-001801-7.

REFERENCES:

1. NETZWERK A1 TEXTBOOK, Deutsch als Fremdsprache,Stefanie Dengler,Paul Rusch, Helen Schmitz, Tanja Sieber, Langenscheidt and Klett, ISBN : 9788183076968
2. STUDIO D A1 (SET OF 3 BOOKS + CD), Hermann Funk. Cornelsen, ISBN: 9788183073509
3. Willkommen! Beginner's course. Paul Coggle, Heiner Schenke. 2nd edition. (chapter 1 - 6) ISBN: 9781444165159 –
4. Willkommen! Beginner's course. Paul Coggle, Heiner Schenke. ISBN: 978-1-444-16518-0
5. An Introduction to the German Language and Culture for Communication, Updated Edition Lovik, Thomas A., J. Douglas Guy & Monika Chavez. Vorsprung -. New York, Houghton Mifflin Company, 1997/2002. ISBN 0-618-14249-5.

OUTCOMES:

On completion of the course, students will be able to

- Show their proficiency in German Language.
- Use appropriate vocabulary in real life contexts.
- Use appropriate grammatical forms while communicating with people.
- Effectively use the language in social and academic contexts.

LNC1183	JAPANESE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To train students to use appropriate vocabulary in academic and technical contexts.
- To facilitate students to speak effectively while exchanging ideas and making presentations.
- To develop their reading skill through sub skills like skimming, scanning and critical reading of a text.
- To sharpen their academic writing skills.
- To expose them to the correct usage of language and help them to apply that knowledge appropriately.

MODULE I **7**

Introduction of the Japanese writing system, i.e. *Hiragana*, *Katakana* and *Kanji*, word-building, writing foreign names and loan words in Katakana.

MODULE II **8**

Oral practice of pronunciation and intonation of Japanese sounds, Japanese greetings, self introduction, identifying things, time of the day, calendar; counting using Japanese numerical classifiers; describing things;

MODULE III **7**

Making comparisons; talking of daily activities, kinship terms used for address and reference, seasons, giving and receiving, shopping; making requests, talking of one's likes and dislikes.

MODULE IV **8**

Extensive practice of basic patterns at the lower intermediate level through drills and exercises.

MODULE V **7**

Comprehension of passages in simple Japanese and writing of composition in Japanese applying lower intermediate grammatical patterns.

MODULE VI **8**

Diverse texts based on Japanese culture, customs, history, food habits, and science etc, for the development of communicative competence of students; skimming, scanning of texts with emphasis on advanced sentence patterns, grammatical structures and idiomatic phrases, reading and writing of approximately

TOTAL HOURS :45

REFERENCES:

1. Nihongo I, Kokusaigakuyukai, and other supplementary material
2. Exersice book 1of Nihongo 1, and other supplementary material
3. Nippon, the Land and its People & Encyclopedia of Contemporary Japanese
4. Japani: Japanese Conversation for Improving Spoken Proficiency, By P.A. George, Inoue Yoriko and Itsuko Nandi, Books Plus.
5. Chukyu Nihongo, Tokyo Gaikokugo Daigaku; Nihongo II, Kokusaigakuyukai, and other supplementary material.

OUTCOMES:

After completion of the course, students will have the ability to

- Demonstrate their range of vocabulary in academic and technical contexts
- Exchange ideas and make presentations
- Comprehend and respond appropriately to listening tasks.
- Read a text efficiently and process information.
- Create and draft different kinds of academic documents
- Communicate effectively using grammatically correct expressions.

PHC 1181	PHYSICS	L	T	P	C
		3	0	2	4

OBJECTIVES:

To make students conversant with the

- basic concepts of crystal physics and its structures
- production and applications of ultrasonic waves
- study of thermal conductivities of good and bad conductors
- phenomenon of wave optics and its applications
- principle of fibre optic communication and its applications to sensors
- wave mechanics principle and its applications in electron microscopy
- green energy physics and its environmental impacts to society

MODULE I CRYSTAL PHYSICS **8**

Crystalline and amorphous solids – Unit Cell – Seven Crystal Systems – Bravais Lattice – Miller Indices – Interplanar Spacing – Characteristics of Unit Cell - Calculation of Number of atoms per unit cell, Atomic Radius, Coordination Number and Packing Factor for SC, BCC, FCC and HCP and Diamond structures –Defects in crystals-Point defects –Edge and screw dislocations and their significance - Surface Defects.

MODULE II ULTRASONICS AND THERMAL PHYSICS **8**

Introduction to Ultrasonics - Properties - Production methods - Magnetostriction Oscillator method- Piezoelectric Oscillator method – Detection of Ultrasonics – Thermal method – Piezoelectric method – Kundt's tube method – Applications of Ultrasonics – Acoustic Grating – SONAR – Depth of sea – Velocity of blood flow, Ultrasonic Flaw detector (qualitative).

Transmission of heat – Conduction, Convection and Radiation – Thermal Conductivity of good Conductor – Forbe's method- Thermal Conductivity of bad Conductor – Lee's Disc method.

MODULE III APPLIED OPTICS **8**

Interference – Air Wedge – Michelson's Interferometer – Determination of wavelength of light and thickness of thin transparent sheet.

Introduction to Laser – Characteristics of Laser – Spontaneous and Stimulated Emissions – Einstein's Coefficients - Population inversion – Pumping Mechanism – Laser Action – Types of Laser: He-Ne laser, CO2 laser and Nd:YAG laser - Applications : Laser Materials

Processing .

MODULE IV FIBRE OPTICS 7

Optical fibre – Principle and propagation of light in optical fibre – Numerical aperture and acceptance angle – Types of optical fibres – Attenuation – Absorption, Scattering losses, Bending losses and Dispersion in Optical fibres – Fiber Connectors and Couplers - Applications – Fibre optic communication system (block diagram only)- Fibre optic sensors - displacement and pressure sensors (qualitative) - Medical endoscope.

MODULE V QUANTUM MECHANICS 7

Black body radiation – Planck's theory of radiation – Deduction of Wien's displacement law and Rayleigh – Jean's law from Planck's theory –Dual nature of matter – de Broglie's wavelength- Physical significance of wave function – Schrodinger wave equation – Time independent and time dependent wave equation – Particle in one dimensional box – Harmonic oscillator(qualitative).

MODULE VI RENEWABLE ENERGY SOURCES 7

Present Energy sources and sustainability - Solar energy - Solar photovoltaics - Solar cells – Bioenergy - Biomass – production of liquid fuels from biomass – Wind energy – Wind turbines – energy and power from wind turbines - Geothermal energy - Ocean energy: Wave energy – Wave energy conversion devices – Tidal energy – Tidal power basics – power generation –Tidal energy potential – Environmental benefits and impacts of renewable energy sources

PRACTICALS

1. Determination of Velocity of Ultrasonic waves in a given liquid using Ultrasonic Interferometer.
2. Determination of wavelength of ultrasonic waves using Kundt's tube method.
3. Determination of thickness of a thin wire using Air Wedge method.
4. Determination of wavelength of light using spectrometer diffraction grating.
5. Determination of angle of divergence of a laser beam using He-Ne laser.
6. Determination of particle size of lycopodium powder using semiconductor laser.
7. Determination of wavelength of laser light using semiconductor laser diffraction.
8. Determination of Acceptance angle and Numerical Aperture using fiber optic cable.
9. Determination of thermal conductivity of a good conductor by Forbe's method.
10. Determination of thermal conductivity of a bad conductor by Lee's disc method.
11. Determination of solar cell characteristics.

L – 45; P – 30; TOTAL HOURS – 75

REFERENCES :

1. Gaur R.K. and Gupta S.L., “Engineering Physics’’, 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2013.
2. Palanisamy P.K., Physics for Engineers, Vol1 & Vol2, 2nd Edition, Scitech Publications, 2003.
3. Serway R.A. and Jewett, J.W. “Physics for Scientists and Engineers with Modern Physics”. Brooks/cole Publishing Co., 2010.
4. Tipler P.A. and Mosca, G.P., “Physics for Scientists and Engineers with Modern Physics”, W.H. Freeman, 2007.
5. Markert J.T., Ohanian. H. and Ohanian, M. “Physics for Engineers and Scientists”. W.W. Norton & Co. 2007.
6. Godfrey Boyle, “Renewable Energy: Power for sustainable future”, 2nd edition, Oxford University Press, UK, 2009.

OUTCOMES:

At the end of the course, students will be able to

- understand the different types of crystal structures
- apply the concept of ultrasonic principle in engineering and medical field
- calculate thermal conductivities of good and bad conductors
- differentiate the various laser systems and its applications in engineering and medical field
- apply the principle of fibre optics for communication and sensor applications
- formulate wave mechanics principle for applications in electron microscopy
- Correlate the different renewable energy sources for societal needs.
- To complement the knowledge acquired in the theory class.
- To correlate the experimental results for application.

CHC1181	CHEMISTRY	L	T	P	C
		3	0	2	4

OBJECTIVES:

The students should be conversant with

- the basic problems like hardness, alkalinity, dissolved oxygen associated with the water used for domestic and industrial purpose and treatment process involved.
- the synthesis, properties and applications of nanomaterials.
- the importance of renewable energy sources like solar, wind, biogas, biomass, geothermal, ocean and their limitations.
- the basic analytical techniques like UV-Visible, FT-IR, NMR, AAS, AES, Circular Dichroism and XRD etc.
- photochemistry concepts related to physical processes and chemical reactions induced by photon absorption and their applications.
- basic principles of electrochemistry, cell construction and evaluation and to understand general methodologies for construction & design of electrochemical cell

MODULE I WATER TECHNOLOGY 9

Impurities present in water, hardness : types of hardness, demerits of hard water in boilers, estimation of hardness by EDTA method (problems) – alkalinity : estimation of alkalinity (problems) – dissolved oxygen: estimation of dissolved oxygen – conditioning methods : external treatment method: – lime soda and zeolite process (principle only), Ion exchange process – Internal treatment : colloidal, carbonate, phosphate and calgon methods – drinking water: standards (BIS), treatment of domestic water {screening, sedimentation, coagulation, filtration, disinfection }– desalination: electrodialysis, reverse osmosis.

MODULE II NANOCHEMISTRY 6

Introduction – distinction between molecules, bulk materials and nanoparticles – classification based on dimension with examples – synthesis (top-down and bottom-up approach} : sol-gel, thermolysis (hydrothermal and solvothermal), electrodeposition, chemical vapour deposition, laser ablation – properties and applications (electronic, magnetic and catalytic) – risk factors and future perspectives.

MODULE III ENERGY SOURCES 8

Energy: past, today, and future – a brief history of energy consumption – present energy scenario of conventional and renewable energy sources – renewable energy : needs of renewable energy, advantages and limitations of renewable energy – solar energy: basics, solar energy in the past , photovoltaic, advantages and disadvantages – bioenergy: conversion, bio degradation, biogas generation, biomass gasifier, factors affecting biogas generation, advantages and disadvantages – geothermal energy: geothermal resources (hot dry rock and magma resources, natural and artificial), advantages and disadvantages – wind energy: wind resources, wind turbines, advantages and disadvantages – ocean energy: wave energy, wave energy conversion devices, ocean thermal energy, advantages and disadvantages.

MODULE IV PHOTOCHEMISTRY 7

Introduction: absorption and emission, chromophores, auxochromes – laws of photochemistry : Grotthus-Draper law, Stark Einstein law – quantum yield (problems) –photo physical processes : fluorescence and phosphorescence - Jablonski diagram (electronic states and transitions) – quenching, annihilation – photosensitization: principle and applications – chemiluminescence, bioluminescence.

MODULE V ANALYTICAL TECHNIQUES 7

Spectroscopy: electromagnetic radiation and spectrum – types of transitions – types of spectra (atomic and molecular with their chemical usefulness) – Beer-Lamberts law (problems) – principles, instrumentation and applications of: Colourimetry – UV-Vis spectrophotometer – atomic absorption spectroscopy – atomic emission spectroscopy – principles and applications of: IR, NMR, mass and X-ray diffraction analysis.

MODULE VI ELECTROCHEMISTRY 8

Electrochemistry - types of electrodes (principle and working) : gas (SHE), metal/metal ion electrode, metal-metal insoluble salt (calomel electrode), ion-selective (glass electrode and fluoride ion selective electrode) – Electrolytic and galvanic cells, construction of cell, EMF measurement and applications (problems), standard cell (Weston-cadmium), reversible and irreversible cell, concentration cell. Determination of fluoride ion using fluoride ion selective electrode – Chemically modified electrodes (CMEs) : concept, approaches and applications.

PRACTICALS

1. Estimation of hardness in given water sample.
2. Estimation of the alkalinity of the given water sample.
3. Estimation of strong acid by conductometry.
4. Estimation of Fe^{2+} present in the given sample by potentiometry.
5. Verification of Beer-Lamberts law and estimation of Cu^{2+} present in unknown sample.
6. Estimation of sodium and potassium present in the given sample by flame photometry.
7. Determination of molecular weight and degree of polymerisation of a polymer by viscosity method.
8. Synthesis of thermosetting polymer.

L – 45; P – 30; TOTAL HOURS – 75

REFERENCES:

1. S. Vairam, P. Kalyani and Suba Ramesh, “Engineering Chemistry”, Wiley India Ltd., New Delhi, 2011.
2. G.A. Ozin and A.C. Arsenault, “Nanochemistry: A Chemical Approach to Nanomaterials”, RSC Publishing, Thomas Graham House, Cambridge, 2005.
3. P.C Jain & Monica Jain, Engineering Chemistry Dhanpatrai Publishing Company (P) Ltd., New Delhi (2013).
4. S S Umare & S S Dara, A text Book of Engineering Chemistry, S. Chand& Company Ltd, New Delhi, 2014.
5. G.D.Rai, “Non conventional energy sources,” Khanna Publishers, New Delhi, 2011.
6. John Twidell and Tony Weir, “Renewable Energy Resources, Taylor & Francis Ltd, London, United Kingdom, 2005
7. Principles of molecular photochemistry: An introduction, Nicholas J. Turro, V.Ramamurthy and Juan C. Scaiano, University Science Books, Sausalito, CA, 2009.

OUTCOMES:

The students will be able to

- solve problems related to hardness, alkalinity, dissolved oxygen associated with the water and describe the treatment processes.
- classify nanomaterials and apply the nanochemistry approach to synthesize the

nanomaterials.

- explain the principle and enumerate the advantages and disadvantages of various renewable energy sources.
- state the principle and illustrate the instrumentation of various analytical techniques.
- apply the concepts of photochemistry to elaborate various photo-physical and photochemical reactions.
- construct a electrochemical cell and describe the various types of electrodes and determine the fluoride content.

GEC 1101 ENGINEERING GRAPHICS L T P C

2 0 2 3

OBJECTIVES:

- To introduce the students of all engineering programs, the basic concepts of engineering drawing, which is the basic communication medium for all engineers
- To provide practical exposure on important aspects like drawing analytic curves, orthographic projections, section of solids, development of surfaces, isometric projection, perspective projection and free hand drawing.
- To introduce computerized drafting.

MODULE I BASICS AND ENGINEERING CURVES 10

Drawing instruments, dimensioning, BIS conventions, types of lines, simple geometric constructions.

Conic sections: ellipse, parabola, hyperbola.

Special curves: cycloid, epicycloid, hypocycloid and involutes.

MODULE II ORTHOGRAPHIC PROJECTION 8

Orthographic projection – first angle, second angle, third angle and fourth angle projections –setup - assumptions, principle. Free hand sketching of orthographic views of simple machine parts as per first angle projection. Orthographic projection of points in all quadrants. Some commands and demonstration of drafting packages.

MODULE III PROJECTION OF STRAIGHT LINES AND PLANES 10

Projection of straight lines in first quadrant – true length and true inclinations – Rotating line and trapezoidal methods –traces of straight line.

Projection of plane lamina in first quadrant and its traces

MODULE IV PROJECTION OF SOLIDS 10

Projection of solids in first quadrant: Axis inclined to one reference plane only- prism, pyramid, cone, cylinder – change of position and auxiliary projection methods.

MODULE V SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES 12

Section of solids: prism, pyramid, cone, cylinder, and sphere – sectional view – true

shape of section Solids in simple position and cutting plane inclined to one reference plane only.

Development of surface of truncated solids: prism, pyramid, cone cylinder – frustum of cone, pyramid and simple sheet metal parts.

MODULE VI PICTORIAL PROJECTIONS 10

Isometric projection: Isometric scale – isometric axes- iso sheet - Isometric projection and view of prism, pyramid, cylinder, cone, frustums, truncated solids and simple products

Perspective projection: station point – vanishing point – Perspective projection and views of prism, pyramid, cylinder and frustums by Visual ray method.

L – 30; P – 30; TOTAL HOURS – 60

TEXT BOOKS:

1. N.D. Bhatt, 'Engineering Drawing' Charotar Publishing house, 53rd Edtion, (2014)

REFERENCES:

1. K.V. Natarajan, 'A text book of Engineering Graphics', Dhanalakshmi publishers, Chennai. (2009)
2. Venugopal. K, and V. Prabhu Raja, Engineering Graphics, New Age International (P) Ltd., Publication, Chennai. (2011)

OUTCOMES:

- Students should be able to read the specifications and standards of technical drawing and able to draw conic sections and special curves.
- Students should be able to understand the insight of orthographic projection and to draw the various views of orthographic projection of a point and various components.
- Students should be able to draw the orthographic views of straight lines and plane figures.
- Students should be able to draw the orthographic views of simple solids.
- Students should be able to draw the sections of solids and development of solid surfaces.
- Students should be able to draw the isometric and perspective projection of simple solids and components.

GEC 1102 ENGINEERING DESIGN L T P C

2 0 0 2

OBJECTIVES:

- To understand the role of design in Engineering
- To understand the basic design concepts
- To understand the role of innovation in design

MODULE I DESIGN AS A CENTRAL ACTIVITY IN ENGINEERING 08

Product design – products and processes – product design methodology Design of systems; Software design

MODULE II NEED ANALYSIS AND CONCEPT DEVELOPMENT 07

Voice of customers – product specification - need analysis Bench marking Product architecture – concept generation and evaluation;

MODULE III CASE STUDIES IN ENGINEERING DESIGN 08

Product design – process design; system design; software design -Ergonomics – usability

MODULE IV INNOVATION AND DESIGN 07

Role of innovation in Engineering – incremental changes and systemic changes; scientific approach to driving innovation – case studies.

TOTAL HOURS – 30

REFERENCES:

1. Clive L. Dym and David C. Brown,“Engineering Design: Representation and Reasoning”, 2nd Edition, Cambridge University Press, New Delhi, 2011.
2. Daniel G. Dorner, G. E. Gorman and Philip J. Calvert, “Information Needs Analysis: Principles and practice in information organizations”, Published by Faced Publishing, London. 2015.
3. Cliff Matthews, “Case Studies in Engineering Design”, John Wiley & Sons Pvt. Ltd, New York, 1998.
4. Bengt-Arne Vedin, “The Design-Inspired Innovation Workbook”, World Scientific, 2011.
5. Navi Radjou, Jaideep Prabhu and Simone Ahuja, “Jugaad Innovation”, Published

by Random House India, 2012.

OUTCOMES:

The students will be able to

- Apply the basic knowledge of design in engineering products / process / service.
- Analyse the problems and give innovative solutions.
- Correlate the basic knowledge of design in the real world problems.
- Apply innovative approaches to engineering design.

GEC1103	BASIC ENGINEERING PRACTICES LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To provide a practical exposure to basic engineering practices like carpentry, fitting, plumbing, welding and making of simple electrical and electronic circuits
- To have an understanding on the use of various tools, instruments and methods
- To enable the students to appreciate the practical difficulties and safety issues

CIVIL ENGINEERING PRACTICE

1. Study of plumbing in general household and industrial systems
2. Making a small window frame with Lap and Mortise & Tenon Joints
3. Introduction to power tools

MECHANICAL ENGINEERING PRACTICE

1. Fabrication of a small Table frame with Butt, Lap and Fillet Joints
2. Machining of a simple component like a table weight using lathe
3. Mold preparation for simple component

ELECTRICAL ENGINEERING PRACTICE

1. Comparison of incandescent, Fluorescent, CFL and LED lamps.
2. Study of Protection Circuits (small relay, fuse, MCB, HRC, MCCB, ECCB).
3. Familiarization of households Electrical Gadgets (Iron Box, Wet Grinder).
4. Understanding of Domestic and Industrial wiring.
5. Earthing and its significance.
6. Troubleshooting in Electrical Circuits.
7. Study of inverter fed UPS/Emergency lamp

ELECTRONICS ENGINEERING PRACTICE

1. Identifications symbolic representation of active and passive electronic components
2. Soldering and tracing of electronic circuits and checking its continuity
3. Assembling of A.C. to D.C, D.C to A.C. Circuits in bread Board and Mini project.

TOTAL HOURS – 30

OUTCOMES:

Upon the completion of the course, students should be able to

- Appreciate the practical skills needed even in making of simple objects, assemblies and circuits
- Attend minor defects especially in items used in day to day life
- Aware of the safety aspects involved in using tools and instruments

GEC 1104 COMPUTER PROGRAMMING I

L	T	P	C
1	0	2	2

OBJECTIVES:

- To identify the hardware and software components of the computer.
- To know the basic concept of operating system and get knowledge about different operating systems.
- To learn various database concepts and operations
- To develop efficient algorithms for solving a problem.
- To implement the algorithms in C language.
- To use arrays in solving problems.

MODULE I COMPUTER FUNDAMENTALS **7**

Introduction -. Number System - Planning the computer program - Computer Software - Basic operating system concepts - Database Operations

MODULE II PROGRAMMING IN C **8**

Introduction to C Programming Language – Operators - Control statements -Iterative statements - Arrays.

LIST OF EXPERIMENTS:

1. Computer organization –Hardware in a typical computer Identification – Booting- error messages and what it means
2. Types of Operating systems – Windows and Linux
3. Structure of a basic program - Hello world program – Debugging it
4. Data types: Type conversions
5. Input / Output: Formatted functions – Unformatted functions – Library functions
6. Properties of operators – Priority of operators – Arithmetic relational logical and bitwise operators
7. If – if else- nested if else- goto- switch case – nested switch case – for loops – nested for loops – while loop – do-while loop – break and continue statement
8. Arrays – Operation with arrays
9. Sorting and searching.

L – 15; P – 30; TOTAL HOURS – 45

REFERENCES:

1. Ashok N Kamthane, “Computer Programming”, Pearson Education, 2nd Edition, ISBN 13: 9788131704370, 2012
2. Paul J. Deitel, Deitel & Associates, “C How to Program”, Pearson Education, 7th Edition, ISBN-13: 978-0132990448, 2012

OUTCOMES:

Students who complete this course will be able to

- Recognize Modular design, logic flow, data abstraction
- Analyze the working of the programming constructs, functions, and I/O.
- Write down programs for sorting and searching algorithms
- Write down programs developing cycle for different applications
- Debug the programs and solve some practical problems in programming
- Develop programs using arrays.

SEMESTER II

MAC 1281	**ADVANCED CALCULUS**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

OBJECTIVES:

The aims of this course are to

- train the students in solving problems using multiple integration.
- provide knowledge in using special functions to find out the area and volume of a region.
- acquire knowledge in tangent and normal vectors.
- gain knowledge in finding the areas of a curve and surface using vector integration.
- learn about the analytic functions and their properties along with bilinear transformation.
- know complex integration using Cauchy's theorems.

MODULE I MULTIPLE INTEGRATION AND ITS APPLICATIONS **8+2**

Multiple integrals– Cartesian and Polar coordinates – change of order of integration – Multiple integral to compute area and volume.

MODULE II TRANSFORMATION OF COORDINATES AND SPECIAL FUNCTIONS **7+3**

Change of variables between Cartesian, polar, cylindrical and spherical coordinates - Beta and Gamma functions – Properties and applications.

MODULE III VECTOR DIFFERENTIATION **7+3**

Operations on vectors – Scalar Product, Vector Product, Projection of Vectors - Angle between two vectors - Gradient, divergence and curl

MODULE IV VECTOR INTEGRATION **8+2**

Line, surface and volume integrals – Green's Theorem, Gauss Divergence Theorem and Stokes Theorem (statement only) – verification and evaluation of integrals.

MODULE V ANALYTIC FUNCTION 8+2

Analytic function - Necessary and Sufficient condition (statement only) – Cauchy-Riemann equations in polar coordinates - properties of analytic function – determination of analytic function – conformal mapping (w = z+a, az and 1/z) and bilinear transformation.

MODULE VI COMPLEX INTEGRATION 7+3

Statement and application of Cauchy's integral theorem – Cauchy's integral formula – Taylor's series and Laurent's series expansion – singularities - classification – residues - Cauchy's residue theorem – contour integration – Unit circle and semi circular contours (excluding poles on the real axis).

L – 45; T – 15; TOTAL HOURS – 60

TEXT BOOKS:

1. Veerarajan.T., "Engineering Mathematics "(5th edition) Tata Mc Graw Hill Publishing Co. New Delhi, 2012
2. Grewal B.S., "Higher Engineering Mathematics" (43rd edition), Khanna Publishers, New Delhi, 2012.
3. John W. Cell "Engineering Problems Illustrating Mathematics" Mc Graw Hill Publishing Co., New York 1943

REFERENCES:

1. Kreyszig, E., "Advanced Engineering Mathematics", 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
2. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th edition, Cengage Learning, 2011.
3. Dennis G. Zill, Warren S. Wright, "Advanced Engineering Mathematics", 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
4. Alan Jeffrey, "Advanced Engineering Mathematics", Academic Press, USA, 2002.
5. Ramana, B.V., "Higher Engineering Mathematics" Tata Mc Graw Hill Publishing Co. New Delhi, 2006.
6. Venkataraman, M.K., "Engineering Mathematics", Volume 2, 2nd edition, National Publishing Co., Chennai, 2003.

7. James Stewart ".Calculus" (7^{th} edition),Brooks/Cole cengage learning,UK.

OUTCOMES:

After completing the course, student will be able to

- compute the area and volume using multiple integrals.
- apply special functions to solve integration problems.
- apply differentiation in scalar and vector fields.
- find area and volume of a region using vector integration.
- verify analyticity, conformity and bilinearity of complex functions.
- evaluate complex integrals.

GEC 1211	BASIC ENGINEERING MECHANICS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To impart knowledge about the basic laws of statics and dynamics and their applications in problem solving
- To acquaint both with scalar and vector approaches for representing forces and moments acting on particles and rigid bodies and their equilibrium
- To give on exposure on inertial properties of surfaces and solids
- To provide an understanding on the concept of work energy principle, friction, kinematics of motion and their relationship

MODULE I VECTOR APPROACH TO MECHANICS 07

Introduction - Units and Dimensions- Vectors – Vectorial representation of forces and moments –Vector Algebra and its Physical relevance in Mechanics - Laws of Mechanics – Parallelogram and triangular Law of forces -Lame's theorem, Coplanar Forces – Resolution and Composition of forces- Equilibrium of a particle.

MODULE II EQUILIBRIUM OF PARTICLE 06

Forces in space - Equilibrium of a particle in space - Equivalent systems of forces – Principle of transmissibility – Single equivalent force

MODULE III EQUILIBRIUM OF RIGID BODY 06

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis –Vectorial representation of moments and couples – Scalar components of a moment –Varignon's theorem - Equilibrium of Rigid bodies in two dimensions - Examples

MODULE IV PROPERTIES OF SURFACES 08

Determination of Areas – First moment of area and the Centroid of sections – Rectangle, circle, triangle from integration – T section, I section, Angle section, Hollow section by using standard formula – second and product moments of plane area – Physical relevance - Rectangle, triangle, circle from integration - T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia- Mass moment of

Area

MODULE V FRICTION 08

Introduction to friction- types of friction- Laws of Coloumb friction- Frictional force – simple contact friction – Rolling resistance –ladder friction

MODULE VI LAWS OF MOTION 10

Review of laws of motion – Newton's law – Work Energy Equation of particles– Impulse and Momentum – Impact of elastic bodies.

L – 45; T – 15; TOTAL HOURS – 60

REFERENCES:

1. Beer, F.P and Johnston Jr. E.R, "Vector Mechanics for Engineers, Dynamics & Statics", Third SI Metric Edition, Tata McGraw-Hill International Edition, 2001.
2. Hibbeller, R.C., Engineering Mechanics, Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., 2000.
3. Irving H. Shames, Engineering Mechanics – Statics and Dynamics, IV Edition Pearson Education Asia Pvt. Ltd., 2003.

OUTCOMES:

On completion of this course students should be able

- Analyse and resolve forces, moments and solve problems using various principles and laws of Mechanics
- Apply the concept of equilibrium to particles and solve problems
- Apply the concept of equilibrium to rigid bodies and solve problems
- Analyse and determine the properties of surfaces
- Analyse and evaluate the fractional forces between the bodies
- Apply the laws of motion in solving dynamics problems

GEC 1212	ENVIRONMENTAL STUDIES	L	T	P	C
		2	0	0	2

OBJECTIVES:

The student will be conversant with the

- various natural resources, availability, utilisation and its current scenario
- different ecosystems, energy transfer, values, threats and conservation of biodiversity
- levels of different pollutants and its impact and the causes and effects of natural disasters
- impacts of human population, impact assessment, human rights and environmental acts and sustainable development

MODULE I NATURAL RESOURCES **8**

Land resources: land degradation, soil erosion and desertification - Forest resources: use and over-exploitation, deforestation - Water resources: use and over-utilisation of surface and ground water, conflicts over water (inter-state and international), dams (benefits and problems), water conservation (rainwater harvesting and watershed management) - Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources, mining - Food resources: world food problems, changes in land use by agriculture and overgrazing, modern agriculture and its effects, fertilizer and pesticide problems, water logging and salinity - Energy resources: increasing energy needs, renewable and non-renewable, use of alternate energy sources.

MODULE II ECOSYSTEM AND BIODIVERSITY **8**

Ecosystem- energy flow in the ecosystem - food chains, food webs and ecological pyramids - characteristics, structure and function of (a) Terrestrial ecosystems (forest, grassland, desert) and (b) Aquatic fresh water ecosystems (pond, lake, river) (c) Aquatic salt water ecosystems (ocean, estuary) - ecological succession.

Biodiversity - genetic, species and ecosystem diversity – hot-spots of biodiversity – biogeographic classification of India - endangered, endemic, extinct and invasive species of India - red data book - values of biodiversity: consumptive, productive, social, ethical, aesthetic and option values - threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts - conservation of biodiversity: in-situ and ex-situ conservation of biodiversity

MODULE III ENVIRONMENTAL POLLUTION AND NATURAL DISASTER **8**

Definition, cause, effects and control measures of (a) air pollution (b) water pollution (c) soil pollution (d) marine pollution (e) noise pollution (f) thermal pollution (g) nuclear hazards - ill-effects of fireworks and upkeep of clean environment - solid waste management: types (urban, industrial, biomedical and electronic wastes), collection, processing and disposal (incineration, composting and land-fill) - natural disaster and management: flood, cyclone, drought, landslide, avalanche, volcanic eruptions, earthquake and tsunami.

MODULE IV HUMAN POPULATION, HEALTH AND SOCIAL ISSUES **6**

Population and population growth, population variation among nations, population explosion, family welfare programme.

Human health: air-borne, water borne diseases, infectious diseases, risks due to chemicals in food and environment.

Sustainable development - environmental legislation and laws: water act, air act, wildlife protection act, forest conservation act, environment protection act - environmental impact assessment, steps in EIA - human rights - women and child welfare.

Case studies related to current situation

TOTAL HOURS – 30

TEXT BOOKS:

1. Erach Bharucha, Textbook for Environmental Studies For Undergraduate Courses of all Branches of Higher Education for University Grants Commission, Orient Blackswan Pvt Ltd, Hyderabad, India, 2013.
2. Benny Joseph, Environmental Studies, Tata McGraw-Hill Education, India, 2009.
3. Ravikrishnan A, Environmental Science and Engineering, Sri Krishna Publications, Tamil Nadu, India, 2015.
4. Raman Sivakumar, Introduction to Environmental Science and Engineering, McGraw Hill Education, India, 2009.
5. Venugopala Rao P, Principles of Environmental Science and Engineering, Prentice Hall India Learning Private Limited; India, 2006.
6. Anubha Kaushik and Kaushik C.P., Environmental Science and Engineering,

New Age International Pvt Ltd., New Delhi, India, 2009.

REFERENCES:

1. Masters G.M., Introduction to Environmental Engineering and Science, Prentice Hall, New Delhi, 1997.
2. Henry J.G. and Heike G.W., Environmental Science and Engineering, Prentice Hall International Inc., New Jersy, 1996.
3. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co. Boston, USA, 2016.

OUTCOMES:

The student will be able to

- predict the scenario of various natural resources and suggest remedies to curb the exploitation of these resources.
- identify food chain and web and its role in various ecosystems, assess the impacts on biodiversity and provide solutions to conserve it.
- analyse the impacts of pollutants in the environment and propose suitable method to alleviate the pollutants and the natural disasters.
- assess on the impact of human population and the health related issues and the ethics to be followed for sustainable life.

GEC 1213	COMPUTER PROGRAMMING II	L	T	P	C
		1	0	2	2

OBJECTIVES:

- To provide knowledge about the benefits of Object Oriented Programming over Procedure oriented programming.
- To learn various File operations
- To expose fundamental concepts of object-oriented programming in classes, invoking methods and functions.
- To prepare students to get full use of code reusability using object oriented programming.
- To implement the basic concepts of object oriented programming using C++concepts.
- To focus on solving problems based on analyzing, designing and implementing programs in C and C++.

MODULE I PROGRAMMING IN C 7

Functions - Storage Classes - Structures and Unions – Pointers -Self Referential Structures and Linked Lists - File Processing.

MODULE II PROGRAMMING IN C++ 8

Programming in C++ - Overview of OOP in C – Inheritance - Polymorphism - Type Casting – Exceptions.

LIST OF EXPERIMENTS:

1. Functions
2. One dimensional arrays, Pointers
3. Recursion
4. Multi dimensional arrays, Linked lists.
5. Operating on Files.
6. Simple C++ program with Control statements.
7. Getting input from user console.
8. Classes, Object and Constructors.
9. Method overloading.
10. Inheritance

L – 15; P – 30; TOTAL HOURS – 45

REFERENCES:

1. Bjarne Stroustrup," The C++ Programming Language", Addison Wesley, 4th edition, ISBN-13: 978-0321563842, 2013.
2. Brian W. Kernighan and Dennis M. Ritchie, " The C Programming Language", Prentice Hall, ISBN 0-13-110362-8, 2015.
3. Bjarne Stroustrup, " Programming: Principles and Practice Using C++ ", Addison Wesley, 2nd edition, ISBN-13: 978-0321992789, 2014.
4. Brian W. Kernighan and Dennis M. Ritchie, " The C Programming Language (Ansi C Version)", Prentice Hall India Learning Private Limited, 2nd edition, ISBN-13: 978-8120305960, 1990.

OUTCOMES:

Students who complete this course will be able to

- Develop efficient algorithms for solving problems
- Handle files in C
- Use simple data structures like arrays and linked lists in solving problems.
- Write simple programs using concepts of object oriented programming.
- Implement algorithms in C++ Language.
- Demonstrate the Object Oriented Programming concepts applied in networking, web development and Database applications.

AEC 1211	INTRODUCTION TO AERONAUTICAL ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the overview of Aeronautical Engineering covering various disciplines including aerodynamics, propulsion, performance, stability & control, materials and structures.

MODULE I AVIATION HISTORY AND AIRPLANE ANATOMY 8

Ornithopters, Lighter-than-Air Craft, Heavier- than-Aircraft, Wright Brothers and their flyer , Developments during and after the World Wars I and II , Developments in Jet transport and military aviation, Airplane configurations, components of airplanes, functions.

MODULE II BASIC AERODYNAMICS 10

Standard Atmosphere, Aerodynamics forces and Moments, Air speed, Mach Number, Reynold's Number, Airfoil Aerodynamics, Wing Aerodynamics and Drag Polar.

MODULE III PROPULSION 7

Production of thrust - Propeller Momentum theory, Jet Momentum; Types of engines, Engine components, Specific fuel consumption, Power.

MODULE IV AIRPLANE PERFORMANCE, STABILITY & CONTROL 7

Coordinate systems, Equations of motion, degrees of freedom, pitch, roll ,yaw, rate of climb, absolute & service ceiling, Range, maximum endurance, glide, descent, Principles of stability and control.

MODULE V AIRCRAFT MATERIALS AND STRUCTURES 7

Development of aircraft structures, Stress, strain, stress-strain diagram, Monocoque and semi-monocoque structures – Wing, fuselage, importance of fatigue, Materials used in aircraft.

MODULE VI AIRCRAFT INSTRUMENTS AND SYSTEMS 6

Air data instruments, Gyro instruments, Fly-by-wire system, ILS, Auto-Pilot, CVR,

Flight data recorder.

TOTAL HOURS – 45

TEXT BOOKS:

1. Anderson, J.D., “Introduction to Flight”, McGraw-Hill, 1995
2. Richard S. Shevell, Fundamentals of Flight, Pearson Education, 2006

REFERENCES:

1. Kermode, A. C., Flight without formulae, McGraw-Hill, 1997
2. B. W. McCormick, Aerodynamics, Aeronautics and Flight Mechanics, John Wiley & Sons, 1995.

OUTCOMES:

Students will be able to

- Identify and relate various components of aircraft and their functions.
- Estimate the aerodynamic forces on airplanes and understand their effects on aircraft structures.
- Differentiate between various types of engines and the need for thrust.
- Solve basic problems on aircraft motion and control.
- Identify different structural elements and materials used in aircraft.
- Gain knowledge about the instruments and systems required for the safe operation of airplanes.

AEC 1212	AIRCRAFT COMPONENT MODELING AND DRAFTING LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To train the students to draft basic aircraft components using modeling packages.

LIST OF EXPERIMENTS

1. Design of riveted joints (Lap joint).
2. Design of riveted joints (Butt joint with single and double straps).
3. Design of welded joints.
4. Layout of typical wing structure.
5. Layout of typical fuselage structure.
6. Computer aided modeling of typical aircraft wing.
7. Computer aided modeling of typical fuselage structure.
8. Computer aided modeling of landing gear
9. Three view diagram of a typical aircraft
10. Layout of control systems

TOTAL HOURS –45

REFERENCES:

1. Basant Agarwal. “Engineering graphics”, first Edition, Tata McGraw Hill, 2012.
2. Frederick Ernest Giesecke, Henry C. Spencer “Technical Drawing with Engineering Graphics” Prentice Hall, 2012
3. CATIA Software tutorial manual

OUTCOMES:

Students will be able to,

- Gain hands-on experience in drafting aircraft components and structures using computer-aided modeling.
- Gain knowledge and experience in drawing the layout of aircraft & control systems using computer-aided modeling.

AEC 1213	AIRCRAFT STRUCTURE REPAIR LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To train the students to draft basic aircraft components using modeling packages.

LIST OF EXPERIMENTS

1. Design of riveted joints (Lap joint).
2. Design of riveted joints (Butt joint with single and double straps).
3. Design of welded joints.
4. Layout of typical wing structure.
5. Layout of typical fuselage structure.
6. Computer aided modeling of typical aircraft wing.
7. Computer aided modeling of typical fuselage structure.
8. Computer aided modeling of landing gear
9. Three view diagram of a typical aircraft
10. Layout of control systems

TOTAL HOURS – 45

REFERENCES:

1. Basant Agarwal. “Engineering graphics”, first Edition, Tata McGraw Hill, 2012.
2. Frederick Ernest Giesecke, Henry C. Spencer “Technical Drawing with Engineering Graphics” Prentice Hall, 2012
3. CATIA Software tutorial manual.

OUTCOMES:

Students will be able to,

- Gain hands-on experience in drafting aircraft components and structures using computer-aided modeling.
- Gain knowledge and experience in drawing the layout of aircraft & control systems using computer-aided modeling.

SEMESTER – III

MAC 2181	PARTIAL DIFFERENTIAL EQUATIONS AND TRANSFORMS	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aims of this course are to

- Familiarize In Solving Partial Differential Equation Of First, Second And Higher Orders.
- Introduce Basics And Engineering Applications Of Fourier Series, Laplace Transform, Fourier Transform And Z- Transform.

MODULE I PARTIAL DIFFERENTIAL EQUATIONS 8+2

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solution of standard types of first order partial differential equations – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients.

MODULE II FOURIER SERIES 8+2

Fourier Series and Dirichlet's conditions - General Fourier series - Half range Fourier series - Parseval's identity - Harmonic Analysis.

MODULE III FOURIER TRANSFORMS 7+3

Fourier integral theorem (without proof) - Fourier transform pair - Fourier Inverse Transform – Properties - Convolution theorem - Parseval's identity.

MODULE IV APPLICATIONS OF FOURIER SERIES AND FOURIER TRANSFORMS 7+3

Applications of Fourier series and Fourier Transform to solution of PDEs having constant coefficients with special reference to Heat & Wave equations, Discrete & point Spectrum and Single pulse.

MODULE V LAPLACE TRANSFORM 8+2

Introduction to Laplace transform - Existence of Laplace Transform - Properties of Laplace Transforms - Initial & Final Value Theorems - Inverse Laplace Transform - Convolution Theorem – Circuits to signal square wave: Integral equations with unrepeated complex factors – Damped forced vibrations: repeated complex factors –

Resonance - Solution of differential equations

MODULE VI Z – TRANSFORM 7+3

Introduction and Definition of Z-transform - Properties of Z- Transform - Convolution Theorem of Z-Transform - Inverse Z–transform - Convolution Theorem of Inverse Z-Transform - Formation of difference equations - Solving Difference Equations using Z-Transform.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Kreyszig .E., “Advanced Engineering Mathematics“, 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
2. Grewal B.S., “Higher Engineering Mathematics”, 42nd edition, Khanna Publishers, New Delhi, 2012.
3. Ramana, B.V, “Higher Engineering Mathematics” Tata Mc Graw Hill Publishing Co. New Delhi, 2006.

REFERENCES:

1. Veerarajan.T., “Engineering Mathematics“, 5th edition, Tata Mc Graw Hill Publishing Co. New Delhi, 2012.
2. Peter V. O'Neil, “Advanced Engineering Mathematics**”**, 7th edition, Cengage Learning, 2011.
3. Dennis G. Zill, Warren S. Wright, “Advanced Engineering Mathematics”, 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
4. Alan Jeffrey, “Advanced Engineering Mathematics”, Academic Press, USA, 2002.

OUTCOMES:

After completing the course, student will be able to

- Solve The Partial Differential Equations.
- Derive A Fourier Series Of A Given Periodic Function By Evaluating Fourier Coefficients.
- Apply Integral Expressions For The Forward And Inverse Fourier Transform To A Range Of Non-Periodic Waveforms.
- Solve Wave Equation And Heat Flow Equation.
- Solve Ordinary Differential Equations Using Laplace Transform.
- Solve Difference Equation Using Z-Transform.

ENC 2181 ORAL COMMUNICATION L T P C
0 0 2 1

OBJECTIVES:

- To expose students to a range of professional contexts through podcasts for learning appropriate expressions.
- To train them in making poster presentations.
- To enable them to make effective business presentations.
- To help them learn persuasive and negotiation skills.
- To train them to debate on issues of current relevance
- To train them to participate in group discussions on current affairs

MODULE I **4**

Orientation to the Importance of Oral Communication -– Verbal and non-verbal communication -Paralinguistic features.

One-minute presentations (using Audacity/Voicethread) – Just a minute (JAM) on random topics

MODULE II **4**

Negotiating and persuading through effective arguments – to arrive at a conclusion (pair-work)

Understanding Negotiation, persuasion and marketing skills through Podcasts

Listening to short conversations and monologues for understanding real life conversations

MODULE III **4**

Making Poster presentations on current issues

Understanding nuances of making effective presentations (TED Videos)

MODULE IV **6**

Deliberation on social and scientific issues – Debates (focus on rebuttal skills and deconstructing arguments)

Viewing videos on debates (NDTV Discussions)

MODULE V **6**

Discussing social issues or current affairs in groups

Viewing group discussions and listening for specific information

MODULE VI **6**

Making full length presentation (through Voicethread) with the focus on one’s career plans

and prospects (discipline specific)

Listening to interviews for understanding speakers' perception (on industry related issues)

P – 30; Total Hours –30

REFERENCES:

1. Hancock, Mark (2012). *English Pronunciation in Use*. Cambridge University Press, UK.
2. Anderson, Kenneth & et.al (2007). *Study Speaking: A Course in Spoken English for Academic Purposes* (Second Edition). Cambridge University Press, UK.
3. Hurlock, B.Elizabeth (2011). *Personality Development*. Tata McGraw Hill, New York.
4. Dhanavel,S.P (2015). *English and Soft Skills*. Orient Blackswan, Chennai.
5. Whitby, Norman (2014). *Business Benchmark: Pre-Intermediate to Intermediate.* Cambridge University Press, UK.

OUTCOMES:

On completion of the course, students will be able to

- Listen to business conversations and do related tasks.
- Deliver effective poster presentations.
- Make effective business presentations.
- Use persuasive and negotiating skills for justifying arguments.
- Participate effectively in debates.
- Speak English intelligibly, fluently and accurately in group discussions.

AEC 2101 **SOLID MECHANICS**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To give brief descriptions on the behavior of materials subjected to axial, bending, and torsional loads and predicting the failure of materials.

MODULE I AXIAL LOADING **7**

Stress and Strain, Hooke's law, Stress- Strain Diagrams for different engg., Materials, elastic constants, thermal stresses, problems on bars.

MODULE II BEAMS **10**

Statically indeterminate beams, Shear Force diagrams and Bending moment diagrams, Bending Stress and Shear stresses in beam sections, Constant Strength Beam, composite beams.

MODULE III DEFLECTION OF BEAMS **8**

Double integration method, Macauly's methods, Moment Area Method, Conjugate Beam Method, principle of superposition.

MODULE IV TORSION –SPRINGS – COLUMNS **8**

Torsion of solid and hollow circular shaft, Shear Stress variation, Power transmissions in shaft, open and closed coil helical springs, Stresses in helical springs, Euler's Column curve, Columns with different end conditions.

MODULE V PRINCIPAL STRESSES **5**

Principle Stress and Strains, Mohr's circle.

MODULE VI BIAXIAL STRESSES **7**

Stresses in thin-walled pressure vessels – combined bending, torsion and axial loading of circular shafts

Total Hours : 45

TEXT BOOKS:

1. James M Gere & Barry J. Goodno, Mechanics of Materials, Cenage Learning, 7th Edition, 2009.

2. R.K.Rajput, “Strenth of Materials:Mechanics of Solid”, Fourth edition, S.Chand Limited, 2007.

REFERENCES:

1. C.T. Sun, “Mechanics of Aircraft Structures”, Second Edition, John Wiley & Sons. 2006.
2. R.C. Hibbeler, “Structural Analysis”, Fifth Edition, Prentice-Hall, 2002.
3. B.C.Punmia, Ashok Kumar Jain, Arun Kumar Jain, “Mechanics of Materials”, Firewall media, 2002.
4. Craig, R.R., 1996, Mechanics of Materials, John Wiley & Sons, New York.
5. R.S.Khurmi, “Strength of Materials”, Twenty third Edition, S.Chand Limited, 2007

LEARNING OUTCOMES:

The students will be able to

- Predict the behavior of bars under various loadings.
- Calculate the bending and shear stress and the deflection of beams under various loadings.
- Calculate the deflection of beams under various loadings.
- Give a theoretical design of shaft for the required working conditions and predictions of the response of the springs and columns subjected to various loads.
- Predict the response of the structural elements subjected to combined loading using the theoretical and the graphical method.
- Predict the load bearing capacity of pressure vessels.

AEC 2102	THERMODYNAMICS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To provide an introduction to the basic concepts of thermodynamics, energy interactions, engine cycles and applications of thermodynamics. The course will also serve as a foundation for aircraft propulsion.

MODULE I FUNDAMENTAL CONCEPT 10

History and relevance of thermodynamics to engineering applications - Basic concepts: system-boundary and surroundings, property, state, equilibrium and state postulate, process, path and cycle - Zeroth law of thermodynamics, Thermal equation of state, Ideal Gas laws - Work transfer, Heat transfer – Modes of heat transfer.

MODULE II FIRST LAW OF THERMODYNAMICS 10

First law – Classical formulation of first law - concept of energy and its various forms, internal energy, enthalpy, specific heats at constant pressure and volume – First Law of thermodynamics for closed systems and open systems – Steady flow energy equation – Examples of steady flow processes and steady flow devices.

MODULE III SECOND LAW OF THERMODYNAMICS 10

Statements of second law – Thermal reservoir, Heat engines, refrigerators and Heat pumps - Reversible and irreversible processes, Carnot Cycle – Carnot theorem - Absolute thermodynamic temperature scale - Clausius inequality. Concept of Entropy - Tds relations - Increase of entropy principle – isentropic process, Perpetual motion machines - Availability and second law efficiency.

MODULE IV GAS AND VAPOUR POWER CYCLES 12

Ideal cycles - Otto, Diesel, Dual, Brayton cycles – efficiency – workdone - mep – Properties of Steam - Properties gas and vapour mixtures - Rankine cycle - Numerical problems.

MODULE V REFRIGERATION AND AIR-CONDITIONING 10

Principle of Refrigeration – Vapour compression & Vapour absorption types – Coefficient of performance, Properties of refrigerants, Psychrometrics – Relative Humidity – WBT/DBT - Principle of Air conditioning – Types.

MODULE VI AIR COMPRESSOR 8

Air compressor – Various types of compressors (descriptive treatment only) - working principle of reciprocating type air compressor, work of compression - minimum workdone equation - Isothermal efficiency – multistage compression and inter-cooling.

Total Hours : 60

TEXT BOOKS:

1. Yunus A. Cengal, “Thermodynamics an Engineering Approach”, 8th Edition, Tata McGraw-Hill Co. Ltd., 2014.
2. Nag P. K., “Engineering Thermodynamics”, 6th Edition, Tata McGraw-Hills Co., Ltd., 2017.

REFERENCES:

1. Mayhew, A. and Rogers, B., “Engineering Thermodynamics”, E.L.B.S. Edition, Longman Green & Co. Ltd., London, 1990.
2. Saad, M.A., “Thermodynamics for Engineers”, Prentice-Hall of India Pvt. Ltd., 1989
3. Reynolds, “Thermodynamics”, Int. Student Edition, McGraw-Hill Book Co., Ltd., 1990
4. Kroes Michael J; Wild Thomas W, “Aircraft Powerplants” 7th Edition, Tata McGraw-Hill, 2007.
5. Hill Philip, Peterson Carl, “Mechanics and Thermodynamics of Propulsion”, Addison Wesly, 2nd Edition, 2009.
6. J.D.Mattingly, “Elements of Propulsion - Gas Turbines and Rockets”, AIAA Education series, 2006

COURSE OUTCOMES:

Students will able to

- Identify and relate various properties and thermodynamic system.
- Apply an appropriate formulation of the first law to relate energy, heat and work.
- Evaluate entropy changes in a wide range of processes and determine the reversibility or irreversibility of a process from such calculations.
- Employ temperature-entropy diagrams to analyze the gas and vapour power

cycles.

- Calculate cooling load for refrigeration and air-conditioning systems.
- Determine work input for an air compressor with a given set of operating parameters.

AEC 2103	FLUID MECHANICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the properties of fluids and the Governing equations representing the fluid flow problems. To introduce the concepts of dimensional analysis and its applications. To provide the basic knowledge of the working principles of pumps and turbines.

MODULE I FLUID PROPERTIES AND CLASSIFICATION 7

Introduction - Definitions, units and dimensions, Mass, density, Specific Volume, Specific Weight Relative density, Viscosity, Newton's law of viscosity, Compressibility, Vapor pressure, surface tension, Capillarity, Center of pressure, Thermodynamics properties of fluid, Types of fluid.

MODULE II FLUID STATICS AND PRESSURE MEASURING DEVICES 7

Fluid statics: concept of fluid static pressure, hydrostatic pressure distribution, hydrostatic forces on plane and curved surfaces, Buoyancy and stability, Pressure ;absolute and gauge pressures - pressure measuring devices, different types of manometers and pressure gauges.

MODULE III KINEMATICS OF FLUID AND GOVERNING EQUATIONS 8

Lagrangian and Eulerian approaches- Acceleration field, material derivative, concept of control volume, control surface, fundamentals of flow visualization, and types of flow. Governing equations; mass momentum and energy conservation.

MODULE IV INTERNAL FLOWS 7

Reynolds number regimes, Internal versus external viscous flow, Head loss-friction factor, Laminar fully developed pipe flow, turbulent pipe flow, flow in non circular ducts, and minor losses in pipe system, fluid meters.

MODULE V DIMENSIONAL ANALYSIS AND FLOW PAST IMMERSED BODIES 7

Dimensional homogeneity, dimensional analysis and similarity Buckingham pi theorem. Reynolds number and geometry effects, momentum integral estimation, the

boundary layer equations, the flat- plate boundary layer, flow separation, external flows.

MODULE VI TURBOMACHINERY 9

Introduction and classification; The centrifugal pumps- performance curve and matching pump to piping system, pump cavitations and net positive suction head, pump in series and parallel, dynamic pump centrifugal pump and axial pump. Turbine; positive- displacement turbine, dynamic turbine, impulse turbine, Reaction turbine, turbine scaling laws.

Total Hours : 45

TEXT BOOKS:

1. Yunus A.Cengel and John M. Cimbala, “Fluid mechanics”, McGraw Hill 2006.

REFERENCES:

1. Frank M. White, “Fluid mechanics”, Tata McGraw Hill 2008.
2. Ira M. Cohen and P. K. Kundu, “Fluid Mechanics”, Academic Press, 2002.

LEARNING OUTCOMES:

Students will be able to:

- Understand the properties of fluid flows and the governing equations.
- Understand the various types of flows and basics of fluid machinery.
- Understand the importance of dimensional analysis.

EIC 2181 BASIC ELECTRICAL & ELECTRONICS ENGG L T P C

3 0 0 3

OBJECTIVES:

- To gain the basic knowledge on electrical circuits and machines.
- To acquaint the students to semiconductor devices and their applications
- To introduce some knowledge about the display system and its applications.
- To introduce the basic knowledge of microprocessor and its application in digital computing.

MODULE I ELECTRICAL CIRCUITS & MEASURMENTS 7

Ohm's Law – Kirchoff's Laws – Steady State Solution of DC Circuits – Introduction to AC Circuits – Waveforms and RMS Value – Power and Power factor – Single Phase and Three Phase Balanced Circuits - Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters.

MODULE II ELECTRICAL MACHINES 8

Construction, Principle of Operation, Basic Equations and Applications of DC Generators - DC Motors - Single Phase Transformer - single phase induction Motor.

MODULE III SEMI CONDUCTOR DEVICES AND APPLICATIONS 8

Introduction to Semi conductor - PN Junction diode - Zener Diode - Transistor - BJT and FET - Silicon Controlled Rectifier, Diac and Triac - Half wave and full wave Rectifier - Filter - Ripple Factor - Regulators- Principle and Types of Transistor Amplifiers.

MODULE IV LINEAR AND DIGITAL ICS 8

Number representation - Binary, Octal and Hexadecimal Number Systems - Logic families and Logic Gates - Half and full Adder - Multiplexers - Demultiplexers - Decoders - Encoders - Flip-flops - Registers - Counters IC Technology - Fabrication of Linear and Digital IC's - D/A and A/D converters - Comparison between Analog and Digital systems

MODULE V FUNDAMENTALS OF DISPLAYS TECHNOLOGIES 7

Display technologies: Construction, Working and principle of CRT - LED - LCD - EL

- Plasma panel Display - Types of Display generations - Raster and strokes - Aspect Ratio -Standard of definition SD, HD, ULD & 3D - Touch panel principles - Types of colour display formats - PAL, NTSC, SECAM.

MODULE VI FUNDAMENTALS OF DIGITAL COMPUTER 7

Digital computer – Memories- Microprocessor basics- Intel 8085 microprocessor - Simple programs using 8085.

Total Hours : 45

TEXT BOOKS:

1.V.K. Mehta, “Principles of Electronics”, 2nd Edition, S. Chand & Co., New Delhi, 2002.

2.Muthusubramanian R, Salivahanan S and Muraleedharan K A, “Basic Electrical, Electronics and Computer Engineering”,Tata McGraw Hill, Second Edition, (2006).

3. N. Mittle “Basic Electrical Engineering”,Tata McGraw Hill Edition, New Delhi, 1990.

4. Goankar R.S, “Microprocessors, Programming to Architecture 8085”, 5th Edition, Penram International publishing Pvt. Ltd., New Delhi, 2002.

REFERENCES:

1. Mehta V K, “Principles of Electronics”, S.Chand & Company Ltd, (1994).
2. Mahmood Nahvi and Joseph A. Edminister, “Electric Circuits”, Schaum’ Outline Series, McGrawHill, (2002).
3. Jacob Millman & Christos C. Halkias, “Electronic Devices and Circuits” TMH, 1991.

OUTCOMES:

Students will be able to

- Demonstrate the ability to design a system using various electrical and semiconductor devices.

- Keep abreast knowledge of latest digital technology and design of various digital logic circuits.
- Demonstrate the fundamental understanding of the display devices and various broadcasting methods
- To understand the various display techniques in aircraft modern display systems.
- Describe the communication protocol and modulation techniques followed in various modern communication systems.
- To get basic knowledge of digital computer system and its processing units.

AEC 2104	THERMODYNAMICS LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To carry out experiments to evaluate the working of different thermodynamic systems and understand heat transfer mechanisms.

LIST OF EXPERIMENTS:

1. Valve timing of a 4 - stroke engine
2. Port timing of a 2 - stroke engine.
3. Performance test on a 4-stroke diesel engine
4. Performance test on a 4-stroke petrol engine.
5. Determination of the viscosity coefficient of a given liquid
6. COP test on a vapour compression refrigeration test rig
7. COP test on a vapour compression air-conditioning test rig
8. Determination of Thermal Resistance of a Composite wall.
9. Determination of effectiveness of a parallel flow & counter flow heat exchangers
10. Performance test on 2-stage air compressor.

Total Hours : 45

OUTCOMES:

Student will be able to

- Understand the thermodynamic cycles involved in 2 and 4 stroke engines.
- Evaluate the performance of refrigeration and air- conditioning systems.
- Evaluate the effectiveness of a parallel flow & counter flow heat exchangers.
- Evaluate the performance of a 4-stroke petrol & diesel engine

AEC 2105	FLUID MECHANICS LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

This course introduces fluid mechanics applications and measurements.

LIST OF EXPERIMENTS:

1. Comparison of coefficients of discharge of given Orifice meter and Venturimeter.
2. Calibration of Rotameter
3. Impact of jet on flat and curved vanes
4. Verification of Bernoulli's equation
5. Determination of friction factor for the given set of pipes.
6. Performance test on a jet pump.
7. Performance study of Centrifugal pump / Submersible pump
8. Determination of maximum efficiency for the given Reciprocating pump.
9. Characteristic curves of Gear pump / Vane pump
10. Determination of the maximum power at constant speed / constant load for an Impulse

    turbine.

11. Performance characteristics of Reaction turbine.

Total Hours : 45

OUTCOMES:

On completing this course the student will be able to:

- Measure fluid flow through ducts and in open channels, selecting appropriate methods of Measurements.
- Conduct designed experiments, analyze and evaluate data.
- Apply dimensional analysis techniques in fluid mechanics problems.
- Evaluate the performance of centrifugal pumps, turbines and compressors.

EIC 2181 ELECTRICAL & ELECTRONICS ENGG. LAB L T P C
0 0 3 1

OBJECTIVES:

- To acquaint the students to semiconductor devices and their applications.
- To introduce the basic methods of designing the digital circuits and provide the fundamental
- concepts used in the design of digital systems.
- To introduce some knowledge about the microprocessor and its programming.

LIST OF EXPERIMENTS

1. Static characteristics of PN junction diode
2. Static characteristics of zener diode
3. Design of full wave, half wave rectifiers.
4. Study of logic gates
5. Design of half adder and full adder.
6. Design of SR and JK flipflop using gates
7. Design of T and D flipflop using gates.
8. Introduction to Arithmetic and logical programs using 8085 microprocessor
9. Saw tooth wave generation using oscilloscope
10. Triangular wave generation using oscilloscope

Total Hours : 60

REFERENCES:

1. V.K. Mehta, “Principles of Electronics”, 2nd Edition, S. Chand & Co., New Delhi, 2002.
2. Goankar R.S, “Microprocessors, Programming to Architecture 8085”, 5th Edition, Penram International publishing Pvt. Ltd., New Delhi, 2002.

OUTCOMES:

Students will be able to

- Demonstrate the ability to design a system using various semiconductor devices.
- Keep abreast of the latest digital technology and design of various digital logic circuits.
- Demonstrate the fundamental understanding of the operation of the

microprocessor and its interfacing devices

- Apply the programming techniques in developing the assembly language program for microprocessor application.

SEMESTER – IV

ENC 2282	**WRITTEN COMMUNICATION**	**L**	**T**	**P**	**C**
		0	**0**	**2**	**1**

OBJECTIVES:

- To help students identify content specific vocabulary and learn its usage.
- To expose them to reading for specific purposes, especially in professional contexts.
- To expose them to the process of different kinds of formal writing.
- To help them learn corporate correspondence for different purposes.
- To train them in preparing effective applications with résumé
- To make them write different types of reports.

MODULE I **4**

Introduction - process of writing – Fundamentals of academic and professional writing – Understanding short, real world notices, messages, etc.

MODULE II **4**

Reading industry related texts (ex. Manufacturing, textile, hospitality sector etc.) for specific information. Writing Instructions and recommendations

MODULE III **6**

Understanding format and conventions of writing email, memo, fax, agenda and minutes of the meeting. Writing email, memo, fax, agenda and minutes of the meeting for various purposes (industry specific)

MODULE IV **6**

Viewing letter of application and Résumé, letter calling for an interview, letter of inquiry and Promotional letter. Writing Functional résumé and letter of application using Edmodo,

MODULE V **6**

Viewing a Video and reading a case study (industry specific) – collaborative writing using Edmodo –reading and information transfer

Writing reports- Survey, feasibility and progress – exposure to discipline specific reports

MODULE VI **4**

Writing Statement of purpose (Higher Education)-- Justifying and writing about one's preparedness for job (Statement of Purpose highlighting strengths and weaknesses) – Peer evaluation skills through Edmodo.

P- 30; Total Hours –30

REFERENCES:

1. Riordan,D (2013). *Technical Report Writing Today*. Cengage Learning, 10th edition. USA.
2. Oliu, W. E., Brusaw, C.T., & Alred, G.J.(2012). *Writing that Works: Communicating Effectively on the Job* . Bedford/St. Martin's. Eleventh Edition.
3. Garner, B.A. (2013). *HBR Guide to Better Business Writing (HBR Guide Series)*. Harvard Business Review Press. USA.
4. Sharma, R.C. & Krishna M. (2002). *Business Correspondence and Report Writing*. Tata MacGraw – Hill Publishing Company Limited, New Delhi.
5. Macknish, C. (2010). *Academic and Professional Writing for Teachers*. McGraw-Hill Education. USA.
6. Whitby, Norman (2014). *Business Benchmark: Pre-Intermediate to Intermediate.* Cambridge University Press, UK.

OUTCOMES:

On completion of the course, the students will have the ability to

- Identify content specific vocabulary and also use them in appropriate contexts.
- Demonstrate reading skills with reference to business related texts.
- Draft professional documents by using the three stages of writing.
- Create different types of documents for various corporate correspondences.
- Write effective letter of applications, résumé and statement of purpose.
- Write business related reports efficiently.

AEC 2211 LOW SPEED AERODYNAMICS L T P C
3 0 0 3

OBJECTIVES:

- To introduce the basic aerodynamic concepts like circulation, vorticity and irrotationality.
- To understand the concepts of superposition of elementary flows for linear incompressible flow.
- To introduce the concept of classical thin airfoil theory and Prandtl's lifting line theory for wings.
- Introduce the basics of viscous flow.

MODULE I FUNDAMENTAL EQUATIONS OF AERODYNAMICS 6

Continuity, momentum and energy equations, Differential equations for streamline, angular velocity, Vortices, circulation. Stream Function, Potential Function, Equi-potential Lines, Elementary Flows and their combinations

MODULE II FUNDAMENTALS OF INVISCID INCOMPRESSIBLE FLOW 8

Bernoulli's equation, incompressible flow in a duct, pitot tube, pressure coefficient, governing equation for irrotational incompressible flow, elementary flow, ideal Flow over a circular cylinder, D'Alembert's Paradox, lifting flow over a cylinder, Kutta Jonkowski Theorem, Real flow over smooth and rough cylinder, method of source panels.

MODULE III INCOMPRESSIBLE FLOW OVER AIRFOILS 9

Airfoil nomenclature, airfoil characteristics, Kutta condition, circulation and vorticity, circulation and lift, Kutta-Joukowski transformation and its applications, Karman Trefftz Profiles, Thin Airfoil theory and its applications, vortex panel method.

MODULE IV INCOMPRESSIBLE FLOW OVER FINITE WINGS 10

Downwash and induced drag, Vortex Filament, Biot-Savart Law, Helmholtz theorems, Bound Vortex and trailing Vortex, Horse Shoe Vortex, Prandtl's Lifting Line Theory, lift and induced drag coefficients for elliptic lift distribution, effect of aspect ratio, non-

linear lifting-line method, lifting surface theory, vortex lattice method.

MODULE V INCOMPRESSIBLE LAMINAR BOUNDARY LAYER 6

Laminar incompressible boundary layer, boundary layer equations, flat plate boundary layer, Blasius solution, effect of pressure gradient, similarity in boundary layer, Karman Integral relation, laminar separation.

MODULE VI TURBULENT BOUNDARY LAYER 6

Turbulent boundary layer on a flat plate, effect of pressure gradient, Prandtl's mixing length hypothesis, free shear layers.

Total Hours –45

TEXT BOOKS:

1. Turbulent boundary layer on a flat plate, effect of pressure gradient, Prandtl's mixing length hypothesis, free shear layers.
2.

REFERENCES:

1. Houghton, E.L., and Caruthers, N.B., Aerodynamics for Engineering students, Edward Arnold Publishers Ltd., London, 1989.
2. Katz and Plotkin, Low Speed Aerodynamics, Cambridge Univ. Press, 2002
3. Milne Thomson, L.H., Theoretical Aerodynamics, Macmillan, 1985
4. John J Bertin., Aerodynamics for Engineers, Pearson Education Inc, 2002

OUTCOMES:

Students shall be able to

- Understand the capability and limitations of potential flow theory
- Estimate the force coefficients of airfoils and wings
- Perform simple viscous flow calculations.

AEC 2212 AIRCRAFT STRUCTURAL MECHANICS

L	T	P	C
3	1	0	4

OBJECTIVES:

To Study different types of structural members of aircraft subjected to various types of loading and support conditions.

MODULE I LOADS AND STRUCTURAL COMPONENTS OF AIRCRAFT **6**

V-n Diagram, Different structural members of aircraft, loads taken by the components general definitions.

MODULE II STATICALLY DETERMINATE STRUCTURES **12**

Plane truss analysis, method of joints, method of sections, 3D trusses.

MODULE III STATICALLY IN DETERMINATE STRUCTURES **12**

Propped Cantilever beams, Fixed-Fixed beams, Clapeyron's 3 moment theorem, moment distribution method, Maxwell's reciprocal theorem.

MODULE IV COLUMNS **10**

Inelastic buckling, Effect of initial curvature, Eccentric loading on columns, South well plot, Use of energy methods in column, Beam-columns

MODULE V ENERGY METHODS **10**

Strain energy due to gradual loading (axial, bending, torsion, Shear), impact loading, Castigliano's theorems, Unit load and Dummy load methods, application of energy methods to frames, beams, trusses and rings.

MODULE VI FAILURE **10**

Maximum principle Stress theory, Maximum principle Strain theory, shear stress theory, distortion energy theory, octahedral shear stress theory.

Total Hours –60

TEXT BOOKS:

1. James M Gere & Barry J. Goodno, Mechanics of Materials, Cenage Learning, 7th Edition, 2009.
2. Aircraft Structures for Engg. Students, THG Megson, Elsevier (BH), 2007.

REFERENCES:

1. C.T. Sun, “Mechanics of Aircraft Structures”, Second Edition, John Wiley & Sons. 2006.
2. R.C. Hibbeler, “Structural Analysis”, Fifth Edition, Prentice-Hall, 2002.
3. B.C.Punmia, Ashok Kumar Jain, Arun Kumar Jain, “Mechanics of Materials”, Firewall media, 2002.
4. Craig, R.R., 1996, Mechanics of Materials, John Wiley & Sons, New York.
5. R.S.Khurmi, “Strength of Materials”, Twenty third Edition, S.Chand Limited, 2007
6. R.K.Rajput, “ Strength of Materials:Mechanics of Solid”, Fourth edition, S.Chand Limited, 2007

LEARNING OUTCOMES:

Students will be able to

- Identify and relate different kinds of load factors experienced in aircraft flight.
- Estimate the load bearing capability of different structural members used in the construction of aircraft.
- Extend the concepts of solid mechanics to in-determinate structural problems.
- Give a theoretical design ofcolumns subjected to various loads.
- Obtain theoretical predictions of structural behavior using energy methods.
- Acquire knowledge on failure theories and to predict the values of the stress at which the structure fails.

AEC 2213	AIR BREATHING PROPULSION	L	T	P	C
		3	0	0	3

OBJECTIVES:

To introduce the fundamentals of air breathing propulsion and the working principles of air breathing engine components.

MODULE I FUNDAMENTALS OF AERO ENGINES 9

Gas turbine Engine development for Aircraft propulsion - Working of Gas turbine engines - the thrust equation and other performance parameters – Factors affecting thrust - Variants of Aircraft jet engines: Turboprop, Turbofan, Turbojet and Turboshaft - Performance characteristics and analysis, Ideal and Real Brayton cycles - analysis, Methods of thrust Augmentation.

MODULE II PISTON ENGINES & PROPELLER THEORY 6

IC engines for aircraft application, performance parameters of IC engines, supercharging of

aircraft IC engines - Propeller fundamentals, propeller aerodynamic theories.

MODULE III SUBSONIC & SUPERSONIC INTAKES 9

Internal flow and stall in subsonic intakes – Boundary layer separation – Major features of external flow near a subsonic intake - Relation between minimum area ratio and external deceleration ratio – Supersonic inlet flows - Starting problems in supersonic inlets - Shock swallowing methods - Modes of inlet operation.

MODULE IV COMBUSTION SYSTEMS 7

Classification of combustion chamber - Factors affecting combustion chamber performance and design - Aerodynamic pressure losses, Combustion Efficiency, combustion Intensity. Fuel Injectors, Flame stabilization, Flame holders, Flame tube cooling - Combustion instability. Numerical Problems.

MODULE V NOZZLES 7

Isentropic flow through nozzles - Choking – Area-velocity relation, Types - Effect of back

pressure on convergent and converging-diverging nozzles - over-expanded and under-expanded nozzle exit flows, Nozzle efficiency – Losses in nozzles - Fixed and variable geometry nozzles – Ejector and Variable area nozzles, Thrust vector control, Thrust reversal.

MODULE VI RAMJET& SCRAMJET PROPULSION 7

Working principle of ramjet engine – ramjet performance – sample ramjet design calculations – introduction to scramjet – preliminary concepts in supersonic combustion – integral ram-rocket - numerical problems.

Total Hours –45

TEXT BOOKS:

1. Saravanamuttoo, H.I.H., Rogers, G.F.C., Cohen H., Paul Straznicky, "Gas Turbine Theory", 6th Edition, Pearson Education Canada, 2008.
2. Hill Philip, Peterson Carl, "Mechanics and Thermodynamics of Propulsion", Addison Wesly, 1992.

REFERENCES:

1. Kroes Michael J, Wild Thomas W, "Aircraft Powerplants", 7th Edition, Tata McGraw Hill, 2010.
2. Mattingly J. D., "Elements of Gas Turbine Propulsion", Tata McGraw Hill, 2005.
3. El-Sayed Ahmed, "Aircraft Propulsion and gas turbine engines", Taylor and Francis (CRC press), 2008.
4. Rolls Royce Jet Engine", 3rd Edition, 1983.
5. Roy Bhaskar, "Aircraft Propulsion", Elsevier (India), 2008.

OUTCOMES:

Students will be able to

- Get perspective of different types of jet engines used in aircraft.
- Apply design concepts in propeller blade design.

- Learn engineering features of subsonic and supersonic intakes of jet engines.
- Acquire basic knowledge on combustion systems used in jet engines.
- Apply the basic design features of exhaust nozzles.
- Acquire knowledge of ramjet & scramjet propulsion systems.

AEC 2214	AIRCRAFT SYSTEMS & INSTRUMENTS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart knowledge of the hydraulic and pneumatic systems components and its operation.
- To introduce the basic knowledge of flight control system and its types.
- To acquaint the students to basic engine components and their applications
- To introduce some knowledge about the cabin comfort system and its applications.

To gain the basic knowledge of navigational instruments to the students.

MODULE I AIRCRAFT SYSTEMS 8

Hydraulic systems – Study of typical workable systems – components – hydraulic systems controllers – modes of operation – pneumatic systems – working principles – typical pneumatic power system – brake system – components, landing gear systems – classification – shock absorbers– retractive mechanism.

MODULE II AIRPLANE CONTROL SYSTEMS 7

Conventional Systems – power assisted and fully powered flight controls – power actuated systems – engine control systems – push pull rod system – operating principles – modern control systems – digital fly by wire systems – auto pilot system, active control technology

MODULE III ENGINE SYSTEMS 8

Fuel systems – piston and jet engines – components – multi-engine fuel systems, lubricating systems – piston and jet engines – starting and ignition systems – piston and jet engines.

MODULE IV AIR CONDITIONING AND PRESSURIZING SYSTEM 7

Basic air cycle systems – vapour cycle systems, boot-strap air cycle system – evaporative vapour cycle systems – evaporation air cycle systems – oxygen systems – fire protection systems, deicing and anti icing system.

MODULE V AIRCRAFT INSTRUMENTS 8

Flight instruments and navigation instruments – accelerometers, air speed indicators – mach meters – altimeters – gyroscopic instruments– principles and operation – study

of various types of engine instruments – tachometers – temperature gauges – pressure gauge – operation and principles.

MODULE VI MODERN AIRCRAFT SYSTEMS 7

Auto pilot system - Digital fly by wire systems - Side stick intelligent flight control system active control Technology - Electronic instrument display, EADI, EHSI - communication and Instrument landing system.

Total Hours –45

TEXT BOOKS:

1. Mekinley, J.L. and R.D. Bent, “Aircraft Power Plants”, McGraw Hill 1993.
2. Pallet, E.H.J, “Aircraft Instruments & Principles”, Pitman & Co 1993.

REFERENCES:

1. Treager, S., “Gas Turbine Technology”, McGraw Hill 1997.
2. Mckinley, J.L. and Bent R.D. “Aircraft Maintenance & Repair”, McGraw Hill,1993.
3. Handbooks of Airframe and Power plant Mechanics, US dept. of Transportation, Federal, Aviation Administration, The English Book Store, New Delhi, 1995

OUTCOMES:

Students will be able to

- Demonstrate the ability to design a various system using pneumatic and hydraulic components.
- Keep abreast knowledge on various flight control system and its recent advancements.
- Demonstrate the fundamental understanding of the operation of engine auxiliary systems.
- To understand the various cabin comfort system used in aircraft modern display systems.
- Describe principle behind the operation of various vital parameter displays and its uses in effective conduct of the flight.
- To get basic knowledge of modern aircraft system which helps in understanding the aircraft navigation system better.

AEC 2215	SOLID MECHANICS LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

To provide training in testing and evaluation of mechanical properties of the materials like hardness, fatigue strength, tensile strength, flexural strength, rigidity modulus etc.

LIST OF EXPERIMENTS:

1. Hardness test - a) Vickers b) Brinell c) Rockwell

2. Tension test

3. Torsion test

4. Impact test – a) Izod b) Charpy

5. Double shear strength test

6. Determination of stiffness and rigidity modulus on open coil spring

7. Determination of stiffness and rigidity modulus on closed coil spring

8. Determination of Young's modulus of a beam

9. Microstructure study of heat treated materials.

10. Study of stress-strain curves for various engineering materials

Total Hours –45

OUTCOMES:

Student will be able to

• Evaluate the mechanical properties of materials and compare it with theoretical models

• understand the fracture pattern of different specimen.

AEC 2216	AIRCRAFT SYSTEMS & INSTRUMENTS LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To train the students to assess the Aircraft Systems and carryout maintenan practices.
- To aware the students about the safety precautions to be followed before certifying t airworthiness of an aircraft.
- To familiarize about various systems in aircraft required to maintain airwort condition.

LIST OF EXPERIMENTS

1. Aircraft “Jacking Up” procedure.
2. Aircraft “Leveling” procedure.
3. Control system “Rigging check” procedure.
4. Aircraft “Symmetry Check” procedure.
5. “Flow test” to assess of filter element clogging.
6. “Pressure test” to assess hydraulic External/ Internal Leakage.
7. “Test of Brake System” and “Bleeding of Brake System”.
8. “Pressure test” procedure on fuel system component.
9. “Break Torque Load Test” on wheel brake units.
10. Maintenance and rectification of snags in hydraulic and fuel systems.

Total Hours – 45

LEARNING OUTCOMES:

Students will able to

- Understand the procedure required to handle an aircraft before testing its systems.
- Identify the snags in aircraft hydraulic and fuel systems and their rectifications.
- Understand the working of various aircraft systems.

AEC 2217	PROPULSION LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

To carryout experiments to study the functions of aircraft engine components, basics of heat transfer, combustion and engine exhaust characteristics.

LIST OF EXPERIMENTS:

1. Study of an aircraft piston engine. (Includes study of assembly of sub systems, various Components, their functions and operating principles)
2. Study of an aircraft jet engine (Includes study of assembly of sub systems, various Components, their functions and operating principles)
3. Study of forced convective heat transfer over a flat plate.
4. Study of free convective heat transfer over a flat plate.
5. Study of performance of a propeller.
6. Study of free jet.
7. Study of wall jet.
8. Determination of spray characteristics of injector.
9. Study of propellant mixing and casting process.
10. Determination of calorific value of fuels

Total Hours – 45

OUTCOMES:

Students will able to

• Understand the principles of heat transfer.

• Evaluate the performance of a typical propeller.

• Evaluate the heat of combustion of typical aviation fuels.

• Evaluate the spray characteristics of injector.

SEMESTER -V

MSC 3181	LEADERSHIP & CEO TRAINING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course aims at

- Bringing about positive transformation in students' attitude.
- Building unique leadership competencies that would ensure successful transition of students across all career stages.
- Sensitizing students to identify their strengths & weakness and training them to deal with it
- Assisting students in enhancing their expressive ability and inducing a high level of self confidence to manage both business and emotions
- Training students to become more adaptable and flexible to changing business environment

MODULE I Introduction to Leadership 12

Leadership concept - meaning, definitions, importance of leadership, leadership traits. Leadership functions- general functions, listening, observing, managing and decision making. Components of leadership - leaders, followers and situation. Leadership theories – Trait theory, Skills theory, Style theory, Situational theory, Transformational theory, Transactional theory, Path Goal Theory and LMX. Assessing emotional intelligence and exploring the capabilities and inherent traits.through psychometric tests - Multi factor leadership questionnaire and personal reflections

MODULE II Leadership Style and Communication 08

Leadership styles-visionary, Coaching, Affiliative, Democratic, Pacesetting Commanding, Transformational, Transactional. Autocratic, Participative, Laissez-Faire Leader versus Managers. Leadership communication - Rationale, tactic, assertive, formal, informal, communication in crisis- leadership and negotiations, Leadership Presentations-convincing and impressive style

MODULE III Leadership Roles 08

Facets of leadership- Leader as an individual – personality and leadership, values, attitudes and ethics of a leader. **Leader as a relationship builder**- empowering

people to meet higher order needs, initiating organization wide motivational programs, involvement with all stakeholders- focusing on organization growth. **Leader as an inspirer**- motivation and leadership, recognizing and appreciating contributions, empowering others to lead **Leader as an innovator** –leader's role in shaping culture and values in an organization. **Leader as a Liaison- Leader as team player**

MODULE IV Leadership Challenges and Strategies 09

Challenges in leadership: Perception of organization culture and values, interpreting the power dynamics in the organization, establishing work life balance. Bad leadership – Reasons and impact.-Case Study of Marissa Mayer-Yahoo.Inc Organizational transformation through efficient leaders-Case study of Apple Inc. Blue Ocean Leadership-Steps to Blue ocean Leadership-Four Pillars of Blue Ocean leadership-Blue Ocean leadership grid.

MODULE V Leadership and CEO Training 08

Leader as a CEO: Traits of a successful CEO, Key responsibilities of a CEO, the path to be a CEO ,Training on Board Room Discussions, Meeting the CEO –Live sessions with industry CEO's. Requirements of Leadership: - Cognitive skills, Interpersonal skills, Business skills, Strategic skills. Role of Emotional Intelligence in taking up key-positions in the organization.

MODULE VI Teaching Pedagogy:

Nurturing – Based on the identified strengths and weaknesses, training will be given to enhance the strengths and overcome the weakness.

Assessment - Continuous evaluation will be effected through group discussions, oratory assignments and situational enactments. Pre-and post-training assessment through peer reviews and faculty feedback.

Sustained development – Training will be imparted for self-development and monitoring of leadership skills to ensure sustained applicability of the skills learnt.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Andrew J DuBrin. "Leadership: Research Findings, Practice, and Skills", 8th Edition, South-Western College Pub, 2015.
2. Yukl G , "Leadership in Organisations", 8th Edition, Pearson Education, 2013.

3. Richard L Daft , “Leadership”, 5th Edition, South Western Cengage Learning 2012.
4. Stephen P. Robbins and Timothy A. Judge. “Organizational Behaviour”, 15th Edition, New Delhi: Pearson, 2013.
5. Fred Luthans, “Organizational Behavior, An Evidence Based Approach”, 12th Edition, New Delhi: McGraw Hill Education, 2013.
6. Emotional Intelligence, Why it can matter no more than IQ by Daniel Goleman (include a book) **Publisher:** Bloomsbury Publishing India Private Limited; Latest edition (2017)
7. Primal Leadership: Unleashing the Power of Emotional Intelligence by Prof Daniel Goleman , Richard Boyatzis and McKee ,Harvard Business Review Press

REFERENCES:

1. Jim Collins, (2001). “Good To Great: Why Some Companies Make the Leap...And Others Don't”, Random House Publishers India Pvt.Ltd, New Delhi
2. George, B. with Sims, P. True North: Discover Your Authentic Leadership, The Times Group Books; First edition (1 October 2015)
3. Kim, W. C., & Mauborgne, R. A. (2014). Blue ocean strategy, expanded edition: How to create uncontested market space and make the competition irrelevant. Harvard business review Press.
4. Leadership Wisdom by Robin Sharma Jaico Publishing House;

OUTCOMES:

The students will be able to

- Explore through self-introspection one’s own leadership style, their strength and weakness
- Gain self confidence to lead a team in the organization
- Realize the role of leadership in making or breaking of an organization
- Acquire the practice of self introspection and development of leadership competencies thorough continuous efforts
- Manage their own emotions as well as other resulting in successful relationship building with all stakeholders

ENC 3181	COMMUNICATION AND SOFT SKILLS - I CAREER CHOICE	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To create awareness of industrial trends and market demands.
- To encourage students to explore career opportunities in an industry and evaluate themselves in relation to industry preparedness

MODULE I **6**

Knowledge about specific industry-Discussion with industry experts --Self evaluating career prospects through survey questionnaire (based on his/her eligibility for taking up a job (industry preparedness)

MODULE II **6**

. Knowing case studies of industries(pertaining to students' choice of career)- Reading and discussing about job markets-goal setting, working on creativity.

MODULE III **4**

SWOC analysis and discussing outcomes--exploring mini projects or case studies of latest industries.

MODULE IV **6**

Writing statement of purpose pertaining to career choice---- Outcomes

MODULE V **8**

Project or case study presentations (Presentation in pairs) -mini project report or case study report.

Total Hours – 30

REFERENCES:

1. Brown,D.(2002). Career Choice and Development. Wiley,J. & Sons.USA
2. Lore,N.(1998). The Pathfinder: How to Choose or Change Your Career for a Lifetime of Satisfaction and Success. Simon & Schuster.USA.
3. Shell, G.R.(2013). *Springboard Launching your Personal Search for Success.Portfolio.USA.*

OUTCOMES:

After the completion of the course, students would be able to

- Speak about their career choice.
- Self evaluate their strengths and weaknesses and speak about it.
- Make effective presentations on case studies or relating to projects.
- Write the statement of purpose relating to their career choice.

AEC 3101 DESIGN OF COMPRESSORS & TURBINES L T P C
2 0 0 2

OBJECTIVES:

To introduce the fundamentals of aircraft compressors & turbine and analysis their design aspects

MODULE I COMPRESSORS 12

Centrifugal Compressors - Principle of operation – work done and pressure rise - slip factor, velocity diagrams, diffuser vane design considerations, Concept of Surging, choking, prewhirl, rotating stall, Performance characteristics.

Axial Compressors - Basic operation - Elementary theory – Velocity triangles – Work and compression, Design parameters - Flow coefficient - loading coefficient - Degree of reaction - diffusion factor, Cascade Analysis nomenclature - Loss and Blade performance estimation, Free vortex theory, Compressor blade design, Single and multi-stage axial compressor characteristics – Performance characteristics.

MODULE II AIRCRAFT ENGINE TURBINES 12

Axial Turbines - Elementary theory – vortex theory – choice of blade profile, pitch and chord, Turbine stage - Turbine blade 2D (cascade analysis), Work done - degree of reaction - stage design, Losses, efficiency and performance, Rotor blade and disc stresses, Multi-staging of turbine, Turbine cooling technology, Overall turbine performance. Radial flow turbines: Radial turbine Aerodynamics and thermodynamics, Losses in radial turbine and efficiency

MODULE III AIRCRAFT ENGINE SIZING & MATCHING 6

Aircraft Engine Component matching: Intake-Compressor Matching, Turbine Nozzle matching, Compressor – Turbine matching: Single and multi-spool. Free turbine and unducted Fan/Propeller Matching.

Total Hours : 30

TEXT BOOKS:

1. Cohen, H., Rogers, G.F.C. and Saravanamuttoo, H.I.H., “Gas Turbine Theory”, Pearson Education Ltd., 2009.
2. Hill, P.G. & Peterson, C.R. “Mechanics & Thermodynamics of Propulsion”, Pearson Education Inc., 2010

REFERENCES:

1. Mattingly J. D., “Elements of Gas Turbine Propulsion”, Tata McGraw Hill, 2005
2. Kroes Michael J, Wild Thomas W, “Aircraft Powerplants”, 7th Edition, Tata McGraw Hill, 2010.
3. El-Sayed Ahmed, “Aircraft Propulsion and gas turbine engines, Taylor and Francis (CRC press), 2008.
4. “Rolls Royce Jet Engine”, Third Edition, 1983.
5. Roy Bhaskar, “Aircraft Propulsion”, Elsevier (India), 2008

OUTCOMES:

Students will be able to

- Design aircraft compressor blades for single and multi-stage compressors.
- Design aircraft turbine blade profiles for gas turbines
- Interpret the performance characteristics of both compressor and turbines
- Understand the matching of components and the parameters characterizing the engine performance.

AEC 3102	AIRCRAFT STRUCTURAL ANALYSIS	L	T	P	C
		3	1	0	4

OBJECTIVES:

To introduce the analysis of various structural components under different loading conditions and the fundamentals of elasticity.

MODULE I UNSYMMETRICAL BENDING OF BEAMS 8

(CROSS SECTIONS)

Bending Stresses in beams of unsymmetrical sections, bending of sections with skew loads, Structural Idealization, bending stress in the wing box.

MODULE II SHEAR FLOW IN OPEN SECTIONS 10

Thin walled beams, concept of shear flow, shear centre, elastic axis,With one axis of symmetry, with wall effective and ineffective in bending, unsymmetrical beam sections.

MODULE III SHEAR FLOW IN CLOSED SECTIONS 10

Bredt – Batho formula, single and multi – cell structures. Shear flow in single & multicell structures under torsion, Shear flow in single and multicell under bending with walls effective and ineffective.

MODULE IV BUCKLING OF PLATES 12

Rectangular sheets under compression, local buckling stress of thin walled sections, crippling stresses by Needham's and Gerard's methods, thin walled column strength. Sheet stiffener panels, Effective width, inter rivet and sheet wrinkling failures.

MODULE V STRESS ANALYSIS IN WING AND FUSELAGE 10

Procedure – Shear and bending moment distribution of wings and fuselage, thin webbed beam. Shear resistant web beams, Tension field web beams (Wagner's).

MODULE VI BASICS OF ELASTICITY 10

Definitions, equations of equilibrium, strain displacement relationships, Stress

– Strain relationship, Compatibility equations

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. THG Megson, “Aircraft Structures for Engineering Students”, 4th Edition, Elsevier (BH) 2007.
2. Elmer Franklin Bruhn, “Analysis and Design of Flight Vehicle Structures”, S.R. Jacobs, 1973.

REFERENCES:

1. David J Peery, Jamal J Azar, “Aircraft Structures”, 2nd Edition, McGraw Hill,1982.
2. R.M Rivello, “Theory and Analysis of Flight Structures”, Illustrated Edition, McGraw Hill, 1969.
3. B. Donaldson, “Analysis of Aircraft Structures: An Introduction”, Cambridge University Press.

OUTCOMES:

Students will be able to

- Analyze the structural members of aircraft under different loading conditions.
- Carry out stress analysis on thin walled Structures such as wing and fuselage under different loading conditions.
- Obtain analytical solutions for the Buckling of finite plates.
- Differentiate between theory of elasticity and solid mechanics approaches in solving aircraft structural problems.

AEC 3103	HIGH SPEED AERODYNAMICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the effect of compressibility at high speed flows.
- To understand the basics of shock and expansion waves at supersonic flows.
- To introduce the compressible flow theories to assess the flow over airfoils and wings.

MODULE I ONE DIMENSIONAL COMPRESSIBLE FLOW E 10

Energy, momentum, continuity and state equations, velocity of sound, adiabatic steady state flow equations, flow through converging, diverging passages, performance under various back pressures.

MODULE II NORMAL SHOCK WAVES 6

Prandtl equation and Rankine – Hugonoit relation, normal shock equations, pitot static tube, corrections for subsonic and supersonic flows

MODULE III OBLIQUE SHOCKS AND EXPANSION WAVES 10

Oblique shocks and corresponding equations, hodograph and pressure turning angle, shock polars, flow past wedges and concave corners, strong, weak and detached shocks, Rayleigh and Fanno Flow. Flow past convex corners, expansion hodograph, reflection and interaction of shocks and expansion, waves, families of shocks, methods of characteristics, two dimensional supersonic nozzle contours.

MODULE IV DIFFERENTIAL EQUATIONS OF MOTION FOR STEADY COMPRESSIBLE FLOWS 13

Small perturbation potential theory, solutions for supersonic flows, Mach waves and Mach angles, Prandtl-Glauert affine transformation relations for subsonic flows, linearised two dimensional supersonic flow theory, lift, drag pitching moment and center of pressure of supersonic profiles

MODULE V AIRFOIL IN HIGH SPEED FLOWS 9

Lower and upper critical Mach numbers, lift and drag divergence, shock induced separation, characteristics of swept wings, effects of thickness, camber and aspect ratio of wings, transonic area rule, tip effects.

MODULE VI HIGH SPEED WIND TUNNELS 12

Blow down, in draft and induction tunnel layouts and their design features, transonic, supersonic and hypersonic tunnels and their peculiarities, helium and gun tunnels, shock tubes, optical methods of flow visualization.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. John D. Anderson, Jr.,"Fundamentals of Aerodynamics", Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 2007.
2. Liepmann, H. W and Roshko, A., "Elements of Gas dynamics", Dover Publication, 2002.
3. Pope, A. and Goin, L., "High Speed Wind Tunnel Testing", John Wiley, 1985

REFERENCES:

1. McCormick. B. W., "Aerodynamics, Aeronautics and Flight Mechanics", John Wiley & Sons, Inc., UK, 1995.
2. Anderson Jr., D., "Modern compressible flow", McGraw-Hill Book Co., New York 2003

OUTCOMES:

Students will be able to

- Apply airfoil theory to predict airfoil performance.
- Analyse wing performance at high speed flight.
- Model 2-D supersonic flows.
- Gain understanding on high speed wind tunnel facilities and testing.

AEC 3104	AERODYNAMICS LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To introduce the basics of Wind Tunnels and their Applications for the study of flow around different configurations and evaluation of aerodynamic forces and moments.

LIST OF EXPERIMENTS:

1. Calibration of subsonic wind tunnel.
2. Pressure distribution over smooth and rough cylinder.
3. Pressure distribution over symmetric airfoils.
4. Pressure distribution over cambered airfoils & thin airfoils
5. Force measurement using wind tunnel balance.
6. Flow over a flat plate at different angles of incidence
7. Flow visualization studies in low speed flows over cylinders
8. Flow visualization studies in low speed flows over airfoil with different angle of incidence
9. Calibration of supersonic wind tunnel.
10. Supersonic flow visualization with Schlieren system.

Total Hours – 45

OUTCOMES:

Students will be able to

- Measure flow velocity, lift and drag coefficients using wind tunnels.
- Understand the dependence of airfoil pressure distribution on the lift coefficient.
- Use the flow visualization techniques to visualize compressible and incompressible
  flows.

AEC 3105 AIRCRAFT STRUCTURAL ANALYSIS LAB

L	T	P	C
0	0	3	1

OBJECTIVES:

- To carryout experiments to study the load-deflection characteristics of beams and the response of structural members under various loading conditions.

LIST OF EXPERIMENTS:

1. Determination of Young's Modulus for the given material (statically determinate beam) and verify Maxwell's reciprocal theorem for the same using extensometers
2. Determination of Young's Modulus for the given material (statically indeterminate beam) and verify Maxwell's reciprocal theorem for the same using extensometers.
3. Southwell – plot.
4. Unsymmetrical bending of beams
5. Determination of Shear center for Closed and Open Section.
6. Constant Strength Beam
7. Beam with combined loading.
8. Calibration of photo-elastic material and determination of Stresses in circular discs and beams.
9. Vibrations of beams
10. Wagner's beam.

Total Hours – 45

OUTCOMES:

Students will be able to

- Evaluate the material properties of aircraft structural members.
- Obtain experimental results of static and dynamic structural responses and compare with that of theoretical values.
- Determine the stress pattern for different cross sections using photo-elastic apparatus.

SEMESTER - VI

MSC 4181	**SOCIAL ENTREPRENEURSHIP**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

1. To be able to understand the field of social entrepreneurship and Social problems
2. To be able to describe and understand the traits of social entrepreneurs
3. To recognize the social business opportunities
4. To synthesize the resource mobilization ways for social entrepreneurship
5. To understand the social entrepreneurship models
6. To recognize the impact of social entrepreneurship on societies.

MODULE I INTRODUCTION TO SOCIAL ENTREPRENEURSHIP 7

Introduction - Emergence and Development of Social Entrepreneurship. Social Problems in India: An Overview. Social Development: The Indian Scenario. Emergence of Social Entrepreneurs and Sustainable Solutions to Social Problem. Characteristics and Context of Social Entrepreneurship .The Role of Social Entrepreneurship in Societies & Economies.

MODULE II SOCIAL ENTREPRENEURSHIP: DRIVERS AND CHALLENGES 7

The Drivers of Social Entrepreneurship. Elements of the Social Entrepreneurial Personality. Challenges of financial constraints. Challenge to attract and cultivate talented workers. Challenge of evaluation of social entrepreneur impact. Challenge of scaling and its impact. Cases

MODULE III SOCIAL ENTREPRENEURSHIP: OPPORTUNITY RECOGNITION 7

Opportunity Recognition and Planning Process. Opportunities for Social Entrepreneurs. The Nature of Social Entrepreneurial Opportunities. Social Problems into Opportunities. Idea development and conceptualization of social problem. Cases

MODULE IV RESOURCE MOBILIZATION FOR SOCIAL VENTURE 8

Resources at Initial Stage. Social Network as a role of Social Capital. Team and Collective Efforts. Need and Determination of Important Resources. Resource of Knowledge, Skills and Abilities. overview of venture capital and angel investment. Cases

MODULE V **BUSINESS MODELS AND BUSINESS PLAN FOR SOCIAL ENTERPRISES** **8**

Design Principles of Social Entrepreneurship Business Models , Evaluation of the Root Cause of a Societal Problem. Developing business plan for social ventures. Developing an investor presentation. Feasibility study and report. How to start a business - Procedures for registration of small scale industry

MODULE VI **THE IMPACT OF SOCIAL ENTREPRENEURSHIP ON SOCIETIES AND CASES** **8**

Static Impact of Social Entrepreneurship. Impact of Charitable NGOs vs. Social Entrepreneurship, Impact of For-Profit Companies vs. Social Entrepreneurship. Social entrepreneurship report preparation by students.

Case Study of Social Entrepreneurs

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Social Entrepreneurship : New models of sustainable social change” . Alex Nicholls, Oxford University Press 2006
2. The Process of social value creation : A multiple case study on Social Entrepreneurship in India , Archana Singh Springer 2016
3. “Social Entrepreneurship and social business” Christine K Volkmann, Springer Gabler 2012
4. “Social Entrepreneurship” Manuel London ,Routlege, 2010.

OUTCOMES:

The students can able to

1. Conceptualize social entrepreneurship in terms of a theoretical framework between changing social values and institutions
2. Think and communicate about social values
3. Learn about practical models of social change to launch, lead, manage, and evaluate a social venture
4. Analyze funding needs and sources for the social venture
5. Experience the ideas can be critically and collaboratively examined prior to commitment.

ENC 3281 COMMUNICATION AND SOFT SKILLS - II L T P C

CONFIDENCE BUILDING 0 0 2 1

OBJECTIVES:

- To develop professional skills like work ethics, analytical skills, presentation skills etc.
- To train them in problem solving skills and leadership skills pertaining to industries.
- To train them in team building skills.
- To train in setting up career goals

MODULE I **6**

Brief about Multinational companies- Analysing work ethics of multinational companies and small industries- discussing as pairs-Knowledge about etiquette (different types)

MODULE II **6**

Visit to an Industry and prepare reports --Critically reading of industry specific journal articles and write ups-- preparing reports.

MODULE III **4**

Analysing problem solving situations in industries (relating to application of core subject to specific jobs) and discussing about them- working on a sample case

MODULE IV **6**

Developing Leadership in team projects-- debating about various aspects of leadership: for example, responsibility and reliability-time management

MODULE V **8**

Team building skills-- group discussions pertaining to industries-- presenting career goals. -- preparing for interviews- interpersonal skills

Total Hours – 30

REFERENCES:

1. Covey,S.R. (2004). The 7Habits of Highly Effective People: Powerful Lessons in Personal Change. Free Press.UK
2. Fine, P.M.& Alice Olins. (2016).Step up: Confidence, Success and Your Stellar Career in 10 Minutes a Day. Vermilion.UK
3. Pai, A. (1993).How to Develop Self-Confidence. Amazon.com
4. Wentz,F.H.(2012). Soft skills training: A Workbook to Develop Skills for Employment. Amazon.com

OUTCOMES:

After completing the course students would be able to

- Exhibit critical reading skills through review of industry specific articles.
- Provide solutions to problem based situations.
- Exhibit leadership qualities by debating over industry specific issues.
- Participate in group discussions confidently.
- Present their career goals.

AEC 3211	ROCKET PROPULSIOn	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce different types of propellants for rocket propulsion and the study of system performance.

MODULE I CLASSIFICATION AND FUNDAMENTAL OF ROCKET PROPULSION 7

Duct Jet Propulsion, Rocket Propulsion, Applications of Rocket Propulsion Thrust, Exhaust Velocity, Energy and Efficiencies, Typical Performance Values, Nozzle Configurations, Nozzle performance parameters.

MODULE II LIQUID PROPELLANT ROCKET ENGINE FUNDAMENTALS 7

Propellants, Propellant Feed Systems, Gas Pressure Feed Systems, Propellant Tanks, Tank Pressurization, Turbopump Feed Systems and Engine Cycles, Flow and Pressure Balance

MODULE III LIQUID PROPELLANTS AND COMBUSTION 8

Propellant Properties, Liquid Oxidizers, Liquid Fuels, Liquid Monopropellants, Gelled Propellants, Gaseous Propellants, Safety and Environmental Concerns, Thrust Chambers, Injectors, Injectors flow characteristics, Combustion Process, Combustion Instability.

MODULE IV SOLID PROPELLANT ROCKET FUNDAMENTALS 7

Propellant Burning Rate, Basic Performance Relations, Propellant Grain and Grain Configuration, Propellant Grain Stress and Strain.

MODULE V SOLID PROPELLANTS AND COMBUSTION 9

Classification, Propellant Characteristics, Hazards, Propellant Ingredients, Other Propellant

Categories Liners, Insulators, and Inhibitors, Combustion of Solid Propellants,

Physical and

Chemical Processes, Ignition Process, Extinction or Thrust Termination, Combustion Instability

MODULE VI THRUST VECTOR CONTROL 7

TVC Mechanisms with a Single Nozzle, TVC with Multiple Thrust Chambers or Nozzles Testing Integration with Vehicle, Attitude Control and Side Maneuvers with Solid Propellant Rocket Motors

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. George P. Sutton, Oscar Biblarz, “Rocket Propulsion Elements”, 7th Edition, John-Wiley

& Sons, Ltd., 2001.

REFERENCES:

1. R. Humble, G. Henry, and W. Larson, “Space Propulsion Analysis and Design”, McGraw-Hill, New York, 1995.
2. Hill, Philip and Carl Peterson, “Mechanics and Thermodynamics of Propulsion”, Prentice Hall, 1991.

OUTCOMES:

Students will be able to

- Apply thermodynamic relations for rocket engines and nozzles for the evaluation of engine performance
- Understand the ballistics properties of propellants and combustion kinetics.
- Understand the mechanisms involved in thrust vector control.

AEC 3212	FLIGHT DYNAMICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the study of performance and stability characteristics of aircraft under various operating conditions and atmospheric disturbances.
-

MODULE I DRAG ON THE AIRPLANE 7

Forces and moments acting on a flight vehicle , equation of motion of a rigid flight vehicle , different types of drag , drag polar of vehicles from low speed to high speeds , variation of thrust, power and SFC with velocity and altitudes for air breathing engines and rockets , power available and power required curves.

MODULE II AIRCRAFT PERFORMANCE 8

Performance of airplane in level flight, maximum speed in level flight , conditions for minimum drag and power required , range and endurance , climbing and gliding flight- maximum rate of climb and steepest angle of climb, minimum rate of sink and shallowest angle of glide, Turning performance -Turning rate turn radius, Bank angle, Limitations of pull up and push over, V-n diagram and load factor.

MODULE III STATIC LONGITUDINAL STABILITYAND CONTROL 8

Degree of freedom of rigid bodies in space , Static and dynamic stability– static longitudinal stability , stick fixed stability , basic equilibrium equation , stability criterion , effects of fuselage and nacelle , influence of CG location , power effects , stick fixed neutral point , stick free stability, Hinge moment coefficient , stick free neutral points, symmetric maneuvers , stick force gradients , aerodynamic balancing.

MODULE IV DIRECTIONAL STABILITY AND CONTROL 7

Static directional stability rudder fixed – directional control, Stick free directional stability adverse yaw effects –slip stream rotation –crosswind during takeoff and landing, spinning, Anti symmetric power.

MODULE V LATERAL STABILITY AND CONTROL 6

Dihedral effect –estimation of airplane dihedral effect–effects of wing sweeps, flaps,

power on dihedral effect, lateral control – Aileron control forces, aileron levers.

MODULE VI DYNAMIC STABILITY 9

Equation of longitudinal motion –Evaluation of stability derivatives –solution of equation of motion (stick fixed case),solution of equation of motion (stick free case) –lateral dynamics – lateral degrees of freedom, characteristics motion of the airplane with control locked., Evaluation of stability derivatives, response to aileron control , response to aileron with adverse yaw, dynamic lateral stability rudder free, aileron free.

L – 45; T – 15; Total Hours –45

TEXT BOOKS:

1. Anderson, J.D., “Aircraft performance and design”, McGraw Hill, 1995.
2. Perkins, C.D., and Hage, R.E., “Airplane Performance stability and Control”, John Wiley & Son, Inc, New York, 2011.

REFERENCES:

1. Nelson, R.C. “Flight Stability and Automatic Control”, McGraw Hill Book Co., 1998.

OUTCOMES:

Students will be able to

- Have a broad understanding of the performance of aircraft during climb, cruise, descent and landing.
- Evaluate and understand the V-n diagram.
- Calculate the basic design parameters such as range and endurance
- Analyze the static and dynamic stability of aircraft.

AEC 3213	AIRCRAFT MATERIALS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce types of materials used in aircraft, their characteristics and applications.

MODULE I INTRODUCTION TO AIRCRAFT MATERIALS 7

General properties of materials, definition of terms, requirements of aircraft materials, testing of aircraft materials, inspection methods, application and trends in usage in aircraft structures and engines, introduction to smart materials and nanomaterials; selection of materials for use in aircraft.

MODULE II AIRCRAFT METAL ALLOYS 6

Aluminum alloys, magnesium alloys, titanium alloys, plain carbon and low carbon steels, corrosion and heat resistant steels, maraging steels, copper alloys,Producibility and surface treatments aspects for each of the above

MODULE III AIRCRAFT SUPERALLOYS AND CORROSION 7

General introduction to superalloys, nickel based superalloys, cobalt based superalloys,and iron based superalloys, manufacturing processes associated with superalloys, heat treatment and surface treatment of superalloys. Knowledge of the various methods used for removal of corrosion from common aircraft metals and methods employed to prevent corrosion.

MODULE IV COMPOSITE MATERIALS 8

Definition and comparison of composites with conventional monolithic materials, reinforcing fibers and matrix materials, carbon-carbon composites production, , inter metallic matrix composites, ablative composites based on polymers, ceramic matrix, metal matrix composites based on aluminum, magnesium, titanium and nickel based composites for engines.

MODULE V POLYMERIC MATERIALS, CERAMICS&GLASS 9

Knowledge and identification of physical characteristics of commonly used polymeric

material: plastics and its categories, properties and applications; commonly used ceramic, glass and transparent plastics, properties and applications, adhesives and sealants and their applications in aircraft.

MODULE VI AIRCRAFT WOOD, RUBBER, FABRICS & DOPE AND PAINT **8**

Classification and properties of wood, seasoning of wood, aircraft woods, their properties and applications, joining processes for wood, plywood; characteristics and definition of terminologies pertaining to aircraft fabrics and their applications, purpose of doping and commonly used dopes; purpose of painting, types of aircraft paints, aircraft painting process.

L – 45; T – 15; Total Hours – 45

TEXT BOOKS:

1. Kenneth. G.Budinski& Michael .K. Budinski, “Engineering material properties and selection”,Prentice Hall publications, 2010.

REFERENCES:

1. F.C Campbell,” Manufacturing technology for aerospace structural materials”, Elsevier publication.

OUTCOMES:

Students will be able to

- Understand the properties of materials used in various parts of aircraft.
- Classify the materials based on the structures and its properties.
- Understand the importance of surface treatment/coating and its process.

EC 3214	AIRCRAFT DESIGN PROJECT - I	L	T	P	C
		1	0	3	2

OBJECTIVES:

- To train the students on preliminary aircraft design work using suitable procedures to evolve the basic configuration design.

1. Comparative configuration study of different types of airplanes
2. Comparative study on specification and performance details of aircraft
3. Preparation of comparative data sheets
4. Work sheet layout procedures
5. Comparative graphs preparation and selection of main parameters for the design
6. Preliminary weight estimations, selection of main parameters,
7. Power plant selection, Aerofoil selection, Wing tail and control surfaces
8. Preparation of layouts of balance diagram and three view drawings
9. Drag estimation
10. Detailed performance calculations and stability estimates

Total Hours – 45

OUTCOMES:

Students will be able to

- Identify information requirements and sources for aircraft design and evaluation.
- Apply the fundamental principles of Aerodynamics, Flight performance & stability and

propulsion to evolve the configuration of an aircraft.

- Learn to work as a team to achieve the goal.
- Apply cognitive design skills to generic design problems.

SEMESTER - VII

		L	T	P	C
AEC 4101	**AVIONICS (LAB INTEGRATED)**	**3**	**0**	**3**	**4**

OBJECTIVES:

- To introduce the basic concepts of avionics systems utilized in Aircraft.

MODULE I INTRODUCTION 7

Need for avionics in civil and military aircraft and space systems – integrated avionics and weapon systems – typical avionics subsystems, design, technologies.

MODULE II PRINCIPLE OF DIGITAL SYSTEMS 7

Digital computer –Digital number system- number systems and codes-fundamentals of logic and combinational logic circuits- Digital arithmetic-interfacing with analogue systems- Microprocessor basics- intel 8085,8086 microprocessor- Memories.

MODULE III DIGITAL AVIONICS ARCHITECTURE: 8

Avionics system architecture – salient features and application of Data buses – MIL-STD-1553B – ARINC 429 –ARINC 629.

MODULE IV FLIGHT DECKS AND COCKPITS: 8

Control and display technologies: CRT, LED, LCD, EL and plasma panel – Touch screen – direct voice input (DVI)- civil and military cockpits: MFDS, HUD, MFK, HOTAS.

MODULE V AVIONICS SYSTEM (AIR DATA INSTRUMENTS & POWER PLANTS INSTRUMENTS) 8

Air data instruments- Airspeed, altitude, vertical speed indicators- Angle of attack measurements- Pressure measurements- Temperature measurements, fuel quantity measurement, engine power and control instruments- measurements of RPM, EPR, fuel flow, engine vibration.

MODULE VI AVIONICS SYSTEMS(COMMUNICATION & NAVIGATIO INSTRUMENTS) 8

Communications systems- Navigation systems – flight control systems – radar –

electronic warfare – utility systems reliability and maintainability –certification.

Total Hours – 45

TEXT BOOKS:

1. Spitzer, C.R. “Digital Avionics Systems”, McGraw Hill, 1993.
2. Gaokar, R.S., “Microprocessors Architecture-Programming and Applications”, Wiley and Sons Ltd., New Delhi, 1990.
3. Pallet, E.H.J., “Aircraft Instruments & integrated systems”, Longman Scientific and Technical, McGraw Hill, 1992.

REFERENCES:

1. Middleton, D.H., Ed., “Avionics systems, Longman Scientific and Technical”, Longman Group UK Ltd., England, 1989.
2. Brain Kendal, “Manual of Avionics”, 3rd Edition, The English Book House, New Delhi,

OUTCOMES:

Students will be able to,

- Understand the basic principles, theory and operation of modern avionics systems
- Implement various modern avionic systems for both civil and military aircraft.
- Understand the principles of various avionics systems like navigation, communication and electronic warfare.

AEC 4102	FINITE ELEMENT METHOD	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the concept of finite element analysis of structural components.

MODULE I INTRODUCTION 6

Basic steps in fem, Solution of differential equations using weighted residual methods, Rayleigh and Ritz Method, Convergence criteria of finite element method.

MODULE II DISCRETE ELEMENTS 8

1 D elements, Bar elements (both Mechanical and thermal Loading), Beam element, Use of local and natural coordinates, Truss Analysis.

MODULE III CONTINUUM ELEMENTS 10

Constant and linear strain triangular elements, Plane stress, Plane strain, Axisymmetric problems.

MODULE IV ISOPARAMETRIC ELEMENTS 7

Mapping of Elements, shape function for quadrilateral elements, stiffness matrix, consistent load vector, Serendipity elements, Gaussian integration.

MODULE V FIELD PROBLEMS 6

Heat transfer problems, steady state fin problems, torsion problems, Flow Field Problems.

MODULE VI VIBRATION ANALYSIS 8

Single degree of Freedom , Multiple degrees of Freedom System, Transverse vibrations of strings, Longitudinal, Lateral and Torsional vibrations.

Total Hours –60

TEXT BOOKS:

1. J.N. Reddy, “An Introduction to Finite Element Method”, 3rd Edition, Tata McGraw Hill, 2006.
2. Chandrupatla and Belegundu, “Introduction to Finite Elements in Engineering”, 4th Edition(revised), Pearson Education, 2011.

REFERENCES:

1. Seshu. P., “Textbook of Finite Element Analysis”, Illustrated Reprint, Prentice Hall of India Learning Pvt Ltd., 2003.
2. R. D. Cook., “Concepts and Applications of Finite Element Analysis”, 2nd Edition, Wiley, 1981.
3. David V. Hutton., “Fundamentals of Finite Element Analysis”, Tata McGraw Hill, 2005.
4. S.S. Rao, “Finite Element Analysis”, 4th Edition, Elsevier Butterworth Heinemann, 2011
5. O. C. Zienkiewicz and Y.K. Cheung., “The Finite Element Method: Its Basis and Fundamentals”, 6th Edition (Reprint), Butterworth Heinemann, 2005.
6. G Lakshmi Narasiah., “Finite Element Analysis”, Illustrated Edition, B S publications, 2009.

OUTCOMES:

Students will be able to

- Apply weighted residual methods to solve differential equations.
- Obtain finite element equations for and 1D and 2D problems and apply the same to solve the structural problems.
- Understand Mapping of elements and formulate Shape functions for different types of elements.
- Obtain finite element equations and solve field problems involving fluid flow and heat transfer.

AEC 4104	AIRCRAFT DESIGN PROJECT - II	L	T	P	C
		1	0	3	2

OBJECTIVES:

- To introduce the detailed design procedure to be adapted for the design of selected type of aircraft

Each student is assigned with work in continuation of the design project – I. The following sequence is to be carried out.

1. V-n diagram for the design study
2. Gust and maneuverability envelopes
3. Critical loading performance and final V-n graph calculation
4. Structural design study – theory approach
5. Load estimation of wings
6. Load estimation of fuselage.
7. Balancing and maneuvering loads on tail plane, aileron and rudder loads.
8. Detailed structural layouts
9. Design of some components of wings, fuselage
10. Preparation of a detailed design report with CAD drawings.

Total Hours –45

OUTCOMES:

Students ill be able to

- Finalize the V-n diagram of the selected aircraft
- Estimate the limiting loads on the aircraft during flight
- Apply suitable design methods and design structural elements/ systems for a given aircraft
- Prepare CAD drawings of the designed aircraft.

AEC 4105	CFD-STRUCTURAL ANALYSIS LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To familiarize the students with the application of CFD/ CSM codes and their applications in aeronautics.
- To train the students to compute the flow features and stress distributions over aircraft components.

LIST OF EXPERIMENTS

CFD Analysis of

(i) Flow over an airfoil
(ii) Flow over a cone cylinder fuselage configuration
(iii) Free jet flow

Computational Structural Analysis of

(i) Wing spar
(ii) Fuselage bulkhead

Total Hours –45

OUTCOMES:

Students will be able to

- Identify suitable computational domains, boundary conditions for simple flow problems
- Select the appropriate meshing techniques and suitable solver for the flow problems
- Simulate the flow around various configurations and interpret the results obtained
- Analyse the structural response of different Aircraft structural components for various
  loads.

PROFESSIONAL ELECTIVES

		L	T	P	C
AECX02	**HYPERSONIC AERODYNAMICS**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To introduce the basic concepts of hypersonic flows and their effects on flight vehicles

MODULE I FUNDAMENTALS OF HYPERSONIC AERODYNAMICS 7

Introduction to hypersonic aerodynamics, differences between hypersonic aerodynamics and supersonic aerodynamics, concept of thin shock layers, hypersonic flight paths, hypersonic Similarity parameters, shock wave and expansion wave relations of inviscid hypersonic flows.

MODULE II SIMPLE SOLUTION METHODS FOR HYPERSONIC INVISCID FLOWS 8

Local surface inclination methods, Newtonian theory, modified Newtonian law, tangent wedge and tangent cone methods, shock expansion methods, approximate theory-thin shock layer theory.

MODULE III VISCOUS HYPERSONIC FLOW THEORY 7

Boundary layer equation for hypersonic flow-hypersonic boundary layers, self-similar and non self-similar boundary layers, solution methods for non self-similar boundary layers aerodynamic heating.

MODULE IV VISCOUS INTERACTIONS IN HYPERSONIC FLOWS 7

Introduction to the concept of viscous interaction in hypersonic flows, strong and weak viscous interactions, hypersonic viscous interaction similarity parameter, introduction to shock wave boundary layer interactions.

MODULE V INTRODUCTION TO HIGH TEMPERATURE EFFECTS 8

Nature of high temperature flows, chemical effects in air-real and perfect gases-Gibb's free energy and entropy-chemically reacting mixtures-recombination and dissociation.

MODULE VI EXPERIMENTAL FACILITIES FOR HYPERSONIC FLOWS **8**

Impulse facilities, hypersonic wind tunnels, shock tunnels, gun tunnels, and heat transfer measurements.

Total Hours – 45

TEXT BOOKS:

1. John. D. Anderson. Jr., “Hypersonic and High Temperature Gas Dyanmics”, McGraw hill Series, New York, 1996.

REFERENCES:

1. John. D. Anderson. Jr ., “Modern compressible flow with historical perspective”, McGraw Hill Publishing Company, New York, 1996.
2. John. T Bertin, “Hypersonic Aerothermodynamics”, published by AIAA Inc.,Washington.D.C., 1994.

OUTCOMES:

Students will be able to:

- Understand the procedure to solve inviscid and viscous hypersonic flow problems.
- Understand high temperature effects in hypersonic aerodynamics.
- Familiar with the experimental setups used for simulating hypersonic flows.

AECX06	THEORY OF ELASTICITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the theoretical concepts of material behavior with elastic properties.

MODULE I ANALYSIS OF STRESS 7

Definitions, stress tensors, notations and sign conventions for stress, equations of equilibrium, principle stresses in three dimensions, Saint Venant's principle, problems.

MODULE II ANALYSIS OF STRAIN 7

Strain – displacement relations, stress – strain relations, Lame's constant – cubical dilation, compressibility of material, bulk modulus, shear modulus, compatibility equations for stresses and strains, problems.

MODULE III PLANE STRESS AND PLANE STRAIN PROBLEMS 9

Airy's stress function, bi-harmonic equations, polynomial solutions, simple two-dimensional problems in cartesian coordinates like bending of cantilever and simply supported beams, etc.

MODULE IV POLAR COORDINATES 7

Equations of equilibrium, strain displacement relations, stress-strain relations, problems axi-symmetric Equilibrium and strain displacement relations.

MODULE V STRESS CONCENTRATION 7

Stress due to concentrated load, stress distribution near concentrated load acting on beam, Kirsch and Boussinesque problems.

MODULE VI TORSION 8

Navier's theory, St. Venant's theory, Prandtl's theory on torsion, the semi-inverse method and applications to shafts of circular, elliptical, equilateral triangular and

rectangular sections.

Total Hours – 45

TEXT BOOKS:

Timoshenko, S., and Goodie, T.N., “Theory of Elasticity”, Tata McGraw Hill, 2010.

REFERENCES:

1. Enrico Volterra & J.H. Caines, “Advanced Strength of Materials”, Prentice Hall, New Jersey, 1991.
2. Wang, C.T., ‘Applied Elasticity”, McGraw Hill Co., New York, 1993.
3. Atkin, R. J., & Fox, N., “An Introduction to the theory of Elasticity”, Dover publication, 2005.
4. Ansel C. Ugural and Fenter S. K., “Advanced strength and applied elasticity”, prentice hall, 2003.

OUTCOMES:

Students will be able to

- Evaluate the state of stress and strain.
- Solve theory of elasticity problems using numerical methods.

AECX07	FATIGUE AND FRACTURE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the mechanisms involved in failure of components due to fatigue and fracture.

MODULE I PLANE ELASTICITY 6

In plane and out of plane problems, Airy's Stress Function, Plates with circular and elliptical hole.

MODULE II PHYSICAL ASPECTS OF FATIGUE 5

Phase in fatigue life, Crack initiation, Crack growth , Final Fracture, Dislocations, Fatigue fracture surfaces.

MODULE III FATIGUE OF STRUCTURES 10

S.N. curves , Endurance limits, Effect of mean stress, Goodman, Gerber and Soderberg relations and diagrams, Notches and stress concentrations, Neuber's stress concentration factors, Plastic stress concentration factors, Notched S.N. curves.

MODULE IV STATISTICAL ASPECTS OF FATIGUE BEHAVIOR 8

Low cycle and high cycle fatigue, Coffin - Manson's relation, Transition life, cyclic strain hardening and softening, Analysis of load histories, Cycle counting techniques , Cumulative damage, Miner's theory , Other theories.

MODULE V FRACTURE MECHANICS 10

Strength of cracked bodies, Potential energy and surface energy, Griffith's theory, Irwin - Orwin extension of Griffith's theory to ductile materials, stress analysis of cracked bodies, Effect of thickness on fracture toughness, stress intensity factors for typical geometries.

MODULE VI FATIGUE AND FRACTURE DESIGN AND TESTING 6

Safe life and fail safe design philosophies, Importance of Fracture Mechanics in aerospace structures – Application to composite materials and structures.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Prashant Kumar, “Elements of Fracture Mechanics”, Tata McGraw Hill, New Delhi, India, 2009.
2. Barrois W, Ripley, E.L., “Fatigue of Aircraft Structure”, Pegamon press. Oxford, 1983.

REFERENCES:

1. K. R.Y.Simha, “Fracture Mechanics for Modern Engineering Design”, Universities Press (India) Limited, 2001
2. D.Broek, “Elementary Engineering Fracture Mechanics”, Kluwer Academic Publishers, Dordrecht, 1986.
3. T.L.Anderson, “Fracture Mechanics - Fundamentals and Applications”, 3rd Edition, Taylor and Francis Group, 2005.
4. Suresh. S., “Fatigue of Materials” , 2nd Edition, Cambridge University Press, 1998

OUTCOMES:

Students will be able to

- Understand the fundamental principles and assumptions involved in the basic analysis of Fatigue and Fracture of Structures.
- Evaluate the structures from the view of fatigue and fracture mechanics.

AECX14	BEHAVIOR OF MATERIALS AT HIGH TEMPERATURES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the effect of high temperatures on the behavior of materials and material properties

MODULE I CREEP 12

Factors influencing functional life of components at elevated temperatures, definition of creep curve, various stages of creep, metallurgical factors influencing various stages, effect of stress, temperature and strain rate, Design of transient creep time, hardening, strain hardening, expressions of rupture life of creep, ductile and brittle materials, Monkman-Grant relationship.

MODULE II FRACTURE 9

Various types of fracture, brittle to ductile from low temperature to high temperature, cleavage fracture, and ductile fracture due to micro void coalescence-diffusion controlled void growth; fracture maps for different alloys and oxides.

MODULE III OXIDATION 5

Oxidation, Pilling, Bedworth ratio, kinetic laws of oxidation, defect structure and control of oxidation by alloy additions,

MODULE IV HOT CORROSION 7

Hot gas corrosion deposit, modified hot gas corrosion, fluxing mechanisms, effect of alloying elements on hot corrosion, interaction of hot corrosion and creep, methods to combat hot corrosion.

MODULE V SUPERALLOYS 7

Iron base, Nickel base and Cobalt base super alloys, composition control, solid solution strengthening, precipitation hardening by gamma prime, grain boundary strengthening, TCP phase, embrittlement, solidification of single crystals, Intermetallics, high temperature ceramics.

MODULE VI ABLATION 5

Ablative materials, Applications, Advantages and Disadvantages, Ablative heat

transfer.

Total Hours –45

TEXT BOOKS:

1. Hertzberg R. W., “Deformation and Fracture Mechanics of Engineering materials”, 4th Edition, John Wiley, USA, 1996.
2. Courtney T.H, “Mechanical Behavior of Materials”, McGraw-Hill, USA, 1990.

REFERENCES:

1. Bressers. J., “Creep and Fatigue in High Temperature Alloys”, Applied Science, 1981.
2. Raj. R., “Flow and Fracture at Elevated Temperatures”, American Society for Metals, USA, 1985.
3. Boyle J.T, Spencer J, “Stress Analysis for Creep”, Butterworths, UK, 1983.
4. McLean D., “Directionally Solidified Materials for High Temperature Service”, The Metals Society, USA, 1985.

OUTCOMES:

Students will be able to

- Understand the failure mechanisms and the cause of surface defects of materials under high temperatures.
- Gain knowledge on Super alloys and their need in high temperature areas.
- Acquire knowledge about ablation and their importance in aeronautical applications.

		L	T	P	C
AECX15	**HEAT TRANSFER**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To introduce the heat transfer principles and the behavior of thermal systems.
- To expose students to the governing differential and algebraic equations associated with thermal systems.
- To expose students to the heat transfer applications in Aerospace industries.

MODULE I FUNDAMENTALS AND HEAT CONDUCTION 10

conduction – convection – radiation, Steady and unsteady state heat conduction in solids - effect of variation of thermal conductivity on heat transfer in solids, conduction with heat generation, heat transfer problems in infinite and semi infinite solids, critical radius of insulation- extended surfaces, application of numerical techniques.

MODULE II FREE CONVECTION 8

Basic equations, boundary layer concept, dimensional analysis, Laminar boundary layer equation, free convection in atmosphere free convection on a vertical flat plate, integral method, empirical relation in free convection –external flows.

MODULE III FORCED CONVECTION 6

Forced convection, laminar and turbulent convective heat transfer analysis in flows between parallel plates, over a flat plate and in a circular pipe. empirical relations - numerical techniques in problem solving.

MODULE IV RADIATIVE HEAT TRANSFER 7

Concept of black body-Intensity of radiation-Laws of black body radiation-radiation from non black surfaces, real surfaces, radiation between surfaces, radiation shape factors, radiation shields.

MODULE V HEAT EXCHANGERS 6

Types-overall heat transfer coefficient- LMTD- NTU method of heat exchanger analysis

MODULE VI HEAT TRANSFER PROBLEMS IN AEROSPACE 8

ENGINEERING

Heat transfer problems in gas turbine combustion chambers - rocket thrust chambers - aerodynamic heating - ablative heat transfer.

Total Hours –45

TEXT BOOKS:

1. Yunus A. Cengel., “Heat Transfer – A practical approach”, 2nd Edition, Tata McGraw-Hill, 2002.
2. Incropera. F.P.and Dewitt.D.P., “Introduction to Heat Transfer”, John Wiley and Sons, 2002.

REFERENCES:

1. Lienhard, J.H., “A Heat Transfer Text Book”, Dover publication, 2011.
2. Holman, J.P. “Heat Transfer”, 6th Edition, McGraw-Hill Book Co., Inc., New York, 1991.
3. Sachdeva, R.C., “Fundamentals of Engineering Heat & Mass Transfer”, New Age International, New Delhi, 2011.

OUTCOMES:

Students will be able to

- Understand the equations governing conduction, convection and radiation problems.
- Apply suitable governing equation to solve the heat transfer problems
- Apply the knowledge base gain to solve simple heat transfer problems experienced by flight vehicles.

AECX16	ADVANCED PROPULSION SYSTEM	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the concepts of advanced propulsion systems applied for propelling flight vehicles within and beyond atmosphere

MODULE I PROPULSION FUNDAMENTALS AND OVERVIEW OF GAS DYNAMICS 6

Operational Envelopes, standard atmosphere, Air-breathing Engines Overview, Aircraft performance, Rocket Engines, H-K diagram, Normal shock wave, Flow with heat addition, flow with friction

MODULE II RAMJET ENGINES AND AIR AUGMENTED ROCKETS 6

Ideal and Actual Ramjet engine cycle analysis - Preliminary performance calculations – Diffuser design and hypersonic inlets – combustor and nozzle design – Air augmented rockets – Engines with supersonic combustion

MODULE III SCRAMJET PROPULSION SYSTEMS 11

Ramjet and Scramjet engine cycle analysis, Fundamental considerations of hypersonic air breathing vehicles – Preliminary concepts in engine airframe integration – calculation of propulsion flow path – flowpath integration – Various types of supersonic combustors – fundamental requirements of supersonic combustors – Mixing of fuel jets in supersonic cross flow – performance estimation of supersonic combustors.

MODULE IV NUCLEAR PROPULSION SYSTEMS 8

Fission propulsion, Radioisotope Nuclear Rocket, Fusion propulsion, Antimatter propulsion

Nuclear rocket engine design and performance – nuclear rocket reactors – nuclear

rocket nozzles – nuclear rocket engine control, Fission propulsion, Fusion propulsion, radioisotope propulsion – basic thruster configurations – thruster technology – heat source development – nozzle development – nozzle performance of radioisotope propulsion systems.

MODULE V ELECTRIC PROPULSION SYSTEMS 8

Basic concepts in electric propulsion, Power requirements and rocket efficiency, Electrothermal thrusters – Resistojet, Arcjet, Solar/Laser/Microwave thermal propulsion, Electrostatic thrusters – Hall Thruster, Field emission thruster, Colloid thruster, Large accelerated plasma Propulsion – current and future trends, Fundamentals of ion propulsion – performance analysis – electrical thrust devices – Ion rocket engine, Electromagnetic thrusters – MPD thruster, PPT, VASIMR, Induced spacecraft Interactions

MODULE VI ADVANCED PROPULSION CONCEPTS 6

Concepts of Micropropulsion – chemical propulsion, electrical propulsion, Propellantless propulsion – Tethers, Propellantless electric/nuclear propulsion, Photon Rocket, Beamed Energy Earth-to-Orbit Propulsion, Solar sails, Magnetic sails, Breakthrough propulsion

Total Hours –60

TEXT BOOKS:

1. Martin Tajmar, “Advance space Propulsion systems”, 1st Edition, Springer; Softcover reprint of the original, 2003.

2. William H. Heiser and David T. Pratt, “Hypersonic Airbreathing propulsion”, AIAA Education Series, 2001.

3. Corin Segal, “The scramjet engine – Processes and characteristics”, Cambridge University Press, 2009

REFERENCES:

1. Curran E.T., S. N. B. Murthy, Paul Zarchan (Editor-in-Chief), “Scramjet

Propulsion", Progress in Aeronautics and Astronautics, Volume 189, AIAA, 2001
2. G.P. Sutton, "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 1998.
3. Fortescue and Stark, "Spacecraft Systems Engineering", 1999.
4. Cumpsty, "Jet propulsion, Cambridge", University Press, 2003.

OUTCOMES:

Students will be able to

- Understand the principle and working of ramjet and scramjet engines
- Understand the concepts and applications of electric and nuclear propulsion systems
- Gain knowledge about the future propulsion systems.

		L	T	P	C
AECX19	**AIR TRAFFIC CONTROL AND AERODROME DESIGN**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To introduce the procedures of for air traffic services and navigations

MODULE I BASIC CONCEPTS 9

Objectives of ATS - parts of ATC service – scope and provision of ATCs – VFR & IFR operations – classification of ATS air spaces – varies kinds of separation– altimeter setting procedures – establishment, designation and identification of units providing ATS – division of responsibility of control.

MODULE II AIR TRAFFIC SERVICES 9

Area control service, assignment of cruising levels minimum flight altitude ATS routes and significant points – RNAV and RNP – vertical, lateral and longitudinal separations based on time / distance –ATC clearances – flight plans – position report

MODULE III FLIGHTINFORMATION ALERTING SERVICES, COORDINATION 5

Radar service, basic radar terminology – identification procedures using primary / secondary radar – performance checks use of radar in area and approach control services

MODULE IV EMERGENCY PROCEDURES AND RULES OF THE AIR 5

Glide path assurance control and co-ordination between radar / non radar control – emergencies – flight information and advisory service – alerting service– co-ordination and emergency procedures – rules of the air

MODULE V AERODROME DATA, PHYSICAL CHARACTERISTICS AND OBSTACLE RESTRICTION 9

Aerodrome data - basic terminology – aerodrome reference code – aerodrome reference point – aerodrome elevation – aerodrome reference temperature – instrument runway, physical characteristics; length of primary / secondary runway –

width of runways – minimum distance between parallel runways etc. – obstacles restriction.

MODULE VI **VISUAL AIDS FOR NAVIGATION, VISUAL AIDSFOR DENOTING OBSTACLES EMERGENCY AND OTHER SERVICES** **8**

Visual aids for navigation wind direction indicator – landing direction indicator – location and characteristics of signal area – markings, general requirements – various markings – lights, general requirements – aerodrome beacon, identification beacon – simple approach lighting system and various lighting systems – VASI & PAPI - visual aids for denoting obstacles; object to be marked and lighter – emergency and other services.

Total Hours –60

TEXT BOOKS:

1. “AIP (India) Vol. I & II”, The English Book Store, 17-1, Connaught Circus, New Delhi.

REFERENCES:

1. “Aircraft Manual (India) Volume I”, latest Edition – The English Book Store, 17-1, Connaught Circus, New Delhi.
2. “PANS – RAC – ICAO DOC 4444”, Latest Edition, The English Book Store, 17-1, Connaught Circus, New Delhi.

OUTCOMES:

Students will be able to

- Understand various Air Traffic Services and the navigation aids for aircraft landing
- Plan layouts of Aerodromes.

		L	T	P	C
AECX20	**AVIATION RULES AND REGULATION**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To introduce the civil aviation regulations followed by Directorate General of Civil Aviation.

MODULE I **C.A.R SERIES 'A' - PROCEDURE FOR CIVIL AIR WORTHINESS QUIRMENTS AND RESPONSIBILITY OPERATORS VIS-À-VIS AIR WORTHINESS DIRECTORATE** **8**

Responsibilities of operators / owners; procedure of CAR issue, amendments etc., objectives and targets of airworthiness directorate; airworthiness regulations and safety oversight of engineering activities of operators. C.A.R. SERIES 'B' - ISSUE APPROVAL OF COCKPIT CHECK LIST, MEL, CDL: Deficiency list (MEL & CDL); preparation and use of cockpit check list and emergency list.

MODULE II **C.A.R. SERIES 'C' - DEFECT RECORDING, MONITORING, INVESTIGATION AND REPORTING** **7**

Defect recording, reporting, investigation, rectification and analysis; flight report;reporting and rectification of defects observed on aircraft; analytical study of in-fight readings & recordings; maintenance control by reliability method. C.A.R. SERIES 'D' - AND AIRCRAFT MAINTENANCE PROGRAMMES: reliability programme (engines); aircraft maintenance programme & their approval; on condition maintenance of reciprocating engines; TBO - revision programme; maintenance of fuel and oil uplift and consumption records - light aircraft engines; fixing routine maintenance Total Hours and component tbos - initial & revisions.

MODULE III **C.A.R. SERIES 'E' - APPROVAL OF ORGANISATIONS:** **10**

Approval of organizations in categories A, B, C, D, E, F, & G; requirements of infrastructure at stations other than parent base. C.A.R. SERIES 'F' - AIR WORTHINESS AND CONTINUED AIR WORTHINESS: Procedure relating to

registration of aircraft; procedure for issue / revalidation of type certificate of aircraft and its engines / propeller; issue / revalidation of certificate of airworthiness; requirements for renewal of certificate of airworthiness.

MODULE IV C.A.R. SERIES 'L' - AIRCRAFT MAINTENANCE ENGINEE LICENSING 8

Issue of AME licence, its classification and experience requirements, complete Series 'L'. C.A.R. SERIES 'M' MANDATORY MODIFICATIONS AND INSPECTIONS: mandatory modifications / inspections.

MODULE V C.A.R. SERIES 'T' - FLIGHT TESTING OF AIRCRAFT 6

Flight testing of (series) aircraft for issue of C of A; fight testing of aircraft for which C or A had been previously issued. C.A.R. SERIES 'X' – MISCELLANEOUS

REQUIREMENTS: Registration Markings of aircraft; weight and balance control of an aircraft; provision of first aid kits & physician's kit in an aircraft; use furnishing materials in an aircraft; concessions

MODULE VI AIRCRAFT DOCUMENTS PROCEDURE AND PERMITS 6

Aircraft log books; document to be carried on board on indian registered aircraft; procedure for issue of taxy permit; procedure for issue of type approval of aircraft components and equipment including instruments.

Total Hours –45

REFERENCES:

1. " Aircraft Manual (India) ", Volume - Latest Edition, The English Book Store, 17-1, Connaught Circus, New Delhi.
2. " Civil Aviation Requirements with latest Amendment (Section 2 Airworthiness) ", Published by DGCA, The English Book Store, 17-1, Connaught Circus,New Delhi.
3. " Aeronautical Information Circulars (relating to Airworthiness) ", from DGCA.

4. " Advisory Circulars ", form DGCA. as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Cod e of Conduct

OUTCOMES:

Students will be able to

- Understand the maintenance requirement for airworthiness of aircraft and systems.
- Gain knowledge of the procedure followed for airworthiness certificate.

Physics Elective Courses
(To be offered in II Semester)

PHCX 01	FUNDAMENTALS OF ENGINEERING MATERIALS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To help students to acquire the properties and applications of conducting and semiconducting materials.
- To familiarize students with basic ideas about the properties of dielectric and magnetic materials and their applications.
- To familiarize students with basic knowledge of nanomaterials and its electrical, electronic, mechanical and magnetic properties.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I CONDUCTING AND SEMICONDUCTING MATERIALS 7

Conductors: properties, Fermi distribution function, Fermi energy in metals- density of states- conducting polymers-properties-applications, semiconductors: intrinsic and extrinsic semiconductors-carrier concentration, conductivity and energy band gap, semiconducting polymers- properties- applications.

MODULE II DIELECTRIC MATERIALS 8

Polarization- dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – Internal field - Clausius Mosotti relation - dielectric loss – dielectric breakdown – applications of dielectric materials (capacitors and transformers) – Pyroelectricity, Piezoelectricity, ferroelectricity and applications in Ferroelectric Random Access Memory (FeRAM) - multiferroic materials and its applications.

MODULE III MAGNETIC MATERIALS 7

Origin of magnetism-magnetic moment, susceptibility, permeability – Bohr magneton – Dia, Para and Ferro magnetism –Spontaneous magnetization- Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites and its application - Giant Magneto-resistance effect (GMR) - Magnetic resonance imaging(MRI).

MODULE IV NANOMATERIALS 8

Properties of nanomaterials – size effect on thermal, electrical, electronic, mechanical,

optical and magnetic properties – quantum confinement – classification of nanomaterials – quantum well, quantum wire, quantum dot - nanoporous materials - carbon nanotubes, graphene - nanocomposites – applications of nano materials.

PRACTICALS

1. Determination of energy band gap of a semiconductor.
2. Determination of resistivity of metals by four point probe method.
3. Determination of dielectric constant of dielectric material.
4. Determination of time constant of a capacitor using RC circuit.
5. Determination of paramagnetic susceptibility of given liquid.
6. Determination of hysteresis loss in a transformer using BH curve.
7. Analysis of size effect on the absorption spectrum of nanomaterials.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. William D. Callister, “Material Science and Engineering”, Wiley Publications, 2006.
2. Raghavan, V., “Materials Science and Engineering”, 5th edition, Printice Hall of India Pvt Ltd. New Delhi, 2004.
3. Wahab. M.A, “Solid State Physics: Structure and Properties of Materials”, Narosa Publishing House Pvt. Ltd., New Delhi , 2nd Edition, 2010.
4. Pillai, S.O., “Solid State Physics”, New Age International, New Delhi, 2005.
5. Charles P. Poole and Frank J. Owens, ”Introduction to nanotechnology”, Wiley (India), 2009.
6. Pradeep. T., “Textbook of Nanoscience and Nanotechnology”, McGraw Hill Education (India) Private Limited, New York, 2012.

OUTCOMES:

On completion of this course, the student will be able to

- apply the concepts of conducting and semiconducting materials for solid state devices.
- comprehend the significance of properties of dielectric magnetic materials and derive these properties from synthesized materials.
- differentiate between the properties of the nanomaterials compared to bulk materials.
- complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 02	HEAT AND THERMODYNAMICS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To familiarize students with basic concepts of heat.
- To help students acquire the fundamentals of heat conduction and radiation.
- To enable students acquaint with the basics of thermodynamic concepts.
- To make students understand the fundamentals of heat based experiments.

MODULE I CONCEPTS OF HEAT **10**

Definition of temperature, thermal and thermodynamic equilibrium - relationship between temperature and kinetic energy - definition of solid, liquid, gas - Introduction to phase transitions, critical and triple points- definition of heat capacity, mechanical equivalent of heat -Joule's calorimeter- latent heat- microscopic model of ideal gas - equation of state, internal energy, equipartition theorem- equation of state for non-ideal gases.

MODULE II CONDUCTION AND RADIATION **10**

Thermal conductivity – rectilinear flow of heat – thermal conductivity of a good conductor – Forbe’s method – thermal conductivity of a bad conductor – Lee’s disc method – conduction of heat through compound media - radiation – Planck’s law of blackbody radiation – Wien’s law – Stefan’s law – Newton’s law of cooling from Stefan’s law – Solar constant – Pyrometry.

MODULE III FUNDAMENTALS OF THERMODYNAMICS **10**

Thermodynamic equilibrium – zeroth law of thermodynamics – first law of thermodynamics – Reversible and irreversible processes – second law of thermodynamics - Heat engine – Carnot’s engine – Carnot’s theorem – Internal combustion engines – petrol and diesel engines (qualitative) – Entropy and available energy – temperature – entropy diagram for Carnot’s cycle - Third Law of thermodynamics (qualitative).

PRACTICALS

1. Determination of mechanical equivalent of heat by Joule’s calorimeter.
2. Relation between temperature of a body and time by plotting a cooling curve-Newton’s law of cooling.

3. Determination of specific heat capacity of liquid by cooling.
4. Determination of thermal conductivity of a good conductor-Forbe's method
5. Determination of thermal conductivity of a bad conductor-Lee's disc method

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Mathur. D.S, “Heat & Thermodynamics”, S.Chand & Co., 2009.
2. Brijlal & Subramaniam, “Heat and Thermodynamics”, S.Chand & Co, Delhi, 2010.
3. Gupta. A.B and Roy. H, “Thermal Physics”, Books and Allied Ltd., 2002.
4. Sharma. J.K and Sarkar. K.K, “Thermodynamics and statistical Physics”, Himalaya Publishing House, 1988.

OUTCOMES:

On completion of this course, the student will be able to

- understand the concepts of heat and its properties.
- comprehend the ideas governing the conduction and radiation processes.
- apply the knowledge of laws of thermodynamics in thermodynamic systems.
- perform heat based experiments and determine its various properties.

PHCX 03	INTRODUCTION TO NANOSCIENCE AND TECHNOLOGY	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To acquire basic knowledge about the nanomaterials and applications.
- To learn about the synthesis and imaging techniques of nanomaterials.
- To gain the basic concepts of fabrication techniques.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I NANOMATERIALS AND APPLICATIONS **10**

Properties of nanomaterials – size effect on thermal, electrical, electronic, mechanical, optical and magnetic properties – quantum confinement – classification of nanomaterials – quantum well, quantum wire, quantum dot - nanoporous materials - zeolite, mesoporous materials, carbon nanotubes, grapheme - nanocomposites - applications (qualitative): Molecular electronics-nanoelectronics – nanophotonics - single electron transistor-drug delivery.

MODULE II SYNTHESIS AND IMAGING TECHNIQUES **12**

Top-down and bottom up approaches – mechanical alloying and mechanical ball milling - sol-gel approach - hydrothermal method - precipitation method - spray pyrolysis - spin coating-self assembled monolayer (SAM) - Chemical vapour deposition method – Physical vapour deposition method: laser ablation method, sputtering method.

Optical microscopy – Phase contrast and interference microscopy – confocal microscopy - high resolution Scanning electron microscope (HRSEM) - high resolution Transmission electron microscope (HRTEM) - Atomic force microscope - Scanning Tunnelling microscope (STM).

MODULE III NANOFABRICATION **8**

Photolithgraphy - electron beam lithography - X-ray and Ion beam lithography - nanoimprint lithography - soft lithograpy - nanoelectromechnical systems (NEMS) - nanoindentation principles.

PRACTICALS

1. Synthesis of nanomaterials by sol-gel method.

2. Synthesis of nanomaterials by hydrothermal method.
3. Synthesis of nanomaterials by solid state reaction method.
4. Synthesis of nanomaterials by chemical bath deposition method.
5. Synthesis of nanomaterials by co-precipitation method.
6. Synthesis of nano thin films by spray pyrolysis method.
7. Synthesis of nano thin films by pulsed laser deposition (PLD) method.
8. Analysis of size effect on the absorption spectrum of nanomaterials.
9. SEM characterization of nanomaterials.
10. AFM characterization of nano thin films.
11. Phase confirmation by XRD.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Charles P.Poole and Frank J. Owens, ”Introduction to nanotechnology”, Wiley (India), 2009.
2. Cao. G., “Nanostructures & Nanomaterials: Synthesis, Properties & Applications”, Imperial College Press, 2004.
3. Gaddand. W., Brenner. D., Lysherski. S. and Infrate. G.J., “Handbook of NanoScience Engineering and Technology”, CRC Press, 2002.
4. Pradeep. T., “Textbook of Nanoscience and Nanotechnology”, McGraw Hill Education (India) Private Limited, New York, 2012.
5. Chris Mack, “Fundamental Principles of Optical Lithography: The Science of Microfabrication”, John Wiley & Sons, 2008.
6. Bandyopadhyay A.K., “Nano Materials”, New Age International Publishers, New Delhi, 2008.

OUTCOMES:

At the end of the course, the students will be able to

- understand the importance and basic concepts of the nanomaterials.
- comprehend the imaging techniques for nanomaterials.
- illustrate the various nanofabrication techniques.
- complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 04 LASERS AND THEIR APPLICATIONS

L	T	P	C
2	0	2	3

OBJECTIVES:

- To recognize the fundamentals of laser and its characteristics.
- To comprehend and compare the different laser systems.
- To apply lasers in metrology and material processing.
- To understand the working of laser instrumentation.
- To correlate the experimental results for applications.

MODULE I LASER THEORY **8**

Spontaneous and stimulated emission - Population inversion – Einstein's A & B coefficients - Threshold condition – super-radiance Laser – Three level and four level laser systems -conditions for CW and pulsed laser action. Q-Switching - experimental methods - cavity dumping - Mode locking - experimental methods - Spatial and Temporal coherence.

MODULE II DIFFERENT LASER SYSTEMS **8**

Laser systems – General description - Laser structure - excitation mechanism - Different laser systems- He-Ne laser, Carbon-dioxide laser - Excimer laser – Free electron laser- Alexandrite laser - Ti-Sapphire laser – Semiconductor diode laser - Diode pumped solid state laser - Pulsed-CW dye laser- Fibre laser.

MODULE III METROLOGICAL AND MATERIAL PROCESSING APPLICATIONS **8**

CW and Pulsed laser beam characteristics and its measurements - Beam focusing effects - spot size - Power and Energy density Measurements - Distance measurement - Interferometric techniques - LIDARS - different experimental arrangements - Pollution monitoring by remote sensing - Laser gyroscope - Laser welding, drilling, machining and cutting - Laser surface treatment - Laser vapour deposition – Biophotonic applications.

MODULE IV LASER INSTRUMENTATION **7**

Laser for measurement of length, current and voltage – Laser Doppler Velocimetry - Holography and speckle in displacement and deformation measurements - Laser for communication with fiber optics as channel.

PRACTICALS

1. Tuning of Dye Laser using DFDL Arrangement
2. Determination of Brewster Angle using He-Ne laser
3. Study of transversely Pumped Dye Lasers
4. Study of longitudinally Pumped Dye Lasers
5. Determination of power and wavelength using Distributed Feedback Dye Laser (DFDL)
6. Determination of fibre optic losses using semiconductor laser.
7. Bandgap determination of a semiconductor diode.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. William T. Silfvast, “Laser Fundamentals”, Cambridge University Press, 2009.
2. Ghatak. A. & Thyagarajan. K. “Optical Electronics”, Cambridge University, 1994.
3. Laud.B.B., “Laser and Non-Linear Optics”, Second Edition, New Age International (p) Limited Publishers, 2011.
4. Nambiar. K.R., “Lasers Principle, Types and Applications”, New Age International (p) Ltd, 2004.
5. Wilson. J. & Hawkes. J.F.B., “Opto Electronics - An Introduction”, Prentice Hall, 1992.
6. William M.Steen, ”Laser Material Processing”, Springer-Verlag, Berlin, Third Edn., 2005.

OUTCOMES:

At the end of the course, the students will be able

- To complement the knowledge acquired in the theory class.
- To work with dye lasers for tunability of laser wavelength.
- To measure the loss of information involved in fibre optic communication.
- To correlate the results for application.

PHCX 05	MATERIALS SCIENCE	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To gain basic knowledge in conducting and semiconducting materials and their properties.
- To provide basic understanding of properties and applications of dielectric materials.
- To impart knowledge on magnetic and optical materials and their properties & applications.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I CONDUCTING AND SEMICONDUCTING MATERIALS 10

Quantum free electron theory of metals and its importance - Energy distribution of electrons in metals - Fermi distribution function - Density of energy states and carrier concentration in metals - Fermi energy – Classification of solids into conductors, semiconductors and insulators on the basis of Band theory – Introduction to Elemental and Compound semiconductors - Carrier concentration derivation for Intrinsic semiconductors - Density of electrons in conduction band & Density of holes in valence band- intrinsic carrier concentration - Fermi energy & Variation of Fermi energy level with temperature - Mobility and electrical conductivity - Band gap determination.

MODULE II DIELECTRIC MATERIALS 7

Introduction to dielectric materials & basic definitions – Electronic, Ionic, Orientation & Space charge polarizations - Total polarization – Frequency and temperature dependence of polarization - Internal field in a dielectric material - Deduction of Clausius - Mosotti's relation - dielectric loss & loss tangent – Different types of dielectric breakdown – Applications of dielectric materials : Capacitors and Transformers.

MODULE III MAGNETIC MATERIALS 6

Introduction to magnetic materials & origin of magnetic moment - Different types of

magnetic materials and their properties - Ferromagnetism & Domain theory of ferromagnetism - Hysteresis, Soft and Hard magnetic materials - Antiferromagnetic materials - Ferrites and its applications – Applications of magnetic materials : Data storage.

MODULE IV OPTICAL MATERIALS 7

Optical properties of semiconductors - Direct and Indirect bandgap semiconductors – Traps, recombination centre, color center and exciton – Luminescence : Fluorescence and Phosphorescence - Liquid crystal display : twisted nematic crystal display – Applications of Optical materials - Optical Sources : light emitting diode and laser diode - Photo detectors : PIN photodiode and Avalanche Photodiode - Pyroelectric devices - Electro optic effect : Kerr effect and Faraday effect.

PRACTICALS

1. Resistivity measurement of a semiconductor using four point probe method.
2. Determination of band gap of a semiconductor diode.
3. Determination of Hall coefficient of a given semiconductor material.
4. Determination of dielectric constant of a given non-polar liquid.
5. Determination of magnetic susceptibility of a given paramagnetic liquid using Quincke's method.
6. Determination of energy loss of a given transformer core using hysteresis method.
7. To study the I-V characteristics of a photodiode.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Palanisamy P.K., ''Physics II'', Material Science for ECE, Scitech Publications (India) Pvt. Ltd., 2006.
2. Kasap. S.O., ''Principles of Electronic materials and devices'', McGraw Hill Publishers, 3rd Edition, 2007.
3. Arumugam. M, "Physics II'', Material Science for ECE, Anuradha Publishers, 5th Edition, 2005.
4. Sze. S.M., ''Semiconductor Devices – Physics and Technology'', John Wiley, 2nd Edition. 2002.
5. Raghavan. V, ''Materials Science and Engineering'', Prentice Hall of India, 5th Edition, 2004.

OUTCOMES:

On the completion of this course, the students will be able to

- Gain knowledge about fundamentals of conducting and semiconducting materials.
- Understand concepts and applications of Dielectric and Magnetic materials.
- Familiarize Optical materials and their applications in Engineering and Medical fields.
- Complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 06	NON-DESTRUCTIVE TESTING	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To study the process and applications of ultrasonic inspection method.
- To understand the basic concepts of radiographic inspection method.
- To acquire the knowledge about the various surface Non-Destructive Testing (NDT) techniques.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I ULTRASONIC INSPECTION METHOD **10**

Ultrasonic Testing - Principle of operations - types of sound waves - types of Transducers - transmission and pulse-echo method - straight beam and angle beam, instrumentation - calibration methods - ultrasonic testing technique- data representation, A Scan, B-scan, C-scan. Phased Array Ultrasound, Time of Flight. Diffraction - thickness determination - advantages, disadvantages and applications.

MODULE II RADIOGRAPHIC INSPECTION METHOD **10**

Radiographic testing – Principle - Interaction of X-ray with matter - X-ray radiography - method of generation-industrial radiography inspection techniques – Equipment - Exposure charts - Types of films – Fluoroscopy - Xero-Radiography – Limitations - Gamma radiography - Equipment, radiation sources - method of generation - film processing - interpretations of radiography - safety in industrial radiography.

MODULE III SURFACE NDT TECHNIQUES **10**

Liquid Penetrant Testing – Principles, Characteristics and types of liquid penetrants – developers - advantages and disadvantages of various methods - Inspection Procedure and Interpretation of results. Applications of Liquid Penetrant testing.

Magnetic Particle Testing - Principle-magnetizing technique - procedure –equipment - Interpretation and evaluation of test indications - applications and limitations - demagnetization.

PRACTICALS

1. Inspection of welds using solvent removable visible dye penetrant.
2. Inspection of welds using solvent removable fluorescent dye penetrant.

3. Inspection on non magnetic materials by eddy current method.
4. Inspection on magnetic materials by eddy current method.
5. Inspection of welds by Eddy current Testing.
6. Inspection of welds by Magnetic Particle Testing - Dry method.
7. Inspection of welds by Magnetic Particle Testing - Wet method.
8. Ultrasonic flaw detector - Inspection of defects.
9. Demonstration of Radiographic inspection.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Baldev Raj., Jayakumar T.,Thavasimuthu., “Practical Non-Destructive Testing”, Narosa Publishing House, 2009.
2. Ravi Prakash., “Non-Destructive Testing Techniques”, 1st revised edition, New Age International Publishers, 2010.
3. ASM Metals Handbook of Non-Destructive Evaluation and Quality Control, American Society of Metals, Metals Park, Ohio, USA, Volume-17, 2000.
4. Paul E Mix,”Introduction to Non-destructive testing: a training guide”, Wiley, 2nd Edition New Jersey, 2005.
5. Charles J., Hellier, “Handbook of Nondestructive evaluation”, McGraw Hill, New York, 2001.

OUTCOMES:

Upon completion of this course, the students will be able to

- illustrate the ultrasonic inspection methods of NDT.
- understand the basic concept of radiographic inspection method.
- test the surfaces by the various surface NDT techniques.
- complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 07	PROPERTIES OF MATTER AND ACOUSTICS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To understand principles and properties of elasticity.
- To understand the basic concepts and application of viscosity.
- To analysis acoustic of building.
- To know about photoelasticity and its applications.

MODULE I ELASTICITY **8**

Stress and strain - Hooke's Law of elasticity - Elastic moduli - Stress-Strain Diagram - Poisson's Ratio - Relation between elastic constants - Work done in stretching and twisting a wire - Twisting couple on a cylinder- Expression for bending moment - Cantilever–Expression for depression - Uniform bending and Non-uniform bending of beams (theory & experiment) - I form Girders (qualitative treatment) and applications.

MODULE II VISCOSITY **8**

Viscosity- Newton’s formula for viscous flow - Streamline and turbulent motion - Reynolds number - Poiseuille's formula - Determination of coefficient of viscosity- factors affecting viscosity - capillary flow method - Stoke's formula- viscosity of highly viscous liquids – Stoke’s method - Lubricants and its applications –viscosity measurements - Viscometer - Variation of Viscosity with Temperature.

MODULE III ACOUSTICS OF BUILDING **7**

Basic requirement for the acoustically good halls - Reverberation and time of reverberation – Sabine’s formula for reverberation time - Absorption coefficient and its measurement -Transmission of sound and transmission loss - Factors affecting the architectural acoustics and their remedy-sound absorbing materials - vibration and noise control systems for buildings.

MODULE IV PHOTOELASTICITY **7**

Polarization - double refraction - Theory of Plane, Circularly and Elliptically polarized light - Quarter wave plate and half wave plate - photo elasticity - Theory of photo-elasticity - Stress optic relations - model materials - analysis techniques - Photo elastic bench - Three dimensional photo elasticity - Digital photo elasticity - Photo elastic

coatings.

PRACTICALS

1. Determination of viscosity of liquid by Poiseuille's method.
2. Determination of viscosity of liquid by Stoke's method.
3. Analysis of stress by photo elastic method.
4. Verification of Hooke's law by spring method.
5. Determination of Young's modulus of the cantilever beam.
6. Determination of rigidity modulus by static torsion method.
7. Visit to acoustically good auditorium and identifying the sound absorbing materials in the auditorium.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Mathur D.S., "Elements of Properties of Matter", S.Chand & Co, Delhi, 2009.
2. Gaur R.K., Gupta S.L.,"Engineering Physics", Dhanpat Rai Publishers, 2010.
3. Brijlal and Subramaniam.," Properties of Matter", Eurasia Publishing Co, New Delhi, 2002.
4. Smith C.J.," General Properties of Matter", Orient & Longman,1960.
5. Kenneth G. Budinski and Michel K., Budinski, "Engineering Materials Properties and Selection", Pearson, Singapore, 2002.

OUTCOMES:

Upon completion of this course, the students will be able to

- understand the basic concepts of the elasticity of materials.
- comprehend the concepts of viscosity of liquid and measurement.
- demonstrate the acoustical aspects of building and its importance in construction.
- apply the fundamental concept of photo elasticity for the stress analysis of the object.

PHCX 08	PROPERTIES OF MATTER AND NONDESTRUCTIVE TESTING	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To impart knowledge about the principles and properties of elasticity.
- To learn the laws governing the dynamic of rigid bodies.
- To acquire the knowledge of the various techniques of Non-Destructive Testing (NDT) of materials.
- To understand the principle and basic concept of low temperature applications.

MODULE I ELASTICITY **8**

Stress and strain - Hooke's Law of elasticity - Elastic moduli - Stress-Strain Diagram - Poisson's Ratio - Relation between elastic constants - Work done in stretching and twisting a wire - Twisting couple on a cylinder- Expression for bending moment- Cantilever–Expression for depression - Uniform Bending and Non-uniform bending of beams (theory & experiment) - I form Girders (qualitative treatment) and applications.

MODULE II DYNAMICS OF RIGID BODIES **8**

Rigid bodies - angular acceleration - Torque on a particle - angular momentum - law of conservation of angular momentum - moment of inertia and its significance - Theorem of parallel and perpendicular axis - moment of inertia of a thin uniform bar - moment of inertia of a rectangular lamina - moment of inertia of uniform circular disc - Moment of inertia of hollow and solid cylinders – flywheel
(qualitative) - kinetic energy of rotating body – Routh rule.

MODULE III NDT TECHNIQUES **6**

Ultrasonic Testing- types of Transducers-transmission and pulse-echo method- Radiographic testing- Principle-Interaction of X-ray with matter-X-ray radiography-method of generation-industrial radiography inspection techniques- Liquid Penetrant Testing**-** Inspection Procedure and Interpretation of results.

MODULE IV LOW TEMPERATURE PHYSICS **8**

Definition of Refrigeration and Air-Conditioning - Types of **Refrigeration Systems-**

Applications- Comfort Air Conditioning, Industrial Refrigeration, Food processing and food chain - **Cryogenic treatment - Low temperature properties of engineering materials: Mechanical properties, Thermal properties, Electrical properties.**

PRACTICALS

1. Verification of Hooke's law by spring method.
2. Determination of Young's modulus of the beam by bending method.
3. Inspection of welds using solvent removable visible dye penetrant.
   Inspection of welds using solvent removable fluorescence dye penetrant.
5. Inspection of welds by Magnetic Particle Testing.
6. Determination of moment of inertia of the disc by torsion pendulum method.
7. Determination of moment of inertia of the disc by static torsion method.
8. Demonstration of working of flywheel.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Mathur D.S.,"Elements of Properties of Matter", S.Chand & Co, Delhi, 2009.
2. Brijlal & Subramaniam," Properties of Matter", Eurasia Publishing Co, Delhi, 2002.
3. Gaur R.K., Gupta S.L., "Engineering Physics" Dhanpat Rai Publishers, 2010.
4. Baldev Raj.,Jayakumar T., Thavasimuthu M.,"Practical Non-Destructive testing", Narosa Publishing House, 2009.
5. Brijlal & Subrahmanyam., "Heat and Thermodynamics" S.Chand & Company Ltd, 2002.
6. Paul E Mix.," Introduction to Non-destructive testing: a training guide", Wiley, 2nd Edition, New Jersey, 2005.
7. Charles J., Hellier.," Handbook of Nondestructive evaluation", McGraw Hill, New York, 2001.

OUTCOMES:

Upon completion of this course, the students will be able to

- understand the basic of concept of elasticity of materials.
- comprehend the basic concepts of motion of rigid bodies and its applications.
- demonstrate the various NDT techniques and its importance.
- know the low temperature systems and its applications.

PHCX 09	SEMICONDUCTOR PHYSICS AND OPTOELECTRONICS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To understand the Physics of Semiconductor devices.
- To make the students learn the fundamentals of Photoluminous - semiconductors, Optoelectronic devices, Optical modulators/detectors.
- To make them understand the technology behind latest Display devices like LCD, Plasma and LED Panels.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I PHYSICS OF SEMICONDUCTORS **8**

Elemental and compound semiconductors – Drift and diffusion current - Intrinsic semiconductors – Carrier concentration (derivation) – Fermi energy – Variation of Fermi energy level with temperature – Mobility and electrical conductivity – Band gap determination – Extrinsic semiconductors – Carrier concentration in n-type and p-type semiconductor (derivation) – Variation of Fermi level with temperature and impurity concentration – Variation of Electrical conductivity with temperature – Hall effect – Experiment and applications of Hall effect.

MODULE II OPTOELECTRONIC DEVICES **7**

Light Emitting Diodes (LED) – power and efficiency - double hetero LED - LED structure - LED characteristics - White LED – Applications. Liquid crystal displays – Dynamic scattering and Twisted nematic display, Semiconductor Lasers, Homojunction and Heterojunction laser diodes - Optical processes in semiconductor lasers.

MODULE III OPTICAL MODULATORS **7**

Modulation of light – birefringence –Modulation Techniques - Electro optic effect – Electro optic materials –Types of Electro optic Modulators : Kerr and Pockel modulators –- Magneto optic effect - Magneto optic Modulators – Acousto Optic modulators.

MODULE IV OPTICAL DETECTORS **8**

Photo detectors - photodiodes - phototransistors - noise characteristics - PIN diode – Avalanche Photodiode (APD) characteristics - APD design of detector arrays – Charged Couple Device - Solar cells - Materials and design considerations, Thin film

solar cells, amorphous silicon solar cells.

PRACTICALS

1. Resistivity measurement of a semiconductor using four point probe method.
2. Determination of band gap of a semiconductor diode.
3. Determination of Hall coefficient of a given semiconductor material.
4. Determination of the wavelength of a given laser source using diffraction grating.
5. Determination of Planck's constant using LED.
6. To study the I-V characteristics of photodiode and phototransistor.
7. To study the characteristics of a solar cell.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Arumugam. M, "Physics II", Anuradha Publishers, 5th Edition, 2005.
2. Sze. S.M., "Semiconductor Devices – Physics and Technology", 2nd edn. John Wiley, 2002.
3. Wilson & J.F.B. Hawkes, "Optoelectronics – An Introduction", Prentice Hall, India, 1996.
4. Bhattacharya, "Semiconductor optoelectronic devices", Second Edn, Pearson Education, 2002.
5. Safa O. Kasap, "Optoelectronics & Photonics:Principles & Practices", Second Edn, Pearson Education,2013.
6. Palanisamy P.K., "Semiconductor physics and optoelectronics" Scitech Publications, 2003.

OUTCOMES:

On completion of this course, the student will be able to

- understand the principles of Physics behind semiconductor devices.
- choose the correct semiconductors for electronic devices and display.
- differentiate the working principle of LED and Diode Laser.
- apply the knowledge of modulation of light for different types of optical modulators.
- select suitable photodetectors for different types of applications.
- complement the knowledge acquired in the theory class and correlate the results for applications.

Chemistry Elective Courses
(To be offered II Semester)

CHCX01	ANALYTICAL INSTRUMENTATION	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make the student conversant with

- principles, instrumentation and applications of different electroanalytical techniques
- different chromatographic techniques
- principles, instrumentation and applications of various types of absorption and emission spectroscopy
- different thermal analytical methods and their applications

MODULE I ELECTROANALYTICAL TECHNIQUES **7**

Principle and applications: conductometric titrations – potentiometrIc titrations, ion-selective electrodes and pH-metry – coulometry – voltammetry - polarography, amperometric titrations.

MODULE II CHROMATOGRAPHY **8**

Basic concepts of chromatography – paper chromatography – column chromatography – thin layer chromatography – gas chromatography – high performance liquid chromatography – gel permeation chromatography.

MODULE III SPECTROSCOPY **8**

Absorption spectroscopy (principle, instrumentation and applications): Colorimetric analysis – UV-Visible spectroscopy – FTIR spectroscopy - Emission Spectroscopy (principle, instrumentation and applications): fluorescence, phosphorescence and chemiluminescence – Atomic absorption spectroscopy – flame emission spectroscopy.

MODULE IV THERMAL ANALYSIS **7**

Principle, instrumentation and applications: Thermo gravimetric analysis – Differential thermal analysis – Differential scanning calorimetry

PRACTICALS

1. Conductometric titrations: acid-base and precipitation titrations

2. Potentiometric titrations
3. Determination of pH of the unknown solution
4. Estimation of alkali metals using flame emission spectroscopy
5. Estimation of metal ions of coloured solutions using colorimetric analysis
6. Separation of compounds using gas chromatography
7. Separation of compounds using high performance liquid chromatography
8. Analysis of the given sample and interpretation of the data using IR, UV-Visible spectroscopy
9. Demonstration of TGA/DTA and DSC and interpretation of data.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Skoog D.A., West D.M., Holler F.J. and Crouch S.R., Fundamentals of Analytical Chemistry, 8th Edition, Thomson Brooks/Cole Publication., Singapore, 2004.
2. Willard H.H., Merritt L.L., Dean J.A. and Settle F.A., Instrumental Methods of Analysis, 7th Edition, CBS Publication, New Delhi Reprint, 2004.
3. A.I. Vogel, Vogel's Textbook of Practical Organic Chemistry, 5th Edition, Prentice Hall, London, 2008.
4. Christian G.D., Analytical Chemistry, 6th Edition, John Wiley, Singapore, 2003.
5. Fifield F.W. and Kealey D., Principles and Practice of Analytical Chemistry, 5th Edition, Blackwell Publication, London, 2000.
6. Settle F. (Editor), Handbook of Instrumental Techniques for Analytical Chemistry, Pearson Education, Singapore, 2004.

OUTCOMES:

The student will be able to

- state the principle and applications of various electro-analytical techniques
- identify the right separation method for a given sample using different chromatographic techniques
- explain the principle, instrumentation & applications of various spectroscopic methods and also to interpret the data
- elaborate the principle, instrumentation and applications of various thermal analytical techniques and interpret the data.

CHCX02	CORROSION AND ITS CONTROL	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students should be conversant with the

- Basic concepts, principles and factors affecting corrosion
- Types and mechanism of corrosion
- Control measures of corrosion by material selection, proper design and by applying organic coatings
- Control of corrosion by applying inorganic coating

MODULE I BASIC CONCEPTS OF CORROSION 8

Corrosion – causes and impacts of corrosion – mechanism of corrosion: Dry corrosion- oxidation corrosion - corrosion by other gases – Pilling-Bedworth rule- Corrosion by hydrogen: hydrogen blistering, hydrogen embritttlement, decarburization and hydrogen attack – corrosion of silver and copper by sulphur compounds – liquid metal corrosion (embritttlement or cracking) – Wet corrosion : hydrogen evolution – presence and absence of oxygen and absorption of oxygen – difference between dry and wet corrosion-factors influencing corrosion-polarization-passivity-emf series and galvanic series- corrosion current -rate of corrosion.

MODULE II FORMS OF CORROSION 7

Forms of corrosion-conditions for electrochemical corrosion –galvanic corrosion – differential aeration corrosion: pitting, water line, wire fencing, crevice and filiform corrosion – stress corrosion – Intergranular corrosion- erosion corrosion – soil corrosion – microbiological corrosion- fretting corrosion- corrosion in composites.

MODULE III CORROSION CONTROL AND ORGANIC COATINGS 8

Corrosion control – selection of materials and designing- cathodic protection – sacrificial anode and impressed current cathodic protection – corrosion inhibitors: anodic, cathodic and vapour phase inhibitors.

Organic protective coatings – paints: constituents – functions – varnishes : types-constituents – functions – lacquers : constituents – functions –enamels-constituents – functions – special paints : fire retardant, water repellant, heat resistant, temperature indicating and luminous paints.

MODULE IV INORGANIC COATINGS 7

Treatment of metal surface-inorganic coatings- classification- metallic coatings : anodic and cathodic coatings-hot dipping : galvanizing and tinning- electroplating—electroless plating – cementation (diffusion) : sherardizing, calorizing and chromizing – metal cladding-metal spraying – non metallic coatings (chemical conversion coatings) : phosphate, chromate, oxide coatings and anodizing – comparison of anodic and cathodic protection.

PRACTICALS

1. Determination and comparison of rate of corrosion of metals in the presence of acid, base and neutral medium by weight loss method.
2. Determination of rate of corrosion of iron in the presence of various acids by weight loss method.
3. Determination of rate of corrosion of iron in the presence and absence of anodic Inhibitor by weight loss method.
4. Determination of rate of corrosion of iron in the presence and absence of cathodic Inhibitor by weight loss method.
5. Electroplating of base metal with copper.
6. Electrolessplating of base metal with copper
7. Chemical conversion coatings such as chromate and phosphate coatings.
8. Demonstration on the study of rate of corrosion by using cyclic voltametry.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. P.C Jain & Monica Jain, Engineering Chemistry Dhanpatrai Publishing Company (P) Ltd., New Delhi (2013).
2. S S Umare & S S Dara, A text Book of Engineering Chemistry, S. Chand& Company Ltd, New Delhi, 2014.
3. M.G. Fontana and N.G. Green, Corrosion Engineering, McGraw Hill Book Company, NewYork, 1984.
4. S. Banerjee, A.K. Tyagi, Functional Materials- Preparation, Processing and Applications, ELSEVIER Publications, London ; Waltham, MA : 2011

OUTCOMES:

Students will be able to

- explain the mechanism, compare and enumerate the factors affecting

corrosion

- describe and identify the place and types for a given situation.
- choose and elaborate the suitable organic coating method for a given real time situation.
- apply a suitable metallic coating for a given situation

CHCX03	ELECTRICAL MATERIALS AND BATTERIES	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students should be conversant with

- preparation, properties and applications of plastics used in electrical and electronic applications
- properties and uses of electrical engineering materials
- classification and description of different types of batteries.
- classification and types of fuel cells

MODULE I POLYMERS FOR ELECTRICAL AND ELECTRONIC APPLICATIONS **8**

Preparation, properties and applications **:** polyethylene, polypropylene, EPDM, Nylon-6,6, PVC, PTFE, polycarbonates, ABS, phenol formaldehyde, urea formaldehyde, epoxy resins – polymer blends and alloys.

MODULE II ELECTRICAL ENGINEERING MATERIALS **7**

Conductors: Silver, Copper, Gold, Aluminum – Semiconductors: Germanium, Silicon, Gallium Arsenic – Insulating Materials: Rubbers, Mica, Plastics, Ceramics, Insulating papers – Magnetic Materials: ferromagnetic materials, paramagnetic materials, diamagnetic materials, antiferromagnetic materials, ferrites

MODULE III BATTERIES **7**

Electrochemical and electrolytic cell – batteries: types (primary, secondary and flow cell) – primary batteries: dry cells, alkaline batteries – secondary batteries: nickel-cadmium cell – lead acid storage cell, lithium battery: primary and secondary type – solar cell – dye sensitized solar cell.

MODULE IV FUEL CELLS **8**

Difference between batteries and fuel cells - chemistry of fuel cells - types of fuel cell (based on temperature and electrolyte) – principle, characteristic features, advantages, disadvantages and applications of polymer electrolyte membrane or proton exchange membrane fuel cell (PEMFC), direct methanol fuel cell (DMFC), alkaline fuel cell (AFC), phosphoric acid fuel cell (PAFC), molten carbonate fuel cell (MCFC) and solid oxide

fuel cells (SOFC).

PRACTICALS

1. Free radical polymerization of styrene.
2. Free radical polymerization of PMMA.
3. Preparation of phenol-formaldehyde.
4. Preparation of urea-formaldehyde.
5. Synthesis of epoxy resin.
6. Demonstration of mechanical properties of insulating materials using UTM
7. Demonstration of electrical properties of insulating materials
8. Construction of batteries using natural resources
9. Measurement of EMF for different batteries.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Jain P.C. and Renuka Jain, Engineering Chemistry, Dhanpat Rai Publication Co. (P) Ltd., New Delhi, 2013.
2. Michael L. Berins, Plastics Engineering Hand Book, 5th Edition, Chapman and Hall, New York, 1991.
3. H.F. Mark and N. Gaylord, Encyclopedia of Polymer Science and Technology, Vol. 1 to XIV Interscience, 2nd Ed. 1988.
4. Gowarikar V.R., Viswanathan N.V and Jayadev Sreedhar, Polymer Science, Wiley Eastern Limited, Madras, 1981.
5. R.K. Rajput,A Textbook of Electrical Engineering Materials, Firewall Media, 2004
6. Vladimir S. Bagotsky, Fuel Cells: Problems and Solutions, 2nd Edition, John Wiley and Sons, 2012.
7. B. Viswanathan and M. Aulice Scibioh, Fuel Cells: Principles and Applications, Taylor and Francis Group, 2007.

OUTCOMES:

The student will be able to

- summarise the preparation, properties and applications of plastics used in electrical and electronic applications
- enumerate the properties and uses of electrical engineering materials
- illustrate various types of batteries with the aid of a diagram
- classify the fuel cells and elaborate the different types of fuel cells.

CHCX04	ENGINEERING MATERIALS	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students should be conversant with

- properties and uses of different types of refractories and abrasives
- adhesives, cements and lime, setting of cements and their chemical behaviors.
- types, properties and uses of lubricants.
- various types of composite materials.

MODULE I REFRACTORIES AND ABRASIVES **8**

Introduction refractory: -classification - based on chemical nature- characteristic and selection of good refractory - general manufacture of refractory- preparation properties and uses of: silica refractory - magnesite refractory - zirconia refractory, properties of refractories: refractoriness - refractoriness under load - thermal spalling - porosity and dimensional stability, Cermets - super refractory.

Abrasives : introduction - Moh's scale - natural abrasives: diamond – corundum – emery - garnet and quartz, synthetic abrasives: preparation properties and uses: carborundum (silicon carbide)– alundum - boron (norbide) carbide

MODULE II ADHESIVES AND BINDING MATERIALS **7**

Introduction - classification of adhesives –advantage –limitation of adhesive bonding – development of adhesive- factors influencing adhesive action: chemical and physical, application techniques of adhesive – Lime: classification – manufacture - setting and hardening, Gypsum: -Manufacture and properties and uses - Cement : chemical composition- Manufacture – setting and hardening – concrete – weathering of cement and concrete and its prevention- special cements: high alumina cement - sorel cement - white portland cement – water proof cement.

MODULE III LUBRICANTS **7**

Introduction –functions of lubricant- mechanism of lubrication - classification of lubricant – liquid lubricant: vegetable and animal oils – mineral oils, semisolid: grease(calcium, lithium, aluminium) – petroleum jelly, solid lubricant: graphite - molybdenum disulphide, Properties of lubricant: viscosity - viscosity index - flash point and fire point - cloud point and pour point – oiliness - aniline point - carbon residue.

MODULE IV COMPOSITE MATERIALS 7

Introduction – advantageous characteristics of composites, applications of composites, main constituent of composites, types and applications of composites: RCC fibre-reinforced plastics (glass , carbon and aramid) - particulate composite - metal matrix composite - layered composites - failures in fibre-reinforced composites, ceramic matrix composites (CMC) – properties and applications.

PRACTICALS

1. Preparation of refractory bricks
2. Preparation of abrasive papers/cloth
3. Preparation of simple adhesives
4. Estimation of alkalinity in cements
5. Determination of cloud point and pour point
6. Determination of flash point and fire point
7. Preparation of fibre-reinforced composite

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. P.C Jain & Monica Jain, Engineering Chemistry Dhanpatrai Publishing Company (P) Ltd., New Delhi (2013).
2. B.Sivasnakar, “Engineering Chemistry”, Tata McGrow-Hill Publication Limited, New Delhi, second reprint 2008.
3. Engineering Chemistry, Wiley India Editorial Team, Willey India Publisher, New Delhi, 2011.
4. S S Umare & S S Dara, A text Book of Engineering Chemistry, S. Chand& Company Ltd, New Delhi, 2014.

OUTCOMES:

The student will be able to

- classify and describe the manufacture the refractories and enumerate the properties and uses of abrasive materials.
- elaborate the manufacture, properties and uses of various adhesives and binding materials.
- classify lubricants and describe the properties and uses of them
- enumerate the properties and uses of various composite materials.

CHCX05	FUELS AND COMBUSTION	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make the students conversant with the

- three types of fuels available and the different processes involved in it.
- analysis of fuel characteristics and manufacture of fuels
- calculations involved in calorific values and minimum air requirement for complete combustion.
- classification, functions, mechanism and properties of lubricants.

MODULE I SOLID FUELS **7**

Characteristics of good fuel. Solid fuel – Wood, Coal – Ranking of coal – selection of coal. Analysis of coal – Proximate analysis. Pulverized coal – Metallurgical coke – Carbonization of coal – types. Manufacture of metallurgical coke – Beehive oven and Otto Hoffman's by-product oven methods.

MODULE II LIQUID AND GASEOUS FUELS **8**

Liquid fuel: Petroleum: Refining of petroleum, Liquid fuels derived from petroleum – Cracking: Thermal (Liquid and Vapour phase) – Catalytic (fixed bed and moving bed cracking – Synthetic petrol: Fischer-Tropsch method– Knocking in petrol and diesel engine: octane number and antiknocking – cetane number and improvement of cetane number – biodiesel (trans-esterification) – Gaseous fuels: Compressed natural gas (CNG) – LPG – oil gas – producer gas – water (blue) gas – biogas.

MODULE III COMBUSTION **8**

Calorific value: Gross and net caloric value – Bomb Calorimeter, Gas calorimeter - Definition of combustion – calculation of minimum requirement of air (problems) – theoretical calculation of calorific values (Dulong's formula), Gross and net calorific values ((problems) – Analysis of flue gas: Orsat's gas analysis method, explosive range, Ignition temperature. Introduction to air pollution from IC (Internal combustion) engines, photochemical smog, primary and secondary pollutants.

MODULE IV LUBRICANTS **7**

Friction and wear – lubricants: definition, functions and mechanism of lubrication

(thick film and thin film) –classification: liquid lubricants: animal and vegetable origin, mineral oil, blended oils, lubricating emulsions and silicones – properties of lubricating oils: viscosity and viscosity index; Flash and fire-point, Cloud and pour point, oiliness, emulsification number, volatility, carbon residue, aniline point – semisolid lubricant: greases and waxes – solid lubricant: graphite and molybdenum disulphide –nanolubricants.

PRACTICALS

1. Testing of fuels - proximate analysis (moisture, volatile matter, ash content and fixed carbon present in coal, coke, charcoal etc)
2. Ash content and carbon residue test
3. Biodiesel synthesis by trans-esterification method (from coconut, groundnut, mustard oil, palm oil)
4. Determination of calorific value of a solid fuel using Bomb calorimeter (coal, charcoal, coke etc)
5. Determination of calorific value of a liquid fuel using Bomb calorimeter (petrol, diesel, biodiesel etc)
6. Determination of cloud point and pour point of a lubricant
7. Determination of flash and fire point of diesel.
8. Aniline Point of diesel
9. Viscosity Index of lubricants and Fuels by Viscometer
10. Flue gas analysis by Orsat's gas analysis method – Demonstration
11. Working of internal combustion engine – Demonstration

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai and Sons, New Delhi, 2001.
2. Engineering Chemistry, Wiley India Editorial Team, Willey India Publisher, New Delhi, 2011.
3. John Griswold, Fuels Combustion and Furnaces, Mc-Graw Hill Book Company Inc. University of Michigan, 1946.
4. J.B. Heywood, Internal Combustion Engine Fundamentals, McGraw Hill International Editions, 1989.
5. Bahl B.S., Tuli and Arun Bahl, Essentials of Physical Chemistry, S. Chand and Company Ltd., New Delhi, 2004.

OUTCOMES:

The students will be able to

- compare and contrast the solid, liquid and gaseous fuels and also describe the processes involved in liquid and gaseous fuels.
- analyse the fuel properties such as moisture, votalite matter, ash content, calorific value etc
- calculate minimum air required for complete combustion and calorific values of fuels.
- categorize different lubricants into three types, explain the preparation and determine their properties.

CHCX06	FUNDAMENTALS OF PHYSICAL CHEMISTRY	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students will be conversant with the

- various thermodynamic terms and relate the laws of thermodynamics in chemical processes
- molecularity and order of reaction and derive the rate constant for different order of reactions
- basics of adsorption of different materials and propose mechanisms and surface area measurement
- conditions for equilibrium and learn different components at equilibrium

MODULE I BASIC THERMODYNAMICS **8**

Introduction - Thermodynamic terms - Thermodynamic equilibrium and processes - 1st law of thermodynamics: internal energy, enthalpy, heat capacity, isothermal and adiabatic expansion, Joule-Thomson effect - Zeroth law of thermodynamics: absolute temperature - 2nd law of thermodynamics: - spontaneous and cyclic process, Entropy in isothermal, isobaric and isochoric processes, work and free energy function, Maxwell's relation - 3rd law of thermodynamics

MODULE II CHEMICAL KINETICS **8**

Rate of chemical reaction - order and molecularity of a reaction - Rate constant - kinetics of opposing, parallel and consecutive and chain reactions - isotope effects - effect of temperature on reaction rate - collision theory - absolute reaction rate theory - kinetics in enzyme catalysis

MODULE III SURFACE SCIENCE AND CATALYSIS **8**

Adsorption - adsorption isotherms - uni and bimolecular adsorption reactions - parahydrogen conversion - factors affecting adsorption – Langmuir adsorption isotherm - Hinshelwood mechanism and *Eley-Rideal* mechanism with example - adsorption of gases on solids and surface area measurement by BET method - Terms in catalysis - homogeneous and heterogeneous and enzyme catalysis with example

MODULE IV PHASE RULE **6**

Terms involved - Conditions for equilibrium - application of phase rule to water, lead-

silver system, freezing mixtures, thermal analysis: cooling curves.

PRACTICALS

1. Determination of the heat capacity of benzoic acid, internal energy of combustion of camphor using Bomb calorimeter. Calculation of enthalpy of combustion and formation for camphor.
2. Determination of adsorption isotherm of (i) acetic acid on charcoal (ii) oxalic acid on charcoal.
3. *Kineticsoffirst and second order reactions.*
4. Phase rule experiments with organic compounds: (i) naphthalene and p-dichloro benzene (ii) naphthalene and diphenyl (iii) m-dinitrobenzenzene and p-nitro toluene.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Rajaram J. and Kuriacose J.C., Chemical Thermodynamics: Classical, Statistical and Irreversible, Pearson Education, India, 2013.
2. Samuel Glasstone, Thermodynamics for Chemists, Read Books, United Kingdom, 2007.
3. James E. House, Principles of Chemical Kinetics, 2nd Edition, Academic Press, United States of America, 2007.
4. Keith J. Laidler, Chemical Kinetics, Pearson Education, India, 1987.
5. Douglas M. Ruthven, Principles of Adsorption and Adsorption Processes, John Wiley & Sons, 1984.
6. Puri B.R., Sharma L.R. and Pathania M.S., Principles of Physical Chemistry, 47th Edition, Vishal Publishing Co. India, 2016.

OUTCOMES:

The student will be able to

- calculate entropy, enthalpy and free energy change for different chemical processes
- calculate the rate constant for any chemical and biochemical processes
- differentiate the adsorption processes and calculate the surface area and predict the suitability of catalysts for different chemical processes
- predict the equilibrium conditions for water, alloys, freezing mixtures and draw the thermal curves for phase transition

CHCX07	GREEN TECHNOLOGY	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make students conversant with the

- basic principles of green chemistry and green technology.
- wastes that causes hazards to human health
- chemicals that harms our environment
- need for green processes in various industries

MODULE I GREEN CHEMISTRY PROTOCOL **7**

Need – Significance – 12 Principles with examples – R4 model – Life cycle analysis – sustainable and cleaner production - Green Technology: definition, examples: CFC free refrigerants, green building, energy, 3D printers, nanotechnology – Awards for Green chemistry – organization promoting green chemistry.

MODULE II WASTE & WASTE MINIMISATION **8**

Source of wastes: domestic, industrial, medical, nuclear, e-waste; problems; prevention – economy of waste disposal – Waste minimization techniques: general waste treatment and recycling – alternate waste water treatment technologies: hybrid process – Green computing: goals, green cloud, green ICT - Pollution statistics from various industries (Industrial case studies).

MODULE III GREEN SYNTHESIS **7**

Introduction - Solvent free reactions - green reagents, green solvents in synthesis - microwave and ultrasound assisted reactions – supercritical fluid extraction – green oxidation and photochemical reactions – catalyst and biocatalysts.

MODULE IV GREEN INDUSTRIAL PROCESSES **8**

Polymer industry: biodegradable polymer - textile industry: greener approaches of dyeing, waste disposal – ecofriendly agrochemicals: biofertilizers, biopesticides – Pharmaceutical industry: atom economy, reduction of toxicity, use of biocatalyst, zero waste disposal – Leather industry: greener process in tanning, crusting, surface coating – ecofriendly batteries & fuel cells.

PRACTICALS

1. Synthesis of an ionic liquids (Ex: imidazolium) and testing the solubility of organic

chemicals.

2. Green bromination of stilbene (using pyridine hydrobromide).
3. Green synthesis: Photocatalytic reactions, solvent-free organic reaction – Aldol; green oxidation, green reduction.
4. Microwave assisted chemical reaction. (synthesis of aspirin, pinacol-pinacolone reaction, etc).
5. Comparison of conventional reaction with microwave assisted reactions (atom economy, solvent, etc) [Ex: aldehyde and ketones with hydrazines to give hydrazones].
6. Diels-Alder reaction in eucalyptus oil (green process).

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai and Sons, New Delhi. 2001.
2. V. K. Ahluwalia, Green Chemistry: Environmentally Benign Reactions, Ane Books India, New Delhi, 2006.
3. Paul Anastas, John C.Warner, John Warner Joint; Green Chemistry: Theory & Practice New Ed Edition; Oxford University press, USA, 2000.
4. Rashmi Sanghi, M. M. Srivastava, Green chemistry, Narosa publishers, New Delhi, 2003.

OUTCOMES:

The students will be able to

- outline the principles and implications of green chemistry.
- comprehend the potential risks of waste generated and analyse the threats to human and environment.
- integrate information into design of molecules to avoid/eliminate toxic solvents & reagents or reduce toxic products.
- identify various alternate greener technologies for various industries.

CHCX08	ORGANIC CHEMISTRY OF BIOMOLECULES	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make students conversant with the

- basic concepts in organic chemistry
- types and structure of carbohydrates and lipids
- formation of different structures of proteins from amino acid
- structure of nucleic acids

MODULE I BASIC CONCEPTS IN ORGANIC CHEMISTRY **8**

Classification and IUPAC nomenclature of organic compounds – stereochemistry – optical, stereo and geometrical isomerism – types of reagents: electrophiles and nucleophiles – types of reactions: addition, substitution, elimination and rearrangement reactions.

MODULE II CARBOHYDRATES, LIPIDS AND VITAMINS **7**

Structure and functions of carbohydrates: mono, di, oligo and polysaccharides – lipids: phospholipids, glycolipids, sphingolipids – cholesterol – steroids – Structure, functions and deficiency disorders of fat soluble vitamins: A, D, E & K - Water soluble vitamins B & C: Thiamine, riboflavin, pantothenic acid, niacin, pyridoxine, biotin, cobalamine, folic acid and ascorbic acid.

MODULE III AMINO ACIDS, PEPTIDES AND PROTEINS **7**

Aminoacids: classification, properties - peptides – polypeptides – proteins: primary, secondary, tertiary and quaternary structure – glycoproteins – lipoproteins – Enzymes: classification and functions

MODULE IV NUCLEIC ACIDS **8**

Nucleic acids – importance - structure of purines and pyrimidines – nucleotides – polynucleotides - RNA – types & structure - DNA – phosphodiester bonds – chemical, helical structure and functions – DNA replication – gene modification.

PRACTICALS

1. Qualitative tests to identify carbohydrates.

2. Quantitative estimation of carbohydrates.
3. Separation of sugars – TLC and/or paper chromatography.
4. Quantitative estimation of lipids.
5. Separation of amino acids – TLC and/or paper chromatography.
6. Quantitative estimation of proteins by Lowry's method.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. V. K. Ahluwalia, Organic Reaction Mechanism, Narosa Publishers, New Delhi, 2002.
2. Johnson Arthur T., Biology for Engineers, CRC Press, Finland, 2011.
3. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai and Sons, New Delhi. 2001.
4. David L. Nelson, Michael M. Cox, Lehninger Principles of biochemistry, Macmillan press, London, 2010

OUTCOMES:

The students will be able to

- classify organic compounds and explain the mechanism of various organic reactions.
- draw the structures and enumerate the functions of carbohydrate, lipids and vitamins.
- correlate the relationship among amino acids, peptides and proteins.
- recognize the role of nucleic acid in the formation of RNA & DNA and differentiate DNA & RNA using their structure and function.

CHCX09	POLYMER SCIENCE AND TECHNOLOGY	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make the student conversant with the

- basic concepts of polymers, classification, types of polymerization and molecular weight & its distribution
- preparation, properties and applications of thermoplastics and introduction to biodegradable polymers
- properties and applications of thermosets, elastomers and FRP
- different types of moulding techniques

MODULE I BASIC CONCEPTS OF POLYMERS **8**

Definitions: monomer, polymer, functionality, degree of polymerization – classification of polymers: source, structure, application, thermal processing behavior (thermoplastics and thermosets), composition and structure (addition and condensation), mechanism (chain growth and step-wise growth) – copolymer: types – Definition –nomenclature of polymers – tacticity – types of polymerization : free radical, cationic and anionic polymerization (concepts only) – average molecular weight of polymer: number, weight – molecular weight distribution (problems)

MODULE II THERMOPLASTICS AND BIODEGRADABLE POLYMERS **8**

Preparation, properties and applications : LDPE, HDPE, polypropylene, PVC, PTFE, PET, polyamides (Nylon-6 and Nylon 6,6) and polycarbonates – polymer blends and alloys – basics of biodegradable polymers.

MODULE III THERMOSET RESINS, ELASTOMERS AND FRP **7**

Thermoset resins : phenolic resins, amino resins (urea and melamine formaldehyde), epoxy resins, unsaturated polyesters – polyurethanes – elastomers : vulcanization of natural rubber, diene based elastomers –fibre reinforced plastics: glass, aramid and carbon.

MODULE IV MOULDING TECHNIQUES 7

Moulding constituents**:** functions – moulding techniques**:** compression, injection, extrusion (single screw), blow moulding, thermoforming, (mechanical and vacuum forming), lamination.

PRACTICALS

1. Determination of molecular weight and degree of polymerization using Oswald's viscometer.
2. Free radical polymerization of styrene.
3. Free radical polymerization of PMMA.
4. Preparation of phenol-formaldehyde.
5. Preparation of urea-formaldehyde.
6. Synthesis of epoxy resin.
7. Synthesis of unsaturated polyester.
8. Preparation of FRP laminates.
9. Demonstration of injection moulding, compression moulding and blow moulding.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Billmeyer F.N., Text Book of Polymer Science, 3rd Edition, John Wiley and Sons, New York, 1994.
2. George Odian, Principles of Polymerisation, 3rd Edition, McGraw Hill Book Company, New York, 1991.
3. Michael L. Berins, Plastics Engineering Hand Book, 5th Edition, Chapman and Hall, New York, 1991.
4. Jacqueline I., Kroschwitz, Concise Encyclopedia of Polymer Science and Engineering, John Wiley and Sons, New York, 1998.
5. Encyclopedia of Polymer Science and Technology, Vol. 1 to XIV, H.F. Mark and N. Gaylord, Interscience, 2nd Ed. 1988.
6. Gowarikar V.R., Viswanathan N.V and Jayadev Sreedhar, Polymer Science, Wiley Eastern Limited, Madras, 1981.

OUTCOMES:

The student will be able to

- classify various polymers, name the polymers and types of polymerization

reactions, calculate molecular weight of polymers,

- summarise preparation, properties and applications of thermoplastics and give examples of biodegradable polymers
- elaborate the properties and applications of thermosets, elastomers and FRP
- select the appropriate moulding technique for a given polymer, based on the application

Maths Elective Courses

(to be offered in IV

Semester)

MACX 01	**DISCRETE MATHEMATICS AND GRAPH THEORY**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

OBJECTIVES:

The aims of this course are to

- introduce Logical and Mathematical ability to deal with abstraction.
- familiarize the basic mathematical ideas and terminologies used in computer science.
- translate real life situations into diagrammatic representations.

MODULE I PROPOSITIONAL CALCULUS 8

Propositions – Logical connectives – Compound propositions – Conditional and biconditional propositions – Truth tables – Tautologies and contradictions – Contrapositive – Logical equivalences and implications – DeMorgan's Laws – Normal forms – Principal conjunctive and disjunctive normal forms – Rules of inference – Arguments – Validity of arguments.

MODULE II PREDICATE CALCULUS 7+3

Predicates – Statement function – Variables – Free and bound variables – Quantifiers – Universe of discourse – Logical equivalences and implications for quantified statements – Theory of inference – The rules of universal specification and generalization – Validity of arguments.

MODULE III FUNCTIONS 7+3

Functions – Classification of functions –– Composition of functions – Inverse functions – Binary and n–ary operations – Characteristic function of a set – Hashing functions – Recursive functions – Permutation functions.

MODULE IV ALGEBRAIC SYSTEMS 8+2

Groups, Cyclic Groups, Subgroups, Cosets, Lagrange's theorem, Normal subgroups – Codes and group codes – Basic notions of error correlation – Error recovery in group codes.

MODULE V GRAPH THEORY 7+3

Graphs – incidence and degree – subgraphs – isomorphism – complement of a graph – operations on graphs

MODULE VI PATH AND CIRCUIT 8+2

Walks, trails and paths – Eulerian graphs – Konigsburg bridge problem - Hamiltonian graphs

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1 Trembly J.P and Manohar R, “Discrete Mathematical Structures with Applications to Computer Science”, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, 30th Reprint 2011.

2 Kenneth H.Rosen, “Discrete Mathematics and its Applications:, 7th Edition, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, Special Indian Edition, 2011.

REFERENCES:

1 Ralph.P.Grimaldi, “Discrete and Combinatorial Mathematics: An Introduction”, 4th Edition, Pearson Education Asia, Delhi, 2007.

2 Thomas Koshy, “Discrete Mathematics with Applications”, Elsevier Publications, 2006.

3 C.L.Liu, D.P.Mohapatra, “Elements of Discrete Mathematics”, 4th Edition, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, 2012.

OUTCOMES:

At the end of the course, student will be able to

- use the concepts of propositional calculus.
- use the concepts of predicate calculus.
- identify types of functions and their importance.
- decode and encode the messages using group theory concepts.
- apply the basic concepts of graph theory.
- represent some real life situations into diagrammatic representation.

MACX 02 PROBABLITY AND STATISTICS L T P C
3 1 0 4

OBJECTIVES:

The aims of this course are to impart the

- knowledge of the theory of probability and random variables
- techniques to carry out probability calculations and identifying probability distributions
- application of statistical inference in practical data analysis

MODULE I BASICS OF PROBABILITY AND STATISTICS 8+2

Sample space, events- axioms of probability and interpretation – Addition, multiplication rules – conditional probability, Independent events - Total probability – Baye's theorem - Descriptive Statistics.

MODULE II ONE DIMENSIONAL RANDOM VARIABLE AND PROBABILITY DISTRIBUTION FUNCTIONS 7+3

Discrete random variable –continuous random variable – Expectation - probability distribution - Moment generating function – Binomial, Poisson, Geometric, Uniform (continuous), Exponential and Normal distributions.

MODULE III TWO DIMENSIONAL RANDOM VARIABLES 8+2

Joint, marginal, conditional probability distributions –covariance, correlation - transformation of random variables.

MODULE IV SAMPLING AND ESTIMATION 7+3

Sampling distributions – basic knowledge on Random , simple random , stratified and cluster samplings – Test of Hypotheses - concepts- Point estimation and Interval estimation.

MODULE V THEORY OF INFERENCE 8+2

Large sample tests – test for single and difference on proportions, single mean, difference of means, difference of variances – confidence intervals. Small sample tests – Student's t test, F test and Chi square test on theory of goodness of fit and analyses of independence of attributes.

MODULE VI DESIGN OF EXPERIMENTS 7+3

Analysis of variance – one way classification – two way classification – Completely

Randomised Block Designs – Randomised Block Design – Latin square designs - Interpretations - case studies.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. T.Veerarajan, “Probability and Statistics”, Tata McGraw-Hill Education, 2008.
2. Miller, I., Miller, M.,Freund, J. E., “Mathematical statistics”, 7th Edition, Prentice Hall International, 1999.
3. S.P.Gupta, “Applied Statistics”, Sultan Chand & Sons

REFERENCES:

1. S.M.Ross, “Introduction to Probability and Statistics for Engineers and Scientists” Fifth Edition, Elesvier.
2. S.C.Gupta and V.K.Kapoor, “Fundamentals of Mathematical Statistics” First edition, Sultan Chand and Sons.
3. Arora and Arora, “Comphrensive Statistical Methods”, S. Chand, 2007

OUTCOMES:

On completion of the course, students will be able to

- do basic problems on probability and descriptive statistics.
- derive the probability mass / density function of a random variable.
- calculate probabilities and derive the marginal and conditional distributions of bivariate random variables.
- calculate point and interval estimates.
- apply some large sample tests and small sample tests.
- carry out the data collection representation analysis and implications and the importance of inferences.

MACX 03	RANDOM PROCESSES	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aims of the course are to

- acquire the knowledge of the theory of probability and random variables
- study discrete and continuous probability distributions.
- demonstrate the techniques of two dimensional random variables and its distributions.
- introduce the random process, stationarity, Markov process and the study of correlation function and spectral analysis.

MODULE I Basics of Probability 7+3

Sample space, events- axioms of probability and interpretation – Addition, multiplication rules – conditional probability, Independent events - Total probability – Baye's theorem - Tchebychev's inequality.

MODULE II One dimensional Random variable and Probability Distribution functions 7+3

Discrete random variable –continuous random variable – Expectation - probability distribution - Moment generating function – Binomial, Poisson, Geometric, Uniform (continuous), Exponential and Normal distributions.

MODULE III Two dimensional random variables 7+3

Joint, marginal, conditional probability distributions - covariance, correlation and regression lines - transformation of random variables.

MODULE IV RANDOM PROCESSES 8+2

Classification of Random process - Stationary process - WSS and SSS processes - Poisson process – Markov Chain and transition probabilities.

MODULE V CORRELATION FUNCTIONS 8+2

Autocorrelation function and its properties - Cross Correlation function and its properties - Linear system with random inputs – Ergodicity.

MODULE VI SPECTRAL DENSITY 8+2

Power spectral Density Function - Properties - System in the form of convolution - Unit Impulse Response of the System – Weiner-Khinchine Theorem - Cross Power

Density Spectrum.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Veerarajan T., “Probability, Statistics and Random Processes”, Tata McGraw Hill,3rd edition, 2008.
2. Papoulis, “Probability, Random Variables and Stochastic Processes”, 4th Edition, Tata McGraw Hill Company, 2002.
3. S.M.Ross, “Introduction to Probability and Statistics for Engineers and Scientists” Fifth Edition, Elesvier

REFERENCES:

1. Scott L. Miller,Donald G. Childers, Probability and Random Processes, Academic Press,2009.
2. Trivedi K S, “ Probability and Statistics with reliability, Queueing and Computer Science Applications”,Prentice Hall of India,New Delhi,2nd revised edition, 2002

OUTCOMES:

On completion of the course, students will be able to

- do basic problems on probability.
- derive the probability mass / density function of a random variable.
- calculate probabilities and derive the marginal and conditional distributions of bivariate random variables.
- identify and study the different random processes.
- compute correlation functions and related identities.
- compute power spectral density functions and apply Weiner-Khinchine formula.

MACX 04 APPLIED NUMERICAL METHODS L T P C
3 1 0 4

OBJECTIVES:

The aims of the course are to

- introduce basic computational methods for analyzing problems that arise in engineering and physical sciences.
- acquire knowledge about approximation theory and convergence analysis associated with numerical computation.

MODULE I NUMERICAL SOLUTIONS OF EQUATIONS 7+3

Bisection method - Regula Falsi method – Secant method - Fixed point iteration method - Newton's Raphson method –Gauss Elimination method - Gauss-Jordon method – Gauss Jacobi method - Gauss-Seidel method.

MODULE II INTERPOLATION 8+2

Finite difference operators – Gregory Newton's forward and backward interpolations – Cubic spline interpolation - Lagrange interpolation - Newton's divided difference formula.

MODULE III NUMERICAL DIFFERENTIATION AND INTEGRATION 8+2

Numerical differentiation using Newton's forward and backward formulae – Numerical integration : Trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Gaussian Two Point and Three Point Quadrature formulae – Double integrals using Trapezoidal and Simpson's 1/3 rule.

MODULE IV INITIAL VALUE PROBLEMS FOR FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS 7+3

Numerical solutions by Taylor's Series method, Euler's method, Modified Euler's Method - Runge – Kutta Method of fourth order – Milne's and Adam's Bashforth Predictor and Corrector methods

MODULE V INITIAL AND BOUNDARY VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 8+2

Numerical solutions by Taylor's Series method - Runge – Kutta Method of fourth order of second order ODE. Finite difference methods.

MODULE VI BOUNDARY VALUE PROBLEMS FOR PARTIAL DIFFERENTIAL EQUATIONS **7+3**

Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace equation.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Grewal, B.S., “Numerical methods in Engineering and Science”, 7th edition, Khanna
   Publishers, 2007.
2. C.F.Gerald, P.O.Wheatley, “Applied Numerical Analysis” ,Pearson Education, New Delhi, 2002.

REFERENCES:

1. Chapra S.C, Canale R.P. “Numerical Methods for Engineers”, 5th Ed., McGraw Hill, 2006.
2. M.K.Jain, S.R.K.Iyengar, R.K.Jain, “Numerical methods for Scientific and Engineering Computation”, New Age International Publishers, New Delhi, 2003

OUTCOMES:

At the end of this course, students will be able to

- solve algebraic, transcendental and system of equations.
- apply interpolation techniques.
- carry out numerical differentiation and integration using different methods.
- solve first order ODE using single and multi step methods.
- solve second order ODE, initial and boundary value problems.
- solve the boundary value problems in PDE.

Maths Elective Courses
(To be offered in VI Semester)

MACX 05	MATHEMATICAL PROGRAMMING	L	T	P	C
		2	0	0	2

OBJECTIVES:

The aims of the course are to

- acquire knowledge and training in optimization techniques.
- obtain knowledge about optimization in utilization of resources.
- understand and apply operations research techniques to industrial operations.

MODULE I LINEAR PROGRAMMING PROBLEM 10

Linear programming – formulation of the problem - graphical interpretation of optimality - Simplex method – to obtain basic feasible solution – types of linear programming solution – complications and their resolution.

MODULE II ADVANCED LINEAR PROGRAMMING PROBLEMS 8

Artificial variable - Big M method – Two phase method – alternative optimal solution – unbounded solution - Duality – primal dual relationships.

MODULE III TRANSPORTATION PROBLEM 7

Transportation problems – Initial basic feasible solutions, MODI method, Unbalanced transportation problem, Degeneracy in transportation models,.

MODULE IV ASSIGNMENT PROBLEM 5

Assignment problem – Minimization and Maximization type of problems by Hungarian method.

Total Hours –30

TEXT BOOKS:

1. Hamdy A Taha, “Operations Research - An introduction”, 8th edition, Phil Pearson, 2007.
2. Winston.W.L., “Operations Research”, 4th edition, Thompson-Brooks/Cole, 2003.

REFERENCES:

1. Wayne.L. Winston, “Operations Research Applications and Algorithms”,

4th edition, Thomson learning, 2007.

2. Frederick. S. Hiller and Gerald J Lieberman, “Operations Research Concepts and Cases”, 8th edition (SIE), Tata McGraw – Hill Pub. Co. Ltd., New Delhi, 2006.
3. A. Ravindran, D. T. Phillips and J. J. Solberg, "Operations Research: Principles and Practice", 2nd edition, John Wiley & Sons, New York, 1992.
4. Robertazzi. T.G., “Computer networks and systems-Queuing theory and performance evaluation”, 3rd edition, Springer, 2002.

OUTCOMES:

At the end of the course, students will be able to

- formulate industrial problems as mathematical programming problems.
- solve linear programming problems by different methods.
- solve transportation problems by different methods.
- solve assignment problems by Hungarian method.

MACX 06	STATISTICAL METHODS FOR DATA ANALYSIS	L	T	P	C
		2	0	0	2

OBJECTIVES:

The aim of the course is to

- introduce statistical quality control tools.

MODULE I TESTS OF HYPOTHESES AND STATISTICAL INFERENCES 8

Small sample tests – Student's ' t ' test for single mean , difference of means, paired t test – F test for difference of variances – Chi square test on theory of goodness of fit and analyses of independence of attributes.

MODULE II DESIGN OF EXPERIMENTS 7

Analysis of variance – one way classification – two way classification – Completely Randomised Block Designs – Randomised Block Design – Latin square designs - Statistical analysis -Interpretations - case studies.

MODULE III STATISTICAL QUALITY CONTROL-I 8

Quality improvement and statistics –Statistical quality control- statistical process control – control charts – design of control charts –analysis of patterns on control charts - X bar chart, R chart and S chart.

MODULE IV STATISTICAL QUALITY CONTROL-II 7

Process and product control – attribute charts – P, np and C charts – control charts performance.

Total Hours –30

TEXT BOOKS:

1. Douglas C.Montgomery, George C. Runger "Applied Statistics and probability for Engineers" V Edition – John Wiley & Sons Inc.
2. Miller, I., Miller, M., Freund, J. E. "Mathematical statistics" 7th Edition. Prentice Hall International, 1999.

REFERENCES:

1. Dekking, F.M., Kraaikamp, C., Lopuhaä, H.P., Meester, L.E. "A Modern Introduction to Probability and Statistics" Springer, 2nd Edition.
2. Chin Long chiang "Statistical Methods of Analysis "World Scientific Books,

2003.
3. S.C.Gupta and V.K. Kapoor, “Mathematical Statistics” , Sultan Chand publications.
4. Veerarajan “Fundamentals of Mathematical Statistics” I Edition, Yes Dee Publishing Pvt. Ltd., 2017.

OUTCOMES:

On completion of the course, students will be able to

- develop and test hypothesis for different statistical tests
- design an experiment and case study the experiment with different data.
- analyze the industrial data using quality control design tools statistically.
- analyze the industrial data using process and product control tools statistically.

MACX 07 NUMERICAL METHODS FOR INTEGRATION AND DIFFERENTIAL EQUATIONS

L	T	P	C
2	0	0	2

OBJECTIVES:

- This course aims to solve numerically integral and differential equations.

MODULE I NUMERICAL INTEGRATION **8**

Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Two Point and Three point Gaussian quadrature formulae.

MODULE II NUMERICAL DOUBLE INTEGRATION **6**

Double integrals using trapezoidal and Simpson's 1/3 rules

MODULE III NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS **8**

Milne's Predictor and Corrector Method – Adam's Predictor-Corrector Method - Finite difference methods for two – point Boundary Value problems for Ordinary Differential Equations.

MODULE IV BOUNDARY VALUE PROBLEMS FOR PARTIAL DIFFERENTIAL EQUATIONS **8**

Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace and Poisson equations

Total Hours –30

TEXT BOOKS:

1. M.K.Jain, S.R.K.Iyengar, R.K.Jain, "Numerical methods for Scientific and Engineering Computation", New Age International Publishers, New Delhi, 2003.
2. Grewal, B.S., "Numerical methods in Engineering and Science" 7th edition, Khanna Publishers, 2007

REFERENCES:

1. C.F.Gerald, P.O.Wheatley, "Applied Numerical Analysis" Pearson Education, New Delhi 2002.
2. P.Dechaumphai, N. Wansophark, "Numerical Methods in Engineering", Narosa Publications, 2012.

OUTCOMES:

At the end of the course students will be able to

- solve the integration by numerical methods.
- solve the double integration by numerical methods
- find numerical solution of ordinary differential equations in engineering problems.
- find numerical solution of partial differential equations in engineering problems.

MACX 08 MATHEMATICAL MODELLING L T P C
3 0 0 3

OBJECTIVES:

The aims of the course are to

- provide basic idea of formation and use of Mathematical models for different purposes.
- determine the extent to which models are able to replicate real-world phenomena under different conditions

MODULE I PRINCIPLES OF MATHEMATICAL MODELING 7

Mathematics as a modelling language - Classification of models - Building, studying, testing and using models - Black and white box models – Difference equations

MODULE II PHENOMENOLOGICAL MODELS 7

Linear, Multiple linear and nonlinear regression - Neural networks - Fuzzy model - Stability and higher dimensional systems

MODULE III MECHANISTIC MODELS –I 8

Setting up ODE models – Initial and Boundary value problems - Numerical solutions - Fitting ODE to data - Applications

L T P C
2 0 0 2

MODULE IV MECHANISTIC MODELS –II 8

Linear and nonlinear equations - Elliptic, parabolic and hyperbolic equations - Closed form solutions - Finite difference and finite element methods

Total Hours –30

TEXT BOOKS:

1. G . Ledder , “Calculus, modelling , probability and dynamic systems”, Springer 2013
2. Kei Velten, “Mathematical modelling and simulation”, J. Wiley and sons,2009

REFERENCES:

1. Michael D Alder, “An introduction to Mathematical modelling”, Heaven for Books.com
2. Alfio Quarteroni, “Mathematical models in science and engineering”, Notices of AMS
3. J.N. Kapur, “Mathematical models in Biology and Medicine”, Affiliated East-

West Press Private Limited, New Delhi, 1992.

OUTCOMES:

On completion of the course, the students will be able to

- identify the relationship between real world and mathematical models
- Classify the data and choose the appropriate model
- Distinguish between linear and nonlinear models
- identify the relationship between empirical and mechanistic models

MACX 09 **GRAPH THEORY** **L T P C**

3 0 0 3

OBJECTIVES:

The aims of this course are to

- represent the real life situations diagrammatically.
- appraise different methods to find solutions to graph theory problems.

MODULE I INTRODUCTION TO GRAPH THEORY 8

Graphs - finite and infinite graphs - Incident and degree-isolated vertex, pendent vertex and null vertex.

MODULE II PATH AND CIRCUIT 8

Isomorphism – sub graphs-walks, paths and circuits – connected and disconnected graphs- Euler graphs – operation on a graph.

MODULE III TREES AND FUNDAMENTAL CIRCUITS 7

Trees- some properties of trees- pendent vertices in a tree – rooted binary tree-spanning trees-fundamental circuits.

MODULE IV CUT SETS AND CUT VERTICES

Cut sets – some properties of cut sets- fundamental circuits and cut sets-network flows.

Total Hours –30

TEXT BOOKS:

1. NARSINGH DEO, Graph theory with applications to Engineering and Computer Science, Prentice Hall INC, New Delhi,
2. J.A. Pondy and U.S.R. Murthy, North Holland, Oxford, New York Graph theory with applications

REFERENCES:

1. Trembly J.P and Manohar R, “Discrete Mathematical Structures with Applications to Computer Science”, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, 30th Reprint 2011
2. Kenneth H.Rosen, “Discrete Mathematics and its Applications”, 7th Edition, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, Special Indian Edition, 2011

3. Md. Saidur Rahman, “Basic graph theory”, Springer, 2017

OUTCOMES:

At the end of the course, students will be able to

- demonstrate the basic concepts of Graph theory.
- explore connected and disconnected graphs.
- identify the real life problems with trees and circuits.
- bring out the cut set properties and network flows properties.

Humanities Elective I

(To be offered in III Semester)

SSCXO1	**FUNDAMENTALS OF ECONOMICS**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**2**

OBJECTIVES:

- To identify and present the basic concepts of demand, supply and equilibrium.
- To explain and discuss the types and concepts of national income and inflation.
- To illustrate the fundamental concepts of money, banking and public finance.
- To apprise the students about Indian economy and the role of engineers in economic development.

MODULE I DEMAND AND SUPPLY ANALYSIS 8

Classification of economy – open and closed economy, Demand - Types of demand - Determinants of demand – Law of Demand - Demand elasticity - Supply - Determinants of Supply – Law of Supply - Supply elasticity - Pricing strategies.

MODULE II NATIONAL INCOME AND INFLATION 7

Concepts of National income and measurement – Importance and difficulties of estimating National Income in India - Aggregate demand and aggregate supply, Macroeconomic equilibrium – meaning of inflation- types - causes and preventive measures

MODULE III MONEY, BANKING AND PUBLIC FINANCE 9

Money – Meaning, types, functions, importance - Commercial Banks - Central Bank - Monetary policy – meaning, objectives, Methods of Credit Control By RBI, Government Budget – Government revenue and Expenditures – Fiscal policy - Its objectives, instruments and limitations - Deficit Financing - The Fiscal Responsibility and Budget Management Act, 2003 (FRBMA) .

MODULE IV INDIAN ECONOMY AND THE ROLE OF ENGINEERS 6

Economic reforms – Liberalization, Privatization and Globalization - challenges and opportunities, Engineers – Engineers' contributions to the economic growth.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Dutt and Sundharam (2013), *Indian Economy*, S. Chand & Company Pvt. Ltd, New Delhi.
2. Hussain, Moon Moon (2015), *Economics for Engineers*, Himalaya Publishing House, New Delhi.

REFERENCES:

1. Cleaver Tony (2004), "*Economics: The Basics*", Routledge, London.
2. Mell Andrew and Walker Oliver (2014), "*The Rough Guide to Economics*", Rough Guide Ltd.

OUTCOMES:

On successful completion of this course,

- Students will have had exposure to the basic concepts of demand, supply and various pricing strategies.
- Students will have understood the macroeconomic concepts of national income and inflation.
- Students will be able to apply the knowledge of money, banking and public finance in their real life situations.
- Students will have an overview of the economic reforms introduced in Indian economy.

SSCXO2 PRINCIPLES OF SOCIOLOGY.

L	T	P	C
2	0	0	2

OBJECTIVES:

- To acquaint the students with Concepts and perspectives of Sociology
- To explain the reflection of society in Individuals and vice versa
- To describe the hierarchical arrangement of individuals and groups in society
- To explicate the dimensions, forms and factors of Social change.
- To examine the context, impact and agencies of Globalization

MODULE I THE FOUNDATIONAL CANON 8

Sociology-Definition, scope and importance; Major theoretical perspectives- Functionalism, Conflict Theorising and Interactionism; Elements of social formation- Society, Community, Groups and Association; Associative Social Process- Co-operation, Accommodation and Assimilation; Dissociative Social Process- Competition and Conflict.

MODULE II INDIVIDUAL AND SOCIETY 7

Culture-definition, characteristics, functions, types, cultural lag and civilization, Socialization – definition, process, stages, agencies and anticipatory socialization; Social Control- definition, characteristics, importance, types & agencies.

MODULE III SOCIAL INEQUALITY AND STRATIFICATION 7

Concepts- inequality, hierarchy, differentiation, Social Exclusion, and Social Stratification. Forms of Social Stratification- Caste, Class and Estate. Gender and Social Stratification- sex and gender, patriarchy, factors perpetuating gender stratification; Globalization and gender inequality

MODULE IV SOCIAL CHANGE AND GLOBALIZATION 8

Social Change-definition, nature, direction; Forms- evolution, development, progress and transformation; Factors of social change- demography, economy, technology, polity and culture. Globalization- definition, characteristics, historical and social context and Impact, agencies of globalization- IGOs, INGOs, Nation-State, MNEs and Media

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Giddens A. 1989. “Sociology” Cambridge: Polity Press.

2. Heald Haralambos, R.M(2014) . ‘‘Sociology Themes and Perspectives”, Oxford, New Delhi-92
3. Bhushan Vidya and D.R. Sachdeva (2012). ‘‘Fundamental of Sociology”, Pearson, Delhi.

REFERENCES:

1. Das Gupta, Samir and Paulomi Saha (2012), ‘‘An Introduction to Sociology”, Pearson, Delhi
2. Bottomore, T.B. 1972. *Sociology- A Guide to Literature and Problems*, New Delhi,

OUTCOMES:

On successful completion of this course,

- Students will have exposure to the fundamentals tenets of Sociology.
- Students will be trained to understand social reality with sociological perspective.
- Students will be oriented to constructively analyze human interactions, social relationship and social issues
- Students will gain exposure to the dynamics of human society with special reference to the contemporary trends of globalization.

SSCXO3	SOCIOLOGY OF INDIAN SOCIETY.	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To present a portrayal of the components of the Indian Social structure
- To describe the nature and contemporary structure of Indian social Institutions.
- To examine the causality and magnitude of social problem facing the contemporary India.
- To elucidate the processes forms and impact of change and development in Indian society

MODULE I INDIAN SOCIAL STRUCTURE 7

Unity and Diversity; Concepts of unity and diversity- racial, religious, ethnic and linguistic composition of India. Types of communities-rural, urban and tribal; Social backwardness- OBC, SC and ST; Indian minorities- religious, ethnic, linguistic and LGBT

MODULE II INDIAN SOCIAL INSTITUTIONS 7

Family- definition, types, characteristics, functions of family; Joint Family- definition features, utility, changes; Marriage- definition, characteristics, marriage as sacrament or contract. Caste- definition, principles, contemporary changes, dominant caste, caste -class interface.

MODULE III SOCIAL PROBLEMS IN INDIA 8

Social Problem-definition, nature, social disorganization; Population explosion-causes, effects, relationship with development; Child Labour- causes, magnitude and consequences; Unemployment-nature , types, causes and effects; Gender issues-social status of women, violence against women and women in work place; Contemporary issues- communalism, terrorism and corruption.

MODULE IV SOCIAL CHANGE AND DEVELOPMENT IN INDIA 8

Socio-cultural Change- Sanskritization, Westernization, Secularization, Modernization; Processes of Social change- Industrialization, Urbanization, Globalization; Development- definition, elements, role of government, industry and corporate sector. Technology and change- invention and innovation, impact of technology on social institutions, technology and development.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Sharma,K.L.2008. *Indian Social Structure and Change*. Jaipur: Rawat Publications,.
2. Shah, A.M. 1998. *The Family in India: Critical Essays*. New Delhi: Orient Longman,
3. Ahuja Ram. 1999. *Social problems in India*, Rawat Publication: New Delhi.
4. Ahuja Ram. 2014. *Society in India,*, Rawat Publication: New Delhi.

REFERENCES:

1. Jayapalan, N.(2001), **"**Indian Society and Social Institutions" Atlantic Publishers & Distri,
2. Atal, yogesh (2006), "Changing Indian Society" Rawat Publications, Jaipur

OUTCOMES:

On successful completion of this course,

- Students will gain an in-depth understanding of the social structure and social institutions that constitute society in India.
- Students will be sensitized to the various categories ,Inequalities and their challenges
- Students will be exposed to the social problems encountered in contemporary India.
- Students will gain knowledge about the various forms and trends of the social change.
- Students will become aware about the challenges in the path of progress of Indian society and realize relevance of their role in bringing about development

Humanities Elective II

(To be offered in IV Semester)

		L	T	P	C
SSCXO4	**ECONOMICS OF SUSTAINABLE DEVELOPMENT**	**2**	**0**	**0**	**2**

OBJECTIVES:

- To have an increased awareness on the concept and components of sustainable development.
- To develop the ability to demonstrate the need of sustainable development and international responses to environmental challenges.
- To have an insight into global environmental issues and sustainable globalization.
- To establish a clear understanding of the policy instruments of sustainable development.

MODULE I CONCEPT OF SUSTAINABLE DEVELOPMENT 7

Evolution of the Concept – Rio Summit and sustainable development - various definitions of sustainable development - Components of sustainable development: Social, environmental and economic components.

MODULE II NEED FOR SUSTAINABLE DEVELOPMENT 8

Need for sustainability – Global environmental challenges: population growth, resource depletion, pollution, energy use, climate change, pollution, growing water scarcity, other urban problems, loss of biodiversity, hazardous wastes disposal.International responses to environmental challenges - Global policy such as Kyoto Protocol, Montreal Protocol, Basel Convention.

MODULE III GLOBALIZATION AND ENVIRONMENT SUSTAINABILITY 8

Impact of Globalization on sustainable development, Co - existence of globalization and Environment sustainability, Globalization and Global Governance.Green economy - Renewable energy, sustainable transport, sustainable construction, land and water management, waste management.

MODULE IV POLICIES FOR ACHIEVING SUSTAINABLE DEVELOPMENT 7

Principles of environmental policy for achieving sustainable development: precautionary principle and polluter pays principle – Business Charter for Sustainable Development.Policy instruments for sustainable development: direct regulation – market based pollution control instruments such as pollution tax, subsidy, pollution permits.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Anderson, David A (2010), "*Environmental Economics and Natural Resource Management*", Routledge, 3rd edition.
2. Karpagam M (1999), "*Environmental Economics: A Textbook*", Sterling Publishers Pvt. Ltd, New Delhi.

REFERENCES:

1. Karpagam M and Jaikumar Geetha (2010), "*Green Management Theory and Applications*", Ane Books Pvt. Ltd, New Delhi.
2. Sengupta Ramprasad (2004), "*Ecology and Economics: An Approach to Sustainable Development*", Oxford University Press, New Delhi.

OUTCOMES:

On successful completion of this course,

- The students will have understood the concepts and components of sustainable development.
- The students will have a holistic overview on the challenges of sustainable development and International responses to environmental challenges.
- The students will have gained knowledge on the global environment issues and demonstrate responsible globalization through global governance.
- The students will have developed awareness of the ethical, economic, social and political dimensions that influence sustainable development.

SSCXO5 INDUSTRIAL SOCIOLOGY L T P C

2 0 0 2

OBJECTIVES:

- To introduce sociological approaches and perspectives to understand the social relationship in manufacturing industries and corporate sector.
- To explain the structure and functions of industrial organizations.
- To elucidate the dynamics of organizational behavior, leadership and communication.
- To inculcate professional ethics and values to equip students to work in organizational settings.

MODULE I INTRODUCTION 8

Industrial Sociology- definition, scope and importance; Theoretical approaches- scientific management, human relations approach, theory of bureaucracy, Fordism and post-fordism; Production system- concept and characteristics of factory system, automation and rationalization; Industrial conflict- strike , lockout and trade unions.

MODULE II INDUSTRIAL ORGANIZATION 7

Formal organization- definition, features, utility; Informal organization- definition, characteristics, types and relevance; Structure of industrial organization- features and functions of line organization, characteristics and roles of staff organization, distinction;

Industrial hierarchy-white collar, blue collar, supervisors and managers.

MODULE III DYNAMICS OF INDUSTRIAL RELATIONS 8

Group dynamics- Definition, Group behaviour model, Group decision making process, group cohesiveness; Leadership- definitions, style and effective supervision; Communication- concepts, types, model barriers; Job satisfaction- nature, employee compensation and job satisfaction.

MODULE IV PROFESSIONAL ETHICS AND VALUES 7

Concepts- values- morals, and ethics, Integrity, work ethics , service learning - Civic Virtue - caring - Sharing - Honesty - Courage - Valuing Time - Co-operation - commitment - empathy - Self-Confidence - Environmental Ethics, Cyber issues - computer ethics, cyber crimes, plagiarism Ethical living-concept of harmony in life.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Narender Singh, Industrial Sociology, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2012.
2. Gisbert Pascal, Fundamentals of Industrial Sociology, Tata Mc. Graw Hill Publishing Co., New Delhi, 1972
3. Schneider Engeno. V, Industrial Sociology 2nd Edition, Mc. Graw Hill Publishing Co., New Delhi, 1979.

REFERENCES:

1. Robbins, Stephen, Organizational Behaviour , Prentice Hall of India PVT ltd new Delhi, 1985
2. Devis Keith , Human Behaviour at work place, Mc. Graw Hill Publishing Co., New Delhi,1984

OUTCOMES:

On successful completion of this course,

- Students will have acclimatized with sociological perspectives for dealing with social relationships in production and service organizations.
- Students will be familiar with structure of authority, roles and responsibility in organizational settings.
- Students will imbibe leadership, communication and behavioral acumen to govern organization
- Students will be sensitized to standards of desirable behavior to engage in industrial and corporate sector.

SSCXO6 LAW FOR ENGINEERS L T P C
2 0 0 2

OBJECTIVES:

- To understand the Constitution and Governance of our country.
- To apprise the students of human rights - local and international and redressal mechanism.
- To have an insight into the industrial, corporate and labour laws of our country.
- To establish a clear understanding about the importance of intellectual property related laws.

MODULE I INDIAN CONSTITUTION AND GOVERNANCE 8

Constitution – salient features, Preamble, Citizenship, Fundamental rights, Fundamental duties, Directive principles, Union executive, Legislature – Union – State and union territories – Election Commission – Election for parliament and state legislature, Judiciary- basic functioning of the Supreme Court and High Courts, Right to information Act 2005 – evolution – concept – practice.

MODULE II HUMAN RIGHTS 7

Human rights – meaning and significance, Covenant on civil and political rights, Covenant on Economic, Social and Cultural rights, UN mechanism and agencies, The Protection of Human Rights Act, 1993 – watch on human rights and enforcement.

MODULE III INDUSTRIAL, CORPORATE AND LABOUR LAWS 8

Corporate laws – meaning and scope, Companies Act 1956 – Indian Contract Act 1872 - Principles of Arbitration - Industrial Employment (Standing Orders) Act 1946 - Industrial Disputes Act 1947 - Workmen's Compensation Act 1923 - The Factories Act, 1948.

MODULE IV LAWS RELATED TO IPR 7

IPR – meaning and scope, International organization – WIPO – TRIPS, Major Indian IPR Acts – Copyright laws, Patent and Design Act, Trademarks Act, Trade Secret Act, Geographical Indicator.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. M.P. Jain (2005) *Indian Constitutional Law*, Wadhwa & Co.
2. H. D, Agarwal (2008), *International Law and Human Rights,* Central Law

Publications,
3. Rao, Meena (2006), *Fundamental Concepts in Law of Contract*, 3rd edn., Professional offset.
4. Ramappa (2010), *Intellectual Property Rights Law in India*, Asia Law House.
5. Singh, Avtar (2007), *Company Law*, Eastern Book Co.
6. R.F, Rustamji (1967)*, Introduction to the Law of Industrial Disputes*, Asia Publishing House.

REFERENCES:

1. Acts: Right to Information Act, Industrial Employees (standing order) Act, Factories Act, Workmen Compensate Act.

OUTCOMES:

On successful completion of this course,

- Students will `be able to apply the basic concepts of Indian Constitution, Governance and power in their real life situation.
- Students will have gained knowledge in human rights, cultural, social and political rights.
- Students will have synthesized knowledge about industrial, corporate and labour laws of our country.
- Students will have an overview of IPRs and laws related to Intellectual Property Rights.

General Elective Courses

Group I courses

(To be offered in V Semester)

		L	T	P	C
GECX101	**DISASTER MANAGEMENT**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To give an exposure to various environmental hazards and disasters: and various concepts and principles to manage disaster.
- To give exposure to various environmental policies & programs in India for disaster management

MODULE I ENVIRONMENTAL HAZARDS 7

Environmental hazards, Environmental Disasters and Environmental stress-Meaning and concepts. Vulnerability and disaster preparedness.

MODULE II NATURAL DISASTERS 7

Natural hazards and Disasters - Volcanic Eruption, Earthquakes, Tsunamis, Landslides, Cyclones, Lightning, Hailstorms, Floods, Droughts, Cold waves, Heat waves and Fire.

MODULE III MAN-MADE DISASTERS 7

Man induced hazards & Disasters - Soil Erosion, Chemical hazards, Population Explosion

MODULE IV DISASTER MANAGEMENT 8

Emerging approaches in Disaster Management- Preparing hazard zonation maps, Predictability / forecasting & warning, Preparing disaster preparedness plan, Land use zoning, Communication. Disaster resistant house construction, Population reduction in vulnerable areas, Awareness - Rescue training for search & operation at national & regional level - Immediate relief, Assessment surveys, Political, Administrative, Social, Economic, Environmental Aspects.

MODULE V NATURAL DISASTER REDUCTION & MANAGEMENT 8

Provision of Immediate relief measures to disaster affected people, Prediction of Hazards & Disasters, Measures of adjustment to natural hazards

MODULE VI ENVIRONMENTAL POLICIES & PROGRAMMES IN INDIA **8**

Regional survey of Land Subsidence, Coastal Disaster, Cyclonic Disaster & Disaster in Hills with particular reference to India. Ecological planning for sustainability & sustainable development in India, Sustainable rural development: A Remedy to Disasters, Role of Panchayats in Disaster mitigations, Environmental policies & programmes in India- Institutions & National Centers for Natural Disaster reduction, Environmental Legislations in India, Awareness, Conservation Movement, Education & training.

L – 45; Total Hours –45

REFERENCES:

1. Satender, “Disaster Management in Hills”, Concept Publishing Co., New Delhi, 2003.
2. Singh, R.B. (Ed.), “Environmental Geography”, Heritage Publishers, New Delhi,1990.
3. Savinder Singh, “Environmental Geography”, Prayag Pustak Bhawan,1997.
4. Kates, B.I. and White, G.F., “The Environment as Hazards”, Oxford University Press, New York, 1978.
5. Gupta, H.K., (Ed), “Disaster Management”, University Press, India, 2003.
6. Singh, R.B.,“Space Technology for Disaster Mitigation in India (INCED)”, University of Tokyo, 1994.
7. Bhandani, R.K., “An overview on Natural & Manmade Disaster & their Reduction”, IIPA Publication, CSIR, New Delhi, 1994.
8. Gupta, M.C., “Manuals on Natural Disaster management in India”, National Centre for Disaster Management, IIPA Publication, New Delhi, 2001.

OUTCOMES:

At the end of the course, the students will

- achieve sufficient knowledge on the disaster prevention strategy, early warning system, disaster preparedness, response and human resource development.
- be familiar with the National Policy on Disaster Management.

GECX102 TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

- To understand the various principles, practices of TQM to achieve quality.
- To get acquainted with the various statistical tools and approaches for quality control and continuous improvement.
- To get aware of the importance of ISO and Quality Systems.

MODULE I INTRODUCTION 8

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

MODULE II TQM PRINCIPLES 7

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits.

MODULE III TQM IMPROVEMENT PROCESS 8

Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

MODULE IV STATISTICAL PROCESS CONTROL (SPC) 8

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

MODULE V TQM TOOLS 7

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

MODULE VI QUALITY SYSTEMS 7

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System– Elements, Implementation of Quality System, Documentation, Quality Auditing, TS 16949, ISO 14000 – Concept, Requirements and Benefits

L – 45; Total Hours –45

TEXT BOOKS:

1. Dale H.Besterfiled, et al., “Total Quality Management”, Pearson Education, Inc. 2003.

REFERENCES:

1. James R.Evans & William M.Lidsay, “The Management and Control of Quality”, 5th Edition, South-Western (Thomson Learning), 2002.
2. Feigenbaum.A.V., “Total Quality Management”, McGraw-Hill, 1991.
3. Oakland.J.S., “Total Quality Management”, Butterworth Hcinemann Ltd., Oxford, 1989.
4. Narayana V. and Sreenivasan. N.S., “Quality Management – Concepts and Tasks”, New Age International, 1996.
5. Zeiri, “Total Quality Management for Engineers”, Wood Head Publishers, 1991.

OUTCOMES:

The student should be able to

- apply the various statistical tools and approaches for Quality control.
- achieve continuous process improvement through TQM.

GECX103 ENERGY STUDIES L T P C
3 0 0 3

OBJECTIVES:

- To learn the growing demand, supply of energy on global and national levels and the need for renewable energy promotion.
- To understand the basic need for energy conservation and waste heat recovery.
- To learn the important aspects of energy audit and management.
- To get acquainted with the global environmental issues and carbon credits.

MODULE I GLOBAL AND NATIONAL ENERGY SCENARIO 7

Role of energy in economic development, various energy resources - overall energy demand and availability- Energy consumption in various sectors and its changing pattern - Exponential increase in energy consumption and projected future demands. Need for renewable energy.

MODULE II SOLAR ENERGY 8

Solar Radiation – Measurements of Solar Radiation - Flat Plate and Concentrating Collectors – Solar direct Thermal Applications – Solar thermal Power Generation - Fundamentals of Solar Photo Voltaic Conversion – Solar Cells – Solar PV Power Generation – Solar PV Applications.

MODULE III OTHER RENEWABLE ENERGY SOURCES 8

Power from wind – wind turbine working and types, solar thermal power plants – low medium and high power generation, power from wave , tidal, geothermal sources, OTEC system. MHD power plants – working, types, merits and demerits. Energy from biomass.

MODULE IV COGENERATION, WASTE HEAT RECOVERY AND COMBINED CYCLE PLANTS 8

Cogeneration principles- topping and bottoming cycles, role in process industries. Energy from wastes- waste heat recovery- heat recovery from industrial processes. Heat exchange systems – recuperative and regenerative heat exchangers – commercially available waste heat recovery devices. Combined cycle plants – concept, need and

advantages, different combinations and practical scope.

MODULE V ENERGY CONSERVATION AND MANAGEMENT 7

Need for energy conservation – use of energy efficient equipment. Energy conservation opportunities - in educational institutions, residential, transport, municipal, industrial and commercial sectors – concept of green building. Energy audit in industries – need, principle and advantages. Case studies.

MODULE VI GLOBAL ENERGY ISSUES AND CARBON CREDITS 7

Energy crisis, fossil consumption and its impact on environmental climate change. Energy treaties – Montreal and Kyoto protocols - Transition from carbon rich and nuclear to carbon free technologies, carbon foot print – credits – clean development mechanism.

L – 45; Total Hours –45

TEXT BOOKS:

1. S.S. Rao and B.B. Parulekar, “Energy Technology”, 3rd Edition, Khanna Publishers, New Delhi, 2011.
2. O. Callaghn. P.W., “Design and Management for Energy Conservation”, Pergamon Press, Oxford, 1981.

REFERENCES:

1. G.D. Rai, “Non Conventional Energy Sources”, Khanna Publishers, New Delhi, 2011.
2. Archie, W Culp. “Principles of Energy Conservation”, McGraw Hill, 1991.
3. D Patrick and S W Fardo, “Energy Management and Conservation”, PHI,1990
4. P. O’Callaghan: “Energy Management”, McGraw - Hill Book Company, 1993.
5. Kenney, W. F., “Energy Conservation in Process Industries”, Academic Press, 1983.

OUTCOMES:

The student should be able to

- Realize the global and national energy status and need to switch over to renewable energy technology.
- Energy audit and suggest methodologies for energy savings.
- Utilize the available resources in an optimal way.
- Concern about the global environmental issues & promote carbon credits.

GECX104 **ROBOTICS** **L T P C**
3 0 0 3

OBJECTIVES:

To learn about the robots, various components, of Robots, programming and their applications.

MODULE I **8**

Definition- Need - Application, Types of robots – Classifications – Configuration, work volume, control loops, controls and intelligence- basic parts - functions – specifications. of robot, degrees of freedoms, end effectors – types, selection

MODULE II ROBOT DRIVES AND CONTROL **8**

Controlling the Robot motion – Position and velocity sensing devices – Design of drive systems – Hydraulic and Pneumatic drives – Linear and rotary actuators and control valves – Electro hydraulic servo valves, electric drives – Motors – Designing of end effectors – Vacuum, magnetic and air operated grippers.

MODULE III ROBOT SENSORS **8**

Transducers and Sensors – Tactile sensor – Proximity and range sensors – Sensing joint forces – Robotic vision system – Image Representation - Image Grabbing –Image processing and analysis – Edge Enhancement – Contrast Stretching – Band Rationing - Image segmentation – Pattern recognition – Training of vision system.

MODULE IV ROBOT PROGRAMMING & AI TECHNIQUES **7**

Types of Programming – Teach pendant programming – Basic concepts in AI techniques – Concept of knowledge representations – Expert system and its components.

MODULE V ROBOTIC WORK CELLS AND APPLICATIONS OF ROBOTS **7**

Robotic cell layouts – Inter locks – Humanoid robots – Micro robots – Application of robots in surgery, Manufacturing industries, space and underwater.

MODULE VI ROBOT KINEMATICS AND DYNAMICS 7

Forward and inverse Kinematic equations, Denvit – Hartenbers representations Fundamental problems with D-H representation, differential motion and velocity
of frames - Dynamic equations for sing, double and multiple DOF robots – static force analysis of robots.

L – 45; Total Hours –45

REFERENCES:

1. Yoram Koren," Robotics for Engineers", Mc Graw-Hill, 1987.
2. Kozyrey, Yu, "Industrial Robots", MIR Publishers Moscow, 1985.
3. Richard. D, Klafter, Thomas, A, Chmielewski, Michael Negin, "Robotics Engineering – An Integrated Approach", Prentice-Hall of India Pvt. Ltd., 1984.
4. Deb, S.R. "Robotics Technology and Flexible Automation", Tata Mc Graw-Hill, 1994.
5. Mikell, P. Groover, Mitchell Weis, Roger, N. Nagel, Nicholas G. Odrey, "Industrial Robotics Technology, Programming and Applications", Mc Graw- Hill, Int. 1986.
6. Timothy Jordanides et al,"Expert Systems and Robotics", Springer – Verlag, New York, May 1991.

OUTCOMES:

Students would be able to

- Understand about the robots, its various components.
- Design Robots for industrial applications.
- Do programming for robots and apply them in real time applications.

GECX105 TRANSPORT MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the transport fleet and their related activities for minimizing operational cost.
- To understand the need of maintenance and its importance.
- To understand the functions and applications of various types of transport system.

MODULE I INTRODUCTION 7

Personnel management; objectives and functions of personnel management, psychology, sociology and their relevance to organization, personality problems. Selection process: job description, employment tests, interviewing, introduction to training objectives, advantages, methods of training, training procedure, psychological tests.

MODULE II ORGANISATION AND MANAGEMENT 7

Forms of Ownership – principle of Transport Management – Staff administration – Recruitment and Training – welfare – health and safety. Basic principles of supervising. Organizing time and people. Driver and mechanic hiring - Driver checklist - Lists for driver and mechanic - Trip leasing - Vehicle operation and types of operations.

MODULE III TRANSPORT SYSTEMS 9

Introduction to various transport systems. Advantages of motor transport. Principal function of administrative, traffic, secretarial and engineering divisions. chain of responsibility, forms of ownership by state, municipality, public body and private undertakings.

MODULE IV SCHEDULING AND FARE STRUCTURE 8

Principal features of operating costs for transport vehicles with examples of estimating the costs. Fare structure and method of drawing up of a fare table. Various types of fare collecting methods. Basic factors of bus scheduling. Problems on bus scheduling.

MODULE V MOTOR VEHICLE ACT 7

Traffic signs, fitness certificate, registration requirements, permit insurance, constructional regulations, description of vehicle-tankers, tippers, delivery vans, recovery vans, Power wagons and fire fighting vehicles. Spread over, running time, test for competence to drive.

MODULE VI MAINTENANCE 7

Preventive maintenance system in transport industry, tyre maintenance procedures. Causes for uneven tyre wear; remedies, maintenance procedure for better fuel economy, Design of bus depot layout.

L – 45; Total Hours –45

TEXT BOOKS:

1. John Duke, "Fleet Management", McGraw-Hill Co, USA, 1984.
2. Kitchin.L.D., "Bus Operation", III edition, Illiffee and Sons Co., London, 1992

REFERENCES:

1. Government Motor Vehicle Act, Publication on latest act to be used as on date.

OUTCOMES:

Upon completion of the course, students will

- Know about different aspects related to transport system and management.
- Features of scheduling, fixing the fares
- Know about the motor vehicle act and maintenance aspects of transport.

GECX106 CONTROL SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the system modeling and to derive their transfer function.
- To provide adequate knowledge of time response of systems and steady state error analysis.
- To accord basic knowledge in obtaining the open loop and closed–loop frequency responses of Control systems.

MODULE I BASIC CONCEPTS AND SYSTEM REPRESENTATION **8**

Control System - Basic elements in control systems – Open and closed loop systems – Electrical analogy of mechanical and thermal systems – Transfer function – Block diagram reduction techniques – Signal flow graphs.

MODULE II TIME RESPONSE ANALYSIS AND DESIGN **8**

Time response – Time domain specifications – Types of test input – First and Second order system - Type I and Type II System – Response - Error coefficients – Generalized error series – Steady state error – P, PI, PID modes of feedback control.

MODULE III FREQUENCY RESPONSE ANALYSIS AND DESIGN **7**

Performance specifications - correlation to time domain specifications - bode plots and polar plots – gain and phase margin – constant M and N circles and Nichols chart – all pass and non-minimum phase systems.

MODULE IV STABILITY **8**

Characteristics equation – Location of roots in s plane for stability – Routh Hurwitz criterion – Root locus construction – Effect of pole, zero addition – Gain margin and phase margin – Nyquist stability criterion.

MODULE V COMPENSATOR DESIGN **8**

Performance criteria – Lag, lead and lag-lead networks – Compensator design using bode plots and root locus technique.

MODULE VI CONTROL SYSTEM COMPONENTS AND APPLICATION OF CONTROL SYSTEMS **6**

Synchros – AC servomotors - DC Servo motors - Stepper motors - AC Tacho generator - DC Tacho generator - Typical applications of control system in industry.

L – 45; Total Hours –45

REFERENCES:

1. K. Ogata, “Modern Control Engineering”, 4th Edition, Pearson Education, New Delhi, 2003.
2. I.J. Nagrath & M. Gopal, “Control Systems Engineering”, New Age International Publishers, 2003.
3. C.J.Chesmond, “Basic Control System Technology”, Viva student edition, 1998.
4. I.J.Nagarath and M.Gopal, “Control System Engineering”, Wiley Eastern Ltd., Reprint, 1995.
5. R.C.Dorf and R.H.Bishop, “Modern Control Systems”, Addison-Wesley (MATLAB Reference), 1995.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Proper understanding of basics of Control Systems.
- Ability and skill to carry-out time domain and frequency domain analysis.
- Capable of determining stability of the system using Routh Hurwitz criterion, Root locus and Nyquist criterion.
- Ability to design lag, lead and lag lead compensator networks.

GECX107 INTRODUCTION TO VLSI DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- Basic concepts of HDL.
- Verilog language and its syntax constructs.
- Programmable Logic Devices and FPGAs
- MOS devices theory
- CMOS based combinational and sequential circuits

PREREQUISITES:

Fundamentals of Electronics

Basics knowledge in Digital Electronics.

MODULE I REVIEW OF BASIC DIGITAL SYSTEMS 7

Boolean algebra, Building blocks of combinational logic design-Adders, multiplexer, encoder, decoder, comparator, Latches & flip-flops, counters, shift registers.

MODULE II LOGIC DESIGN USING VERILOG HDL 8

Overview of Digital Design with Verilog HDL, Levels of Design Description, Concurrency, Hierarchical Modeling Concepts, Modules and Ports, Component instantiation Data flow and RTL, structural, gate level, switch level modeling and Behavioral Modeling.

MODULE III LANGUAGE CONSTRUCTS OF VERILOG HDL 7

Identifiers- gate primitives, gate delays, operators, timing controls, procedural assignments, conditional statements Variable types, arrays and tables, Tasks and functions, Test bench.

MODULE IV BUILDING BLOCKS OF DIGITAL VLSI SYSTEMS 8

HDL Design -Data Path Operations-Addition/Subtraction, Parity Generators, Comparators, Zero/One Detectors, Binary Counters, ALUs, Multiplication, Shifters, Memory Elements. Programmable logic elements and AND-OR arrays, FPGAs programming methods.

MODULE V TRANSISTOR THEORY 7

Introduction to MOS Transistors-NMOS & PMOS Characteristics, Current Equations, Complementary CMOS Inverter-DC Characteristics, Static Load MOS Inverters.

MODULE VI BASICS OF DIGITAL CMOS DESIGN 8

NMOS & PMOS Logic Gate, CMOS Logic Gate, Basic layout design of simple gate-stick diagram, CMOS Logic Structures-full adder, multiplexers.

Total Hours –45

TEXT BOOKS:

1. M.Morris Mano "Digital Design", 3rd Edition, Prentice Hall of India Pvt. Ltd New Delhi, 2003

REFERENCES:

1. Michael D. Ciletti“Advanced Digital Design with the Verilog HDL" (2nd Edition) Hardcover – January 31, 2010
2. J.Bhasker: Verilog HDL primer, BS publication, 2001.
3. J. P. Uyemura, "Introduction to VLSI Circuits and System", Wiley, 2002
4. Neil Weste and K. Eshragian, “Principles of CMOS VLSI Design: A System Perspective,” 2nd edition, Pearson Education (Asia) Pvt.Ltd., 2000
5. Douglas A Pucknell& Kamran Eshragian , “Basic VLSI Design” PHI 3rd Edition (original edition – 1994)

OUTCOMES:

At the end of the course the students will be able to

- Create basic Register Transfer Level (RTL) models for combinational circuits & Sequential circuits using Verilog HDL.
- Create basic behavioral models for combinational circuits & Sequential circuits using Verilog HDL.
- Describe the usage of Programmable Logic Devices and FPGAs.
- Describe MOS devices theory and inverter circuit DC characteristics
- Design the basic digital building blocks using MOS circuit.
- Apply VLSI design concepts based on the requirements to conduct experiments or projects

GECX108 PLANT ENGINEERING L T P C

3 0 0 4

OBJECTIVES:

- To provide in depth knowledge on Plant Engineering
- To introduce detail engineering and P&ID
- To learn about the support to Instrumentation from other disciplines
- To study about the Installation and commissioning

MODULE I INTRODUCTION OF PLANTS 7

General Project Cycle – Feed – Sales - Plant Description, Component / Areas of Plant, Plant Layout, Plant Interfaces, Plant Location

MODULE II ELEMENTS OF PLANT 8

Main Elements of a Plant, Process Flow Scheme (PFD – Process Flow Diagram) P&ID's, Plant Legend Finalization.

MODULE III DETAIL ENGINEERING 10

P& ID Development with PFD's, Major Discipline Involvement & Inter discipline Interaction, Major Instrumentation & Control Systems - Development Phase – Instrument List , I/O Count, Specification Sheets, Instrument Installation (Hook ups) , Control Philosophy – Detail Engineering.

MODULE IV SUPPORT FROM OTHER DISCIPLINE 8

Other Discipline Supports to Instrumentation – Plot Plan, Piping / Equipment Plan, Electrical Area Classification, Fire Hazardous Classification Telecommunication Systems - Control Network architecture.

MODULE V INSTALLATION AND COMMISSIONING 7

Plant Construction - Key Drawings for Construction Support Construction Activities, System Testing, Startup / Commissioning, Production.

MODULE VI CASE STUDIES 5

Case studies of Water Treatment Plant - Paper Industry – Power Plant etc

L – 45; Total Hours –45

REFERENCES:

1. Duncan C Richardson, Plant Equipment and Maintenance Engineering Handbook, McGraw-Hill Education: New York, Chicago, San Francisco, Athens, London, Madrid, Mexico City, Milan, New Delhi, Singapore, Sydney, Toronto, 2014 McGraw-Hill Education
2. Gabriel Salvendy, Handbook of Industrial Engineering – Technology and operations Management, John Wiley & Sons, 2001.
3. Robert C Rosaler , Standard Handbook of Plant Engineering, Mc Graw Hill third Edition, 2004
4. R. Keith Mobley, Plant Engineer's Handbook, Technology and Engineering, 2001.

OUTCOMES:

At the end of the course, the student will be able to

- Review and correct P&IDs
- Do installation and commissioning of new plants
- Apply plant engineering in design and maintenance of water treatment plant / power plant etc

GECX109	NETWORK SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

The students should be able to

- Discuss the basic concepts of computer security, model and attacks
- Examine the major types of threats and the associated attacks
- Identify the encryption techniques in real time applications
- Understand the special requirements for wireless security and how authentication is implemented in wireless systems
- Understand the functions of Network Security Device Firewall and its types
- Interpret the various network intrusion such as computer viruses, network worms etc

MODULE I INTRODUCTION 6

Computer Security Concepts - The OSI Security Architecture - Security Attacks - Security Services - Security Mechanisms - A Model for Network Security - Standards – classical encryption techniques.

MODULE II SYMMETRIC ENCRYPTION AND MESSAGE CONFIDENTIALITY 7

Symmetric Encryption Principles - Symmetric Block Encryption Algorithms - Random and Pseudorandom Numbers - Stream Ciphers and RC4 - Cipher Block Modes of Operation

MODULE III PUBLIC KEY CRYPTOGRAPHY AND MESSAGE AUTHENTICATION 8

Approaches to Message Authentication - Secure Hash Functions - Message Authentication Codes - Public-Key Cryptography Principles - Public-Key Cryptography Algorithms - Digital Signatures

MODULE IV KEY DISTRIBUTION ,USER AUTHENTICATION AND TRANSPORT-LEVEL SECURITY 8

Symmetric Key Distribution Using Symmetric Encryption - Kerberos - Key Distribution Using Asymmetric Encryption - X.509 Certificates - Public-Key Infrastructure -Federated Identity Management - Web Security Considerations -

Secure Socket Layer and Transport Layer Security - Transport Layer Security

MODULE V WIRELESS NETWORK SECURITY, ELECTRONIC MAIL SECURITY AND IP SECURITY **8**

IEEE 802.11 Wireless LAN Overview -IEEE 802.11i Wireless LAN Security - Wireless Application Protocol Overview - Wireless Transport Layer Security - WAP End-to-End Security - Pretty Good Privacy - S/MIME – Domain Keys Identified Mail- IP Security Overview -IP Security Policy - Encapsulating Security Payload - Combining Security Associations - Internet Key Exchange - Cryptographic Suites

MODULE VI SYSTEM SECURITY **8**

Intruders -Intrusion Detection -Password Management - Types of Malicious Software - Viruses Virus Countermeasures – Worms - Distributed Denial of Service Attacks- The Need for Firewalls - Firewall Characteristics - Types of Firewalls - Firewall Basing - Firewall Location and Configurations

L – 45; Total Hours –45

REFERENCES:

1. William Stallings,"Network security Essentials:Applications and standards", Prentice Hall, Fifth Edition , ISBN-13: 978-0134527338, 2013
2. William Stallings, "Cryptography and Network Security: Principles and Practice", Pearson, ISBN-13:978-0-273-79335-9,2013
3. Behrouz Forouzan, Debdeep Mukhopadhyay,Cryptography and network security (sie) 2nd edition, ISBN-13: 978-0070702080, 2016
4. Wikipedia, "Network Security and Management" , https://en.wikipedia.org/wiki/Book:Network Security and Management, 2014.
5. Nitesh Dhanjani, Justin Clarke, "Network Security Tools", O'Reilly Media, ISBN-13: 9780596007942, 2005.

OUTCOMES:

Students who complete this course will be able to

- Recognize the computer security concepts, architecture attacks and model
- Distinguish the symmetric and asymmetric encryption techniques
- Apply the cryptographic algorithms in different applications
- Express the network security designs using available secure solutions

such as PGP,SSL, IPSec, etc.

- Describe the firewalls principles and different types of firewalls applied in organization
- Identify abnormalities within the network caused by worms, viruses and Network related security treats**.**

GECX110	KNOWLEDGE MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course

- Focuses on positioning knowledge as a valuable commodity, embedded in products and in the tacit knowledge of highly mobile individual employees.
- Presents KM as a deliberate and systematic approach to cultivating and sharing an organization's knowledge base.
- Brings out the paradigm in terms of information technology and intellectual capital.

MODULE I KNOWLEDGE MANAGEMENT 6

KM Myths – KM Life Cycle – Understanding Knowledge – Knowledge, intelligence – Experience – Common Sense – Cognition and KM – Types of Knowledge – History of Knowledge Management - From Physical assets to Knowledge Assets – Expert knowledge – Human Thinking and Learning.

MODULE II KNOWLEDGE MANAGEMENT SYSTEMS AND MODELS 9

Challenges in Building KM Systems – Conventional Vs KM System Life Cycle (KMSLS) – Knowledge Creation and Knowledge Architecture – KM cycle - Different variants of KM cycle - KM models - Implications and practical implementations.

MODULE III CAPTURING KNOWLEDGE AND SHARING 9

Tacit knowledge capture - Explicit knowledge codification – Knowledge taxonomies - Knowledge sharing - Communities - Obstacles to knowledge capture and sharing.

MODULE IV KNOWLEDGE MANAGEMENT TOOLS 9

KM System tools – Neural Network – Association Rules – Classification Trees – Data Mining and Business Intelligence – Knowledge capture and creation tools - Content creation tools - Data mining and knowledge discovery – Content management tools - Knowledge sharing and dissemination tools – Group ware

and Collaboration tools - Intelligent filtering tools.

MODULE V KNOWLEDGE APPLICATION 6

KM at individual level - Knowledge workers - Task analysis and modeling - Knowledge application at group and organizational levels – Knowledge repositories - Knowledge reuse -Case study: e-learning.

MODULE VI VALUE OF KNOWLEDGE MANAGEMENT 6

KM return on investment and metrics - Benchmarking method – Balanced scorecard method - House of quality method - Results based assessment method - Measuring success - Future challenges for KM.

L – 45; Total Hours –45

TEXT BOOKS:

1. Elias M. Awad, Hassan M. Ghaziri, “Knowledge Management”, Prentice Hall, 2nd Edition, 2010.
2. Jay Liebowitz, “Handbooks on Knowledge Management”, 2nd Edition, 2012.
3. Irma Becerra-Fernandez, Rajiv Sabherwal, ”Knowledge Management: Systems and Processes”, 2010.

OUTCOMES:

Students who complete this course will be able to

- Describe the fundamental concepts in the study of knowledge and its creation, acquisition, representation, dissemination, use and re-use, and management.
- Explains the core concepts, methods, techniques, and tools for computer support of knowledge management.
- Critically evaluate current trends in knowledge management and apply it for e-learning

GECX111 CYBER SECURITY L T P C

3 0 0 3

OBJECTIVES:

- To understand the basics of Cyber Security Standards and Policies.
- To know the legal, ethical and professional issues in Cyber security.
- To understand Cyber Frauds and Abuse and its Security Measures.
- To know the technological aspects of Cyber Security.

MODULE I FUNDAMENTALS OF CYBER SECURITY 7

Security problem in computing – Cryptography Basics – History of Encryption – Modern Methods – Legitimate versus Fraudulent Encryption methods – Encryption used in Internet.

MODULE II CYBERCRIME AND CYBEROFFENSES 8

Cybercrime and Information Security – Cybercriminals – Classifications of Cybercrimes – Email Spoofing – Spamming – Cyber defamation – Internet Time Theft – Forgery – Web jacking – Hacking – Online Frauds – Software Piracy – Mail Bombs – Password Sniffing – Cyberoffenses – Categories – Planning the attacks – Cyberstalking – Cybercafe and Cybercrimes – Botnets.

MODULE III CYBERCRIME: MOBILE AND WIRELESS DEVICES 8

Proliferation of Mobile and Wireless Devices – Trends in Mobility – Credit card frauds in Mobile and Wireless Computing – Security Challenges – Authentication Service Security – Attacks on Mobile Phones.

MODULE IV TOOLS AND METHODS USED IN CYBERCRIME 8

Proxy Servers and Anonymizers – Phishing – Password Cracking – Keyloggers and Spywares – Virus and Worms – Trojan Horses and Backdoors – Steganography – DoS and DDoS Attacks.

MODULE V SECURITY POLICIES 7

Introduction - Defining User Policies – Passwords – Internet Use – Email Usage – Installing/ Uninstalling Software – Instant Messaging – Defining System Administrative Policies – Defining Access Control Developmental Policies Standards, Guidelines and Procedures – Basics of assessing a system

MODULE VI COMPUTER FORENSICS 7

General Guidelines – Finding Evidence on the PC - Finding Evidence in System Logs – Windows Logs – Linux Logs – Getting Back Deleted Files – Operating System Utilities – The Windows Registry.

L – 45; Total Hours –45

TEXT BOOKS:

1. Nina Godbole, Sunit Belapure, “Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Wiley, 2011.

2. Chuck Easttom, “Computer Security Fundamentals”, 2nd Edition, Pearson Education, 2012.

REFERENCES:

1. Charles B. Pfleeger, Shari Lawrence Pfleeger, “Security in Computing”, 3rd Edition, Pearson Education, 2003.
2. William Stallings, “Cryptography and Network Security – Principles and Practices”, 3rd Edition, Pearson Education, 2003.
3. Atul Kahate, “Cryptography and Network Security”, Tata McGraw Hill, 2000.

OUTCOMES:

Upon completion of this course, students will be able to

- Explain the general security issues.
- Discuss various cybercrimes and offenses.
- Outline the occurrence of Cybercrime in mobile and wireless environment.
- Use relevant tools and methods in cybercrime
- Apply security policies in cyber forensics.
- Outline the strategies adopted in computer forensics.

GECX112 GENETIC ENGINEERING L T P C
4 0 0 4

OBJECTIVES:

The course aims to provide an advanced understanding of the core principles and topics of Cell and Organism reproduction and the Principles of heredity and their experimental basis, and to enable students to be able to apply these principles in assessment of pedigrees to identify genotypes and predict the mating outcomes.

MODULE I GENETICS AND ORGANISM 10

Genetics and human affairs, Genetics and Biology, Genes and Environment, Techniques of genetic analysis, The chromosome theory of heredity, Sex chromosomes, Sex linkage, The parallel behaviour of autosomal genes and chromosomes.

MODULE II MENDELISM AND LINKAGE 12

Mendel's laws of inheritance, Interaction of genes, Variations on dominance, Multiple alleles, Lethal alleles, Several genes affecting the same character, Penetrance and expressivity, Linkage- Basic eukaryotic chromosome mapping, The discovery of linkage, Recombination linkage symbolism, Linkage of genes on X chromosomes, Linkage maps, Examples of linkage maps.

MODULE III FINE STRUCTURE OF GENES 10

The concept of promoter, Coding sequence, Terminator, Induction of gene for expression. The concept of extranuclear genome in higher plants and animals, Overview of mitochondrial genome, Chloroplast genome.

MODULE IV RECOMBINATION IN BACTERIA AND VIRUSES 10

Conjugation recombination and mapping the E.coli chromosomes, Transformation, Transduction, Chromosome mapping. Population genetics: Darwin's revolution, Variation and its modulation, The effect of sexual reproduction on variation, The sources of variation, Selection quantitative genetics

MODULE V PRINCIPLES OF PLANT BREEDING 9

Objectives, Selfing and crossing techniques, Male sterility,Incompatability,

Hybrid vigour.

MODULE VI HUMAN GENOME PROJECT 9

Genetic diseases in humans, Genetics and society

L – 45; T – 15; Total Hours –60

REFERENCES:

1. In Introduction to genetic analysis, Griffiths, Miller, Suzuki, Lewontin and Gelbart, Freeman and Company.
2. Genetics, A.V.S.S. Sambamurty, Narosa Publishing House.
3. Concepts of Genetics, Klug & Cummings, Prientice Hall.
4. Molecular Cloning, Moniatisetal, Cold Spring Harbor Laboratory.

OUTCOMES:

At the end of the course students will be able to

- Describe the structure, function and replication of DNA as the genetic material
- Describe gene structure, expression and regulation
- Describe the chromosomal basis of inheritance and how alterations in chromosome number or structure may arise during mitosis and meiosis

GECX113	FUNDAMENTALS OF PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The students would gain knowledge on

- Technicalities attached to Project Management and Significance of Quality Consideration
- Project management methodologies – tools and techniques, supplemented with examples from case studies
- The importance of Efficient HR team and role of Communication in executing Projects.
- Managing Risks in Project Management

MODULE I INTRODUCTION TO PROJECT MANAGEMENT 9

Introduction to Project and Project Management-Project Management as a Career-Project Management Skill Sets-Project Scope Management: Project Charter, Scope Creep, Scope Validation, Scope Change Control-Type of Organization: Organization Structure-Influence of Organization Structure on Project, Project Stakeholders and Organizational Productivity.

MODULE II PROJECT MANAGEMENT PROCESS, TOOLS AND TECHNIQUES 8

Project life cycle-Initiation, Planning, Execution, Monitoring and Closing Phase; - Link between project management process, process groups and knowledge areas; Project management tools and techniques- Project Stakeholders description and mapping - Stakeholder Management Process

MODULE III PROJECT QUALITY, COST AND SCHEDULE MANAGEMENT 10

Triple constraints of project-quality, cost and schedule-Quality Planning, Quality Assurance and Quality Control, Process Control, Cost of Quality, Seven Tools of Quality Control- Cost Management: Cost Estimating Methods, Estimating Completion Cost, Earned Value Management, Budgeting, Life-Cycle Cost analysis- Project Time Management: Duration Estimation Method, FS/FF/SS/ SF Relations, Lead/Lag, Arrow Diagram Method and Precedence Diagram Method for Scheduling-Resource Allocation

MODULE IV PROJECT HR MANAGEMENT 5

Organizational Goals- (MBO/MBE/MBP)-Responsibility Assignment Matrix (RAM)-Types of Powers- Manage or Lead-Conflict management Techniques-Performance Evaluation Process-Motivation Theories and its Application for execution of Projects-Leadership Styles-Project Team Building-Project Staffing Constraints/Policies

MODULE V COMMUNICATION MANAGEMENT 5

Communication Management: Understanding Body languages of Project Personnel-Effective Communications- Interpersonal Skills for project Managers-PMIS-Communicating with the Customer-Communicating with Management- Formal vs. Informal Communications-Written, Verbal and Non-Verbal Communications.

MODULE VI PROJECT PROCUREMENT & RISK MANAGEMENT 8

Introduction to Project Procure Management: Soliciting RFQ/RFP-Contract Proposals-Contract Negotiation-Contract Closure-Risk Management: Defining risks-Risk management process-Risk identification-Qualitative and Quantitative Risk-Probability and Decision trees-Risk Response strategies / methods-Expected monetary value-Risk vs. life cycle phases

L – 45; Total Hours –45

REFERENCES:

1. Jack. R. Meredith, Samuel. J. Mantel & Scott. M. Shafer, Project Management in Practice, Fifth Edition, Bangalore: Wiley, 2015
2. Bob Hughes, Mike Cotterrel “Software Project Management”, Tata McGraw-Hill, 2009

OUTCOMES:

- Learners will be able to identify the Key Knowledge Areas and apply PM process in hypothetical project assignments given as continuous assessment.
- They would be able to suitably recognize tools and techniques required for various phases included in a project.
- They would also be able to manage scope, time, cost and other major components that would help them to execute the project efficiently.

GECX114 OPERATIONS RESEARCH L T P C
3 0 0 3

OBJECTIVES:

- To acquire knowledge and training in optimization techniques.
- To get knowledge about optimization in utilization of resources.
- To understand and apply operations research techniques to industrial operations

MODULE I LINEAR PROGRAMMING PROBLEM 8

Linear programming – formulation of the problem - graphical interpretation of optimality - Simplex method – to obtain basic feasible solution – types of linear programming solution – complications and their resolution.

MODULE II ARTIFICIAL VARIABLE AND TWO PHASE METHOD, DUALITY 6

Artificial variable - Big M method – Two phase method – alternative optimal solution – unbounded solution - Duality – primal dual relationships - rules of constructing the dual from primal.

MODULE III TRANSPORTATION PROBLEM & ASSIGNMENT PROBLE 8

Transportation problems – Initial basic feasible solutions, MODI method, Unbalance in transportation, Degeneracy in transportation models, Assignment problem – Minimization and Maximization type of problems by Hungarian method.

MODULE IV NETWORK AND SEQUENCING PROBLEMS 8

PERT and CPM – Network diagram – Fulkerson's rule - CPM Probability of achieving completion date – Crash time – Cost analysis. Sequencing N jobs through 2 machines and 3 machines.

MODULE V QUEUING THEORY & SIMULATION 7

Poisson arrivals and exponential service times – characteristics of Queuing models – single channel – Introduction to multi channel models – Random number generation – Monte Carlo Simulation.

MODULE VI INVENTORY CONTROL, REPLACEMENT MODELS AND GAME THEORY 8

Types of inventory- Inventory cost - EOQ - Deterministic inventory problems – Introduction to probabilistic models & system level inventory control - Replacement models – Replacement of items that deteriorate with time – value of money changing with time – not changing with time – Individual and group replacement policy - Game theory – simple games.

L – 45; Total Hours –45

TEXT BOOKS:

3. Hamdy ATaha, “Operations Research an introduction”, 8th edition, Phil Pearson, 2007.
4. Winston.W.L., “Operations Research”, 4th edition, Thompson-Brooks/Cole, 2003.

REFERENCES:

1. Wayne.L. Winston, “Operations Research applications and algorithms”, 4th edition, Thomson learning, 2007.
2. Frederick. S. Hiller and Gerald.J.Lieberman, “Operations Research concepts and cases”, 8th edition (SIE), Tata McGraw – Hill Pub. Co. Ltd., New Delhi, 2006.
3. A. Ravindran, D. T. Phillips and J. J. Solberg, "Operations Research:Principles and Practice", 2nd edition, John Wiley & Sons, New York, 1992.
4. Robertazzi. T.G., “Computer networks and systems-Queuing theory and performance evaluation”, 3rd edition, Springer, 2002.

OUTCOMES:

At the end of the course students will be able to

- solve linear programming problems
- solve transportation and assignment problems.
- solve network and sequencing problems.
- apply the operations research techniques to solve industrial problems.

GECX115 NANO TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES:

- To introduce the basic concepts of Nanoscience relevant to the field of engineering.
- To provide an exposure about the importance of various synthesis method.
- To enrich the knowledge of students in various characterisation techniques.

MODULE I INTRODUCTION & CLASSIFICATION OF NANOMATERIALS 9

Definition - Origin of nanotechnology - Difference between bulk and nanomaterials- Top-down and bottom-up processes - Size dependent properties (magnetic, electronic,transport and optical), Classification based on dimensional property - 0D, 1D, 2D and 3D nanostructures – Kubo gap.

MODULE II TYPES OF NANOMATERIALS 9

Metal oxides and metal nano particles - Ceramic nano particles - Semi conducting quantum dots - Core-shell quantum dots - Nanocomposites - Micellar nanoparticles.

MODULE III PRODUCTION OF NANOPARTICLES 7

Sol-gel, hydrothermal, solvothermal, Plasma Arcing, Electro deposition, RF sputtering, Pulsed laser deposition, Chemical vapour, deposition.

MODULE IV CARBON BASED NANOMATERIALS 6

Carbon nanotubes: Single wall nanotubes (SWNT), Multiwall nanotubes (MWNT) - structures-carbon nanofibre, Fullerenes-Application of carbon nanotubes and Fullerenes.

MODULE V NANOPHOTONICS 7

Light and nanotechnology, Interaction of light and nanotechnology, Nanoholes and photons, nanoparticles and nanostructures; Nanostructured polymers, Photonic Crystals, Solar cells.

MODULE VI CHARACTERISATION TECHNIQUES 7

Basic principles of scanning Electron Microscopy (SEM), Atomic force microscopy (AFM), Scanning tunneling microscopy (STM), Scanning probe

microscopy (SPM) and Transmission electron microscopy (TEM), Particle size analyzer, Luminescence techniques.

L – 45; Total Hours –45

TEXT BOOKS:

1. Hari Singh Nalwa, “Handbook of Nanostructured Materials and Nanotechnology”, Academic Press, 2000.
2. Guozhong Cao, “Nanostructures and Nano materials-Synthesis, Properties and Applications”, Imperial College Press (2011).
3. Zhong Lin Wang, “Handbook of Nanophase and Nanomaterials (Vol 1 and II)”, Springer, 2002.
4. Mick Wilson, Kamali Kannangara, Geoff smith, “Nanotechnology: Basic Science and Emerging Technologies”, Overseas press, 2005.

REFERENCES:

1. A. Nabok, “Organic and Inorganic Nanostructures”, Artech House, 2005.
2. C.Dupas, P.Houdy, M.Lahmani, Nanoscience: “Nanotechnologies and Nanophysics”, Springer-Verlag Berlin Heidelberg, 2007.
3. Mick Wilson, Kamali Kannangara, Michells Simmons and Burkhard Raguse, “Nano Technology – Basic Science and Emerging Technologies”, 1st Edition, Overseas Press, New Delhi,2005.
4. M.S. Ramachandra Rao, Shubra SinghH, “Nanoscience and Nanotechnology: Fundamentals to Frontiers”, Wiley, 2013.

OUTCOMES:

At the end of this course, the students will be able to:

- Apply the knowledge of different types of nanomaterials for various engineering applications.
- Acquire the knowledge of various methods of production of nanomaterials.
- Familiarize with various characterization techniques.

GECX116	VEHICLE MAINTENANCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To know about the various methods of maintaining procedure, vehicle insurance and basic problems in a vehicle.
- The student able to impart knowledge in maintaining of engine components and subsystems.
- The student able to impart knowledge in maintaining of transmission, driveline, steering, suspension, braking and wheels.
- The student able to impart **carefully maintaining their vehicle and can increase driving safety.**

MODULE I MAINTENANCE, WORKSHOP PRACTICES, SAFETY AND TOOLS **7**

Maintenance – Need, importance, primary and secondary functions, policies - classification of maintenance work - vehicle insurance - basic problem diagnosis. Automotive service procedures – workshop operations – workshop manual - vehicle identification. Safety – Personnel, machines and equipment, vehicles, fire safety - First aid. Basic tools – special service tools – measuring instruments – condition checking of seals, gaskets and sealants. Scheduled maintenance services – service intervals - Towing and recovering.

MODULE II ENGINE AND ENGINE SUBSYSTEM MAINTENANCE **8**

General Engine service- Dismantling of Engine components- Engine repair- working on the underside, front, top, ancillaries- Service of basic engine parts, cooling and lubricating system, fuel system, Intake and Exhaust system, electrical system - Electronic fuel injection and engine management service - fault diagnosis- servicing emission controls.

MODULE III TRANSMISSION AND DRIVELINE MAINTENANCE **8**

Clutch- general checks, adjustment and service- Dismantling, identifying, checking and reassembling transmission, transaxle- road testing- Removing and replacing propeller shaft, servicing of cross and yoke joint and constant velocity joints- Rear axle service points- removing axle shaft and bearings- servicing differential assemblies- fault diagnosis.

MODULE IV STEERING AND SUSPENSION MAINTENANCE 7

Maintenance and Service of Mc person strut, coil spring, leaf spring, shock absorbers. Dismantling and assembly procedures. Inspection, Maintenance and Service of steering linkage, steering column, Rack and pinion steering, Recirculating ball steering service- Worm type steering, and power steering system.

MODULE V BRAKE AND WHEEL MAINTENANCE 7

Inspection, Maintenance and Service of Hydraulic brake, Drum brake, Disc brake, parking brake. Bleeding of brakes. Wheel alignment and balance, removing and fitting of tyres, tyre wear and tyre rotation.

MODULE VI AUTO ELECTRICAL AND AIR CONDITIOING MAINTENANCE 8

Maintenance of batteries, starting system, charging system and body electrical -Fault diagnosis using Scan tools. Maintenance of air conditioning parts like compressor, condenser, expansion valve, evaporator - Replacement of hoses- Leak detection- AC Charging- Fault diagnosis Vehicle body repair like panel beating, tinkering, soldering, polishing, painting.

L – 45; Total Hours –45

TEXT BOOKS:

1. Ed May, "Automotive Mechanics Volume One" , Mc Graw Hill Publications, 2003
2. Ed May, "Automotive Mechanics Volume Two" , Mc Graw Hill Publications, 2003
3. Vehicle Service Manuals of reputed manufacturers
4. Vehicle maintenance and garage practice by Jigar A.Doshi Dhru U.Panchal,Jayesh P.Maniar. 2014
5. A Practical Approach to Motor Vehicle Engineering and Maintenance 3rd Edition by Allan Bonnick.

REFERENCES:

1. Bosch Automotive Handbook, Sixth Edition, 2004.
2. Advanced Automotive Fault Diagnosis by Tom Denton 2011.
3. Nissan Patrol Automotive Repair Manual: 1998-2014 by Haynes Manuals Inc.
4. Automobile electrical manual a comprehensive guide by Haynes manual car repair.

OUTCOMES:

On completion of the course student should be able to

- Prepare maintenance schedules and procedures with appropriate tools.
- Demonstrate the procedure and methods to repair and calibrate the engine.
- **Analyze the causes and remedies for fault in transmission and drive line systems.**
- **Analyze the causes and remedies of steering and suspension systems.**
- **Analyze the causes and remedies of brake system.**
- **Demonstrate the procedure for wheel alignment and wheel balanced.**

GECX117 FUNDAMENTALS OF DIGITAL IMAGE PROCESSING

L	T	P	C
3	0	0	3

OBJECTIVES:

- Describe and explain basic principles of digital image processing
- Design and implement algorithms that perform basic image processing
- Design and implement algorithms for advanced image analysis
- Assess the performance of image processing algorithms and systems

PRE-REQUISITES:

- Basic knowledge of transforms in Mathematics

MODULE I DIGITAL IMAGE FUNDAMENTALS 8

Elements of Image Processing System, Fundamentals steps in Digital Image Processing, Image Sampling & Quantization, Spatial and Gray Level Resolution.

MODULE II COLOR IMAGE PROCESSING 8

Fundamental of color image processing, color models- RGB, CMY, HIS, Pseudo color image processing

MODULE III IMAGE ENHANCEMENT 7

Basic gray level Transformations, Histogram Processing, Spatial Filtering

MODULE IV IMAGE TRANSFORMS 7

2D-DFT, DCT, Haar Transform, Fundamentals of 2D-wavelet transform, sub-band coding

MODULE V IMAGE SEGMENTATION AND RESTORATION 8

Point, line and edge detection methods ,Image Segmentation and its types, Restoration: Noise model, Inverse filter and Wiener filter.

MODULE VI IMAGE COMPRESSION 7

Fundamentals of redundancies, Basic Compression Methods: Huffman coding, Arithmetic coding, JPEG and MPEG Compression standards.

TOTAL HOURS 45

TEXT BOOKS

1. Gonzalez and Woods, "Digital Image Processing", 3rd Edition, Pearson Education, 2016.
2. Anil. K. Jain, "Fundamentals of Digital Image Processing"; 4th Edition, PHI, 2007

REFERENCES

1. Pratt William, "Digital Image Processing", John Wiley & Sons, 2007.
2. Arthur Weeks Jr., "Fundamentals of Digital Image Processing", PHI, 2006.

OUTCOMES:

On completion of the course, students will be able to

- Explain the fundamental concepts of digital image processing.
- Discuss about color image processing
- Recognize & apply various image enhancement techniques.
- Apply various transforms for image processing.
- Apply various techniques for image segmentation and restoration.
- Identify and use appropriate image compression techniques

Group II courses
(To be offered in VII Semester)

GECX201	GREEN DESIGN AND SUSTAINABILITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart knowledge to face challenges, the technology poses for water, energy, and climate change by implementing sustainable design.

MODULE I CONCEPTS OF SUSTAINABLE DEVELOPMENT 7

Objectives of Sustainable Development - Need for sustainable development-Environment and development linkages - Globalisation and environment-Population, poverty and pollution- global, regional and local environment issues-Green house gases and climate change.

MODULE II SUSTAINABLE DEVELOPMENT OF SOCIO ECONOMIC SYSTEMS 8

Demographic dynamics of sustainability- Policies for socio economic development- Sustainable Development through trade- Economic growth- Action Plan for implementing sustainable development- Sustainable Energy and Agriculture.

MODULE III FRAME WORK FOR ACHIEVING SUSTAINBAILITY 7

Sustainability indicators- Hurdles to sustainability- Business and Industry – Science and Technology for Sustainable Development- Performance indicators of sustainability and assessment mechanism- Constraints and barriers of Sustainable Development.

MODULE IV GREEN BUILDINGS 8

Introduction to Green Building- Energy- Water- Materials and Resources - Sustainable Sites and Land Use - Indoor Environmental Quality- Life Cycle Assessment- Energy, water and materials efficiency.

MODULE V ENERGY CONSERVATION AND EFFICIENCY 7

Energy savings- Energy Audit- Requirements- Benefits of Energy conservation-Energy conservation measures for buildings- Energy wastage- impact to the environment.

MODULE VI GREEN BUILDINGS DESIGN 8

Elements of Green Buildings Design- Foundation, Electrical, Plumbing, flooring, Decking, roofing, insulation, wall coverings, windows, siding, doors and finishing, LEED certification for Green Buildings, Green Buildings for sustainability.

L – 45; Total Hours –45

TEXT BOOKS:

1. Kirby, J., Okeefe, P., and Timber lake, “Sustainable Development”, Earthscan Publication, London, 1995.

REFERENCES:

1. Charles Kibert, J., “Sustainable Construction: Green Building Design and Delivery”, 2nd Edition, John Wiley and sons, 2007.

OUTCOMES:

At the end of the course, the students will be able to

- Explain the relationship between sustainability and emergence of green building practices.
- Address the economic, environmental, and social concerns.

GECX202 APPROPRIATE TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES:

- To impart students knowledge about the basics and applications of various appropriate technologies in the field of civil engineering.

MODULE I BASICS CONCEPTS 7

Back ground, Tools, Choices and Implications, Appropriate Technology Movement (an overview) - Basic design process, basic financial analysis-discounted cash flow, and energy fundamentals.

MODULE II APPROPRIATE TECHNOLOGY WITH REFERENCE TO BUILDING DESIGN 7

Appropriate Building Materials, Appropriate Energy Saving Techniques, Water Conservation (Indoor), Rain Water Harvesting.

MODULE III WATER, HEALTH AND SANITATION MANAGEMENT 7

Water Storage: Designing Dams and Pipelines, Appropriate Selection for Sanitation Technique, Sewerage, Communal Health and Waste Water Recycling.

MODULE IV WASTE MANAGEMENT 8

Types of Waste - Sources - Collections and On-Site Processing -Transferring Stations - Disposal Systems - Recycling.

MODULE V ENERGY EFFICIENT TECHNIQUES 8

Green building concepts-renewable energy sources- Solar – Steam and wind-Biofuels - Biogas – Electricity.

MODULE VI TECHNOLOGY POLICY 8

Government Policies- Energy Policy-Appropriate technology Development Centre-its function and responsibilities-Building policies-Case Studies.

L – 45; Total Hours –45

TEXT BOOKS:

1. Barrett Hazeltine and Christopher Bull, “Appropriate Technology: Tools Choices and Implications”, Academic Press, Orlando, USA, 1998.
2. Ken Darrow and Mike Saxenian, “Appropriate Technology Source Book : A Guide to Practical Books for Village and Small Community Technology”, Stanford, 1986.

REFERENCES:

1. Richard Heeks, “Technology and Developing Countries: Practical Applications Theoretical Issues”, 1995.
2. John Pickford, “The Worth of Water : Technical Briefs on Health, Water and Sanitation”, Intermediate Technology Publications, 1998.

OUTCOMES:

- At the end of the course, the students will be able to use suitable technologies for various conditions for sustainable development.

GECX203 ENGINEERING SYSTEM MODELLING AND SIMULATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn the concepts, techniques, tools for modeling and simulation systems and environments through the use of computers.
- To study the various aspects of discrete dynamic, stochastic systems modeling and conducting experiments with those models on a computer.

MODULE I INTRODUCTION 6

Systems – Modelling – types – systems components – Steps in model building- Simulation Algorithms and Heuristics; Simulation Languages.

MODULE II RANDOM NUMBERS / VARIATES 7

Random numbers – methods of generation – random variates for standard distributions like uniform, exponential, Poisson, binomial, normal etc. – Testing of Random variates – Monte Carlo Simulation.

MODULE III MODELLING PROCESS 7

Primitive Models : Establishing relationships via physical laws; Establishing relationships via curve fitting; Parameters estimation problems; Elementary state transition models.

MODULE IV DESIGN OF SIMULATION EXPERIMENTS 9

Steps on Design of Simulation Experiments – Development of models using of Highlevel language for systems like Queuing, Inventory, Replacement, Production etc., – Model validation and verification, Output analysis.

MODULE V SIMULATION LANGUAGES 10

Need for simulation Languages – Comparisons & Selection of Languages – GPSSARENA- EXTEND – Study of any one of the languages.

MODULE VI CASE STUDIES USING SIMULATION LANGUAGES 6

Case Study using simulation languages

L – 45; Total Hours –45

REFERENCES:

1. Law, A.M., & W.D. Kelton, “Simulation Modelling and Analysis”, McGraw

Hill, Singapore, 2000.
2. Harrel, C.R., et. al., “System Improvement Using Simulation”, 3rd Edition, JMI Consulting Group and ProModel Corporation, 1995.
3. Harrel, C.R. & T. Kerim, “Simulation Made Easy, A Manager’s Guide”, IIE Press, 1995.
4. Geoffrey Gordon, “Systems Simulation”, Prentice Hall, 2002.
5. David Kelton, Rondall P Sadowski, David T Sturrock, “Simulation with Arena”, Mc Graw Hill, 2004.

OUTCOMES:

The student should be able to

- Model and simulate systems and environments through the use of computers.
- Conduct experiments with discrete dynamic, stochastic system models on a computer.

GECX204 VALUE ANALYSIS AND ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To get acquainted with value analysis and engineering tool for productivity improvement.
- To understand and analyze the theory and methodology of Value Engineering.

MODULE I VALUE ENGINEERING BASICS 8

Origin of Value Engineering, Meaning of value, Definition of Value Engineering and Value analysis, Difference between Value analysis and Value Engineering, Types of Value, function - Basic and Secondary functions, concept of cost and worth, creativity In Value Engineering.

MODULE II VALUE ENGINEERING JOB PLAN AND PROCESS 6

Seven phases of job plan, FAST Diagram as Value Engineering Tool, Behavioural and organizational aspects of Value Engineering, Ten principles of Value analysis, Benefits of Value Engineering.

MODULE III ORIENTATION AND INFORMATION PHASES 8

Launching Value Engineering project work - Objectives and Targets - VE Project work: a time-bound programme - Projects and Teams - Time Schedule - Co-ordination - Consultant. Technical data - Marketing related information - Competition profile - Cost data - Materials Management related information - Quality related information - Manufacturing data.

MODULE IV FUNCTION ANALYSIS AND CREATIVE PHASES 9

Objectives - Function definition - Classification of functions - Higher level functions – Function – Cost – Function – Worth - Value Gap - Value index - How to carry out Function Analysis? – Fast Diagraming - Cost Modelling.

Creativity - How to improve creativity of an individual? – How to promote creativity in the organisation? - Obstacles to Creativity - Mental road blocks - Creativity killer phrases. Positive thinking - Ideas stimulators - Creativity techniques - Brainstorming.

MODULE V EVALUATION, INVESTIGATION AND RECOMMENDATION 6

Paired comparison and Evaluation Matrix techniques - Criteria for selection of

VE solutions. Design – Materials – Quality – Marketing – Manufacturing - Preview session. The report - presentation.

MODULE VI IMPLEMENTATION PHASE AND CASE STUDIES 8

Design department - Materials department - Production Planning & Control - Quality Control – Manufacturing – Marketing - Need for co-ordinated teams - The Action Plan. Value Engineering case studies.

L – 45; Total Hours –45

TEXT BOOKS:

1. Mudge, Arthur E. “Value Engineering- A systematic approach”, McGraw Hill, New York, 2000.
2. Kumar S, Singh R K and Jha J K (Ed), “Value Engineering”, Narosa Publishing House, 2005.

REFERENCES:

1. Park RJ, “Value Engineering: A Plan for Invention”, St.Lucie Press, New York, 1999.
2. Lawrence, D.M., “Techniques of Value Analysis and Engineering”, McGraw Hill 1988.
3. George, E.D., “Engineering Design: a Material and Processing Approach”, McGraw Hill, 1991.
4. Heller, D.E., “Value Management, Value Engineering and Cost Reduction”, Addison Wesley, 1988.

OUTCOMES:

- The student will be able to realize the value of products, processes and implement value analysis to achieve productivity improvement.

GECX205 INDUSTRIAL SAFETY L T P C

3 0 0 3

OBJECTIVES:

- To understand the various safety measures to be taken in different industrial environments.

MODULE I SAFETY MANAGEMENT 7

Evolution of modern safety concept- Safety policy - Safety Organization - line and staff functions for safety- Safety Committee- budgeting for safety. safety education and training.

MODULE II SAFETY IN MANUFACTURING 7

Safety in metal working-Machine guarding -Safety in welding and gas cutting - Safety in cold forming and hot working of metals -Safety in finishing, inspection and testing -Regulation.

MODULE III SAFETY IN CONSTRUCTION 8

General safety consideration in Excavation, foundation and utilities – Cordoning – Demolition – Dismantling –Clearing debris – Types of foundations – Open footings.

Safety in Erection and closing operation - Safety in typical civil structures – Dams-bridges-water Tanks-Retaining walls-Critical factors for failure-Regular Inspection and monitoring.

MODULE IV ELECTRICAL SAFETY 8

Electrical Hazards – Energy leakage – Clearance and insulation – Excess energy – Current surges – Electrical causes of fire and explosion – National electrical Safety code.

Selection of Environment, Protection and Interlock – Discharge rods and earthing device – Safety in the use of portable tools - Preventive maintenance.

MODULE V SAFETY IN MATERIAL HANDLING 8

General safety consideration in material handling devices - Ropes, Chains, Sling, Hoops, Clamps, Arresting gears – Prime movers.

Ergonomic consideration in material handling, design, installation, operation and

maintenance of Conveying equipments, hoisting, traveling and slewing mechanisms.

Storage and Retrieval of common goods of shapes and sizes in a general store of a big industry.

MODULE VI SAFETY EDUCATION AND TRAINING 7

Importance of training-identification of training needs-training methods – programme, seminars, conferences, competitions – method of promoting safe practice - motivation – communication - role of government agencies and private consulting agencies in safety training – creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign – Domestic Safety and Training.

L – 45; Total Hours –45

REFERENCES:

1. Krishnan N.V, “Safety Management in Industry”, Jaico Publishing House, Bombay, 1997.
2. Blake R.B., “Industrial Safety”, Prentice Hall, Inc., New Jersey, 1973.
3. Fulman J.B., “Construction Safety, Security, and Loss Prevention”, John Wiley and Sons, 1979.
4. Fordham Cooper W., “Electrical Safety Engineering”, Butterworths, London, 1986.
5. Alexandrov M.P., “Material Handling Equipment”, Mir Publishers, Moscow, 1981.

OUTCOMES:

Students would be able to

- Acquire knowledge on various safety Hazards.
- Carry out safety measures for different industrial environments.

GECX206 ADVANCED OPTIMIZATION TECHNIQUES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the various advanced optimization tools.
- To provide an understanding to deal with ill identified and fuzzy problems.

MODULE I INTRODUCTION **7**

Review of conventional optimization techniques - limitations - limitation of exhaustive search - need for artificial intelligence - bio mimicking methods

MODULE II HEURISTICS METHODS **8**

Introduction – Advanced methods of algorithm design: Greedy method, Backtracking method, Divide and Conquer method – Dynamic programming – Heuristics exploration algorithms – Greedy search - Local search – Hill climbing – Tabu search – Gradient search – Beam search – Simulated Annealing.

MODULE III GENETIC ALGORITHM **7**

Introduction - Basics of GA – Population – Reproduction – Cross over – Mutation -genetic algorithms in search, optimization and machine learning-practical genetic algorithms.

MODULE IV ANT COLONY OPTIMIZATION **8**

Introduction: Ant Colony Optimization – Meta-heuristic Optimization – History – The ACO Meta-heuristic – ACO Algorithms: Main ACO – Ant system – Ant colony system – Max-Min Ant system – Applications: Routing in telecommunication networks – Travelling salesmen – Graph Coloring – Advantages & Disadvantages

MODULE V FUZZY LOGIC AND ANN **8**

Fuzzy logic, knowledge representation and inference mechanism – Fuzzy and expert control – standard Takagi-Sugeno mathematical characterizations – Design example – Biological foundations to intelligent systems: Artificial neural networks, Back-propagation networks, Radial basis function networks, and recurrent networks.

MODULE VI IMPLEMENTATIONS & APPLICATIONS 7

Reduction of size of an optimization problem – multilevel optimization – parallel processing – multi objective optimization – Job shop scheduling – Vehicle scheduling – Line balancing – Sensor integration.

L – 45; Total Hours –45

REFERENCES:

1. Singiresu S. Rao, “Engineering optimization – Theory and practices”, John Wiley and Sons, 1996.
2. Ravindran – Phillips –Solberg, “Operations Research – Principles and Practice, John Wiley and Sons, 1987.
3. Fredrick S.Hillier and G.J.Liberman, “Introduction to Operations Research”, McGraw Hill Inc. 1995.
4. Kalymanoy Deb, “Optimization for Engineering Design”, PHI, 2003
5. Christos H. Papadimitriou, Kenneth Steiglitz, Combinatorial Optimization, PHI 2006

OUTCOMES:

At the end of the course student will be able to

1. Formulate a real life situation as an optimization the problem.
2. Identify the appropriate solution methodology and provide a solution

GECX207 **MATLAB SIMULINK** **L T P C**
3 0 0 3

OBJECTIVES:

- Teach students how to mathematically model engineering systems
- Teach students how to use computer tools to solve the resulting mathematical models. The computer tool used is MATLAB and the focus will be on developing and solving models of problems encountered in engineering fields

MODULE I INTRODUCTION MATLAB DATA PRESENTATION 7

Vectors, Matrices -Vector/Matrix Operations & Manipulation- Functions vs scripts- Making clear and compelling plots-Solving systems of linear equations numerically and symbolically- Least squares regression -Curve fitting.

MODULE II MATLAB PLOT FUNCTION 7

Introduction- Plot Function – Animation- 3D Plots-Customizing Plots – Plot Applications- Saving &Painting Plots.

MODULE III ROOT FINDING AND COMPUTER REPRESENTATION OF NUMBERS 7

Linearization and solving non-linear systems of equations- The Newton-Rapson method- Integers and rational numbers in different bases- Floating point numbers- Round off and errors in basic arithmetic-Significant digits when reporting results

MODULE IV ORDINARY DIFFERENTIAL EQUATIONS 8

Numerical integration and solving 1^{st} order, ordinary differential equations (Euler's method and Runge-Kutta)- Use of ODE function in MATLAB

MODULE V NON-LINEAR DIFFERENTIAL EQUATIONS 8

Converting 2^{nd} order and higher ODEs to systems of 1^{st} order ODEs- Solving systems of ODEs via Euler's method and Runge-Kutta)- Solving single and systems of non-linear differential equations by linearization-Use of the function ODE in MATLAB to solve differential equations

MODULE VI INTRODUCTION OF SIMULINK 8

Simulink & its relations to MATLAB – Modeling a Electrical Circuit- Modeling a fourth order differential equations- Modeling the solution of three equations with three unknowns- Representing a model as a subsystem-Simulink demos.

L – 45; Total Hours –45

REFERENCES:

1. Griffiths D V and Smith I M, Numerical Methods for Engineers, Blackwell, 1991.
2. Laurene Fausett, Applied Numerical Analysis Using MATLAB, Pearson 2008.
3. Moin P, Fundamentals of Engineering Numerical Analysis, Cambridge University Press, 2001.
4. Wilson HB, Turcotte LH, Advanced mathematics and mechanics applications using MATLAB. CRC Press, 1997
5. Ke Chen, Peter Giblin and Alan Irving , Mathematical Exploration with MATLAB, Cambridge University Press, 1999.

OUTCOMES:

At the end of this unit students will be able to:

1. Use Matlab as a convenient tool for solving a broad range of practical problems in engineering from simple models to real examples.
2. Write programs using first principles without automatic use of built-in ones.
3. Write programs for solving linear and nonlinear systems, including those arising from boundary value problems and integral equations, and for root-finding and interpolation, including piecewise approximations.
4. Be fluent in exploring Matlab's capabilities, such as using matrices as the fundamental data-storage unit, array manipulation, control flow, script and function m-files, function handles, graphical output.
5. Make use of Maltab visual capabilities for all engineering applications.
6. An ability to identify, formulate, and solve engineering problems. This will be accomplished by using MATLAB to simulate the solution to various problems in engineering fields

GECX208	EMBEDDED SYSTEMS AND ITS APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide a detailed overview of embedded system.
- To equip students with the software development skills necessary for practitioners in the embedded systems field.
- To understand entire software development lifecycle and examine the various issues involved in developing software for embedded systems.

MODULE I EMBEDDED SYSTEMS OVERVIEW 8

Introduction –Embedded Systems vs. General computing systems- Fundamental Components of embedded systems- Characteristics- Challenges-Examples- Embedded System design process.

MODULE II EMBEDDED COMPUTING PLATFORM 8

Overview of Processors and hardware units in an embedded system-CPU buses – Memory devices –Memory types- I/O devices – Designing with computing platforms- Consumer electronics architecture-Design example: Alarm clock.

MODULE III REAL TIME EMBEDDED SYSTEMS 8

Programming embedded systems in assembly and C – Real time systems – Hard and Soft real time systems- Need for RTOS in Embedded Systems- Multiple tasks and processes –Context switching-Scheduling policies- Interprocess communication and synchronization.

MODULE IV EMBEDDED SOFTWARE DEVELOPMENT PROCESS and TOOLS 8

Development process of an embedded system-software modules and tools for implementation of an embedded system- Integrated development environment- Host and target machines-cross compiler-cross assembler-Choosing right platform.

MODULE V PROGRAM MODELING IN EMBEDDED SYSTEMS 8

Program Models – Data Flow Graph model-control DFG model-Synchronous DFG model- Finite state machines- UML modeling – UML Diagrams.

MODULE VI EMBEDDED SYSTEMS APPLICATION 5

Application specific embedded system – case study: digital camera hardware and software architecture, embedded systems in automobile, embedded system for a smart card.

Total Hours –45

TEXT BOOKS:

1. Marilyn Wolf , "Computers as components", Elsevier 2012.
2. Shibu. K.V, “Introduction to Embedded Systems”, Tata Mcgraw Hill,2009.
3. Rajkamal, "Embedded Systems Architecture, Programming and Design",1st Reprint,Tata McGraw-Hill, 2003
4. Frank Vahid and Tony Gwargie, "Embedded System Design", John Wiley & sons, 2002.

REFERENCES:

1. Sriram V Iyer and PankajGupta ,”Embedded Realtime Systems Programming ”Tata McGraw-Hill,2008
2. Qing Li and Carolyn Yao," Real-Time Concepts for Embedded Systems", CMPBooks, 2003
3. David E.Simon, "An Embedded Software Primer", Pearson Education, 2003

OUTCOMES:

On completion of this course, the students will be able to

- Identify the suitable processor and peripherals in embedded applications
- Develop embedded programs in assembly and c
- Choose the right platform for designing an embedded system
- Explore different scheduling mechanism in rtos
- Design the program model for embedded applications.
- Analyze different domain specific applications in embedded systems.

GECX209 USABILITY ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

The objective of this course is

- To understand the emerging concept of usability, requirements gathering and analysis.
- To learn about human computer interaction with the help of interfaces that has high usability.

MODULE I INTRODUCTION 6

Cost Savings – Usability Now – Usability Slogans – Discount Usability Engineering – Usability – Definition – Example – Trade-offs – Categories – Interaction Design – Understanding & Conceptualizing Interaction – Cognitive Aspects.

MODULE II USER INTERFACES 8

Generation of User Interfaces – Batch Systems, Line Oriented Interfaces, Full Screen Interfaces, Graphical User Interfaces, Next Generation Interfaces, Long Term Trends – Usability Engineering Life Cycle – Interfaces – Data Gathering – Data Analysis Interpretation and Presentation.

MODULE III INTERACTION DESIGN 8

Process of Interaction Design - Establishing Requirements – Design,Prototyping and Construction - Evaluation and Framework.

MODULE IV USABILITY TESTING 8

Usability Heuristics – Simple and Natural Dialogue, Users' Language, Memory Load, Consistency, Feedback, Clearly Marked Exits, Shortcuts, Error Messages, Prevent Errors, Documentation, Heuristic Evaluation – Usability Testing - Test Goals and Test Plans, Getting Test Users, Choosing Experimenters, Ethical Aspects, Test Tasks, Stages of a Test, Performance Measurement, Thinking Aloud, Usability Laboratories.

MODULE V USABILITY ASSESSMENT METHODS 8

Observation, Questionnaires and Interviews, Focus Groups, Logging Actual Use, User Feedback, Usability Methods – Interface Standards - National, International and Vendor Standards, Producing Usable In-House Standards.

MODULE VI USER INTERFACES 7

International Graphical Interfaces, International Usability Engineering, Guidelines for Internationalization, Resource Separation, Multilocale Interfaces – Future Developments – Case Study.

L – 45; Total Hours –45

TEXT BOOKS:

1. Yvonne Rogers, Helen Sharp, Jenny Preece, “Interaction Design: Beyond Human - Computer Interaction”, John Wiley & Sons, 3rd Edition, 2011 (Module I, II, III).
2. Jakob Nielsen, “Usability Engineering”, Morgan Kaufmann Academic Press, 1994. (Module I – VI).

REFERENCES:

1. Ben Shneiderman, Plaisant, Cohen, Jacobs, “Designing the User Interface: Strategies for Effective Human Interaction”, Pearson Education, 5th Edition, 2010.
2. Laura M. Leventhal, Julie A. Barnes, “Usability Engineering: Process, Products, and Examples”, Pearson/Prentice Hall, 2008

OUTCOMES:

Students who complete this course will be able to

- build effective, flexible and robust user interfaces.
- translate system requirements into appropriate human/computer interaction sequences.
- choose mode, media and device for the application requirements.

GECX210 SUPPLY CHAIN MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

- To understand the various decision phases in a supply chain
- To be aware of the Supply Chain and its drivers
- To design Supply Chain Network
- To build a aggregate plan in supply chain
- To understand Sourcing Decisions in Supply Chain
- To comprehend the influence of Information technology in Supply Chain

MODULE I INTRODUCTION TO SUPPLY CHAIN 7

Understanding Supply Chain - Decision phases - Supply chain performance - Competitive and supply chain strategies - Achieving strategic fit - Expanding strategic scope

MODULE II SUPPLY CHAIN DRIVERS AND DESIGN 7

Drivers of supply chain performance – Designing distribution network - Network Design in the Supply Chain - Network design in Uncertain Environment

MODULE III AGGREGATE PLANNING AND MANAGING SUPPLY, DEMAND AND INVENTORY 8

Aggregate Planning in a Supply chain: role - Managing Supply - Managing Demand in Supply Chain – Cycle and Safety inventory in supply chain – Level of product availability.

MODULE IV MANAGING INVENTORY IN SUPPLY CHAIN 8

Managing Economies of Scale in a Supply Chain : Cycle Inventory- Managing uncertainty in a Supply Chain Safety Inventory- Determining optimal level of Product Availability

MODULE V SOURCING AND TRANSPORTATION 8

Sourcing decision in supply chain - Third and Fourth – Party Logistics providers - Supplier scoring and assessment - Transportation in a Supply Chain – Risk and Trade-offs in transportation design.

MODULE VI INFORMATION TECHNOLOGY IN A SUPPLY CHAIN 7

Information technology in a supply chain – CRM, ISCM, SRM in supply chain -

Over view of recent trends in Supply Chain: e-SRM, e-LRM, e-SCM.

L – 45; Total Hours –45

REFERENCES:

1. Sunil Chopra and Peter Meindl, “Supply Chain Management-Strategy Planning and Operation”, Pearson Education, 5th Indian Reprint, 2013.
2. Jananth Shah “Supply Chain Management – Text and Cases“ Pearson Education, 2008.
3. Altekar Rahul V, “Supply Chain Management-Concept and Cases”, Prentice Hall India, 2005.
4. Monczka et al., “Purchasing and Supply Chain Management”, Thomson Learning, 2nd Edition, 2nd Reprint, 2002.

OUTCOMES:

- After taking up the course the student will be able to brighten his prospects of taking up a career on supply chain management.
- The student decision making capability specific to supply chain issues in an industry is improved.
- The student can plan a well defined execution of supply chain strategy in companies.
- The student will be able to design a optimal distribution network as per the demands of the industry.
- The student can also determine the most favorable transportation plan for a company.
- The student will also be able to bring in company from paper environment to paperless environment.

GECX211 SYSTEMS ANALYSIS AND DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To describe the phases of the systems development life cycle
- To teach the automated tools for system development
- To develop and evaluate system requirements.
- To explain the organizational issues in system implementation
- To teach the usability testing and electronic data interchange
- To elucidate the importance of System analysis and design in electronic commerce.

MODULE I FUNDAMENTALS OF SYSTEM DEVELOPMENT 8

System Concept – Characteristics – Elements of System – Types of System – Modern Approach to System Analysis and Design – System Development Life Cycle – Approaches to Improving Development – Tools for System Development – Succeeding as a System Analyst – Skills – Managing the Project.

MODULE II AUTOMATED TOOLS FOR SYSTEMS DEVELOPMENT 7

What is requirements determination? Fact finding techniques, Tools for documenting procedure and decision-CASE Tools-Need for CASE tools-Reverse engineering and reengineering- phases of the software life cycle-Ranking projects-Value Chain Analysis- Corporate Strategic Planning vs. Information Systems Planning.

MODULE III SYSTEM ANALYSIS 8

Determining System Requirements – Traditional Methods - Modern Methods – Radical Methods – Structuring System Requirements – Process Modeling – Data Flow Diagramming – Logic Modeling – Conceptual Data Modeling – E-R Modeling.

MODULE IV SYSTEM DESIGN 8

System Implementation – Software Application Testing – Installation – Documentation – Training and Support – Organizational Issues in Systems Implementation – Maintaining Information System – Conducting System Maintenance.

MODULE V USABILITY AND MEASURING USER SATISFACTION 7

Usability Testing-User satisfaction test- A tool for analyzing user satisfaction – Unified Modeling Language(UML)- Case study: System Design: Application in Human Resource-Financial Applications

MODULE VI SAD IN E-COMMERCE 7

Systems analysis and design in the era of electronic commerce: B2B, B2C and C2C e-commerce -advantages and disadvantages of e-commerce. E-commerce system architecture – physical networks, logical network, World Wide Web, web-services - HTML, XML - case studies-El electronic data interchange: EDI standards - virtual private networks - XML and EDI

L – 45; Total Hours –45

REFERENCES:

1. Jeffrey A. Hoffer, Joey F. George, Joseph S. Valacich, “Modern Systems Analysis and Design”,Fifth Edition, Prentice Hall,March 2007.

2.Ned Kock, “Systems Analysis & Design Fundamentals” Sage South Asia, May 2008.

3. Joseph S. Valacich, Jeffrey A. Hoffer, Joey F. George, “Essentials Of System Analysis And Design” Prentice Hall , August 2005.

4. Rumbaugh et al, “Succeeding with Booch and Rambaugh Methods”, Addisson Wesley, second Edition, 1998.

5.Larman, C.,” Applying UML and Patterns. An introduction to Object-Oriented Analysis and Design”. Prentice-Hall PTR, 2002.

OUTCOMES:

- List the characteristics of the system and specify the approaches in the development of the system.
- Summarize the phases of the software life cycle
- Differentiate Corporate Strategic Planning and Information Systems Planning.
- Illustrate the system requirements through various modeling diagrams.
- Use tools and techniques for process and data modeling.
- Solve realistic systems analysis problems and perform user satisfaction test.

GECX212 ADVANCED MATERIALS

L	T	P	C
3	0	0	3

OBJECTIVES:

To make the student conversant with

- Dielectric materials
- Magnetic materials
- Energy materials
- Nano materials
- Semi conductors
- Smart materials

MODULE I **8**

Dielectric Materials- Polarization and Mechanism-Internal or local field-Clausius-Mossotti relation- Dielectric loss- Temperature and Frequency effect-Measurement of Dielectric constant and loss using Scherring bridge- electric break down- ferro, piezo, pyroelectric materials and its application.

MODULE II **8**

Magnetic Materials- Terminology and classification of magnetic materials (Dia, Para, Ferro & Ferri) – Magnetic moments due to electrospin – Domain theory of Hysteresis – Heisenberg theory of Exchange Interaction (without derivation)- Structure and properties of Ferrites- Properties of Soft and Hard Magnetic Materials- Application: floppy disk, CD ROM, Magneto optical recording.

MODULE III **8**

Energy Materials (Nuclear) - Introduction to nuclear materials- Materials for nuclear fuel in fission and fusion reactors, Fissile and fertile materials- Control & Construction Materials for Nuclear reactors, Moderators, Heat Exchangers- Radiation proof materials- Brief discussion of safety and radioactive waste disposal.

MODULE IV **7**

Nano Materials- The nanosize range- classification of nanomaterials- processing of nanomaterials-properties of nanomaterials- mechanical, electrical, magnetic properties- other properties- carbon based nanomaterials- other nanomaterials and its application.

MODULE V **7**

Semiconductors- The energy gap in solids-Extrinsic Semiconductors- Intrinsic Semiconductors- Hall Effect in semiconductors- Application of Hall Effect- Basic ideas of compound semiconductors -Semiconductor materials- Fabrication of Integrated Circuits- Some semiconductor Devices

MODULE VI **7**

Smart materials- aerospace materials Ni and Co based super alloys, Special steels, Titanium alloys, Intermetallics, ceramics and their composites, New High strength material, Properties of Materials, Materials in Medical Applications, Stainless steel alloys,Cobalt based alloys, titanium based alloys, polymers

L – 45; Total Hours –45

REFERENCES:

1. Materials science and Engineering: A first course by V. RAGHAVAN, 6th ed., Eastern Economy edition,Prentice Hall of India,2015
2. Materials science and Engineering: An Introduction by William D. Callister Jr., 7th ed. John Wiley & Sons Inc. 2007
3. Material science by Dr.M.Arumugam, Anurasha agencies ,third revised edition ,2002

OUTCOMES:

Students will be able to know

- significance of dielectric materials
- types and applications of magnetic materials
- applications of nuclear materials for energy harvesting
- applications of nano materials
- significance of semi conductor devices
- applications of smart materials

GECX213	NATIONAL SERVICE SCHEME	L	T	P	C
		2	0	0	2

OBJECTIVES:

Primary Objective: Personality development through community service.
To achieve the above objective, the following should be adhered:

1. To provide an understanding about the aims, structure and programmes and activities of National Service scheme in terms of Nation Building
2. To develop certain basic skills for personality development through community development.
3. Understand the community in which they work and their relation
4. Identify the needs and problems of the community and involve them in problem-solving and
5. Practice national integration and social harmony.

MODULE I INTRODUCTION TO NSS 8

Orientation and structure of NSS,-Aims and Objectives of National Service Scheme- The history of NSS- Symbol and meaning- NSS hierarchy from national to college level – Role and responsibilities of various NSS functionaries

MODULE II PERSONALITY AND COMMUNITY DEVELOPMENT SKILLS 8

Importance of youth Leadership, Traits of Good Leadership and Personality Development. Role of youth in creating awareness through NSS Programmes on Health & Hygiene; Environmental Conservation and Enrichment for Sustainable Development; Sanitation and Swachh Bharat.

MODULE III UNDERSTANDING YOUTH 7

Definition and Profiles of youth categories, Youth Issues, Challenges and Opportunities for Youth, Youth as agent of social change & Community Mobilization .Role of Youth in Nation Building. National Youth Policy.

MODULE IV SOCIAL HARMONY AND NATIONAL INTEGRATION 7

National Integration, Various obstacles in the way of National Integration; such as caste, religion, language and provisional problems etc. Role of youth in Peace building and conflict resolution- Globalization and its Economic Social Political and

Cultural impacts.

L – 30; Total Hours –30

TEXT BOOKS:

1. National Service Scheme – A Youth Volunteers Programme for Under Graduate students as per UGC guidelines J.D.S.Panwar et al. Astral International. New Delhi.
2. National Service Scheme Revised Manual, 2006.Govt. of India. Ministry of Youth Affairs & Sports. New Delhi.
3. Social Problems in India, *Ram Ahuja.*

REFERENCES:

1. National Youth Policy-2014. Ministry of Youth Affairs & Sports. .Govt. of India

OUTCOMES:

On successful completion of this course-

- Students will have exposure to the the aims, structure and programmes and activities of National Service scheme in terms of Nation Building
- Students will be trained to skills for personality development through community development.
- Students will gain knowledge about national integration and social harmony.
- Students will be exposed to the role of youths in Nation building Students will gain

GECX214	AUTOMOTIVE POLLUTION AND CONTROL	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To have a fair knowledge in automotive pollution control.
- To understand the concept of formation and control techniques of pollutants like UBHC, CO, NOx, particulate matter and smoke for both SI and CI engine will be taught to the students.
- To know about the instruments for measurement of pollutants
- To get introduced about emission standards

MODULE I EMISSION FROM AUTOMOBILES 8

Sources of Air Pollution. Various emissions from Automobiles — Formation — Effects of ollutants on environment and human beings. Emission control techniques – Modification of fuel, after treatment devices. Emission standards. Automotive waste management, old vehicle disposal, recycling, tyre recycling

MODULE II SI ENGINE EMISSIONS AND CONTROL 9

Emission formation in SI Engines- Carbon monoxide & Carbon di oxide - Unburned hydrocarbon, NOx, Smoke —Effects of design and operating variables on emission formation – controlling of pollutants - Catalytic converters, Charcoal Canister, Positive Crank case ventilation system, Secondary air injection, thermal reactor

MODULE III CI ENGINE EMISSION AND CONTROL 8

Formation of White, Blue, and Black Smokes, NOx, soot, Effect of Operating variables on Emission formation — Fumigation, Split injection, Catalytic Coating, EGR, Particulate Traps, SCR, Fuel additives — Cetane number Effect.

MODULE IV NOISE POLLUTION FROM AUTOMOBILES 8

Sources of Noise — Engine Noise, Transmission Noise, vehicle structural Noise, aerodynamics noise, Exhaust Noise. Noise reduction in Automobiles — Encapsulation technique for noise reduction —Silencer Design.

MODULE V TEST PROCEDURES 6

Constant Volume Sampling I and 3 (CVSI &CVS3) Systems- Sampling Procedures — Chassis dynamometers - Seven mode and thirteen mode cycles for Emission Sampling.

MODULE VI EMISSION MEASUREMENTS 6

Emission analysers —NDIR, FID, Chemiluminesecent, Smoke meters, Dilution Tunnel, SHED Test, Sound level meters.

L – 45; Total Hours –45

TEXT BOOKS:

1. V.Ganesan, 'Internal combustion Engines', Tata McGraw Hill Book Co, Eighth Reprint, 2005.
2. Crouse and Anglin, 'Automotive Emission Control', McGraw Hill company., Newyork 1993.

REFERENCES:

1. G.P.Springer ad D.J.Patterson, Engine Emissions, Pollutant formation, Plenum Press, New York. 1986.
2. D.J.Patterson and N.A.Henin, 'Emission from Combustion Engine and their control', Anna Arbor Science Publication,1985.
3. L.Lberanek, 'Noise Reduction', Mcgrawhill Company., Newyork1993.
4. C.Duerson, 'Noise Abatment', Butterworths ltd., London1990.
5. A.Alexander, J.P.Barde, C.lomure and F.J. Langdan, 'Road traffic noise', Applied science publisher ltd., London,1987.

OUTCOMES:

On completion of the course student should be able to

- Identify the sources of emission from vehicles.
- Analyse the causes and effects of emissions.
- Analyse causes and effects of noise pollution
- Bring out solutions for control of emissions.
- Demonstrate the test procedures and emission norms.
- Select suitable instruments for measurement of emissions.

GECX215	MOTOR VEHICLE ACT, INSURANCE & POLICY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn about basic act and regulation followed for road vehicle
- To learn about systematic steps involved to get licence and registration of motor vehicle
- To learn arbour various types of motor vehicle polices and insurances

MODULE I BASIC RULES FOR ROAD VEHICLE 8

Display and Use of Number Plates- Attachment of number plates- Number plates in horizontal position- Removal of number plates on transfer- Hours prescribed for lighted lamps- Mounting of lamps and reflectors- Multiple beam headlamps- Daytime running lamps- Auxiliary driving lamps- Parking lamps- Brakes- Stopping distances- Emergency or parking brakes- Horn- Muffler- Mirrors- Inspection of motor vehicles- Standards of safety and repair

MODULE II LICENSING OF DRIVERS OF MOTOR VEHICLES 8

Necessity of driving licence- Age limit in connection with driving of motor vehicle-Responsibility of owners of motor vehicles-Restriction on the holding of driving licence-Grant of learner's licence-Grant of driving licence-Addition to driving licence- Renewal of driving licence-Revocation of driving licence on grounds of disease or disability-Driving licence to drive motor vehicle belonging to the central government- power of court to disqualify- suspension of driving licence in certain cases- suspension or cancellation of driving licence on convection- Endorsement.

MODULE III REGISTRATION OF MOTOR VEHICLE 7

Necessity for registration – Registration Where and how to be made- Special provision for registration of motor vehicle of diplomatic officers-Temporary registration- Production of vehicle at the time of registration- Refusal of registration- renewal of certificate of registration- effectiveness in India of registration- Change of residence or place of business-transfer of ownership-Suspension of registration – cancellation of registration suspended under section 53- certificate of fitness of transport vehicle-cancellation of registration.

MODULE IV INSURANCE OF MOTOR VEHICLE 8

Necessity for insurance against third party – Requirements of policies and limits of liability- - Duty of insurers to satisfy judgements and awards against person insured in respect of third party risks-Duty to give information as to insurance-Settlement between insurers and insured persons- transfer of certificate of insurance-production of certain certificates, licences and permit in certain cases-Special provisions as to compensation in case of hit and run motor accident – Types of motor polices

MODULE V CONTROL OF TRANSPORT VEHICLES 7

Power to State Government to control road transport- Transport authorities-General provision as to applications for permits- Application for stage carriage permit- Procedure of Regional Transport Authority in considering application for stage carriage permit- Scheme for renting of motor cabs- Application for private service vehicle permit- Procedure in applying for and granting permits- Duration and renewal of permits- Transfer of permit- Replacement of vehicles-Temporary permits

MODULE VI OFFENCES AND PUNISHMENT 7

Driving without holding an effective driving licence- Driving by an under-aged person (Minor driving vehicle)- Holding of a driving licence permitting it to be used by other person.- Driving a vehicle at an excessive speed- Driving or permitting to drive a vehicle carrying excess load- Driving dangerously / its Abetment Driving an uninsured vehicle

Rider and pillion rider failing to wear protective head gear (Helmet) -Violation of Mandatory Signs -.e-challan and spot challan

L – 45; Total Hours –45

TEXT BOOKS:

1. The motor vehicle act 1988, Universal law publishing co.cpvt ltd. Newdelhi 2011
2. A Commentary On The Motor Vehicles Act, 1988 by SUKHDEV AGGARWAL The Bright Law House, New Delhi

REFERENCES:

1. The Motor Vehicles Act, 1988 Along with Latest Case Law, Notifications

& Table of Offences and Punishments Asia Law House; 15th edition (2014)

2. Assessment of Compensation in Accidents under Motor Vehicles Act by Karkara Delhi Law House (2013)

OUTCOMES:

On completion of the course students should be able to

- Explain the analysis of rules and regulations for road vehicles
- Analyze the procedure for getting driving license for vehicles at national and international level
- Analyze the procedure for registration of vehicles.
- Analyze the procedure for Insurance of vehicles and claims.
- Analyze the procedure for obtaining Government Permits and renewal
- Analyze the consequences of not following the rules and regulations

GECX216	PRINCIPLES OF COMMUNICATION SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

To introduce the analog and digital modulation techniques.
To elaborate the working of communication receivers in the presence of noise.
To give an overview of various communication systems.

MODULE I LINEAR MODULATION 8

Baseband signals, Amplitude Modulation – Modulation Index, Power Transmitted, Double Side Band and Single Side Band AM, AM Modulators and AM Receivers, AM Radio systems, Frequency Division Multiplexing.

MODULE II ANGLE MODULATION 8

Frequency Modulation and Phase Modulation, Frequency deviation and modulation index, Bandwidth of FM, FM Modulators and FM receivers, FM Radio and FM Stereo Systems

MODULE III SAMPLING AND PULSE MODULATION 7

Sampling, Nyquist's Sampling Theorem, Pulse Modulations - PAM, PPM and PWM, Time Division Multiplexing, Bandwidth of TDM systems.

MODULE IV DIGITAL COMMUNICATION 7

Digital baseband data, Digital Modulations – ASK, FSK, PSK and QPSK. Digital Communication Transmitters and Receivers.

MODULE V NOISE 8

Sources of Noise, Thermal Noise, shot noise, White noise, Narrow band Noise, Effect of noise in communication, SNR, Receiver Noise Temperature and Noise Equivalent Bandwidth.

MODULE VI COMMUNICATION SYSTEMS & NETWORK 7

FM Radio Systems, Cellular Mobile network, Satellite Communications, Optical Fiber Communication.

L – 45; T – 0; Total Hours – 45

TEXT BOOKS:

1. A. Bruce Carlson, Paul B. Crilly, "Communication Systems", 5th Edition,

McGraw Hill Int., 2011.
2. B.P. Lathi, Zhi Ding, Hari M. Gupta, “Modern Digital and Analog Communication Systems”, 4th Edition, Oxford University Press, 2017.

REFERENCES:

1. Herbert Taub, Donald L. Schilling, Goutam Saha, “Principles of Communication Systems” 4th Edition, McGraw Hill Int. 2013.
2. Simon Haykin, “An Introduction To Analog And Digital Communications”, 1st Edition, Wiley India, 2010.
3. Simon Haykin , “Communications Systems” 4th Edition, Wiley India, 2006.
4. Hwei P. Hsu, “Analog and Digital Communications” 3rd Edition,

OUTCOMES:

On completion of the course students will be able to

1. Identify various communication systems and the corresponding modulation schemes.
2. Predict the characteristics of various analog and digital modulation schemes.
3. Interpret the effect of noise and bandwidth in a communication systems
4. Apply the Nyquist criteria for a given baseband signals.
5. Evaluate the performance of communication receivers.
6. Demonstrate the applications of common communication systems.

GECX217 **LEAN MANAGEMENT** **L T P C**

3 1 0 4

OBJECTIVES:

The objective of the Course to make the student know about

- the basics of lean production management,
- how Lean principles are applied to the Construction industry to improve the operation management and product development.

MODULE I **8**

lean production? – Introduction, background, and lean thinking. Importance of philosophy, strategy, culture, alignment, focus and systems view. Discussion of Toyota Production System.

MODULE II **8**

Manufacturing systems – an overview of manufacturing strategies. Job shops, batch flow, and flexible manufacturing systems Flow production and lean production systems

MODULE III **7**

Value stream mapping in process design and product development Waste reduction - lead time reduction

Process cycle time and value-added vs. non-value added activities Optimum lot sizing

MODULE IV **8**

Lean production processes, approaches and techniques.—Importance of focusing upon flow. Tools -. Workplace organization – 5S. - Stability. - Just-In-Time – One piece flow – Pull. - . Cellular systems. - . Quick change and set-up reduction methods. f. Total productive maintenance. -. Poka-Yoke – mistake proofing, quality improvement. Standards. - . Leveling. - . Visual management. Just-in-time techniques – SMED and Takt Times - Standard work processes and line balancing Poka-yoke and pull systems material handling reduction and facilities planning

MODULE V **8**

Managing change in the lean organization Human resource management and the lean enterprise Employee involvement – Teams – Training – Supporting and encouraging involvement – Involving people in the change process -- communication -- Importance of culture. Startup of lean processes and examples of applications.

Sustaining improvement and change, auditing, follow-up actions.

7

MODULE VI

The lean enterprise and supply chain management Costs and risks of lean initiatives - Measuring lean initiatives

L – 45; Total Hours –45

TEXT BOOKS:

1. The Toyota Way Fieldbook, Jeffrey Liker and David Meier, McGraw-Hill, 2006. Lean Production Simplified, Pascal Dennis, Productivity Press, 2007.
2. Womack, James P., and Daniel T. Jones. Lean Thinking. New York, NY: Simon and Schuster, 2003. ISBN: 0743249275.
3. Murman, Earll. Lean Enterprise Value. New York, NY: Palgrave Macmillan, 2002. ISBN: 0333976975.

REFERENCES:

1. Readings at http://www.leanconstruction.org/readings.htm
2. Hopp, W. J., and Spearman, M. L. (2011). Factory Physics, Third Edition, Waveland Press, Long Grove, Il. 720 pp.

OUTCOMES:

The student will be able to

- Describe the manufacturing approaches employed and the background and philosophy of lean production.
- Illustrate the concept of waste reduction
- Apply evaluation techniques that can be used in preparation for and use in learn production activities.
- Select the tools that can be used implementing lean production in production operations.
- Discuss the importance of workplace organization, pull production, cellular arrangement and employee involvement, need for employee creativity
- Describe about the Methods for promoting success in implementing lean transformations

GECX218 GEOSPATIAL MODELING & ANALYSIS L T P C
3 0 0 3

OBJECTIVES:

- To equip the students with fundamental representation and analysis of geospatial phenomena and provides foundations in methods and algorithms used in GIS analysis.
- To focus is on terrain modeling, geomorphometry, watershed analysis and introductory GIS-based modeling of landscape processes (water, sediment). The course includes analysis from lidar data, coastal change assessment and 3D visualization.

MODULE I INTRODUCTION TO GEOSPATIAL DATA 7

Mapping natural phenomena –Concept of continuous fields and discrete sampling – Units, projections, coordinate transformation – Georeferencing, geospatial formats, conversions, geospatial data abstraction library – Raster and vector representation, raster and vector conversions and resampling.

MODULE II DATA DISPLAY AND VISUALIZATION 7

Display of continuous and discrete data, use of color, shading, symbols, to extract the spatial pattern and relationships – 3D visualization: multiple surfaces and volumes, 3D vector objects – visualization for data analysis (lighting, scaling, transparency, cutting planes, animations) – view/create maps/post your data on-line (Google Earth/Maps, GPS visualizer)

MODULE III GEOSPATIAL ANALYSIS 7

Foundations for analysis of continuous and discrete phenomena – neighborhood operations and buffers – analysis and modeling with map algebra – cost surfaces and least cost path – spatial interpolation and approximation (gridding)

MODULE IV TERRAIN MODELING AND ANALYSIS 9

terrain and bathymetry mapping – mathematical and digital representations (point clouds, contour, raster, TIN) – DEM and DSM, working with multiple return lidar data – spatial interpolation of elevation data and topographic analysis, line of sight, view shed analysis – solar irradiation, photovoltaic energy potential, time series of elevation data, analysis of coastal change.

MODULE V FLOW TRACING, WATERSHED ANALYSIS AND LANDFORMS 8

Methods for flow routing and flow accumulation – Extraction of stream networks – Extraction of watershed boundaries and building watershed hierarchies – feature extraction, types of landforms.

MODULE VI MODELING OF GEOSPATIAL PROCESSES 7

Model formulation, input data processing – introduction to GIS-based hydrologic, erosion and environmental modeling – Geocomputational methods, including agent-based modeling, artificial neural networks and evolutionary computing.

L – 45; T – 0; Total Hours –45

TEXT BOOKS:

1. Hassan A, Karimi (2017), *Geospatial Data Science Techniques and Applications*, CRS Press & Co.
2. Sudipto Banerjee, Bradley P, Carlin, Alan E. Gelfand (2014), *Hierarchical Modeling and Analysis for Spatial Data*, CRS Press & Co.

REFERENCES:

1. Maguire, D., M. Batty, and M. Goodchild. 2015. GIS, Spatial analysis, and modeling. ESRI Press (G70.212 .G584 2005)
2. Zeiler, M. 2010. Modeling Our World: The ESRI Guide to Geodatabase Design. Second Ed. ESRI Press, Redlands, California

OUTCOMES:

On successful completion of this course,

- Students will be able to apply the basic concepts of Conceptualize models as representations of real life systems with inputs, outputs, and processes.
- Students will have gained knowledge in spatial tools to make simulations and predictions of real life phenomena.
- Students will have synthesized knowledge about Apply, integrate, and develop models with geospatial data through a GIS.
- Students will have an overview of Evaluate models in terms of accuracy, sensitivity, and uncertainty.
- Students will have Use of a system-based approach for problem solving, with an emphasis on sustainability.

B.S. Abdur Rahman Crescent Institute of Science & Technology

Deemed to be University u/s 3 of the UGC Act, 1956

REGULATIONS 2017

CURRICULUM AND SYLLABI

B.TECH.

AUTOMOBILE ENGINEERING

DEPARTMENT OF AUTOMOBILE ENGINEERING
VISION AND MISSION

VISION

- To be a leader for Education, Training, Consultancy and Research in Automobile Engineering for the progress of Automotive Industries and over-all Socio-Economic progress of the Country in a sustainable manner.

MISSION

- To provide quality education to the students and to mould them as professionals with sound knowledge in the field of Automobile Engineering.
- To equip students to solve challenging problems in Automobile Engineering and related areas taking in to account their impact on the society.
- To facilitate students to develop good communication, leadership and managerial skills through team approach in conducting experiments and projects
- To pursue academic and collaborative research with industry and related research institutions.

PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES
B.Tech. (Automobile Engineering)

PROGRAMME EDUCATIONAL OBJECTIVES

The Mission of the Automobile Engineering Program is achieved by student learning outcomes that prepare the graduate to be able to:

- To inculcate involvement in learning by adapting a holistic approach through well designed curriculum, pedagogy and evaluation for a successful professional career.
- To provide a strong foundation in physical sciences and analytics to enable comprehensive understanding of the basic principles of Automobile Engineering.
- To develop knowledge and skill in applying engineering principles to conceive, design, analyze, manufacture, maintain and recycle Automobile Engineering systems and components.
- To equip the students with essential fundamental knowledge from other relevant disciplines to infuse a multi-disciplinary approach.
- To empower the students through projects, internships leading to development of creativity, self confidence and team spirit.
- To create the ambience with scope for developing communication and life skills so as to meet the needs of the society in the globalized environment

PROGRAMME OUTCOMES

The following list of educational outcomes was chosen by the department to describe what the students are expected to know or be able to do at time for graduation from the program:

- Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

- Problem analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
- Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- Model tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.
- Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- Individual and team work: Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary settings.
- Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

- Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAMME SPECIFICOUTCOMES

B. Tech Automobile Engineering graduates will be able to

- Design, model and analyze automobile components, sub systems and automotive electronic systems.
- Develop as professionals in automotive system design, validation, operation, testing with emission measurement and control and maintenance of vehicles

B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE AND TECHNOLOGY

B.TECH. AUTOMOBILE ENGINEERING

CURRICULUM & SYLLABUS, REGULATIONS 2017

SEMESTER I

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	BS	MAC 1181	Differential Calculus and Geometry	3	1	0	4	
2.	HS	ENC 1181/ ISC 1181/ LNC 1181/ LNC 1182/ LNC 1183	English / Arabic / Mandarin / German / Japanese	3	0	0	3	
3.	BS	PHC 1181	Physics	3	0	2	4	
4.	BS	CHC 1181	Chemistry	3	0	2	4	
5.	ESF	GEC 1101	Engineering Graphics	2	0	2	3	
6.	ESF	GEC 1102	Engineering Design	2	0	0	2	
7.	ESF	GEC 1103	Basic Engineering Practices Laboratory	0	0	2	1	
8.	ESF	GEC 1104	Computer Programming I	1	0	2	2	**23**

SEMESTER II

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	BS	MAC 1281	Advanced Calculus	3	1	0	4
2.	BS	-	Physics Elective	2	0	2	3
3.	BS	-	Chemistry Elective	2	0	2	3
4.	ESF	GEC1211	Basic Engineering Mechanics	3	1	0	4
5.	BS	GEC 1212	Environmental Studies	2	0	0	2
6.	ESF	GEC 1213	Computer Programming II	1	0	2	2

7.	ESF	EEC 1281	Automobile Electrical Engineering	2	0	0	2	
8.	EC	AUC1211	Applied Fluid Mechanics	3	0	0	3	
9.	ESF	EEC 1282	Automobile Electrical Engineering Laboratory	0	0	3	1	**24**

SEMESTER III

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	BS	MAC 2181	Partial Differential Equations and Transforms	3	1	0	4	
2.	HS	-	Humanities Elective I	2	0	0	2	
3.	EC	AUC 2101	Applied Thermal Engineering	3	1	0	4	
4.	EC	AUC 2102	Vehicle Body Engineering	2	0	0	2	
5.	EC	AUC 2103	Basic Manufacturing Process	2	0	2	3	
6.	EC	AUC 2104	Strength of Materials	3	1	0	4	
7.	EC	AUC 2105	Automotive Engines	2	0	2	3	
8.	HS	ENC 2181	Oral Communication	0	0	2	1	
9.	EC	AUC 2106	Applied Fluid Mechanics Laboratory	0	0	3	1	**24**

SEMESTER IV

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	BS	-	Mathematics Elective I	3	1	0	4
2.	HS	-	Humanities Elective I	2	0	0	2
3.	EC	AUC 2211	Automotive Chassis	3	0	0	3
4.	EC	AUC 2212	Mechanics of Machinery	3	1	0	4
5.	EC	AUC 2213	Automotive Electrical & Electronics	2	0	0	2
6.	EC	AUC 2214	Automotive Material & Metallurgy	2	0	2	3
7.	EC	AUC 2215	Production Process of Automotive Components	2	0	0	2

8.	HS	ENC 2282	Written Communication	0	0	2	1	
9.	EC	AUC 2216	Automotive Chassis Laboratory	0	0	3	1	
10.	EC	AUC 2217	Automotive Electrical and Electronics Laboratory	0	0	3	1	**23**

SEMESTER V

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	MS	MSC 3181/ MSC 3182	Leadership and CEO Training/ Social Entrepreneurship	3	0	0	3	
2.	EC	AUC 3101	Design of Automotive Components	3	1	0	4	
3.	EC	AUC 3102	Automotive Transmission	3	0	0	3	
4.	EC	AUC 3103	Measurements and Instrumentation	1	0	2	2	
5.	PE	-	Professional Elective I	3	0	0	3	
6.	PE	-	Professional Elective II	3	0	0	3	
7.	GE	-	General Elective I	3	0	0	3	
8.	HS	ENC 3181	Communication and Soft Skills - I Career Choice	0	0	2	1	
9.	EC	AUC 3104	Engine Testing and Emission Laboratory	0	0	3	1	
								23

SEMESTER VI

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	MS	MSC 3181/ MSC 3182	Leadership and CEO Training/ Social Entrepreneurship	3	0	0	3
2.	BS	-	Mathematics Elective II	2	0	0	2
3.	EC	AUC 3211	Modeling of Simulation of vehicle system	3	0	0	3
4.	EC	AUC 3212	Vehicle Dynamics	3	1	0	4
5.	PE	-	Professional Elective III	3	0	0	3

6.	PE	-	Professional Elective IV	3	0	0	3	
7.	HS	ENC 3281	Communication and Soft Skill – II Confidence Building	0	0	2	1	
8.	EC	AUC 3213	Vehicle system simulation laboratory	0	0	3	1	
9.	EC	AUC 3214	Vehicle Dynamics Laboratory	0	0	3	1	
10.	EC	AUC 3215	Vehicle design laboratory (C- language, CATIA)	0	0	3	1	**22**

SEMESTER VII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	EC	AUC 4101	Vehicle Management System	2	0	0	2	
2.	EC	AUC 4102	Finite Element Analysis of Automotive Components	2	0	2	3	
3.	EC	AUC 4103	Evaluation of Vehicle Performance	3	0	0	3	
4.	EC	AUC 4104	Two and Three Wheelers Technology	2	0	2	3	
5.	PE	-	Professional Elective V	3	0	0	3	
6.	PE	-	Professional Elective VI	3	0	0	3	
7.	GE	-	General Elective II	3	0	0	3	
8.	EC	AUC 4105	Vehicle Maintenance Laboratory	0	0	3	1	
9.	EC	AUC 4106	Advanced Automobile Components Manufacturing Laboratory	0	0	3	1	
10.	EC	AUC 4107	Internship.	0	0	0	1*	**23**

SEMESTER VIII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	EC	AUC 4211	Project Work	0	0	24	12	**12**

Total credits – 174

*Industrial training will be undertaken during Third year summer vacation. The credit will be awarded in the 7th Semester.

PROGRAMME ELECTIVES

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	AUCX01	Homologation and Testing	1	0	0	1
2.	PE	AUCX02	Geometric Dimensioning and Tolrencing	1	0	0	1
3.	PE	AUCX03	Vehicle Engineering & Integration	1	0	0	1
4.	PE	AUCX04	Automotive HVAC(Heating Ventilation Air Conditioning)	2	0	0	2
5.	PE	AUCX05	Hybrid and electric vehicle	2	0	0	2
6.	PE	AUCX06	Vehicle diagnostics	2	0	0	2
7.	PE	AUCX07	Spark Engine Technology	3	0	0	3
8.	PE	AUCX08	Compression Engine Technology	3	0	0	3
9.	PE	AUCX09	Automotive Aerodynamics	3	0	0	3
10.	PE	AUCX10	Vehicle comfort system and ergonomics	3	0	0	3
11.	PE	AUCX11	Vehicle design data characteristics	3	0	0	3
12.	PE	AUCX12	Design of transmission system and characteristics analysis	3	0	0	3
13.	PE	AUCX13	Design of hydraulics pneumatics systems for automotives	3	0	0	3
14.	PE	AUCX14	Tractor and Agricultural Machineries	3	0	0	3
15.	PE	AUCX15	Vehicle control system	3	0	0	3
16.	PE	AUCX16	Modern and intelligent vehicle system	3	0	0	3
17.	PE	AUCX17	Alternative Fuels and Energy Systems	3	0	0	3
18.	PE	AUCX18	Vehicle Networking and Internet of things	3	0	0	3
19.	PE	AUCX19	Automotive Instrumentation & Embedded System	3	0	0	3

20.	PE	AUCX20	Advanced material testing and failure analysis	3	0	0	3
21.	PE	AUCX21	Computer aided design and manufacturing	3	0	0	3
22.	PE	AUCX22	Design of Jigs, Fixtures and Press Tools	3	0	0	3
23.	PE	AUCX23	Simulation of I.C. Engine Processes	3	0	0	3
24.	PE	AUCX24	Combustion thermodynamics and heat transfer	3	0	0	3
25.	PE	AUCX25	Unconventional energy sources	3	0	0	3
26.	PE	AUCX26	Computational flow and heat transfer	3	0	0	3
27.	PE	AUCX27	Motorsport Engineering	3	0	0	3
28.	PE	AUCX28	Composite Materials for Automobiles	3	0	0	3
29.	PE	AUCX29	Traffic Engineering	3	0	0	3
30.	PE	AUCX30	Surface Engineering	3	0	0	3
31.	PE	AUCX31	Advanced IC Engine	3	0	0	3
32.	PE	AUCX32	Fuel Cell Technology	3	0	0	3
33.	PE	AUCX33	Power Plant Engineering	3	0	0	3

Physics Elective Courses

(to be offered in II Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	PHCX 01	Fundamentals of Engineering Materials	2	0	2	3
2.	PHCX 02	Heat and Thermodynamics	2	0	2	3
3.	PHCX 03	Introduction to Nanoscience and Technology	2	0	2	3
4.	PHCX 04	Lasers and their applications	2	0	2	3
5.	PHCX 05	Materials Science	2	0	2	3
6.	PHCX 06	Non-Destructive Testing	2	0	2	3
7.	PHCX 07	Properties of Matter and Acoustics	2	0	2	3
8.	PHCX 08	Properties of Matter and Nondestructive Testing	2	0	2	3
9.	PHCX 09	Semiconductor Physics and Optoelectronics	2	0	2	3

Chemistry Elective Courses

(to be offered in II Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	CHCX01	Analytical Instrumentation	2	0	2	3
2.	CHCX02	Corrosion and its Control	2	0	2	3
3.	CHCX03	Electrical Materials and Batteries	2	0	2	3
4.	CHCX04	Engineering Materials	2	0	2	3
5.	CHCX05	Fuels and Combustion	2	0	2	3
6.	CHCX06	Fundamentals of Physical Chemistry	2	0	2	3
7.	CHCX07	Green Technology	2	0	2	3
8.	CHCX08	Organic Chemistry of Biomolecules	2	0	2	3
9.	CHCX09	Polymer Science and Technology	2	0	2	3

Maths Elective Courses

(to be offered in IV Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	MACX 01	Discrete Mathematics And Graph Theory	3	1	0	4
2.	MACX 02	Probability And Statistics	3	1	0	4
3.	MACX 03	Random Processes	3	1	0	4
4.	MACX 04	Applied Numerical Methods	3	1	0	4

Maths Elective Courses

(to be offered in VI Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	MACX 05	Mathematical Programming	2	0	0	2
2.	MACX 06	Statistical Methods for Data Analysis	2	0	0	2
3.	MACX 07	Numerical Methods for Integral and Differential Equations	2	0	0	2
4.	MACX 08	Mathematical Modelling	2	0	0	2
5.	MACX 09	Graph Theory	2	0	0	2

Humanities Elective I

(to be offered in III Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	SSCX01	Fundamentals of Economics	2	0	0	2
2.	SSCX02	Principles of Sociology	2	0	0	2
3.	SSCX03	Sociology of Indian Society	2	0	0	2

Humanities Elective II

(to be offered in IV Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	SSCX04	Economics of Sustainable Development	2	0	0	2
2.	SSCX05	Industrial Sociology	2	0	0	2
3.	SSCX06	Law for Engineers	2	0	0	2

General Elective

Group I Courses
(To be offered in V semester)

Sl. No.	Course Code	Course Title	Offering Department
1.	GECX101	Disaster Management	Civil
2.	GECX102	Total Quality Management	Mechanical
3.	GECX103	Energy Studies	Mechanical
4.	GECX104	Robotics	Mechanical
5.	GECX105	Transport Management	Automobile
6.	GECX106	Control Systems	EEE
7.	GECX107	Introduction to VLSI Design	ECE
8.	GECX108	Plant Engineering	EIE
9.	GECX109	Network Security	CSE
10.	GECX110	Knowledge management	CSE
11.	GECX111	Cyber security	IT
12.	GECX112	Genetic Engineering	LS
13.	GECX113	Fundamentals of Project Management	CBS
14.	GECX114	Operations Research	Mathematics
15.	GECX115	Nano Technology	Physics / Chemistry
16.	GECX116	Vehicle Maintenance	Automobile
17.	GECX117	Fundamentals of Digital Image Processing	ECE

Group II Courses

(To be offered in VII semester)

Sl. No.	Course Code	Course Title	Offering Department
1.	GECX201	Green Design and Sustainability	Civil
2.	GECX202	Appropriate Technology	Civil / Mechanical
3.	GECX203	Engineering System Modelling and Simulation	Mechanical
4.	GECX204	Value Analysis and Engineering	Mechanical
5.	GECX205	Industrial Safety	Mechanical
6.	GECX206	Advanced Optimization Techniques	Mechanical
7.	GECX207	Mat Lab Simulation	EEE
8.	GECX208	Embedded Systemsand its Applications	ECE
9.	GECX209	Usability Engineering	CSE
10.	GECX210	Supply Chain Management	CBS
11.	GECX211	System Analysis and Design	CA
12.	GECX212	Advanced Materials	Physics & Chemistry
13.	GECX213	National Service Scheme	School of Humanities
14.	GECX214	Automotive Pollution and Control	Automobile
15.	GECX215	Motor Vehicle Act, Insurance and Policy	Automobile
16.	GECX216	Principles of Communication Systems	ECE
17.	GECX217	Lean Management	Civil
18.	GECX218	Spatial Data Modeling & Analysis	Civil

SEMESTER I

MAC 1181	DIFFERENTIAL CALCULUS AND GEOMETRY	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aims of this course are to

- introduce eigen values and eigenvectors of matrix algebra.
- make the student knowledgeable in the area of Three Dimensional Analytical Geometry.
- demonstrate the application of Differential Calculus.
- familiarize the student with the functions of several variables.
- develop the use of ODE solvable techniques necessary for engineering applications.
- motivate the students with some basic engineering application problems in ODE.

MODULE I **MATRICES** **8+2**

Characteristic Equation- Eigenvalues and Eigenvectors of a real matrix –Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton Theorem (without proof) – Orthogonal matrices – orthogonal transformations of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation.

MODULE II **THREE DIMENSIONAL ANALYTICAL GEOMETRY** **7+3**

Direction cosines and ratios – angle between two lines – equations of a plane – equations of a straight line, coplanar lines - shortest distance between skew lines - sphere – tangent plane – plane section of a sphere – orthogonal spheres.

MODULE III **DIFFERENTIAL GEOMETRY** **7+3**

Curvature – Cartesian and polar coordinates – centre and radius of curvature – circle of curvature – involutes and evolutes – envelopes.

MODULE IV **DIFFERENTIAL CALCULUS OF SEVERAL VARIABLES** **8+2**

Functions of two variables – partial derivatives – total differential – Implicit Functions – Jacobian - Taylor’s series expansion – Optima of two variables – Lagrange’s multiplier method.

MODULE V **ORDINARY DIFFERENTIAL EQUATIONS** **8+2**

Linear equations of second order with constant and variable coefficients – Simultaneous first order linear equations with constant coefficients – homogeneous equations of Euler's type – method of undetermined coefficients, method of variation of parameters

MODULE VI **APPLICATIONS OF ORDINARY DIFFERENTIAL EQUATIONS** **7+3**

Solution of Ordinary Differential Equation Related to Electric Circuits – Bending of Beams- Motion of a Particle in a resisting medium – Simple harmonic motion.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Ramana, B.V, "Higher Engineering Mathematics" Tata McGraw Hill Publishing Co. New Delhi, 2006.
2. Grewal B.S., "Higher Engineering Mathematics" (43rd edition), Khanna Publishers, New Delhi, 2012.
3. John W. Cell "Engineering Problems Illustrating Mathematics" Mc Graw Hill Publishing Co., New York 1943.

REFERENCES:

1. Veerarajan.T., "Engineering Mathematics" (5th edition) Tata Mc Graw Hill Publishing Co. New Delhi, 2012
2. Kreyszig, E., "Advanced Engineering Mathematics", 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
3. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th edition, Cengage Learning, 2011.
4. Dennis G. Zill, Warren S. Wright, "Advanced Engineering Mathematics", 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
5. Alan Jeffrey, "Advanced Engineering Mathematics", Academic Press, USA, 2002.
6. Venkataraman, M.K., "Engineering Mathematics", Volume I, 2nd edition, National Publishing Co., Chennai, 2003.
7. James Stewart ".Calculus" (7th edition),Brooks/Cole cengage learning,UK

OUTCOMES:

After completing the course, student will be able to

- Understand the matrix techniques and compute eigen values and eigenvectors of a given matrix.
- Do the problems based on three dimensional analytic geometry.
- Apply differential calculus in engineering problems.
- Differentiate more than one variable and their applications.
- Solve the differential equations with constant coefficient and variable coefficient.
- Form and solve differential equations.

ENC 1181	ENGLISH	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To train students to use appropriate vocabulary in academic and technical contexts.
- To facilitate students to speak effectively while exchanging ideas and making presentations.
- To develop students' listening skill for comprehending and analyzing information.
- To develop their reading skill through sub skills like skimming , scanning and critical reading of a text.
- To sharpen their academic writing skills.
- To expose them to the correct usage of language and help them to apply that knowledge appropriately.

MODULE I **8**

L: Listening for general information

S : Self Introduction, Introducing one another.

R: Predicting the content

W: Paragraph Writing

Language Focus: Affixes, Simple Present tense , Connective & Prepositions.

MODULE II **8**

L: Listening for specific information (from dialogues)

S:Exchanging opinion.

R: Skimming technical Passages

W: Argumentative Writing (using the concept of Flipped Learning), Letter to the Editor.

Language Focus: Idioms, use of Modals, Simple Past tense & use of "Wh" and question tags.

MODULE III **7**

L: Learning the ways of describing images and presenting specific information (focusing on note making)

S: Making Presentations using visuals.

R : Scanning short texts for gist of information

W: Letter of Invitation, Expository Writing

Language Focus: Homophones, Homographs, Simple Future & Collocations.

MODULE IV **7**

L: Understanding prepared presentation techniques through videos

S: Short Presentations.

R: Reading for coherence and cohesion

W: Letter seeking permission for Industrial Visit

Language Focus: S-V agreement, Euphemism

MODULE V **8**

L : Understanding Non- Verbal Communications while listening to narration of incidents.

S: Narrating an expereince

R: Inferential Reading

W: Process Description – Transcoding a Flow chart.

Language Focus: Interchange of Active & passive voice, Impersonal Passive voice.

MODULE VI **7**

L: Learning Story telling techniques (stories & visuals) through audio files

S: Discussion in groups

R: Reading for critical appreciation

W: Developing an idea, Slogan writing, Interpreting a Bar Chart.

Language Focus: If clause and phrasal verbs.

TOTAL HOURS :45

REFERENCES:

1. Carol Rosenblun perry(2011). The Fine Art of Technical Writing. Create Space Independent Publishing Platform, New Delhi.
2. Dutt, P.K. Rajeevan. G and Prakash , C.L.N. (2007) A course in Communication Skills. Cambridge Univesity Press, India.
3. Kala, Abdul & Arun Tiwari (2004). Wings of Fire: An Autobiography (Simplified and A bridged by Mukul Chowdhri). Hyderabad Univeristy Press.
4. Sen, Leena. (2004) Communication Skills. Prentice Hall, New Delhi.

5. Matt Firth, Chris Sowton et.al. (2012). Academic English: An Integrated Skills Course for EAP. Cambridge University Press, Cambridge.

OUTCOMES:

After completion of the course, students will have the ability to

- Demonstrate their range of vocabulary in academic and technical contexts
- Exchange ideas and make presentations
- Comprehend and respond appropriately to listening tasks.
- Read a text efficiently and process information.
- Create and draft different kinds of academic documents
- Communicate effectively using grammatically correct expressions.

ISC1181	ARABIC	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To read and write in Arabic language.
- To learn vocabulary of different fields
- To develop situational communication skills.

MODULE I PREPARATORY ARABIC **7**

Introducing Arabic Alphabets.
Listening and Reading.
Audio & Video aided listening, Tajweed listening,
Writing Arabic Alphabets (connected & unconnected).
Introducing words.
Reading simple sentences.
Learning names of the things in and around the class room.
Exercises.

MODULE II FUNCTIONAL ARABIC **7**

Listening Arabic texts, stories and action verbs
Communicating Simple sentences.
Jumla' Ismiyya and Jumla' Fi'liyya
Situational Conversation:
Greetings, Introduction.
Classroom, College, Picnic.
Dining and Kitchen.
Reading skills.
Exercises

MODULE III FUNCTIONAL ARABIC **8**

Implication of effective listening.
Audio aids.
Writing Simple sentences.
Communicating ordinal and cardinal numbers.
Situational communication:

Playground, library.
Forms of plural – Sample sentences.
Introduction to tenses.
Exercises.

MODULE IV FUNCTIONAL ARABIC 8

Communication:
Family, travel
Market, Prayer hall
Writing skills:
Note making.
Sequencing of sentences.
Developing answers from the questions.
Exercises.

MODULE V TECHNICAL ARABIC 8

Importance of technical communication.
Reading and writing skills.
Audio & Video aided listening.
Introduction to Arabic terms related to administration.
Situation communication:
Air travel, Office administration, passport, visa.
Exercises

MODULE VI TECHNICAL ARABIC 7

Situation communication:
Contractual work, machineries and equipments..
Computer, internet browsing.
Banking,
Exercises.

TOTAL HOURS :45

TEXT BOOKS:

1. Arabic for professionals and employees, Kilakarai Bukhari Aalim Arabic College, Chennai, India, 2013.

REFERENCES:

1. Arabic Reader for Non Arabs (Ummul Qura University, Makkah), Kilakarai Bukhari Aalim Arabic College, 2005.

OUTCOMES:

On successful completion of the course, the student will be able to:

- Write correct sentences in Arabic.
- Communicate in Arabic at primary level in working situations in the fields of engineering and administration.

LNC1181	MANDARIN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To improve the proficiency of students in Mandarin language.
- To develop their knowledge of vocabulary.
- To train them in using appropriate grammatical forms during communications.
- To empower them for successful communication in social and academic contexts.
- To make them appreciate the language usage in real life situations.

MODULE I **8**

· General Introduction to Chinese • Pinyin and Tones • Introduction to the Writing System: basic strokes and stroke order · Numbers 1-100, song · Days of the Week · Months of the Year

MODULE II **8**

· Chinese names and related culture · Chinese family structures and values · Greetings · Introducing Yourself · Family members · Occupations

MODULE III **7**

· Languages and Nationalities · Daily Routine · Chinese breakfast · Negative Sentences and Interrogative Sentences · Asking for Personal Information · The Verb *shi* and Basic Sentence Structures

MODULE IV **7**

· Answering an Affirmative-negative Question · Food and drinks · Transportation · Likes and dislikes · Adverbs *bu*, *jiu* and *dou* · Verb-absent Sentences

MODULE V **8**

·*Jisui* and *duoda* Questions · S+V+O Construction · Routines and Daily Activities ·*Haishi* Questions · Modal Verbs · Hobbies and Habits

MODULE VI **7**

· Making Suggestions with *haoma* ·Colors · Clothing · Body parts · Talking about Likes and Dislikes · Measurement Words in Chinese

TOTAL HOURS :45

TEXT BOOKS:

1.Ma, Yanmin, and Li, Xinying. *Easy Steps to Chinese, Vol*. *1 Textbook*. Beijing: Beijing Language and Culture University Press, 2006. Print.

2. Ma, Yanmin, and Li, Xinying. *Easy Steps to Chinese, Vol. 1 Workbook*. Beijing: Beijing Language and Culture University Press, 2006. Print.

OUTCOMES:

On completion of the course, students will be able to

- Exhibit proficiency in Chinese Language.
- Use vocabulary in appropriate contexts.
- Use appropriate grammatical forms effectively.
- Use the language in social and academic contexts.
- Appreciate the use of language forms.

LNC1182	GERMAN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To improve the proficiency of students in German language.
- To create awareness of using vocabulary among students.
- To expose them to correct grammatical forms of the language.
- To empower them for successful communication in social and academic contexts.

MODULE I **8**

Introduction to German alphabets, phonetics and pronunciation- Introducing themselves and others using simple sentences and answer to some basic personal questions-: Introduction to different types of articles and verbs, Nouns

MODULE II **8**

Understanding and responding to everyday queries like instruction, questions, - number & gender, pronouns, present and past tense.

MODULE III **7**

Short telephone messages, requests etc., if spoken slowly and clearly-- Detailed overview of articles, adjectives with/without articles, Prepositions

MODULE IV **7**

Ask and giving directions using simple prepositions- Ability to fill basic information on forms while registering for courses / classes.

MODULE V **8**

Ability to extract and understand relevant information in a public announcement, broadcast, newspaper, radio etc-- dative & accusative

MODULE VI **7**

Ability to describe about people, work, immediate environment, education and other topics related to personal needs in a concise manner-- Understanding of matters that are familiar and are encountered regularly like instances at school, work, at public places, places of leisure etc.

TOTAL HOURS :45

TEXT BOOKS:

1. Course book : Tangram aktuell 1 – Lektion 1–4 (Kursbuch + Arbeitsbuch mit Audio-CD zum Arbeitsbuch), Rosa-Maria Dallapiazza, Eduard von Jan, Til Schönherr, Hueber Publisher, ISBN 978-3-19-001801-7
2. Practice book: Tangram aktuell 1 – Lektion 1–4 (Kursbuch + Arbeitsbuch mit Audio-CD zum Arbeitsbuch), Rosa-Maria Dallapiazza, Eduard von Jan, Til Schönherr, Hueber Publisher, ISBN 978-3-19-001801-7.

REFERENCES:

1. NETZWERK A1 TEXTBOOK, Deutsch als Fremdsprache,Stefanie Dengler,Paul Rusch, Helen Schmitz, Tanja Sieber, Langenscheidt and Klett, ISBN : 9788183076968
2. STUDIO D A1 (SET OF 3 BOOKS + CD), Hermann Funk. Cornelsen, ISBN: 9788183073509
3. Willkommen! Beginner's course. Paul Coggle, Heiner Schenke. 2nd edition. (chapter 1 - 6) ISBN: 9781444165159 –
4. Willkommen! Beginner's course. Paul Coggle, Heiner Schenke. ISBN: 978-1-444-16518-0
5. An Introduction to the German Language and Culture for Communication, Updated Edition Lovik, Thomas A., J. Douglas Guy & Monika Chavez. Vorsprung -. New York, Houghton Mifflin Company, 1997/2002. ISBN 0-618-14249-5.

OUTCOMES:

On completion of the course, students will be able to

- Show their proficiency in German Language.
- Use appropriate vocabulary in real life contexts.
- Use appropriate grammatical forms while communicating with people.
- Effectively use the language in social and academic contexts.

LNC1183	JAPANESE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To train students to use appropriate vocabulary in academic and technical contexts.
- To facilitate students to speak effectively while exchanging ideas and making presentations.
- To develop their reading skill through sub skills like skimming, scanning and critical reading of a text.
- To sharpen their academic writing skills.
- To expose them to the correct usage of language and help them to apply that knowledge appropriately.

MODULE I **7**

Introduction of the Japanese writing system, i.e. *Hiragana*, *Katakana* and *Kanji*, word-building, writing foreign names and loan words in Katakana.

MODULE II **8**

Oral practice of pronunciation and intonation of Japanese sounds, Japanese greetings, self introduction, identifying things, time of the day, calendar; counting using Japanese numerical classifiers; describing things;

MODULE III **7**

Making comparisons; talking of daily activities, kinship terms used for address and reference, seasons, giving and receiving, shopping; making requests, talking of one's likes and dislikes.

MODULE IV **8**

Extensive practice of basic patterns at the lower intermediate level through drills and exercises.

MODULE V **7**

Comprehension of passages in simple Japanese and writing of composition in Japanese applying lower intermediate grammatical patterns.

MODULE VI **8**

Diverse texts based on Japanese culture, customs, history, food habits, and science etc, for the development of communicative competence of students; skimming, scanning of texts with emphasis on advanced sentence patterns, grammatical structures and idiomatic phrases, reading and writing of approximately

TOTAL HOURS :45

REFERENCES:

1. Nihongo I, Kokusaigakuyukai, and other supplementary material
2. Exersice book 1of Nihongo 1, and other supplementary material
3. Nippon, the Land and its People & Encyclopedia of Contemporary Japanese
4. Japani: Japanese Conversation for Improving Spoken Proficiency, By P.A. George, Inoue Yoriko and Itsuko Nandi, Books Plus.
5. Chukyu Nihongo, Tokyo Gaikokugo Daigaku; Nihongo II, Kokusaigakuyukai, and other supplementary material.

OUTCOMES:

After completion of the course, students will have the ability to

- Demonstrate their range of vocabulary in academic and technical contexts
- Exchange ideas and make presentations
- Comprehend and respond appropriately to listening tasks.
- Read a text efficiently and process information.
- Create and draft different kinds of academic documents
- Communicate effectively using grammatically correct expressions.

PHC 1181	PHYSICS	L	T	P	C
		3	0	2	4

OBJECTIVES:

To make students conversant with the

- basic concepts of crystal physics and its structures
- production and applications of ultrasonic waves
- study of thermal conductivities of good and bad conductors
- phenomenon of wave optics and its applications
- principle of fibre optic communication and its applications to sensors
- wave mechanics principle and its applications in electron microscopy
- green energy physics and its environmental impacts to society

MODULE I CRYSTAL PHYSICS **8**

Crystalline and amorphous solids – Unit Cell – Seven Crystal Systems – Bravais Lattice – Miller Indices – Interplanar Spacing – Characteristics of Unit Cell - Calculation of Number of atoms per unit cell, Atomic Radius, Coordination Number and Packing Factor for SC, BCC, FCC and HCP and Diamond structures –Defects in crystals-Point defects –Edge and screw dislocations and their significance - Surface Defects.

MODULE II ULTRASONICS AND THERMAL PHYSICS **8**

Introduction to Ultrasonics - Properties - Production methods - Magnetostriction Oscillator method- Piezoelectric Oscillator method – Detection of Ultrasonics – Thermal method – Piezoelectric method – Kundt's tube method – Applications of Ultrasonics – Acoustic Grating – SONAR – Depth of sea – Velocity of blood flow, Ultrasonic Flaw detector (qualitative).

Transmission of heat – Conduction, Convection and Radiation – Thermal Conductivity of good Conductor – Forbe's method- Thermal Conductivity of bad Conductor – Lee's Disc method.

MODULE III APPLIED OPTICS **8**

Interference – Air Wedge – Michelson's Interferometer – Determination of wavelength of light and thickness of thin transparent sheet.

Introduction to Laser – Characteristics of Laser – Spontaneous and Stimulated Emissions – Einstein's Coefficients - Population inversion – Pumping Mechanism – Laser Action – Types of Laser: He-Ne laser, CO2 laser and Nd:YAG laser - Applications : Laser Materials

Processing .

MODULE IV FIBRE OPTICS 7

Optical fibre – Principle and propagation of light in optical fibre – Numerical aperture and acceptance angle – Types of optical fibres – Attenuation – Absorption, Scattering losses, Bending losses and Dispersion in Optical fibres – Fiber Connectors and Couplers - Applications – Fibre optic communication system (block diagram only)- Fibre optic sensors - displacement and pressure sensors (qualitative) - Medical endoscope.

MODULE V QUANTUM MECHANICS 7

Black body radiation – Planck's theory of radiation – Deduction of Wien's displacement law and Rayleigh – Jean's law from Planck's theory –Dual nature of matter – de Broglie's wavelength- Physical significance of wave function – Schrodinger wave equation – Time independent and time dependent wave equation – Particle in one dimensional box – Harmonic oscillator(qualitative).

MODULE VI RENEWABLE ENERGY SOURCES 7

Present Energy sources and sustainability - Solar energy - Solar photovoltaics - Solar cells – Bioenergy - Biomass – production of liquid fuels from biomass – Wind energy – Wind turbines – energy and power from wind turbines - Geothermal energy - Ocean energy: Wave energy – Wave energy conversion devices – Tidal energy – Tidal power basics – power generation –Tidal energy potential – Environmental benefits and impacts of renewable energy sources

PRACTICALS

1. Determination of Velocity of Ultrasonic waves in a given liquid using Ultrasonic Interferometer.
2. Determination of wavelength of ultrasonic waves using Kundt's tube method.
3. Determination of thickness of a thin wire using Air Wedge method.
4. Determination of wavelength of light using spectrometer diffraction grating.
5. Determination of angle of divergence of a laser beam using He-Ne laser.
6. Determination of particle size of lycopodium powder using semiconductor laser.
7. Determination of wavelength of laser light using semiconductor laser diffraction.
8. Determination of Acceptance angle and Numerical Aperture using fiber optic cable.
9. Determination of thermal conductivity of a good conductor by Forbe's method.
10. Determination of thermal conductivity of a bad conductor by Lee's disc method.
11. Determination of solar cell characteristics.

L – 45; P – 30; TOTAL HOURS – 75

REFERENCES :

1. Gaur R.K. and Gupta S.L., “Engineering Physics’’, 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2013.
2. Palanisamy P.K., Physics for Engineers, Vol1 & Vol2, 2nd Edition, Scitech Publications, 2003.
3. Serway R.A. and Jewett, J.W. “Physics for Scientists and Engineers with Modern Physics”. Brooks/cole Publishing Co., 2010.
4. Tipler P.A. and Mosca, G.P., “Physics for Scientists and Engineers with Modern Physics”, W.H. Freeman, 2007.
5. Markert J.T., Ohanian. H. and Ohanian, M. “Physics for Engineers and Scientists”. W.W. Norton & Co. 2007.
6. Godfrey Boyle, “Renewable Energy: Power for sustainable future”, 2nd edition, Oxford University Press, UK, 2009.

OUTCOMES:

At the end of the course, students will be able to

- understand the different types of crystal structures
- apply the concept of ultrasonic principle in engineering and medical field
- calculate thermal conductivities of good and bad conductors
- differentiate the various laser systems and its applications in engineering and medical field
- apply the principle of fibre optics for communication and sensor applications
- formulate wave mechanics principle for applications in electron microscopy
- Correlate the different renewable energy sources for societal needs.
- To complement the knowledge acquired in the theory class.
- To correlate the experimental results for application.

CHC1181	CHEMISTRY	L	T	P	C
		3	0	2	4

OBJECTIVES:

The students should be conversant with

- the basic problems like hardness, alkalinity, dissolved oxygen associated with the water used for domestic and industrial purpose and treatment process involved.
- the synthesis, properties and applications of nanomaterials.
- the importance of renewable energy sources like solar, wind, biogas, biomass, geothermal, ocean and their limitations.
- the basic analytical techniques like UV-Visible, FT-IR, NMR, AAS, AES, Circular Dichroism and XRD etc.
- photochemistry concepts related to physical processes and chemical reactions induced by photon absorption and their applications.
- basic principles of electrochemistry, cell construction and evaluation and to understand general methodologies for construction & design of electrochemical cell

MODULE I WATER TECHNOLOGY 9

Impurities present in water, hardness : types of hardness, demerits of hard water in boilers, estimation of hardness by EDTA method (problems) – alkalinity : estimation of alkalinity (problems) – dissolved oxygen: estimation of dissolved oxygen – conditioning methods : external treatment method: – lime soda and zeolite process (principle only), Ion exchange process – Internal treatment : colloidal, carbonate, phosphate and calgon methods – drinking water: standards (BIS), treatment of domestic water {screening, sedimentation, coagulation, filtration, disinfection }– desalination: electrodialysis, reverse osmosis.

MODULE II NANOCHEMISTRY 6

Introduction – distinction between molecules, bulk materials and nanoparticles – classification based on dimension with examples – synthesis (top-down and bottom-up approach} : sol-gel, thermolysis (hydrothermal and solvothermal), electrodeposition, chemical vapour deposition, laser ablation – properties and applications (electronic, magnetic and catalytic) – risk factors and future perspectives.

MODULE III ENERGY SOURCES 8

Energy: past, today, and future – a brief history of energy consumption – present energy scenario of conventional and renewable energy sources – renewable energy : needs of renewable energy, advantages and limitations of renewable energy – solar energy: basics, solar energy in the past , photovoltaic, advantages and disadvantages – bioenergy: conversion, bio degradation, biogas generation, biomass gasifier, factors affecting biogas generation, advantages and disadvantages – geothermal energy: geothermal resources (hot dry rock and magma resources, natural and artificial), advantages and disadvantages – wind energy: wind resources, wind turbines, advantages and disadvantages – ocean energy: wave energy, wave energy conversion devices, ocean thermal energy, advantages and disadvantages.

MODULE IV PHOTOCHEMISTRY 7

Introduction: absorption and emission, chromophores, auxochromes – laws of photochemistry : Grotthus-Draper law, Stark Einstein law – quantum yield (problems) –photo physical processes : fluorescence and phosphorescence - Jablonski diagram (electronic states and transitions) – quenching, annihilation – photosensitization: principle and applications – chemiluminescence, bioluminescence.

MODULE V ANALYTICAL TECHNIQUES 7

Spectroscopy: electromagnetic radiation and spectrum – types of transitions – types of spectra (atomic and molecular with their chemical usefulness) – Beer-Lamberts law (problems) – principles, instrumentation and applications of: Colourimetry – UV-Vis spectrophotometer – atomic absorption spectroscopy – atomic emission spectroscopy – principles and applications of: IR, NMR, mass and X-ray diffraction analysis.

MODULE VI ELECTROCHEMISTRY 8

Electrochemistry - types of electrodes (principle and working) : gas (SHE), metal/metal ion electrode, metal-metal insoluble salt (calomel electrode), ion-selective (glass electrode and fluoride ion selective electrode) – Electrolytic and galvanic cells, construction of cell, EMF measurement and applications (problems), standard cell (Weston-cadmium), reversible and irreversible cell, concentration cell. Determination of fluoride ion using fluoride ion selective electrode – Chemically modified electrodes (CMEs) : concept, approaches and applications.

PRACTICALS

1. Estimation of hardness in given water sample.
2. Estimation of the alkalinity of the given water sample.
3. Estimation of strong acid by conductometry.
4. Estimation of Fe^{2+} present in the given sample by potentiometry.
5. Verification of Beer-Lamberts law and estimation of Cu^{2+} present in unknown sample.
6. Estimation of sodium and potassium present in the given sample by flame photometry.
7. Determination of molecular weight and degree of polymerisation of a polymer by viscosity method.
8. Synthesis of thermosetting polymer.

L – 45; P – 30; TOTAL HOURS – 75

REFERENCES:

1. S. Vairam, P. Kalyani and Suba Ramesh, “Engineering Chemistry”, Wiley India Ltd., New Delhi, 2011.
2. G.A. Ozin and A.C. Arsenault, “Nanochemistry: A Chemical Approach to Nanomaterials”, RSC Publishing, Thomas Graham House, Cambridge, 2005.
3. P.C Jain & Monica Jain, Engineering Chemistry Dhanpatrai Publishing Company (P) Ltd., New Delhi (2013).
4. S S Umare & S S Dara, A text Book of Engineering Chemistry, S. Chand& Company Ltd, New Delhi, 2014.
5. G.D.Rai, “Non conventional energy sources,” Khanna Publishers, New Delhi, 2011.
6. John Twidell and Tony Weir, “Renewable Energy Resources, Taylor & Francis Ltd, London, United Kingdom, 2005
7. Principles of molecular photochemistry: An introduction, Nicholas J. Turro, V.Ramamurthy and Juan C. Scaiano, University Science Books, Sausalito, CA, 2009.

OUTCOMES:

The students will be able to

- solve problems related to hardness, alkalinity, dissolved oxygen associated with the water and describe the treatment processes.
- classify nanomaterials and apply the nanochemistry approach to synthesize the

nanomaterials.

- explain the principle and enumerate the advantages and disadvantages of various renewable energy sources.
- state the principle and illustrate the instrumentation of various analytical techniques.
- apply the concepts of photochemistry to elaborate various photo-physical and photochemical reactions.
- construct a electrochemical cell and describe the various types of electrodes and determine the fluoride content.

GEC 1101	ENGINEERING GRAPHICS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To introduce the students of all engineering programs, the basic concepts of engineering drawing, which is the basic communication medium for all engineers
- To provide practical exposure on important aspects like drawing analytic curves, orthographic projections, section of solids, development of surfaces, isometric projection, perspective projection and free hand drawing.
- To introduce computerized drafting.

MODULE I BASICS AND ENGINEERING CURVES **10**

Drawing instruments, dimensioning, BIS conventions, types of lines, simple geometric constructions.

Conic sections: ellipse, parabola, hyperbola.

Special curves: cycloid, epicycloid, hypocycloid and involutes.

MODULE II ORTHOGRAPHIC PROJECTION **8**

Orthographic projection – first angle, second angle, third angle and fourth angle projections –setup - assumptions, principle. Free hand sketching of orthographic views of simple machine parts as per first angle projection. Orthographic projection of points in all quadrants. Some commands and demonstration of drafting packages.

MODULE III PROJECTION OF STRAIGHT LINES AND PLANES **10**

Projection of straight lines in first quadrant – true length and true inclinations – Rotating line and trapezoidal methods –traces of straight line.

Projection of plane lamina in first quadrant and its traces

MODULE IV PROJECTION OF SOLIDS **10**

Projection of solids in first quadrant: Axis inclined to one reference plane only- prism, pyramid, cone, cylinder – change of position and auxiliary projection methods.

MODULE V SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES **12**

Section of solids: prism, pyramid, cone, cylinder, and sphere – sectional view – true shape of section Solids in simple position and cutting plane inclined to one reference

plane only.

Development of surface of truncated solids: prism, pyramid, cone cylinder – frustum of cone, pyramid and simple sheet metal parts.

MODULE VI PICTORIAL PROJECTIONS 10

Isometric projection: Isometric scale – isometric axes- iso sheet - Isometric projection and view of prism, pyramid, cylinder, cone, frustums, truncated solids and simple products

Perspective projection: station point – vanishing point – Perspective projection and views of prism, pyramid, cylinder and frustums by Visual ray method.

L – 30; P – 30; TOTAL HOURS – 60

TEXT BOOKS:

1. N.D. Bhatt, ‘Engineering Drawing’ Charotar Publishing house, 53rd Edtion, (2014)

REFERENCES:

1. K.V. Natarajan, ‘A text book of Engineering Graphics’, Dhanalakshmi publishers, Chennai. (2009)
2. Venugopal. K, and V. Prabhu Raja, Engineering Graphics, New Age International (P) Ltd., Publication, Chennai. (2011)

OUTCOMES:

- Students should be able to read the specifications and standards of technical drawing and able to draw conic sections and special curves.
- Students should be able to understand the insight of orthographic projection and to draw the various views of orthographic projection of a point and various components.
- Students should be able to draw the orthographic views of straight lines and plane figures.
- Students should be able to draw the orthographic views of simple solids.
- Students should be able to draw the sections of solids and development of solid surfaces.
- Students should be able to draw the isometric and perspective projection of simple solids and components.

GEC 1102	ENGINEERING DESIGN	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To understand the role of design in Engineering
- To understand the basic design concepts
- To understand the role of innovation in design

MODULE I DESIGN AS A CENTRAL ACTIVITY IN ENGINEERING 08

Product design – products and processes – product design methodology Design of systems; Software design

MODULE II NEED ANALYSIS AND CONCEPT DEVELOPMENT 07

Voice of customers – product specification - need analysis Bench marking Product architecture – concept generation and evaluation;

MODULE III CASE STUDIES IN ENGINEERING DESIGN 08

Product design – process design; system design; software design -Ergonomics – usability

MODULE IV INNOVATION AND DESIGN 07

Role of innovation in Engineering – incremental changes and systemic changes; scientific approach to driving innovation – case studies.

TOTAL HOURS – 30

REFERENCES:

1. Clive L. Dym and David C. Brown,“Engineering Design: Representation and Reasoning”, 2nd Edition, Cambridge University Press, New Delhi, 2011.
2. Daniel G. Dorner, G. E. Gorman and Philip J. Calvert, “Information Needs Analysis: Principles and practice in information organizations”, Published by Faced Publishing, London. 2015.
3. Cliff Matthews, “Case Studies in Engineering Design”, John Wiley & Sons Pvt. Ltd, New York, 1998.
4. Bengt-Arne Vedin, “The Design-Inspired Innovation Workbook”, World Scientific, 2011.

5. Navi Radjou, Jaideep Prabhu and Simone Ahuja, “Jugaad Innovation”, Published by Random House India, 2012.

OUTCOMES:

The students will be able to

- Apply the basic knowledge of design in engineering products / process / service.
- Analyse the problems and give innovative solutions.
- Correlate the basic knowledge of design in the real world problems.
- Apply innovative approaches to engineering design.

GEC1103	BASIC ENGINEERING PRACTICES LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To provide a practical exposure to basic engineering practices like carpentry, fitting, plumbing, welding and making of simple electrical and electronic circuits
- To have an understanding on the use of various tools, instruments and methods
- To enable the students to appreciate the practical difficulties and safety issues

CIVIL ENGINEERING PRACTICE

1. Study of plumbing in general household and industrial systems
2. Making a small window frame with Lap and Mortise & Tenon Joints
3. Introduction to power tools

MECHANICAL ENGINEERING PRACTICE

1. Fabrication of a small Table frame with Butt, Lap and Fillet Joints
2. Machining of a simple component like a table weight using lathe
3. Mold preparation for simple component

ELECTRICAL ENGINEERING PRACTICE

1. Comparison of incandescent, Fluorescent, CFL and LED lamps.
2. Study of Protection Circuits (small relay, fuse, MCB, HRC, MCCB, ECCB).
3. Familiarization of households Electrical Gadgets (Iron Box, Wet Grinder).
4. Understanding of Domestic and Industrial wiring.
5. Earthing and its significance.
6. Troubleshooting in Electrical Circuits.
7. Study of inverter fed UPS/Emergency lamp

ELECTRONICS ENGINEERING PRACTICE

1. Identifications symbolic representation of active and passive electronic components
2. Soldering and tracing of electronic circuits and checking its continuity
3. Assembling of A.C. to D.C, D.C to A.C. Circuits in bread Board and Mini project.

TOTAL HOURS – 30

OUTCOMES:

Upon the completion of the course, students should be able to

- Appreciate the practical skills needed even in making of simple objects, assemblies and circuits
- Attend minor defects especially in items used in day to day life
- Aware of the safety aspects involved in using tools and instruments

GEC 1104	COMPUTER PROGRAMMING I	L	T	P	C
		1	0	2	2

OBJECTIVES:

- To identify the hardware and software components of the computer.
- To know the basic concept of operating system and get knowledge about different operating systems.
- To learn various database concepts and operations
- To develop efficient algorithms for solving a problem.
- To implement the algorithms in C language.
- To use arrays in solving problems.

MODULE I COMPUTER FUNDAMENTALS **7**

Introduction -. Number System - Planning the computer program - Computer Software - Basic operating system concepts - Database Operations

MODULE II PROGRAMMING IN C **8**

Introduction to C Programming Language – Operators - Control statements -Iterative statements - Arrays.

LIST OF EXPERIMENTS:

1. Computer organization –Hardware in a typical computer Identification – Booting- error messages and what it means
2. Types of Operating systems – Windows and Linux
3. Structure of a basic program - Hello world program – Debugging it
4. Data types: Type conversions
5. Input / Output: Formatted functions – Unformatted functions – Library functions
6. Properties of operators – Priority of operators – Arithmetic relational logical and bitwise operators
7. If – if else- nested if else- goto- switch case – nested switch case – for loops – nested for loops – while loop – do-while loop – break and continue statement
8. Arrays – Operation with arrays
9. Sorting and searching.

L – 15; P – 30; TOTAL HOURS – 45

REFERENCES:

1. Ashok N Kamthane, “Computer Programming”, Pearson Education, 2nd Edition, ISBN 13: 9788131704370, 2012
2. Paul J. Deitel, Deitel & Associates, “C How to Program”, Pearson Education, 7th Edition, ISBN-13: 978-0132990448, 2012

OUTCOMES:

Students who complete this course will be able to

- Recognize Modular design, logic flow, data abstraction
- Analyze the working of the programming constructs, functions, and I/O.
- Write down programs for sorting and searching algorithms
- Write down programs developing cycle for different applications
- Debug the programs and solve some practical problems in programming
- Develop programs using arrays.

SEMESTER II

MAC 1281	ADVANCED CALCULUS	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aims of this course are to

- train the students in solving problems using multiple integration.
- provide knowledge in using special functions to find out the area and volume of a region.
- acquire knowledge in tangent and normal vectors.
- gain knowledge in finding the areas of a curve and surface using vector integration.
- learn about the analytic functions and their properties along with bilinear transformation.
- know complex integration using Cauchy's theorems.

MODULE I MULTIPLE INTEGRATION AND ITS APPLICATIONS 8+2

Multiple integrals– Cartesian and Polar coordinates – change of order of integration – Multiple integral to compute area and volume.

MODULE II TRANSFORMATION OF COORDINATES AND SPECIAL FUNCTIONS 7+3

Change of variables between Cartesian, polar, cylindrical and spherical coordinates - Beta and Gamma functions – Properties and applications.

MODULE III VECTOR DIFFERENTIATION 7+3

Operations on vectors – Scalar Product, Vector Product, Projection of Vectors - Angle between two vectors - Gradient, divergence and curl

MODULE IV VECTOR INTEGRATION 8+2

Line, surface and volume integrals – Green's Theorem, Gauss Divergence Theorem and Stokes Theorem (statement only) – verification and evaluation of integrals.

MODULE V

ANALYTIC FUNCTION 8+2

Analytic function - Necessary and Sufficient condition (statement only) – Cauchy-Riemann equations in polar coordinates - properties of analytic function – determination of analytic function – conformal mapping (w = z+a, az and 1/z) and bilinear transformation.

MODULE VI COMPLEX INTEGRATION **7+3**

Statement and application of Cauchy's integral theorem – Cauchy's integral formula – Taylor's series and Laurent's series expansion – singularities - classification – residues - Cauchy's residue theorem – contour integration – Unit circle and semi circular contours (excluding poles on the real axis).

L – 45; T – 15; TOTAL HOURS – 60

TEXT BOOKS:

1. Veerarajan.T., "Engineering Mathematics "(5th edition) Tata Mc Graw Hill Publishing Co. New Delhi, 2012
2. Grewal B.S., "Higher Engineering Mathematics" (43rd edition), Khanna Publishers, New Delhi, 2012.
3. John W. Cell "Engineering Problems Illustrating Mathematics" Mc Graw Hill Publishing Co., New York 1943

REFERENCES:

1. Kreyszig, E., "Advanced Engineering Mathematics", 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
2. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th edition, Cengage Learning, 2011.
3. Dennis G. Zill, Warren S. Wright, "Advanced Engineering Mathematics", 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
4. Alan Jeffrey, "Advanced Engineering Mathematics", Academic Press, USA, 2002.
5. Ramana, B.V., "Higher Engineering Mathematics" Tata Mc Graw Hill Publishing Co. New Delhi, 2006.
6. Venkataraman, M.K., "Engineering Mathematics", Volume 2, 2nd edition, National Publishing Co., Chennai, 2003.
7. James Stewart ".Calculus" (7th edition),Brooks/Cole cengage learning,UK.

OUTCOMES:

After completing the course, student will be able to

- compute the area and volume using multiple integrals.

- apply special functions to solve integration problems.
- apply differentiation in scalar and vector fields.
- find area and volume of a region using vector integration.
- verify analyticity, conformity and bilinearity of complex functions.
- evaluate complex integrals.

GEC 1211	BASIC ENGINEERING MECHANICS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To impart knowledge about the basic laws of statics and dynamics and their applications in problem solving
- To acquaint both with scalar and vector approaches for representing forces and moments acting on particles and rigid bodies and their equilibrium
- To give on exposure on inertial properties of surfaces and solids
- To provide an understanding on the concept of work energy principle, friction, kinematics of motion and their relationship

MODULE I VECTOR APPROACH TO MECHANICS **07**

Introduction - Units and Dimensions- Vectors – Vectorial representation of forces and moments –Vector Algebra and its Physical relevance in Mechanics - Laws of Mechanics – Parallelogram and triangular Law of forces -Lame's theorem, Coplanar Forces – Resolution and Composition of forces- Equilibrium of a particle.

MODULE II EQUILIBRIUM OF PARTICLE **06**

Forces in space - Equilibrium of a particle in space - Equivalent systems of forces – Principle of transmissibility – Single equivalent force

MODULE III EQUILIBRIUM OF RIGID BODY **06**

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis –Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem - Equilibrium of Rigid bodies in two dimensions -Examples

MODULE IV PROPERTIES OF SURFACES **08**

Determination of Areas – First moment of area and the Centroid of sections – Rectangle, circle, triangle from integration – T section, I section, Angle section, Hollow section by using standard formula – second and product moments of plane area – Physical relevance - Rectangle, triangle, circle from integration - T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia- Mass moment of Area

MODULE V FRICTION 08

Introduction to friction- types of friction- Laws of Coloumb friction- Frictional force – simple contact friction – Rolling resistance –ladder friction

MODULE VI LAWS OF MOTION 10

Review of laws of motion – Newton's law – Work Energy Equation of particles– Impulse and Momentum – Impact of elastic bodies.

L – 45; T – 15; TOTAL HOURS – 60

REFERENCES:

1. Beer, F.P and Johnston Jr. E.R, "Vector Mechanics for Engineers, Dynamics & Statics", Third SI Metric Edition, Tata McGraw-Hill International Edition, 2001.
2. Hibbeller, R.C., Engineering Mechanics, Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., 2000.
3. Irving H. Shames, Engineering Mechanics – Statics and Dynamics, IV Edition Pearson Education Asia Pvt. Ltd., 2003.

OUTCOMES:

On completion of this course students should be able

- Analyse and resolve forces, moments and solve problems using various principles and laws of Mechanics
- Apply the concept of equilibrium to particles and solve problems
- Apply the concept of equilibrium to rigid bodies and solve problems
- Analyse and determine the properties of surfaces
- Analyse and evaluate the fractional forces between the bodies
- Apply the laws of motion in solving dynamics problems

GEC 1212	ENVIRONMENTAL STUDIES	L	T	P	C
		2	0	0	2

OBJECTIVES:

The student will be conversant with the

- various natural resources, availability, utilisation and its current scenario
- different ecosystems, energy transfer, values, threats and conservation of biodiversity
- levels of different pollutants and its impact and the causes and effects of natural disasters
- impacts of human population, impact assessment, human rights and environmental acts and sustainable development

MODULE I NATURAL RESOURCES **8**

Land resources: land degradation, soil erosion and desertification - Forest resources: use and over-exploitation, deforestation - Water resources: use and over-utilisation of surface and ground water, conflicts over water (inter-state and international), dams (benefits and problems), water conservation (rainwater harvesting and watershed management) - Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources, mining - Food resources: world food problems, changes in land use by agriculture and overgrazing, modern agriculture and its effects, fertilizer and pesticide problems, water logging and salinity - Energy resources: increasing energy needs, renewable and non-renewable, use of alternate energy sources.

MODULE II ECOSYSTEM AND BIODIVERSITY **8**

Ecosystem- energy flow in the ecosystem - food chains, food webs and ecological pyramids - characteristics, structure and function of (a) Terrestrial ecosystems (forest, grassland, desert) and (b) Aquatic fresh water ecosystems (pond, lake, river) (c) Aquatic salt water ecosystems (ocean, estuary) - ecological succession.

Biodiversity - genetic, species and ecosystem diversity – hot-spots of biodiversity – biogeographic classification of India - endangered, endemic, extinct and invasive species of India - red data book - values of biodiversity: consumptive, productive, social, ethical, aesthetic and option values - threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts - conservation of biodiversity: in-situ and ex-situ conservation of biodiversity

MODULE III ENVIRONMENTAL POLLUTION AND NATURAL DISASTER **8**

Definition, cause, effects and control measures of (a) air pollution (b) water pollution (c) soil pollution (d) marine pollution (e) noise pollution (f) thermal pollution (g) nuclear hazards - ill-effects of fireworks and upkeep of clean environment - solid waste management: types (urban, industrial, biomedical and electronic wastes), collection, processing and disposal (incineration, composting and land-fill) - natural disaster and management: flood, cyclone, drought, landslide, avalanche, volcanic eruptions, earthquake and tsunami.

MODULE IV HUMAN POPULATION, HEALTH AND SOCIAL ISSUES **6**

Population and population growth, population variation among nations, population explosion, family welfare programme.

Human health: air-borne, water borne diseases, infectious diseases, risks due to chemicals in food and environment.

Sustainable development - environmental legislation and laws: water act, air act, wildlife protection act, forest conservation act, environment protection act - environmental impact assessment, steps in EIA - human rights - women and child welfare.

Case studies related to current situation

TOTAL HOURS – 30

TEXT BOOKS:

1. Erach Bharucha, Textbook for Environmental Studies For Undergraduate Courses of all Branches of Higher Education for University Grants Commission, Orient Blackswan Pvt Ltd, Hyderabad, India, 2013.
2. Benny Joseph, Environmental Studies, Tata McGraw-Hill Education, India, 2009.
3. Ravikrishnan A, Environmental Science and Engineering, Sri Krishna Publications, Tamil Nadu, India, 2015.
4. Raman Sivakumar, Introduction to Environmental Science and Engineering, McGraw Hill Education, India, 2009.
5. Venugopala Rao P, Principles of Environmental Science and Engineering, Prentice Hall India Learning Private Limited; India, 2006.
6. Anubha Kaushik and Kaushik C.P., Environmental Science and Engineering,

New Age International Pvt Ltd., New Delhi, India, 2009.

REFERENCES:

1. Masters G.M., Introduction to Environmental Engineering and Science, Prentice Hall, New Delhi, 1997.
2. Henry J.G. and Heike G.W., Environmental Science and Engineering, Prentice Hall International Inc., New Jersy, 1996.
3. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co. Boston, USA, 2016.

OUTCOMES:

The student will be able to

- predict the scenario of various natural resources and suggest remedies to curb the exploitation of these resources.
- identify food chain and web and its role in various ecosystems, assess the impacts on biodiversity and provide solutions to conserve it.
- analyse the impacts of pollutants in the environment and propose suitable method to alleviate the pollutants and the natural disasters.
- assess on the impact of human population and the health related issues and the ethics to be followed for sustainable life.

GEC 1213	COMPUTER PROGRAMMING II	L	T	P	C
		1	0	2	2

OBJECTIVES:

- To provide knowledge about the benefits of Object Oriented Programming over Procedure oriented programming.
- To learn various File operations
- To expose fundamental concepts of object-oriented programming in classes, invoking methods and functions.
- To prepare students to get full use of code reusability using object oriented programming.
- To implement the basic concepts of object oriented programming using C++concepts.
- To focus on solving problems based on analyzing, designing and implementing programs in C and C++.

MODULE I PROGRAMMING IN C 7

Functions - Storage Classes - Structures and Unions – Pointers -Self Referential Structures and Linked Lists - File Processing.

MODULE II PROGRAMMING IN C++ 8

Programming in C++ - Overview of OOP in C – Inheritance - Polymorphism - Type Casting – Exceptions.

LIST OF EXPERIMENTS:

1. Functions
2. One dimensional arrays, Pointers
3. Recursion
4. Multi dimensional arrays, Linked lists.
5. Operating on Files.
6. Simple C++ program with Control statements.
7. Getting input from user console.
8. Classes, Object and Constructors.
9. Method overloading.
10. Inheritance

L – 15; P – 30; TOTAL HOURS – 45

REFERENCES:

1. Bjarne Stroustrup," The C++ Programming Language", Addison Wesley, 4th edition, ISBN-13: 978-0321563842, 2013.
2. Brian W. Kernighan and Dennis M. Ritchie, " The C Programming Language", Prentice Hall, ISBN 0-13-110362-8, 2015.
3. Bjarne Stroustrup, " Programming: Principles and Practice Using C++ ", Addison Wesley, 2nd edition, ISBN-13: 978-0321992789, 2014.
4. Brian W. Kernighan and Dennis M. Ritchie, " The C Programming Language (Ansi C Version)", Prentice Hall India Learning Private Limited, 2nd edition, ISBN-13: 978-8120305960, 1990.

OUTCOMES:

Students who complete this course will be able to

- Develop efficient algorithms for solving problems
- Handle files in C
- Use simple data structures like arrays and linked lists in solving problems.
- Write simple programs using concepts of object oriented programming.
- Implement algorithms in C++ Language.
- Demonstrate the Object Oriented Programming concepts applied in networking, web development and Database applications.

EEC1281	AUTOMOBILE ELECTRICAL ENGINEERING	L	T	P	C
		2	0	0	2

OBJECTIVES:

To impart knowledge on

- Basic concepts of electrical circuits and their solutions
- Principle of operationand applications of engine starting systems
- Basics of charging systems
- Concepts of Transformers and Induction motors.

MODULE I DC AND AC CIRCUITS 8

Ohm's law and its limitations .Kirchhoff's laws and its applications. Analysis of series, parallel and series-parallel resistive circuits. Power and Energy in such circuits. Generation of sinusoidal AC voltage, definition of average value, R.M.S value, form factor, peak factor. Phase and phase difference of sinusoidal varying voltage and current. Definition of real power, reactive power, apparent power and power factor -. The relationship between line and phase voltage & currents in balanced 3phase Star and Delta connections - Illustrative Examples

MODULE II ENGINE STARTING SYSTEMS 7

Requirements of the starting system-Choosing a starter motor -Starter motors and circuits: Starting system circuits -Principle of operation of starter motor - DC motor characteristics - Types of starter motor: Inertia starters - Pre-engaged starters - Permanent magnet starters - Heavy vehicle starters -Integrated starters.

MODULE III AUTOMOBILE CHARGING SYSTEMS 7

Basic principles - Charging voltages -Alternators and charging circuits- Generation of electricity - Rectification of AC to DC -Regulation of output voltage - Charging circuits.

MODULE IV TRANSFORMER AND INDUCTION MOTORS 8

Principle of operation and construction and types of single phase transformers.E.M.F equation, - voltage regulation. Three Phase Induction Motor: Principle of operation, constructional features, types, slip and its significance. Applications of squirrel- cage and slip-ring motors, Star Delta starter. Single phase Induction Motor: Principle of operation and applications.

TOTAL HOURS – 30

REFERENCES:

1. Edward Hughes, “Electrical and Electronics Technology”, Pearson India, 9th Edition, 2007.
2. D P Kothari and I J Nagrath, “Basic Electrical Engineering”, McGraw Hill Publishing Co. Ltd., 2nd Edition, 2002.
3. Cotton H, Electrical Technology, Pitman, 2004.
4. B L Theraja and A K Theraja, “A textbook of Electrical Technology”, S.Chand, 2005.
5.Tom Denton “Automobile Electrical and Electronic Systems” Elsevier Butterworth-Heinemann,Third edition, 2004

OUTCOMES:

On completion of this course, the student will be familiar with

- Demonstrate the basics of Electrical circuits and their solution methods.
- Understand the working of starter- motors.
- Explain the structure of Engine starting systems.
- Understand the working of automobile charging system.
- Understand the concept of Voltage Regulation.
- Explain the operation of Transformers and Induction motors

AUC 1211	APPLIED FLUID MECHANICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the properties of the fluid.
- To understand and solve the fluid flow problems.
- To understand the mathematical techniques of practical flow problems.
- To understand the energy exchange process in fluid machines.

MODULE I FLUID PROPERTIES AND HYDROSTATICS 8

Fluid properties: Mass density, specific weight, specific volume, specific gravity, viscosity, vapour pressure, compressibility, surface tension and capillarity. Fluid statics: fluid pressure at a point, variation of pressure within a static fluid, hydrostatic law - Pressure head, Pascal's law. Measurement of pressure - Piezometric tube, manometry.

MODULE II FLUID DYNAMICS 8

Control volume – Fluid Kinematics - Types of flows; Steady flow, Unsteady flow, Uniform and Non Uniform flow, Rotational flow, Irrotational flow, 1-D, 2-D, 3-D flows– Streamline and Velocity potential lines- Euler and Bernoulli's equations and their applications – moment of momentum – Momentum and Energy correction factors – Impulse – Momentum equation-Navier-Stokes Equations-Applications.

MODULE III OPEN CHANNEL FLOW 7

Flow through pipes – Open Channels and Measurement pipe flow: Darcy's law – Minor losses – Multi reservoir problems – pipe network design – Moody's diagram – Hagen Poiseuille equation – Turbulent flow. Specific Energy – Critical flow concept – specific force – Hydraulic jump – uniform flow and gradually varying flow

MODULE IV DIMENSIONAL ANALYSIS 7

Dimensional homogeneity – Raleigh and Buckingham theorems – Non-dimensional numbers – Model laws and distorted models-Unit quantities-Specific quantities

MODULE V BOUNDARY LAYERS 8

Boundary layer development on a flat plate and its characteristics - Boundary layer thickness, displacement thickness, momentum thickness, energy thickness .Momentum equation for boundary layer by Vonkarman, drag on flat plate, boundary layer separation and its control. Aerofoil theory, lift and drag coefficients, stream lined and bluff bodies.

MODULE VI TURBOMECHINERY 7

Hydraulic turbine: Classification, difference between impulse and reaction turbine. Construction and working of Pelton turbine, Francis turbine and Kaplan turbine, velocity triangle, heads and efficiencies. Pumps: classification, difference between positive and non-positive displacement pumps. construction and working of reciprocating pump. Centrifugal pump-heads of a centrifugal pump, priming, velocity triangle, work done, efficiencies of centrifugal pump.

TOTAL HOURS – 45

TEXT BOOKS:

1. Rajput.R.K, “A text book of Fluid Mechanics and Hydraulic Machines”, S. Chand & Company Ltd., New Delhi, Fourth edition, 2010.
2. Dr.R.K. Bansal, (2000), Fluid Mechanics and Hydraulic Machines, Laxmi Publication (P) Ltd., New Delhi.

REFERENCES:

1. P.N.Modi and S.M.Seth (1999), Hydraulics and Fluid Mechanics including Hydraulic Machines, Standard Book House, Naisarak, Delhi.
2. Vijay Gupta and S.K.Gupta, (1999), Fluid Mechanics and Applications, New-Age International Ltd.
3. D.S. Kumar,(2004), Fluid Mechanics and Fluid Power Engineering, Katson Publishing House, Delhi.

OUTCOMES:

Student will be able to

- To find frictional losses in a pipe when there is a flow between two places.
- Calculate the conjugate depths in a flow.

- Analyse the model and the prototype.
- Find the dependent and independent parameters for a model of fluid flow.
- Explain the various methods available for the boundary layer separation.

AUC1212	FUELS AND LUBRICANTS LAB	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To understand the fuel properties
- To learn the behavior of viscosity liquid fuels
- To examine the ash content, carbon residue, flash and fire point of fuels
- To examine properties of liquid and gaseous fuel.

LIST OF EXPERIMENTS:

1. ASTM distillation test of liquid fuels
2. Aniline Point test of diesel
3. Calorific value of liquid fuel.
4. Calorific value of gaseous fuel.
5. Reid vapour pressure test.
6. Flash and Fire points of petrol and diesel.
7. Copper strip Corrosion Test
8. Temperature dependence of viscosity of lubricants & Fuels by Redwood Viscometer.
9. Viscosity Index of lubricants & Fuels by Saybolt Viscometer
10. Ash content and Carbon Residue Test

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Brame, J.S.S. and King, J.G. – "Fuels Solids, Liquids, Gaseous". Edward Arnold, 1961
2. Francis, W, "Fuels and Fuel Technology", Vol. I & II, Pergamon, 1965
3. Hobson, G.D. & Pohl.W "Modern Petroleum Technology", 1974
4. Lansdown. A.R., Lubrication, "A practical guide to lubricant selection", Pergamon press, 1982.
5. Raymond. C. Gunther, "Lubrication", Chilton Book Co., 1971.

OUTCOMES:

After completion of this course the students should be able to

- Analyze the viscosity, flash point, fire point and Reid vapour pressure of liquid fuel.
- Determine calorific value of liquid and gaseous fuel.

- Analyze of cloud and pour point of liquid fuel and copper strip corrosion.
- Determine the aniline point of given liquid fuel.

EEC1282	AUTOMOBILE ELECTRICAL ENGINEERING LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To understand, simulate and verify Ohm's Law and Kirchhoff's Laws theorem.
- To understand and verify the characteristics of various Electrical Machines
- To fabricate the interfacing and power supply circuits.
- To understand the battery chargers

LIST OF EXPERIMENTS:

1. Verification of Ohm's Law and Kirchhoff's Laws using MATLAB.
2. Power and power factor measurement using two wattmeter method.
3. Load Test on DC Shunt Motor.
4. Load Test on DC Series Motor
5. Load Test on Single Phase Transformer
6. Load Test on Three Phase Induction Motor.
7. Three phase transformer connections.
8. Fabrication of IC78XX based Regulated power supply.
9. Fabrication of opto - Isolator based transistor- relay driver circuit.
10. Study of battery chargers.

TOTAL HOURS –30

OUTCOMES:

At the end of the course, the student should be able to

- Construct and simulate any given simple electric circuits and verify theorems using MATLAB.
- Study and understand the performance of Electrical Machines.
- Fabricate the power supplies.
- Design the relay driver stage.
- Implement the opto - coupler circuits.
- Analyse the battery charging system.

SEMESTER - III

MAC 2181	PARTIAL DIFFERENTIAL EQUATIONS AND TRANSFORMS	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aims of this course are to

- Familiarize In Solving Partial Differential Equation Of First, Second And Higher Orders.
- Introduce Basics And Engineering Applications Of Fourier Series, Laplace Transform, Fourier Transform And Z- Transform.

MODULE I PARTIAL DIFFERENTIAL EQUATIONS 8+2

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solution of standard types of first order partial differential equations – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients.

MODULE II FOURIER SERIES 8+2

Fourier Series and Dirichlet's conditions - General Fourier series - Half range Fourier series - Parseval's identity - Harmonic Analysis.

MODULE III FOURIER TRANSFORMS 7+3

Fourier integral theorem (without proof) - Fourier transform pair - Fourier Inverse Transform – Properties - Convolution theorem - Parseval's identity.

MODULE IV APPLICATIONS OF FOURIER SERIES AND FOURIER TRANSFORMS 7+3

Applications of Fourier series and Fourier Transform to solution of PDEs having constant coefficients with special reference to Heat & Wave equations, Discrete & point Spectrum and Single pulse.

MODULE V LAPLACE TRANSFORM 8+2

Introduction to Laplace transform - Existence of Laplace Transform - Properties of Laplace Transforms - Initial & Final Value Theorems - Inverse Laplace Transform - Convolution Theorem – Circuits to signal square wave: Integral equations with unrepeated complex factors – Damped forced vibrations: repeated complex factors – Resonance - Solution of differential equations

MODULE VI Z – TRANSFORM 7+3

Introduction and Definition of Z-transform - Properties of Z- Transform - Convolution Theorem of Z-Transform - Inverse Z–transform - Convolution Theorem of Inverse Z-Transform - Formation of difference equations - Solving Difference Equations using Z-Transform.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Kreyszig .E., “Advanced Engineering Mathematics“, 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
2. Grewal B.S., “Higher Engineering Mathematics”, 42nd edition, Khanna Publishers, New Delhi, 2012.
3. Ramana, B.V, “Higher Engineering Mathematics” Tata Mc Graw Hill Publishing Co. New Delhi, 2006.

REFERENCES:

1. Veerarajan.T., “Engineering Mathematics“, 5th edition, Tata Mc Graw Hill Publishing Co. New Delhi, 2012.
2. Peter V. O'Neil, “Advanced Engineering Mathematics**”**, 7th edition, Cengage Learning, 2011.
3. Dennis G. Zill, Warren S. Wright, “Advanced Engineering Mathematics”, 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
4. Alan Jeffrey, “Advanced Engineering Mathematics”, Academic Press, USA, 2002.

OUTCOMES:

After completing the course, student will be able to

- Solve The Partial Differential Equations.
- Derive A Fourier Series Of A Given Periodic Function By Evaluating Fourier Coefficients.
- Apply Integral Expressions For The Forward And Inverse Fourier Transform To A Range Of Non-Periodic Waveforms.
- Solve Wave Equation And Heat Flow Equation.
- Solve Ordinary Differential Equations Using Laplace Transform.
- Solve Difference Equation Using Z-Transform.

AUC 2101	APPLIED THERMAL ENGINEERING	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To gain knowledge on the concept of systems and energy transfer
- To understand analyze and apply the basic laws of thermodynamics
- To understand the principle of steam power cycle and its improvement
- Perform air-standard analysis of IC engines based cycle and Refrigeration cycle
- To understanding of basic concept of hear transfer
- To learn the fundamental concepts of heat exchanger.

MODULE I BASIC CONCEPT AND FIRST LAW 8+2

Basic concepts - concept of continuum, macroscopic approach, types of thermodynamic systems. Property, state, path and process, quasi-static process, work, modes of work, Zeroth law of thermodynamics – concept of temperature and heat. Concept of ideal and real gases. First law of thermodynamics – application to closed and open systems, internal energy, specific heat capacities, enthalpy, steady flow process with reference to various thermal equipment.

MODULE II SECOND LAW, ENTROPY AND AVAILABILITY 8+3

Second law of thermodynamics – Kelvin's and Clausius statements of second law. Reversibility and irreversibility. Carnot cycle, reversed carnot cycle, efficiency, COP. Thermodynamic temperature scale, Clausius inequality, concept of entropy, entropy of ideal gas, principle of increase of entropy – Carnot theorem, absolute entropy, availability, Concept of Exergy analysis.

MODULE III P R O P E R T I E S OF PURE SUBSTANCE AND VAPOUR PROCESSES 8+2

Properties of pure substances – Thermodynamic properties of pure substances in solid, liquid and vapour phases, phase rule, P-V, P-T, T-V, T-S, H-S diagrams, PVT surfaces, thermodynamic properties of steam. Calculations of work done and heat transfer in non-flow and flow processes.

MODULE IV VAPOR AND GAS CYCLES 8+3

Rankine Cycle - Rankine Cycle Efficiency - Reheat Cycle- Regenerative Cycle - Vapor Refrigeration Cycle - Air-Standard Cycle - Otto Cycle - Diesel Cycle - Brayton Cycle - Regenerative Brayton Cycle - Combined Cycle - Gas Refrigeration Cycle

MODULE V CONDUCTION, CONVECTION AND RADIATION 6+2

Modes of heat transfer, Heat conduction in parallel, radial and composite wall - Basics of Convective heat transfer. Fundamentals of Radioactive heat transfer

MODULE VI HEAT EXCHANGERS 7+3

Nusselt's theory of condensation - Regimes of Pool boiling and Flow boiling. Correlations in boiling and condensation. Heat Exchanger Types - Overall Heat Transfer Coefficient - Fouling Factors - Analysis - LMTD method - NTU method.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Nag.P.K., "Engineering Thermodynamics",5th ed, Tata McGraw-Hill(2013). 1998.
2. Cengel, "Thermodynamics An Engineering Approach", 8th Edition – 2015, Tata McGraw Hill, New Delhi.

REFERENCES:

1. Holman.J.P., "Thermodynamics", 3rd Edition McGraw-Hill, 1995.
2. Natarajan. E., "Engineering Thermodynamics" Anuragam Publications, Chennai, 2012.
3. Arora C.P, " Thermodynamics", Tata McGraw-Hill, New Delhi.
4. Merala C, Pother, Craig W, Somerton, "Thermodynamics for Engineers", Schaum Outline Series, Tata McGraw-Hill, New Delhi.
5. Sri Vastava R.C, Saha S. K, Jan A. K, "Thermodynamics" Prentice Hall of India, New Delhi.

OUTCOMES:

The Student Should Be Able To

- Conceptualize and apply the first of thermodynamics to any real life situation
- Conceptualize and apply the second of thermodynamics to any real life situation
- Apply the knowledge for design of air conditioning system
- Design and analyze gas power cycles
- Synthesize and utilize thermodynamic relations for practical problems solving
- Design and analyze heat exchanger

AUC 2102	VEHICLE BODY ENGINEERING	L	T	P	C
		2	0	0	2

OBJECTIVES:

- The students can impart knowledge in construction of car body, design criteria, types of car and safety aspects of car.
- The students able to know the construction of bus body and dimensions of bus body and safety aspects.
- The students can impart knowledge in types of commercial vehicles; design of cab and in aerodynamic testing, forces and moments.
- The student will be well versed in the design and construction of external body of the vehicles and materials used in vehicles.

MODULE I CAR BODY DETAILS 7

Types of Car body - Saloon, convertibles, Limousine, Estate Van, Racing and Sports car – Visibility regulations, driver's visibility, improvement in visibility and tests for visibility. Driver seat design -Car body construction-Various panels in car bodies. Car body construction; design criteria. Crash tests on full scale model, Dummies and Instrumentation. Safety aspect of car body.

MODULE II BUS BODY DETAILS 8

Types of bus body: based on capacity, distance traveled and based on construction. Bus body lay out for various types, floor height, engine location, entrance and exit location, seating dimensions. Types of metal sections used – Regulations – Constructional details: Conventional and integral.

MODULE III COMMERCIAL VEHICLE DETAILS 7

Types of commercial vehicle bodies - Light commercial vehicle body. Construction details of commercial vehicle body - Flat platform body, Trailer, Tipper body and Tanker body, Drivers cab design - Regulations.

MODULE IV BODY MATERIALS AND BODY REPAIR 8

Types of materials used in body construction-Steel sheet, timber, plastics, GRP, properties of materials. Hand tools-power tools-panel repair-repairing sheet metal-repairing plastics-body fillers-passenger compartment service- corrosion and Anticorrosion methods. Modern painting process procedure-paint problems and Body trim items-body mechanisms.

Total Hours – 30

TEXT BOOKS:

1. Powloski, J., "Vehicle Body Engineering", Business Books Ltd., 1998.
2. James E Duffy, "Body Repair Technology for 4-Wheelers", Cengage Learning, 2009.

REFERENCES:

1. Giles, G.J., "Body construction and design", Illiffe Books Butterworth & Co., 1991.
2. John Fenton, "Vehicle Body layout and analysis", Mechanical Engg. Publication Ltd., London, 1992.
3. Braithwaite, J.B., "Vehicle Body building and drawing", Heinemann Educational Books Ltd., London.
4. Dieler Anselm., The passenger car body, SAE International, 200

OUTCOMES:

- The students will able to know design of car body and identify the car body parts in a vehicle.
- The students will able to evaluate about different aspects of car body and bus body, types, commercial vehicle.
- The students will able to analyze the Role of various aerodynamic forces and moments, measuring instruments.
- The students will able to evaluate about different aspects of car body and bus body, types, commercial vehicle.
- The students able to find the material which can be used in car body, bus body of an automobile vehicle.
- The students will able to know painting process for a commercial vehicle and tools used for body repairs.

AUC 2103 BASIC MANUFACTURING PROCESS

L	T	P	C
2	0	2	3

OBJECTIVES:

- To know about the functions of lathe machine and casting process
- To study about the types of welding process and sheet metal forming process
- To know about forging, Rolling and Extrusion process with its applications
- To understand the methods shaping of plastics and powder metallurgy components.

MODULE I LATHE MACHINE AND CASTING PROCESS 8

Lathe Machine: Function of lathe, parts of lathe and Operations performed on lathe machine. Casting Process, Sand casting process, pattern types, pattern allowance, properties of Moulding sand, Cupola furnace, Shell casting and die casting process.

MODULE II WELDING AND SHEET METAL FORMING PROCESS 7

Welding Process: Types of welding- Gas welding, Arc Welding, Resistance welding, MIG and TIG welding . Sheet metal forming Process: Sheet metal forming operations, Hydro forming, Super plastic forming and Explosive forming.

MODULE III FORGING, ROLLING AND EXTRUSION PROCESS 8

Forging process: Open and closed die forging, Types of forging operations Rolling process; Types of rolling mills , Extrusion process: Forward and Backward Extrusion, Principle of rod and wire drawing

MODULE IV SHAPING OF PLASTICS AND POWDER METALLURGY 7

Thermosetting and Thermoplastics, Blow moulding , Injection moulding . Compression and transfer moulding. Powder metallurgy: Steps followed in powder metallurgy, applications.

LAB EXPERIMENTS: **30**

- Turning, Step turning and step turning
- Single start V thread and knurling
- Internal key cutting by slotter
- Many holes on a circular plate with tapping operations.
- Sand Casting : Dumble and Flange mould
- Welding: Different joints welding

- Tray and funnel from sheet metal
- Forging: Fan hook and desired polygon shape.

Total Hours – 60 Hours

TEXT BOOKS:

1. Hajra Choudhury, Elements of Workshop Technology, Vol. I and II, Media Promotors Pvt Ltd., Mumbai, 2007
2. Serope Kalpajian, Steven R.Schmid, Manufacturing Engineering and Technology, Pearson Education, Inc. 2006

REFERENCES:

1. B.S.MegendranParashar & R.K..Mittal, Elements of Manufacturing Processes, Prentice Hall of India, 2003.
2. P.N. Rao, Manufacturing Technology,Tata McGraw-Hill Publishing Limited, IInd Edition, 2009
3. P.C. Sharma, S. Chand and Company, A Text Book of production technology, Xth Edition, 2008
4. Begman, John Wilely & Sons, Manufacturing Process, VIIIth Edition, 1999]

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OUTCOMES:

- Able to do various operations using lathe machine and produce components by casting process.
- Able to make component by welding and sheet metal forming process
- Able to produce component by forging process
- Understand the principle of sheet metal forming operations and able to produce component by sheet metal forming process

AUC 2104 STRENGTH OF MATERIALS

L	T	P	C
3	1	0	4

OBJECTIVES:

- To gain knowledge of simple stresses, strains and deformation in components.
- To assess stresses and deformations through mathematical models of beams, twisting bars or combinations of both.
- Effect of component dimensions and shape on stresses and deformations are to be understood.
- To gain knowledge in the torsion of circular bars.
- To analyze the two dimensional stresses.
- The study would provide knowledge for use in the design courses.

MODULE I STRESS, STRAIN AND DEFORMATION OF SOLIDS 7+2

Rigid and Deformable bodies – Strength, Stiffness and Stability – Stresses; Tensile, Compressive and Shear – Deformation of simple and compound bars under axial load – Thermal stress.

MODULE II LOADS AND STRESSES IN BEAMS 9+2

Types of beams: Supports and loads – Shear force and Bending Moment in beams – Cantilever and simply supported – Stresses in beams – Theory of simple bending – Stress variation along the length and in the beam section

MODULE III DEFLECTION OF BEAMS 7+3

Evaluation of beam deflection and slope: Double integration method, Macaulay ethod and Moment-area method.

MODULE IV TORSION 7+2

Analysis of torsion of circular bars – Bars of Solid and hollow circular section – Stepped shaft – Twist and torsion stiffness.

MODULE V APPLICATION OF TORSION AND BEAM DEFLECTION 8+3

Application to close-coiled helical springs – Maximum shear stress in spring section including Wahl Factor – Deflection of helical coil springs under axial loads – Columns – End conditions – Equivalent length of a column – Euler equation – Slenderness ratio.

MODULE VI TWO DIMENSIONAL STRESSES 7+3

Thin cylindrical and spherical shells – Volumetric strains – Biaxial stresses at a point – Stresses on inclined plane – Principal planes and stresses – Mohr's circle for biaxial stresses

L – 45; T – 15 – 60 Hours

TEXT BOOKS:

1. Beer F. P. and Johnston R, Mechanics of Materials, McGraw-Hill Book Co, Third Edition, 2002.

REFERENCES:

1. Popov E.P, Engineering Mechanics of Solids, Prentice-Hall of India, New Delhi, 1997.
2. Nash W.A, Theory and problems in Strength of Materials, Schaum Outline Series, McGraw-Hill Book Co, New York, 1995
3. Timoshenko S.P, Elements of Strength of Materials, Tata McGraw-Hill, New Delhi 1997.
4. Ryder G.H, Strength of Materials, Macmillan India Ltd., Third Edition, 2002.
5. Ray Hulse, Keith Sherwin & Jack Cain,"Solid Mechanics", Palgrave ANE Books, 2004.
6. Singh D.K "Mechanics of Solids" Pearson Education 2002.
7. Kazimi S.M.A, Solid Mechanics, Tata McGraw-Hill Publishing Co, New Delhi, 1981.

OUTCOMES:

On completion of the course students should be able to

- Gain knowledge of simple stresses, strains and deformation in components.
- Understood the effect of stresses and deformations on component dimensions and shape.
- To determine and analyse the stresses in two dimensions.
- To determine and analyse the shear forces, bending moments and principal stresses.
- Gain knowledge in columns and springs.
- Use basic knowledge in the design courses.

AUC 2105	AUTOMOTIVE ENGINES	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To understand the basic concepts, construction, types and working of internal combustion engines used for automotive applications
- To have a clear understanding of the combustion processes of SI and CI engines.
- To have a clear understanding of the testing procedures and performance parameters of automotive engines.
- To understand the developments taking place in automotive engines.

MODULE I ENGINE COMPONENTS AND SYSTEMS 9

Construction and working of Four stroke SI and CI engines, Construction and working of Two stroke SI and CI engines, Engine classification, firing order, Engine specifications, Intake and Exhaust systems, Carburetor, MPFI and CRDI systems, Exhaust system components, Cooling and Lubrication systems

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MODULE II COMBUSTION IN SI AND CI ENGINES 7

Introduction to combustion in SI and diesel engines and stages of combustion. Combustion chambers for SI and CI engines. Importance of Swirl, squish and turbulence. Factors controlling combustion chamber design. Knocking combustion.

MODULE III ENGINE TESTING AND PERFORMANCE 7

Dynamometers, Indicated thermal, brake thermal and volumetric efficiencies. Measurement of friction, Cylinder pressure measurement. Engine performance maps, Engine testing standards.

MODULE IV DEVELOPMENTS IN AUTOMOTIVE ENGINES 7

Bi fuel and Flexi fuel engines, Adiabatic engines, HCCI engines, Lean burn engines, Stratified charge ignition engines, LPG and Bio gas fuelled engines. Use of hydrogen in automotive engines.

List of Experiments cylinder

Dismantling study and assembling of 4 cylinder SI engine

Measure the bore stroke, cubic capacity and compression ratio of a given 4 cylinder petrol engine. Compare the significance of cubic capacity with power. Identify the name, function and material of the components.

1. **Dismantling study and assembling of 4 cylinder CI engine**

To calculate the clearance volume and compression ratio of a 4 cylinder diesel engine. Measure the pressure in the cylinder at the end of compression stroke. Draw the motoring curve. Identify the name, function and material of the components.

2. **Dismantling study and assembling of 2 stroke SI engine**

Measurement of 2 stroke SI engine specifications Identification of Name function and material of of the components. Understanding of the following scavenging and short circuiting process, air cooling system.

3. **Study of intake systems**

Carburettor, TBI, MPFI and GDI for SI engine and DI, IDI and CRDI systems for CI engine . Identify the Name of components function material etc. Measurement of injector performance, Measurement of runner length of manifold and its significance.

4. **Study of Exhaust systems**

Exhaust system components like catalytic combater muffler, Identification of name of components function and material. Measurement of runner length of exhaust manifold and its significance.

5. **Study of Ignition systems**

Battery coil, magneto and Electronic Ignition systems. Identification of name and function material. Measurement of density of Electrolyte .

6. **Study of cooling systems**

Identification of name, function and material of the components. Measurement of discharge of water pump at various speed.

7. **Study of lubrication systems**

Identification of Name, function and material of the components. Measurement of discharge of oil pump at such pressure for difference speeds.

8. **Measurement of dimensional variation of cylinder block and gudgeon pin**

Measurement on cylinder block – cylinder bore, crankshaft bore and camshaft bore for taper and ovality. Measurement of gudgeon pin, diameter and taper Analysis of the impact of dimensional variation on engine performance

10. **Measurement of dimensional variation of Crankshaft, camshaft, connecting rod**

Measurement of crankshaft journal and pin for taper and ovality

Measurement of camshaft journal taper and ovality and cam lift.

Measurement of connecting rod big end and small end bores for taper and ovality.

Analysis of the impact of dimensional variation on engine performance

PROJECT TITLES:

1. Selection and coupling of suitable I.C. Engine to run a system
2. Measurement of Air intake and calculation of volumetric efficiency
3. Measurement of fuel intake and calculation of energy of the fuel metered
4. Making a working model of CDI system
5. Measurement of Exhaust pressure and calculation of exhaust quantity
6. Working model of Electronic ignition system
7. Working model of lubrication system
8. Working model of cooling system
9. Working model of Rocker arm mechanism
10. Working model of a CRDI system
11. Working model of a MPFI system
12. Working model of variable valve timing.
13. Energy recovery from exhaust system
14. Turbo charger model.

Total Hours – 60 Hours

TEXT BOOKS:

1. Ganesan.V., “Internal Combustion Engines”, Tata McGraw-Hill Publishing Co.,New Delhi, 2003.
2. M.L.Mathur and R.P.Sharma, “A course in Internal combustion engines”,Dhanpat Rai & Sons Publications, New Delhi, 2001.
3. K.K.Ramalingam, “Internal Combustion Engines”, Scitech Publications,Chennai, 2000.
4. William H.Crouse, “Automotive Engines”, McGraw-Hill Publishers, 1985.
5. Pulkrabek “Engineering Fundamentals of the Internal Combustion Engines”,Practice Hall of India, 2003.

REFERENCES:

1. Heldt P.M., “High Speed Combustion Engines”, Oxford IBH PublishingCo., Calcutta,1975.
2. Obert E.F., “Internal Combustion Engines Analysis and Practice”, International

Text Books Co., Scrantron, Pennsylvania - 1988.
3. Ellinger H.E., “Automotive Engines”, Prentice Hall Publishers, 1992.
4. John B.Heywood, “Internal Combustion Engine Fundamental”, McGraw-Hill, 1988.
5. Richard Stone.," Introduction to Internal Combustion Engines”, Third Edition-1999, Society of Automotive Engineers Inc.

OUTCOMES:

- Should be able to analyse and select a suitable power plant for particular application and justify the selection.
- Should critically examine the combustion parameters of engines.
- Should be able to apply the knowledge gained in engine testing laboratory and evaluate the performance parameters of engines.
- Should be able deliberate the developments and suggest improvements for automotive power system.

ENC 2181	ORAL COMMUNICATION	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To expose students to a range of professional contexts through podcasts for learning appropriate expressions.
- To train them in making poster presentations.
- To enable them to make effective business presentations.
- To help them learn persuasive and negotiation skills.
- To train them to debate on issues of current relevance
- To train them to participate in group discussions on current affairs

MODULE I **4**

Orientation to the Importance of Oral Communication -– Verbal and non-verbal communication -Paralinguistic features.

One-minute presentations (using Audacity/Voicethread) – Just a minute (JAM) on random topics

MODULE II **4**

Negotiating and persuading through effective arguments – to arrive at a conclusion (pair-work)

Understanding Negotiation, persuasion and marketing skills through Podcasts

Listening to short conversations and monologues for understanding real life conversations

MODULE III **4**

Making Poster presentations on current issues

Understanding nuances of making effective presentations (TED Videos)

MODULE IV **6**

Deliberation on social and scientific issues – Debates (focus on rebuttal skills and deconstructing arguments)

Viewing videos on debates (NDTV Discussions)

MODULE V **6**

Discussing social issues or current affairs in groups

Viewing group discussions and listening for specific information

MODULE VI **6**

Making full length presentation (through Voicethread) with the focus on one's career plans and prospects (discipline specific)

Listening to interviews for understanding speakers' perception (on industry related issues)

P – 30; Total Hours –30

REFERENCES:

1. Hancock, Mark (2012). *English Pronunciation in Use*. Cambridge University Press, UK.
2. Anderson, Kenneth & et.al (2007). *Study Speaking: A Course in Spoken English for Academic Purposes* (Second Edition). Cambridge University Press, UK.
3. Hurlock, B.Elizabeth (2011). *Personality Development*. Tata McGraw Hill, New York.
4. Dhanavel,S.P (2015). *English and Soft Skills*. Orient Blackswan, Chennai.
5. Whitby, Norman (2014). *Business Benchmark: Pre-Intermediate to Intermediate.* Cambridge University Press, UK.

OUTCOMES:

On completion of the course, students will be able to

- Listen to business conversations and do related tasks.
- Deliver effective poster presentations.
- Make effective business presentations.
- Use persuasive and negotiating skills for justifying arguments.
- Participate effectively in debates.
- Speak English intelligibly, fluently and accurately in group discussions.

AUC 2106	APPLIED FLUID MECHANICS LABORATORY	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To learn about the various measurements of fluid parameters
- To verify the laws of fluid mechanics
- To study the performance of various pumps and turbines.

LIST OF EXPERIMENTS:

1. Comparison of Coefficient of Discharge of given Orifice meter and venturi meter.
2. Calibration of Rota meter.
3. Determination of friction factor for the given set of pipes
4. Performance study of centrifugal pumps / Submersible pumps.
5. Determination of maximum efficiency for the given reciprocating pump.
6. Characteristic curves for Gear pump / Vane pump.
7. Determination of maximum power at constant speed / constant load for an impulse turbine.
8. Performance characteristic of Reaction turbine.
9. Impact of jet on flat and curved vanes.
10. Verification of Bernoulli's theorem.
11. Performance test on a jet pump.
12. Flow visualization :- Laminar and Turbulent flows
13. Flow visualization and pressure measurement on aerofoil

Total Hours – 45

OUTCOMES:

- Students will learn the parameters important for measuring the fluid flows.
- They will be able to run and calculate the performance of the pumps and turbines

SEMESTER - IV

AUC 2211	**AUTOMOTIVE CHASSIS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

- To Study the constructional details and Structures of different types of frames used in vehicle
- To Study mechanism of different types of steering system
- To Study mechanism of different types of drive line and final drive.
- To study use age of wheels and tyres.
- To Study the fundamental and working of different types of Suspension Systems of Automobiles
- To Study the fundamental and working of different types of Braking Systems of Automobiles

MODULE I INTRODUCTION AND FRAME, STEERING SYSTEM 6

Types of Chassis layout, with reference to Power Plant location and drive, various types of frames, Loads acting on vehicle frame, Constructional details and materials for frames, Testing of frames

MODULE II FRONT AXLE AND STEERING SYSTEMS 7

Types of Front Axles and Stub Axles, Front Wheel Geometry, namely, Castor, Camber, King Pin Inclination and Toe–in, Condition for True Rolling Motion of Wheels during Steering, Ackerman's and Davis Steering Mechanisms, Steering Error Curve, Steering Linkages, Different Types of Steering Gears, Slip Angle, Over–Steer and Under–Steer, Reversible and Irreversible Steering, Power–Assisted Steering.

MODULE III PROPELLER SHAFT AND FINAL DRIVE 8

Effect of Driving Thrust, torque reactions and side thrust, Hotchkiss drive, torque tube drive, radius rods and stabilizers, Propeller Shaft, Universal Joints, Constant Velocity Universal Joints, Front Wheel drive, Final drive, different types, Double reduction and twin speed final drives, Multi–axled vehicles, Differential principle and types, Differential housings, Non–Slip differential, Differential locks, Final drive of Crawler Tractors.

MODULE IV AXLES AND TYRES 8

Construction and Design of Drive Axles, Types of Loads acting on drive axles, Full –

Floating, Three–Quarter Floating and Semi–Floating Axles, Axle Housings and Types, Types and Constructional Details of Different Types of Wheels and Rims, Different Types of Tyres and their constructional details

MODULE V SUSPENSION SYSTEM 8

Need for Suspension System, Types of Suspension Springs, Constructional details and characteristics of Single Leaf, Multi–Leaf, Coil, Torsion bar, Rubber, Pneumatic and Hydro – elastic Suspension Spring Systems, Independent Suspension System, Shock Absorbers, Types and Constructional details, Design of Leaf and Coil Springs.

MODULE VI BRAKING SYSTEM 8

Theory of Automobile Braking, Stopping Distance Time and Braking Efficiency, Effect of Weight Transfer during Braking, Theory of Drum Brakes, Loading and Trailing Shoes, Braking Torque, Constructional Details of Drum Brake and its Actuators, Disc Brake Theory, Types and Construction, Hydraulic Braking System, Mechanical Braking System, Pneumatic Braking System, Power–Assisted Braking System, Servo Brakes, Retarders, Types and Construction, Anti–Lock Braking System, Constructional Details. Traction control, Hill assist, Engine brakes (alias Jake brake)

Total Hours - 45

TEXT BOOKS:

1. Kripal Singh, Automobile Engineering, Standard Publisher, New Delhi, 2006
2. R.K. Rajput, A Text–Book of Automobile Engineering, Laxmi Publications Private Limited, 2007
3. N.K. Giri, Automotive Mechanics, Kanna Publishers, 2007

REFERENCES:

1. Heldt P.M., Automotive Chassis, Chilton Co., New York, 1990
2. Newton Steeds and Garret, Motor Vehicles, 13th Edition, Butterworth, London, 2005.
3. Heinz Hazler, Modern Vehicle Technology, Butterworth, London, 2005.

OUTCOMES

On completion of the course student should be able to

- Select suitable frame for different vehicle with justification
- Select suitable steering system for different vehicles with justification.
- Analyze various drive line systems for automobiles.

- Select suitable wheels and tires with justification
- Evaluate the different types of suspension system for vehicle.
- Select and analyze different types of vehicle layouts.

AUC 2212 MECHANICS OF MACHINERY

L	T	P	C
3	1	0	4

OBJECTIVES:

- To understand about the links and different types of pairs and the principles in the formation of mechanisms and their kinematics.
- To study the principles involved in assessing the displacement, velocity and acceleration at any point in a link of a mechanism
- To understand the kinematic aspects of friction involved in machineries such as belts, clutches and brakes
- To analyze the kinematics of machineries such as cam, toothed gearing and gear trains.
- To understand the fundamentals of Vibration and Dynamics

MODULE I MECHANISMS 8+3

Machine Structure – Kinematic link, pair and chain – Grueblers criteria – Constrained motion – Degrees of freedom – Slider crank and crank rocker mechanisms – Inversions – Applications – Kinematic analysis of simple mechanisms – Determination of velocity and acceleration.

MODULE II FRICTION 7+3

Friction in screw and nut – Pivot and collar – Thrust bearing – Plate and disc clutches – Belt (flat and V) and rope drives. Ratio of tensions – Effect of centrifugal and initial tension – Condition for maximum power transmission – Open and crossed belt drive.

MODULE III GEARS 7+3

Gear profile and geometry – Nomenclature of spur and helical gears – Gear trains: Simple, compound gear trains and epicylic gear trains – Determination of speed and torque

MODULE IV CAMS 7+2

Cams – Types of cams – Design of profiles – Knife edged, flat faced and roller ended followers with and without offsets for various types of follower motions

MODULE V BALANCING 8+2

Static and dynamic balancing – Single and several masses in different planes – Balancing of reciprocating masses- primary balancing and concepts of

secondary balancing – Single and multi cylinder engines (Inline) – Balancing of radial V engine – direct and reverse crank method.

MODULE VI VIBRATION 8+2

Free, forced and damped vibrations of single degree of freedom systems – Force transmitted to supports – Vibration isolation – Vibration absorption – Torsional vibration of shaft – Single and multi rotor systems – Geared shafts – Critical speed of shaft.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Rattan.S.S, “Theory of Machines”, Tata McGraw–Hill Publishing Co., New Delhi, 2004.
2. Ballaney.P.L, “Theory of Machines”, Khanna Publishers, New Delhi, 2002.

REFERENCES:

1. Rao,J.S and Dukkipati, R.V, “Mechanism and Machine Theory”, Second Edition, Wiley Eastern Ltd., 1992.
2. Malhotra, D.R and Gupta, H.C., “The Theory of Machines”, Satya Prakasam, Tech. India Publications, 1989.
3. Gosh, A. and Mallick, A.K., “Theory of Machines and Mechanisms”, Affiliated East West Press, 1989.
4. Shigley, J.E. and Uicker, J.J., “Theory of Machines and Mechanisms”, McGraw-Hill, 1980.
5. Burton Paul, “Kinematics and Dynamic of Planer Machinery”, Prentice Hall, 1979.

OUTCOMES:

On completion of the course the students should be able to

- Demonstrate the fundamentals of mechanisms and their applications and able to analyze the kinematic properties of mechanism such as displacement , velocity and acceleration
- Analyze the effect of friction in machines such as belt drives, clutches and brakes
- Understand the basic nomenclature of gears and analyze gear kinematics.
- Kinematic analysis of cams .
- Demonstrate the balancing of any kinematic system
- Analyze different types of Vibrations.

AUC 2213 AUTOMOTIVE ELECTRICAL &ELECTRONICS L T P C
2 0 0 2

OBJECTIVES:

- To learn about working principle and different types battery used in automobile.
- To impart knowledge to the students in the principles of operation and construction details of various Automotive of starting system and charging systems.
- To provide fundamental knowledge about various types of ignition systems.
- To impart knowledge to students about lighting system, wiring system and accessories.

MODULE I BATTERIES 7

Requirements of the vehicle battery, Principle and construction of lead-acid battery Characteristics of battery, battery rating, Maintenance and charging, Diagnosing of lead-acid battery faults - Servicing batteries, Testing batteries. Details of modern storage batteries- ZEBRA battery, Ultra-capacitors, Fuel cells, Sodium sulphur battery, Swing battery.

MODULE II STARTING SYSTEM AND CHARGING SYSTEM 8

Condition of starting Behavior of starter during starting. Series motor and its characteristics. Principle & construction of starter motor. Working of different starter drive units. Care & maintenance of starter motor, Starter switches. Function, Components of DC and AC Charging System for Automobile, construction, operating principle, characteristics, charging circuit controls – cut out, relays, voltage and current regulators, troubleshooting

MODULE III IGNITION SYSTEM 7

Types, construction & working of battery coil and magneto ignition systems. Relative merits, centrifugal and vacuum advance mechanisms. Types and construction of spark plugs, Electronic Ignition system. Digital ignition system.

MODULE IV LIGHTING SYSTEM AND WIRING CRCUTE 8

Lighting Fundamentals and Lighting Circuit ,Conventional Headlamps and LED Lighting System, fog lamps; side and tail light; brake warning lights heater and defrosters, wiring and installation; auto cables; cable colours; cable connectors; wiring harnesses; circuit breakers; fuses, Electrical fuel-pump, Speedometer, Fuel, oil & temperature gauges, air bag electrical diagram, Horn, Wiper system, Trafficator,

wiring system. (Accessories) - Parking assist, Electronic brakes, Power window, automatic lock controls, GPS and Satellite navigation.

Total Hours –30

TEXT BOOKS:

1. Tom Denton “Automobile Electrical and Electronic Systems” 3rd edition,Elsiever Butterworth-Heinemann 2004..
2. Judge,A.W., Modern Electrical Equipment of Automobiles, Chapman & Hall, London.

REFERENCES:

1. Young,A.P. & Griffiths,L., Automobile Electrical Equipment, English Language Book Society & New Press.
2. Robert Bosch Gmbh “Bosch Automotive Electric and Electronics” 5th edition Springer-Vieweg
3. Kholi,P.L., Automotive Electrical Equipment, Tata McGraw-Hill Co. Ltd., New Delhi.

OUTCOMES:

On completion of the course the students should be able to

- Enumerate the working principle and different types battery used in automobile.
- Demonstrate the principles of operation and constructional details of various Aut starting system and charging systems.
- Analyze the starting and ignition systems.
- Evaluate the functioning of modern lighting system and accessories.

AUC 2214 AUTOMOTIVE MATERIAL & METALLURGY

L	T	P	C
2	0	2	3

OBJECTIVES:

- Expose the students with various constitutions of alloys and its effects on adding with steel and also modifying the mechanical behavior of materials.
- To impart knowledge on the structure, properties, phase diagrams and applications of materials so as to identify and select suitable materials for various engineering applications.
- Impart to the students the ability to investigate, analyze and provide solutions to problems arising from metallurgical and materials engineering processes.
- To develop an overall sound knowledge of metallurgical and materials engineering .

MODULE I METALLURGICAL FUNDAMENTALS AND CONSITITUTION OF ALLOYS AND PHASE DIAGRAMS 8

Crystal structure –crystal imperfections– Grain size, Constitution of alloys – Solid solutions, substitutional and interstitial. Phase diagrams- Isomorphous, eutectic, peritectic, eutectoid and peritectoid reactions, Lever Rule, Iron – Iron carbide equilibrium diagram- Development of Microstructure in Iron–Carbon Alloys

MODULE II FERROUS AND NON FERROUS METALS 7

Effect of alloying additions on steel (Mn, Si, Cr, Mo, V Ti & W) - stainless and tool steels – HSLA - maraging steels – cast Irons- Gray, White malleable, Spheroidal Graphite. Copper and its alloys– Aluminium and its alloys – Magnesium and its alloys – Titanium and its alloys - microstructure, properties and applications.

MODULE III HEAT TREATMENT AND STRENGTHENING MECHANISMS 8

Full annealing, normalising, hardening and tempering of steel, Isothermal transformation diagrams, Continuous Cooling Transformation Diagrams, case hardening- carburising, nitriding, cyaniding, carbonitriding – Flame and Induction hardening. Hardenability-Jominy end quench test. Grain size strengthening, Solid solution strengthening, Strain hardening, Yield point phenomenon, dispersion strengthening, fibre strengthening, precipitation strengthening.

MODULE IV POWDER METALLURGY 6

Pressure compaction- Isostatic pressing, powder rolling, forging and extrusion,

explosive compaction. Sintering, Hot pressing and Hot Isostatic Pressing , vacuum sintering, finishing operations – sizing, coining, repressing and heat treatment, Processing of nano materials

List of Experiments

1. Metallographic Examination-Demonstration and Practice
   a. Study of metallurgical microscope.
   b. Specimen preparation for micro structural examination-cutting, grinding, polishing, etching.
   c. Selections of etchants for various metals and alloys.
2. Identification of microstructures of Plain Carbon Steel, Tool Steel, Gray C.I, SG Iron,
3. Heat treatment: Annealing, normalizing, hardening and tempering of steel-Hardness and its microstructure.
4. Study of microstructure of welded (HAZ) and cast component.
5. Hardenability test - Jominy End quench test.
6. Tension test
7. Compression test
8. Torsion test.
9. Deflection test
10. Impact test
11. Double shear test

T- 30, P- 30,Total Hours –60

TEXT BOOKS:

1. Syndney H Avner, “Introduction to Physical Metallurgy”, 2/E Tata McGraw Hill Book Company, 2007.

REFERENCES:

1. Williams D Callister, “Material Science and Engineering” Wiley India Pvt Ltd, Revised Indian Edition 2007.
2. Raghavan. V. Materials Science and Engineering”, Prentice Hall of India Pvt. Ltd, 5th Edition 2007.
3. Kenneth G. Budinski and Michael K. Budinski “Engineering Materials”, PHI / Pearson Education, 8th Edition, 2007.
4. George E. Dieter, Mechanical Metallurgy, McGraw Hill, 2007.

OUTCOMES:

On completion of the course the students should be able to:

- Describe the structure of materials, classify defects and explore the constitutional of alloys for different industrial components.
- Interpret and demonstrate phase diagrams.
- Classify and analyze ferrous and non-ferrous materials with properties and applications.
- Select and apply appropriate heat treatment practices to modify the mechanical behaviour of various materials
- Select and apply appropriate strengthening mechanism to modify the mechanical behavior of materials
- Analyze the various operations involved in the powder metallurgy technique.

AUC 2215	PRODUCTION PROCESS OF AUTOMOTIVE COMPONENTS	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To study about the components produced by powder metallurgy
- To understand the concepts of forming process and know the components produced by this process
- To Know about the principle and methods of gear manufacturing process
- To know about the recent trends for production of automobile components.

MODULE I POWDER METALLURGY PROCESS 6

Process flow chart – Production of metal powders and their raw materials – Manufacture of friction lining materials for clutches and brakes – Testing and inspection of PM parts

MODULE II FORMING PROCESS 9

.Forging – forging of valves – connecting rod, crank shaft, cam shaft, propeller shaft, transmission gear blanks, foot brake linkage, steering knuckles.

Extrusions: Basic process steps, extrusion of transmission shaft, steering worm blanks, brake anchor pins, rear axle drive shaft, axle housing spindles, piston pin and valve tappets.

Hydro forming: Process, hydro forming of manifold and tail lamp housing. Stretch forming – Process, stretch forming of auto body panels – Super plastic alloys for auto body panels.

MODULE III GEAR MANUFACTURING 6

Different methods of Gear manufacture – Gear hobbing and gear shaping machines specifications – gear generation – different methods – gear finishing and shaving – Grinding and lapping of hobs and shaping cutters – gear honing – gear broaching

MODULE IV RECENT TRENDS IN MANUFACTURING OF AUTO COMPONENTS 9

Powder injection moulding – Shotpeen hardening of gears – Production of aluminium MMC liners for engine blocks – Plasma spray coated engine blocks and valves – Recent developments in auto body panel forming – Squeeze casting of pistons – aluminium composite brake rotors.

Total – 30 Hours

TEXT BOOKS:

Heldt,P.M., High Speed Combustion Engines, Oxford Publishing Co., New York, 199

REFERENCES:

1. Haslehurst,S.E., Manufacturing Technology, ELBS, London, 1990
2. Rusinoff, Forging and Forming of metals, D.B. Taraporevala Son & Co. Pvt.Ltd., Mumbai, 1995.
3. Subroff, A.M. & Others, Forging Materials & Processes, Reinhold Book Corporation, New York, 1988. 4. High Velocity Forming of Metals, ASTME, Prentice Hall of India (P) Ltd., New Delhi, 1990.
4. High Velocity Forming of Metals, ASTME, Prentice Hall of India (P) Ltd., New Delhi, 1990.
5. Groover. M.P., Automatic production systems and computer integrated manufacturing, Prentice-Hall, 1990.
6. GE Thyer, Computer Numerical Control of Machine Tools, BH.Newners, 1991.

OUTCOMES:

Students will able to

- Design and produce components by powder Metallurgy process .
- Design and fabricate the forming equipments for production of automotive components.
- Apply the various gear manufacturing methods needed for the automotive components.
- Use the recent trend in manufacturing for making auto Components
-

ENC 2282 WRITTEN COMMUNICATION L T P C
0 0 2 1

OBJECTIVES:

- To help students identify content specific vocabulary and learn its usage.
- To expose them to reading for specific purposes, especially in professional contexts.
- To expose them to the process of different kinds of formal writing.
- To help them learn corporate correspondence for different purposes.
- To train them in preparing effective applications with résumé
- To make them write different types of reports.

MODULE I **4**

Introduction - process of writing – Fundamentals of academic and professional writing – Understanding short, real world notices, messages, etc.

MODULE II **4**

Reading industry related texts (ex. Manufacturing, textile, hospitality sector etc.) for specific information. Writing Instructions and recommendations

MODULE III **6**

Understanding format and conventions of writing email, memo, fax, agenda and minutes of the meeting. Writing email, memo, fax, agenda and minutes of the meeting for various purposes (industry specific)

MODULE IV **6**

Viewing letter of application and Résumé, letter calling for an interview, letter of inquiry and Promotional letter. Writing Functional résumé and letter of application using Edmodo,

MODULE V **6**

Viewing a Video and reading a case study (industry specific) – collaborative writing using Edmodo –reading and information transfer

Writing reports- Survey, feasibility and progress – exposure to discipline specific reports

MODULE VI **4**

Writing Statement of purpose (Higher Education)-- Justifying and writing about one's

preparedness for job (Statement of Purpose highlighting strengths and weaknesses) – Peer evaluation skills through Edmodo.

P- 30; Total Hours –30

REFERENCES:

1. Riordan,D (2013). *Technical Report Writing Today*. Cengage Learning, 10th edition. USA.
2. Oliu, W. E., Brusaw, C.T., & Alred, G.J.(2012). *Writing that Works: Communicating Effectively on the Job* . Bedford/St. Martin's. Eleventh Edition.
3. Garner, B.A. (2013). *HBR Guide to Better Business Writing (HBR Guide Series)*. Harvard Business Review Press. USA.
4. Sharma, R.C. & Krishna M. (2002). *Business Correspondence and Report Writing*. Tata MacGraw – Hill Publishing Company Limited, New Delhi.
5. Macknish, C. (2010). *Academic and Professional Writing for Teachers*. McGraw-Hill Education. USA.
6. Whitby, Norman (2014). *Business Benchmark: Pre-Intermediate to Intermediate.* Cambridge University Press, UK.

OUTCOMES:

On completion of the course, the students will have the ability to

- Identify content specific vocabulary and also use them in appropriate contexts.
- Demonstrate reading skills with reference to business related texts.
- Draft professional documents by using the three stages of writing.
- Create different types of documents for various corporate correspondences.
- Write effective letter of applications, résumé and statement of purpose.
- Write business related reports efficiently.

AUC 2216	AUTOMOTIVE CHASSIS LABORATORY	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To Study the constructional details and Structures of different types of frames used in vehicle
- To Study mechanism of different types of steering system
- To Study mechanism of different types of drive line and final drive.
- To study use age of wheels and tyres.
- To Study the fundamental and working of different types of Suspension Systems of Automobiles
- To Study the fundamental and working of different types of Braking Systems of Automobiles.

LIST OF EXPERIMENTS

1. Measurement of Automotive Chassis and Identification of various parts & types of frame and its Cross Section.
2. Evaluate the steering geometry practically by eye vision also find steering value angle of out side lock of front wheel and true turning circle radius.
3. Evaluate the function of different types of clutches and torque converter .
4. Evaluate the function of transmission system (gear box, propeller shaft, universal joint) also determine the gear ratios for each speed & speed of propeller shaft.
5. Evaluate the function of the final drive differential also find the final reduction and wheel reduction.
6. Evaluate the function of different types of wheel & tires also measure the various parameters of wheels and tyre.
7. Identification and function of each components of front and rears suspension system also find the deflection of springs.
8. Study the power steering and manual steering mechanism also find steering gear ratio.
9. Study the function of disc & drum braking system and also find the different hydraulic pressure value of drum &disc brake.
10. Project work.

Total Hours –45 Hours

OUTCOMES:

On completion of the course student should be able to

- Select suitable frame for different vehicle with justification

- Select suitable steering system for different vehicles with justification.
- Analyze various drive line systems for automobiles.
- Select suitable wheels and tires with justification
- Evaluate the different types of suspension system for vehicle.
- Select and analyze different types of vehicle layouts.

AUC 2217	AUTOMOTIVE ELECTRICAL AND ELECTRONICS LABORATORY	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To study the working principle of the various electrical and electronic control devices used in automobile.

STUDY EXPERIMENTS:

- Study of revolution counter circuit
- Study of control of DC motors
- Study of IC 555 timer for motor control

LIST OF EXPERIMENTS:

1. Verify logic gates (AND,OR, NAND, NOR, EX-OR)
2. Lab VIEW basic programming (tank level control)
3. Implementation of half adder and full adder
4. Characteristics of Silicon controlled rectifier (SCR)
5. Addition and Multiplication of 8 bit numbers using 8085
6. Stepper motor control using 8051.
7. Temperature monitoring using Lab VIEW
8. Heating and ventilation control using Lab VIEW.

Total Hours – 45

OUTCOMES:

On completion of the course students should be able to

- Demonstrate the working of various electronic and control devices used in automobiles
- Design simple electronic circuits for automotive applications
- Design stepper motor actuation for automotive applications

SEMESTER V

MSC 3181	LEADERSHIP AND CEO TRAINING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course aims at

- Bringing about positive transformation in students' attitude.
- Building unique leadership competencies that would ensure successful transition of students across all career stages.
- Sensitizing students to identify their strengths & weakness and training them to deal with it
- Assisting students in enhancing their expressive ability and inducing a high level of self confidence to manage both business and emotions
- Training students to become more adaptable and flexible to changing business environment

MODULE I INTRODUCTION TO LEADERSHIP 12

Leadership concept - meaning, definitions, importance of leadership, leadership traits. Leadership functions- general functions, listening, observing, managing and decision making. Components of leadership - leaders, followers and situation. Leadership theories – Trait theory, Skills theory, Style theory, Situational theory, Transformational theory, Transactional theory, Path Goal Theory and LMX. Assessing emotional intelligence and exploring the capabilities and inherent traits.through psychometric tests - Multi factor leadership questionnaire and personal reflections

MODULE II LEADERSHIP STYLE AND COMMUNICATION 08

Leadership styles-visionary, Coaching, Affiliative, Democratic, Pacesetting Commanding, Transformational, Transactional. Autocratic, Participative, Laissez-Faire Leader versus Managers. Leadership communication - Rationale, tactic, assertive, formal, informal, communication in crisis- leadership and negotiations, Leadership Presentations-convincing and impressive style

MODULE III LEADERSHIP ROLES 08

Facets of leadership- Leader as an individual – personality and leadership, values, attitudes and ethics of a leader. Leader as a relationship builder- empowering people to meet higher order needs, initiating organization wide motivational programs, involvement with all stakeholders- focusing on organization growth. Leader as an inspirer- motivation and leadership, recognizing and appreciating contributions,

empowering others to lead Leader as an innovator –leader's role in shaping culture and values in an organization. Leader as a Liaison- Leader as team player

MODULE IV LEADERSHIP CHALLENGES AND STRATEGIES 09

Challenges in leadership: Perception of organization culture and values, interpreting the power dynamics in the organization, establishing work life balance. Bad leadership – Reasons and impact.-Case Study of Marissa Mayer-Yahoo.Inc Organizational transformation through efficient leaders-Case study of Apple Inc. Blue Ocean Leadership-Steps to Blue ocean Leadership-Four Pillars of Blue Ocean leadership-Blue Ocean leadership grid

MODULE V LEADERSHIP AND CEO TRAINING 08

Leader as a CEO: Traits of a successful CEO, Key responsibilities of a CEO, the path to be a CEO ,Training on Board Room Discussions, Meeting the CEO –Live sessions with industry CEO's. Requirements of Leadership: - Cognitive skills, Interpersonal skills, Business skills, Strategic skills. Role of Emotional Intelligence in taking up key-positions in the organization.

Teaching Pedagogy:

Nurturing – Based on the identified strengths and weaknesses, training will be given to enhance the strengths and overcome the weakness.

Assessment - Continuous evaluation will be effected through group discussions, oratory assignments and situational enactments. Pre-and post-training assessment through peer reviews and faculty feedback.

Sustained development – Training will be imparted for self-development and monitoring of leadership skills to ensure sustained applicability of the skills learnt.

Total Hours –45 Hours

REFERENCES:

1. Andrew J DuBrin. "Leadership: Research Findings, Practice, and Skills", 8th Edition, South-Western College Pub, 2015.
2. Yukl G , "Leadership in Organisations", 8th Edition, Pearson Education, 2013.
3. Richard L Daft , "Leadership", 5th Edition, South Western Cengage Learning 2012.
4. Stephen P. Robbins and Timothy A. Judge. "Organizational Behaviour", 15th Edition, New Delhi: Pearson, 2013.
5. Fred Luthans, "Organizational Behavior, An Evidence Based Approach", 12th

AUC 3101 DESIGN OF AUTOMOTIVE COMPONENTS L T P C
3 1 0 4

OBJECTIVES:

- To familiarize the various steps involved in the Design Process
- To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
- To learn to use standard practices and standard data
- To familiarize various forces, stresses and strains on several engine components.
- To design different automotive components in accordance with standard design procedure and design criteria.
- To know the basic design procedure of automotive components

MODULE I INTRODUCTION 5+2

Classification of design - Engineering materials and their physical properties as applied to design -Selection of materials - Factors of safety in design - Endurance limit of materials - Design for variable loading – Soderberg, Goodman and Gerber relations.

MODULE II SHAFT AND SPRING DESIGN 7+4

Design of shafts on the basis of strength -Design of shaft on the basis of rigidity- Design of close coiled helical spring subjected to axial loading - Design of leaf springs.

MODULE III DESIGN OF BEARINGS 8+2

Design of bearings - Journal and ball bearings - Bearing life - Static load capacity - Dynamic load capacity - Bearing material- Boundary lubrication - Oil flow and temperature rise.

MODULE IV DESIGN OF GEARS 9+3

Design considerations - Strength of gear teeth - Terminology of gears - Design of spur gears - helical gears - bevel gears and worm gears.

MODULE V DESIGN OF FLYWHEEL 8+2

Determination of the mass of a flywheel for a given co-efficient of speed fluctuation, Engine flywheels stresses of rim of flywheels, Design of hubs and arms of flywheel.

MODULE VI CLUTCH DESIGN 8+2

Principle of operation- Types of friction materials- Single plate clutch- Multiplate clutch- Cone clutch- Energy dissipated due to clutch slip and the time required to reach full speed from rest during the acceleration period.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Jain,R.K., "Machine Design", Khanna Publishers, 1992.
2. Sundararaja Murthy, T.V., "Machine Design", Khanna Publishers, New Delhi,1991.
3. Bhandari,v.B., "Design of Machine Elements", Tata McGraw Hill PublishingCo. Ltd., New Delhi, 1990.
4. Engine Design – Giles J. G., Lliffe Book Ltd.
5. Engine Design – Crouse, Tata McGraw Publication, Delhi
6. Design of Automotive Engine – A. Kolchin and V. Demidov

REFERENCES:

1. Hall Allen,S. & other, “Machine Design”, Schaum publisher Co., 1982.
2. Sigley, “Machine Design”, McGraw Hill,1981.
3. Design Data Book”, PSG College of Technology, Coimbatore,1992

OUTCOMES:

On completion of the course students should be able to

- Illustrate various design aspects and design procedures.
- Design shafts and springs.
- Design various gears used in automotive.
- Design bearings, flywheels and clutches.
- Evaluate the shape and dimensions of a component to satisfy functional and strength requirements.
- Evaluate the various forces, stresses and strains acting on the different engine components.

AUC 3102 AUTOMOTIVE TRANSMISSION L T P C
3 0 0 3

OBJECTIVES:

- To know about the various components in transmission system and drive line units of automobiles.
- To know about the working principle of transmission system and hydrodynamic transmission.
- The students able to know about the various automatic transmission systems in a vehicle.
- The students able to know the applications of automatic transmission in a vehicle.
- To know about the hydrostatic drive principle and working of electric drive in a vehicle.

MODULE I CLUTCH AND GEAR BOX 9

Requirement of transmission system, Different types of clutches, principle & Construction of Single plate and multiplate clutch, centrifugal clutch. Need and Objectives of Gear box. Construction and operation of Sliding mesh, Constant mesh and Synchromesh gearboxes – Determination of gear ratios for vehicles.

MODULE II HYDRODYNAMIC TRANSMISSION 7

Fluid coupling-working principle and Constructional details, Torque capacity and Performance characteristics. Reduction of drag torque in fluid coupling. Torque converter-working principle and constructional details, performance characteristics.

MODULE III EPICYCLIC GEARBOXES 8

Requirements of Epicycle gear system, Epicycle gearbox working and operation and Constructional details. Principle of Planetary gear trains - Wilson Gear box, Hydraulic Control system for Automatic Transmission.

MODULE IV AUTOMATIC TRANSMISSIONS APPLICATION 7

Need for automatic transmission, Chevrolet “Turboglide” Transmission, Continuously Variable Transmission (CVT) – Types and Operations of a typical CVT and applications.

MODULE V HYDROSTATIC TRANSMISSION 7

Hydrostatic drive- various types of hydrostatic systems – Principles of Hydrostatic

drive system. Advantages and limitations. Comparison of hydrostatic drive with hydrodynamic drive, construction and working of typical Janny hydrostatic drive.

MODULE VI ELECTRIC DRIVE 7

Electric drive, layout of electric drive, types- Principle of early and modified Ward Leonard Control system-Advantages & limitations. Comparison of early and modified ward Leonard control system. Hybrid vehicle, fuel cell powered vehicle and solar powered vehicle.

Total Hours –45

TEXT BOOKS:

- Heldt, P.M., "Torque converters", Chilton Book Co., 1962.
- Newton and Steeds, "Motor vehicles", Illiffe Publishers, 1985.
- Devaradjane. Dr. G., Kumaresan. Dr. M., "Automobile Engineering", AMK Publishers, 2013.
- A Text book of Auto Transmission and Electrical systems by K.S Raghu Ram.
- Automotive Transmissions Fundamentals, Selection, Design and Application 2011. Naunheimer, H., Bertsche, B., Ryborz, J., Novak, W.

REFERENCES:

- SAE Transactions 900550 & 930910.
- Hydrostatic transmissions for vehicle applications, I Mech E Conference, 1981
- Crouse,W.H., Anglin,D.L.," Automotive Transmission and Power Trains construction", McGraw-Hill, 1976.
- Heinz Heisler, "Advance vehicle Technology", Butterworth-Heinemann, 2002

OUTCOMES:

- The students will able to know the constructional and working principle of various types of clutch and gearbox.
- The students will able to evaluate the various types of automatic transmission used in automobile vehicle.
- The students can analyze the design ratio of gear box used in a automobile vehicle.
- The students will able to know about the various types of transmission used in automobile vehicle.
- The students will able to know the constructional and working principle of hydrostatic, hydrodynamic transmission.
  The students will able to analyze the merits of electric drive used in a vehicle.

AUC 3103 MEASUREMENTS AND INSTRUMENTATION L T P C
1 0 2 2

OBJECTIVES:

- To learn about the various linear and angular measuring instruments of vari accuracies and ranges.
- To learn about measuring systems for parameters like force, torque temperature.

MODULE I MEASUREMENTS 7

Metrology, Units and standards-measuring instruments, linear and angular measurements, Range, Variance and Standard deviation, slip gauges, Taper and roundness measurements, form measurement, Flatness and surface finish measurements.

MODULE II INSTRUMENTATION 8

Instruments for gears and threads measurement, laser instrumentation, CMM, machine vision systems, Instrumentation for force and torque measurements, Instrumentation for temperature, flow and acoustic measurements. Instrumentation for engine testing.

Laboratory Experiments.

1. Calibration and Error analysis of measuring Instruments.
2. Measuring Instrument Fabrication:
   Fabrication of 0.2 mm accurate simple Vernier caliper.
   Fabrication of 0.2 mm accurate simple Micrometer.
   Fabrication of simple strain gauge load cell etc.
   Fabrication of simple strain gauge, load cell etc.
3. Complete all measurements including intricate internal details of the given component using standard equipment and by other measuring procedures (Quick setting compounds, moulds etc.).
4. Setting up of comparators for inspection (Mechanical / Pneumatic / Electrical).
5. Measurement of angle using Sine bar / Sine Center /Toolmakers microscope /Slip gauge.
6. Measurement of taper using standard balls / rollers.
7. Measurement of straightness and flatness.
8. Measurement of thread parameters.
9. Measurement of gear parameters.

10. Measurement of radius and surface roughness.
11. Measurement of Temperature.
12. Measurement of Displacement, Force and Torque.
13. Measurement of Acoustic Emission.
14. Scanning the surface using Coordinate Measuring Machine (CMM).
15. Measurement using vision system.

L – 15; P – 30; Total Hours -45

TEXT BOOKS:

1. Jain R.K.,"Engineering Metrology", Khanna Publishers, 1994.
2. Alan S. Morris," The Essence of Measurement", Prentice Hall of India, 1997.

REFERENCES:

1. Gupta S. C," Engineering Metrology", Dhanpat rai Publications, 1984.
2. Beckwith T.G, and R. D. Marangoni, "Mechanical Measurement", Addi Wesley 1999.
3. Donald D Eckma, "Industrial Instrumentation", Wiley Eastern, 1985.
4. ASTME," Hand book of industrial metrology" Prentice hall of India, 1988.
5. ASNT," Nondestructive testing handbook Emission" volume5 – acou emission testing, 1994.

OUTCOMES:

Students should be able to

- Measure various engineering specifications with linear, angular, flatness, form and roughness instruments (PO1 & PO2)
- Set up Instrumentation and measurement of threads, gears, force, torque, flow and temperature. (PO1 & PO2)

ENC 3181	COMMUNICATION AND SOFT SKILLS - I CAREER CHOICE	L 0	T 0	P 2	C 1

OBJECTIVES:

- To create awareness of industrial trends and market demands.
- To encourage students to explore career opportunities in an industry and evaluate themselves in relation to industry preparedness

MODULE I **6**

Knowledge about specific industry-Discussion with industry experts --Self evaluating career prospects through survey questionnaire (based on his/her eligibility for taking up a job (industry preparedness)

MODULE II **6**

. Knowing case studies of industries(pertaining to students' choice of career)- Reading and discussing about job markets-goal setting, working on creativity.

MODULE III **4**

SWOC analysis and discussing outcomes--exploring mini projects or case studies of latest industries.

MODULE IV **6**

Writing statement of purpose pertaining to career choice---- Outcomes

MODULE V **8**

Project or case study presentations (Presentation in pairs) -mini project report or case study report.

Total Hours – 30

REFERENCES:

1. Brown,D.(2002). Career Choice and Development. Wiley,J. & Sons.USA
2. Lore,N.(1998). The Pathfinder: How to Choose or Change Your Career for a Lifetime of Satisfaction and Success. Simon & Schuster.USA.
3. Shell, G.R.(2013). *Springboard Launching your Personal Search for Success.Portfolio.USA.*

OUTCOMES:

After the completion of the course, students would be able to

- Speak about their career choice.
- Self evaluate their strengths and weaknesses and speak about it.
- Make effective presentations on case studies or relating to projects.
- Write the statement of purpose relating to their career choice.

AUC 3104	ENGINE TESTING AND EMISSION LABORATORY	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To learn the various performance characteristics of both petrol and diesel engines
- To learn the various constituents of exhaust emission.

LIST OF EXPERIMENTS:

1. Performance study of petrol engine at full throttle and part throttle conditions.
2. Performance study of twin cylinder constant diesel engine.
3. Performance and combustion study of single cylinder constant speed CI engine.
4. Performance study on variable speed single cylinder compression ignition engine.
5. Performance study of variable speed twin cylinder compression ignition engine.
6. Morse test on petrol engines.
7. Determination of volumetric efficiency and optimum cooling water flow rate in IC engines.
8. Head balance test on a Automotive diesel engine.
9. Engine tuning for performance improvement.
10. Measurement of HC, CO, CO2, O2 using exhaust gas analyzer.
11. Diesel smoke measurement.

Total Hours - 45

REFERENCES:

1. Giles,J.G., Vehicle Operation and performance, lliffe Books Ltd., London, 1989.
2. Obert,E.F., Internal Combustion Engine analysis and Practice, International Text Book Co., Scranton, Pennsylvania, 1988. .

OUTCOMES:

After completion of this course the students should be able to

- Analyze the engine performance of given diesel and petrol engine.
- Analyze the friction loss of given IC engine.
- Measure the heat apportion of given IC engine.
- Analyze the petrol and diesel emission with suitable instruments

SEMESTER - VI

MSC 3182	SOCIAL ENTREPRENEURSHIP	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To be able to understand the field of social entrepreneurship and Social problems
- To be able to describe and understand the traits of social entrepreneurs
- To recognize the social business opportunities
- To synthesize the resource mobilization ways for social entrepreneurship
- To understand the social entrepreneurship models
- To recognize the impact of social entrepreneurship on societies

MODULE I INTRODUCTION TO SOCIAL ENTREPRENEURSHIP 7

Introduction - Emergence and Development of Social Entrepreneurship. Social Problems in India: An Overview. Social Development: The Indian Scenario. Emergence of Social Entrepreneurs and Sustainable Solutions to Social Problem. Characteristics and Context of Social Entrepreneurship .The Role of Social Entrepreneurship in Societies & Economies.

MODULE II SOCIAL ENTREPRENEURSHIP: DRIVERS AND CHALLENGES 7

The Drivers of Social Entrepreneurship. Elements of the Social Entrepreneurial Personality. Challenges of financial constraints. Challenge to attract and cultivate talented workers. Challenge of evaluation of social entrepreneur impact. Challenge of scaling and its impact. Cases

MODULE III SOCIAL ENTREPRENEURSHIP: OPPORTUNITY RECOGNITION 7

Opportunity Recognition and Planning Process. Opportunities for Social Entrepreneurs. The Nature of Social Entrepreneurial Opportunities. Social Problems into Opportunities. Idea development and conceptualization of social problem. Cases

MODULE IV RESOURCE MOBILIZATION FOR SOCIAL VENTURE 8

Resources at Initial Stage. Social Network as a role of Social Capital. Team and Collective Efforts. Need and Determination of Important Resources. Resource of Knowledge, Skills and Abilities. overview of venture capital and angel investment. Cases.

MODULE V **BUSINESS MODELS AND BUSINESS PLAN FOR SOCIAL ENTERPRISES** **8**

Design Principles of Social Entrepreneurship Business Models , Evaluation of the Root Cause of a Societal Problem. Developing business plan for social ventures. Developing an investor presentation. Feasibility study and report. How to start a business - Procedures for registration of small scale industry

MODULE VI **THE IMPACT OF SOCIAL ENTREPRENEURSHIP ON SOCIETIES AND CASES** **8**

Static Impact of Social Entrepreneurship. Impact of Charitable NGOs vs. Social Entrepreneurship, Impact of For-Profit Companies vs. Social Entrepreneurship. Social entrepreneurship report preparation by students.

Case Study of Social Entrepreneurs

Total Hours –45

REFERENCES:

1. “Social Entrepreneurship : New models of sustainable social change” . Alex Nicholls, Oxford University Press 2006
2. The Process of social value creation : A multiple case study on Social Entrepreneurship in India , Archana Singh Springer 2016
3. “Social Entrepreneurship and social business” Christine K Volkmann, Springer Gabler 2012
4. “Social Entrepreneurship” Manuel London ,Routlege, 2010

OUTCOMES:

The students can able to

- Conceptualize social entrepreneurship in terms of a theoretical framework between changing social values and institutions
- Think and communicate about social values
- Learn about practical models of social change to launch, lead, manage, and evaluate a social venture
- Analyze funding needs and sources for the social venture
- Experience the ideas can be critically and collaboratively examined prior to commitment.

AUC 3211	MODELING AND SIMULATION OF VEHICLE SYSTEM	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To gather knowledge about mathematical modelling technique adopted for different vehicle systems.
- To learn various modelling software and its application in automobile.
- To learn the modelling and simulation technique applies in Automobile.
- To gain knowledge of the different types of simulation software's automotive application and application of FEA techniques

MODULE I COMPUTER FUNDAMENTALS AND TYRE 8

Introduction, Computer fundamentals. Introduction to the modelling and simulation methods of vehicle systems-Fundamental of tyre principles, Vehicle tyre performances in various surfaces, Cornering characteristics of vehicle, Introduction working model two dimensional tyre model.

MODULE II COMPUTER DRAFTING AND MODELLING 7

Fundamental of 2D and 3D drafting. Introduction - 3D geometry - Surface types - Conventions - Attributes - Geometry - Examples of surface modelling - Solid modelling. Vehicle Kinematics, Multi body vehicle system design, Introduction to 3D vehicle design- Mechanisms-various Auto body panels, Introduction to Nastran2D, Nastran4D.

MODULE III VEHICLE FRAME AND STEERING SYSTEMS 7

Vehicle Frame **-** loads, moments and stresses on frame members - Computer aided design of leaf springs - Coil springs and torsion bar springs. Determination of optimum dimensions and proportions for steering linkages ensuring minimum error in steering, Steering Mechanisms, steering mechanisms design and analysis.

MODULE IV SUSPENSION AND FRONT AXLE 7

Suspension computer models & simulations using MATLAB/Simulink, Fundamental concepts of vehicle vibrations principle. Bumper design computer model - moments and stresses at different sections of front axle. Determination of bearing loads at Kingpin bearings.

MODULE V CLUTCH AND GEAR BOX 8

Torque capacity of clutch, design of four speed gear boxes. Drive train model, computer modelling using MATLAB/Simulink-Analysis of loads

MODULE VI CRASH AND READ AXLE 8

Vehicle Collision analysis, Fundamental law of motion, energy and momentum forces and moments 2D and 3D computer models for calculation of impact forces. Computer aided design of propeller shaft. Modelling of final drive. Roll overs analysis, Modelling and analysis of axles. Introduction to the ADAMS vehicle design software. Finite Element modelling (FEA) and failure analysis stress. Deformation calculation.

Total Hours –45

Term work

- Two and three dimensional tyre model
- 3D vehicle design mechanisms, various Auto body panels
- Suspension model and simulations using MATLAB/Simulink
- Computer aided design of propeller shaft and final drive gearing.
- Finite Element modelling(FEA) and failure analysis
- Individual vehicle design project.

TEXT BOOKS:

1. Dean Averns, " Automobile Chassis Design ", llliffe Books Ltd, 1992.
2. Radhakrishnan.P. and Kothandaraman.C.P., "Computer Graphics and Design", Dhanpal Rai & Sons, Delhi 1990.

REFERENCES:

1. Heldt.P.M., " Automotive Chassis", Chilton Co., New York, 1992.
2. Steeds.W., "Mechanics of Road vehicles", llliffe Books Ltd., London, 1990.
3. Giles.J.G., Steering, "Suspension and tyres", llliffe Books Ltd., London, 1988.
4. Newton, Steeds & Garret, "Motor vehicle", llliffe Books Ltd., London, 1982.
5. Heldt.P.M., "Torque converter", Chilton Book Co., New York, 1982.
6. Ramamurthi.V., "Computer Aided Design in Mechanical Engg"., Tata McGraw Hill, New Delhi, 1987.
7. Naim A Kheir system modeling and computer simulation Marcel Dekker Inc 1996
8. Hatmut Bossel Modeling and simulation Volume 1
9. Michael Blundell,Damian Harty –The multibody systems approach to vehicle dynamics Elsevier 2004
10. Gui Rong Liu S S Quek The finite element method:A Practicalcourse Butterworth Heinemann 2003.

OUTCOMES:

On completion of the course students should be able to

- Identify the fundamental the modelling and simulation methods of vehicle systems.
- Apply the concepts and create two and three dimensional tyre models.
- Design the vehicle frame and steering systems by recall the basic concept
- Develop mathematical model and analyse the performance characteristics of Suspension model using MATLAB/ Simulink.
- Generate the mathematical model and estimate clutch and transmission performances
- Assess the crashworthiness performance of vehicle body associate with FEA techniques.

AUC 3212 VEHICLE DYNAMICS

L	T	P	C
3	1	0	4

OBJECTIVES:

- Understand the concept of sources of vibrations and methods to reduce these vibrations
- Gain knowledge about the suspension related vibrations for improving passenger comfort.
- Understand about the stability of vehicle in various terrains.
- Understand characteristics of tyres in different surfaces.

MODULE I VIBRATION BASICS 8+3

Fundamentals of vibration, Classification of vibration, definitions, Mechanical vibration and human comfort. Single degree of freedom, two degree of freedom, multi-degree freedom systems, free, forced and damped vibrations, sources of vibration in automobile, magnification factor, transmissibility, Vibration absorber. Vibration measuring instruments

MODULE II VERTICAL DYNAMICS 7+3

Vertical forces, Fundamental and types of suspension system, Single, Half and full car wheel models, passive, semi active and active suspension, Influence of suspension stiffness, suspension damping, and tyre stiffness. Pneumatic suspension system.

MODULE III LONGITUDINAL DYNAMICS 7+2

Forces acting in longitudinal direction, load distribution, calculation of acceleration, tractive effort and reactions for different drives, stability of a vehicle on a curved track, slope and a banked road.

MODULE IV LATERAL DYNAMICS 7+2

Forces acting in lateral direction, steady state handling characteristics. Transient response characteristics, Direction control of vehicles. Roll center, Roll axis, Vehicle under side forces. Effect of suspension on cornering.

MODULE V WHEELS AND TYRES 7+2

Types of wheel, wheel wobble, wheel shimmy, wheel balancing - recent, statics, dynamic - tyre - requirements, types, testing dynamics, characteristics, power consumed by a tyre, rolling resistance.

MODULE VI DYNAMIC VEHICLE CONTROL TECHNIQUES 9+3

Suspension Control techniques. Anti lock braking control, stability control, Traction control, Bicycle Model, cruise control.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Singiresu S. Rao, Mechanical Vibrations (5th Edition), Prentice Hall, 2010
2. Giri N.K – Automotive Mechanics, Khanna Publishers, 2002.
3. Rao J.S and Gupta. K “Theory and Practice of Mechanical Vibrations”, Wiley
4. J. Y. Wong, Theory of Ground Vehicles, 3rd Edition, Wiley-Interscience, 2001
   Gillespie T.D, “Fundamentals of Vehicle Dynamics”, SAE USA 1992

REFERENCES:

1. Heldt.P.M -”Automotive Chassis”- Chilton Co., New York- 1992
2. Ellis.J.R - “Vehicle Dynamics”- Business Books Ltd., London- 1991
3. Giles.J.G.Steering - “Suspension and Tyres”, Illiffe Books Ltd., London- 1998
4. Ham B, Pacejka - Tyre and Vehicle Dynamics - SAE Publication - 2002.

OUTCOMES:

- Develop the fundament concepts to analyses the vehicle system performance in dynamic condition
- Generate mathematical model and analyze the performance characteristics of Suspension
- Analyse the performance at different surfaces like curved track, slope and a banked road.
- Discuss the handling characteristics and Transient response characteristic associate with the effect of suspension on cornering.
- Demonstrate characteristics wheels and tyre dynamics control systems.
- Apply the knowledge of modern control methods to develop vehicles for modern scenario.

ENC 3281	COMMUNICATION AND SOFT SKILLS - II	L	T	P	C
	CONFIDENCE BUILDING	0	0	2	1

OBJECTIVES:

- To develop professional skills like work ethics, analytical skills, presentation skills etc.
- To train them in problem solving skills and leadership skills pertaining to industries.
- To train them in team building skills.
- To train in setting up career goals

MODULE I **6**

Brief about Multinational companies- Analysing work ethics of multinational companies and small industries- discussing as pairs-Knowledge about etiquette (different types)

MODULE II **6**

Visit to an Industry and prepare reports --Critically reading of industry specific journal articles and write ups-- preparing reports.

MODULE III **4**

Analysing problem solving situations in industries (relating to application of core subject to specific jobs) and discussing about them- working on a sample case

MODULE IV **6**

Developing Leadership in team projects-- debating about various aspects of leadership: for example, responsibility and reliability-time management

MODULE V **8**

Team building skills-- group discussions pertaining to industries-- presenting career goals. -- preparing for interviews- interpersonal skills

Total Hours – 30

REFERENCES:

1. Covey,S.R. (2004). The 7Habits of Highly Effective People: Powerful Lessons in Personal Change. Free Press.UK
2. Fine, P.M.& Alice Olins. (2016).Step up: Confidence, Success and Your Stellar Career in 10 Minutes a Day. Vermilion.UK

3. Pai, A. (1993).How to Develop Self-Confidence. Amazon.com
4. Wentz,F.H.(2012). Soft skills training: A Workbook to Develop Skills for Employment. Amazon.com

OUTCOMES:

After completing the course students would be able to

- Exhibit critical reading skills through review of industry specific articles.
- Provide solutions to problem based situations.
- Exhibit leadership qualities by debating over industry specific issues.
- Participate in group discussions confidently.
- Present their career goals.

AUC 3213	VEHICLE SYSTEM SIMULATION LABORATORY	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To train the students for developing 2D, 3D and solid model of various components of automobiles.
- To train the students to analyze the characteristics of various structures under load of automotive components

LIST OF EXPERIMENTS:

1. Two dimensional mechanisms.
2. Forward Vehicle Dynamics Two dimensional mechanisms and vehicle analysis.
3. Working Model 2D
4. Introduction to 3D vehicle design SOLIDWORKS.
5. Mechanisms, Door, Auto Body.
6. suspensions Simulations
7. Vehicle vibrations principles
8. Drive train dynamics
9. energy and momentum Forces and Moments 2D and 3D Computer models
10. Finite Element Modeling (FEA) and failure analysis Stress, deformation calculations

Total Hours –30

OUTCOMES:

On Completion of the course students should be able to

- Create three dimensional tyre model using basic concepts
- Develop vehicle design mechanisms and various Auto body panels
- Generate mathematical model and analyse the performance characteristics of Suspension model using MATLAB/ Simulink.
- Analyze the propeller shaft and final drive under various load conditions
- Discuss the drive train dynamics and devise Finite Element analysis (FEA) under vibration and failure condition.
- Create Individual vehicle design report

AUC 3214 VEHICLE DYNAMICS LABORATORY

L	T	P	C
0	0	3	1

OBJECTIVES:

- Measure forces due to dynamic imbalance of a rotating shaft.
- Compute magnitudes and locations of balancing masses in two given planes.
- Implement balancing masses.
- Measure forces after balancing and assess the effectiveness of the balancing design

LIST OF EXPERIMENTS:

1. Governors - Determination of sensitivity, effort, etc.
2. Cam - Study of jump phenomenon and drawing profile of the cam.
3. Gyroscope-Verification of law's -Determination of gyroscopic couple.
4. Determination of critical speed of shaft with concentrated loads.(Whirling of shaft)
5. Balancing of reciprocating masses.
6. Balancing of rotating masses.
7. Determination of moment of inertia for connecting rod and flywheel.
8. Vibrating system Spring mass-system-Determination of damping co-efficient of single degree of freedom system.
9. Determination of influence co-efficients for multidegree freedom suspension system.
10. Determination of transmissibility ratio - Vibrating plateform.
11. Determination of torsional frequencies for compound pendulum and flywheel –system with lumped Moment of inertia
12. Transverse vibration –free- Beam. Determination of natural frequency and deflection of beam.
13. Estimation spring rate of leaf spring
14. Design and determination of spring rate of coil spring
15. Testing of damper – determination of damping rate

Total Hours –30

OUTCOMES:

- Ability to analyze kinematics of the three-dimensional particle motion in various coordinate systems: cartesian, natural and cylindrical.
- Understanding of the concepts of displacement, velocity and acceleration as vectors and how to determine them.
- Understanding of the notion of a force as a vector.

- Ability to understand concepts of kinetic, potential and mechanical energies and the concept of a conservative force.
- Understanding of the concepts of power and mechanical efficiency.
- Ability to analyze particle dynamics
- Ability to make a right decision related to a choice of the system of particles whose motion is to be studied.
- Ability to correctly draw the free-body diagram (FBD) for the system.
- Ability to write and solve Newton equations of motion for the system.
- Ability to use concepts of angular displacement, angular velocity and angular acceleration.
- Ability to draw a FBD for a system of rigid bodies.
- Ability to determine mass moment of inertia for some simple body geometries.
- Ability to use principles derived from Newton's second law, including Work & Energy.

AUC 3215	VEHICLE DESIGN LABORATORY (C-LANGUAGE, CATIA)	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To learn to generate part models assembly of various machine components and systems using modeling packages
- To generate part and assembly models of actual Mechanical Products

INTRODUCTION TO AUTO CAD **9**

Getting into Auto CAD. Drawing Editor, Menus, Co-ordinator systems, Creating adrawing. Line input methods, Angle measures, Circle-5 methods, Unity commands.Organising a Drawing Area: Limits, Zoom all, Drawing Aids, Grid, Shape, Ortho,Function keys, Entity creation, Arc, Point, Polygon, Donut, Trace, Ellipse. EditingCommands: Erase, Object selection methods, U, Oops, Redo, Move, Copy, Mirror,Rotate, Scale, Array.Two-Dimensional geometrical construction curves – Projection of points – Projection of solids – Three dimensional views of simple solids.

MODELING SOFTWARE APPLICATION **36**

Introduction of Modelling Software, Formatting of 2D and 3D objects.3D Part Modeling – Protrusion, cut, sweep, draft, loft, blend, rib, round, chamferEditing-Move, Pattern, Mirror Assembly- Creating assembly from parts-assembly constrains Conversions of 3D solid model to 2D drawing – different views, sections, isometric view and dimensioning Introduction to Surface Modeling Introduction to File import, Export – DXF, IGES, STL, STEP 3D Modeling of machine elements like Flanged coupling, screw, jack etc.,

NOTE: Any one of the 3D MODELING softwares like Pro/E, IDEAS, CATIA UNIGRAPHICS, AutoCAD to be used

LIST OF EXPERIMENTS:

1. 2D – Drawing
2. 3D – Drawing
3. Simple drawing using c- language
4. Piston development CATIA –C
5. Radiator Fan
6. Helical spring design
7. Tension Spring design
8. Leaf Spring design
9. Connecting ROD assembly design

10. Tyre design
11. Wheel – Spoke , Alloy

Total Hours – 45

REFERENCES:

1. Bhatt .N.D. and PANCHAL.V.M. "Machine Drawing", Charotar Publishing House, 388001, 38th Edition, 2003.
2. K.R. Gopalakrishnan., "Machine Drawing", 18th Edition, 2004.
3. P.S.G. Design Data Book
4. Ellen Finkelstein, "AutoCAD 2004 Bible", Wiley Publishing Inc, 2003.
5. Sham Tikoo, "AutoCAD 2002 with Applications", Tata McGraw-Hili Publishing Company, New Delhi, 2002.

OUTCOMES:

On completion of the course the students should be able to

- Generate solid models and 2-D drawings of products adhering to standards
- Generate part models assembly of various machine components and systems using modeling packages.
- Evaluate various codes and specifications of BIS concerned with engineering Drawings.
- Generate solid models and 3-D drawing for simple components

SEMESTER – VII

AUC 4101	**VEHICLE MANAGEMENT SYSTEM**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**2**

OBJECTIVES:

- To understand the principle of electronic engine management systems.
- To have an understanding about the management SI and CI engines.
- To understand about engine pollutant formation and management.
- To understand the principle of vehicle management systems

MODULE I FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS 7

Components for electronic engine management system, open and closed loop control strategies, PID control, Look up tables, introduction to modern control strategies like Fuzzy logic and adaptive control. Parameters to be controlled in SI and CI engines .Sensors and actuators.

MODULE II MANAGEMENT OF SI AND CI ENGINES 8

Layout and working of SI engine management systems. Group and sequential injection techniques. TBI, MPFI and GDI systems. electronic ignition system, Electronic spark timing control. Diesel injection, Pilot, main, advanced post injection and retarded post injection techniques. Electronically controlled Unit Injection system. Layout of the common rail fuel injection system.

MODULE III MANAGEMENT OF POLLUTANTS 7

Emission from automobiles, transient emission, effect of pollutants, global warming, formation of pollutants in SI engines, formation of pollutants in CI engines. Noise pollution and control. Measurement of pollution. NVH.

MODULE IV VEHICLE MANAGEMENT SYSTEMS 8

Sensors for throttle position, mass air flow, crank shaft position, cam position, engine and wheel speed, steering position, tire pressure, brake pressure, steering torque, fuel level, crash, exhaust oxygen level, knock, engine temperature, manifold temperature and pressure , actuators, various types of actuators. ABS, ESP

Total Hours – 30

TEXT BOOKS:

1. Tom Weather Jr and Cland C.Hunter, “Automotive Computers and Control

System", Prentice Hall Inc., New Jersey, 1984.
2. William B.Ribbens Butterworth, Heinemann,"Understanding Automotive Electronics",5th Edition, 1998.
3. Jeff Hartman, "How to tune and Modify Automotive Engine Management System"Motor books, 2013.
4. Ganesan.V., "Internal Combustion Engines", Tata McGraw-Hill Publishing Co.,New Delhi, 2003.
5. M.L.Mathur and R.P.Sharma, "A course in Internal combustion engines",Dhanpat Rai & Sons Publications, New Delhi, 2001.

REFERENCES:

1. Robert Bosch ,"Diesel Engine Management", Wiley Publications, 2006
2. Robert Bosch , "Gasoline Engine Management", Wiley Publications, 2006
3. Robert N Brady, "Automotive Computers and Digital Instrumentation'", A reston Book, Prentice Hall, Eagle Wood Cliffs, New Jersey, 1988.
4. Bechtold, "Understanding Automotive Electronics", SAE, 1998
5. John B.Heywood, "Internal Combustion Engine Fundamental", McGraw-Hill, 1988

OUTCOMES:

On completion of the course the students should be able to,

- Analyze the requirement and components of engine management system.
- .Select sensors for ignition and injection system with justification.
- Analyze design and operating parameters on emission and select suitable control devices.
- Identify various sensors in VMS and link the actuators

AUC 4102	FINITE ELEMENT ANALYSIS OF AUTOMOTIVE COMPONENTS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To understand about the concept of Continuum Mechanics
- To Study about the 2D and 3D parametric elements
- To know the static and dynamic problems in FEA

MODULE I INTRODUCTION **7**

Basic concepts of finite element method. Review of various approximate methods in structural analysis, Stiffness and flexibility matrices for simple cases. Direct stiffness method- plane truss idealization, joint forces and displacements. Formulation of governing equations and convergence criteria.

MODULE II DISCRETE ELEMENTS **7**

Use of bar and beam elements in structural analysis. Computer implementation of procedure for these elements. 1D problems with second order equations, weak formulations-Examples from solid mechanics and heat transfer.

MODULE III CONTINUM ELEMENTS **7**

Classification of C0 C1 continuous problems, parameter functions and its properties – completeness and compatibility condition. Different forms of 2D elements and their applications for plane stress, plane strain and axi-symmetric problems. Consistent and lumped formulation. Use of local coordinates. Numerical integration.

MODULE IV ELEMENTS **8**

Isoparametric quadrilateral elements-Shape functions for rectangular elements, Isoparametric mapping for quadrilateral elements, Numerical integration for quadrilateral elements, Four node quadrilateral element for 2DBVP,Eight node serendipity element for 2D BV

MODULE V FEA IN THERMAL ANALYSIS **8**

Finite element analysis of 2D steady state thermal analysis-Galerkin approach-General two dimensional heat conduction-Axisymmetric heat conduction-Triangular, Quadrilateral elements-Simple problems using three

noded triangular only.

MODULE VI FEA IN STRUCTURAL ANALYSIS 8

Finite element analysis of plane elasticity 2D problems-Introduction to theory of elasticity-plane stress-plane strain and Axisymmetric formulation-Element matrices using energy approach-Simple problems using three noded triangular element only.

Total Hours –45

TEXT BOOKS:

1. Segerlind.L.J., " Applied Finite Element Analysis ", Second Edition, John Wiley and Sons Inc., New York, 1984.

REFERENCES:

1. Bathe.K.J. and Wilson.E.L., " Numerical methods in finite elements analysis ", Prentice Hall of India Ltd, 1983.
2. Cook.R.D., "Concepts and Applications of Finite Element analysis ", 3rd Edition, John Wiley & Sons, 1989.
3. Krishnamurthy.C.S., " Finite Elements analysis ", Tata McGraw Hill, 1987.
4. Ramamurthi.V., " Computer Aided Design in Mechanical Engg. ", Tata McGraw-Hill, 1987.

OUTCOMES:

- Apply the numerical methods involved in Finite Element basics of truss, beam, membrane, plate, and continuum elements
- Create of planar one-dimensional (truss and beam) elements having linear, quadratic, and cubic shape functions
- Develop the Global, local, and natural coordinates for analysis.
- Generation of planar, plane stress two-dimensional elements (rectangular and quadratic quadrilateral elements)
- Devise of 3-dimensional elements (four-node tetrahedral and eight-node brick elements)
- Compile the formulation and basic energy and weighted residual formulation of finite elements.

AUC 4103 EVALUATION OF VEHICLE PERFORMANCE

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the minimum power requirement for vehicle propulsion and significance of aerodynamic drag forces related to vehicle performance.
- To acquire knowledge about the transmission and engine system performance analysis for ground vehicles.
- To expose the modern control system evaluation for engine, steering, suspension and brake systems.
- To acquire knowledge about various types of testing methods used for validating the vehicle design.

MODULE I VEHICLE PERFORMANCE 7

Vehicle performance estimation and prediction, Aerodynamic drag, methods of estimation of resistance to motion, power requirement for propulsion, Power plant characteristics & transmission related requirements, vehicle acceleration, maximum speed, and gradiability drive systems comparison.

MODULE II VEHICLE TRANSMISSION 7

Vehicle transmission performance: Characteristics and features of friction clutches, mechanical gear transmission and Epicyclic gear boxes, fluid coupling & torque converters. Transmission efficiency measurement

MODULE III ENGINE PERFORMANCE 7

Operational performance: Engine performance and operating characteristics at full load and part load condition, fuel economy, effect of vehicle condition, tire and road condition, traffic condition and driving habits on fuel economy.

MODULE IV VEHICLE SYSTEM CONTROL 8

Different Vehicle Control Systems, Braking arrangements and characteristics, weight transfer, steering arrangements, rigid & independent suspension, roll centre, torsion bar, stabilizer, and radius bar. Drive by wire technology, vehicle safety systems.

MODULE V TESTING AND VALIDATION 8

Vehicle performance Testing: Laboratory testing – Testing of major components of vehicle like clutch, suspension, braking, steering etc., Engine testing- noise vibrations, emission, power &fuel consumption, brake testing on the road.

MODULE VI VEHICLE TESTING 8

Vehicle testing on chassis dynamometers, Road and Track testing, Initial inspection, running in and durability, extensive driving, maximum speed & acceleration, handling and ride characteristics on different road surfaces, ride comfort, corrosion testing.

Total Hours – 45

TERM WORKS

- Estimation of power requirement for vehicle propulsion considering Aero dynamic describe the ride characteristics for different road surfaces. Also compute maximum acceleration with respect to speed
- Analyse the performance and characteristic of transmission system for different friction values
- Engine testing for finding the performance characterises and on road fuel consumption measurement
- Brake Efficiency measurement and Noise and vibration measurement in passenger compartment
- Study of chassis dynamometer for vehicle performance testing and study of vehicle component testing

Case Studies

- Study the Automatic Transmission system performances for different speed and Load conditions
- Study the engine performance characterises for various load and speed condition
- Evaluation human ride comfort characteristics for ISO class A to Class E road surfaces

REFERENCES:

1. Gousha H.M., “Engine performance diagnosis & Tune up shop manual”
2. J.G. Giles, “Vehicle Operation & performance”.
3. W.H. Crouse & D.L. Anglin, “Motor vehicle inspection”.
4. SAE Transactions papers – 831814 / 820346 / 820371 /820375
5. CIRT &VRDE Manuals

OUTCOMES:

On completion of the course the students should be able to

- Estimate the power requirement for vehicle propulsion by considering aero dynamic effects and the ride characteristics analysis for different road surfaces. Also able to compute maximum acceleration with respect to vehicle speed.
- Demonstrate basic elements to investigate the performance of transmission

system and brake efficiency measurement.

- Analyze the various performance characteristics of Engines
- Analyze the requirements of modern control methods in steering, suspension and braking systems.
- Compute the vehicle subsystem performance characteristics using fundamental concepts
- Validate the vehicle design with vehicle performance testing, component testing in chassis dynamometer, vibration and noise measurements in passenger compartment

AUC 4104	TWO AND THREE WHEELERS TECHNOLOGY	L	T	P	C
		2	0	2	3

OBJECTIVES:

- Gain the knowledge about the constructional and design aspects of two wheelers and three wheelers.
- Develop the ability to know the operating characteristics two and three wheelers
- To create an experience to know the working principle and different types engine, transmission system of two and three wheelers
- To impart knowledge to the learners in the principles of working and operation and of various barking systems. brakes, wheels and tyres
- Enhance ability of the learners about working principles of electrical and electronic subsystem and sensors are using in two wheeler sand three wheelers.

MODULE I INTRODUCTION AND POWER PLANT 7

Classification and layout of two wheelers (Motorcycles, scooters mopeds) and Three wheelers, (Auto rickshaws, pickup van and delivery van) applications and capacity – goods and passengers; study of technical specifications of Two and Three wheelers; Selection of engine, Design considerations of power plants requirements for lubrication, cooling, starting, Recent engine developments

MODULE II STEERING AND TRANSMISSION SYSTEM 8

Steering geometry, steering column construction; steering system for three wheelers, controls on handle bar of two wheelers. Clutch – requirements; different types -need of primary reduction, selection of transmission – gear transmission, gear shift mechanism, belt transmission, automatic transmission (Continuous Variable Transmission – CVT),final drive and differential for three wheeler;

MODULE III SUSPENSION, BRAKES, WHEELS AND TYRES 8

suspension requirements; design considerations; Front and rear suspension systems layouts. Springs and dampers. Design consideration of brake; types of brakes: disc; drum; braking mechanism: mechanical; hydraulic and servo; ABS in two wheelers, Front and rear brake link lay-outs: wheel types Spoked wheel, cast wheel and Disc wheel; Tyre requirements details

MODULE IV FRAMES, BODY AND COMFORT 7

Types of frame; construction; loads acting on frame; design consideration; materials;

three wheeler layout; aerodynamic; aesthetic and ergonomics considerations regulations. Handling characteristics; driver and pillion seating arrangement; ergonomics and comfort; road holding and vehicle stability; gyroscope effect; riding characteristics;

Total Hours – 45

TEXT BOOKS:

1. Irvind, P.E., Motor cycle Engineering , Temple Press Book, London

REFERENCES:

1. The Cycle Motor Manual, Temple Press Ltd., London.
2. Marshall Cavensih, Encyclopedia of Motor cycling,20 Volumes,New York and London.
3. Bryaut,R.V., Vespa Maintenance and Repair series.
4. Raymond Broad, Lambretta – A practical guide to maintenance and repair.

PRACTICAL SESSION: **Hours: 15**

1. Port timing diagram and Port area measurement for Two wheeler (Scooter) Engine and Three Wheeler (Auto rickshaw) Engine.
2. Dismantling and Assembling of two stroke petrol Engine (Zentap) with cubic capacity compression ratio and brake power measurements.
3. Dismantling and Assembling of four stroke petrol engine with cubic capacity compression ratio and brake power measurements.
4. Two and Three wheeler lightning and rooting system inspection and maintenance.
5. Inspection and Testing of Battery for various load condition including measurement of specific gravity.
6. Inspection service and Maintenance of Two and Three wheeler.
7. Removal refitting of wheels and tyres and measurement of aspect ratio and other dimension of the tyre.
8. Inspection and Measurement of pollution is Two and Three wheeler.
9. Actual compression ratio measurement of four stroke petrol Engine (150 cc).

OUTCOME:

On completion of the course students should be able to

- Extrapolate the constructional details of various types of two and three wheelers.
- Analyze the requirement and performance of the two and three wheelers

transmissions systems.

- Summarize the construction of different types steering and suspension system.
- Demonstrate the construction details and design consideration of Braking system, wheel and tyres.
- Apply the basic element while develop a two wheeler frames and body.
- Develop comprehensive knowledge about the functioning of two wheelers and three wheelers and analyze the vehicle performance.

AUC 4105 VEHICLE MAINTENANCE LABORATORY

L	T	P	C
0	0	3	1

OBJECTIVES:

- To study the various maintenance the reconditioning of vehicle parts.
- To train the structures in identifying the fault and rectification.
- To impart the fundamental knowledge in evaluation and maintenance.
- To know about the various methods of maintaining vehicles and their subsystems.

STUDY EXPERIMENTS:

- Study and layout of an automobile repair, service and maintenance shop.
- Safety aspects with respect to man, machine and tools.
- General procedures for servicing and maintenance schedule.
- Fault diagnosis and service of transmission system
- Fault diagnosis and service of Electrical system like battery, starting system,
- charging system, lighting system etc.
- Fault diagnosis and service of vehicle air conditioning system

LIST OF EXPERIMENTS

1. Minor and major tune up of gasoline and diesel engines.
2. Calibration of Fuel injection pump.
3. Cylinder reboring - checking the cylinder bore, Setting the tool and reboring.
4. Calibration of fuel injection nozzle and tester
5. Removal and fitting of tire and tube.
6. Fault diagnosis of ignition system and spark plug cleaner & tester
7. Adjustment of pedal play in clutch, brake, hand brake lever and steering wheel play.
8. Wheel alignment procedure for servicing and maintenance.
9. Fault diagnosis of brake/clutch
10. Calibration of head lamp aligner
11. Calibration of Refacer of valve.

Total Hours –45

TEXT BOOKS:

- Vehicle maintenance and garage practice by Jigar A.Doshi Dhru U.Panchal, Jayesh P.Maniar. 2014
- A Practical Approach to Motor Vehicle Engineering and Maintenance 3rd

Edition by Allan Bonnick.

REFERENCES:

- Vehicle Service Manuals of reputed manufacturers
- Advanced Automotive Fault Diagnosis by Tom Denton 2011.
- Nissan Patrol Automotive Repair Manual: 1998-2014 by Haynes Manuals Inc.
- Automobile electrical manual a comprehensive guide by Haynes manual car repair.

OUTCOMES:

On completion of the course the students should be able to

- Identify the analyze faults in a vehicle.
- Demonstrate the procedure for reconditioning and repairing of various component and subsystems of vehicles.
- Illustrate the complete methodology of evaluation and maintenance of automobile.
- Perform dismantling & assembling of automobile components using tools.
- Enumerate the importance of maintenance and also the step by step procedure for maintaining the various automotive subsystems.

AUC 4106	ADVANCED AUTOMOBILE COMPONENTS MANUFACTURING LABORATORY	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To familiarize the various mechanisms available in the, milling ,gear hobbing and grinding machines.
- To know the various tools and work holding devices used in machining processes
- To practice the basic machining operations performed in the special purpose machines
- To have knowledge about product manufacturing phases and experience working in teams to manufacture a product.
- To know the application of various CNC machines

- Milling Machines
    1. Milling Polygon Surfaces
    2. Keyway Milling
- Grinding / Polishing
    3. Surface Grinding
    4. Cylindrical Grinding
- Machining Components for Assembly of different fits.
    5. Bush and Shaft
    6. Step turning with drilling using capstan lathe
- Gear Machining
    7. Gear Milling
    8. Machining using CNC vertical machining
    9. Machining using CNC turning tap
- Project work
    10. Combined Skill (Each team has to make one simple product)

Total Hours –45

OUTCOMES:

On completion of the course, students should be able to:

- Select suitable machining operations for automobile components.
- Equip with good practical knowledge required in the core industry.
- Write the CNC program for particular machining operations.
- Compute the various operations in the CNC machine.
- Interpret the different machining process using different techniques.

- Apply and analyze the machining operations performed in the special purpose machines

AUC 4107	INTERNSHIP	L	T	P	C
		0	0	0	1

OBJECTIVES:

- To expose the students to industrial environment
- To study the industrial process, product and services
- To study the resources used in industries

OUTCOMES:

- To analyze the present process product for improvement
- To prepare consolidated with findings and conclusion
- To present a seminar on the outcome of the internship

The students will undertake internship training in automotive and related industry for one month during the summer vacation. The student should be submit a report and make presentation about learning outcome for the industry. The credit will be awarded in the 7^{th} semester.

SEMESTER - VIII

		L	T	P	C
AUC 4211	**PROJECT WORK**	**0**	**0**	**24**	**12**

OBJECTIVES:

- To enable the students to apply their acquired knowledge during the course of study and provide solutions to real life problems

OUTCOMES:

- To identify and define the problem
- To carry out literature survey related to the problem and critically review the literature
- To device suitable methodology by adopting methods and modeling & analytical techniques
- To do research on a specified area and find a solution for the objective
- To prepare a consolidated report with all findings and conclusion
- To publish the findings in national / international conference in the form of research paper.

PROFESSIONAL ELECTIVES

AUC X01	HOMOLOGATION AND TESTING	L	T	P	C
		1	0	0	1

OBJECTIVES:

- To provide knowledge on, vehicle certification
- To get familiarized with Vehicle testing procedures

MODULE I HOMOLOGATION **7**

Certification of vehicles, ARAI, NATRIP, GARC, Standards, Testing procedures, Testing conditions, Preparation of vehicles for testing.

MODULE II TESTING **8**

Testing of Vehicles, components, systems such as Engine, Powertrain, Passive safety, EMC (Electrical and Electronic components), NVH, Fatigue, Material, Tyres and Vehicle dynamics, Brakes, HVAC, Crash worthiness

Total Hours: 15

REFERENCES:

1. ARAI Standards and case studies
2. www.araiindia.com

OUTCOMES:

- Ability to demonstrate the procedure for vehicle certification
- Ability to explain the testing procedure of vehicle systems and components.

AUC X02	GEOMETRIC DIMENSIONING AND TOLRENCING	L	T	P	C
		1	0	0	1

OBJECTIVES:

- To provide knowledge on, Dimensioning and Tolerancing.
- To get familiarized Engineering Drawings

MODULE I FUNDAMENTALS 7

Drawing standards, Dimensions, Tolerances, Notes used in drawings, Limits, Fits and Tolerance, Key GD&T Terms, Symbols and ,Modifiers, Rules and Concepts

MODULE II GD&T 8

Datum system. Targets and Features, Orientation, Runout, Concentricity, Symmetry and profile, Applications.

Total Hours –15

TEXT BOOKS:

1. Fundamentals of Geometric Dimensioning and Tolerancing, Third Edition, Alex Krulikowski
2. Geometric Dimensioning and Tolerancing: Workbook and Answerbook, ASME, James D. Meadows

REFERENCES:

1. Geometric Dimensioning and Tolerancing: Applications and Inspection, Prentice Hall, 2002 - Technology & Engineering , Gary.K.Griffith.

OUTCOMES:

- Ability to select suitable dimensions and tolerances for particular application
- Ability to prepare engineering drawings for components

AUC X03	VEHICLE ENGINEERING & INTEGRATION	L	T	P	C
		1	0	0	1

OBJECTIVES:

- To provide knowledge on latest practices in the vehicle manufacture
- To get familiarized with practices on vehicle packaging and integration

MODULE I VEHICLE ENGINEERING 7

Production of components, testing of components, making of sub-systems, testing of sub-systems, prototype of vehicle

MODULE II VEHICLE INTEGRATION 8

Integration of vehicle components, subsystems and systems into vehicle, Integration of soft wares to test the design of vehicle, Vehicle packaging such as engine packaging, interior packaging, auto jewels etc for a particular model to the requirement.

Total Hours – 15

TEXT BOOKS:

1. The Fundamentals of Car Design and Packaging Paperback – Import, 1 Feb 2009 by Stacey Macey

REFERENCES:

1. The Fundamentals of Car Design Packaging Read Online.

OUTCOMES:

- Ability to select suitable components for making a particular vehicle.
- Ability to suggest packages for particular vehicle model

AUC X04	AUTOMOTIVE HVAC(Heating Ventilation Air Conditioning)	L	T	P	C
		2	0	0	2

OBJECTIVES:

Upon completion of this course, the student will be able to:

- Identify and use Heating and Air Conditioning Service specialty test equipment and basic mechanics hand tools.
- Visually inspect a heating and air conditioning system and locate obvious troubles.
- Diagnose common heating and air conditioning problems.
- Perform general repair procedures on the heating and air conditioning system including
- Charging the air conditioning system , Recovering and recycling refrigerant, Evacuating the air conditioning system, Removing and replacing heating and air conditioning system components

MODULE I AUTOMOTIVE AIRCONDITIONING FUNDAMENTALS 7

Purposes of Heating, Ventilation and Air Conditioning- Environmental Concerns- Ozone layer depletion- Location of air conditioning components in a car – Schematic layout of a vehicle refrigeration system. Psychrometry – Basic terminology and Psychrometric mixtures- Psychrometric Chart- Related problem

MODULE II AUTOMOTIVE COOLING AND HEATING SYSTEM 8

Vehicle Refrigeration System and related problems- Fixed thermostatic and Orifice tube system- Variable displacement thermostatic and Orifice tube system- Vehicle air conditioning operation Types of compressor- Compressor Clutches- Compressor Clutch electrical circuit- Compressor lubrication- Condensers- Evaporators- Expansion devices- Evaporator temperature and pressure controls- receiver-drier- Accumulators- refrigerant hoses, Connections and other assemblies- Heating system

MODULE III AIR-CONDITIOING CONTROLS, DELIVERY SYSTEM AND REFRIGERANTS 7

Types of Control devices- Preventing Compressor damage- Preventing damage to other systems- Maintaining driveability- Preventing Overheating Ram air ventilation- Air delivery Components- Control devices- Vacuum Controls Containers – Handling refrigerants – Discharging, Charging & Leak detection – Refrigeration system diagnosis – Diagnostic procedure – Ambient conditions affecting system pressures.

MODULE IV AUTOMATIC TEMPERATURE CONTROL AND A/C SERVICING **8**

Different types of sensors and actuators used in automatic temperature control- Fixed and variable displacement temperature control- Semi Automatic- Controller design for Fixed and variable displacement type air conditioning system. Special tools for servicing vehicle air conditioning – Diagnosing components and air conditioning systems- Diagnosing cooling system- Air delivery system Automatic temperature Control system diagnosis and service

Total Hours –30

TEXT BOOKS:

1. William H. Crouse, 'Automotive Air Conditioning', Tata McGraw Hill Publication.
2. 'Automotive Air Conditioning', Mitchell Information Service, PHI.
3. W.H. Hucho, 'Aerodynamic of Road Vehicles, Butterworths Co.
4. Warren Farnell and James D.Halderman, "Automotive Heating, Ventilation, and Air Conditioning systems", Classroom Manual, Pearson Prentice Hall, 2004
5. William H Crouse and Donald L Anglin, "Automotive Air conditioning", McGraw Hill Inc., 1990.

REFERENCES:

1. Mitchell Information Services, Inc., "Mitchell Automatic Heating and Air Conditioning Systems", Prentice Hall Inc., 1989.
2. Paul Weisler, "Automotive Air Conditioing", Reston Publishing Co. Inc., 1990.
3. McDonald,K.L., "Automotive Air Conditioning", Theodore Audel series, 1978.
4. Goings,L.F., "Automotive Air Conditioning", American Technical services, 1974.

OUTCOMES:

- Upon the completion of the course, the student should understand the basic of vehicle air- conditioning system, its components, working principle, control mechanism, service etc.

AUC X05 HYBRID AND ELECTRIC VEHICLE

L	T	P	C
2	0	0	2

OBJECTIVES:

- To familiar with hybrid vehicles and types
- To understand the hybrid vehicle design, architecture and its specification.
- To study the powerplant specifications
- To study the electric drives and its types

MODULE I HYBRID VEHICLES **8**

Performance characteristics of road vehicles, calculation of road load, predicting fuel economy, Grid connected hybrids. DC motors-series wound, shunt wound. Compound wound and separately excited motors AC motors - induction, synchronous, brushless DC motor, switched reluctance motors.

MODULE II HYBRID ARCHITECTURE **7**

Series configuration- locomotive drives, series parallel switching, load tracking architecture. Pre transmission parallel and combined configurations-Mild hybrid, power assist, dual mode, power split, power split with shift, Continuously Variable transmission (CVT). Wheel motors.

MODULE III HYBRID POWER PLANT SPECIFICATIONS **7**

Grade and cruise targets. launching and boosting, braking and energy recuperation, drive cycle implications, engine fraction-engine downsizing and range and performance, usage requirements.

MODULE IV ELECTRIC DRIVES **8**

Early Ward Leonard control system - main features, generator, merits, reverse motion, modified WARD LEONARD control system - main features, modifications. Modern electric drives - main features, advantages of electric drives, limitations of electric drive, variations of torque and speed with armature current Generator, motor, series motor, variations of efficiency with armature current

Total Hours –30

TEXT BOOKS:

1. Mehrdad Ehsani, Yimin Gao, Ali Emadi., "Modern Electric, Hybrid Electric, and Fuel Cell vehicles", Fundamentals, Theory, and Design, CRC Press 2009.

2. Ron Hodkinson and John Fenton, "Lightweight Electric/Hybrid Vehicle ", Butterworth –Heinemann, 2001.

REFERENCES:

1. James Larminie and John Loury, " Electric Vehicle Technology -Explained", John Wiley & Sons.
2. Ronald K Jurgen, "Electric and Hybrid -Electric Vehicles", SAE, 2002.
3 Sandeep Dhameja, "Electric Vehicle Battery Systems", Butterworth – Heinemann,2002.

OUTCOMES:

On completion of the course the students should be able to

- Identify different types of hybrid vehicles
- Identify different types of hybrid architectures and draw layouts
- To find out the power plant specifications.
- Identify different Electric drives for vehicles

AUC X06	VEHICLE DIAGNOSTICS	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To provide knowledge on, diagnostic procedure and instrumentation.
- To get familiarized with the world of vehicle diagnostics

MODULE I INTRODUCTION 8

Diagnostic process, Mechanical techniques, Electrical techniques, Fault codes, Data sources, Basic equipments, Piecoscope oscilloscope, Scanners, Emission testing, pressure testing, Automotive pressure oscilloscope transducer.

MODULE II ENGINE DIAGNOSTICS 7

Si engine management, OBD, Monitors, Misfire detection, Ignition faults, Fuel system, CI engine management, Fuel system and Injection system faults.

MODULE III CHASSIS SYSTEMS 7

Fault Diagnosis of brake system, ABS, Traction control system, Steering system, Suspension system, Transmission systems, Manual and Automatic, Tires

MODULE IV ELECTRICAL AND ELECTRONIC SYSTEMS 8

Diagnosis of Electronic components and circuits, Multiplexing, Diagnosis of lighting and electrical system and components, Instruments, Auxiliaries.

Total Hours – 30

TEXT BOOKS:

1. Advanced Automotive Fault Diagnosis, 4th Ed: Automotive Technology: Vehicle Maintenance and Repair, Tom Denton.
2. Road vehicles - Diagnostic communication Paperback – 2008, Peter Subke

REFERENCES:

1. How To Use Automotive Diagnostic Scanners (Motor books Workshop) Paperback – Import, 1 Aug 2015 Tracy Martin

OUTCOMES:

- Ability to analyze the faults of vehicle systems and set up instrumentation for identifying the faults.
- Ability to design and develop methods for rectifying the faults in vehicle systems.

AUC X07 SPARK ENGINE TECHNOLOGY L T P C

3 0 0 3

OBJECTIVES:

- To gain knowledge on construction, fuel system and ignition system.
- To understand about the cooling and lubricating system.
- To understand the principle of combustion
- To learn about the formation of emission and control technique.

MODULE I ENGINE CONSTRUCTION AND OPERATION 7

Four and two stroke engine - Constructional details, working principle. Otto cycle, Actual indicator diagram, Fuel air cycle. Cylinder layout and configurations. Firing order and its significance. Engine balancing. Materials for engine components.

MODULE II FUEL SYSTEM 7

Gasoline - air mixtures. Mixture requirements - Mixture formation - Carburettor, Choke, Carburettor systems for emission control- Secondary Air Injection. Electronic injection – requirement – Manifold injection – Port injection – Gasoline direct injection – Air assisted direct injection

MODULE III IGNITION SYSTEM 8

Ignition fundamentals, Solid state ignition systems, High energy ignition systems, Electronic spark timing and control. Combined ignition and fuel management systems. Dwell angle calculation, Ignition timing calculation.

MODULE IV COOLING AND LUBRICATION SYSTEM 7

Need for cooling. Types of cooling system – air cooling and Liquid cooled systems. Forced circulation system, pressure cooling system, Evaporative cooling system – Need for Lubrication system. Mist lubrication system, wet & dry sump lubrication, Properties of lubricants, properties of coolant – Recent Technologies.

MODULE V COMBUSTION IN S.I. ENGINES 8

Stages of combustion, normal and abnormal combustion, knocking, Variables affecting Knock,

Features and design consideration of combustion chambers. Flame structure and speed, Cyclic

variations, Lean burn combustion, Stratified charge combustion systems. Heat release correlations.

MODULE VI EMISSION FORMATION AND CONTROL TECHNIQUES 8

Formation of oxides of nitrogen, carbon monoxide, hydrocarbon, aldehydes emission.

Effects of Engine Design - operating variables on Emission formation. Engine Design modifications, fuel modification, evaporative emission control, EGR, air injection,thermal reactors, catalytic convertors, catalytic converter efficiency.

Total Hours – 45

TEXT BOOKS:

1. Ganesan.V., “Internal Combustion Engines”, Tata McGraw-Hill Publishing Co., New Delhi,2012.
2. M.L.Mathur and R.P.Sharma, “A course in Internal combustion engines”, Dhanpat Rai & Sons Publications, New Delhi, 2001.
3. K.K.Ramalingam, “Internal Combustion Engines”, Scitech Publications, Chennai, 2000.

REFERENCES:

1. Heldt P.M., “High Speed Combustion Engines”, Oxford IBH Publishing Co., Calcutta, 1975.
2. Obert E.F., “Internal Combustion Engines Analysis and Practice”, International Text Books Co., Scrantron, Pennsylvania - 1988.
3. William H.Crouse, “Automotive Engines”, McGraw-Hill Publishers, 2011.
4. Ellinger H.E., “Automotive Engines”, Prentice Hall Publishers, 1992.
5. John B.Heywood, “Internal Combustion Engine Fundamental”, McGraw-Hill, 1988.
6. Pulkrabek “Engineering Fundamentals of the Internal Combustion Engines”, Practice Hall of India, 2003.

OUTCOMES:

The student should be able to

- Identify the two and four stroke engine construction.
- Design the fuel system and ignition system.
- Analyze the cooling and lubricating system.
- Determine the parameter affect the combustion phenomenon.
- Control the emission formation in SI engine

AUC X08 COMPRESSION ENGINE TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn the knowledge on basic concepts on Compression Ignition Engines
- To understand various sub components along with its functions.
- To learn combustion process of diesel engine
- To understand different types of combustion chambers.
- To learn the concept of supercharging and turbo charging.
- To understand the performance testing of diesel engines.

MODULE I DIESEL ENGINE BASIC THEORY 8

Diesel engine construction and operation. Two stroke and four stroke diesel engines. Diesel cycle – Fuel-air and actual cycle analysis. Diesel fuel. Ignition quality. Cetane number. Laboratory tests for diesel fuel. Standards and specifications.

MODULE II FUEL INJECTION SYSTEM 8

Requirements – solid injection. Function of components –common rail direct injection - Jerk and distributor type pumps. Pressure waves, Injection lag. Unit injector. Mechanical and pneumatic governors. Fuel injector, Types of injection nozzle, Nozzle tests. Spray characteristics. Injection timing. Pump calibration. Pilot injection.

MODULE III AIR MOTION, COMBUSTION 7

Importance of air motion – Swirl, squish and turbulence, Swirl ratio. Fuel air mixing. Stages of combustion. Delay period – factors affecting delay period. Knock in CI engines. Comparison of knock in CI & SI engines.

MODULE IV COMBUSTION CHAMBERS 7

Direct and indirect injection combustion chambers. Air cell chamber. Combustion chamber design – objectives – Different types of combustion chamber. Combustion chamber. Combustion chambers for Homogeneous charge compression ignition systems – Dual and alternate fueled engine systems.

MODULE V SUPERCHARGING AND TURBOCHARGING 7

Necessity and limitation – Charge cooling. Types of supercharging and turbocharging – Relative merits. Matching of turbocharger. Inter cooler, Inseries

Twin turbo

MODULE VI TESTING AND PERFORMANCE 8

Automotive and stationary engine testing and related standards – Engine power and efficiencies – performance characteristics. Variables affecting engine performance – Methods to improve engine performance – Heat balance – Performance maps. Hot testing of engines, Dynamometer type, Chassis dynamometer for emission test

Total Hours – 45

TEXT BOOKS:

1. Mathur M.L. and R.P. Sharma, Internal Combustion Engines, Dhanpat Rai Publication, Delhi, 2010.
2. Ganesan,V., Internal Combustion Engines, Tata-McGraw Hill Publishing Co., New Delhi, 1994.

REFERENCES:

1. Heldt,P.M., High Speed Combustion Engines, Oxford IBH Publishing Co., Calcutta, 1985.
2. Obert,E.F., Internal Combustion Engine analysis and Practice, International Text Book Co., Scranton, Pennsylvania, 1988.
3. Maleev,V.M., Diesel Engine Operation and Maintenance, McGraw Hill, 1974. Dicksee, C.B., Diesel Engines, Blackie & Son Ltd., London, 1964.

OUTCOMES:

On completion of course the students should be able to,

- Demonstrate the working concepts of various components of Diesel engine
- Analyze Diesel cycle efficiency.
- Analyze and prepare a layout of fuel system for various diesel engine.
- Demonstrate combustion process and design a combustion chamber in CI engine.
- Analyze the performance of supercharger and turbocharger.
- Analyze the engine performance characteristics.

AUC X09 AUTOMOTIVE AERODYNAMICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- The students able to study the basics of Automotive Aerodynamics in a automobile vehicle.
- The student can impart knowledge in the performance of the automobile vehicle.
- The students able to know the resistance of motion, rolling and grade resistance
- The students can impart knowledge in the aerodynamic drag and pressure occurs in an automobile vehicle.
- The students will have good exposure in automotive aerodynamic aspects.
- The students also able to know about the wind tunnel test in a vehicle and behaviour of a vehicle.

MODULE I INTRODUCTION 5

Scope - historical development trends - Fundamental of fluid mechanics - Flow phenomenon related to vehicles -External & Internal flow problem - Potential of vehicle aerodynamics.

MODULE II RESISTANCE AND PERFORMANCE OF VEHICLE 5

Deceleration of vehicle inside passenger compartment, deceleration on impact with stationary and movable obstacle, concept of crumble zone, safety sandwich construction.

MODULE III AERODYNAMIC DRAG OF CARS 8

Cars as a bluff body - Flow field around car - drag force - types of drag force - analysis of aerodynamic drag - drag coefficient of cars - strategies for aerodynamic development - low drag profiles.

MODULE IV ANALYSIS OF DRAG OF CARS 7

Front end modification - front and rear wind shield angle - Boat tailing - Hatch back, fast back and square back - Dust flow patterns at the rear - Effects of gap configuration - effect of fasteners.

MODULE V VEHICLE HANDLING 10

The origin of forces and moments on vehicle - side wind problems - methods to calculate forces and moments - vehicle dynamics under side winds - the effects of forces and moments - Characteristics of forces and moments - Dirt accumulation on the vehicle - wind noise - drag reduction in commercial vehicles.

MODULE VI WIND TUNNELS FOR AUTOMOTIVE AERODYNAMIC 10

Introduction - Principle of wind tunnel technology - Limitation of simulation - Stress with scale models – full scale wind tunnels - measurement techniques - Equipment and transducers - road testing methods – Numerical methods.

Total Hours – 45

TEXT BOOKS:

1. Hucho.W.H., "Aerodynamic of Road vehicles", Butterworths Co. Ltd., 1997

REFERENCES:

1. Pope. A., "Wind Tunnel Testing", John Wiley & Sons, 2nd Edition, New York, 1974.
2. Automotive Aerodynamic: Update SP-706, SAE, 1987
3. Vehicle Aerodynamic, SP-1145, SAE, 1996.

OUTCOMES:

- Demonstrate knowledge and understanding of the essential facts, concepts and principles of incompressible flows including vortices and viscous effects, boundary layers, wing and diffuser aerodynamic characteristics.
- Demonstrate understanding of how aerodynamics affects the motorsport vehicle design and operation.
- Demonstrate a critical awareness of the wind tunnel techniques used to analyse motorsport aerodynamic problems and apply these techniques and concepts to develop solution strategies for relevant wind tunnel simulations.
- Demonstrate competence in analyzing and evaluating the low speed aerodynamic characteristics of representative vehicles.
- The students able to identify the handling characteristics of a vehicle.
- The students able to know the components using acquired wind tunnel data, data sheets and fundamental principles.

AUC X10	VEHICLE COMFORT SYSTEM AND ERGONOMICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the engineering principles that underpins the design of an automotive vehicle for the comfort of the occupants and other road users.
- Recognize the future direction of the design of comfort systems within the automotive engineering sector.
- Appreciate the role and use of comfort systems in automobile engineering.
- The students also able to know about the safety systems in a vehicle and deformation behavior of a vehicle.

MODULE I INTRODUCTION TO AUTOMOTIVE COMFORT SYSTEMS 9

Introduction to automotive comfort systems for both the vehicle occupants and other road users. Driver assistance systems-Traffic jam assist, Road sign assistant, Intelligent headlight control, Remote park assist, Side view assist, Interior comfort systems-Seat and comfort actuation, Window lift and sunroof drives.

MODULE II DESIGN,CONSTRUCTION AND OPERATION OF COMFORT SYSTEMS 7

Introduction to the design, construction and operation of comfort systems such as: NVH (noise, vibration and harshness) of chassis, engines and power train, ride quality and sound quality; heating, ventilation and air conditioning systems.

MODULE III DRIVER COMFORT 7

Driving comfort for a passenger car and commercial vehicle – driving, seating, visibility, man-machine system, Psychological factors – stress and attention of a driver.

MODULE IV PASSENGER COMFORTS 7

Passenger comforts - Ingress and egress, spaciousness, ventilation, temperature control, dust and fume prevention and vibration.

MODULE V COMFORT AND CONVENIENCE SYSTEM 8

Steering and mirror adjustment, Central locking system- Garage door opening system, Tyre pressure control system, Rain sensor system, Environment information system.

MODULE VI VEHICLE ERGNOMICS 7

Introduction to human body, Anthropometrics and its application to vehicle ergonomics and cockpit design. Ergonomic research methods / ergonomic audit, Practical work aimed at integrating design and ergonomics.

Total Hours – 45

REFERENCES:

1. B.Peacock, Waldemar Karwowski; Automobile ergonomics. Publisher: CRC; 1st edition, 1993
2. Bosch, “Automotive Handbook”, 5th Edition, SAE publication, 2000.
3. Ronald.K.Jurgen, “Automotive Electronics Handbook”, 2nd Edition, McGraw-Hill Inc.,1999

OUTCOMES:

- Describe the characteristics and importance of ergonomics in automotive design technology.
- Identify relevant automotive design standards with regard to ergonomics.
- Design a vehicle system based on automotive design standards with regard to ergonomics.
- Analyze vehicle design performance related to ergonomic aspect.
- The students able to analyze the various comfort system in a automobile vehicle.
- The students able to identify relevant vehicle ergonomics aspects.

AUC X11 VEHICLE DESIGN DATA CHARACTERISTICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- The Students able to collect important technical specifications of an automobile from Technical notes, research publications.

MODULE I INTRODUCTION **8**

Fundamentals of vehicle design, Gross Vehicle, Weight, laden and un-laden weights , Front and rear axle weights, Frontal Area, maximum speed, maximum acceleration, gradability in different gears.

MODULE II POWER ESTIMATION **7**

Analysis of air and rolling resistances at various vehicle speeds - Calculation, Tabulation and Plotting of Curves, Estimation of Driving force, determination of power requirement for different loads and speeds, Maximum Power calculation.

MODULE III PERFORMANCE CURVES **7**

Calculation, Tabulation and Plotting of Torque and Mechanical Efficiency for different vehicle speeds, Interpolation of Pressure – Volume diagram, Calculation of frictional Mean Effective Pressure, Calculation of Engine Cubic Capacity, Bore and Stroke Length.

MODULE IV VELOCITY , ACCERELATION AND TURNING MOVEMENT **7**

Connecting rod length to Crank Radius Ratio, Plotting of Piston Velocity and Acceleration against Crank Angle, Plotting Gas force, inertia force and Resultant force against Crank Angle, Turning Moment and Side Thrust against Crank Angle.

MODULE V GEAR RATIOS **8**

Determination of Gear Ratios, Acceleration and Gradability, Typical Problems on Vehicle performance .

MODULE VI OVERALL VEHICLE PERFORMANCE **8**

Over all vehicle performance, Characteristics of different vehicle sub systems.

Total Hours – 45

TEXT BOOKS:

1. N. K. Giri, Automotive Mechanics, Khanna Publishers, New Delhi, 2005.
2. Heldt, P.M., High Speed Combustion Engines, Oxfore and I.B.H. Publishing Co.,Kolkata, 2002.

REFERENCES:

1. R.B.Gupta, Automobile Engineering

OUTCOMES:

The students should be able to

- Calculate and tabulate various vehicle performance parameters and design parameters
- Draw curves using these data for the system .

AUC X12	DESIGN OF TRANSMISSION SYSTEM AND CHARACTERISTICS ANALYSIS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the design procedures and practices and automotive components like frame, suspension systems, axles, clutch, gear box, drive line components etc.

MODULE I GENERAL DESIGN CONSIDERATIONS

Theory of Failure, Selection of materials, Basic criteria of selection of material for automotive parts like piston, cylinder, connecting rod, crankshaft and camshaft, mechanical properties of those materials in brief. Study of Stress concentration, factor of safety under different loading conditions

MODULE II INTRODUCTION ABOUT TRANSMISSION SYSTEM

Need for Transmission system, Tractive effort and resistances to Motion of a Vehicle, Requirements of transmission system, Classification of Transmission systems, Different Wheel drive systems (Single, Two and Four), Drives (Belt, Chain, Shaft, Hydraulic and Electric drives), Multi-axle drives, Location of transmission system, Different Transmissions units in scooter, car, MUVs and different transport vehicles of Indian make.

MODULE III CLUTCH

Principle of operation, Constructional details, torque capacity and design aspects of different types of clutches, Operation of single plate: helical spring and diaphragm type, and multi-plate clutch, Centrifugal and Automatic Clutches, Dry and Wet type of clutch, Friction lining materials, Over-running clutches, Modes of Operating clutch – mechanical, hydraulic and electric, Dual Clutch transmission.

MODULE IV GEAR BOX

Gear train calculations, layout of gearboxes. Calculation of bearing loads and selection of bearings. Design of three speed and four speed gearboxes. Determination of gear ratios for vehicles, Different types of gearboxes – sliding, constant and synchromesh type, need for double declutching and working of synchronizing unit, Power and economy modes in gearbox, transfer box, Transaxles, Overdrives, Gear shifting mechanisms – mechanical link and wire types, Paddle shift.

MODULE V HYDRODYNAMIC DRIVE

Fluid coupling- principle of operation, constructional details, Torque capacity, Performance characteristics, Reduction of drag torque, Torque converter, converter

coupling- Principle of operation, constructional details & performance characteristics.
Hydrostatic Drive: Hydrostatic drive, various types of hydrostatic systems, Principles of hydrostatic drive system, Advantages and limitations, Comparison of hydrostatic drive with hydrodynamic drive, Construction and working of typical Janny hydrostatic drive.

MODULE VI

Electric Drive: Electric drive, Principle of early and modified Ward Leonard Control system, Advantage & limitations, Performance characteristics.
Automatic Transmission & Applications: Block diagrams of- Chevrolet "Turbo-glide" Transmission, Power-glide Transmission & Clutch Hydraulic Actuation system, Introduction to Toyota "ECT-i" Automatic Transmission with Intelligent Electronic controls system.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

- Giri, N.K., “Automobile Mechanics”, Khanna publishers, New Delhi.
- Khurmi. R.S. & Gupta. J.K., “A textbook of Machine Design”, Eurasia Publishing House (Pvt) Ltd, 2001

REFERENCES:

1. Newton and Steeds, ‘Motor vehicles’, Illiffe Publishers.
2. A.W. Judge, ‘Modern Transmission Systems’, Chapman and Hall Ltd.
3. W.H. Crouse, D.L. Anglin, ‘Automotive Transmission and Power Trains Construction’, McGraw Hill.
4. R.C. Juvenal, ‘Fundamental of Machine Component Design’, John Wiley.
5. ‘PSG Design Data’, PSG College of Technology.
6. J.A. Charles, ‘Selection & Use of Engineering Materials’, Butterworth – Heinemann.
7. V.B. Bhandari, ‘Design of Machine Elements’, McGraw Hill, ED.
8. Joseph Edward, ‘Mechanical Engg. Design’, Shigley.

OUTCOMES:

- At the end of the course, the student can able to design the automotive components like frame, suspension systems, axles, clutch, gear box, drive line components etc

AUC X13	DESIGN OF HYDRAULICS PNEUMATICS SYSTEMS FOR AUTOMOTIVES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- The student will able to know fluid power fundamentals
- The student will have good exposure to applied hydraulics and pneumatics.
- The students can impart knowledge basic in fundamentals of fluids, hydraulics system and components.
- The students can impart knowledge basic in design of circuits and in accumulators.
- The students can impart knowledge in properties of air, compressors and regulators.
- The students can impart knowledge in pneumatic systems and components.

MODULE I FLUID POWER SYSTEMS AND FUNDAMENTALS 8

Introduction to fluid power, Advantages of fluid power, Application of fluid power system. Types of fluid power systems, Properties of hydraulic fluids – General types of fluids - Fluid power symbols. Basics of Hydraulics-Applications of Pascal’s Law- Laminar and Turbulent flow - Reynold's number - Darcy's equation - Losses in pipe, valves and fittings.

MODULE II HYDRAULIC SYSTEM & COMPONENTS 8

Sources of Hydraulic Power: Pumping theory - Pump classification - Gear pump, Vane Pump, piston pump, construction and working of pumps – pump performance - Variable displacement pumps. Fluid Power Actuators: Linear hydraulic actuators - Types of hydraulic cylinders - Single acting, Double acting special cylinders like tandem, Rodless, Telescopic, Cushioning mechanism, Construction of double acting cylinder, Rotary actuators - Fluid motors, Gear, Vane and Piston motors. Construction of Control Components : Direction control valve - 3/2 way valve - 4/2 way valve - Shuttle valve - check valve - pressure control valve – pressure reducing valve, sequence valve, Flow control valve - Fixed and adjustable, electrical control solenoid valves, Relays, ladder diagram.

MODULE III DESIGN OF HYDRAULIC CIRCUITS 8

Reciprocation, quick return, sequencing, synchronizing circuits, simple industrial circuits- press circuits, earth movers, grinding machines. Safety and emergency modules. Accumulators and intensifiers: Types of accumulators - Accumulators

circuits, sizing of accumulators, intensifier - Applications of Intensifier - Intensifier circuit

MODULE IV PNEUMATIC SYSTEMS AND COMPONENTS 7

Pneumatic Components: Properties of air - Compressors - Filter, Regulator, Lubricator Unit - Air control valves, Quick exhaust valves, pneumatic actuators

MODULE V PNEUMATIC SYSTEMS AND CIRCUIT DESIGN 7

Pneumatic Power Circuit Design, Speed control circuits, synchronizing circuit, Pneumo hydraulic circuit, Sequential circuit design for simple industrial applications using cascade method.

MODULE VI DESIGN OF FLUIDIC SYSTEMS 7

Fluidic systems - Hydro Mechanical servo systems, Electro hydraulic servo systems and proportional valves. Fluids - Introduction to fluidic devices, simple circuits, Introduction to Electro Hydraulic Pneumatic logic circuits, ladder diagrams, PLC applications in fluid power control. Fluid power circuits; failure and troubleshooting.

Total Hours – 45

TEXT BOOKS:

1. Anthony Esposito, "Fluid Power with Applications", Pearson Education 2000.
2. Majumdar S.R., "Oil Hydraulics", Tata McGraw-Hill, 2000.

REFERENCES:

1. Majumdar S.R., "Pneumatic systems - Principles and maintenance", Tata McGraw Hill, 1995
2. Anthony Lal, "Oil hydraulics in the service of industry", Allied publishers, 1982.
3. Harry L. Stevart D.B, "Practical guide to fluid power", Taraoeala sons and Port Ltd. Broadey, 1976.
4. Michael J, Prinches and Ashby J. G, "Power Hydraulics", Prentice Hall, 1989.
5. Dudely A. Pease and John T. Pippenger, "Basic Fluid Power", Prentice Hall, 1987.

OUTCOMES:

On completion of the course students should be able to

- Analyze the merits and demerits the fluid power.

- Analyze different types of fluid power system, and properties of hydraulic fluids and general types of fluids
- Design hydraulic circuits.
- Compare different pneumatic systems and components
- Design pneumatic circuits
- Select suitable system for different applications.

AUC X14	TRACTOR AND AGRICULTURAL MACHINERIES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- The student will have good exposure to Tractors and form equipments

MODULE I GENERAL DESIGN OF TRACTORS 7

Classification of tractors – Main components of tractor – Safety rules.

MODULE II CONTROL OF THE TRACTOR AND FUNDAMENTALS OF ENGINE OPERATION 8

Tractor controls and the starting of the tractor engines – Basic notions and definition – Engine cycles – Operation of multicylinder engines – General engine design – Basic engine performance characteristics.

MODULE III ENGINE FRAME WORK AND VALVE MECHANISM OF TRACTOR 8

Cylinder and pistons – Connecting rods and crankshafts – Engine balancing – Construction and operation of the valve mechanism – Valve mechanism troubles.

MODULE IV COOLING SYSTEM OF A TRACTOR 6

Cooling system – Classification – Liquid cooling system – Components,

MODULE V LUBRICATION SYSTEM AND FUEL SYSTEM OF A TRACTOR 8

Lubricating system servicing and troubles – Air cleaner and turbo charger – Fuel tanks and filters – Fuel pumps.

MODULE VI FARM EQUIPMENTS 8

Working attachment of tractors – Farm equipment – Classification –Auxiliary equipment – Trailers and body tipping mechanism.

Total Hours –45

TEXT BOOKS:

1. Rodichev and G.Rodicheva, Tractor and Automobiles, MIR Publishers, 1987

REFERENCES:

1. Kolchin,A., and V.Demidov, Design of Automotive Engines for Tractor
2. MIR Publishers, 1972.

OUTCOMES:

On completion of the course students should be able able to

- Demonstrate various design aspects of tractors.
- Analyze the control techniques of tractors and performance of tractor engines.
- Select suitable cooling system with justification.
- Analyze various types of lubrication and system.
- Evaluate different types of suspension system
- Select suitable layout for tractors with justification

AUC X15 VEHICLE CONTROL SYSTEM

L	T	P	C
3	0	0	3

OBJECTIVES:

- To study about different sensors and actuator used in the vehicle.
- To understand the methods of representation of system and their transfer function models
- To provide adequate knowledge in the time response of systems and steady state error analysis.
- To give basic knowledge in obtaining the open loop and closed loop frequency responses of systems
- To understand the concept of stability of control system and methods of stability analysis
- To study the three way of designing compensators for a control system.

MODULE I INTRODUCTION 7

Basic elements in control systems-Open loop and Closed loop system-Feedback characteristics-mechanical, Thermal, hydraulic and Pneumatic systems-

MODULE II BASICS OF CONTROL SYSTEM 7

Transfer function- Time response - Types Steady state error - Frequency response - Bode plot- Polar plot- Nichols chart- Determination of closed loop responses from open loop response.

MODULE III SAFETY SYSTEM CONTROL 8

Speed control – cylinder cut - off technology, Gear shifting control – Traction / braking control, brake by wire – Adaptive cruise control, throttle by wire. Steering - automatic parking – steer by wire.

MODULE IV COMFORT SYSTEM CONTROL 8

Active suspension systems, requirement and characteristics, different types, Vehicle Handling and Ride characteristics of road vehicle, pitch, yaw, bounce control, power windows, thermal management system, adaptive noise control.

MODULE V CHASSIS CONTROL SYSTEM 8

Components of chassis management system – role of various sensors and actuators pertaining to chassis system – construction – working of chassis management system .

MODULE VI ROUTING AND TRAFFIC CONTROLS 7

Traffic routing system - Automated highway - Lane departure warning system, Data communication within the car, Future Cars – Case studies.

Total Hours –45

TEXT BOOKS:

1. U. Kiencke, and L. Nielsen, Automotive Control Systems, SAE and Springer-Verlag, 2000.
2. Ljubo Vlacic, Michel Parent, Fumio Harashima, “Intelligent Vehicle Technologies”, Butterworth Heinemann publications, Oxford, 2001.

REFERENCES:

1. Crouse, W.H. & Anglin, D.L., “Automotive Mechanics”, Intl. Student edition, 9thedition, TMH, New Delhi, 2002.
2. William B.Ribbens -Understanding Automotive Electronics, 5th edition, Butter worth Heinemann Woburn,1998.
3. Bosch, “Automotive Hand Book”, 6th edition, SAE, 2004

OUTCOMES:

- Apply the fundamentals of chassis management system and its control
- Apply the knowledge to evaluate open loop and closed loop frequency responses of systems
- Analysis of different sensors and actuators for automotive applications.
- Apply the knowledge in the time response of systems and steady state error analysis
- Apply the knowledge in stability of control system development and analysis
- Discuss case studies on Research focused areas

AUC X16	MODERN AND INTELLIGENT VEHICLE SYSTEM	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To acquire knowledge about the principle of modern vehicle systems.
- To learn about different sensors and actuator used in the vehicle.
- To gather knowledge about the modern techniques in the vehicle
- To learn control systems like steering, suspension, and braking system.
- To gain knowledge of the different controls system in vehicle navigation systems.

MODULE I INTRODUCTION 8

Fundamental of modern and intelligent vehicle systems, different types, functions, Unmaned vehicle technologies

MODULE II SENSOR AND ACTUATORS 7

Working principle of wheel speed sensor, steering position, oxygen sensor, tyre pressure, brake pressure, steering torque, exhaust temperature sensor, fuel level sensors.

MODULE III SAFETY AND SECURITY SYSTEM 7

Airbags, seat belt tightening system, collision warning systems, child Lock, anti lock braking systems, Vision enhancement, road recognition system, Anti theft technologies, smart card system, number plate coding, central locking system.

MODULE IV DRIVER INFORMATION SYSTEMS 7

Traffic routing system - Automated highway systems - Lane warning system – Driver Information system, side blind zone warning system, automatic parking system, driver assistance systems

MODULE V INTELLIGENT TRANSPORTATION SYSTEM 8

Radar guide brakes, radar guided lane assist, Global positioning system. Data communication within the car, Driver conditioning warning -Route Guidance and Navigation Systems – vision enhancement system.

MODULE VI MODERN VEHICLE SYSTEMS 8

Integrator starter, Alternator, Starts stop operation, Un man vehicle technology, Regenerative energy recovery, advanced lead acid batteries, alkaline batteries,

Lithium batteries, Development of new energy storage systems,Deep discharge and rapid charging, ultra-capacitors. - In-Vehicle Computing –Vehicle Diagnostics system – Hybrid / Electric and Future Cars – Case studies.

Total Hours – 45

TEXT BOOKS:

1. U. Kiencke, and L. Nielsen, Automotive Control Systems,SAE and Springer-Verlag, 2000.
2. LjuboVlacic, Michel Parent, Fumio Harashima, “Intelligent Vehicle Technologies” ButterworthHeinemann publications, Oxford, 2001.

REFERENCES:

1. Crouse, W.H. & Anglin, D.L., “Automotive Mechanics”, Intl. Student edition, 9thedition, TMH, New Delhi, 2002.
2. William B.Ribbens -Understanding Automotive Electronics, 5th edition, Butter worth Heinemann Woburn,1998.
3. Bosch, “Automotive HandBook”, 6th edition, SAE, 2004.

TERM WORK

- Modern storage devices
- Future Cars in Hybrid and Electric
- Intelligent transportation systems
- Safety and security systems
- Energy control and regenerative technologies

OUTCOMES:

- Apply the fundamentals of chassis management system and its control
- Analysis of different sensors and actuators for automotive applications.
- Discuss case studies on research focused areas
- Learner can able to apply the knowledge to develop future technology cars
- Apply The knowledge to develop different controls system in vehicle navigation systems
- Analysis the different vehicle system to develop intelligent transportation system

AUC X17	ALTERNATIVE FUELS AND ENERGY SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To acquire knowledge of alternate fuels
- To understand the changes in the engine design for alternative fuels handling.
- To understand various type of energy systems for use in the automobiles.

MODULE I INTRODUCTION 6

Estimation of petroleum reserve “World Energy Scenerio, Energy Survey of India” – Need for alternate fuel – Availability of alternate fuels.

MODULE II ALCOHOLS 8

Properties of alcohols, engine modifications required to use alcohols in SI engines, performance, combustion and emission characteristics in SI engines, alcohol – gasoline blends, fuel flexible vehicle, methanol reformed gas engine, use of alcohols in CI engines-emulsions, dual fuel system, spark assisted diesel engine, surfaceS ignition engine, ignition accelerators, performance, combustion and emission characteristics in CI engines.

MODULE III GASEOUS FUELS 8

Properties of hydrogen, production and storage methods, safety precautions , use in SI and CI engines, biogas production and its properties, use in SI and CI engines, properties of LPG and CNG, use in SI and CI engines. Performance, combustion and emission characteristics of hydrogen, biogas, LPG and CNG in SI and CI engines.

MODULE IV VEGETABLE OIL 8

Various vegetable oils for diesel engines, structure and properties, problems in using vegetable oils in diesel engines, methods to improve the engine performance using vegetable oils-preheating, Esterification (biodiesel, blending with good secondary fuels, semi-adiabatic engine, surface ignition engine, ignition accelerators dual fuelling with gaseous and liquid fuels, performance, combustion and emission characteristics of vegetable oil fuelled diesel engines.

MODULE V ELECTRIC POWERED VEHICLES 8

Layout of an electric vehicle – advantage and limitations – Specifications – System component, Electronic control system – High energy and power density batteries –

Hybrid vehicle – Fuel cell vehicles- Solar energy power vehicle.

MODULE VI GAS TURBILE VEHICLES 7

Construction and working of gas turbine – Gas turbine cycle – Fuel used in gas turbine – Flame stability – Layout of gas turbine vehicle – power transmitted to wheel - advantage and limitation -

Total Hours –45

TEXT BOOKS:

1. Ramalingam. K.K., Internal combustion engine, scitech publications, Chennai, 2003.
2. Bechtold, R.L., Alternative Fuels Guide Book, SAE, 1997.

REFERENCES:

1. Nagpal, Power Plant Engineering, Khanna Publishers, 1991.
2. Alcohols and motor fuels progress in technology, Series No.19, SAE Publication USA 1980.
3. SAE Paper Nos.840367, 841156, 841333, 841334.
4. The properties and performance of modern alternate fuels – SAE Paper No.841210.

OUTCOMES:

The student should be able to

- Analyze various needs of alternative fuels.
- Select suitable fuels for existing engines.
- Analyze various types of natural fuels.
- Select suitable various vegetable oils for engines with justification.
- Evaluate different layouts for an electric vehicle.
- Select suitable layout for solar vehicle with justification.

AUC X18	VEHICLE NETWORKING AND INTERNET OF THINGS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide with a working knowledge of vehicle systems networks and exposure to aspects of design, development, application and performance issues associated with those systems.
- To provide Knowledge in concepts of capture of sensor data, storage and exchange of data to obtain remote services.

MODULE I FUNDAMENTALS OF VEHICLE NETWORKING 7

Need of Networking - Overview of data communication and networking - need of vehicle networking - layers of communication (Link Layer, Network layer , transport layer, Application layer) multiplexing and de-multiplexing concepts - vehicle buses and types.

MODULE II PROTOCOLS AND NETWORK 8

Multiple access protocols - Ethernet, TCP, UDP, IP, ICMP, ARP, RARP - Hubs, Bridges, and switches - PPP - Overview of CAN - fundamentals - selecting CAN Controllers - CAN development tools - CAN application areas.

CAN Protocol : Principles of data exchange - real time data transmission - message frame formats, bit encoding - bit timing and synchronization - data rate and bus length - network topology - bus access - physical layer standards.

MODULE III LOCAL INTERCONNECT NETWORK (LIN) PROTOCOL 7

Introduction to LIN Protocol - Standard overview - applications - LIN communications real time data transmission - message frame formats, bit encoding - bit timing and synchronization - data rate and bus length - network topology - bus access - physical layer standards.

MODULE IV ADVANCED PROTOCOLS 8

MOST and FlexRay: MOST review - data rates - data types - topology - application areas - FlexRay Introduction - network topology - ECUs and Bus interfaces - Controller host interface and protocol operation controls - media access control and frame and symbol processing - coding/decoding unit - FlexRay scheduling - message processing - Wakeup/startup -applications.

MODULE V WAN AND SATELLITE NETWORKS 7

Introduction to WAN Networks - GPS - setting receivers - Positioning - activating the

navigation function -Concept of latitude and longitude grid system - Mapping and location technologies - application.

MODULE VI SENSORS AND ACTUATORS 8

Electronics and Embedded computing fundamentals - Sensors - Actuators - Microcontrollers - simple microcontroller coding introduction - system on chips - platform considerations - power supply and ranges.

Total Hours – 45

REFERENCES:

1. B.Hoffman - Wellenhof, H.Lichtenegger and J.collins, " GPS Theory and Practice" 4 revised edition ,Springer, wein new york, 1997.
2. Wireless systems, W.C.Y.lee, prentice hall publ.(LBS) - mobile and wireless design essentials - Martyn Mallick - Wiley publishing, inc. - first edition.
3. Indira Widjaja, Alberto Leon-Garcia, communication networks: Fundamental concepts and Key Architectures, Mcgraw- Hill college, 1st edition, January, 15,2000.
4. Konrad Etschberger, Controller Area Network, IXXAT Automation August 22, 2001.
5. Olaf Pfeiffer, Andrew Ayre, Christian Keydal, Embedded Networking With CAN and CANopen, Annbooks/Rtc Books, November 1, 2003.
6. Ronald K Jurgen, Automotive Electronics Handbook, McGraw- Hill Inc. 1999.

OUTCOMES:

- Ability to analyze information for intensive applications that are being enabled for vehicles by a combination of telecommunications and computing technology.
- Ability to develop communications, and navigation/routing, in automotive telematics.

AUC X19	AUTOMOTIVE INSTRUMENTATION & EMBEDDED SYSTEM	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide with a working knowledge of measurements and instrumentation for Automotive applications
- To provide Knowledge in concepts of embedded systems and real time operating systems

MODULE I BASICS OF MEASUREMENT 7

Classification of Instrument, Characteristics of Instruments – Static and dynamic, experimental error analysis, Systematic and random errors, Statistical analysis, Uncertainty, Experimental planning and selection of measuring instruments, Reliability of instruments.

MODULE II AUTOMOTIVE INSTRUMENTATION 8

Modern automotive instrumentation – computerized instrumentation system, multiplexing, sampling and advantages – Measurements – fuel quality, coolant temperature, oil pressure vehicles speed, Display devices – LED, LCD, VFD, CRT and types, CAN network, the glass cockpit and information system

MODULE III DIAGNOSTICS 7

Onboard diagnostics – fault code displays. Off board diagnostics – engine data display , expert system occupant protection system – Airbag deployment system security and warning systems.

MODULE IV MEASUREMENT ANALYSIS 7

Chemical, thermal, magnetic and optical gas analyzers, measurement of smoke, dust and moisture, gas chromatography, spectrometry, measurement of pH, Review of basic measurement techniques.

MODULE V INTRODUCTION TO EMBEDDED SYSTEMS 8

Introduction to functional building blocks of embedded systems – Register, memory devices, ports, timer, interrupt controllers using circuit block diagram representation for each categories – Devices & buses for devices network - serial communication using I2C, CAN, USB buses - parallel communication using ISA, PCI - device drivers in a system – Serial port & parallel port.

MODULE VI REAL TIME OPERATING SYSTEMS 8

Introduction to basic concepts of RTOS, Basics of real time & embedded system operating systems, RTOS – Interrupt handling, task scheduling; embedded system design issues in system development process – Action plan, use of target system, emulator, use of software tools.

Total Hours – 45

TEXT BOOKS:

1.William B.Riddens - Understanding Automotive Electronics, 5th edition- Butter worth Heinemann, Woburn- 1998
2. Rajkamal, 'Embedded System – Architecture, Programming, Design', Tata McGraw Hill, 2003.
3. Daniel W. Lewis 'Fundamentals of Embedded Software', Prentice Hall of India, 2004.
4. Holman, J.P., Experimental methods for engineers, McGraw-Hill, 1988
5. Raman, C.S., Sharma, G.R., Mani, V.S.V., Instrumentation Devices and Systems, Tata McGraw Hill, New Delhi, 1983.

REFERENCES:

1. Bechhold- Understanding Automotive Electronics- SAE- 1998.
2. David E. Simon, 'An Embedded Software Primer', Pearson Education, 2004.
3. Frank Vahid, 'Embedded System Design – A Unified hardware & Software Introduction', John Wiley, 2002

OUTCOMES:

- Ability to analyze the data for measurement of parameters and set up instrumentation systems for automotive applications.
- Ability to design and develop embedded circuits for automotive applications.

AUC X20	ADVANCED MATERIAL TESTING AND FAILURE ANALYSIS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To have knowledge about importance and significances of material quality in service.
- To understand the impact on component life, customers satisfaction in performance.
- To know the procedure of Material Testing characterization and failure analysis.

MODULE I MATERIAL PROPERITES 7

Mechanical Characterization: Mechanical Property characterization- Principles & characterization techniques related to tensile, compressive, hardness, fatigue, and fracture toughness properties. Deformation, Super plasticity Stress-strain diagram, Determination of YS, UTS, MoE, %E, %RA, Hardness testing, true stress-strain diagram, stretcher strain characteristics, effects of cold working, & n values, poisons ratio

MODULE II MECHANICAL TESTS 7

Deep drawn quality of sheets, Impact test, bend test, shear test, Significances of property evaluation, SN curves and fatigue life, non-destructive testing, residual stress measurements, microscopy and scanning electron microscopy, EDAX / WDS analysis, corrosion testing, wear & tear characteristics, slow strain rate characteristics, thermal behaviors. Thermal Analysis: Principles and applications of thermal analysis.

MODULE III PROPERTIES OF PLASTICS, ELASTOMERS AND COMPOSITES 8

Molecular weight distribution, MFI, HDT & VICAT softening point, cold temperature behaviors, Rheological behaviors, hardness and impact properties, identification of polymers, weathering characteristics, cyclic temperature test, flammability, VOC and odor test, scratch resistance test, metal composition analysis, RoHS analysis.

MODULE IV MATERIAL BEHAVIOURS – ELECTRICAL EFFECTS 7

Electrical properties of Materials – Dielectric constant, electrical resistivity, wire harness test Mechanical behaviors, Electrical-Magnetic-Optical properties of

ploymer nano-composites.

MODULE V MATERIAL BEHAVIOURS – EFFECTS 8

THermal properties of Materials – coeffic ent of thermal expansion & contraction, Thermal response, Fire retardancy, Chemical resistance.

MODULE VI INSTRUMENTAL TECHNIQUES 8

FTIR spectrometer, Thermal analyzer, X-ray analyzer, Optical emission spectroscopy, Ion Chromatography, Gas and Liquid Chromatography, High strain rate tester, Non-destructive instruments, etc. New innovations in testing and characterization, X-ray Diffraction, Electron microscope (SEM, TEM), Scanning probe microscopy (SPM, AFM), Spectroscopic methods (EDS, FTIR); Mechanical behaviors, Thermal response, Fire retardancy, Chemical resistance and Electrical-Magnetic-Optical properties of ploymer nano-composites.

Total Hours – 45

TEXT BOOK:

1. Dictionary of Materials and Testing, Second Edition by Joan Tomsic
2. "Metallurgy of Failure Analysis" by A K. Das; by McGraw- Hill Professional Publication.

REFERENCES:

1. Material Characterization: Introduction to Microscopic & Spectroscopic Methods by Yang Leng John Wiley & Sons (Asia) Pte Ltd.
2. ASM Handbook on Metals Handbook: Vol. 8 Mechanical Testing – 1978.
3. ASM Handbook Vol.11 - Failure Analysis and Prevention, ASM International Publication, 1995.
4. Automotive Component Failures by A. M. Heyes .
5. Handbook of Case Histories of Failure Analysis, Vol 1 by C.Uhietal Robert

OUTCOMES:

On completion of the course, students should be able to:

- Select the suitable material testing processes with justification
- Identify and analyze the relation between the mechanical properties.
- Evaluate the various mechanical and chemical properties of composites.
- Summarize the characteristics of electrical effects of the material.
- Analyze the material behaviour on thermal and chemical loading.
- Analyze the instrumental techniques employed in material testing.

AUC X21	COMPUTER AIDED DESIGN AND MANUFACTURING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- The student will have good exposure in basic of computer aided design and Manufacturing.
- The students shall understand the drafting and geometric modeling of database structure for graphics modeling.
- The students shall understand the numerical control, machining center, turning centre And CNC programming.
- The students will know the importance of computer aided production planning
- The students shall understand the CAD production group technology and production planning.
- The students will understand the principle of automation.

MODULE I INTRODUCTION 7

Computers in Industrial Manufacturing, Product cycle, CAD / CAM Hardware, Basic structure, CPU, Memory types, input devices, display devices, hard copy devices, storage devices. Computer Graphics: Raster scans graphics coordinate system, database structure for graphics modeling, transformation of geometry, 3D transformations, mathematics of projections, clipping, hidden surface removal.

MODULE II GEOMETRIC MODELING 8

Geometric modeling: Requirements, geometric models, geometric construction models, curve representation methods, surface representation methods, modeling facilities desired. Drafting and Modeling systems: Basic geometric commands, layers, display control commands, editing, dimensioning, solid modeling, constraint based modeling.

MODULE III COMPUTER AIDED MANUFACTURING 8

Numerical control, NC modes, NC elements, NC machine tools, structure of CNC machine tools, features of Machining center, turning center, CNC Part Programming: fundamentals, manual part programming methods, Computer Aided Part Programming

MODULE IV COMPUTER AIDED PRODUCTION PLANNING 7

Computer Aided Processes Planning, Material requirement planning, manufacturing resources planning

MODULE V COMPUTER AIDED PRODUCTION GROUP TECHNOLOGY **8**

Part family, coding and classification, production flow analysis, advantages and limitations, Retrieval type and Generative type

MODULE VI FLEXIBLE MANUFACTURING SYSTEMS **7**

Elements of FMS, DNC, AGV, ASRS, Flexible manufacturing systems - FMS equipment, system layouts, FMS control.CIM: Integration, CIM implementation, major functions in CIM, Benefits of CIM, Lean manufacturing, Just-in-time.

Total Hours – 45

TEXT BOOKS:

1. CAD / CAM Principles and Applications - 2nd edition, P.N. Rao, Tata Mc. Graw Hill.

REFERENCES:

1. CAD / CAM Theory and Practice / Ibrahim Zeid / TMH
2. CAD / CAM / CIM / Radhakrishnan and Subramanian / New Age
3. Principles of Computer Aided Design and Manufacturing / Farid Amirouche / Pearson
4. Computer Numerical Control Concepts and programming / Warren S Seames / Thomson.

OUTCOMES:

On completion of the course the students should be able to

- Interpret complex engineering drawings including geometric dimensioning and tolerancing.
- Perform competently in solving technical manufacturing and engineering mathematics problems.
- Exhibit competency in two-dimensional, three-dimensional and solid modeling skills as applied to complex computer-aided design technology.
- Demonstrate an understanding of the role and function of computers and effectively use the computer to solve complex technical problems.
- Able to classify part families and understand production flow analysis.
- Select the suitable manufacturing principle for particular product development with justification.

AUC X22	DESIGN OF JIGS , FIXTURES AND PRESS TOOLS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basic design of jigs and fixtures
- To study about design of jigs for desired component
- To Know about fixtures design principle for various machining process
- To study about the press working tools
- To understand about press working elements of dies
- To know about the dies and their elements

MODULE I PURPOSE TYPES AND FUNCTIONS OF JIGS AND FIXTURES **8**

Tool design objectives –Design procedures for Jigs and Fixtures-Locating devices-Clamping devices- Production devices - Inspection devices - Materials used in Jigs and Fixtures – Types of Jigs - Types of Fixtures-Mechanical actuation-pneumatic and hydraulic actuation-Analysis of clamping force-Tolerance and error analysis

MODULE II JIGS **8**

Drill bushes –different types of jigs-plate latch, channel, box, post, angle plate, angular post, turnover, pot jigs-Automatic drill jigs-Rack and pinion operated. Air operated Jigs components. Design and development of Jigs for given components

MODULE III FIXTURES **9**

General principles of boring, lathe, milling and broaching fixtures- Grinding, planning and shaping fixtures, assembly, Inspection and welding fixtures-Modular fixtures. Design and development of fixtures for given component

MODULE IV PRESS WORKING TERMINOLOGIES **5**

Press working terminology-Presses and press accessories-Computation of capacities and tonnage requirements

MODULE V PRESS WORKING ELEMENTS OD DIES AND STRIP LAYOUT **6**

Elements of progressive combination and compound dies:Die block-die shoe. Bolster plate-punch plate-punch holder-guide pins and bushes – strippers – knockouts-stops –pilots-Selection of standard die sets strip lay out-strip lay out calculations.

MODULE VI DESIGN AND DEVELOPMENT OF DIES 9

Design and development of progressive and compound dies for Blanking and piercing operations. Bending dies – development of bending dies-forming and drawing dies-Development of drawing dies. Design considerations in forging, extrusion, casting and plastic dies.

Total Hours – 45

TEXT BOOKS:

1. Edward G Hoffman, “Jigs & Fixture Design”, Thomson – Delmar Learning, Singapore 2004
2. Donaldson. C, “Tool Design”, Tata McGraw-Hill, 1986

REFERENCES:

1. Kempster, “Jigs & Fixtures Design”, The English Language Book Society”, 1978.
2. Joshi, P.H., “Jigs & Fixtures”, Second Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi 2004 Hiram E Grant, “Jigs and Fixture” Tata McGraw-Hill, New Delhi, 2003.
3. “Fundamentals of Tool Design”, CEEE Edition, ASTME, 1983.
4. Design Data Handbook PSG College of Technology, Coimbatore.

OUTCOMES:

Upon completion of the subject, students will be able to

- Apply the basic principles in designing general jigs and fixtures,
- Use the basic principles in designing general jigs for any desired component
- Use the basic principles in designing general fixtures for any desired component.
- Implement the basic principles in designing press
- Implement the basic principles in designing elements of dies
- Apply the basic principles in designing dies

AUC X23 SIMULATION OF I.C. ENGINE PROCESSES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn about the heat of reaction and adiabatic flame temperature.
- To learn about the constant volume and constant pressure adiabatic combustion.
- To learn about the progressive combustion and multi zone combustion.
- To learn new concept engine development

MODULE I INTRODUCTION 8

Introduction-Heat of reaction-Measurement of URP-Measurement of HRP-Adiabatic flame temperature, complete combustion in C/H/O/N Systems,

MODULE II ADIABATIC PROCESS 8

Constant volume adiabatic combustion, constant pressure adiabatic combustion. Calculation of adiabatic flame temperature-Isentropic changes of state.

MODULE III SI ENGINE SIMULATION WITH AIR AS WORKING MEDIUM 7

Deviation between actual and ideal cycle-Problems, IC engine simulation with adiabatic combustion, temperature drop due to fuel vaporization, full throttle operation-efficiency calculation, part-throttle operation, super charged operation

MODULE IV PROGRESSIVE COMBUSTION 8

SI Engines simulation with progressive combustion with gas exchange process, Heat transfer process, friction calculation, compression of simulated values, validation of the computer code, engine performance simulation, pressure crank angle diagram and other engine performance.

MODULE V SIMULATION OF CI ENGINE 7

Diesel Engine Simulation: Multi Zone model for combustion, different heat transfer models, equilibrium calculations, simulation of engine performance, and simulation for pollution estimation.

MODULE VI SIMULATION OF NEW ENGINE CONCEPTS 7

Dual fuel engine, low heat rejection engine, lean burn engine, variable compression ratio engine, homogeneously charged compression ignition engine, controlled auto

ignition engine.

Total Hours – 45

TEXT BOOKS:

1. Ganesan .V – 'Computer Simulation of Spark Ignition Processes' - Universities Process Ltd, Hyderabad - 1993.
2. Ganesan.V. – Computer Simulation of compression ignition engines – Orcent Longman – 2000

REFERENCES:

1. Ramoss. A.L., Modelling of Internal Combustion Engines Processes, McGraw Hill Publishing Co., 1992.
2. Ashley Campbel, Thermodynamic analysis of combustion engines, John Wiley & Sons, New York, 1986
3. Benson. R.S., Whitehouse. N.D., Internal Combustion Engines, Pergamon Press, Oxford, 1979.

OUTCOMES:

After completing the course students must be able to

- Analyze the heat reaction and combustion product.
- Analyze the adiabatic flame temperature of constant pressure and volume combustion process.
- Analyze the ideal and actual cycle
- Analyze the progressive combustion and multi zone combustion.
- Design a combustion chamber for HCCI, Dual fuel and multi-fuel engines.

AUCX24	COMBUSTION THERMODYNAMICS OF HEAT TRANSFER	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Acquire the fundamental knowledge of combustion.
- Understand the thermodynamics of combustion.
- Understand the kinetics of combustion.
- Understand the combustion aspects in SI and CI Engines

MODULE I COMBUSTION OF FUELS 7

Combustion equations - Theoretical air, excess air - Air fuel ratio, equivalence ratio - Exhaust gas composition - Air fuel ratio from exhaust gas composition and heating value of fuels.

MODULE II THERMODYNAMICS OF COMBUSTION 7

Thermo-chemistry, first law analysis of reacting systems - Adiabatic combustion temperature - Second law analysis of reacting systems - Criterion for chemical equilibrium - Equilibrium constant for gaseous mixtures - Evaluation of equilibrium composition - Chemical availability.

MODULE III KINETICS OF COMBUSTION 7

Rates of reaction - Reaction order and molecularity complex reactions – Chain reactions - Arrhenius rate equation, collection theory - Activated complex theory - Explosive and general oxidative characteristics of fuels.

MODULE IV FLAMES 8

Laminar and turbulent flames - Premixed and diffusion flames - Burning velocity and its determination - Factors affecting burning velocity - Quenching, flammability and ignition - Flame stabilization in open burners.

MODULE V ENGINE COMBUSTION 8

Combustion in SI and CI engines - Stages of combustion in SI and CI engines, normal combustion and abnormal combustion - Emissions from premixed combustion - Emission from non premixed combustion - Control of emissions.

MODULE VI HEAT TRANSFER IN IC ENGINES 8

Basic definitions - Convective heat traanfer - Radiative heat transfer - Heat transfer,

temperature distribution and thermal stresses in piston - Cylinder liner - Cylinder head - fins and values.

Total Hours – 45

TEXT BOOKS:

1. Ganesan .V - "IC Engines" – 4th edition Tata McGraw-Hill, 2012.
2. John B. Haywodd, "Internal Combustion Engine Fundamentals", McGraw-Hill-Indian edition,2011.

REFERENCES:

1. Ganesan .V – 'Computer Simulation of Spark Ignition Processes' - Universities Process Ltd, Hyderabad - 1993.
2. Ganesan.V. – Computer Simulation of compression ignition engines – Orcent Longman – 2000.
3. Richard Stone – "Introduction to IC Engines" – 2nd edition – Macmilan – 1992

OUTCOMES:

The student should be able to

- Conduct analysis on combustion process of given engine
- Analyze heat apportion of given engine
- Perform photographic analysis of give automobile engines
- Analysis causes of the knocking.
- Perform calculations to evaluate the heat transfer in IC engines.
- Investigate the state variables of combustion and heat flow in IC engines

AUC X25 UNCONVENTIONAL ENERGY SOURCES

L	T	P	C
3	0	0	3

OBJECTIVES:

- Familiarize the biomass energy conversion technologies.
- Familiarize the solar energy technologies.
- Understand the wind energy and hybrid energy systems.
- Know concepts of hydro, ocean and geothermal energy systems.
- Familiarize the operations of direct energy conversion systems.

MODULE I BIOMASS **8**

Biomass, sources of biomass, thermo-chemical and bio-chemical conversion of biomass - pyrolysis, gasification, combustion and fermentation. Gasifiers - up draft, downdraft and fluidized bed gasifiers. Digesters - Fixed and floating digester biogas plants, economics of biomass power generation.

MODULE II SOLAR ENERGY **9**

Solar radiation and its measurements, types of solar thermal collectors - Flat and concentrating collectors, solar thermal applications - Water heaters, dryers, stills, refrigeration, air-conditioning, solar pond, central receiver power generation, thermal energy storage systems, solar photovoltaic components and solar photovoltaic power plants.

MODULE III WIND ENERGY **8**

Basic principle of wind energy conversion system, wind data and energy estimation, Site selection, components of wind energy conversion systems, design consideration of horizontal axis wind mill, aerofoil theory, analysis of aerodynamic forces acting on the blade, performance of wind machines. Introduction to solar - Wind hybrid energy systems.

MODULE IV OCEAN AND HYDRO ENERGY **6**

Wave and tidal energy, ocean thermal energy conversion - Principle, types, power plants - Small, mini and micro hydro power plants.

MODULE V GEOTHREMAL ENERGY **6**

Exploration of geothermal energy, geothermal power plants, challenges - Availability, geographical distribution, scope and economics.

MODULE VI DIRECT ENERGY CONVERSION SYSTEMS 8

Basic principle of thermo-electric and thermo-ionic power generations, fuel cellprinciple, types, conversion efficiency, applications. Magneto hydrodynamic power generation - Principle, open cycle and closed cycles, design considerations and recent developments. Hydrogen energy - Production, storage, transportation and applications.

Total Hours – 45

TEXT BOOKS:

1. Rai.G.D, “Non-Conventional Energy Sources”, Khanna Publishers, 4th edition, New Delhi, 2009.
2. Domkundwar.V.M, Domkundwar.A.V, “Solar energy and Non-conventional sources of energy”, Dhanpat rai & Co. (P) Ltd, 1st edition, New Delhi, 2010.

REFERENCES:

1. Godfrey Boyle, “Renewable energy”, 2nd ed, Oxford University Press, 2010.
2. Khan.B, “Non-conventional Sources of energy”, 2nd edition, New Delhi, Tata McGraw Hill, 2009.
3. Tiwari.G.N, Ghosal.M.K, “Fundamentals of renewable energy sources”,1st edition, UK, Alpha Science International Ltd, 2007.
4. Twidell.J.W and Weir.A.D, “Renewable Energy Resources”,1st edition, UK, E.&F.N. Spon Ltd, 2006.

OUTCOMES:

The student should be able to

- Apply knowledge in production of Bio-mass.
- Design and analysis the solar heater and power plant.
- Apply the knowledge in extraction and utilization of wind, hydro and geothermal energy.

AUC X26	COMPUTATIONAL FLOW AND HEAT TRANSFER	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basic governing equation and Boundary conditions of various FEA problems
- To gain knowledge about discretization and solution methods.
- To study about the heat conduction of fluids
- To know about the convection and their significances.
- To study flow modelling for fluids.
- To impart knowledge about diffusion problems.

MODULE I GOVERNING EQUATIONS AND BOUNDARY CONDITIONS 7

Basics of computational fluid dynamics – Governing equations of fluid dynamics– Continuity, Momentum and Energy equations – Chemical species transport – Physical boundary conditions – Time-averaged equations for Turbulent flow - Turbulence -Kinetic - Energy Equations – mathematical behavior of PDEs on CFD: Elliptic, Parabolic and Hyperbolic equations.

MODULE II DISCRETIZATION AND SOLUTION METHODOLOGIES 8

Methods of Deriving the Discretization Equations - Taylor Series formulation – Finite difference method – Control volume Formulation – Spectral method. Solution methodologies: Direct and iterative methods, Thomas algorithm, Relaxation method, Alternating Direction Implicit method.

MODULE III HEAT CONDUCTION 7

Finite difference and finite volume formulation of steady/transient one dimensional conduction equation, Source term linearization, Incorporating boundary conditions, Finite volume formulations for two and three dimensional conduction problems

MODULE IV CONVECTION 8

Finite volume formulation of steady one-dimensional convection and Diffusion problems, Central, upwind, hybrid and power-law schemes – Discretization equations for two dimensional convection and diffusion.

MODULE V CALCULATION OF FLOW FIELD 7

Representation of the pressure - Gradient term and continuity equation -Staggered grid - Momentum equations - Pressure and velocity corrections -Pressure - Correction

equation, SIMPLE algorithm and its variants. Turbulence models: mixing length model, Two equation (k-epsilon) models.

MODULE VI DIFFUSION 8

Finite volume formulation of steady one-dimensional Diffusion problems, Central, upwind, hybrid and power-law schemes - Discretization equations for two dimensional diffusion.

Total Hours –45

REFERENCES:

1. Construction Equipment Operation & Maintenance" by Y. Pokras and M. Tushnyakov, MIR,
2. "Truck Cranes", by A. Astskhov, MIR, Moscow.
3. Pipenger, 'Industrial Hydralics', Mcgraw Hill, Tokoyo, 1979.
4. A. Astakhov, 'Truck cranes', MIR Publishers, Moscow, 1971.
5. Bart H Vanderveen, 'Tanks and Transport Vehicles', Frederic Warne and co. Ltd., London, 1974.
6. K. Abrosimov, A. Bromberg and F. Katayer, 'Road making machineries', MIR Publisher, Moscow,1975.

OUTCOMES:

After successfully completing this course you will be able to:

- The student will able to demonstrate the ability to simplify a real fluid-flow system into a simplified model problem.
- To develop an understanding for the major theories, approaches and methodologies used in CFD;
- To build up the skills in the actual implementation of CFD methods (e.g.boundary conditions, turbulence modeling etc.) in using commercial CFD codes;
- To gain experience in the application of CFD analysis to real engineering designs.
- The students able to convert heat transfer problems into mathematical models.
- The student will able to demonstrate the ability to analyze a flow field to determine various quantities of interest, such as flow rates, heat fluxes, pressure drops, losses, etc., using flow visualization and analysis tools.
- The student will able to demonstrate an ability to recognize the type of fluid flow that is occurring in a particular physical system and to use the appropriate model equations to investigate the flow.

AUC X27 MOTORSPORT ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To Study the constructional details and Structures of different types of frames used in motorsports vehicle
- To Study mechanism of different types of steering system used in motorsports vehicle.
- To Study mechanism of different types of drive line and final drive used in motorsports vehicle.
- To study use age of wheels and tyres used in motorsports vehicle.
- To Study the fundamental and working of different types of Suspension Systems of motorsports vehicle.

  To Study the fundamental and working of different types of Braking Systems of motorsports vehicle

MODULE I OVER VIEW OF MOTOR SPORT ENGINEERING 8

Introduction about motor sport vehicles, various types of motor sport vehicles and their requirements, competitions and requirements, Preparing for the competitions, bench marking, project planning, Case studies of completed events.

MODULE II POWER TRAIN 8

Engine management systems, sensors, alternative fuels, oxidizing agents, chemical composition of fuels, ignition systems and components.Engine and transmission configurations – front/ rear/mid engine and associated driveline Transmission systems – clutches, torque converters, manual gearbox types, automatic gearbox types, electronic and hydraulic transmission control, traction control, launch control, KERS systems. Final drive systems – differentials, Torsen, torque biasing, LSD, Salisbury, air-locking, fluid coupling Hybrid Drive systems.

MODULE III MATERIALS AND PROCESSES 8

Selection criteria: material properties, including cost drivers, mechanical, physical, chemical and process characteristics. basic properties of materials such as ceramics, metals, composites and polymers. Testing of materials, ISI standards, standard published data sources, engineering drawings Joining techniques including, brazing and welding, effect on structure and properties,

use of adhesives.Processing limitations: effects of properties such as structure preventing or facilitating processing techniques. heat treatments of metals and alloys, coatings and other surface treatments, polymer processing.

MODULE IV FAILURE MECHANISMS 7

Causes of failure: appreciation of failure mechanisms in materials such as metals, ceramics, polymers and composites; such as creep, fatigue, impact, overstressing, corrosion, temperature, thermal cycling, residual stresses, stress relaxation, degradation (composition change), radiation, electrical breakdown.

MODULE V VEHICLE ELECTRONICS 7

Electronics – semiconductors, electronic circuitry, integrated circuits. ignition systems, Engine management systems, sensors transistorized and capacitor discharge types, fuel injection systems and sensors, ECU programming and mapping., ABS, TRS, active suspension system, Tuned manifloding

MODULE VI MOTOR VEHICLE CHASSIS 7

Frame design for different vehicles, layout of components, weight distribution, weight transfer and braking requirements, suspension system, steering system, body design and fabrication, driver seat and safety requirements, Electrical systems and wiring, wheels and tires. Testing and validation.

Total Hours – 45

REFERENCES:

- Hillier, VAW (2006) Fundamentals of Motor Vehicle TechnologyStanleyThornes Davis & Davis (2001) Supercharging, Turbocharging and Nitrous Oxide performance. Motorbooks.
- Marek, J. (2003) Sensors applications: sensors for automotive technology. Wiley
- Walker, D. (2001) Engine management. Haynes
- Staniforth, A (2002)Race and rally car sourcebook Haynes
- Staniforth, A (2006)Competition car suspension Haynes
- van Valkenburg, P (2001)Race car engineering and mechanicsMotorbooks International
- Milliken & Milliken (1997) Vehicle dynamics. SAE

OUTCOMES:

On completion of the course student should be able to

- Design and select suitable frame for different vehicles.
- Select suitable layout of components, based on weight distribution, weight transfer and braking requirements.
- Design suitable transmission, suspension system and steering system.
- Design and fabricate body, driver seat and safety requirements.
- Design of electrical systems and wiring and power train tuning.
- Select suitable wheels and tires.
- Test and validate the vehicle

AUC X28	COMPOSITE MATERIALS FOR AUTOMOBILES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the composite materials and its applications in automotive industry
- To impart knowledge in several composite materials production processes.
- To have knowledge in different polymers, metals and ceramics reinforced composites.
- To gain knowledge in different matrices and reinforcements
- To have knowledge about composite structure.
- To understand the various types of composite materials

MODULE I INTRODUCTION 8

Reinforcement – Fibres – Glass fibre, Aramid fibre, Carbon fibre, boron fibre – Fabrication – Properties – Applications – Comparison of fibres – Particulate and whisker reinforcements. Matrix materials – Properties-Wettability – Effect of surface roughness – Interfacial bonding – Methods for measuring bond strength .

MODULE II POLYMER MATRIX COMPOSITES 8

Polymer Matrix Composites -Types – Processing – Thermal matrix composites – Hand layup and spray technique, filament winding, Pultrution, resin transfer moulding, autoclave molding – Thermoplastic matrix composites – Injection molding, film stacking – Diaphragm forming – Thermoplastic tape laying. Glass fibre/polymer interface. Mechanical properties – Fracture. Applications.

MODULE III METAL MATRIX COMPOSITES 6

Metal Matrix Composites Types. Important metallic matrices. Processing – Solid state, liquid state, deposition, Mechanical properties. Applications.

MODULE IV CERAMIC MATRIX COMPOSITES 6

Ceramic matrix materials – Processing – Hot pressing, liquid infiltration technique, Lanxide process, insitu chemical reaction techniques – CVD, CVI, sol gel process. Interface in CMCs. Mechanical properties – Thermal shock resistance – Applications.

MODULE V COMPOSITE STRUCTURES 9

Fatigue – S-N curves – Fatigue behaviors of CMCs – Fatigue of particle and whisker reinforced composites – Hybrid composites – Thermal fatigue – Creep Introduction to structures - selection of material, manufacturing and laminate configuration -design of joints - bonded joints - bolted joints - bonded and bolted – laminate optimization.

MODULE VI AUTOMOTIVE APPLICATIONS 8

Drive Shafts, Suspension Arms, Wheels, Valve Guides, Clutch Plates, use of MMC in disc brakes, Mufflers and other applications.

Total Hours – 45

REFERENCES:

1. Mathews F L and Rawlings R D, “Composite Materials: Engineering and Science”, CRC Press and Woodhead Publishing Limited, 2002.
2. Krishnan K Chawla, “Composite Materials Science and Engineering”, Springer, 2001.
3. Handbook of Composites – American Society of Metals, 1990.
4. Derek Hull, “An introduction to Composite Materials”, Cambridge University Press, 1988.

OUTCOMES:

On completion of the course, students should be able to:

- Classify the characterization of different composite materials.
- Demonstrate the polymer matrix composite manufacturing processes.
- Identify different metal matrix composites and their productions with justification
- Enumerate the ceramic applications in the composite materials.
- Evaluate the effects of structural parameters on the properties of composite.
- Analyze current automotive applications of composite materials in the industry.

AUCX29 TRAFFIC ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the knowledge of traffic engineering includes traffic survey highway, characteristics and traffic control
- To understand the measure of traffic management and importance motor vehicle act.

MODULE I INTRODUCTION AND TRAFFIC CHRACTERISTICS 7

Objectives and scope of traffic engg. Organizational set up of traffic engg department in India; Importance of traffic characteristics; Road user characteristics; Vehicular characteristics; Max dimensions and weights of vehicles allowed in India. Effects of traffic characteristics on various design elements of the road.

MODULE II TRAFFIC SURVEYS 7

Methods of conducting the study and presentation of the data for traffic volume study; speed study and origin and destination study. Speed and delay study. Parking surveys; On street parking; off street parking. Accident surveys. Causes of road accidents and preventive measures; Use of photographic techniques in traffic surveys.

MODULE III HIGHWAY CAPACITY 7

Importance. Space and time headway. Fundamental diagram of traffic flow. Relationship between speed; volume and density. Level of service. PCU. Design service volume. Capacity of non-urban roads. IRC recommendations. Brief review of capacity of urban roads.

MODULE IV TRAFFIC CONTROL 8

Types of traffic control devices. Traffic signs; general principles of traffic signing; types of traffic signs. Road markings; types; general principles of pavement markings. Design of rotary. Grade separated intersections. Miscellaneous traffic control aids and street furniture.

MODULE V SIGNAL DESIGN 8

Types of signals. Linked or coordinated signal systems. Design of signal timings by trial cycle method; approximate method; Webstor’s method and IRC method

MODULE VI TRAFFIC REGULATION AND MANAGEMENT 8

Need and scope of traffic regulations. Regulation of speed; vehicles and drivers. General traffic regulations. Motor vehicle act. Scope of traffic management. Traffic management measures: restrictions on turning movements; one way streets; tidal flow operations; exclusive bus lanes; traffic restraint; road pricing.

Total Hours – 45

TEXT BOOKS:

1. Khanna S. K. and Justo C. E. G., “Highway Engineering”, Nem Chand Bros., Roorkee.

REFERENCES:

1. Kadiyali L. R., “Traffic Engg. and Transport Planning”, Khanna Publishers
2. Matson T. M., Smith W. S. and Hurd F. W., “Traffic Engineering”, McGraw Hill, New York.
3. Drew D. R., “Traffic Flow Theory”, McGraw Hill, New York.

OUTCOMES:

On completion of the course the students should be able to

- Describe the various traffic characteristic in India
- Analyze the causes for road accident and its preventive methods
- Summarize Non –urban and urban roads characteristics
- Evaluate the various traffic control devices and traffic signs for roads
- Enumerate the procedure for designing of signal timing
- Analyze the latest motor vehicle act and traffic rules and regulations.

AUCX30 SURFACE ENGINEERING

L	T	P	C
3	0	0	3

BJECTIVES:

- To provide knowledge of principle and practice of surface engineering and coating techniques
- To provide knowledge about hardfacing and plating processes.
- To familiarise about thin film coating techniques.
- To provide knowledge about high energy modification processes

MODULE I TRIBOLOGY PROCESSES 7

Introduction to tribology, Wear: Types of wear - adhesive, abrasive, oxidative, corrosive, erosive and fretting wear, roles of friction and lubrication and wear testing.

MODULE II PLATING PROCESSES 7

Plating Processes: Fundamentals of electrodeposition, plating of nickel, chromium, tin and copper, pulsed plating, hydrogen embrittlement, plating adhesion, electroless plating, electrochemical conversion coating, selective plating for repair, plating properties, hard anodizing.

MODULE III HARDFACING PROCESSES 8

SMAW, GTAW, GMAW, FCAW, SAW, PAW, Oxy-Acetylene Welding, Furnace fusing, Thermal -spray, flame spray processes - HVOF, Detonation gun and jet kote processes, hard facing consumables.

MODULE IV SPECIAL DIFFUSION PROCESSES 7

Principle of diffusion processes – Boriding, Aluminising, Siliconising, Chromising, Sursulf - Selection of diffusion processes – Characteristics of diffused layer – micro structure and micro hardness evaluation – properties and applications.

MODULE V THIN FILM COATINGS 8

Physical vapour deposition processes – Thermal evaporation - sputter coating - Ion plating – Chemical vapour deposition – reactive sputtering - TiC, TiN, Alumina, CBN, Diamond and DLC coatings. Structure, properties and applications.

MODULE VI HIGH ENERGY MODIFICATION AND SPECIAL PROCESSES 8

Electron beam hardening/ glazing, Laser beam hardening / glazing ion

inplantation, Composite surface created by laser and Electron beam. Surface cements, Wear tiles, Electro spark deposition, fused carbide cloth, thermal / chemical,Ceramic coatings, centrifugal cast wear coatings, Wear sleeves and Wear plates.

Total Hours – 45

REFERENCES:

1. William D. Callister, Materials Science and Engineering: An Introduction, 7th Edition, John Wiley & Sons, New York, 2007.
2. Yip-Wah Chung, Practical Guide to Surface Science and Spectroscopy, Academic Press, San Diego, CA, 2001.
3. Donald L. Smith, Thin-Film Deposition: Principles and Practice, McGraw-Hill, Boston, 1995.
4. Hornyak G. Louis, Tibbals, H.F., Dutta Joydeep, Fundamentals of Nanotechnology, CRC Press, Boca Raton, 2009.
5. Rao R. Tummala, Fundamentals of Microsystems Packaging, McGraw-Hill, New York, 2001, TK7870.15. F86 2001.
6. William M. Steen, Laser Material Processing, Springer, New York, 2003, TS183.S73.

OUTCOMES:

The students will be able to

- Evaluate various tribology processes.
- Demonstrate the different plating processes.
- Summarize the principles and key characteristics of technologies used in hardfacing processes.
- Characterize the special diffusion processes.
- Identify and describe the various thin film coatings.
- Analyze the high energy modification and special processes.

AUC X31	ADVANCED IC ENGINE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To gain knowledge on ideal cycle and actual cycle.
- To understand the chemical reason of fuels and combustion processes.
- To gain the knowledge in unconventional engines.
- To learn about flow analysis of combustion.

MODULE I INTRODUCTION 7

Fuel air cycle and Actual cycle analysis, Properties of IC engine fuels, Refining process,chemical composition and molecular structure of fuels, octane number, cetane number. Knock rating of SI engine fuels.

MODULE II COMBUSTION OF FUELS 7

Combustion Stoichiometry of petrol, diesel, alcohol and hydrogen fuels – Chemical energy and heating values – Chemical equilibrium and maximum temperature

MODULE III SI AND CI ENGINE COMBUSTION 7

SI engine combustion – Flame velocity and area of flame front – performance number – CI engine combustion. Fuel spray characteristics – droplet size, penetration and atomization.

MODULE IV COMBUSTION MODELLING 8

Basic concepts of engine simulation, governing equations, simulation of various engine processes for SI and CI engines. Adiabatic flame temperature, Heat release calculations. Thermodynamic and Fluid mechanic based models.

MODULE V NON-CONVENTIONAL IC ENGINES 8

Adiabatic and L.H.R. engines – Variable compression ratio engine – Wankel rotary combustion engine – Free piston engine - HCCI and multi fuel engines – Stratified charge and lean burn engines – Locomotive and marine engines.

MODULE VI COMBUSTION ANALYSIS IN IC ENGINES 8

Photographic studies of combustion processes – P-ϕ diagrams in SI and CI engines, Rate of heat release – hot wire and laser Doppler anemometry and velocimetry for flow and combustion analysis in IC engines

Total Hours – 45

TEXT BOOKS:

1. Ganesan .V - "IC Engines" – 4th edition Tata McGraw-Hill, 2012.
2. John B. Haywodd, "Internal Combustion Engine Fundamentals", McGraw-Hill-Indian edition,2011.

REFERENCES:

1. Ganesan .V – 'Computer Simulation of Spark Ignition Processes' - Universities Process Ltd, Hyderabad - 1993.
2. Ganesan.V. – Computer Simulation of compression ignition engines – Orcent Longman – 2000.
3. Richard Stone – "Introduction to IC Engines" – 2nd edition – Macmilan – 1992.

OUTCOMES:

The student should be able to

- Analyze the actual and ideal cycle.
- Calculate the air-fuel ratio of fuels.
- Analyze the adiabatic flame temperature and heat release.
- Analyze the combustion processes of IC engine.

AUC X32 FUEL CELL TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- Understand the basic principles involved fuel cell operation.
- Gain knowledge of various fuel cells and their specific operating principles.
- Understand the research and development challenges in various types of fuel cells.

MODULE I FUNDAMENTALS OF FUEL CELLS 8

Chemoelectricity - what is a fuel cell and how does it work. Electrochemical aspects: Cell potential, reversible potential, Gibbs free energy - Chemical activity and the Nernst equation - Thermo-electrochemical aspects: enthalpy, thermoneutral potential, heat vs. electricity - Real fuel cell behavior: open circuit voltage, polarization curves, over potentials - Fuel cell problem areas: crossover, contamination, leakage currents, partial reactions - Fuel cell efficiencies: voltage, thermodynamic, current, fuel utilization - Types of fuel cells: materials, operating conditions, and applications.

MODULE II FUELS OF FUEL CELLS 6

Fuel cell reactions - Fuels and fuel properties - Fuel processing: steam, reforming, partial oxidation, auto thermal reforming - Water gas shift reaction - Control of contaminants: CO and sulphur - Process integration

MODULE III TYPES OF FUEL CELL 7

Proton Exchange Membrane Fuel Cell (PEMFC) –Direct Methanol Fuel Cell (DMFC) - Phosphoric Acid Fuel Cell (PAFC) - Alkaline Fuel Cell (AFC) – Molten Carbonate Fuel Cell (MCFC) – Solid Oxide Fuel Cell (SOFC).

MODULE IV FUEL CELL PROCESS DESIGN 8

Fuel cell applications and systems overview - Operating and design variables - Examination of process flow diagrams - Theoretical and practical efficiencies: tradeoff of heat and work - Rankine and Brayton cycles - SOFC - Gas turbine combined cycle system - PEM system: material recycle and heat integration.

MODULE V ELECTRODE MODELS 8

Fuel utilization and the envelope of polarization curves - Influence of the Nernst equation (concentration polarization) - Mass balance on SOFC electrode – Energy

balance on SOFC electrode - Multiple reactions in fuel cells: reforming, water gas shift, coking - Temperature profiles.

MODULE VI STACK DESIGN AND SYSTEM INTEGRATION 8

Basic geometry approaches: flat plate vs. tubular - Flow field plate and interconnect design - Fluid mechanics: manifolding, pressure drop - Fuel utilization, efficiency, and current distribution - Internal heat exchange and recovery, internal reforming – Seals and insulation - Safety.

Total Hours – 45

TEXT BOOKS:

1. Pukushpan, J.T., Stctanopoulon, A.G., Peng, H.,"Fuel Cell Power Systems", Springer, 2006.
2. Viswanathan, B., and Aulice Scibioh, M.,"Fuel Cells Principles and Applications", Universities Press (India) Pvt. Ltd., Hyderabad, 2006.

REFERENCES:

1. Larminie.J and Dicks.A, "*Fuel Systems Explained"*, John Wiley & Sons, Ltd., New York, 2001.
2. O'Hayre.R, Suk-Woncha, Whitney Colella, Prinz, F.B., "*Fuel Cell Fundamentals"*, John Wiley & Sons, New York, 2006.
3. Hoogers.G. Edr, "*Fuel Cell Technology Handbook"*, CRC Press, Washington D.C., 2013.

OUTCOMES:

The student should be able to

- Evaluate locate the operational issues and challenges for all major types of fuel cell.
- Evaluate the significance of hydrogen and automobile application
- Formulate the various components required to build the fuel cell
- Determine the performance characteristics of fuel cell for various parameters
- Compare the various types of liquid hydrogen storage methods
- Enumerate the need of fuel cell with various fuel cycle analysis

AUC X33 POWER PLANT ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- Know the functions of various auxiliary combustion equipment
- Understand the thermal power plant systems.
- Familiarize with operation of nuclear, Diesel and gas turbine power Plants.
- Familiarize with renewable energy sources and power plant economics.

MODULE I FUEL COMBUSTION EQUIPMENTS 8

Types of combustion, stokers, fuel and ash handling equipments. Draft - forced, induced and balanced drafts. Selection of fans. Heat recovery equipmentseconomisers, air preheaters and reheaters, different types of superheaters and desuperheaters. Emission control, flue gas cleaning, particulate and gaseous emission control methods.

MODULE II THERMAL POWER PLANT SYSTEMS 8

Steam generators - forced circulation, high-pressure boilers and super critical boilers, fluidized bed boiler, boiler accessories and mountings. Boiler testing. Condensers: Different types, design factors, air removal, performance calculation. Cooling towers - natural and mechanical draft types.

MODULE III NUCLEAR POWER PLANTS 7

General nuclear fuels used in reactors, elements of nuclear reactor, moderator, control rods, coolants, description of different types of reactors. Radiation hazards, radioactive waste disposal.

MODULE IV DIESEL AND GAS TURBINE POWER PLANTS 7

Diesel power plant - Classifications, components, selection of engine type. Gas turbine plant - closed and open cycles. Combined power cycles

MODULE V RENEWABLE ENERGY SOURCES 8

Solar energy - measurement, methods of utilization, flat plate and concentrating collectors, water heater, air driers, photovoltaic cell. Wind energy - Horizontal and vertical axis wind turbines. Geothermal plants, tidal power plant, biomass and biogas plants, OTEC plants.

MODULE VI POWER PLANT ECONOMICS 7

Plant load factor and utilization factor, cost economics - Tariff rates, demand changes, load distributions. Energy conservation and audit. Maintenance aspects of power plants.

Total Hours – 45

TEXT BOOKS:

1. Nag.P.K, “Power Plant Engineering”, Tata McGraw Hill, New Delhi, 3rd edition, 2008.
2. Arora.S.C and Domkundwar.S, “Power Plant Engineering”, Dhanpat Rai & Sons, New Delhi, 2001.

REFERENCES:

1. Ramalingam.K.K, “Power Plant Engineering”, Scitech Publication Pvt. Ltd, 2002.
2. Rai.G.D, “Non-Conventional Energy Sources”, Khanna Publishers, 4th edition, New Delhi, 2009.
3. El Wakil.M.M, “Power Plant Technology”, McGraw Hill Inc., New York, 1985.

OUTCOMES:

The student should be able to

- Analyze various sub-systems in power plant.
- Design the power plant sub-system.
- Analyze entire power plants and its efficiency.
- Design and develop low cast power plant components.

Physics Elective Courses
(To be offered in II Semester)

PHCX 01	FUNDAMENTALS OF ENGINEERING MATERIALS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To help students to acquire the properties and applications of conducting and semiconducting materials.
- To familiarize students with basic ideas about the properties of dielectric and magnetic materials and their applications.
- To familiarize students with basic knowledge of nanomaterials and its electrical, electronic, mechanical and magnetic properties.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I CONDUCTING AND SEMICONDUCTING MATERIALS 7

Conductors: properties, Fermi distribution function, Fermi energy in metals- density of states- conducting polymers-properties-applications, semiconductors: intrinsic and extrinsic semiconductors-carrier concentration, conductivity and energy band gap, semiconducting polymers- properties- applications.

MODULE II DIELECTRIC MATERIALS 8

Polarization- dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – Internal field - Clausius Mosotti relation - dielectric loss – dielectric breakdown – applications of dielectric materials (capacitors and transformers) – Pyroelectricity, Piezoelectricity, ferroelectricity and applications in Ferroelectric Random Access Memory (FeRAM) - multiferroic materials and its applications.

MODULE III MAGNETIC MATERIALS 7

Origin of magnetism-magnetic moment, susceptibility, permeability – Bohr magneton – Dia, Para and Ferro magnetism –Spontaneous magnetization- Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites and its application - Giant Magneto-resistance effect (GMR) - Magnetic resonance imaging(MRI).

MODULE IV NANOMATERIALS 8

Properties of nanomaterials – size effect on thermal, electrical, electronic, mechanical,

optical and magnetic properties – quantum confinement – classification of nanomaterials – quantum well, quantum wire, quantum dot - nanoporous materials - carbon nanotubes, graphene - nanocomposites – applications of nano materials.

PRACTICALS

1. Determination of energy band gap of a semiconductor.
2. Determination of resistivity of metals by four point probe method.
3. Determination of dielectric constant of dielectric material.
4. Determination of time constant of a capacitor using RC circuit.
5. Determination of paramagnetic susceptibility of given liquid.
6. Determination of hysteresis loss in a transformer using BH curve.
7. Analysis of size effect on the absorption spectrum of nanomaterials.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. William D. Callister, “Material Science and Engineering”, Wiley Publications, 2006.
2. Raghavan, V., “Materials Science and Engineering”, 5th edition, Printice Hall of India Pvt Ltd. New Delhi, 2004.
3. Wahab. M.A, “Solid State Physics: Structure and Properties of Materials”, Narosa Publishing House Pvt. Ltd., New Delhi , 2nd Edition, 2010.
4. Pillai, S.O., “Solid State Physics”, New Age International, New Delhi, 2005.
5. Charles P. Poole and Frank J. Owens, ”Introduction to nanotechnology”, Wiley (India), 2009.
6. Pradeep. T., “Textbook of Nanoscience and Nanotechnology”, McGraw Hill Education (India) Private Limited, New York, 2012.

OUTCOMES:

On completion of this course, the student will be able to

- apply the concepts of conducting and semiconducting materials for solid state devices.
- comprehend the significance of properties of dielectric magnetic materials and derive these properties from synthesized materials.
- differentiate between the properties of the nanomaterials compared to bulk materials.
- complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 02	HEAT AND THERMODYNAMICS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To familiarize students with basic concepts of heat.
- To help students acquire the fundamentals of heat conduction and radiation.
- To enable students acquaint with the basics of thermodynamic concepts.
- To make students understand the fundamentals of heat based experiments.

MODULE I CONCEPTS OF HEAT **10**

Definition of temperature, thermal and thermodynamic equilibrium - relationship between temperature and kinetic energy - definition of solid, liquid, gas - Introduction to phase transitions, critical and triple points- definition of heat capacity, mechanical equivalent of heat -Joule's calorimeter- latent heat- microscopic model of ideal gas - equation of state, internal energy, equipartition theorem- equation of state for non-ideal gases.

MODULE II CONDUCTION AND RADIATION **10**

Thermal conductivity – rectilinear flow of heat – thermal conductivity of a good conductor – Forbe’s method – thermal conductivity of a bad conductor – Lee’s disc method – conduction of heat through compound media - radiation – Planck’s law of blackbody radiation – Wien’s law – Stefan’s law – Newton’s law of cooling from Stefan’s law – Solar constant – Pyrometry.

MODULE III FUNDAMENTALS OF THERMODYNAMICS **10**

Thermodynamic equilibrium – zeroth law of thermodynamics – first law of thermodynamics – Reversible and irreversible processes – second law of thermodynamics - Heat engine – Carnot’s engine – Carnot’s theorem – Internal combustion engines – petrol and diesel engines (qualitative) – Entropy and available energy – temperature – entropy diagram for Carnot’s cycle - Third Law of thermodynamics (qualitative).

PRACTICALS

1. Determination of mechanical equivalent of heat by Joule’s calorimeter.
2. Relation between temperature of a body and time by plotting a cooling curve-Newton’s law of cooling.

3. Determination of specific heat capacity of liquid by cooling.
4. Determination of thermal conductivity of a good conductor-Forbe's method
5. Determination of thermal conductivity of a bad conductor-Lee's disc method

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Mathur. D.S, “Heat & Thermodynamics”, S.Chand & Co., 2009.
2. Brijlal & Subramaniam, “Heat and Thermodynamics”, S.Chand & Co, Delhi, 2010.
3. Gupta. A.B and Roy. H, “Thermal Physics”, Books and Allied Ltd., 2002.
4. Sharma. J.K and Sarkar. K.K, “Thermodynamics and statistical Physics”, Himalaya Publishing House, 1988.

OUTCOMES:

On completion of this course, the student will be able to

- understand the concepts of heat and its properties.
- comprehend the ideas governing the conduction and radiation processes.
- apply the knowledge of laws of thermodynamics in thermodynamic systems.
- perform heat based experiments and determine its various properties.

PHCX 03	INTRODUCTION TO NANOSCIENCE AND TECHNOLOGY	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To acquire basic knowledge about the nanomaterials and applications.
- To learn about the synthesis and imaging techniques of nanomaterials.
- To gain the basic concepts of fabrication techniques.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I NANOMATERIALS AND APPLICATIONS **10**

Properties of nanomaterials – size effect on thermal, electrical, electronic, mechanical, optical and magnetic properties – quantum confinement – classification of nanomaterials – quantum well, quantum wire, quantum dot - nanoporous materials - zeolite, mesoporous materials, carbon nanotubes, grapheme - nanocomposites - applications (qualitative): Molecular electronics-nanoelectronics – nanophotonics - single electron transistor-drug delivery.

MODULE II SYNTHESIS AND IMAGING TECHNIQUES **12**

Top-down and bottom up approaches – mechanical alloying and mechanical ball milling - sol-gel approach - hydrothermal method - precipitation method - spray pyrolysis - spin coating-self assembled monolayer (SAM) - Chemical vapour deposition method – Physical vapour deposition method: laser ablation method, sputtering method.

Optical microscopy – Phase contrast and interference microscopy – confocal microscopy - high resolution Scanning electron microscope (HRSEM) - high resolution Transmission electron microscope (HRTEM) - Atomic force microscope - Scanning Tunnelling microscope (STM).

MODULE III NANOFABRICATION **8**

Photolithgraphy - electron beam lithography - X-ray and Ion beam lithography - nanoimprint lithography - soft lithograpy - nanoelectromechnical systems (NEMS) - nanoindentation principles.

PRACTICALS

1. Synthesis of nanomaterials by sol-gel method.

2. Synthesis of nanomaterials by hydrothermal method.
3. Synthesis of nanomaterials by solid state reaction method.
4. Synthesis of nanomaterials by chemical bath deposition method.
5. Synthesis of nanomaterials by co-precipitation method.
6. Synthesis of nano thin films by spray pyrolysis method.
7. Synthesis of nano thin films by pulsed laser deposition (PLD) method.
8. Analysis of size effect on the absorption spectrum of nanomaterials.
9. SEM characterization of nanomaterials.
10. AFM characterization of nano thin films.
11. Phase confirmation by XRD.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Charles P.Poole and Frank J. Owens, ”Introduction to nanotechnology”, Wiley (India), 2009.
2. Cao. G., “Nanostructures & Nanomaterials: Synthesis, Properties & Applications”, Imperial College Press, 2004.
3. Gaddand. W., Brenner. D., Lysherski. S. and Infrate. G.J., “Handbook of NanoScience Engineering and Technology”, CRC Press, 2002.
4. Pradeep. T., “Textbook of Nanoscience and Nanotechnology”, McGraw Hill Education (India) Private Limited, New York, 2012.
5. Chris Mack, “Fundamental Principles of Optical Lithography: The Science of Microfabrication”, John Wiley & Sons, 2008.
6. Bandyopadhyay A.K., “Nano Materials”, New Age International Publishers, New Delhi, 2008.

OUTCOMES:

At the end of the course, the students will be able to

- understand the importance and basic concepts of the nanomaterials.
- comprehend the imaging techniques for nanomaterials.
- illustrate the various nanofabrication techniques.
- complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 04 LASERS AND THEIR APPLICATIONS L T P C

2 0 2 3

OBJECTIVES:

- To recognize the fundamentals of laser and its characteristics.
- To comprehend and compare the different laser systems.
- To apply lasers in metrology and material processing.
- To understand the working of laser instrumentation.
- To correlate the experimental results for applications.

MODULE I LASER THEORY 8

Spontaneous and stimulated emission - Population inversion – Einstein's A & B coefficients - Threshold condition – super-radiance Laser – Three level and four level laser systems -conditions for CW and pulsed laser action. Q-Switching - experimental methods - cavity dumping - Mode locking - experimental methods - Spatial and Temporal coherence.

MODULE II DIFFERENT LASER SYSTEMS 8

Laser systems – General description - Laser structure - excitation mechanism - Different laser systems- He-Ne laser, Carbon-dioxide laser - Excimer laser – Free electron laser- Alexandrite laser - Ti-Sapphire laser – Semiconductor diode laser - Diode pumped solid state laser - Pulsed-CW dye laser- Fibre laser.

MODULE III METROLOGICAL AND MATERIAL PROCESSING APPLICATIONS 8

CW and Pulsed laser beam characteristics and its measurements - Beam focusing effects - spot size - Power and Energy density Measurements - Distance measurement - Interferometric techniques - LIDARS - different experimental arrangements - Pollution monitoring by remote sensing - Laser gyroscope - Laser welding, drilling, machining and cutting - Laser surface treatment - Laser vapour deposition – Biophotonic applications.

MODULE IV LASER INSTRUMENTATION 7

Laser for measurement of length, current and voltage – Laser Doppler Velocimetry - Holography and speckle in displacement and deformation measurements - Laser for communication with fiber optics as channel.

PRACTICALS

1. Tuning of Dye Laser using DFDL Arrangement
2. Determination of Brewster Angle using He-Ne laser
3. Study of transversely Pumped Dye Lasers
4. Study of longitudinally Pumped Dye Lasers
5. Determination of power and wavelength using Distributed Feedback Dye Laser (DFDL)
6. Determination of fibre optic losses using semiconductor laser.
7. Bandgap determination of a semiconductor diode.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. William T. Silfvast, “Laser Fundamentals”, Cambridge University Press, 2009.
2. Ghatak. A. & Thyagarajan. K. “Optical Electronics”, Cambridge University, 1994.
3. Laud.B.B., “Laser and Non-Linear Optics”, Second Edition, New Age International (p) Limited Publishers, 2011.
4. Nambiar. K.R., “Lasers Principle, Types and Applications”, New Age International (p) Ltd, 2004.
5. Wilson. J. & Hawkes. J.F.B., “Opto Electronics - An Introduction”, Prentice Hall, 1992.
6. William M.Steen, ”Laser Material Processing”, Springer-Verlag, Berlin, Third Edn., 2005.

OUTCOMES:

At the end of the course, the students will be able

- To complement the knowledge acquired in the theory class.
- To work with dye lasers for tunability of laser wavelength.
- To measure the loss of information involved in fibre optic communication.
- To correlate the results for application.

PHCX 05	MATERIALS SCIENCE	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To gain basic knowledge in conducting and semiconducting materials and their properties.
- To provide basic understanding of properties and applications of dielectric materials.
- To impart knowledge on magnetic and optical materials and their properties & applications.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I CONDUCTING AND SEMICONDUCTING MATERIALS 10

Quantum free electron theory of metals and its importance - Energy distribution of electrons in metals - Fermi distribution function - Density of energy states and carrier concentration in metals - Fermi energy – Classification of solids into conductors, semiconductors and insulators on the basis of Band theory – Introduction to Elemental and Compound semiconductors - Carrier concentration derivation for Intrinsic semiconductors - Density of electrons in conduction band & Density of holes in valence band- intrinsic carrier concentration - Fermi energy & Variation of Fermi energy level with temperature - Mobility and electrical conductivity - Band gap determination.

MODULE II DIELECTRIC MATERIALS 7

Introduction to dielectric materials & basic definitions – Electronic, Ionic, Orientation & Space charge polarizations - Total polarization – Frequency and temperature dependence of polarization - Internal field in a dielectric material - Deduction of Clausius - Mosotti's relation - dielectric loss & loss tangent – Different types of dielectric breakdown – Applications of dielectric materials : Capacitors and Transformers.

MODULE III MAGNETIC MATERIALS 6

Introduction to magnetic materials & origin of magnetic moment - Different types of

magnetic materials and their properties - Ferromagnetism & Domain theory of ferromagnetism - Hysteresis, Soft and Hard magnetic materials - Antiferromagnetic materials - Ferrites and its applications – Applications of magnetic materials : Data storage.

MODULE IV OPTICAL MATERIALS 7

Optical properties of semiconductors - Direct and Indirect bandgap semiconductors – Traps, recombination centre, color center and exciton – Luminescence : Fluorescence and Phosphorescence - Liquid crystal display : twisted nematic crystal display – Applications of Optical materials - Optical Sources : light emitting diode and laser diode - Photo detectors : PIN photodiode and Avalanche Photodiode - Pyroelectric devices - Electro optic effect : Kerr effect and Faraday effect.

PRACTICALS

1. Resistivity measurement of a semiconductor using four point probe method.
2. Determination of band gap of a semiconductor diode.
3. Determination of Hall coefficient of a given semiconductor material.
4. Determination of dielectric constant of a given non-polar liquid.
5. Determination of magnetic susceptibility of a given paramagnetic liquid using Quincke's method.
6. Determination of energy loss of a given transformer core using hysteresis method.
7. To study the I-V characteristics of a photodiode.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Palanisamy P.K., ''Physics II'', Material Science for ECE, Scitech Publications (India) Pvt. Ltd., 2006.
2. Kasap. S.O., ''Principles of Electronic materials and devices'', McGraw Hill Publishers, 3rd Edition, 2007.
3. Arumugam. M, "Physics II'', Material Science for ECE, Anuradha Publishers, 5th Edition, 2005.
4. Sze. S.M., ''Semiconductor Devices – Physics and Technology'', John Wiley, 2nd Edition. 2002.
5. Raghavan. V, ''Materials Science and Engineering'', Prentice Hall of India, 5th Edition, 2004.

OUTCOMES:

On the completion of this course, the students will be able to

- Gain knowledge about fundamentals of conducting and semiconducting materials.
- Understand concepts and applications of Dielectric and Magnetic materials.
- Familiarize Optical materials and their applications in Engineering and Medical fields.
- Complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 06	NON-DESTRUCTIVE TESTING	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To study the process and applications of ultrasonic inspection method.
- To understand the basic concepts of radiographic inspection method.
- To acquire the knowledge about the various surface Non-Destructive Testing (NDT) techniques.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I ULTRASONIC INSPECTION METHOD **10**

Ultrasonic Testing - Principle of operations - types of sound waves - types of Transducers - transmission and pulse-echo method - straight beam and angle beam, instrumentation - calibration methods - ultrasonic testing technique- data representation, A Scan, B-scan, C-scan. Phased Array Ultrasound, Time of Flight. Diffraction - thickness determination - advantages, disadvantages and applications.

MODULE II RADIOGRAPHIC INSPECTION METHOD **10**

Radiographic testing – Principle - Interaction of X-ray with matter - X-ray radiography - method of generation-industrial radiography inspection techniques – Equipment - Exposure charts - Types of films – Fluoroscopy - Xero-Radiography – Limitations - Gamma radiography - Equipment, radiation sources - method of generation - film processing - interpretations of radiography - safety in industrial radiography.

MODULE III SURFACE NDT TECHNIQUES **10**

Liquid Penetrant Testing – Principles, Characteristics and types of liquid penetrants – developers - advantages and disadvantages of various methods - Inspection Procedure and Interpretation of results. Applications of Liquid Penetrant testing.

Magnetic Particle Testing - Principle-magnetizing technique - procedure –equipment - Interpretation and evaluation of test indications - applications and limitations - demagnetization.

PRACTICALS

1. Inspection of welds using solvent removable visible dye penetrant.
2. Inspection of welds using solvent removable fluorescent dye penetrant.

3. Inspection on non magnetic materials by eddy current method.
4. Inspection on magnetic materials by eddy current method.
5. Inspection of welds by Eddy current Testing.
6. Inspection of welds by Magnetic Particle Testing - Dry method.
7. Inspection of welds by Magnetic Particle Testing - Wet method.
8. Ultrasonic flaw detector - Inspection of defects.
9. Demonstration of Radiographic inspection.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Baldev Raj., Jayakumar T.,Thavasimuthu., “Practical Non-Destructive Testing”, Narosa Publishing House, 2009.
2. Ravi Prakash., “Non-Destructive Testing Techniques”, 1st revised edition, New Age International Publishers, 2010.
3. ASM Metals Handbook of Non-Destructive Evaluation and Quality Control, American Society of Metals, Metals Park, Ohio, USA, Volume-17, 2000.
4. Paul E Mix,”Introduction to Non-destructive testing: a training guide”, Wiley, 2nd Edition New Jersey, 2005.
5. Charles J., Hellier, “Handbook of Nondestructive evaluation”, McGraw Hill, New York, 2001.

OUTCOMES:

Upon completion of this course, the students will be able to

- illustrate the ultrasonic inspection methods of NDT.
- understand the basic concept of radiographic inspection method.
- test the surfaces by the various surface NDT techniques.
- complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 07	PROPERTIES OF MATTER AND ACOUSTICS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To understand principles and properties of elasticity.
- To understand the basic concepts and application of viscosity.
- To analysis acoustic of building.
- To know about photoelasticity and its applications.

MODULE I ELASTICITY **8**

Stress and strain - Hooke's Law of elasticity - Elastic moduli - Stress-Strain Diagram - Poisson's Ratio - Relation between elastic constants - Work done in stretching and twisting a wire - Twisting couple on a cylinder- Expression for bending moment - Cantilever–Expression for depression - Uniform bending and Non-uniform bending of beams (theory & experiment) - I form Girders (qualitative treatment) and applications.

MODULE II VISCOSITY **8**

Viscosity- Newton’s formula for viscous flow - Streamline and turbulent motion - Reynolds number - Poiseuille's formula - Determination of coefficient of viscosity- factors affecting viscosity - capillary flow method - Stoke's formula- viscosity of highly viscous liquids – Stoke’s method - Lubricants and its applications –viscosity measurements - Viscometer - Variation of Viscosity with Temperature.

MODULE III ACOUSTICS OF BUILDING **7**

Basic requirement for the acoustically good halls - Reverberation and time of reverberation – Sabine’s formula for reverberation time - Absorption coefficient and its measurement -Transmission of sound and transmission loss - Factors affecting the architectural acoustics and their remedy-sound absorbing materials - vibration and noise control systems for buildings.

MODULE IV PHOTOELASTICITY **7**

Polarization - double refraction - Theory of Plane, Circularly and Elliptically polarized light - Quarter wave plate and half wave plate - photo elasticity - Theory of photo-elasticity - Stress optic relations - model materials - analysis techniques - Photo elastic bench - Three dimensional photo elasticity - Digital photo elasticity - Photo elastic

coatings.

PRACTICALS

1. Determination of viscosity of liquid by Poiseuille's method.
2. Determination of viscosity of liquid by Stoke's method.
3. Analysis of stress by photo elastic method.
4. Verification of Hooke's law by spring method.
5. Determination of Young's modulus of the cantilever beam.
6. Determination of rigidity modulus by static torsion method.
7. Visit to acoustically good auditorium and identifying the sound absorbing materials in the auditorium.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Mathur D.S., "Elements of Properties of Matter", S.Chand & Co, Delhi, 2009.
2. Gaur R.K., Gupta S.L.,"Engineering Physics", Dhanpat Rai Publishers, 2010.
3. Brijlal and Subramaniam.," Properties of Matter", Eurasia Publishing Co, New Delhi, 2002.
4. Smith C.J.," General Properties of Matter", Orient & Longman,1960.
5. Kenneth G. Budinski and Michel K., Budinski, "Engineering Materials Properties and Selection", Pearson, Singapore, 2002.

OUTCOMES:

Upon completion of this course, the students will be able to

- understand the basic concepts of the elasticity of materials.
- comprehend the concepts of viscosity of liquid and measurement.
- demonstrate the acoustical aspects of building and its importance in construction.
- apply the fundamental concept of photo elasticity for the stress analysis of the object.

PHCX 08	PROPERTIES OF MATTER AND NONDESTRUCTIVE TESTING	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To impart knowledge about the principles and properties of elasticity.
- To learn the laws governing the dynamic of rigid bodies.
- To acquire the knowledge of the various techniques of Non-Destructive Testing (NDT) of materials.
- To understand the principle and basic concept of low temperature applications.

MODULE I ELASTICITY **8**

Stress and strain - Hooke's Law of elasticity - Elastic moduli - Stress-Strain Diagram - Poisson's Ratio - Relation between elastic constants - Work done in stretching and twisting a wire - Twisting couple on a cylinder- Expression for bending moment- Cantilever–Expression for depression - Uniform Bending and Non-uniform bending of beams (theory & experiment) - I form Girders (qualitative treatment) and applications.

MODULE II DYNAMICS OF RIGID BODIES **8**

Rigid bodies - angular acceleration - Torque on a particle - angular momentum - law of conservation of angular momentum - moment of inertia and its significance - Theorem of parallel and perpendicular axis - moment of inertia of a thin uniform bar - moment of inertia of a rectangular lamina - moment of inertia of uniform circular disc - Moment of inertia of hollow and solid cylinders – flywheel
(qualitative) - kinetic energy of rotating body – Routh rule.

MODULE III NDT TECHNIQUES **6**

Ultrasonic Testing- types of Transducers-transmission and pulse-echo method- Radiographic testing- Principle-Interaction of X-ray with matter-X-ray radiography-method of generation-industrial radiography inspection techniques- Liquid Penetrant Testing**-** Inspection Procedure and Interpretation of results.

MODULE IV LOW TEMPERATURE PHYSICS **8**

Definition of Refrigeration and Air-Conditioning - Types of **Refrigeration Systems-** Applications- Comfort Air Conditioning, Industrial Refrigeration, Food processing

and food chain - **Cryogenic treatment - Low temperature properties of engineering materials: Mechanical properties, Thermal properties, Electrical properties.**

PRACTICALS

1. Verification of Hooke's law by spring method.
2. Determination of Young's modulus of the beam by bending method.
3. Inspection of welds using solvent removable visible dye penetrant.
   Inspection of welds using solvent removable fluorescence dye penetrant.
5. Inspection of welds by Magnetic Particle Testing.
6. Determination of moment of inertia of the disc by torsion pendulum method.
7. Determination of moment of inertia of the disc by static torsion method.
8. Demonstration of working of flywheel.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Mathur D.S.,"Elements of Properties of Matter", S.Chand & Co, Delhi, 2009.
2. Brijlal & Subramaniam," Properties of Matter", Eurasia Publishing Co, Delhi, 2002.
3. Gaur R.K., Gupta S.L., "Engineering Physics" Dhanpat Rai Publishers, 2010.
4. Baldev Raj.,Jayakumar T., Thavasimuthu M.,"Practical Non-Destructive testing", Narosa Publishing House, 2009.
5. Brijlal & Subrahmanyam., "Heat and Thermodynamics" S.Chand & Company Ltd, 2002.
6. Paul E Mix.," Introduction to Non-destructive testing: a training guide", Wiley, 2nd Edition, New Jersey, 2005.
7. Charles J., Hellier.," Handbook of Nondestructive evaluation", McGraw Hill, New York, 2001.

OUTCOMES:

Upon completion of this course, the students will be able to

- understand the basic of concept of elasticity of materials.
- comprehend the basic concepts of motion of rigid bodies and its applications.
- demonstrate the various NDT techniques and its importance.
- know the low temperature systems and its applications.

PHCX 09	SEMICONDUCTOR PHYSICS AND OPTOELECTRONICS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To understand the Physics of Semiconductor devices.
- To make the students learn the fundamentals of Photoluminous - semiconductors, Optoelectronic devices, Optical modulators/detectors.
- To make them understand the technology behind latest Display devices like LCD, Plasma and LED Panels.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I PHYSICS OF SEMICONDUCTORS **8**

Elemental and compound semiconductors – Drift and diffusion current - Intrinsic semiconductors – Carrier concentration (derivation) – Fermi energy – Variation of Fermi energy level with temperature – Mobility and electrical conductivity – Band gap determination – Extrinsic semiconductors – Carrier concentration in n-type and p-type semiconductor (derivation) – Variation of Fermi level with temperature and impurity concentration – Variation of Electrical conductivity with temperature – Hall effect – Experiment and applications of Hall effect.

MODULE II OPTOELECTRONIC DEVICES **7**

Light Emitting Diodes (LED) – power and efficiency - double hetero LED - LED structure - LED characteristics - White LED – Applications. Liquid crystal displays – Dynamic scattering and Twisted nematic display, Semiconductor Lasers, Homojunction and Heterojunction laser diodes - Optical processes in semiconductor lasers.

MODULE III OPTICAL MODULATORS **7**

Modulation of light – birefringence –Modulation Techniques - Electro optic effect – Electro optic materials –Types of Electro optic Modulators : Kerr and Pockel modulators –- Magneto optic effect - Magneto optic Modulators – Acousto Optic modulators.

MODULE IV OPTICAL DETECTORS **8**

Photo detectors - photodiodes - phototransistors - noise characteristics - PIN diode – Avalanche Photodiode (APD) characteristics - APD design of detector arrays – Charged Couple Device - Solar cells - Materials and design considerations, Thin film

solar cells, amorphous silicon solar cells.

PRACTICALS

1. Resistivity measurement of a semiconductor using four point probe method.
2. Determination of band gap of a semiconductor diode.
3. Determination of Hall coefficient of a given semiconductor material.
4. Determination of the wavelength of a given laser source using diffraction grating.
5. Determination of Planck's constant using LED.
6. To study the I-V characteristics of photodiode and phototransistor.
7. To study the characteristics of a solar cell.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Arumugam. M, "Physics II", Anuradha Publishers, 5th Edition, 2005.
2. Sze. S.M., "Semiconductor Devices – Physics and Technology", 2nd edn. John Wiley, 2002.
3. Wilson & J.F.B. Hawkes, "Optoelectronics – An Introduction", Prentice Hall, India, 1996.
4. Bhattacharya, "Semiconductor optoelectronic devices", Second Edn, Pearson Education, 2002.
5. Safa O. Kasap, "Optoelectronics & Photonics:Principles & Practices", Second Edn, Pearson Education,2013.
6. Palanisamy P.K., "Semiconductor physics and optoelectronics" Scitech Publications, 2003.

OUTCOMES:

On completion of this course, the student will be able to

- understand the principles of Physics behind semiconductor devices.
- choose the correct semiconductors for electronic devices and display.
- differentiate the working principle of LED and Diode Laser.
- apply the knowledge of modulation of light for different types of optical modulators.
- select suitable photodetectors for different types of applications.
- complement the knowledge acquired in the theory class and correlate the results for applications.

Chemistry Elective Courses
(To be offered II Semester)

CHCX01	ANALYTICAL INSTRUMENTATION	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make the student conversant with

- principles, instrumentation and applications of different electroanalytical techniques
- different chromatographic techniques
- principles, instrumentation and applications of various types of absorption and emission spectroscopy
- different thermal analytical methods and their applications

MODULE I ELECTROANALYTICAL TECHNIQUES **7**

Principle and applications: conductometric titrations – potentiometrIc titrations, ion-selective electrodes and pH-metry – coulometry – voltammetry - polarography, amperometric titrations.

MODULE II CHROMATOGRAPHY **8**

Basic concepts of chromatography – paper chromatography – column chromatography – thin layer chromatography – gas chromatography – high performance liquid chromatography – gel permeation chromatography.

MODULE III SPECTROSCOPY **8**

Absorption spectroscopy (principle, instrumentation and applications): Colorimetric analysis – UV-Visible spectroscopy – FTIR spectroscopy - Emission Spectroscopy (principle, instrumentation and applications): fluorescence, phosphorescence and chemiluminescence – Atomic absorption spectroscopy – flame emission spectroscopy.

MODULE IV THERMAL ANALYSIS **7**

Principle, instrumentation and applications: Thermo gravimetric analysis – Differential thermal analysis – Differential scanning calorimetry

PRACTICALS

1. Conductometric titrations: acid-base and precipitation titrations

2. Potentiometric titrations
3. Determination of pH of the unknown solution
4. Estimation of alkali metals using flame emission spectroscopy
5. Estimation of metal ions of coloured solutions using colorimetric analysis
6. Separation of compounds using gas chromatography
7. Separation of compounds using high performance liquid chromatography
8. Analysis of the given sample and interpretation of the data using IR, UV-Visible spectroscopy
9. Demonstration of TGA/DTA and DSC and interpretation of data.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Skoog D.A., West D.M., Holler F.J. and Crouch S.R., Fundamentals of Analytical Chemistry, 8th Edition, Thomson Brooks/Cole Publication., Singapore, 2004.
2. Willard H.H., Merritt L.L., Dean J.A. and Settle F.A., Instrumental Methods of Analysis, 7th Edition, CBS Publication, New Delhi Reprint, 2004.
3. A.I. Vogel, Vogel's Textbook of Practical Organic Chemistry, 5th Edition, Prentice Hall, London, 2008.
4. Christian G.D., Analytical Chemistry, 6th Edition, John Wiley, Singapore, 2003.
5. Fifield F.W. and Kealey D., Principles and Practice of Analytical Chemistry, 5th Edition, Blackwell Publication, London, 2000.
6. Settle F. (Editor), Handbook of Instrumental Techniques for Analytical Chemistry, Pearson Education, Singapore, 2004.

OUTCOMES:

The student will be able to

- state the principle and applications of various electro-analytical techniques
- identify the right separation method for a given sample using different chromatographic techniques
- explain the principle, instrumentation & applications of various spectroscopic methods and also to interpret the data
- elaborate the principle, instrumentation and applications of various thermal analytical techniques and interpret the data.

CHCX02	CORROSION AND ITS CONTROL	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students should be conversant with the

- Basic concepts, principles and factors affecting corrosion
- Types and mechanism of corrosion
- Control measures of corrosion by material selection, proper design and by applying organic coatings
- Control of corrosion by applying inorganic coating

MODULE I BASIC CONCEPTS OF CORROSION 8

Corrosion – causes and impacts of corrosion – mechanism of corrosion: Dry corrosion- oxidation corrosion - corrosion by other gases – Pilling-Bedworth rule- Corrosion by hydrogen: hydrogen blistering, hydrogen embritttlement, decarburization and hydrogen attack – corrosion of silver and copper by sulphur compounds – liquid metal corrosion (embritttlement or cracking) – Wet corrosion : hydrogen evolution – presence and absence of oxygen and absorption of oxygen – difference between dry and wet corrosion-factors influencing corrosion-polarization-passivity-emf series and galvanic series- corrosion current -rate of corrosion.

MODULE II FORMS OF CORROSION 7

Forms of corrosion-conditions for electrochemical corrosion –galvanic corrosion – differential aeration corrosion: pitting, water line, wire fencing, crevice and filiform corrosion – stress corrosion – Intergranular corrosion- erosion corrosion – soil corrosion – microbiological corrosion- fretting corrosion- corrosion in composites.

MODULE III CORROSION CONTROL AND ORGANIC COATINGS 8

Corrosion control – selection of materials and designing- cathodic protection – sacrificial anode and impressed current cathodic protection – corrosion inhibitors: anodic, cathodic and vapour phase inhibitors.

Organic protective coatings – paints: constituents – functions – varnishes : types-constituents – functions – lacquers : constituents – functions –enamels-constituents – functions – special paints : fire retardant, water repellant, heat resistant, temperature indicating and luminous paints.

MODULE IV INORGANIC COATINGS 7

Treatment of metal surface-inorganic coatings- classification- metallic coatings : anodic and cathodic coatings-hot dipping : galvanizing and tinning- electroplating—electroless plating – cementation (diffusion) : sherardizing, calorizing and chromizing – metal cladding-metal spraying – non metallic coatings (chemical conversion coatings) : phosphate, chromate, oxide coatings and anodizing – comparison of anodic and cathodic protection.

PRACTICALS

1. Determination and comparison of rate of corrosion of metals in the presence of acid, base and neutral medium by weight loss method.
2. Determination of rate of corrosion of iron in the presence of various acids by weight loss method.
3. Determination of rate of corrosion of iron in the presence and absence of anodic Inhibitor by weight loss method.
4. Determination of rate of corrosion of iron in the presence and absence of cathodic Inhibitor by weight loss method.
5. Electroplating of base metal with copper.
6. Electrolessplating of base metal with copper
7. Chemical conversion coatings such as chromate and phosphate coatings.
8. Demonstration on the study of rate of corrosion by using cyclic voltametry.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. P.C Jain & Monica Jain, Engineering Chemistry Dhanpatrai Publishing Company (P) Ltd., New Delhi (2013).
2. S S Umare & S S Dara, A text Book of Engineering Chemistry, S. Chand& Company Ltd, New Delhi, 2014.
3. M.G. Fontana and N.G. Green, Corrosion Engineering, McGraw Hill Book Company, NewYork, 1984.
4. S. Banerjee, A.K. Tyagi, Functional Materials- Preparation, Processing and Applications, ELSEVIER Publications, London ; Waltham, MA : 2011

OUTCOMES:

Students will be able to

- explain the mechanism, compare and enumerate the factors affecting

corrosion

- describe and identify the place and types for a given situation.
- choose and elaborate the suitable organic coating method for a given real time situation.
- apply a suitable metallic coating for a given situation

CHCX03	ELECTRICAL MATERIALS AND BATTERIES	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students should be conversant with

- preparation, properties and applications of plastics used in electrical and electronic applications
- properties and uses of electrical engineering materials
- classification and description of different types of batteries.
- classification and types of fuel cells

MODULE I POLYMERS FOR ELECTRICAL AND ELECTRONIC APPLICATIONS **8**

Preparation, properties and applications **:** polyethylene, polypropylene, EPDM, Nylon-6,6, PVC, PTFE, polycarbonates, ABS, phenol formaldehyde, urea formaldehyde, epoxy resins – polymer blends and alloys.

MODULE II ELECTRICAL ENGINEERING MATERIALS **7**

Conductors: Silver, Copper, Gold, Aluminum – Semiconductors: Germanium, Silicon, Gallium Arsenic – Insulating Materials: Rubbers, Mica, Plastics, Ceramics, Insulating papers – Magnetic Materials: ferromagnetic materials, paramagnetic materials, diamagnetic materials, antiferromagnetic materials, ferrites

MODULE III BATTERIES **7**

Electrochemical and electrolytic cell – batteries: types (primary, secondary and flow cell) – primary batteries: dry cells, alkaline batteries – secondary batteries: nickel-cadmium cell – lead acid storage cell, lithium battery: primary and secondary type – solar cell – dye sensitized solar cell.

MODULE IV FUEL CELLS **8**

Difference between batteries and fuel cells - chemistry of fuel cells - types of fuel cell (based on temperature and electrolyte) – principle, characteristic features, advantages, disadvantages and applications of polymer electrolyte membrane or proton exchange membrane fuel cell (PEMFC), direct methanol fuel cell (DMFC), alkaline fuel cell (AFC), phosphoric acid fuel cell (PAFC), molten carbonate fuel cell (MCFC) and solid oxide

fuel cells (SOFC).

PRACTICALS

1. Free radical polymerization of styrene.
2. Free radical polymerization of PMMA.
3. Preparation of phenol-formaldehyde.
4. Preparation of urea-formaldehyde.
5. Synthesis of epoxy resin.
6. Demonstration of mechanical properties of insulating materials using UTM
7. Demonstration of electrical properties of insulating materials
8. Construction of batteries using natural resources
9. Measurement of EMF for different batteries.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Jain P.C. and Renuka Jain, Engineering Chemistry, Dhanpat Rai Publication Co. (P) Ltd., New Delhi, 2013.
2. Michael L. Berins, Plastics Engineering Hand Book, 5th Edition, Chapman and Hall, New York, 1991.
3. H.F. Mark and N. Gaylord, Encyclopedia of Polymer Science and Technology, Vol. 1 to XIV Interscience, 2nd Ed. 1988.
4. Gowarikar V.R., Viswanathan N.V and Jayadev Sreedhar, Polymer Science, Wiley Eastern Limited, Madras, 1981.
5. R.K. Rajput,A Textbook of Electrical Engineering Materials, Firewall Media, 2004
6. Vladimir S. Bagotsky, Fuel Cells: Problems and Solutions, 2nd Edition, John Wiley and Sons, 2012.
7. B. Viswanathan and M. Aulice Scibioh, Fuel Cells: Principles and Applications, Taylor and Francis Group, 2007.

OUTCOMES:

The student will be able to

- summarise the preparation, properties and applications of plastics used in electrical and electronic applications
- enumerate the properties and uses of electrical engineering materials
- illustrate various types of batteries with the aid of a diagram
- classify the fuel cells and elaborate the different types of fuel cells.

CHCX04	ENGINEERING MATERIALS	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students should be conversant with

- properties and uses of different types of refractories and abrasives
- adhesives, cements and lime, setting of cements and their chemical behaviors.
- types, properties and uses of lubricants.
- various types of composite materials.

MODULE I REFRACTORIES AND ABRASIVES **8**

Introduction refractory: -classification - based on chemical nature- characteristic and selection of good refractory - general manufacture of refractory- preparation properties and uses of: silica refractory - magnesite refractory - zirconia refractory, properties of refractories: refractoriness - refractoriness under load - thermal spalling - porosity and dimensional stability, Cermets - super refractory.

Abrasives : introduction - Moh's scale - natural abrasives: diamond – corundum – emery - garnet and quartz, synthetic abrasives: preparation properties and uses: carborundum (silicon carbide)– alundum - boron (norbide) carbide

MODULE II ADHESIVES AND BINDING MATERIALS **7**

Introduction - classification of adhesives –advantage –limitation of adhesive bonding – development of adhesive- factors influencing adhesive action: chemical and physical, application techniques of adhesive – Lime: classification – manufacture - setting and hardening, Gypsum: -Manufacture and properties and uses - Cement : chemical composition- Manufacture – setting and hardening – concrete – weathering of cement and concrete and its prevention- special cements: high alumina cement - sorel cement - white portland cement – water proof cement.

MODULE III LUBRICANTS **7**

Introduction –functions of lubricant- mechanism of lubrication - classification of lubricant – liquid lubricant: vegetable and animal oils – mineral oils, semisolid: grease(calcium, lithium, aluminium) – petroleum jelly, solid lubricant: graphite - molybdenum disulphide, Properties of lubricant: viscosity - viscosity index - flash point and fire point - cloud point and pour point – oiliness - aniline point - carbon residue.

MODULE IV COMPOSITE MATERIALS 7

Introduction – advantageous characteristics of composites, applications of composites, main constituent of composites, types and applications of composites: RCC fibre-reinforced plastics (glass , carbon and aramid) - particulate composite - metal matrix composite - layered composites - failures in fibre-reinforced composites, ceramic matrix composites (CMC) – properties and applications.

PRACTICALS

1. Preparation of refractory bricks
2. Preparation of abrasive papers/cloth
3. Preparation of simple adhesives
4. Estimation of alkalinity in cements
5. Determination of cloud point and pour point
6. Determination of flash point and fire point
7. Preparation of fibre-reinforced composite

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. P.C Jain & Monica Jain, Engineering Chemistry Dhanpatrai Publishing Company (P) Ltd., New Delhi (2013).
2. B.Sivasnakar, “Engineering Chemistry”, Tata McGrow-Hill Publication Limited, New Delhi, second reprint 2008.
3. Engineering Chemistry, Wiley India Editorial Team, Willey India Publisher, New Delhi, 2011.
4. S S Umare & S S Dara, A text Book of Engineering Chemistry, S. Chand& Company Ltd, New Delhi, 2014.

OUTCOMES:

The student will be able to

- classify and describe the manufacture the refractories and enumerate the properties and uses of abrasive materials.
- elaborate the manufacture, properties and uses of various adhesives and binding materials.
- classify lubricants and describe the properties and uses of them
- enumerate the properties and uses of various composite materials.

CHCX05	FUELS AND COMBUSTION	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make the students conversant with the

- three types of fuels available and the different processes involved in it.
- analysis of fuel characteristics and manufacture of fuels
- calculations involved in calorific values and minimum air requirement for complete combustion.
- classification, functions, mechanism and properties of lubricants.

MODULE I SOLID FUELS **7**

Characteristics of good fuel. Solid fuel – Wood, Coal – Ranking of coal – selection of coal. Analysis of coal – Proximate analysis. Pulverized coal – Metallurgical coke – Carbonization of coal – types. Manufacture of metallurgical coke – Beehive oven and Otto Hoffman's by-product oven methods.

MODULE II LIQUID AND GASEOUS FUELS **8**

Liquid fuel: Petroleum: Refining of petroleum, Liquid fuels derived from petroleum – Cracking: Thermal (Liquid and Vapour phase) – Catalytic (fixed bed and moving bed cracking – Synthetic petrol: Fischer-Tropsch method– Knocking in petrol and diesel engine: octane number and antiknocking – cetane number and improvement of cetane number – biodiesel (trans-esterification) – Gaseous fuels: Compressed natural gas (CNG) – LPG – oil gas – producer gas – water (blue) gas – biogas.

MODULE III COMBUSTION **8**

Calorific value: Gross and net caloric value – Bomb Calorimeter, Gas calorimeter - Definition of combustion – calculation of minimum requirement of air (problems) – theoretical calculation of calorific values (Dulong's formula), Gross and net calorific values ((problems) – Analysis of flue gas: Orsat's gas analysis method, explosive range, Ignition temperature. Introduction to air pollution from IC (Internal combustion) engines, photochemical smog, primary and secondary pollutants.

MODULE IV LUBRICANTS **7**

Friction and wear – lubricants: definition, functions and mechanism of lubrication

(thick film and thin film) –classification: liquid lubricants: animal and vegetable origin, mineral oil, blended oils, lubricating emulsions and silicones – properties of lubricating oils: viscosity and viscosity index; Flash and fire-point, Cloud and pour point, oiliness, emulsification number, volatility, carbon residue, aniline point – semisolid lubricant: greases and waxes – solid lubricant: graphite and molybdenum disulphide –nanolubricants.

PRACTICALS

1. Testing of fuels - proximate analysis (moisture, volatile matter, ash content and fixed carbon present in coal, coke, charcoal etc)
2. Ash content and carbon residue test
3. Biodiesel synthesis by trans-esterification method (from coconut, groundnut, mustard oil, palm oil)
4. Determination of calorific value of a solid fuel using Bomb calorimeter (coal, charcoal, coke etc)
5. Determination of calorific value of a liquid fuel using Bomb calorimeter (petrol, diesel, biodiesel etc)
6. Determination of cloud point and pour point of a lubricant
7. Determination of flash and fire point of diesel.
8. Aniline Point of diesel
9. Viscosity Index of lubricants and Fuels by Viscometer
10. Flue gas analysis by Orsat's gas analysis method – Demonstration
11. Working of internal combustion engine – Demonstration

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai and Sons, New Delhi, 2001.
2. Engineering Chemistry, Wiley India Editorial Team, Willey India Publisher, New Delhi, 2011.
3. John Griswold, Fuels Combustion and Furnaces, Mc-Graw Hill Book Company Inc. University of Michigan, 1946.
4. J.B. Heywood, Internal Combustion Engine Fundamentals, McGraw Hill International Editions, 1989.
5. Bahl B.S., Tuli and Arun Bahl, Essentials of Physical Chemistry, S. Chand and Company Ltd., New Delhi, 2004.

OUTCOMES:

The students will be able to

- compare and contrast the solid, liquid and gaseous fuels and also describe the processes involved in liquid and gaseous fuels.
- analyse the fuel properties such as moisture, votalite matter, ash content, calorific value etc
- calculate minimum air required for complete combustion and calorific values of fuels.
- categorize different lubricants into three types, explain the preparation and determine their properties.

CHCX06	FUNDAMENTALS OF PHYSICAL CHEMISTRY	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students will be conversant with the

- various thermodynamic terms and relate the laws of thermodynamics in chemical processes
- molecularity and order of reaction and derive the rate constant for different order of reactions
- basics of adsorption of different materials and propose mechanisms and surface area measurement
- conditions for equilibrium and learn different components at equilibrium

MODULE I BASIC THERMODYNAMICS **8**

Introduction - Thermodynamic terms - Thermodynamic equilibrium and processes - 1st law of thermodynamics: internal energy, enthalpy, heat capacity, isothermal and adiabatic expansion, Joule-Thomson effect - Zeroth law of thermodynamics: absolute temperature - 2nd law of thermodynamics: - spontaneous and cyclic process, Entropy in isothermal, isobaric and isochoric processes, work and free energy function, Maxwell's relation - 3rd law of thermodynamics

MODULE II CHEMICAL KINETICS **8**

Rate of chemical reaction - order and molecularity of a reaction - Rate constant - kinetics of opposing, parallel and consecutive and chain reactions - isotope effects - effect of temperature on reaction rate - collision theory - absolute reaction rate theory - kinetics in enzyme catalysis

MODULE III SURFACE SCIENCE AND CATALYSIS **8**

Adsorption - adsorption isotherms - uni and bimolecular adsorption reactions - parahydrogen conversion - factors affecting adsorption – Langmuir adsorption isotherm - Hinshelwood mechanism and *Eley-Rideal* mechanism with example - adsorption of gases on solids and surface area measurement by BET method - Terms in catalysis - homogeneous and heterogeneous and enzyme catalysis with example

MODULE IV PHASE RULE 6

Terms involved - Conditions for equilibrium - application of phase rule to water, lead-silver system, freezing mixtures, thermal analysis: cooling curves.

PRACTICALS

1. Determination of the heat capacity of benzoic acid, internal energy of combustion of camphor using Bomb calorimeter. Calculation of enthalpy of combustion and formation for camphor.
2. Determination of adsorption isotherm of (i) acetic acid on charcoal (ii) oxalic acid on charcoal.
3. *Kineticsoffirst and second order reactions.*
4. Phase rule experiments with organic compounds: (i) naphthalene and p-dichloro benzene (ii) naphthalene and diphenyl (iii) m-dinitrobenzenzene and p-nitro toluene.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Rajaram J. and Kuriacose J.C., Chemical Thermodynamics: Classical, Statistical and Irreversible, Pearson Education, India, 2013.
2. Samuel Glasstone, Thermodynamics for Chemists, Read Books, United Kingdom, 2007.
3. James E. House, Principles of Chemical Kinetics, 2nd Edition, Academic Press, United States of America, 2007.
4. Keith J. Laidler, Chemical Kinetics, Pearson Education, India, 1987.
5. Douglas M. Ruthven, Principles of Adsorption and Adsorption Processes, John Wiley & Sons, 1984.
6. Puri B.R., Sharma L.R. and Pathania M.S., Principles of Physical Chemistry, 47th Edition, Vishal Publishing Co. India, 2016.

OUTCOMES:

The student will be able to

- calculate entropy, enthalpy and free energy change for different chemical processes
- calculate the rate constant for any chemical and biochemical processes
- differentiate the adsorption processes and calculate the surface area and predict the suitability of catalysts for different chemical processes

- predict the equilibrium conditions for water, alloys, freezing mixtures and draw the thermal curves for phase transition

CHCX07	GREEN TECHNOLOGY	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make students conversant with the

- basic principles of green chemistry and green technology.
- wastes that causes hazards to human health
- chemicals that harms our environment
- need for green processes in various industries

MODULE I GREEN CHEMISTRY PROTOCOL **7**

Need – Significance – 12 Principles with examples – R4 model – Life cycle analysis – sustainable and cleaner production - Green Technology: definition, examples: CFC free refrigerants, green building, energy, 3D printers, nanotechnology – Awards for Green chemistry – organization promoting green chemistry.

MODULE II WASTE & WASTE MINIMISATION **8**

Source of wastes: domestic, industrial, medical, nuclear, e-waste; problems; prevention – economy of waste disposal – Waste minimization techniques: general waste treatment and recycling – alternate waste water treatment technologies: hybrid process – Green computing: goals, green cloud, green ICT - Pollution statistics from various industries (Industrial case studies).

MODULE III GREEN SYNTHESIS **7**

Introduction - Solvent free reactions - green reagents, green solvents in synthesis - microwave and ultrasound assisted reactions – supercritical fluid extraction – green oxidation and photochemical reactions – catalyst and biocatalysts.

MODULE IV GREEN INDUSTRIAL PROCESSES **8**

Polymer industry: biodegradable polymer - textile industry: greener approaches of dyeing, waste disposal – ecofriendly agrochemicals: biofertilizers, biopesticides – Pharmaceutical industry: atom economy, reduction of toxicity, use of biocatalyst, zero waste disposal – Leather industry: greener process in tanning, crusting, surface coating – ecofriendly batteries & fuel cells.

PRACTICALS

1. Synthesis of an ionic liquids (Ex: imidazolium) and testing the solubility of organic

chemicals.

2. Green bromination of stilbene (using pyridine hydrobromide).
3. Green synthesis: Photocatalytic reactions, solvent-free organic reaction – Aldol; green oxidation, green reduction.
4. Microwave assisted chemical reaction. (synthesis of aspirin, pinacol-pinacolone reaction, etc).
5. Comparison of conventional reaction with microwave assisted reactions (atom economy, solvent, etc) [Ex: aldehyde and ketones with hydrazines to give hydrazones].
6. Diels-Alder reaction in eucalyptus oil (green process).

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai and Sons, New Delhi. 2001.
2. V. K. Ahluwalia, Green Chemistry: Environmentally Benign Reactions, Ane Books India, New Delhi, 2006.
3. Paul Anastas, John C.Warner, John Warner Joint; Green Chemistry: Theory & Practice New Ed Edition; Oxford University press, USA, 2000.
4. Rashmi Sanghi, M. M. Srivastava, Green chemistry, Narosa publishers, New Delhi, 2003.

OUTCOMES:

The students will be able to

- outline the principles and implications of green chemistry.
- comprehend the potential risks of waste generated and analyse the threats to human and environment.
- integrate information into design of molecules to avoid/eliminate toxic solvents & reagents or reduce toxic products.
- identify various alternate greener technologies for various industries.

CHCX08	ORGANIC CHEMISTRY OF BIOMOLECULES	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make students conversant with the

- basic concepts in organic chemistry
- types and structure of carbohydrates and lipids
- formation of different structures of proteins from amino acid
- structure of nucleic acids

MODULE I BASIC CONCEPTS IN ORGANIC CHEMISTRY **8**

Classification and IUPAC nomenclature of organic compounds – stereochemistry – optical, stereo and geometrical isomerism – types of reagents: electrophiles and nucleophiles – types of reactions: addition, substitution, elimination and rearrangement reactions.

MODULE II CARBOHYDRATES, LIPIDS AND VITAMINS **7**

Structure and functions of carbohydrates: mono, di, oligo and polysaccharides – lipids: phospholipids, glycolipids, sphingolipids – cholesterol – steroids – Structure, functions and deficiency disorders of fat soluble vitamins: A, D, E & K - Water soluble vitamins B & C: Thiamine, riboflavin, pantothenic acid, niacin, pyridoxine, biotin, cobalamine, folic acid and ascorbic acid.

MODULE III AMINO ACIDS, PEPTIDES AND PROTEINS **7**

Aminoacids: classification, properties - peptides – polypeptides – proteins: primary, secondary, tertiary and quaternary structure – glycoproteins – lipoproteins – Enzymes: classification and functions

MODULE IV NUCLEIC ACIDS **8**

Nucleic acids – importance - structure of purines and pyrimidines – nucleotides – polynucleotides - RNA – types & structure - DNA – phosphodiester bonds – chemical, helical structure and functions – DNA replication – gene modification.

PRACTICALS

1. Qualitative tests to identify carbohydrates.

2. Quantitative estimation of carbohydrates.
3. Separation of sugars – TLC and/or paper chromatography.
4. Quantitative estimation of lipids.
5. Separation of amino acids – TLC and/or paper chromatography.
6. Quantitative estimation of proteins by Lowry's method.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. V. K. Ahluwalia, Organic Reaction Mechanism, Narosa Publishers, New Delhi, 2002.
2. Johnson Arthur T., Biology for Engineers, CRC Press, Finland, 2011.
3. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai and Sons, New Delhi. 2001.
4. David L. Nelson, Michael M. Cox, Lehninger Principles of biochemistry, Macmillan press, London, 2010

OUTCOMES:

The students will be able to

- classify organic compounds and explain the mechanism of various organic reactions.
- draw the structures and enumerate the functions of carbohydrate, lipids and vitamins.
- correlate the relationship among amino acids, peptides and proteins.
- recognize the role of nucleic acid in the formation of RNA & DNA and differentiate DNA & RNA using their structure and function.

CHCX09	POLYMER SCIENCE AND TECHNOLOGY	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make the student conversant with the

- basic concepts of polymers, classification, types of polymerization and molecular weight & its distribution
- preparation, properties and applications of thermoplastics and introduction to biodegradable polymers
- properties and applications of thermosets, elastomers and FRP
- different types of moulding techniques

MODULE I BASIC CONCEPTS OF POLYMERS **8**

Definitions: monomer, polymer, functionality, degree of polymerization – classification of polymers: source, structure, application, thermal processing behavior (thermoplastics and thermosets), composition and structure (addition and condensation), mechanism (chain growth and step-wise growth) – copolymer: types – Definition –nomenclature of polymers – tacticity – types of polymerization : free radical, cationic and anionic polymerization (concepts only) – average molecular weight of polymer: number, weight – molecular weight distribution (problems)

MODULE II THERMOPLASTICS AND BIODEGRADABLE POLYMERS **8**

Preparation, properties and applications : LDPE, HDPE, polypropylene, PVC, PTFE, PET, polyamides (Nylon-6 and Nylon 6,6) and polycarbonates – polymer blends and alloys – basics of biodegradable polymers.

MODULE III THERMOSET RESINS, ELASTOMERS AND FRP **7**

Thermoset resins : phenolic resins, amino resins (urea and melamine formaldehyde), epoxy resins, unsaturated polyesters – polyurethanes – elastomers : vulcanization of natural rubber, diene based elastomers –fibre reinforced plastics: glass, aramid and carbon.

MODULE IV MOULDING TECHNIQUES 7

Moulding constituents**:** functions – moulding techniques**:** compression, injection, extrusion (single screw), blow moulding, thermoforming, (mechanical and vacuum forming), lamination.

PRACTICALS

1. Determination of molecular weight and degree of polymerization using Oswald's viscometer.
2. Free radical polymerization of styrene.
3. Free radical polymerization of PMMA.
4. Preparation of phenol-formaldehyde.
5. Preparation of urea-formaldehyde.
6. Synthesis of epoxy resin.
7. Synthesis of unsaturated polyester.
8. Preparation of FRP laminates.
9. Demonstration of injection moulding, compression moulding and blow moulding.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Billmeyer F.N., Text Book of Polymer Science, 3rd Edition, John Wiley and Sons, New York, 1994.
2. George Odian, Principles of Polymerisation, 3rd Edition, McGraw Hill Book Company, New York, 1991.
3. Michael L. Berins, Plastics Engineering Hand Book, 5th Edition, Chapman and Hall, New York, 1991.
4. Jacqueline I., Kroschwitz, Concise Encyclopedia of Polymer Science and Engineering, John Wiley and Sons, New York, 1998.
5. Encyclopedia of Polymer Science and Technology, Vol. 1 to XIV, H.F. Mark and N. Gaylord, Interscience, 2nd Ed. 1988.
6. Gowarikar V.R., Viswanathan N.V and Jayadev Sreedhar, Polymer Science, Wiley Eastern Limited, Madras, 1981.

OUTCOMES:

The student will be able to

- classify various polymers, name the polymers and types of polymerization

reactions, calculate molecular weight of polymers,

- summarise preparation, properties and applications of thermoplastics and give examples of biodegradable polymers
- elaborate the properties and applications of thermosets, elastomers and FRP
- select the appropriate moulding technique for a given polymer, based on the application

Maths Elective Courses

(to be offered in IV

Semester)

MACX 01	**DISCRETE MATHEMATICS AND GRAPH THEORY**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

OBJECTIVES:

The aims of this course are to

- introduce Logical and Mathematical ability to deal with abstraction.
- familiarize the basic mathematical ideas and terminologies used in computer science.
- translate real life situations into diagrammatic representations.

MODULE I PROPOSITIONAL CALCULUS 8

Propositions – Logical connectives – Compound propositions – Conditional and biconditional propositions – Truth tables – Tautologies and contradictions – Contrapositive – Logical equivalences and implications – DeMorgan's Laws – Normal forms – Principal conjunctive and disjunctive normal forms – Rules of inference – Arguments – Validity of arguments.

MODULE II PREDICATE CALCULUS 7+3

Predicates – Statement function – Variables – Free and bound variables – Quantifiers – Universe of discourse – Logical equivalences and implications for quantified statements – Theory of inference – The rules of universal specification and generalization – Validity of arguments.

MODULE III FUNCTIONS 7+3

Functions – Classification of functions –— Composition of functions – Inverse functions – Binary and n–ary operations – Characteristic function of a set – Hashing functions – Recursive functions – Permutation functions.

MODULE IV ALGEBRAIC SYSTEMS 8+2

Groups, Cyclic Groups, Subgroups, Cosets, Lagrange's theorem, Normal subgroups – Codes and group codes – Basic notions of error correlation – Error recovery in group codes.

MODULE V GRAPH THEORY 7+3

Graphs – incidence and degree – subgraphs – isomorphism – complement of a graph – operations on graphs

MODULE VI PATH AND CIRCUIT 8+2

Walks, trails and paths – Eulerian graphs – Konigsburg bridge problem - Hamiltonian graphs

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1 Trembly J.P and Manohar R, “Discrete Mathematical Structures with Applications to Computer Science”, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, 30th Reprint 2011.

2 Kenneth H.Rosen, “Discrete Mathematics and its Applications:, 7th Edition, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, Special Indian Edition, 2011.

REFERENCES:

1 Ralph.P.Grimaldi, “Discrete and Combinatorial Mathematics: An Introduction”, 4th Edition, Pearson Education Asia, Delhi, 2007.

2 Thomas Koshy, “Discrete Mathematics with Applications”, Elsevier Publications, 2006.

3 C.L.Liu, D.P.Mohapatra, “Elements of Discrete Mathematics”, 4th Edition, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, 2012.

OUTCOMES:

At the end of the course, student will be able to

- use the concepts of propositional calculus.
- use the concepts of predicate calculus.
- identify types of functions and their importance.
- decode and encode the messages using group theory concepts.
- apply the basic concepts of graph theory.
- represent some real life situations into diagrammatic representation.

MACX 02 PROBABLITY AND STATISTICS L T P C
3 1 0 4

OBJECTIVES:

The aims of this course are to impart the

- knowledge of the theory of probability and random variables
- techniques to carry out probability calculations and identifying probability distributions
- application of statistical inference in practical data analysis

MODULE I BASICS OF PROBABILITY AND STATISTICS 8+2

Sample space, events- axioms of probability and interpretation – Addition, multiplication rules – conditional probability, Independent events - Total probability – Baye's theorem - Descriptive Statistics.

MODULE II ONE DIMENSIONAL RANDOM VARIABLE AND PROBABILITY DISTRIBUTION FUNCTIONS 7+3

Discrete random variable –continuous random variable – Expectation - probability distribution - Moment generating function – Binomial, Poisson, Geometric, Uniform (continuous), Exponential and Normal distributions.

MODULE III TWO DIMENSIONAL RANDOM VARIABLES 8+2

Joint, marginal, conditional probability distributions –covariance, correlation - transformation of random variables.

MODULE IV SAMPLING AND ESTIMATION 7+3

Sampling distributions – basic knowledge on Random , simple random , stratified and cluster samplings – Test of Hypotheses - concepts- Point estimation and Interval estimation.

MODULE V THEORY OF INFERENCE 8+2

Large sample tests – test for single and difference on proportions, single mean, difference of means, difference of variances – confidence intervals. Small sample tests – Student's t test, F test and Chi square test on theory of goodness of fit and analyses of independence of attributes.

MODULE VI DESIGN OF EXPERIMENTS 7+3

Analysis of variance – one way classification – two way classification – Completely

Randomised Block Designs – Randomised Block Design – Latin square designs - Interpretations - case studies.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. T.Veerarajan, “Probability and Statistics”, Tata McGraw-Hill Education, 2008.
2. Miller, I., Miller, M.,Freund, J. E., “Mathematical statistics”, 7th Edition, Prentice Hall International, 1999.
3. S.P.Gupta, “Applied Statistics”, Sultan Chand & Sons

REFERENCES:

1. S.M.Ross, “Introduction to Probability and Statistics for Engineers and Scientists” Fifth Edition, Elesvier.
2. S.C.Gupta and V.K.Kapoor, “Fundamentals of Mathematical Statistics” First edition, Sultan Chand and Sons.
3. Arora and Arora, “Comphrensive Statistical Methods”, S. Chand, 2007

OUTCOMES:

On completion of the course, students will be able to

- do basic problems on probability and descriptive statistics.
- derive the probability mass / density function of a random variable.
- calculate probabilities and derive the marginal and conditional distributions of bivariate random variables.
- calculate point and interval estimates.
- apply some large sample tests and small sample tests.
- carry out the data collection representation analysis and implications and the importance of inferences.

MACX 03	RANDOM PROCESSES	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aims of the course are to

- acquire the knowledge of the theory of probability and random variables
- study discrete and continuous probability distributions.
- demonstrate the techniques of two dimensional random variables and its distributions.
- introduce the random process, stationarity, Markov process and the study of correlation function and spectral analysis.

MODULE I Basics of Probability 7+3

Sample space, events- axioms of probability and interpretation – Addition, multiplication rules – conditional probability, Independent events - Total probability – Baye's theorem - Tchebychev's inequality.

MODULE II One dimensional Random variable and Probability Distribution functions 7+3

Discrete random variable –continuous random variable – Expectation - probability distribution - Moment generating function – Binomial, Poisson, Geometric, Uniform (continuous), Exponential and Normal distributions.

MODULE III Two dimensional random variables 7+3

Joint, marginal, conditional probability distributions - covariance, correlation and regression lines - transformation of random variables.

MODULE IV RANDOM PROCESSES 8+2

Classification of Random process - Stationary process - WSS and SSS processes - Poisson process – Markov Chain and transition probabilities.

MODULE V CORRELATION FUNCTIONS 8+2

Autocorrelation function and its properties - Cross Correlation function and its properties - Linear system with random inputs – Ergodicity.

MODULE VI SPECTRAL DENSITY 8+2

Power spectral Density Function - Properties - System in the form of convolution - Unit Impulse Response of the System – Weiner-Khinchine Theorem - Cross Power

Density Spectrum.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Veerarajan T., “Probability, Statistics and Random Processes”, Tata McGraw Hill,3rd edition, 2008.
2. Papoulis, “Probability, Random Variables and Stochastic Processes”, 4th Edition, Tata McGraw Hill Company, 2002.
3. S.M.Ross, “Introduction to Probability and Statistics for Engineers and Scientists” Fifth Edition, Elesvier

REFERENCES:

1. Scott L. Miller,Donald G. Childers, Probability and Random Processes, Academic Press,2009.
2. Trivedi K S, “ Probability and Statistics with reliability, Queueing and Computer Science Applications”,Prentice Hall of India,New Delhi,2nd revised edition, 2002

OUTCOMES:

On completion of the course, students will be able to

- do basic problems on probability.
- derive the probability mass / density function of a random variable.
- calculate probabilities and derive the marginal and conditional distributions of bivariate random variables.
- identify and study the different random processes.
- compute correlation functions and related identities.
- compute power spectral density functions and apply Weiner-Khinchine formula.

MACX 04 APPLIED NUMERICAL METHODS L T P C
3 1 0 4

OBJECTIVES:

The aims of the course are to

- introduce basic computational methods for analyzing problems that arise in engineering and physical sciences.
- acquire knowledge about approximation theory and convergence analysis associated with numerical computation.

MODULE I NUMERICAL SOLUTIONS OF EQUATIONS 7+3

Bisection method - Regula Falsi method – Secant method - Fixed point iteration method - Newton's Raphson method –Gauss Elimination method - Gauss-Jordon method – Gauss Jacobi method - Gauss-Seidel method.

MODULE II INTERPOLATION 8+2

Finite difference operators – Gregory Newton's forward and backward interpolations – Cubic spline interpolation - Lagrange interpolation - Newton's divided difference formula.

MODULE III NUMERICAL DIFFERENTIATION AND INTEGRATION 8+2

Numerical differentiation using Newton's forward and backward formulae – Numerical integration : Trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Gaussian Two Point and Three Point Quadrature formulae – Double integrals using Trapezoidal and Simpson's 1/3 rule.

MODULE IV INITIAL VALUE PROBLEMS FOR FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS 7+3

Numerical solutions by Taylor's Series method, Euler's method, Modified Euler's Method - Runge – Kutta Method of fourth order – Milne's and Adam's Bashforth Predictor and Corrector methods

MODULE V INITIAL AND BOUNDARY VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 8+2

Numerical solutions by Taylor's Series method - Runge – Kutta Method of fourth order of second order ODE. Finite difference methods.

MODULE VI BOUNDARY VALUE PROBLEMS FOR PARTIAL DIFFERENTIAL EQUATIONS **7+3**

Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace equation.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Grewal, B.S., “Numerical methods in Engineering and Science”, 7th edition, Khanna
   Publishers, 2007.
2. C.F.Gerald, P.O.Wheatley, “Applied Numerical Analysis” ,Pearson Education, New Delhi, 2002.

REFERENCES:

1. Chapra S.C, Canale R.P. “Numerical Methods for Engineers”, 5th Ed., McGraw Hill, 2006.
2. M.K.Jain, S.R.K.Iyengar, R.K.Jain, “Numerical methods for Scientific and Engineering Computation”, New Age International Publishers, New Delhi, 2003

OUTCOMES:

At the end of this course, students will be able to

- solve algebraic, transcendental and system of equations.
- apply interpolation techniques.
- carry out numerical differentiation and integration using different methods.
- solve first order ODE using single and multi step methods.
- solve second order ODE, initial and boundary value problems.
- solve the boundary value problems in PDE.

Maths Elective Courses
(To be offered in VI Semester)

MACX 05	MATHEMATICAL PROGRAMMING	L	T	P	C
		2	0	0	2

OBJECTIVES:

The aims of the course are to

- acquire knowledge and training in optimization techniques.
- obtain knowledge about optimization in utilization of resources.
- understand and apply operations research techniques to industrial operations.

MODULE I LINEAR PROGRAMMING PROBLEM 10

Linear programming – formulation of the problem - graphical interpretation of optimality - Simplex method – to obtain basic feasible solution – types of linear programming solution – complications and their resolution.

MODULE II ADVANCED LINEAR PROGRAMMING PROBLEMS 8

Artificial variable - Big M method – Two phase method – alternative optimal solution – unbounded solution - Duality – primal dual relationships.

MODULE III TRANSPORTATION PROBLEM 7

Transportation problems – Initial basic feasible solutions, MODI method, Unbalanced transportation problem, Degeneracy in transportation models,.

MODULE IV ASSIGNMENT PROBLEM 5

Assignment problem – Minimization and Maximization type of problems by Hungarian method.

Total Hours –30

TEXT BOOKS:

1. Hamdy A Taha, “Operations Research - An introduction”, 8th edition, Phil Pearson, 2007.
2. Winston.W.L., “Operations Research”, 4th edition, Thompson-Brooks/Cole, 2003.

REFERENCES:

1. Wayne.L. Winston, “Operations Research Applications and Algorithms”,

4th edition, Thomson learning, 2007.

2. Frederick. S. Hiller and Gerald J Lieberman, “Operations Research Concepts and Cases”, 8th edition (SIE), Tata McGraw – Hill Pub. Co. Ltd., New Delhi, 2006.
3. A. Ravindran, D. T. Phillips and J. J. Solberg, "Operations Research: Principles and Practice", 2nd edition, John Wiley & Sons, New York, 1992.
4. Robertazzi. T.G., “Computer networks and systems-Queuing theory and performance evaluation”, 3rd edition, Springer, 2002.

OUTCOMES:

At the end of the course, students will be able to

- formulate industrial problems as mathematical programming problems.
- solve linear programming problems by different methods.
- solve transportation problems by different methods.
- solve assignment problems by Hungarian method.

MACX 06	STATISTICAL METHODS FOR DATA ANALYSIS	L	T	P	C
		2	0	0	2

OBJECTIVES:

The aim of the course is to

- introduce statistical quality control tools.

MODULE I TESTS OF HYPOTHESES AND STATISTICAL INFERENCES 8

Small sample tests – Student's ' t ' test for single mean , difference of means, paired t test – F test for difference of variances – Chi square test on theory of goodness of fit and analyses of independence of attributes.

MODULE II DESIGN OF EXPERIMENTS 7

Analysis of variance – one way classification – two way classification – Completely Randomised Block Designs – Randomised Block Design – Latin square designs - Statistical analysis -Interpretations - case studies.

MODULE III STATISTICAL QUALITY CONTROL-I 8

Quality improvement and statistics –Statistical quality control- statistical process control – control charts – design of control charts –analysis of patterns on control charts - X bar chart, R chart and S chart.

MODULE IV STATISTICAL QUALITY CONTROL-II 7

Process and product control – attribute charts – P, np and C charts – control charts performance.

Total Hours –30

TEXT BOOKS:

1. Douglas C.Montgomery, George C. Runger "Applied Statistics and probability for Engineers" V Edition – John Wiley & Sons Inc.
2. Miller, I., Miller, M., Freund, J. E. "Mathematical statistics" 7th Edition. Prentice Hall International, 1999.

REFERENCES:

1. Dekking, F.M., Kraaikamp, C., Lopuhaä, H.P., Meester, L.E. "A Modern Introduction to Probability and Statistics" Springer, 2nd Edition.
2. Chin Long chiang "Statistical Methods of Analysis "World Scientific Books,

2003.
3. S.C.Gupta and V.K. Kapoor, “Mathematical Statistics” , Sultan Chand publications.
4. Veerarajan “Fundamentals of Mathematical Statistics” I Edition, Yes Dee Publishing Pvt. Ltd., 2017.

OUTCOMES:

On completion of the course, students will be able to

- develop and test hypothesis for different statistical tests
- design an experiment and case study the experiment with different data.
- analyze the industrial data using quality control design tools statistically.
- analyze the industrial data using process and product control tools statistically.

MACX 07 NUMERICAL METHODS FOR INTEGRATION AND DIFFERENTIAL EQUATIONS

L	T	P	C
2	0	0	2

OBJECTIVES:

- This course aims to solve numerically integral and differential equations.

MODULE I NUMERICAL INTEGRATION 8

Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Two Point and Three point Gaussian quadrature formulae.

MODULE II NUMERICAL DOUBLE INTEGRATION 6

Double integrals using trapezoidal and Simpson's 1/3 rules

MODULE III NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS 8

Milne's Predictor and Corrector Method – Adam's Predictor-Corrector Method - Finite difference methods for two – point Boundary Value problems for Ordinary Differential Equations.

MODULE IV BOUNDARY VALUE PROBLEMS FOR PARTIAL DIFFERENTIAL EQUATIONS 8

Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace and Poisson equations

Total Hours –30

TEXT BOOKS:

1. M.K.Jain, S.R.K.Iyengar, R.K.Jain, "Numerical methods for Scientific and Engineering Computation", New Age International Publishers, New Delhi, 2003.
2. Grewal, B.S., "Numerical methods in Engineering and Science" 7th edition, Khanna Publishers, 2007

REFERENCES:

1. C.F.Gerald, P.O.Wheatley, "Applied Numerical Analysis" Pearson Education, New Delhi 2002.
2. P.Dechaumphai, N. Wansophark, "Numerical Methods in Engineering", Narosa Publications, 2012.

OUTCOMES:

At the end of the course students will be able to

- solve the integration by numerical methods.
- solve the double integration by numerical methods
- find numerical solution of ordinary differential equations in engineering problems.
- find numerical solution of partial differential equations in engineering problems.

MACX 08 MATHEMATICAL MODELLING

L	T	P	C
3	0	0	3

OBJECTIVES:

The aims of the course are to

- provide basic idea of formation and use of Mathematical models for different purposes.
- determine the extent to which models are able to replicate real-world phenomena under different conditions

MODULE I PRINCIPLES OF MATHEMATICAL MODELING 7

Mathematics as a modelling language - Classification of models - Building, studying, testing and using models - Black and white box models – Difference equations

MODULE II PHENOMENOLOGICAL MODELS 7

Linear, Multiple linear and nonlinear regression - Neural networks - Fuzzy model - Stability and higher dimensional systems

MODULE III MECHANISTIC MODELS –I 8

Setting up ODE models – Initial and Boundary value problems - Numerical solutions - Fitting ODE to data - Applications

L	T	P	C
2	0	0	2

MODULE IV MECHANISTIC MODELS –II 8

Linear and nonlinear equations - Elliptic, parabolic and hyperbolic equations - Closed form solutions - Finite difference and finite element methods

Total Hours –30

TEXT BOOKS:

1. G . Ledder , “Calculus, modelling , probability and dynamic systems”, Springer 2013
2. Kei Velten, “Mathematical modelling and simulation”, J. Wiley and sons,2009

REFERENCES:

1. Michael D Alder, “An introduction to Mathematical modelling”, Heaven for Books.com
2. Alfio Quarteroni, “Mathematical models in science and engineering”, Notices of AMS
3. J.N. Kapur, “Mathematical models in Biology and Medicine”, Affiliated East-

West Press Private Limited, New Delhi, 1992.

OUTCOMES:

On completion of the course, the students will be able to

- identify the relationship between real world and mathematical models
- Classify the data and choose the appropriate model
- Distinguish between linear and nonlinear models
- identify the relationship between empirical and mechanistic models

MACX 09 **GRAPH THEORY** **L T P C**
3 0 0 3

OBJECTIVES:

The aims of this course are to

- represent the real life situations diagrammatically.
- appraise different methods to find solutions to graph theory problems.

MODULE I INTRODUCTION TO GRAPH THEORY **8**

Graphs - finite and infinite graphs - Incident and degree-isolated vertex, pendent vertex and null vertex.

MODULE II PATH AND CIRCUIT **8**

Isomorphism – sub graphs-walks, paths and circuits – connected and disconnected graphs- Euler graphs – operation on a graph.

MODULE III TREES AND FUNDAMENTAL CIRCUITS **7**

Trees- some properties of trees- pendent vertices in a tree – rooted binary tree-spanning trees-fundamental circuits.

MODULE IV CUT SETS AND CUT VERTICES

Cut sets – some properties of cut sets- fundamental circuits and cut sets-network flows.

Total Hours –30

TEXT BOOKS:

1. NARSINGH DEO, Graph theory with applications to Engineering and Computer Science, Prentice Hall INC, New Delhi,
2. J.A. Pondy and U.S.R. Murthy, North Holland, Oxford, New York Graph theory with applications

REFERENCES:

1. Trembly J.P and Manohar R, “Discrete Mathematical Structures with Applications to Computer Science”, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, 30th Reprint 2011
2. Kenneth H.Rosen, “Discrete Mathematics and its Applications”, 7th Edition, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, Special Indian Edition, 2011

3. Md. Saidur Rahman, “Basic graph theory”, Springer, 2017

OUTCOMES:

At the end of the course, students will be able to

- demonstrate the basic concepts of Graph theory.
- explore connected and disconnected graphs.
- identify the real life problems with trees and circuits.
- bring out the cut set properties and network flows properties.

Humanities Elective I

(To be offered in III Semester)

		L	T	P	C
SSCXO1	**FUNDAMENTALS OF ECONOMICS**	**2**	**0**	**0**	**2**

OBJECTIVES:

- To identify and present the basic concepts of demand, supply and equilibrium.
- To explain and discuss the types and concepts of national income and inflation.
- To illustrate the fundamental concepts of money, banking and public finance.
- To apprise the students about Indian economy and the role of engineers in economic development.

MODULE I DEMAND AND SUPPLY ANALYSIS 8

Classification of economy – open and closed economy, Demand - Types of demand - Determinants of demand – Law of Demand - Demand elasticity - Supply - Determinants of Supply – Law of Supply - Supply elasticity - Pricing strategies.

MODULE II NATIONAL INCOME AND INFLATION 7

Concepts of National income and measurement – Importance and difficulties of estimating National Income in India - Aggregate demand and aggregate supply, Macroeconomic equilibrium – meaning of inflation- types - causes and preventive measures

MODULE III MONEY, BANKING AND PUBLIC FINANCE 9

Money – Meaning, types, functions, importance - Commercial Banks - Central Bank - Monetary policy – meaning, objectives, Methods of Credit Control By RBI, Government Budget – Government revenue and Expenditures – Fiscal policy - Its objectives, instruments and limitations - Deficit Financing - The Fiscal Responsibility and Budget Management Act, 2003 (FRBMA) .

MODULE IV INDIAN ECONOMY AND THE ROLE OF ENGINEERS 6

Economic reforms – Liberalization, Privatization and Globalization - challenges and opportunities, Engineers – Engineers' contributions to the economic growth.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Dutt and Sundharam (2013), *Indian Economy*, S. Chand & Company Pvt. Ltd, New Delhi.
2. Hussain, Moon Moon (2015), *Economics for Engineers*, Himalaya Publishing House, New Delhi.

REFERENCES:

1. Cleaver Tony (2004), "*Economics: The Basics*", Routledge, London.
2. Mell Andrew and Walker Oliver (2014), "*The Rough Guide to Economics*", Rough Guide Ltd.

OUTCOMES:

On successful completion of this course,

- Students will have had exposure to the basic concepts of demand, supply and various pricing strategies.
- Students will have understood the macroeconomic concepts of national income and inflation.
- Students will be able to apply the knowledge of money, banking and public finance in their real life situations.
- Students will have an overview of the economic reforms introduced in Indian economy.

SSCXO2	PRINCIPLES OF SOCIOLOGY.	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To acquaint the students with Concepts and perspectives of Sociology
- To explain the reflection of society in Individuals and vice versa
- To describe the hierarchical arrangement of individuals and groups in society
- To explicate the dimensions, forms and factors of Social change.
- To examine the context, impact and agencies of Globalization

MODULE I THE FOUNDATIONAL CANON 8

Sociology-Definition, scope and importance; Major theoretical perspectives- Functionalism, Conflict Theorising and Interactionism; Elements of social formation- Society, Community, Groups and Association; Associative Social Process- Co-operation, Accommodation and Assimilation; Dissociative Social Process- Competition and Conflict.

MODULE II INDIVIDUAL AND SOCIETY 7

Culture-definition, characteristics, functions, types, cultural lag and civilization, Socialization – definition, process, stages, agencies and anticipatory socialization; Social Control- definition, characteristics, importance, types & agencies.

MODULE III SOCIAL INEQUALITY AND STRATIFICATION 7

Concepts- inequality, hierarchy, differentiation, Social Exclusion, and Social Stratification. Forms of Social Stratification- Caste, Class and Estate. Gender and Social Stratification- sex and gender, patriarchy, factors perpetuating gender stratification; Globalization and gender inequality

MODULE IV SOCIAL CHANGE AND GLOBALIZATION 8

Social Change-definition, nature, direction; Forms- evolution, development, progress and transformation; Factors of social change- demography, economy, technology, polity and culture. Globalization- definition, characteristics, historical and social context and Impact, agencies of globalization- IGOs, INGOs, Nation-State, MNEs and Media

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Giddens A. 1989. “Sociology” Cambridge: Polity Press.
2. Heald Haralambos, R.M(2014) . ‘‘Sociology Themes and Perspectives”, Oxford, New Delhi-92
3. Bhushan Vidya and D.R. Sachdeva (2012). ‘‘Fundamental of Sociology”, Pearson, Delhi.

REFERENCES:

1. Das Gupta, Samir and Paulomi Saha (2012), ‘‘An Introduction to Sociology”, Pearson, Delhi
2. Bottomore, T.B. 1972. *Sociology- A Guide to Literature and Problems*, New Delhi,

OUTCOMES:

On successful completion of this course,

- Students will have exposure to the fundamentals tenets of Sociology.
- Students will be trained to understand social reality with sociological perspective.
- Students will be oriented to constructively analyze human interactions, social relationship and social issues
- Students will gain exposure to the dynamics of human society with special reference to the contemporary trends of globalization.

SSCXO3	SOCIOLOGY OF INDIAN SOCIETY.	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To present a portrayal of the components of the Indian Social structure
- To describe the nature and contemporary structure of Indian social Institutions.
- To examine the causality and magnitude of social problem facing the contemporary India.
- To elucidate the processes forms and impact of change and development in Indian society

MODULE I INDIAN SOCIAL STRUCTURE 7

Unity and Diversity; Concepts of unity and diversity- racial, religious, ethnic and linguistic composition of India. Types of communities-rural, urban and tribal; Social backwardness- OBC, SC and ST; Indian minorities- religious, ethnic, linguistic and LGBT

MODULE II INDIAN SOCIAL INSTITUTIONS 7

Family- definition, types, characteristics, functions of family; Joint Family- definition features, utility, changes; Marriage- definition, characteristics, marriage as sacrament or contract. Caste- definition, principles, contemporary changes, dominant caste, caste -class interface.

MODULE III SOCIAL PROBLEMS IN INDIA 8

Social Problem-definition, nature, social disorganization; Population explosion-causes, effects, relationship with development; Child Labour- causes, magnitude and consequences; Unemployment-nature , types, causes and effects; Gender issues-social status of women, violence against women and women in work place; Contemporary issues- communalism, terrorism and corruption.

MODULE IV SOCIAL CHANGE AND DEVELOPMENT IN INDIA 8

Socio-cultural Change- Sanskritization, Westernization, Secularization, Modernization; Processes of Social change- Industrialization, Urbanization, Globalization; Development- definition, elements, role of government, industry and corporate sector. Technology and change- invention and innovation, impact of technology on social institutions, technology and development.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Sharma,K.L.2008. *Indian Social Structure and Change*. Jaipur: Rawat Publications,.
2. Shah, A.M. 1998. *The Family in India: Critical Essays*. New Delhi: Orient Longman,
3. Ahuja Ram. 1999. *Social problems in India*, Rawat Publication: New Delhi.
4. Ahuja Ram. 2014. *Society in India,*, Rawat Publication: New Delhi.

REFERENCES:

1. Jayapalan, N.(2001), **"**Indian Society and Social Institutions" Atlantic Publishers & Distri,
2. Atal, yogesh (2006), "Changing Indian Society" Rawat Publications, Jaipur

OUTCOMES:

On successful completion of this course,

- Students will gain an in-depth understanding of the social structure and social institutions that constitute society in India.
- Students will be sensitized to the various categories ,Inequalities and their challenges
- Students will be exposed to the social problems encountered in contemporary India.
- Students will gain knowledge about the various forms and trends of the social change.
- Students will become aware about the challenges in the path of progress of Indian society and realize relevance of their role in bringing about development

Humanities Elective II

(To be offered in IV Semester)

		L	T	P	C
SSCXO4	ECONOMICS OF SUSTAINABLE DEVELOPMENT	2	0	0	2

OBJECTIVES:

- To have an increased awareness on the concept and components of sustainable development.
- To develop the ability to demonstrate the need of sustainable development and international responses to environmental challenges.
- To have an insight into global environmental issues and sustainable globalization.
- To establish a clear understanding of the policy instruments of sustainable development.

MODULE I CONCEPT OF SUSTAINABLE DEVELOPMENT 7

Evolution of the Concept – Rio Summit and sustainable development - various definitions of sustainable development - Components of sustainable development: Social, environmental and economic components.

MODULE II NEED FOR SUSTAINABLE DEVELOPMENT 8

Need for sustainability – Global environmental challenges: population growth, resource depletion, pollution, energy use, climate change, pollution, growing water scarcity, other urban problems, loss of biodiversity, hazardous wastes disposal.International responses to environmental challenges - Global policy such as Kyoto Protocol, Montreal Protocol, Basel Convention.

MODULE III GLOBALIZATION AND ENVIRONMENT SUSTAINABILITY 8

Impact of Globalization on sustainable development, Co - existence of globalization and Environment sustainability, Globalization and Global Governance.Green economy - Renewable energy, sustainable transport, sustainable construction, land and water management, waste management.

MODULE IV POLICIES FOR ACHIEVING SUSTAINABLE DEVELOPMENT 7

Principles of environmental policy for achieving sustainable development:

precautionary principle and polluter pays principle – Business Charter for Sustainable Development.Policy instruments for sustainable development: direct regulation – market based pollution control instruments such as pollution tax, subsidy, pollution permits.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Anderson, David A (2010), "*Environmental Economics and Natural Resource Management*", Routledge, 3rd edition.
2. Karpagam M (1999), "*Environmental Economics: A Textbook*", Sterling Publishers Pvt. Ltd, New Delhi.

REFERENCES:

1. Karpagam M and Jaikumar Geetha (2010), "*Green Management Theory and Applications*", Ane Books Pvt. Ltd, New Delhi.
2. Sengupta Ramprasad (2004), "*Ecology and Economics: An Approach to Sustainable Development*", Oxford University Press, New Delhi.

OUTCOMES:

On successful completion of this course,

- The students will have understood the concepts and components of sustainable development.
- The students will have a holistic overview on the challenges of sustainable development and International responses to environmental challenges.
- The students will have gained knowledge on the global environment issues and demonstrate responsible globalization through global governance.
- The students will have developed awareness of the ethical, economic, social and political dimensions that influence sustainable development.

SSCXO5 INDUSTRIAL SOCIOLOGY

L	T	P	C
2	0	0	2

OBJECTIVES:

- To introduce sociological approaches and perspectives to understand the social relationship in manufacturing industries and corporate sector.
- To explain the structure and functions of industrial organizations.
- To elucidate the dynamics of organizational behavior, leadership and communication.
- To inculcate professional ethics and values to equip students to work in organizational settings.

MODULE I INTRODUCTION 8

Industrial Sociology- definition, scope and importance; Theoretical approaches- scientific management, human relations approach, theory of bureaucracy, Fordism and post-fordism; Production system- concept and characteristics of factory system, automation and rationalization; Industrial conflict- strike , lockout and trade unions.

MODULE II INDUSTRIAL ORGANIZATION 7

Formal organization- definition, features, utility; Informal organization- definition, characteristics, types and relevance; Structure of industrial organization- features and functions of line organization, characteristics and roles of staff organization, distinction;

Industrial hierarchy-white collar, blue collar, supervisors and managers.

MODULE III DYNAMICS OF INDUSTRIAL RELATIONS 8

Group dynamics- Definition, Group behaviour model, Group decision making process, group cohesiveness; Leadership- definitions, style and effective supervision; Communication- concepts, types, model barriers; Job satisfaction- nature, employee compensation and job satisfaction.

MODULE IV PROFESSIONAL ETHICS AND VALUES 7

Concepts- values- morals, and ethics, Integrity, work ethics , service learning - Civic Virtue - caring - Sharing - Honesty - Courage - Valuing Time - Co-operation - commitment - empathy - Self-Confidence - Environmental Ethics, Cyber issues - computer ethics, cyber crimes, plagiarism Ethical living-concept of harmony in life.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Narender Singh, Industrial Sociology, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2012.
2. Gisbert Pascal, Fundamentals of Industrial Sociology, Tata Mc. Graw Hill Publishing Co., New Delhi, 1972
3. Schneider Engeno. V, Industrial Sociology 2nd Edition, Mc. Graw Hill Publishing Co., New Delhi, 1979.

REFERENCES:

1. Robbins, Stephen, Organizational Behaviour , Prentice Hall of India PVT ltd new Delhi, 1985
2. Devis Keith , Human Behaviour at work place, Mc. Graw Hill Publishing Co., New Delhi,1984

OUTCOMES:

On successful completion of this course,

- Students will have acclimatized with sociological perspectives for dealing with social relationships in production and service organizations.
- Students will be familiar with structure of authority, roles and responsibility in organizational settings.
- Students will imbibe leadership, communication and behavioral acumen to govern organization
- Students will be sensitized to standards of desirable behavior to engage in industrial and corporate sector.

SSCXO6	LAW FOR ENGINEERS	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To understand the Constitution and Governance of our country.
- To apprise the students of human rights - local and international and redressal mechanism.
- To have an insight into the industrial, corporate and labour laws of our country.
- To establish a clear understanding about the importance of intellectual property related laws.

MODULE I INDIAN CONSTITUTION AND GOVERNANCE 8

Constitution – salient features, Preamble, Citizenship, Fundamental rights, Fundamental duties, Directive principles, Union executive, Legislature – Union – State and union territories – Election Commission – Election for parliament and state legislature, Judiciary- basic functioning of the Supreme Court and High Courts, Right to information Act 2005 – evolution – concept – practice.

MODULE II HUMAN RIGHTS 7

Human rights – meaning and significance, Covenant on civil and political rights, Covenant on Economic, Social and Cultural rights, UN mechanism and agencies, The Protection of Human Rights Act, 1993 – watch on human rights and enforcement.

MODULE III INDUSTRIAL, CORPORATE AND LABOUR LAWS 8

Corporate laws – meaning and scope, Companies Act 1956 – Indian Contract Act 1872 - Principles of Arbitration - Industrial Employment (Standing Orders) Act 1946 - Industrial Disputes Act 1947 - Workmen's Compensation Act 1923 - The Factories Act, 1948.

MODULE IV LAWS RELATED TO IPR 7

IPR – meaning and scope, International organization – WIPO – TRIPS, Major Indian IPR Acts – Copyright laws, Patent and Design Act, Trademarks Act, Trade Secret Act, Geographical Indicator.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. M.P. Jain (2005) *Indian Constitutional Law*, Wadhwa & Co.

2. H. D, Agarwal (2008), *International Law and Human Rights,* Central Law Publications,
3. Rao, Meena (2006), *Fundamental Concepts in Law of Contract*, 3rd edn., Professional offset.
4. Ramappa (2010), *Intellectual Property Rights Law in India*, Asia Law House.
5. Singh, Avtar (2007), *Company Law*, Eastern Book Co.
6. R.F, Rustamji (1967)*, Introduction to the Law of Industrial Disputes*, Asia Publishing House.

REFERENCES:

1. Acts: Right to Information Act, Industrial Employees (standing order) Act, Factories Act, Workmen Compensate Act.

OUTCOMES:

On successful completion of this course,

- Students will `be able to apply the basic concepts of Indian Constitution, Governance and power in their real life situation.
- Students will have gained knowledge in human rights, cultural, social and political rights.
- Students will have synthesized knowledge about industrial, corporate and labour laws of our country.
- Students will have an overview of IPRs and laws related to Intellectual Property Rights.

General Elective Courses
Group I courses
(To be offered in V Semester)

		L	T	P	C
GECX101	**DISASTER MANAGEMENT**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To give an exposure to various environmental hazards and disasters: and various concepts and principles to manage disaster.
- To give exposure to various environmental policies & programs in India for disaster management

MODULE I ENVIRONMENTAL HAZARDS 7

Environmental hazards, Environmental Disasters and Environmental stress-Meaning and concepts. Vulnerability and disaster preparedness.

MODULE II NATURAL DISASTERS 7

Natural hazards and Disasters - Volcanic Eruption, Earthquakes, Tsunamis, Landslides, Cyclones, Lightning, Hailstorms, Floods, Droughts, Cold waves, Heat waves and Fire.

MODULE III MAN-MADE DISASTERS 7

Man induced hazards & Disasters - Soil Erosion, Chemical hazards, Population Explosion

MODULE IV DISASTER MANAGEMENT 8

Emerging approaches in Disaster Management- Preparing hazard zonation maps, Predictability / forecasting & warning, Preparing disaster preparedness plan, Land use zoning, Communication. Disaster resistant house construction, Population reduction in vulnerable areas, Awareness - Rescue training for search & operation at national & regional level - Immediate relief, Assessment surveys, Political, Administrative, Social, Economic, Environmental Aspects.

MODULE V NATURAL DISASTER REDUCTION & MANAGEMENT 8

Provision of Immediate relief measures to disaster affected people, Prediction of Hazards & Disasters, Measures of adjustment to natural hazards

MODULE VI ENVIRONMENTAL POLICIES & PROGRAMMES IN INDIA **8**

Regional survey of Land Subsidence, Coastal Disaster, Cyclonic Disaster & Disaster in Hills with particular reference to India. Ecological planning for sustainability & sustainable development in India, Sustainable rural development: A Remedy to Disasters, Role of Panchayats in Disaster mitigations, Environmental policies & programmes in India- Institutions & National Centers for Natural Disaster reduction, Environmental Legislations in India, Awareness, Conservation Movement, Education & training.

L – 45; Total Hours –45

REFERENCES:

1. Satender, “Disaster Management in Hills”, Concept Publishing Co., New Delhi, 2003.
2. Singh, R.B. (Ed.), “Environmental Geography”, Heritage Publishers, New Delhi,1990.
3. Savinder Singh, “Environmental Geography”, Prayag Pustak Bhawan,1997.
4. Kates, B.I. and White, G.F., “The Environment as Hazards”, Oxford University Press, New York, 1978.
5. Gupta, H.K., (Ed), “Disaster Management”, University Press, India, 2003.
6. Singh, R.B.,“Space Technology for Disaster Mitigation in India (INCED)”, University of Tokyo, 1994.
7. Bhandani, R.K., “An overview on Natural & Manmade Disaster & their Reduction”, IIPA Publication, CSIR, New Delhi, 1994.
8. Gupta, M.C., “Manuals on Natural Disaster management in India”, National Centre for Disaster Management, IIPA Publication, New Delhi, 2001.

OUTCOMES:

At the end of the course, the students will

- achieve sufficient knowledge on the disaster prevention strategy, early warning system, disaster preparedness, response and human resource development.
- be familiar with the National Policy on Disaster Management.

GECX102 TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

- To understand the various principles, practices of TQM to achieve quality.
- To get acquainted with the various statistical tools and approaches for quality control and continuous improvement.
- To get aware of the importance of ISO and Quality Systems.

MODULE I INTRODUCTION 8

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

MODULE II TQM PRINCIPLES 7

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits.

MODULE III TQM IMPROVEMENT PROCESS 8

Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

MODULE IV STATISTICAL PROCESS CONTROL (SPC) 8

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

MODULE V TQM TOOLS 7

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

MODULE VI QUALITY SYSTEMS 7

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System– Elements, Implementation of Quality System, Documentation, Quality Auditing, TS 16949, ISO 14000 – Concept, Requirements and Benefits

L – 45; Total Hours –45

TEXT BOOKS:

1. Dale H.Besterfiled, et al., “Total Quality Management”, Pearson Education, Inc. 2003.

REFERENCES:

1. James R.Evans & William M.Lidsay, “The Management and Control of Quality”, 5th Edition, South-Western (Thomson Learning), 2002.
2. Feigenbaum.A.V., “Total Quality Management”, McGraw-Hill, 1991.
3. Oakland.J.S., “Total Quality Management”, Butterworth Hcinemann Ltd., Oxford, 1989.
4. Narayana V. and Sreenivasan. N.S., “Quality Management – Concepts and Tasks”, New Age International, 1996.
5. Zeiri, “Total Quality Management for Engineers”, Wood Head Publishers, 1991.

OUTCOMES:

The student should be able to

- apply the various statistical tools and approaches for Quality control.
- achieve continuous process improvement through TQM.

GECX103 ENERGY STUDIES L T P C
3 0 0 3

OBJECTIVES:

- To learn the growing demand, supply of energy on global and national levels and the need for renewable energy promotion.
- To understand the basic need for energy conservation and waste heat recovery.
- To learn the important aspects of energy audit and management.
- To get acquainted with the global environmental issues and carbon credits.

MODULE I GLOBAL AND NATIONAL ENERGY SCENARIO 7

Role of energy in economic development, various energy resources - overall energy demand and availability- Energy consumption in various sectors and its changing pattern - Exponential increase in energy consumption and projected future demands. Need for renewable energy.

MODULE II SOLAR ENERGY 8

Solar Radiation – Measurements of Solar Radiation - Flat Plate and Concentrating Collectors – Solar direct Thermal Applications – Solar thermal Power Generation - Fundamentals of Solar Photo Voltaic Conversion – Solar Cells – Solar PV Power Generation – Solar PV Applications.

MODULE III OTHER RENEWABLE ENERGY SOURCES 8

Power from wind – wind turbine working and types, solar thermal power plants – low medium and high power generation, power from wave , tidal, geothermal sources, OTEC system. MHD power plants – working, types, merits and demerits. Energy from biomass.

MODULE IV COGENERATION, WASTE HEAT RECOVERY AND COMBINED CYCLE PLANTS 8

Cogeneration principles- topping and bottoming cycles, role in process industries. Energy from wastes- waste heat recovery- heat recovery from industrial processes. Heat exchange systems – recuperative and regenerative heat exchangers – commercially available waste heat recovery devices. Combined cycle plants – concept, need and

advantages, different combinations and practical scope.

MODULE V ENERGY CONSERVATION AND MANAGEMENT 7

Need for energy conservation – use of energy efficient equipment. Energy conservation opportunities - in educational institutions, residential, transport, municipal, industrial and commercial sectors – concept of green building. Energy audit in industries – need, principle and advantages. Case studies.

MODULE VI GLOBAL ENERGY ISSUES AND CARBON CREDITS 7

Energy crisis, fossil consumption and its impact on environmental climate change. Energy treaties – Montreal and Kyoto protocols - Transition from carbon rich and nuclear to carbon free technologies, carbon foot print – credits – clean development mechanism.

L – 45; Total Hours –45

TEXT BOOKS:

1. S.S. Rao and B.B. Parulekar, “Energy Technology”, 3rd Edition, Khanna Publishers, New Delhi, 2011.
2. O. Callaghn. P.W., “Design and Management for Energy Conservation”, Pergamon Press, Oxford, 1981.

REFERENCES:

1. G.D. Rai, “Non Conventional Energy Sources”, Khanna Publishers, New Delhi, 2011.
2. Archie, W Culp. “Principles of Energy Conservation”, McGraw Hill, 1991.
3. D Patrick and S W Fardo, “Energy Management and Conservation”, PHI,1990
4. P. O’Callaghan: “Energy Management”, McGraw - Hill Book Company, 1993.
5. Kenney, W. F., “Energy Conservation in Process Industries”, Academic Press, 1983.

OUTCOMES:

The student should be able to

- Realize the global and national energy status and need to switch over to renewable energy technology.
- Energy audit and suggest methodologies for energy savings.
- Utilize the available resources in an optimal way.
- Concern about the global environmental issues & promote carbon credits.

GECX104	ROBOTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

To learn about the robots, various components, of Robots, programming and their applications.

MODULE I **8**

Definition- Need - Application, Types of robots – Classifications – Configuration, work volume, control loops, controls and intelligence- basic parts - functions – specifications. of robot, degrees of freedoms, end effectors – types, selection

MODULE II ROBOT DRIVES AND CONTROL **8**

Controlling the Robot motion – Position and velocity sensing devices – Design of drive systems – Hydraulic and Pneumatic drives – Linear and rotary actuators and control valves – Electro hydraulic servo valves, electric drives – Motors – Designing of end effectors – Vacuum, magnetic and air operated grippers.

MODULE III ROBOT SENSORS **8**

Transducers and Sensors – Tactile sensor – Proximity and range sensors – Sensing joint forces – Robotic vision system – Image Representation - Image Grabbing –Image processing and analysis – Edge Enhancement – Contrast Stretching – Band Rationing - Image segmentation – Pattern recognition – Training of vision system.

MODULE IV ROBOT PROGRAMMING & AI TECHNIQUES **7**

Types of Programming – Teach pendant programming – Basic concepts in AI techniques – Concept of knowledge representations – Expert system and its components.

MODULE V ROBOTIC WORK CELLS AND APPLICATIONS OF ROBOTS **7**

Robotic cell layouts – Inter locks – Humanoid robots – Micro robots – Application of robots in surgery, Manufacturing industries, space and underwater.

MODULE VI ROBOT KINEMATICS AND DYNAMICS 7

Forward and inverse Kinematic equations, Denvit – Hartenbers representations Fundamental problems with D-H representation, differential motion and velocity
of frames - Dynamic equations for sing, double and multiple DOF robots – static force analysis of robots.

L – 45; Total Hours –45

REFERENCES:

1. Yoram Koren," Robotics for Engineers", Mc Graw-Hill, 1987.
2. Kozyrey, Yu, "Industrial Robots", MIR Publishers Moscow, 1985.
3. Richard. D, Klafter, Thomas, A, Chmielewski, Michael Negin, "Robotics Engineering – An Integrated Approach", Prentice-Hall of India Pvt. Ltd., 1984.
4. Deb, S.R. "Robotics Technology and Flexible Automation", Tata Mc Graw-Hill, 1994.
5. Mikell, P. Groover, Mitchell Weis, Roger, N. Nagel, Nicholas G. Odrey, "Industrial Robotics Technology, Programming and Applications", Mc Graw- Hill, Int. 1986.
6. Timothy Jordanides et al,"Expert Systems and Robotics", Springer – Verlag, New York, May 1991.

OUTCOMES:

Students would be able to

- Understand about the robots, its various components.
- Design Robots for industrial applications.
- Do programming for robots and apply them in real time applications.

GECX105	TRANSPORT MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the transport fleet and their related activities for minimizing operational cost.
- To understand the need of maintenance and its importance.
- To understand the functions and applications of various types of transport system.

MODULE I INTRODUCTION 7

Personnel management; objectives and functions of personnel management, psychology, sociology and their relevance to organization, personality problems. Selection process: job description, employment tests, interviewing, introduction to training objectives, advantages, methods of training, training procedure, psychological tests.

MODULE II ORGANISATION AND MANAGEMENT 7

Forms of Ownership – principle of Transport Management – Staff administration – Recruitment and Training – welfare – health and safety. Basic principles of supervising. Organizing time and people. Driver and mechanic hiring - Driver checklist - Lists for driver and mechanic - Trip leasing - Vehicle operation and types of operations.

MODULE III TRANSPORT SYSTEMS 9

Introduction to various transport systems. Advantages of motor transport. Principal function of administrative, traffic, secretarial and engineering divisions. chain of responsibility, forms of ownership by state, municipality, public body and private undertakings.

MODULE IV SCHEDULING AND FARE STRUCTURE 8

Principal features of operating costs for transport vehicles with examples of estimating the costs. Fare structure and method of drawing up of a fare table. Various types of fare collecting methods. Basic factors of bus scheduling. Problems on bus scheduling.

MODULE V MOTOR VEHICLE ACT 7

Traffic signs, fitness certificate, registration requirements, permit insurance, constructional regulations, description of vehicle-tankers, tippers, delivery vans, recovery vans, Power wagons and fire fighting vehicles. Spread over, running time, test for competence to drive.

MODULE VI MAINTENANCE 7

Preventive maintenance system in transport industry, tyre maintenance procedures. Causes for uneven tyre wear; remedies, maintenance procedure for better fuel economy, Design of bus depot layout.

L – 45; Total Hours –45

TEXT BOOKS:

1. John Duke, "Fleet Management", McGraw-Hill Co, USA, 1984.
2. Kitchin.L.D., "Bus Operation", III edition, Illiffee and Sons Co., London, 1992

REFERENCES:

1. Government Motor Vehicle Act, Publication on latest act to be used as on date.

OUTCOMES:

Upon completion of the course, students will

- Know about different aspects related to transport system and management.
- Features of scheduling, fixing the fares
- Know about the motor vehicle act and maintenance aspects of transport.

GECX106 CONTROL SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the system modeling and to derive their transfer function.
- To provide adequate knowledge of time response of systems and steady state error analysis.
- To accord basic knowledge in obtaining the open loop and closed–loop frequency responses of Control systems.

MODULE I BASIC CONCEPTS AND SYSTEM REPRESENTATION **8**

Control System - Basic elements in control systems – Open and closed loop systems – Electrical analogy of mechanical and thermal systems – Transfer function – Block diagram reduction techniques – Signal flow graphs.

MODULE II TIME RESPONSE ANALYSIS AND DESIGN **8**

Time response – Time domain specifications – Types of test input – First and Second order system - Type I and Type II System – Response - Error coefficients – Generalized error series – Steady state error – P, PI, PID modes of feedback control.

MODULE III FREQUENCY RESPONSE ANALYSIS AND DESIGN **7**

Performance specifications - correlation to time domain specifications - bode plots and polar plots – gain and phase margin – constant M and N circles and Nichols chart – all pass and non-minimum phase systems.

MODULE IV STABILITY **8**

Characteristics equation – Location of roots in s plane for stability – Routh Hurwitz criterion – Root locus construction – Effect of pole, zero addition – Gain margin and phase margin – Nyquist stability criterion.

MODULE V COMPENSATOR DESIGN **8**

Performance criteria – Lag, lead and lag-lead networks – Compensator design using bode plots and root locus technique.

MODULE VI CONTROL SYSTEM COMPONENTS AND APPLICATION OF CONTROL SYSTEMS **6**

Synchros – AC servomotors - DC Servo motors - Stepper motors - AC

Tacho generator - DC Tacho generator - Typical applications of control system in industry.

L – 45; Total Hours –45

REFERENCES:

1. K. Ogata, “Modern Control Engineering”, 4th Edition, Pearson Education, New Delhi, 2003.
2. I.J. Nagrath & M. Gopal, “Control Systems Engineering”, New Age International Publishers, 2003.
3. C.J.Chesmond, “Basic Control System Technology”, Viva student edition, 1998.
4. I.J.Nagarath and M.Gopal, “Control System Engineering”, Wiley Eastern Ltd., Reprint, 1995.
5. R.C.Dorf and R.H.Bishop, “Modern Control Systems”, Addison-Wesley (MATLAB Reference), 1995.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Proper understanding of basics of Control Systems.
- Ability and skill to carry-out time domain and frequency domain analysis.
- Capable of determining stability of the system using Routh Hurwitz criterion, Root locus and Nyquist criterion.
- Ability to design lag, lead and lag lead compensator networks.

GECX107 INTRODUCTION TO VLSI DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- Basic concepts of HDL.
- Verilog language and its syntax constructs.
- Programmable Logic Devices and FPGAs
- MOS devices theory
- CMOS based combinational and sequential circuits

PREREQUISITES:

Fundamentals of Electronics

Basics knowledge in Digital Electronics.

MODULE I REVIEW OF BASIC DIGITAL SYSTEMS 7

Boolean algebra, Building blocks of combinational logic design-Adders, multiplexer, encoder, decoder, comparator, Latches & flip-flops, counters, shift registers.

MODULE II LOGIC DESIGN USING VERILOG HDL 8

Overview of Digital Design with Verilog HDL, Levels of Design Description, Concurrency, Hierarchical Modeling Concepts, Modules and Ports, Component instantiation Data flow and RTL, structural, gate level, switch level modeling and Behavioral Modeling.

MODULE III LANGUAGE CONSTRUCTS OF VERILOG HDL 7

Identifiers- gate primitives, gate delays, operators, timing controls, procedural assignments, conditional statements Variable types, arrays and tables, Tasks and functions, Test bench.

MODULE IV BUILDING BLOCKS OF DIGITAL VLSI SYSTEMS 8

HDL Design -Data Path Operations-Addition/Subtraction, Parity Generators, Comparators, Zero/One Detectors, Binary Counters, ALUs, Multiplication, Shifters, Memory Elements. Programmable logic elements and AND-OR arrays, FPGAs programming methods.

MODULE V TRANSISTOR THEORY 7

Introduction to MOS Transistors-NMOS & PMOS Characteristics, Current Equations, Complementary CMOS Inverter-DC Characteristics, Static Load MOS Inverters.

MODULE VI BASICS OF DIGITAL CMOS DESIGN 8

NMOS & PMOS Logic Gate, CMOS Logic Gate, Basic layout design of simple gate-stick diagram, CMOS Logic Structures-full adder, multiplexers.

Total Hours –45

TEXT BOOKS:

1. M.Morris Mano "Digital Design", 3rd Edition, Prentice Hall of India Pvt. Ltd New Delhi, 2003

REFERENCES:

1. Michael D. Ciletti“Advanced Digital Design with the Verilog HDL" (2nd Edition) Hardcover – January 31, 2010
2. J.Bhasker: Verilog HDL primer, BS publication, 2001.
3. J. P. Uyemura, "Introduction to VLSI Circuits and System", Wiley, 2002
4. Neil Weste and K. Eshragian, “Principles of CMOS VLSI Design: A System Perspective,” 2nd edition, Pearson Education (Asia) Pvt.Ltd., 2000
5. Douglas A Pucknell& Kamran Eshragian , “Basic VLSI Design” PHI 3rd Edition (original edition – 1994)

OUTCOMES:

At the end of the course the students will be able to

- Create basic Register Transfer Level (RTL) models for combinational circuits & Sequential circuits using Verilog HDL.
- Create basic behavioral models for combinational circuits & Sequential circuits using Verilog HDL.
- Describe the usage of Programmable Logic Devices and FPGAs.
- Describe MOS devices theory and inverter circuit DC characteristics
- Design the basic digital building blocks using MOS circuit.
- Apply VLSI design concepts based on the requirements to conduct experiments or projects

GECX108 PLANT ENGINEERING L T P C
3 0 0 4

OBJECTIVES:

- To provide in depth knowledge on Plant Engineering
- To introduce detail engineering and P&ID
- To learn about the support to Instrumentation from other disciplines
- To study about the Installation and commissioning

MODULE I INTRODUCTION OF PLANTS 7

General Project Cycle – Feed – Sales - Plant Description, Component / Areas of Plant, Plant Layout, Plant Interfaces, Plant Location

MODULE II ELEMENTS OF PLANT 8

Main Elements of a Plant, Process Flow Scheme (PFD – Process Flow Diagram) P&ID's, Plant Legend Finalization.

MODULE III DETAIL ENGINEERING 10

P& ID Development with PFD's, Major Discipline Involvement & Inter discipline Interaction, Major Instrumentation & Control Systems - Development Phase – Instrument List , I/O Count, Specification Sheets, Instrument Installation (Hook ups) , Control Philosophy – Detail Engineering.

MODULE IV SUPPORT FROM OTHER DISCIPLINE 8

Other Discipline Supports to Instrumentation – Plot Plan, Piping / Equipment Plan, Electrical Area Classification, Fire Hazardous Classification Telecommunication Systems - Control Network architecture.

MODULE V INSTALLATION AND COMMISSIONING 7

Plant Construction - Key Drawings for Construction Support Construction Activities, System Testing, Startup / Commissioning, Production.

MODULE VI CASE STUDIES 5

Case studies of Water Treatment Plant - Paper Industry – Power Plant etc

L – 45; Total Hours –45

REFERENCES:

1. Duncan C Richardson, Plant Equipment and Maintenance Engineering Handbook, McGraw-Hill Education: New York, Chicago, San Francisco, Athens, London, Madrid, Mexico City, Milan, New Delhi, Singapore, Sydney, Toronto, 2014 McGraw-Hill Education
2. Gabriel Salvendy, Handbook of Industrial Engineering – Technology and operations Management, John Wiley & Sons, 2001.
3. Robert C Rosaler , Standard Handbook of Plant Engineering, Mc Graw Hill third Edition, 2004
4. R. Keith Mobley, Plant Engineer's Handbook, Technology and Engineering, 2001.

OUTCOMES:

At the end of the course, the student will be able to

- Review and correct P&IDs
- Do installation and commissioning of new plants
- Apply plant engineering in design and maintenance of water treatment plant / power plant etc

GECX109	NETWORK SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

The students should be able to

- Discuss the basic concepts of computer security, model and attacks
- Examine the major types of threats and the associated attacks
- Identify the encryption techniques in real time applications
- Understand the special requirements for wireless security and how authentication is implemented in wireless systems
- Understand the functions of Network Security Device Firewall and its types
- Interpret the various network intrusion such as computer viruses, network worms etc

MODULE I INTRODUCTION 6

Computer Security Concepts - The OSI Security Architecture - Security Attacks - Security Services - Security Mechanisms - A Model for Network Security - Standards – classical encryption techniques.

MODULE II SYMMETRIC ENCRYPTION AND MESSAGE CONFIDENTIALITY 7

Symmetric Encryption Principles - Symmetric Block Encryption Algorithms - Random and Pseudorandom Numbers - Stream Ciphers and RC4 - Cipher Block Modes of Operation

MODULE III PUBLIC KEY CRYPTOGRAPHY AND MESSAGE AUTHENTICATION 8

Approaches to Message Authentication - Secure Hash Functions - Message Authentication Codes - Public-Key Cryptography Principles - Public-Key Cryptography Algorithms - Digital Signatures

MODULE IV KEY DISTRIBUTION ,USER AUTHENTICATION AND TRANSPORT-LEVEL SECURITY 8

Symmetric Key Distribution Using Symmetric Encryption - Kerberos - Key Distribution Using Asymmetric Encryption - X.509 Certificates - Public-Key Infrastructure -Federated Identity Management - Web Security Considerations -

Secure Socket Layer and Transport Layer Security - Transport Layer Security

MODULE V WIRELESS NETWORK SECURITY, ELECTRONIC MAIL SECURITY AND IP SECURITY **8**

IEEE 802.11 Wireless LAN Overview -IEEE 802.11i Wireless LAN Security - Wireless Application Protocol Overview - Wireless Transport Layer Security - WAP End-to-End Security - Pretty Good Privacy - S/MIME – Domain Keys Identified Mail- IP Security Overview -IP Security Policy - Encapsulating Security Payload - Combining Security Associations - Internet Key Exchange - Cryptographic Suites

MODULE VI SYSTEM SECURITY **8**

Intruders -Intrusion Detection -Password Management - Types of Malicious Software - Viruses Virus Countermeasures – Worms - Distributed Denial of Service Attacks- The Need for Firewalls - Firewall Characteristics - Types of Firewalls - Firewall Basing - Firewall Location and Configurations

L – 45; Total Hours –45

REFERENCES:

1. William Stallings,"Network security Essentials:Applications and standards", Prentice Hall, Fifth Edition , ISBN-13: 978-0134527338, 2013
2. William Stallings, "Cryptography and Network Security: Principles and Practice", Pearson, ISBN-13:978-0-273-79335-9,2013
3. Behrouz Forouzan, Debdeep Mukhopadhyay,Cryptography and network security (sie) 2nd edition, ISBN-13: 978-0070702080, 2016
4. Wikipedia, "Network Security and Management" , https://en.wikipedia.org/wiki/Book:Network Security and Management, 2014.
5. Nitesh Dhanjani, Justin Clarke, "Network Security Tools", O'Reilly Media, ISBN-13: 9780596007942, 2005.

OUTCOMES:

Students who complete this course will be able to

- Recognize the computer security concepts, architecture attacks and model
- Distinguish the symmetric and asymmetric encryption techniques
- Apply the cryptographic algorithms in different applications
- Express the network security designs using available secure solutions

such as PGP,SSL, IPSec, etc.

- Describe the firewalls principles and different types of firewalls applied in organization
- Identify abnormalities within the network caused by worms, viruses and Network related security treats**.**

GECX110	KNOWLEDGE MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course

- Focuses on positioning knowledge as a valuable commodity, embedded in products and in the tacit knowledge of highly mobile individual employees.
- Presents KM as a deliberate and systematic approach to cultivating and sharing an organization's knowledge base.
- Brings out the paradigm in terms of information technology and intellectual capital.

MODULE I KNOWLEDGE MANAGEMENT 6

KM Myths – KM Life Cycle – Understanding Knowledge – Knowledge, intelligence – Experience – Common Sense – Cognition and KM – Types of Knowledge – History of Knowledge Management - From Physical assets to Knowledge Assets – Expert knowledge – Human Thinking and Learning.

MODULE II KNOWLEDGE MANAGEMENT SYSTEMS AND MODELS 9

Challenges in Building KM Systems – Conventional Vs KM System Life Cycle (KMSLS) – Knowledge Creation and Knowledge Architecture – KM cycle - Different variants of KM cycle - KM models - Implications and practical implementations.

MODULE III CAPTURING KNOWLEDGE AND SHARING 9

Tacit knowledge capture - Explicit knowledge codification – Knowledge taxonomies - Knowledge sharing - Communities - Obstacles to knowledge capture and sharing.

MODULE IV KNOWLEDGE MANAGEMENT TOOLS 9

KM System tools – Neural Network – Association Rules – Classification Trees – Data Mining and Business Intelligence – Knowledge capture and creation tools - Content creation tools - Data mining and knowledge discovery – Content management tools - Knowledge sharing and dissemination tools – Group ware

and Collaboration tools - Intelligent filtering tools.

MODULE V KNOWLEDGE APPLICATION 6

KM at individual level - Knowledge workers - Task analysis and modeling - Knowledge application at group and organizational levels – Knowledge repositories - Knowledge reuse -Case study: e-learning.

MODULE VI VALUE OF KNOWLEDGE MANAGEMENT 6

KM return on investment and metrics - Benchmarking method – Balanced scorecard method - House of quality method - Results based assessment method - Measuring success - Future challenges for KM.

L – 45; Total Hours –45

TEXT BOOKS:

1. Elias M. Awad, Hassan M. Ghaziri, “Knowledge Management”, Prentice Hall, 2nd Edition, 2010.
2. Jay Liebowitz, “Handbooks on Knowledge Management”, 2nd Edition, 2012.
3. Irma Becerra-Fernandez, Rajiv Sabherwal, ”Knowledge Management: Systems and Processes”, 2010.

OUTCOMES:

Students who complete this course will be able to

- Describe the fundamental concepts in the study of knowledge and its creation, acquisition, representation, dissemination, use and re-use, and management.
- Explains the core concepts, methods, techniques, and tools for computer support of knowledge management.
- Critically evaluate current trends in knowledge management and apply it for e-learning

GECX111 CYBER SECURITY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the basics of Cyber Security Standards and Policies.
- To know the legal, ethical and professional issues in Cyber security.
- To understand Cyber Frauds and Abuse and its Security Measures.
- To know the technological aspects of Cyber Security.

MODULE I FUNDAMENTALS OF CYBER SECURITY 7

Security problem in computing – Cryptography Basics – History of Encryption – Modern Methods – Legitimate versus Fraudulent Encryption methods – Encryption used in Internet.

MODULE II CYBERCRIME AND CYBEROFFENSES 8

Cybercrime and Information Security – Cybercriminals – Classifications of Cybercrimes – Email Spoofing – Spamming – Cyber defamation – Internet Time Theft – Forgery – Web jacking – Hacking – Online Frauds – Software Piracy – Mail Bombs – Password Sniffing – Cyberoffenses – Categories – Planning the attacks – Cyberstalking – Cybercafe and Cybercrimes – Botnets.

MODULE III CYBERCRIME: MOBILE AND WIRELESS DEVICES 8

Proliferation of Mobile and Wireless Devices – Trends in Mobility – Credit card frauds in Mobile and Wireless Computing – Security Challenges – Authentication Service Security – Attacks on Mobile Phones.

MODULE IV TOOLS AND METHODS USED IN CYBERCRIME 8

Proxy Servers and Anonymizers – Phishing – Password Cracking – Keyloggers and Spywares – Virus and Worms – Trojan Horses and Backdoors – Steganography – DoS and DDoS Attacks.

MODULE V SECURITY POLICIES 7

Introduction - Defining User Policies – Passwords – Internet Use – Email Usage – Installing/ Uninstalling Software – Instant Messaging – Defining System Administrative Policies – Defining Access Control Developmental Policies Standards, Guidelines and Procedures – Basics of assessing a system

MODULE VI COMPUTER FORENSICS 7

General Guidelines – Finding Evidence on the PC - Finding Evidence in System Logs – Windows Logs – Linux Logs – Getting Back Deleted Files – Operating System Utilities – The Windows Registry.

L – 45; Total Hours –45

TEXT BOOKS:

1. Nina Godbole, Sunit Belapure, “Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Wiley, 2011.

2. Chuck Easttom, “Computer Security Fundamentals”, 2nd Edition, Pearson Education, 2012.

REFERENCES:

1. Charles B. Pfleeger, Shari Lawrence Pfleeger, “Security in Computing”, 3rd Edition, Pearson Education, 2003.
2. William Stallings, “Cryptography and Network Security – Principles and Practices”, 3rd Edition, Pearson Education, 2003.
3. Atul Kahate, “Cryptography and Network Security”, Tata McGraw Hill, 2000.

OUTCOMES:

Upon completion of this course, students will be able to

- Explain the general security issues.
- Discuss various cybercrimes and offenses.
- Outline the occurrence of Cybercrime in mobile and wireless environment.
- Use relevant tools and methods in cybercrime
- Apply security policies in cyber forensics.
- Outline the strategies adopted in computer forensics.

GECX112 GENETIC ENGINEERING L T P C
4 0 0 4

OBJECTIVES:

The course aims to provide an advanced understanding of the core principles and topics of Cell and Organism reproduction and the Principles of heredity and their experimental basis, and to enable students to be able to apply these principles in assessment of pedigrees to identify genotypes and predict the mating outcomes.

MODULE I GENETICS AND ORGANISM 10

Genetics and human affairs, Genetics and Biology, Genes and Environment, Techniques of genetic analysis, The chromosome theory of heredity, Sex chromosomes, Sex linkage, The parallel behaviour of autosomal genes and chromosomes.

MODULE II MENDELISM AND LINKAGE 12

Mendel's laws of inheritance, Interaction of genes, Variations on dominance, Multiple alleles, Lethal alleles, Several genes affecting the same character, Penetrance and expressivity, Linkage- Basic eukaryotic chromosome mapping, The discovery of linkage, Recombination linkage symbolism, Linkage of genes on X chromosomes, Linkage maps, Examples of linkage maps.

MODULE III FINE STRUCTURE OF GENES 10

The concept of promoter, Coding sequence, Terminator, Induction of gene for expression. The concept of extranuclear genome in higher plants and animals, Overview of mitochondrial genome, Chloroplast genome.

MODULE IV RECOMBINATION IN BACTERIA AND VIRUSES 10

Conjugation recombination and mapping the E.coli chromosomes, Transformation, Transduction, Chromosome mapping. Population genetics: Darwin's revolution, Variation and its modulation, The effect of sexual reproduction on variation, The sources of variation, Selection quantitative genetics

MODULE V PRINCIPLES OF PLANT BREEDING 9

Objectives, Selfing and crossing techniques, Male sterility,Incompatability,

Hybrid vigour.

MODULE VI HUMAN GENOME PROJECT 9

Genetic diseases in humans, Genetics and society

L – 45; T – 15; Total Hours –60

REFERENCES:

1. In Introduction to genetic analysis, Griffiths, Miller, Suzuki, Lewontin and Gelbart, Freeman and Company.
2. Genetics, A.V.S.S. Sambamurty, Narosa Publishing House.
3. Concepts of Genetics, Klug & Cummings, Prientice Hall.
4. Molecular Cloning, Moniatisetal, Cold Spring Harbor Laboratory.

OUTCOMES:

At the end of the course students will be able to

- Describe the structure, function and replication of DNA as the genetic material
- Describe gene structure, expression and regulation
- Describe the chromosomal basis of inheritance and how alterations in chromosome number or structure may arise during mitosis and meiosis

GECX113	FUNDAMENTALS OF PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The students would gain knowledge on

- Technicalities attached to Project Management and Significance of Quality Consideration
- Project management methodologies – tools and techniques, supplemented with examples from case studies
- The importance of Efficient HR team and role of Communication in executing Projects.
- Managing Risks in Project Management

MODULE I INTRODUCTION TO PROJECT MANAGEMENT 9

Introduction to Project and Project Management-Project Management as a Career-Project Management Skill Sets-Project Scope Management: Project Charter, Scope Creep, Scope Validation, Scope Change Control-Type of Organization: Organization Structure-Influence of Organization Structure on Project, Project Stakeholders and Organizational Productivity.

MODULE II PROJECT MANAGEMENT PROCESS, TOOLS AND TECHNIQUES 8

Project life cycle-Initiation, Planning, Execution, Monitoring and Closing Phase; - Link between project management process, process groups and knowledge areas; Project management tools and techniques- Project Stakeholders description and mapping - Stakeholder Management Process

MODULE III PROJECT QUALITY, COST AND SCHEDULE MANAGEMENT 10

Triple constraints of project-quality, cost and schedule-Quality Planning, Quality Assurance and Quality Control, Process Control, Cost of Quality, Seven Tools of Quality Control- Cost Management: Cost Estimating Methods, Estimating Completion Cost, Earned Value Management, Budgeting, Life-Cycle Cost analysis- Project Time Management: Duration Estimation Method, FS/FF/SS/ SF Relations, Lead/Lag, Arrow Diagram Method and Precedence Diagram Method for Scheduling-Resource Allocation

MODULE IV PROJECT HR MANAGEMENT 5

Organizational Goals- (MBO/MBE/MBP)-Responsibility Assignment Matrix (RAM)-Types of Powers- Manage or Lead-Conflict management Techniques-Performance Evaluation Process-Motivation Theories and its Application for execution of Projects-Leadership Styles-Project Team Building-Project Staffing Constraints/Policies

MODULE V COMMUNICATION MANAGEMENT 5

Communication Management: Understanding Body languages of Project Personnel-Effective Communications- Interpersonal Skills for project Managers-PMIS-Communicating with the Customer-Communicating with Management- Formal vs. Informal Communications-Written, Verbal and Non-Verbal Communications.

MODULE VI PROJECT PROCUREMENT & RISK MANAGEMENT 8

Introduction to Project Procure Management: Soliciting RFQ/RFP-Contract Proposals-Contract Negotiation-Contract Closure-Risk Management: Defining risks-Risk management process-Risk identification-Qualitative and Quantitative Risk-Probability and Decision trees-Risk Response strategies / methods-Expected monetary value-Risk vs. life cycle phases

L – 45; Total Hours –45

REFERENCES:

1. Jack. R. Meredith, Samuel. J. Mantel & Scott. M. Shafer, Project Management in Practice, Fifth Edition, Bangalore: Wiley, 2015
2. Bob Hughes, Mike Cotterrel “Software Project Management”, Tata McGraw-Hill, 2009

OUTCOMES:

- Learners will be able to identify the Key Knowledge Areas and apply PM process in hypothetical project assignments given as continuous assessment.
- They would be able to suitably recognize tools and techniques required for various phases included in a project.
- They would also be able to manage scope, time, cost and other major components that would help them to execute the project efficiently.

GECX114	OPERATIONS RESEARCH	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To acquire knowledge and training in optimization techniques.
- To get knowledge about optimization in utilization of resources.
- To understand and apply operations research techniques to industrial operations

MODULE I LINEAR PROGRAMMING PROBLEM 8

Linear programming – formulation of the problem - graphical interpretation of optimality - Simplex method – to obtain basic feasible solution – types of linear programming solution – complications and their resolution.

MODULE II ARTIFICIAL VARIABLE AND TWO PHASE METHOD, DUALITY 6

Artificial variable - Big M method – Two phase method – alternative optimal solution – unbounded solution - Duality – primal dual relationships - rules of constructing the dual from primal.

MODULE III TRANSPORTATION PROBLEM & ASSIGNMENT PROBLE 8

Transportation problems – Initial basic feasible solutions, MODI method, Unbalance in transportation, Degeneracy in transportation models, Assignment problem – Minimization and Maximization type of problems by Hungarian method.

MODULE IV NETWORK AND SEQUENCING PROBLEMS 8

PERT and CPM – Network diagram – Fulkerson's rule - CPM Probability of achieving completion date – Crash time – Cost analysis. Sequencing N jobs through 2 machines and 3 machines.

MODULE V QUEUING THEORY & SIMULATION 7

Poisson arrivals and exponential service times – characteristics of Queuing models – single channel – Introduction to multi channel models – Random number generation – Monte Carlo Simulation.

MODULE VI INVENTORY CONTROL, REPLACEMENT MODELS AND GAME THEORY 8

Types of inventory- Inventory cost - EOQ - Deterministic inventory problems –

Introduction to probabilistic models & system level inventory control - Replacement models – Replacement of items that deteriorate with time – value of money changing with time – not changing with time – Individual and group replacement policy - Game theory – simple games.

L – 45; Total Hours –45

TEXT BOOKS:

3. Hamdy ATaha, “Operations Research an introduction”, 8th edition, Phil Pearson, 2007.
4. Winston.W.L., “Operations Research”, 4th edition, Thompson-Brooks/Cole, 2003.

REFERENCES:

1. Wayne.L. Winston, “Operations Research applications and algorithms”, 4th edition, Thomson learning, 2007.
2. Frederick. S. Hiller and Gerald.J.Lieberman, “Operations Research concepts and cases”, 8th edition (SIE), Tata McGraw – Hill Pub. Co. Ltd., New Delhi, 2006.
3. A. Ravindran, D. T. Phillips and J. J. Solberg, "Operations Research:Principles and Practice", 2nd edition, John Wiley & Sons, New York, 1992.
4. Robertazzi. T.G., “Computer networks and systems-Queuing theory and performance evaluation”, 3rd edition, Springer, 2002.

OUTCOMES:

At the end of the course students will be able to

- solve linear programming problems
- solve transportation and assignment problems.
- solve network and sequencing problems.
- apply the operations research techniques to solve industrial problems.

GECX115	NANO TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the basic concepts of Nanoscience relevant to the field of engineering.
- To provide an exposure about the importance of various synthesis method.
- To enrich the knowledge of students in various characterisation techniques.

MODULE I INTRODUCTION & CLASSIFICATION OF NANOMATERIALS 9

Definition - Origin of nanotechnology - Difference between bulk and nanomaterials- Top-down and bottom-up processes - Size dependent properties (magnetic, electronic,transport and optical), Classification based on dimensional property - 0D, 1D, 2D and 3D nanostructures – Kubo gap.

MODULE II TYPES OF NANOMATERIALS 9

Metal oxides and metal nano particles - Ceramic nano particles - Semi conducting quantum dots - Core-shell quantum dots - Nanocomposites - Micellar nanoparticles.

MODULE III PRODUCTION OF NANOPARTICLES 7

Sol-gel, hydrothermal, solvothermal, Plasma Arcing, Electro deposition, RF sputtering, Pulsed laser deposition, Chemical vapour, deposition.

MODULE IV CARBON BASED NANOMATERIALS 6

Carbon nanotubes: Single wall nanotubes (SWNT), Multiwall nanotubes (MWNT) - structures-carbon nanofibre, Fullerenes-Application of carbon nanotubes and Fullerenes.

MODULE V NANOPHOTONICS 7

Light and nanotechnology, Interaction of light and nanotechnology, Nanoholes and photons, nanoparticles and nanostructures; Nanostructured polymers, Photonic Crystals, Solar cells.

MODULE VI CHARACTERISATION TECHNIQUES 7

Basic principles of scanning Electron Microscopy (SEM), Atomic force microscopy (AFM), Scanning tunneling microscopy (STM), Scanning probe

microscopy (SPM) and Transmission electron microscopy (TEM), Particle size analyzer, Luminescence techniques.

L – 45; Total Hours –45

TEXT BOOKS:

1. Hari Singh Nalwa, “Handbook of Nanostructured Materials and Nanotechnology”, Academic Press, 2000.
2. Guozhong Cao, “Nanostructures and Nano materials-Synthesis, Properties and Applications”, Imperial College Press (2011).
3. Zhong Lin Wang, “Handbook of Nanophase and Nanomaterials (Vol 1 and II)”, Springer, 2002.
4. Mick Wilson, Kamali Kannangara, Geoff smith, “Nanotechnology: Basic Science and Emerging Technologies”, Overseas press, 2005.

REFERENCES:

1. A. Nabok, “Organic and Inorganic Nanostructures”, Artech House, 2005.
2. C.Dupas, P.Houdy, M.Lahmani, Nanoscience: “Nanotechnologies and Nanophysics”, Springer-Verlag Berlin Heidelberg, 2007.
3. Mick Wilson, Kamali Kannangara, Michells Simmons and Burkhard Raguse, “Nano Technology – Basic Science and Emerging Technologies”, 1st Edition, Overseas Press, New Delhi,2005.
4. M.S. Ramachandra Rao, Shubra SinghH, “Nanoscience and Nanotechnology: Fundamentals to Frontiers”, Wiley, 2013.

OUTCOMES:

At the end of this course, the students will be able to:

- Apply the knowledge of different types of nanomaterials for various engineering applications.
- Acquire the knowledge of various methods of production of nanomaterials.
- Familiarize with various characterization techniques.

GECX116	VEHICLE MAINTENANCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To know about the various methods of maintaining procedure, vehicle insurance and basic problems in a vehicle.
- The student able to impart knowledge in maintaining of engine components and subsystems.
- The student able to impart knowledge in maintaining of transmission, driveline, steering, suspension, braking and wheels.
- The student able to impart carefully maintaining their vehicle and can increase driving safety.

MODULE I MAINTENANCE, WORKSHOP PRACTICES, SAFETY AND TOOLS **7**

Maintenance – Need, importance, primary and secondary functions, policies - classification of maintenance work - vehicle insurance - basic problem diagnosis. Automotive service procedures – workshop operations – workshop manual - vehicle identification. Safety – Personnel, machines and equipment, vehicles, fire safety - First aid. Basic tools – special service tools – measuring instruments – condition checking of seals, gaskets and sealants. Scheduled maintenance services – service intervals - Towing and recovering.

MODULE II ENGINE AND ENGINE SUBSYSTEM MAINTENANCE **8**

General Engine service- Dismantling of Engine components- Engine repair- working on the underside, front, top, ancillaries- Service of basic engine parts, cooling and lubricating system, fuel system, Intake and Exhaust system, electrical system - Electronic fuel injection and engine management service - fault diagnosis- servicing emission controls.

MODULE III TRANSMISSION AND DRIVELINE MAINTENANCE **8**

Clutch- general checks, adjustment and service- Dismantling, identifying, checking and reassembling transmission, transaxle- road testing- Removing and replacing propeller shaft, servicing of cross and yoke joint and constant velocity joints- Rear axle service points- removing axle shaft and bearings- servicing differential assemblies- fault diagnosis.

MODULE IV STEERING AND SUSPENSION MAINTENANCE 7

Maintenance and Service of Mc person strut, coil spring, leaf spring, shock absorbers. Dismantling and assembly procedures. Inspection, Maintenance and Service of steering linkage, steering column, Rack and pinion steering, Recirculating ball steering service- Worm type steering, and power steering system.

MODULE V BRAKE AND WHEEL MAINTENANCE 7

Inspection, Maintenance and Service of Hydraulic brake, Drum brake, Disc brake, parking brake. Bleeding of brakes. Wheel alignment and balance, removing and fitting of tyres, tyre wear and tyre rotation.

MODULE VI AUTO ELECTRICAL AND AIR CONDITIOING MAINTENANCE 8

Maintenance of batteries, starting system, charging system and body electrical -Fault diagnosis using Scan tools. Maintenance of air conditioning parts like compressor, condenser, expansion valve, evaporator - Replacement of hoses- Leak detection- AC Charging- Fault diagnosis Vehicle body repair like panel beating, tinkering, soldering, polishing, painting.

L – 45; Total Hours –45

TEXT BOOKS:

1. Ed May, "Automotive Mechanics Volume One" , Mc Graw Hill Publications, 2003
2. Ed May, "Automotive Mechanics Volume Two" , Mc Graw Hill Publications, 2003
3. Vehicle Service Manuals of reputed manufacturers
4. Vehicle maintenance and garage practice by Jigar A.Doshi Dhru U.Panchal,Jayesh P.Maniar. 2014
5. A Practical Approach to Motor Vehicle Engineering and Maintenance 3rd Edition by Allan Bonnick.

REFERENCES:

1. Bosch Automotive Handbook, Sixth Edition, 2004.
2. Advanced Automotive Fault Diagnosis by Tom Denton 2011.
3. Nissan Patrol Automotive Repair Manual: 1998-2014 by Haynes Manuals Inc.
4. Automobile electrical manual a comprehensive guide by Haynes manual car repair.

OUTCOMES:

On completion of the course student should be able to

- Prepare maintenance schedules and procedures with appropriate tools.
- Demonstrate the procedure and methods to repair and calibrate the engine.
- Analyze the causes and remedies for fault in transmission and drive line systems.
- Analyze the causes and remedies of steering and suspension systems.
- Analyze the causes and remedies of brake system.
- Demonstrate the procedure for wheel alignment and wheel balanced.

GECX117	FUNDAMENTALS OF DIGITAL IMAGE PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Describe and explain basic principles of digital image processing
- Design and implement algorithms that perform basic image processing
- Design and implement algorithms for advanced image analysis
- Assess the performance of image processing algorithms and systems

PRE-REQUISITES:

- Basic knowledge of transforms in Mathematics

MODULE I DIGITAL IMAGE FUNDAMENTALS 8

Elements of Image Processing System, Fundamentals steps in Digital Image Processing, Image Sampling & Quantization, Spatial and Gray Level Resolution.

MODULE II COLOR IMAGE PROCESSING 8

Fundamental of color image processing, color models- RGB, CMY, HIS, Pseudo color image processing

MODULE III IMAGE ENHANCEMENT 7

Basic gray level Transformations, Histogram Processing, Spatial Filtering

MODULE IV IMAGE TRANSFORMS 7

2D-DFT, DCT, Haar Transform, Fundamentals of 2D-wavelet transform, sub-band coding

MODULE V IMAGE SEGMENTATION AND RESTORATION 8

Point, line and edge detection methods ,Image Segmentation and its types, Restoration: Noise model, Inverse filter and Wiener filter.

MODULE VI IMAGE COMPRESSION 7

Fundamentals of redundancies, Basic Compression Methods: Huffman coding, Arithmetic coding, JPEG and MPEG Compression standards.

TOTAL HOURS 45

TEXT BOOKS

1. Gonzalez and Woods, "Digital Image Processing", 3rd Edition, Pearson Education, 2016.
2. Anil. K. Jain, "Fundamentals of Digital Image Processing"; 4th Edition, PHI, 2007

REFERENCES

1. Pratt William, "Digital Image Processing", John Wiley & Sons, 2007.
2. Arthur Weeks Jr., "Fundamentals of Digital Image Processing", PHI, 2006.

OUTCOMES:

On completion of the course, students will be able to

- Explain the fundamental concepts of digital image processing.
- Discuss about color image processing
- Recognize & apply various image enhancement techniques.
- Apply various transforms for image processing.
- Apply various techniques for image segmentation and restoration.
- Identify and use appropriate image compression techniques

Group II courses

(To be offered in VII Semester)

		L	T	P	C
GECX201	**GREEN DESIGN AND SUSTAINABILITY**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To impart knowledge to face challenges, the technology poses for water, energy, and climate change by implementing sustainable design.

MODULE I CONCEPTS OF SUSTAINABLE DEVELOPMENT 7

Objectives of Sustainable Development - Need for sustainable development-Environment and development linkages - Globalisation and environment-Population, poverty and pollution- global, regional and local environment issues-Green house gases and climate change.

MODULE II SUSTAINABLE DEVELOPMENT OF SOCIO ECONOMIC SYSTEMS 8

Demographic dynamics of sustainability- Policies for socio economic development- Sustainable Development through trade- Economic growth- Action Plan for implementing sustainable development- Sustainable Energy and Agriculture.

MODULE III FRAME WORK FOR ACHIEVING SUSTAINBAILITY 7

Sustainability indicators- Hurdles to sustainability- Business and Industry – Science and Technology for Sustainable Development- Performance indicators of sustainability and assessment mechanism- Constraints and barriers of Sustainable Development.

MODULE IV GREEN BUILDINGS 8

Introduction to Green Building- Energy- Water- Materials and Resources - Sustainable Sites and Land Use - Indoor Environmental Quality- Life Cycle Assessment- Energy, water and materials efficiency.

MODULE V ENERGY CONSERVATION AND EFFICIENCY 7

Energy savings- Energy Audit- Requirements- Benefits of Energy conservation-Energy conservation measures for buildings- Energy wastage- impact to the environment.

MODULE VI GREEN BUILDINGS DESIGN 8

Elements of Green Buildings Design- Foundation, Electrical, Plumbing, flooring, Decking, roofing, insulation, wall coverings, windows, siding, doors and finishing, LEED certification for Green Buildings, Green Buildings for sustainability.

L – 45; Total Hours –45

TEXT BOOKS:

1. Kirby, J., Okeefe, P., and Timber lake, “Sustainable Development”, Earthscan Publication, London, 1995.

REFERENCES:

1. Charles Kibert, J., “Sustainable Construction: Green Building Design and Delivery”, 2nd Edition, John Wiley and sons, 2007.

OUTCOMES:

At the end of the course, the students will be able to

- Explain the relationship between sustainability and emergence of green building practices.
- Address the economic, environmental, and social concerns.

GECX202 APPROPRIATE TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart students knowledge about the basics and applications of various appropriate technologies in the field of civil engineering.

MODULE I BASICS CONCEPTS **7**

Back ground, Tools, Choices and Implications, Appropriate Technology Movement (an overview) - Basic design process, basic financial analysis-discounted cash flow, and energy fundamentals.

MODULE II APPROPRIATE TECHNOLOGY WITH REFERENCE TO BUILDING DESIGN **7**

Appropriate Building Materials, Appropriate Energy Saving Techniques, Water Conservation (Indoor), Rain Water Harvesting.

MODULE III WATER, HEALTH AND SANITATION MANAGEMENT **7**

Water Storage: Designing Dams and Pipelines, Appropriate Selection for Sanitation Technique, Sewerage, Communal Health and Waste Water Recycling.

MODULE IV WASTE MANAGEMENT **8**

Types of Waste - Sources - Collections and On-Site Processing -Transferring Stations - Disposal Systems - Recycling.

MODULE V ENERGY EFFICIENT TECHNIQUES **8**

Green building concepts-renewable energy sources- Solar – Steam and wind-Biofuels - Biogas – Electricity.

MODULE VI TECHNOLOGY POLICY **8**

Government Policies- Energy Policy-Appropriate technology Development Centre-its function and responsibilities-Building policies-Case Studies.

L – 45; Total Hours –45

TEXT BOOKS:

1. Barrett Hazeltine and Christopher Bull, “Appropriate Technology: Tools Choices and Implications”, Academic Press, Orlando, USA, 1998.
2. Ken Darrow and Mike Saxenian, “Appropriate Technology Source Book : A Guide to Practical Books for Village and Small Community Technology”, Stanford, 1986.

REFERENCES:

1. Richard Heeks, “Technology and Developing Countries: Practical Applications Theoretical Issues”, 1995.
2. John Pickford, “The Worth of Water : Technical Briefs on Health, Water and Sanitation”, Intermediate Technology Publications, 1998.

OUTCOMES:

- At the end of the course, the students will be able to use suitable technologies for various conditions for sustainable development.

GECX203	ENGINEERING SYSTEM MODELLING AND SIMULATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the concepts, techniques, tools for modeling and simulation systems and environments through the use of computers.
- To study the various aspects of discrete dynamic, stochastic systems modeling and conducting experiments with those models on a computer.

MODULE I INTRODUCTION 6

Systems – Modelling – types – systems components – Steps in model building- Simulation Algorithms and Heuristics; Simulation Languages.

MODULE II RANDOM NUMBERS / VARIATES 7

Random numbers – methods of generation – random variates for standard distributions like uniform, exponential, Poisson, binomial, normal etc. – Testing of Random variates – Monte Carlo Simulation.

MODULE III MODELLING PROCESS 7

Primitive Models : Establishing relationships via physical laws; Establishing relationships via curve fitting; Parameters estimation problems; Elementary state transition models.

MODULE IV DESIGN OF SIMULATION EXPERIMENTS 9

Steps on Design of Simulation Experiments – Development of models using of Highlevel language for systems like Queuing, Inventory, Replacement, Production etc., – Model validation and verification, Output analysis.

MODULE V SIMULATION LANGUAGES 10

Need for simulation Languages – Comparisons & Selection of Languages – GPSSARENA- EXTEND – Study of any one of the languages.

MODULE VI CASE STUDIES USING SIMULATION LANGUAGES 6

Case Study using simulation languages

L – 45; Total Hours –45

REFERENCES:

1. Law, A.M., & W.D. Kelton, “Simulation Modelling and Analysis”, McGraw

Hill, Singapore, 2000.
2. Harrel, C.R., et. al., “System Improvement Using Simulation”, 3rd Edition, JMI Consulting Group and ProModel Corporation, 1995.
3. Harrel, C.R. & T. Kerim, “Simulation Made Easy, A Manager’s Guide”, IIE Press, 1995.
4. Geoffrey Gordon, “Systems Simulation”, Prentice Hall, 2002.
5. David Kelton, Rondall P Sadowski, David T Sturrock, “Simulation with Arena”, Mc Graw Hill, 2004.

OUTCOMES:

The student should be able to

- Model and simulate systems and environments through the use of computers.
- Conduct experiments with discrete dynamic, stochastic system models on a computer.

GECX204 VALUE ANALYSIS AND ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To get acquainted with value analysis and engineering tool for productivity improvement.
- To understand and analyze the theory and methodology of Value Engineering.

MODULE I VALUE ENGINEERING BASICS 8

Origin of Value Engineering, Meaning of value, Definition of Value Engineering and Value analysis, Difference between Value analysis and Value Engineering, Types of Value, function - Basic and Secondary functions, concept of cost and worth, creativity In Value Engineering.

MODULE II VALUE ENGINEERING JOB PLAN AND PROCESS 6

Seven phases of job plan, FAST Diagram as Value Engineering Tool, Behavioural and organizational aspects of Value Engineering, Ten principles of Value analysis, Benefits of Value Engineering.

MODULE III ORIENTATION AND INFORMATION PHASES 8

Launching Value Engineering project work - Objectives and Targets - VE Project work: a time-bound programme - Projects and Teams - Time Schedule - Co-ordination - Consultant. Technical data - Marketing related information - Competition profile - Cost data - Materials Management related information - Quality related information - Manufacturing data.

MODULE IV FUNCTION ANALYSIS AND CREATIVE PHASES 9

Objectives - Function definition - Classification of functions - Higher level functions – Function – Cost – Function – Worth - Value Gap - Value index - How to carry out Function Analysis? – Fast Diagraming - Cost Modelling.

Creativity - How to improve creativity of an individual? – How to promote creativity in the organisation? - Obstacles to Creativity - Mental road blocks - Creativity killer phrases. Positive thinking - Ideas stimulators - Creativity techniques - Brainstorming.

MODULE V EVALUATION, INVESTIGATION AND RECOMMENDATION 6

Paired comparison and Evaluation Matrix techniques - Criteria for selection of

VE solutions. Design – Materials – Quality – Marketing – Manufacturing - Preview session. The report - presentation.

MODULE VI IMPLEMENTATION PHASE AND CASE STUDIES 8

Design department - Materials department - Production Planning & Control - Quality Control – Manufacturing – Marketing - Need for co-ordinated teams - The Action Plan. Value Engineering case studies.

L – 45; Total Hours –45

TEXT BOOKS:

1. Mudge, Arthur E. “Value Engineering- A systematic approach”, McGraw Hill, New York, 2000.
2. Kumar S, Singh R K and Jha J K (Ed), “Value Engineering”, Narosa Publishing House, 2005.

REFERENCES:

1. Park RJ, “Value Engineering: A Plan for Invention”, St.Lucie Press, New York, 1999.
2. Lawrence, D.M., “Techniques of Value Analysis and Engineering”, McGraw Hill 1988.
3. George, E.D., “Engineering Design: a Material and Processing Approach”, McGraw Hill, 1991.
4. Heller, D.E., “Value Management, Value Engineering and Cost Reduction”, Addison Wesley, 1988.

OUTCOMES:

- The student will be able to realize the value of products, processes and implement value analysis to achieve productivity improvement.

GECX205 INDUSTRIAL SAFETY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the various safety measures to be taken in different industrial environments.

MODULE I SAFETY MANAGEMENT **7**

Evolution of modern safety concept- Safety policy - Safety Organization - line and staff functions for safety- Safety Committee- budgeting for safety. safety education and training.

MODULE II SAFETY IN MANUFACTURING **7**

Safety in metal working-Machine guarding -Safety in welding and gas cutting - Safety in cold forming and hot working of metals -Safety in finishing, inspection and testing -Regulation.

MODULE III SAFETY IN CONSTRUCTION **8**

General safety consideration in Excavation, foundation and utilities – Cordoning – Demolition – Dismantling –Clearing debris – Types of foundations – Open footings.

Safety in Erection and closing operation - Safety in typical civil structures – Dams-bridges-water Tanks-Retaining walls-Critical factors for failure-Regular Inspection and monitoring.

MODULE IV ELECTRICAL SAFETY **8**

Electrical Hazards – Energy leakage – Clearance and insulation – Excess energy – Current surges – Electrical causes of fire and explosion – National electrical Safety code.

Selection of Environment, Protection and Interlock – Discharge rods and earthing device – Safety in the use of portable tools - Preventive maintenance.

MODULE V SAFETY IN MATERIAL HANDLING **8**

General safety consideration in material handling devices - Ropes, Chains, Sling, Hoops, Clamps, Arresting gears – Prime movers.

Ergonomic consideration in material handling, design, installation, operation and

maintenance of Conveying equipments, hoisting, traveling and slewing mechanisms.

Storage and Retrieval of common goods of shapes and sizes in a general store of a big industry.

MODULE VI SAFETY EDUCATION AND TRAINING 7

Importance of training-identification of training needs-training methods – programme, seminars, conferences, competitions – method of promoting safe practice - motivation – communication - role of government agencies and private consulting agencies in safety training – creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign – Domestic Safety and Training.

L – 45; Total Hours –45

REFERENCES:

1. Krishnan N.V, “Safety Management in Industry”, Jaico Publishing House, Bombay, 1997.
2. Blake R.B., “Industrial Safety”, Prentice Hall, Inc., New Jersey, 1973.
3. Fulman J.B., “Construction Safety, Security, and Loss Prevention”, John Wiley and Sons, 1979.
4. Fordham Cooper W., “Electrical Safety Engineering”, Butterworths, London, 1986.
5. Alexandrov M.P., “Material Handling Equipment”, Mir Publishers, Moscow, 1981.

OUTCOMES:

Students would be able to

- Acquire knowledge on various safety Hazards.
- Carry out safety measures for different industrial environments.

GECX206 ADVANCED OPTIMIZATION TECHNIQUES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the various advanced optimization tools.
- To provide an understanding to deal with ill identified and fuzzy problems.

MODULE I INTRODUCTION **7**

Review of conventional optimization techniques - limitations - limitation of exhaustive search - need for artificial intelligence - bio mimicking methods

MODULE II HEURISTICS METHODS **8**

Introduction – Advanced methods of algorithm design: Greedy method, Backtracking method, Divide and Conquer method – Dynamic programming – Heuristics exploration algorithms – Greedy search - Local search – Hill climbing – Tabu search – Gradient search – Beam search – Simulated Annealing.

MODULE III GENETIC ALGORITHM **7**

Introduction - Basics of GA – Population – Reproduction – Cross over – Mutation -genetic algorithms in search, optimization and machine learning-practical genetic algorithms.

MODULE IV ANT COLONY OPTIMIZATION **8**

Introduction: Ant Colony Optimization – Meta-heuristic Optimization – History – The ACO Meta-heuristic – ACO Algorithms: Main ACO – Ant system – Ant colony system – Max-Min Ant system – Applications: Routing in telecommunication networks – Travelling salesmen – Graph Coloring – Advantages & Disadvantages

MODULE V FUZZY LOGIC AND ANN **8**

Fuzzy logic, knowledge representation and inference mechanism – Fuzzy and expert control – standard Takagi-Sugeno mathematical characterizations – Design example – Biological foundations to intelligent systems: Artificial neural networks, Back-propagation networks, Radial basis function networks, and recurrent networks.

MODULE VI IMPLEMENTATIONS & APPLICATIONS 7

Reduction of size of an optimization problem – multilevel optimization – parallel processing – multi objective optimization – Job shop scheduling – Vehicle scheduling – Line balancing – Sensor integration.

L – 45; Total Hours –45

REFERENCES:

1. Singiresu S. Rao, “Engineering optimization – Theory and practices”, John Wiley and Sons, 1996.
2. Ravindran – Phillips –Solberg, “Operations Research – Principles and Practice, John Wiley and Sons, 1987.
3. Fredrick S.Hillier and G.J.Liberman, “Introduction to Operations Research”, McGraw Hill Inc. 1995.
4. Kalymanoy Deb, “Optimization for Engineering Design”, PHI, 2003
5. Christos H. Papadimitriou, Kenneth Steiglitz, Combinatorial Optimization, PHI 2006

OUTCOMES:

At the end of the course student will be able to

1. Formulate a real life situation as an optimization the problem.
2. Identify the appropriate solution methodology and provide a solution

GECX207	MATLAB SIMULINK	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Teach students how to mathematically model engineering systems
- Teach students how to use computer tools to solve the resulting mathematical models. The computer tool used is MATLAB and the focus will be on developing and solving models of problems encountered in engineering fields

MODULE I INTRODUCTION MATLAB DATA PRESENTATION 7

Vectors, Matrices -Vector/Matrix Operations & Manipulation- Functions vs scripts- Making clear and compelling plots-Solving systems of linear equations numerically and symbolically- Least squares regression -Curve fitting.

MODULE II MATLAB PLOT FUNCTION 7

Introduction- Plot Function – Animation- 3D Plots-Customizing Plots – Plot Applications- Saving &Painting Plots.

MODULE III ROOT FINDING AND COMPUTER REPRESENTATION OF NUMBERS 7

Linearization and solving non-linear systems of equations- The Newton-Rapson method- Integers and rational numbers in different bases- Floating point numbers- Round off and errors in basic arithmetic-Significant digits when reporting results

MODULE IV ORDINARY DIFFERENTIAL EQUATIONS 8

Numerical integration and solving 1^{st} order, ordinary differential equations (Euler's method and Runge-Kutta)- Use of ODE function in MATLAB

MODULE V NON-LINEAR DIFFERENTIAL EQUATIONS 8

Converting 2^{nd} order and higher ODEs to systems of 1^{st} order ODEs- Solving systems of ODEs via Euler's method and Runge-Kutta)- Solving single and systems of non-linear differential equations by linearization-Use of the function ODE in MATLAB to solve differential equations

MODULE VI INTRODUCTION OF SIMULINK 8

Simulink & its relations to MATLAB – Modeling a Electrical Circuit- Modeling a fourth order differential equations- Modeling the solution of three equations with three unknowns- Representing a model as a subsystem-Simulink demos.

L – 45; Total Hours –45

REFERENCES:

1. Griffiths D V and Smith I M, Numerical Methods for Engineers, Blackwell, 1991.
2. Laurene Fausett, Applied Numerical Analysis Using MATLAB, Pearson 2008.
3. Moin P, Fundamentals of Engineering Numerical Analysis, Cambridge University Press, 2001.
4. Wilson HB, Turcotte LH, Advanced mathematics and mechanics applications using MATLAB. CRC Press, 1997
5. Ke Chen, Peter Giblin and Alan Irving , Mathematical Exploration with MATLAB, Cambridge University Press, 1999.

OUTCOMES:

At the end of this unit students will be able to:

1. Use Matlab as a convenient tool for solving a broad range of practical problems in engineering from simple models to real examples.
2. Write programs using first principles without automatic use of built-in ones.
3. Write programs for solving linear and nonlinear systems, including those arising from boundary value problems and integral equations, and for root-finding and interpolation, including piecewise approximations.
4. Be fluent in exploring Matlab's capabilities, such as using matrices as the fundamental data-storage unit, array manipulation, control flow, script and function m-files, function handles, graphical output.
5. Make use of Maltab visual capabilities for all engineering applications.
6. An ability to identify, formulate, and solve engineering problems. This will be accomplished by using MATLAB to simulate the solution to various problems in engineering fields

GECX208	EMBEDDED SYSTEMS AND ITS APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide a detailed overview of embedded system.
- To equip students with the software development skills necessary for practitioners in the embedded systems field.
- To understand entire software development lifecycle and examine the various issues involved in developing software for embedded systems.

MODULE I EMBEDDED SYSTEMS OVERVIEW 8

Introduction –Embedded Systems vs. General computing systems- Fundamental Components of embedded systems- Characteristics- Challenges-Examples- Embedded System design process.

MODULE II EMBEDDED COMPUTING PLATFORM 8

Overview of Processors and hardware units in an embedded system-CPU buses – Memory devices –Memory types- I/O devices – Designing with computing platforms- Consumer electronics architecture-Design example: Alarm clock.

MODULE III REAL TIME EMBEDDED SYSTEMS 8

Programming embedded systems in assembly and C – Real time systems – Hard and Soft real time systems- Need for RTOS in Embedded Systems- Multiple tasks and processes –Context switching-Scheduling policies- Interprocess communication and synchronization.

MODULE IV EMBEDDED SOFTWARE DEVELOPMENT PROCESS and TOOLS 8

Development process of an embedded system-software modules and tools for implementation of an embedded system- Integrated development environment- Host and target machines-cross compiler-cross assembler-Choosing right platform.

MODULE V PROGRAM MODELING IN EMBEDDED SYSTEMS 8

Program Models – Data Flow Graph model-control DFG model-Synchronous DFG model- Finite state machines- UML modeling – UML Diagrams.

MODULE VI EMBEDDED SYSTEMS APPLICATION 5

Application specific embedded system – case study: digital camera hardware and software architecture, embedded systems in automobile, embedded system for a smart card.

Total Hours –45

TEXT BOOKS:

1. Marilyn Wolf , "Computers as components", Elsevier 2012.
2. Shibu. K.V, “Introduction to Embedded Systems”, Tata Mcgraw Hill,2009.
3. Rajkamal, "Embedded Systems Architecture, Programming and Design",1st Reprint,Tata McGraw-Hill, 2003
4. Frank Vahid and Tony Gwargie, "Embedded System Design", John Wiley & sons, 2002.

REFERENCES:

1. Sriram V Iyer and PankajGupta ,”Embedded Realtime Systems Programming ”Tata McGraw-Hill,2008
2. Qing Li and Carolyn Yao," Real-Time Concepts for Embedded Systems", CMPBooks, 2003
3. David E.Simon, "An Embedded Software Primer", Pearson Education, 2003

OUTCOMES:

On completion of this course, the students will be able to

- Identify the suitable processor and peripherals in embedded applications
- Develop embedded programs in assembly and c
- Choose the right platform for designing an embedded system
- Explore different scheduling mechanism in rtos
- Design the program model for embedded applications.
- Analyze different domain specific applications in embedded systems.

GECX209 USABILITY ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

The objective of this course is

- To understand the emerging concept of usability, requirements gathering and analysis.
- To learn about human computer interaction with the help of interfaces that has high usability.

MODULE I INTRODUCTION 6

Cost Savings – Usability Now – Usability Slogans – Discount Usability Engineering – Usability – Definition – Example – Trade-offs – Categories – Interaction Design – Understanding & Conceptualizing Interaction – Cognitive Aspects.

MODULE II USER INTERFACES 8

Generation of User Interfaces – Batch Systems, Line Oriented Interfaces, Full Screen Interfaces, Graphical User Interfaces, Next Generation Interfaces, Long Term Trends – Usability Engineering Life Cycle – Interfaces – Data Gathering – Data Analysis Interpretation and Presentation.

MODULE III INTERACTION DESIGN 8

Process of Interaction Design - Establishing Requirements – Design,Prototyping and Construction - Evaluation and Framework.

MODULE IV USABILITY TESTING 8

Usability Heuristics – Simple and Natural Dialogue, Users' Language, Memory Load, Consistency, Feedback, Clearly Marked Exits, Shortcuts, Error Messages, Prevent Errors, Documentation, Heuristic Evaluation – Usability Testing - Test Goals and Test Plans, Getting Test Users, Choosing Experimenters, Ethical Aspects, Test Tasks, Stages of a Test, Performance Measurement, Thinking Aloud, Usability Laboratories.

MODULE V USABILITY ASSESSMENT METHODS 8

Observation, Questionnaires and Interviews, Focus Groups, Logging Actual Use, User Feedback, Usability Methods – Interface Standards - National, International and Vendor Standards, Producing Usable In-House Standards.

MODULE VI USER INTERFACES 7

International Graphical Interfaces, International Usability Engineering, Guidelines for Internationalization, Resource Separation, Multilocale Interfaces – Future Developments – Case Study.

L – 45; Total Hours –45

TEXT BOOKS:

1. Yvonne Rogers, Helen Sharp, Jenny Preece, “Interaction Design: Beyond Human - Computer Interaction”, John Wiley & Sons, 3rd Edition, 2011 (Module I, II, III).
2. Jakob Nielsen, “Usability Engineering”, Morgan Kaufmann Academic Press, 1994. (Module I – VI).

REFERENCES:

1. Ben Shneiderman, Plaisant, Cohen, Jacobs, “Designing the User Interface: Strategies for Effective Human Interaction”, Pearson Education, 5th Edition, 2010.
2. Laura M. Leventhal, Julie A. Barnes, “Usability Engineering: Process, Products, and Examples”, Pearson/Prentice Hall, 2008

OUTCOMES:

Students who complete this course will be able to

- build effective, flexible and robust user interfaces.
- translate system requirements into appropriate human/computer interaction sequences.
- choose mode, media and device for the application requirements.

GECX210	SUPPLY CHAIN MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the various decision phases in a supply chain
- To be aware of the Supply Chain and its drivers
- To design Supply Chain Network
- To build a aggregate plan in supply chain
- To understand Sourcing Decisions in Supply Chain
- To comprehend the influence of Information technology in Supply Chain

MODULE I INTRODUCTION TO SUPPLY CHAIN 7

Understanding Supply Chain - Decision phases - Supply chain performance - Competitive and supply chain strategies - Achieving strategic fit - Expanding strategic scope

MODULE II SUPPLY CHAIN DRIVERS AND DESIGN 7

Drivers of supply chain performance – Designing distribution network - Network Design in the Supply Chain - Network design in Uncertain Environment

MODULE III AGGREGATE PLANNING AND MANAGING SUPPLY, DEMAND AND INVENTORY 8

Aggregate Planning in a Supply chain: role - Managing Supply - Managing Demand in Supply Chain – Cycle and Safety inventory in supply chain – Level of product availability.

MODULE IV MANAGING INVENTORY IN SUPPLY CHAIN 8

Managing Economies of Scale in a Supply Chain : Cycle Inventory- Managing uncertainty in a Supply Chain Safety Inventory- Determining optimal level of Product Availability

MODULE V SOURCING AND TRANSPORTATION 8

Sourcing decision in supply chain - Third and Fourth – Party Logistics providers - Supplier scoring and assessment - Transportation in a Supply Chain – Risk and Trade-offs in transportation design.

MODULE VI INFORMATION TECHNOLOGY IN A SUPPLY CHAIN 7

Information technology in a supply chain – CRM, ISCM, SRM in supply chain -

Over view of recent trends in Supply Chain: e-SRM, e-LRM, e-SCM.

L – 45; Total Hours –45

REFERENCES:

1. Sunil Chopra and Peter Meindl, “Supply Chain Management-Strategy Planning and Operation”, Pearson Education, 5th Indian Reprint, 2013.
2. Jananth Shah “Supply Chain Management – Text and Cases“ Pearson Education, 2008.
3. Altekar Rahul V, “Supply Chain Management-Concept and Cases”, Prentice Hall India, 2005.
4. Monczka et al., “Purchasing and Supply Chain Management”, Thomson Learning, 2nd Edition, 2nd Reprint, 2002.

OUTCOMES:

- After taking up the course the student will be able to brighten his prospects of taking up a career on supply chain management.
- The student decision making capability specific to supply chain issues in an industry is improved.
- The student can plan a well defined execution of supply chain strategy in companies.
- The student will be able to design a optimal distribution network as per the demands of the industry.
- The student can also determine the most favorable transportation plan for a company.
- The student will also be able to bring in company from paper environment to paperless environment.

GECX211	SYSTEMS ANALYSIS AND DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To describe the phases of the systems development life cycle
- To teach the automated tools for system development
- To develop and evaluate system requirements.
- To explain the organizational issues in system implementation
- To teach the usability testing and electronic data interchange
- To elucidate the importance of System analysis and design in electronic commerce.

MODULE I FUNDAMENTALS OF SYSTEM DEVELOPMENT 8

System Concept – Characteristics – Elements of System – Types of System – Modern Approach to System Analysis and Design – System Development Life Cycle – Approaches to Improving Development – Tools for System Development – Succeeding as a System Analyst – Skills – Managing the Project.

MODULE II AUTOMATED TOOLS FOR SYSTEMS DEVELOPMENT 7

What is requirements determination? Fact finding techniques, Tools for documenting procedure and decision-CASE Tools-Need for CASE tools-Reverse engineering and reengineering- phases of the software life cycle-Ranking projects-Value Chain Analysis- Corporate Strategic Planning vs. Information Systems Planning.

MODULE III SYSTEM ANALYSIS 8

Determining System Requirements – Traditional Methods - Modern Methods – Radical Methods – Structuring System Requirements – Process Modeling – Data Flow Diagramming – Logic Modeling – Conceptual Data Modeling – E-R Modeling.

MODULE IV SYSTEM DESIGN 8

System Implementation – Software Application Testing – Installation – Documentation – Training and Support – Organizational Issues in Systems Implementation – Maintaining Information System – Conducting System Maintenance.

MODULE V USABILITY AND MEASURING USER SATISFACTION 7

Usability Testing-User satisfaction test- A tool for analyzing user satisfaction – Unified Modeling Language(UML)- Case study: System Design: Application in Human Resource-Financial Applications

MODULE VI SAD IN E-COMMERCE 7

Systems analysis and design in the era of electronic commerce: B2B, B2C and C2C e-commerce -advantages and disadvantages of e-commerce. E-commerce system architecture – physical networks, logical network, World Wide Web, web-services - HTML, XML - case studies-El electronic data interchange: EDI standards - virtual private networks - XML and EDI

L – 45; Total Hours –45

REFERENCES:

1. Jeffrey A. Hoffer, Joey F. George, Joseph S. Valacich, “Modern Systems Analysis and Design”,Fifth Edition, Prentice Hall,March 2007.

2.Ned Kock, “Systems Analysis & Design Fundamentals” Sage South Asia, May 2008.

3. Joseph S. Valacich, Jeffrey A. Hoffer, Joey F. George, “Essentials Of System Analysis And Design” Prentice Hall , August 2005.

4. Rumbaugh et al, “Succeeding with Booch and Rambaugh Methods”, Addisson Wesley, second Edition, 1998.

5.Larman, C.,” Applying UML and Patterns. An introduction to Object-Oriented Analysis and Design”. Prentice-Hall PTR, 2002.

OUTCOMES:

- List the characteristics of the system and specify the approaches in the development of the system.
- Summarize the phases of the software life cycle
- Differentiate Corporate Strategic Planning and Information Systems Planning.
- Illustrate the system requirements through various modeling diagrams.
- Use tools and techniques for process and data modeling.
- Solve realistic systems analysis problems and perform user satisfaction test.

GECX212	ADVANCED MATERIALS	L	T	P	C
		3	0	0	3

OBJECTIVES:

To make the student conversant with

- Dielectric materials
- Magnetic materials
- Energy materials
- Nano materials
- Semi conductors
- Smart materials

MODULE I **8**

Dielectric Materials- Polarization and Mechanism-Internal or local field-Clausius-Mossotti relation- Dielectric loss- Temperature and Frequency effect- Measurement of Dielectric constant and loss using Scherring bridge- electric break down- ferro, piezo, pyroelectric materials and its application.

MODULE II **8**

Magnetic Materials- Terminology and classification of magnetic materials (Dia, Para, Ferro & Ferri) – Magnetic moments due to electrospin – Domain theory of Hysteresis – Heisenberg theory of Exchange Interaction (without derivation)- Structure and properties of Ferrites- Properties of Soft and Hard Magnetic Materials- Application: floppy disk, CD ROM, Magneto optical recording.

MODULE III **8**

Energy Materials (Nuclear) - Introduction to nuclear materials- Materials for nuclear fuel in fission and fusion reactors, Fissile and fertile materials- Control & Construction Materials for Nuclear reactors, Moderators, Heat Exchangers- Radiation proof materials- Brief discussion of safety and radioactive waste disposal.

MODULE IV **7**

Nano Materials- The nanosize range- classification of nanomaterials- processing of nanomaterials-properties of nanomaterials- mechanical, electrical, magnetic properties- other properties- carbon based nanomaterials- other nanomaterials and its application.

MODULE V **7**

Semiconductors- The energy gap in solids-Extrinsic Semiconductors- Intrinsic Semiconductors- Hall Effect in semiconductors- Application of Hall Effect- Basic ideas of compound semiconductors -Semiconductor materials- Fabrication of Integrated Circuits- Some semiconductor Devices

MODULE VI **7**

Smart materials- aerospace materials Ni and Co based super alloys, Special steels, Titanium alloys, Intermetallics, ceramics and their composites, New High strength material, Properties of Materials, Materials in Medical Applications, Stainless steel alloys,Cobalt based alloys, titanium based alloys, polymers

L – 45; Total Hours –45

REFERENCES:

1. Materials science and Engineering: A first course by V. RAGHAVAN, 6th ed., Eastern Economy edition,Prentice Hall of India,2015
2. Materials science and Engineering: An Introduction by William D. Callister Jr., 7th ed. John Wiley & Sons Inc. 2007
3. Material science by Dr.M.Arumugam, Anurasha agencies ,third revised edition ,2002

OUTCOMES:

Students will be able to know

- significance of dielectric materials
- types and applications of magnetic materials
- applications of nuclear materials for energy harvesting
- applications of nano materials
- significance of semi conductor devices
- applications of smart materials

GECX213	NATIONAL SERVICE SCHEME	L	T	P	C
		2	0	0	2

OBJECTIVES:

Primary Objective: Personality development through community service.
To achieve the above objective, the following should be adhered:

1. To provide an understanding about the aims, structure and programmes and activities of National Service scheme in terms of Nation Building
2. To develop certain basic skills for personality development through community development.
3. Understand the community in which they work and their relation
4. Identify the needs and problems of the community and involve them in problem-solving and
5. Practice national integration and social harmony.

MODULE I INTRODUCTION TO NSS 8

Orientation and structure of NSS,-Aims and Objectives of National Service Scheme- The history of NSS- Symbol and meaning- NSS hierarchy from national to college level – Role and responsibilities of various NSS functionaries

MODULE II PERSONALITY AND COMMUNITY DEVELOPMENT SKILLS 8

Importance of youth Leadership, Traits of Good Leadership and Personality Development. Role of youth in creating awareness through NSS Programmes on Health & Hygiene; Environmental Conservation and Enrichment for Sustainable Development; Sanitation and Swachh Bharat.

MODULE III UNDERSTANDING YOUTH 7

Definition and Profiles of youth categories, Youth Issues, Challenges and Opportunities for Youth, Youth as agent of social change & Community Mobilization .Role of Youth in Nation Building. National Youth Policy.

MODULE IV SOCIAL HARMONY AND NATIONAL INTEGRATION 7

National Integration, Various obstacles in the way of National Integration; such as caste, religion, language and provisional problems etc. Role of youth in Peace building and conflict resolution- Globalization and its Economic Social Political and

Cultural impacts.

L – 30; Total Hours –30

TEXT BOOKS:

1. National Service Scheme – A Youth Volunteers Programme for Under Graduate students as per UGC guidelines J.D.S.Panwar et al. Astral International. New Delhi.
2. National Service Scheme Revised Manual, 2006.Govt. of India. Ministry of Youth Affairs & Sports. New Delhi.
3. Social Problems in India, *Ram Ahuja.*

REFERENCES:

1. National Youth Policy-2014. Ministry of Youth Affairs & Sports. .Govt. of India

OUTCOMES:

On successful completion of this course-

- Students will have exposure to the the aims, structure and programmes and activities of National Service scheme in terms of Nation Building
- Students will be trained to skills for personality development through community development.
- Students will gain knowledge about national integration and social harmony.
- Students will be exposed to the role of youths in Nation building Students will gain

GECX214	AUTOMOTIVE POLLUTION AND CONTROL	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To have a fair knowledge in automotive pollution control.
- To understand the concept of formation and control techniques of pollutants like UBHC, CO, NOx, particulate matter and smoke for both SI and CI engine will be taught to the students.
- To know about the instruments for measurement of pollutants
- To get introduced about emission standards

MODULE I EMISSION FROM AUTOMOBILES 8

Sources of Air Pollution. Various emissions from Automobiles — Formation — Effects of ollutants on environment and human beings. Emission control techniques – Modification of fuel, after treatment devices. Emission standards. Automotive waste management, old vehicle disposal, recycling, tyre recycling

MODULE II SI ENGINE EMISSIONS AND CONTROL 9

Emission formation in SI Engines- Carbon monoxide & Carbon di oxide - Unburned hydrocarbon, NOx, Smoke —Effects of design and operating variables on emission formation – controlling of pollutants - Catalytic converters, Charcoal Canister, Positive Crank case ventilation system, Secondary air injection, thermal reactor

MODULE III CI ENGINE EMISSION AND CONTROL 8

Formation of White, Blue, and Black Smokes, NOx, soot, Effect of Operating variables on Emission formation — Fumigation, Split injection, Catalytic Coating, EGR, Particulate Traps, SCR, Fuel additives — Cetane number Effect.

MODULE IV NOISE POLLUTION FROM AUTOMOBILES 8

Sources of Noise — Engine Noise, Transmission Noise, vehicle structural Noise, aerodynamics noise, Exhaust Noise. Noise reduction in Automobiles — Encapsulation technique for noise reduction —Silencer Design.

MODULE V TEST PROCEDURES 6

Constant Volume Sampling I and 3 (CVSI &CVS3) Systems- Sampling Procedures — Chassis dynamometers - Seven mode and thirteen mode cycles for Emission Sampling.

MODULE VI EMISSION MEASUREMENTS 6

Emission analysers —NDIR, FID, Chemiluminesecent, Smoke meters, Dilution Tunnel, SHED Test, Sound level meters.

L – 45; Total Hours –45

TEXT BOOKS:

1. V.Ganesan, 'Internal combustion Engines', Tata McGraw Hill Book Co, Eighth Reprint, 2005.
2. Crouse and Anglin, 'Automotive Emission Control', McGraw Hill company., Newyork 1993.

REFERENCES:

1. G.P.Springer ad D.J.Patterson, Engine Emissions, Pollutant formation, Plenum Press, New York. 1986.
2. D.J.Patterson and N.A.Henin, 'Emission from Combustion Engine and their control', Anna Arbor Science Publication,1985.
3. L.Lberanek, 'Noise Reduction', Mcgrawhill Company., Newyork1993.
4. C.Duerson, 'Noise Abatment', Butterworths ltd., London1990.
5. A.Alexander, J.P.Barde, C.lomure and F.J. Langdan, 'Road traffic noise', Applied science publisher ltd., London,1987.

OUTCOMES:

On completion of the course student should be able to

- Identify the sources of emission from vehicles.
- Analyse the causes and effects of emissions.
- Analyse causes and effects of noise pollution
- Bring out solutions for control of emissions.
- Demonstrate the test procedures and emission norms.
- Select suitable instruments for measurement of emissions.

GECX215	MOTOR VEHICLE ACT, INSURANCE & POLICY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn about basic act and regulation followed for road vehicle
- To learn about systematic steps involved to get licence and registration of motor vehicle
- To learn arbour various types of motor vehicle polices and insurances

MODULE I BASIC RULES FOR ROAD VEHICLE 8

Display and Use of Number Plates- Attachment of number plates- Number plates in horizontal position- Removal of number plates on transfer- Hours prescribed for lighted lamps- Mounting of lamps and reflectors- Multiple beam headlamps- Daytime running lamps- Auxiliary driving lamps- Parking lamps- Brakes- Stopping distances- Emergency or parking brakes- Horn- Muffler- Mirrors- Inspection of motor vehicles- Standards of safety and repair

MODULE II LICENSING OF DRIVERS OF MOTOR VEHICLES 8

Necessity of driving licence- Age limit in connection with driving of motor vehicle-Responsibility of owners of motor vehicles-Restriction on the holding of driving licence-Grant of learner's licence-Grant of driving licence-Addition to driving licence- Renewal of driving licence-Revocation of driving licence on grounds of disease or disability-Driving licence to drive motor vehicle belonging to the central government- power of court to disqualify- suspension of driving licence in certain cases- suspension or cancellation of driving licence on convection- Endorsement.

MODULE III REGISTRATION OF MOTOR VEHICLE 7

Necessity for registration – Registration Where and how to be made- Special provision for registration of motor vehicle of diplomatic officers-Temporary registration- Production of vehicle at the time of registration- Refusal of registration- renewal of certificate of registration- effectiveness in India of registration- Change of residence or place of business-transfer of ownership-Suspension of registration – cancellation of registration suspended under section 53- certificate of fitness of transport vehicle-cancellation of registration.

MODULE IV INSURANCE OF MOTOR VEHICLE 8

Necessity for insurance against third party – Requirements of policies and limits of liability- - Duty of insurers to satisfy judgements and awards against person insured in respect of third party risks-Duty to give information as to insurance-Settlement between insurers and insured persons- transfer of certificate of insurance-production of certain certificates, licences and permit in certain cases-Special provisions as to compensation in case of hit and run motor accident – Types of motor polices

MODULE V CONTROL OF TRANSPORT VEHICLES 7

Power to State Government to control road transport- Transport authorities-General provision as to applications for permits- Application for stage carriage permit- Procedure of Regional Transport Authority in considering application for stage carriage permit- Scheme for renting of motor cabs- Application for private service vehicle permit- Procedure in applying for and granting permits- Duration and renewal of permits- Transfer of permit- Replacement of vehicles-Temporary permits

MODULE VI OFFENCES AND PUNISHMENT 7

Driving without holding an effective driving licence- Driving by an under-aged person (Minor driving vehicle)- Holding of a driving licence permitting it to be used by other person.- Driving a vehicle at an excessive speed- Driving or permitting to drive a vehicle carrying excess load- Driving dangerously / its Abetment Driving an uninsured vehicle

Rider and pillion rider failing to wear protective head gear (Helmet) -Violation of Mandatory Signs -.e-challan and spot challan

L – 45; Total Hours –45

TEXT BOOKS:

1. The motor vehicle act 1988, Universal law publishing co.cpvt ltd. Newdelhi 2011
2. A Commentary On The Motor Vehicles Act, 1988 by SUKHDEV AGGARWAL The Bright Law House, New Delhi

REFERENCES:

1. The Motor Vehicles Act, 1988 Along with Latest Case Law, Notifications

& Table of Offences and Punishments Asia Law House; 15th edition (2014)

2. Assessment of Compensation in Accidents under Motor Vehicles Act by Karkara Delhi Law House (2013)

OUTCOMES:

On completion of the course students should be able to

- Explain the analysis of rules and regulations for road vehicles
- Analyze the procedure for getting driving license for vehicles at national and international level
- Analyze the procedure for registration of vehicles.
- Analyze the procedure for Insurance of vehicles and claims.
- Analyze the procedure for obtaining Government Permits and renewal
- Analyze the consequences of not following the rules and regulations

GECX216	PRINCIPLES OF COMMUNICATION SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

To introduce the analog and digital modulation techniques.
To elaborate the working of communication receivers in the presence of noise.
To give an overview of various communication systems.

MODULE I LINEAR MODULATION 8

Baseband signals, Amplitude Modulation – Modulation Index, Power Transmitted, Double Side Band and Single Side Band AM, AM Modulators and AM Receivers, AM Radio systems, Frequency Division Multiplexing.

MODULE II ANGLE MODULATION 8

Frequency Modulation and Phase Modulation, Frequency deviation and modulation index, Bandwidth of FM, FM Modulators and FM receivers, FM Radio and FM Stereo Systems

MODULE III SAMPLING AND PULSE MODULATION 7

Sampling, Nyquist's Sampling Theorem, Pulse Modulations - PAM, PPM and PWM, Time Division Multiplexing, Bandwidth of TDM systems.

MODULE IV DIGITAL COMMUNICATION 7

Digital baseband data, Digital Modulations – ASK, FSK, PSK and QPSK. Digital Communication Transmitters and Receivers.

MODULE V NOISE 8

Sources of Noise, Thermal Noise, shot noise, White noise, Narrow band Noise, Effect of noise in communication, SNR, Receiver Noise Temperature and Noise Equivalent Bandwidth.

MODULE VI COMMUNICATION SYSTEMS & NETWORK 7

FM Radio Systems, Cellular Mobile network, Satellite Communications, Optical Fiber Communication.

L – 45; T – 0; Total Hours – 45

TEXT BOOKS:

1. A. Bruce Carlson, Paul B. Crilly, "Communication Systems", 5th Edition,

McGraw Hill Int., 2011.
2. B.P. Lathi, Zhi Ding, Hari M. Gupta, “Modern Digital and Analog Communication Systems”, 4th Edition, Oxford University Press, 2017.

REFERENCES:

1. Herbert Taub, Donald L. Schilling, Goutam Saha, “Principles of Communication Systems” 4th Edition, McGraw Hill Int. 2013.
2. Simon Haykin, “An Introduction To Analog And Digital Communications”, 1st Edition, Wiley India, 2010.
3. Simon Haykin , “Communications Systems” 4th Edition, Wiley India, 2006.
4. Hwei P. Hsu, “Analog and Digital Communications” 3rd Edition,

OUTCOMES:

On completion of the course students will be able to

1. Identify various communication systems and the corresponding modulation schemes.
2. Predict the characteristics of various analog and digital modulation schemes.
3. Interpret the effect of noise and bandwidth in a communication systems
4. Apply the Nyquist criteria for a given baseband signals.
5. Evaluate the performance of communication receivers.
6. Demonstrate the applications of common communication systems.

GECX217	LEAN MANAGEMENT	L	T	P	C
		3	1	0	4

OBJECTIVES:

The objective of the Course to make the student know about

- the basics of lean production management,
- how Lean principles are applied to the Construction industry to improve the operation management and product development.

MODULE I **8**

lean production? – Introduction, background, and lean thinking. Importance of philosophy, strategy, culture, alignment, focus and systems view. Discussion of Toyota Production System.

MODULE II **8**

Manufacturing systems – an overview of manufacturing strategies. Job shops, batch flow, and flexible manufacturing systems Flow production and lean production systems

MODULE III **7**

Value stream mapping in process design and product development Waste reduction - lead time reduction

Process cycle time and value-added vs. non-value added activities Optimum lot sizing

MODULE IV **8**

Lean production processes, approaches and techniques.—Importance of focusing upon flow. Tools -. Workplace organization – 5S. - Stability. - Just-In-Time – One piece flow – Pull. - . Cellular systems. - . Quick change and set-up reduction methods. f. Total productive maintenance. -. Poka-Yoke – mistake proofing, quality improvement. Standards. - . Leveling. - . Visual management. Just-in-time techniques – SMED and Takt Times - Standard work processes and line balancing Poka-yoke and pull systems material handling reduction and facilities planning

MODULE V **8**

Managing change in the lean organization Human resource management and the lean enterprise Employee involvement – Teams – Training – Supporting and encouraging involvement – Involving people in the change process -- communication -- Importance of culture. Startup of lean processes and examples of applications.

Sustaining improvement and change, auditing, follow-up actions.

7

MODULE VI

The lean enterprise and supply chain management Costs and risks of lean initiatives - Measuring lean initiatives

L – 45; Total Hours –45

TEXT BOOKS:

1. The Toyota Way Fieldbook, Jeffrey Liker and David Meier, McGraw-Hill, 2006. Lean Production Simplified, Pascal Dennis, Productivity Press, 2007.
2. Womack, James P., and Daniel T. Jones. Lean Thinking. New York, NY: Simon and Schuster, 2003. ISBN: 0743249275.
3. Murman, Earll. Lean Enterprise Value. New York, NY: Palgrave Macmillan, 2002. ISBN: 0333976975.

REFERENCES:

1. Readings at http://www.leanconstruction.org/readings.htm
2. Hopp, W. J., and Spearman, M. L. (2011). Factory Physics, Third Edition, Waveland Press, Long Grove, Il. 720 pp.

OUTCOMES:

The student will be able to

- Describe the manufacturing approaches employed and the background and philosophy of lean production.
- Illustrate the concept of waste reduction
- Apply evaluation techniques that can be used in preparation for and use in learn production activities.
- Select the tools that can be used implementing lean production in production operations.
- Discuss the importance of workplace organization, pull production, cellular arrangement and employee involvement, need for employee creativity
- Describe about the Methods for promoting success in implementing lean transformations

GECX218 GEOSPATIAL MODELING & ANALYSIS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To equip the students with fundamental representation and analysis of geospatial phenomena and provides foundations in methods and algorithms used in GIS analysis.
- To focus is on terrain modeling, geomorphometry, watershed analysis and introductory GIS-based modeling of landscape processes (water, sediment). The course includes analysis from lidar data, coastal change assessment and 3D visualization.

MODULE I INTRODUCTION TO GEOSPATIAL DATA 7

Mapping natural phenomena –Concept of continuous fields and discrete sampling – Units, projections, coordinate transformation – Georeferencing, geospatial formats, conversions, geospatial data abstraction library – Raster and vector representation, raster and vector conversions and resampling.

MODULE II DATA DISPLAY AND VISUALIZATION 7

Display of continuous and discrete data, use of color, shading, symbols, to extract the spatial pattern and relationships – 3D visualization: multiple surfaces and volumes, 3D vector objects – visualization for data analysis (lighting, scaling, transparency, cutting planes, animations) – view/create maps/post your data on-line (Google Earth/Maps, GPS visualizer)

MODULE III GEOSPATIAL ANALYSIS 7

Foundations for analysis of continuous and discrete phenomena – neighborhood operations and buffers – analysis and modeling with map algebra – cost surfaces and least cost path – spatial interpolation and approximation (gridding)

MODULE IV TERRAIN MODELING AND ANALYSIS 9

terrain and bathymetry mapping – mathematical and digital representations (point clouds, contour, raster, TIN) – DEM and DSM, working with multiple return lidar data – spatial interpolation of elevation data and topographic analysis, line of sight, view shed analysis – solar irradiation, photovoltaic energy potential, time series of elevation data, analysis of coastal change.

MODULE V FLOW TRACING, WATERSHED ANALYSIS AND LANDFORMS 8

Methods for flow routing and flow accumulation – Extraction of stream networks –

Extraction of watershed boundaries and building watershed hierarchies – feature extraction, types of landforms.

MODULE VI MODELING OF GEOSPATIAL PROCESSES 7

Model formulation, input data processing – introduction to GIS-based hydrologic, erosion and environmental modeling – Geocomputational methods, including agent-based modeling, artificial neural networks and evolutionary computing.

L – 45; T – 0; Total Hours –45

TEXT BOOKS:

1. Hassan A, Karimi (2017), *Geospatial Data Science Techniques and Applications*, CRS Press & Co.
2. Sudipto Banerjee, Bradley P, Carlin, Alan E. Gelfand (2014), *Hierarchical Modeling and Analysis for Spatial Data*, CRS Press & Co.

REFERENCES:

1. Maguire, D., M. Batty, and M. Goodchild. 2015. GIS, Spatial analysis, and modeling. ESRI Press (G70.212 .G584 2005)
2. Zeiler, M. 2010. Modeling Our World: The ESRI Guide to Geodatabase Design. Second Ed. ESRI Press, Redlands, California

OUTCOMES:

On successful completion of this course,

- Students will be able to apply the basic concepts of Conceptualize models as representations of real life systems with inputs, outputs, and processes.
- Students will have gained knowledge in spatial tools to make simulations and predictions of real life phenomena.
- Students will have synthesized knowledge about Apply, integrate, and develop models with geospatial data through a GIS.
- Students will have an overview of Evaluate models in terms of accuracy, sensitivity, and uncertainty.
- Students will have Use of a system-based approach for problem solving, with an emphasis on sustainability.

B.S. Abdur Rahman Crescent Institute of Science & Technology

Deemed to be University u/s 3 of the UGC Act, 1956

GST Road, Vandalur, Chennai 600 048

REGULATIONS 2017

CURRICULUM AND SYLLABI

B.A

ISLAMIC STUDIES

VISION AND MISSION OF THE DEPARTMENT OF ISLAMIC STUDIES

VISION

The department looks forward to be a pioneer in the field of Islamic Studies to promote Scholars, capable of bringing about positive change for the betterment of self, family, society and humanity on the basis of moderate approach derived from the Holy Quran and Sunnah - Tradition of the Prophet (PBUH).

MISSION

The department is committed:

- To empower the younger generation through quality education in both revealed and scientific knowledge.
- To promote competent, creative scholars in the field through scientific research.
- To provide excellent ambience for language skill development and leadership qualities through various training programmes

PROGRAMME EDUCATIONAL OBJECTIVES:

The programme objectives covering all three years of under graduate courses are as follows:

- To provide a broad understanding of Islam as a way of life.
- To acquire revealed knowledge of Quran and Hadeeth (Traditions of Prophet (PBUH).
- To develop students' ability in analyzing texts of Quran and Hadeeth as sources of Islamic Jurisprudence.
- To train students in finding solutions for modern issues of family life and social life in the light of Quran and Hadeeth.
- To learn basic concepts and philosophy of Major religions namely Hinduism, Christianity and Judaism about God, world life and hereafter.
- To develop students' language skills in both Arabic and English.

PROGRAMME OUTCOMES:

A successful learner of this programme will be able to:

- Demonstrate Islamic viewpoints to people from all walks of life.
- Derive principles and theories from the sources of Islamic jurisprudence.
- Compare views of different schools of thought by applying principles of jurisprudence.
- Contribute to the inter-faith dialogues to promote harmony among plural societies.
- Address modern issues related to family and social life in the Islamic perspective.
- Give solutions for disputes related to inheritance and waqf (Endowments).
- Lead congregational prayers and deliver sermons.
- Translate and interpret texts from Arabic to English and vice versa.
- Pursue higher studies in Islamic studies, Arabic language and other fields.
- Emphasizing the importance of adherence to a high standard of ethical behavior

B.A (BACHELOR OF ARTS)

IN ISLAMIC STUDIES

CURRICULUM & SYLLABUS, REGULATIONS 2017

SEMESTER I

Sl. No.	Course Code	Course Title	L	T	P	C	
1	ISC1101	Functional Arabic	3	0	0	3	
2	ISC1102	Communicative English	3	0	0	3	
3	ISC1103	Introduction to Quranic Studies	4	0	0	4	
4	ISC1104	Guidance of Prophet (PBUH) - Ibadaath	4	0	0	4	
5	ISC1105	Islamic Fiqh: Ibadaath	3	0	0	3	
6	ISC1106	Modern Arabic Grammar	4	0	0	4	
7	ISC 1107	Arabic Comprehension	2	0	0	2	**23**

SEMESTER II

Sl. No.	Course Code	Course Title	L	T	P	C	
1	ISC1211	Communicative Arabic	3	0	0	3	
2	ISC1212	Advanced Communicative English	3	0	0	3	
3	ISC1213	Quran Exegesis: Al Baqara	4	0	0	4	
4	ISC1214	Hadeeth - Teachings of Prophet	4	0	0	4	
5	ISC1215	Islamic Doctrine - Aqeedah	3	0	0	3	
6	ISC1216	Advanced Arabic Grammar	3	0	0	3	
7	ISC 1217	Islamic History: Seerah & Caliphate Period	3	0	0	3	**23**

SEMESTER III

Sl. No.	Course Code	Course Title	L	T	P	C
1	ISC2101	Advanced Communicative Arabic	2	0	0	2

2	ISC2102	Quran Exegesis: An Nisa	4	0	0	4	
3	ISC2103	A Study on Abu Dawood	4	0	0	4	
4	ISC2104	Islamic Fiqh: Al Muamalath	4	0	0	4	
5	ISC2105	Principles of Jurisprudence: Al Adillah	3	0	0	3	
6	ISC2106	Arabic Language: Grammar & Rhetoric	3	0	0	3	
7	ISC2107	Islamic History: Umayyad & Abbasids Period	3	0	0	3	**23**

SEMESTER IV

Sl. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	
1	ISC2211	Quran Exegesis: Selected Chapters	4	0	0	4	
2	ISC2212	Hadeeth: Sunan At Tirmidhi	3	0	0	3	
3	ISC2213	Muslim Personal Law: Inheritance & Waqf	3	0	0	3	
4	ISC2214	Principles of Jurisprudence: Al Qawayid	3	0	0	3	
5	ISC2215	Development of Islamic Religious Sciences: Tafseer & Hadeeth	4	0	0	4	
6	ISC2216	Arabic Literature: Prose & Poetry	4	0	0	4	
7	ISC2217	Modern Islamic Finance	2	0	0	2	**23**

SEMESTER V

Sl. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	
1	ISC3101	Shariah Rulings in Chapter Al Maidah	4	0	0	4	
2	ISC3102	A Special Study on Saheeh Muslim	4	0	0	4	
3	ISC3103	Muslim Family Law	4	0	0	4	

4	ISC3104	Comparative Fiqh	3	0	0	3	
5	ISC3105	History of Islamic Thought	3	0	0	3	
6	ISC3106	Muslims in India & Plural Society	2	0	0	2	
7	ISC3107	Business Arabic & Secretarial Practice	2	0	0	2	
8	ISC3108	Indian Constitution: Minority Rights	1	0	0	1	**23**

SEMESTER VI

Sl. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	
1	ISC3211	Thematic Study of Quran	3	0	0	3	
2	ISC3212	A Special Study on Saheeh Al Bukhari	4	0	0	4	
3	ISC3213	Quran and Modern Issues	3	0	0	3	
4	ISC3214	Da'wah & Comparative Religion	3	0	0	3	
5	ISC3215	History of Modern Arabic Literature	3	0	0	3	
6	ISC3216	Islamic Philosophy	4	0	0	4	
7	ISC3217	Journal Arabic, Web Translation & SAP	1	0	0	1	
8	ISC3218	Project	2	0	0	2	**23**

TOTAL CREDITS – 138

ISC 1101	FUNCTIONAL ARABIC	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course aims to

- Impart the student's basic elements of Arabic and its structure.
- Train the students in Arabic conversation according to the situations.
- Practice the Arabic language according to context, purpose and audience.

MODULE I TECHNICAL VOCABULARY 8

Al Aalam qaryathun sagirathun: As sabkathu dhavliyath - wasailun naql val Ithisal qadheeman va Hadeesan - Nadva anil Avlama - Dhuvalu shimal va dhuvalul janub - An nazhafa : Al muslimu yahthammu binazafath - Al Islamu vathaharath

MODULE II 8

Al Aklathu sariath - nazafathul biath - Al Islam: kaifa thafhamul Isalama fahman sahihan? - Haqeeqathul Islam - limadha aslama Charles? - Arkanul Islamil khamsa.

MODULE III 8

As sabab : Marhalathul Murahaqa - Marhalthus Sabab - Al Alaqathu binal A'ba val abn'a - Min muskilathus sabab - Al Aalamul Islamiyyu : Musabaqa Islamiyya.

MODULE IV 7

Meezathul Aalamil Islamiyyi - Asbabu dha'ful muslimeen - Minad duwalil Islamia - Al Amn: Haadisu sariqa - Alharbu vassalam.

MODULE V 7

Ababul jareema - Asarul Amu fil hayathi - Athalavus: dafnun Nufayath - anv' thalavusul bia' - Man yahmi Albia' vaman yufsiduha?

MODULE VI 7

Wasayilul Muhafaza alal bia' - Athaqath: Fathurathul kahraba - An nifth - Azmathun Nifth - Athaqathus shamsiya - Al mufradath

TOTAL HOURS – 45

TEXT BOOKS:

1. Al Lugathul Arabiyya, Volume III, Part I, Kilakarai Bukhari Aalim Arabic College, 2017

REFERENCES:

1. Al Arabiya Lin Nashiyeen (Education Ministry, K.S.A.), Bukhari Aalim Arabic College, 2005.
2. Durus Al Lugathil Arabiyya by Dr. F. Abdur Raheem, Published by Islamic Foundation Trust, Chennai, 2002.
3. Al Qirathul Arabiyya Lil Mubtadiyeen (Ummul Qura University, Makkah), Bukhari Aalim Arabic College, 2005.

OUTCOMES:

At the end of the course, the student is expected to:

- Recognize and understand Arabic language elements that have been recombined in new ways.
- Communicate in Arabic on familiar topics such as personal and accommodation needs, introduction and identification of self, others, objects, exchange of greetings etc.
- Develop sentences and short paragraphs related to most survival needs such as food, lodging, transportation, immediate surroundings and some important situations.

ISC 1102	COMMUNICATIVE ENGLISH	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To enable students to use basic grammatical categories and its functi appropriately.
- To aid students to improve speaking skills effectively in contexts of ba conversation and role-plays.
- To assist students understand the significance of basic reading skills.
- To help students develop listening skills for academic purpose.

To develop their basic letter writing skills

MODULE I **8**

Language Skills I: Articles – Prepositions – Antonyms and Synonyms – Correct Form of Verb – Question Tags – Prefixes and Suffixes - Active and Passive Voice – Direct and Indirect Speech.

MODULE II **8**

Language Skills II: Forming Negatives – Forming Questions - Punctuation and correction of sentences with regard to gender, Clauses to be combined – Completion of sentences with dependent or independent clauses.

MODULE III **8**

Language Skills III: Correction of Sentences (Case, Adjective, Adverb) – Rewriting sentences in the right order – Correction of spelling – Substitution, Idioms and Phrases.

MODULE IV **7**

Speaking: Introducing oneself – Introducing one another – Conversations – Role play.

MODULE V **7**

Reading Comprehension: Skimming – Scanning – Passages from real life Situations.

MODULE VI **7**

Writing: Paragraph Writing – How to write Structured Paragraphs – Writing Essays.
Letter writing: Letter to class teacher asking for leave – Letter to father asking for hostel fees, permission for picnic, Letter congratulating a friend.

TOTAL HOURS – 45

REFERENCES:

1. Bansal R.K., Harrison.J.B. – Spoken English, Orient Langman, Mumbai (1999).
2. Leacock Steven – An Anthology of Prose.
3. A.S.Hornby – Guide to Patterns and Usage in English, Oxford University Press (1999)
4. Grellet, Francoise. Developing Reading Skills: A Practical Guide to Reading Comprehension Exercises. Ney York: Cambridge University Press, 1981.
5. Bender, Michael. Academic Vocabulary and Reading Comprehension. Virginia: Linguizz, 2013

OUTCOMES:

At the end of this course, the students will be able to:

- Apply grammatical categories in writing English at the functional level effectively.
- Converse fluently in English at the low beginning level.
- Understand various stages of reading and interpret any given texts at the beginning level.
- Develop listening skills for the academic purpose.
- Write basic letters effectively for academic purpose.

ISC 1103 INTRODUCTION TO QURANIC STUDIES

L	T	P	C
4	0	0	4

OBJECTIVES:

The course aims to:

- Introduce the significance of learning Quran.
- Familiarize the student with the nature of revelation and the unique qualities of the Qur'an
- Explain the student about the context and the guidance of Chapter Al Baqara.

MODULE I **10**

Introduction to Tafseer, Al Mufassiroon & Sura al Fathihah

MODULE II **10**

Sura al Baqarah: Verse nos. 1 – 20

MODULE III **10**

Sura al Baqarah: Verse nos. 21 – 40

MODULE IV **10**

Sura al Baqarah: Verse nos. 41 – 60

MODULE V **10**

Sura al Baqarah: Verse nos. 61 – 90

MODULE VI **10**

Sura al Baqarah: Verse nos. 91 - 129

Total Hours –60

TEXT BOOKS:

Safwat al-Tafasir by Muhammad Ali Al-Sabouni, Maktabathul Asriyya, Lebanon, 2001.

REFERENCES:

1. Tafseer Al Jalalain by Jalaluddeen Al Mahalli and Jalaludeen Al Suyooti, Darul Jeel, Beirut, 1995.
2. Meanings of the Quran by Abdullah Yusuf Ali, Amana Corp., Maryland, USA, 1983.

OUTCOMES:

At the end of the course, the student will be able to

- Describe the significance of learning Quran.
- Analyze the student with the nature of revelation and the unique qualities of the Qur'an.
- Discuss about the characteristics of Believers, Non Believers, and Hypocrites, the ideologies of the Jews, Christians and other contents of Chapter Al Baqara.

ISC 1104	GUIDANCE OF PROPHET (PBUH) – IBADAATH	L	T	P	C
		4	0	0	4

OBJECTIVES:

The course aims to:

- Impart the knowledge of Hadith
- Introduce the rules (Ahkam) of cleanness, timing of prayers and various types of prayers
- Learn the prophetic guidance towards the worship.

MODULE I **10**

Bab al miyah- al niyyat- Babu Izalah al Najasa-Bab al wudhu

MODULE II **10**

Bab al mash ala khuffain- Bab al nawaqidhul wudhu-Bab Aadabu Qadha al Hajaa- al ghusl wa hukmul junub- Bab al Tayammum- Bab al Haidh

MODULE III **10**

Bab al Mawaqeeth- Bab al Adhan- Bab shooruthu Salaah- Bab al suthra h al musalli- al khushu' fee Salah

MODULE IV **10**

Bab al Masjid- Babu sifathissalah- Babu Sahwu wa gairihi- Babu thathavvu- Babul jamathi wal imama

MODULE V **10**

Babu Salathil musafir wal mareed- Salathul Jumu'a- Babu Salathil khawf- Babu Salathil Eidain- Babu Salathil khusoof

MODULE VI **10**

Babu Salathil Isthiqsa – Kithab al Libas- Kithab al Janaiz

Total Hours –60

TEXT BOOKS:

Bulugh al-Maram min Adillat al-Ahkam by Al Hafizh Ibn Hajar Al Asqalani, Darul Jeel, Beirut.

REFERENCES:

1. Subulus Salam by Imam San'ani, Maktabathu Ishathil Islam, Delhi, India.
2. Nailul Awtaar by Shawkani, Dar Al Fikr, Beirut, 2000

OUTCOMES:

At the end of the course, the student is expected to:

- Explain the Meaning of Hadiths
- Perform the prayer as guided by Prophet (PBUH).
- Analyze the rules (Ahkam) of cleanness, timing of prayers and various types of prayers.

ISC 1105 **ISLAMIC FIQH - IBADAATH** **L T P C**

3 0 0 3

OBJECTIVES:

The course aims to:

- Learn the procedures of Ibadaath in the light of Hanafi and Shafi schools and their methods and approaches related with the concerned chapters.
- Collect basic rules and information from the classical texts of Islamic Jurisprudence.

MODULE I SALATH (Prayer) 8

Prerequisites of Babu shurooth assalath va arkanuha – Vajibathu assalath va sununuha va aadabuha – Al Imamath – Ma yufsidus salath va ma la yufsidu salath – Al makruhath – Salathul vithri – An Navafil – Salathul Musafir – Salathul Mareedh

MODULE II SALATH (Prayer) 7

Qalaul Favaeith – Idrak ul Fareedha – Sujudusahvu Va sujusu Thilavath – Babu ul jumu'a – Babu ul Eidain – Ahkamul Janaiz

MODULE III SAUM (Fasting) 8

Definition of Saum – Sababu vugubihi Va ruknihi Va sifathihi – Anniyath – ruayathul Hilal – Babu mala yufsidu saum Va ma yufsidu saum Va tajibu bihi Al Kaffarath ma al qadha – Babu ma yufsidu saum Va yuvgibul qadha maa gairi kaffarath - Babul I'thikaf.

MODULE IV ZAKATH (Charity) 8

Definition of Zakath - Ta'reefu Zakath va Fardhiyathiha – sharth vujubi adaiha – sharth sihath adaaiha – Zakathu dain – Malu dhamar – Mala yuzjiu ani Zakath- Ma yesihu ani naqdin – Thaqdeeru Nisab – Ma la Zakath fihi – Halakul maal- Babul masrif – Babu sadaqthul Fithr.

MODULE V HAJ (Pilgrimage) 7

Explanation of Hajj - Ta'reeful Haj – Shuruthul Fareedha – Shuruthu Vujubi ada – Ma esihu bihi adau fardhul haj – Kaifiyathu tharkeebu af'aalul haj – Al Qiran – Al Thamathu' – Al Umrah

MODULE VI HAJ (Pilgrimage) 7

Babul Jinayah – Al hadhyu – Ziyarah al Nabi

Total Hours –45

TEXT BOOKS:

1. Noorul Eidhah by Abul Ikhlas Hasan al Shurunbulali, IthihadBook depot, Deoband, India.
2. Umdah al Salik by Shihabuddin Ahmed bin Naqeeb, Ithihad Book depot, Deoband, India.

REFERENCES:

1. Fiqh al Sunnah by Syed Sabiq, Darul Fath, Cairo, 1999.

OUTCOMES:

At the end of the course, the student is expected to:

- Apply basic shariah procedures of Ibadath (like ablution, Salah, Zakath, Saum and Haj) in the light of Hanafi and Shafi schools of thought.
- Examine the judicial verdicts of the interpretation and application of procedures of Ibadaath.

ISC 1106 **MODERN ARABIC GRAMMAR** **L T P C**
4 0 0 4

OBJECTIVES:

The course aims to:

- Introduce the Grammar in Arabic language.
- Understand Nahv &Sarf - basic principles of grammar.
- Read Arabic text without I'rab (Grammatical signs).

MODULE I **10**

Al Mubthadha wal Khabar - Khabar al Mubthadha Heena Yakoonu Jumlah - Khabar al Nawasikh - Mawadhi' Fath-h Hamzah Anna - Al masdhar al Muawwal - Mawadhi' Kasr Hamzah Inna - Thaqseem al Fi'l.

MODULE II **10**

Dhamair al Raf' al Baarizah - Isnaad al af'aal al saheehah wal Mu'thallah - Al Mujarrad wal Mazeedh - Hamathaa al wasl wal Qat' - Al Laazim wal Mutha adhi

MODULE III **10**

Aqsaam al Mutha adhi - Tha'dhiyah al Fi'l - Ism al Faa'il - Ism al Mafuool - Al Musthasnaa.- Hukmul Musthansna - Anwaaul Al Haal

MODULE IV **10**

Al Thamieez – Hukmuth thameez,- Hukmul Al adhad - Al Munaadha - Al Mamnu' min al Sarf.-Al Na'at al Haqeeqi & Al Sababi

MODULE V **10**

Al Thawkeed - Al Athf - Waaw al Athf & Waaw al Maiyyah - Al Badhal - Adawaat al Isthifhaam - Al Isthifhaam wan Nafi ma'an

MODULE VI **10**

Al Mujarradh wal Mazeedh - Al Ibdaal & Al I'laal – Qalbul vaavi Yaan-Qalbul vaavi & ya ee Hamzathan – Al ibdal - Al I'laal bithaskeen

Total Hours –60

TEXT BOOKS:

Al Nahw Al Wadhih by Ali Al Jarim & Mustafa Ameen (Preliminary - Part: III& Secondary- Part: I (First Half)), Danish Book Depot, Delhi, India

REFERENCES:

1. Al Qawaid al Asaasiya Lillughathil Arabiya, Ahmed Ibn Ibrahim Musthafa Al Hashimi, KSA, 2000.

OUTCOMES:

Expected outcome of the course:

On successful completion of the course, students will be able to:

- Describe the Arabic texts and its significance through grammar.
- Explain the various rules of Arabic grammar in a proper manner.

Create sentences and write comprehension in Arabic correctly.

ISC 1107 **ARABIC COMPREHENSION** **L T P C**
2 0 0 2

OBJECTIVES:

The course aims to:

- Develop the Arabic writing skill.
- Train the students in paragraph and essay writing in Arabic.
- Improve the Arabic writing flow.

MODULE I **5**

Introduction and Importance of Arabic Insha and Ta'bir – Alaamat al Tharqeem (Punctuation Marks): Comma – Semicolon - Full stop – Colon – Question Mark – Exclamation mark – Parentheses – Quotation Mark.

MODULE II **5**

Practice on writing Hamzah wasl and Hamzah Qata' – Yaa Mu'jama and Yaa Muhmalah - Making Arabic Phrases: Mudhaaf and Mudhaaf Ilaihi – Na't and Man'ut.

MODULE III **5**

Sentence Making: Nominal Sentences – Verbal Sentences – Using Inna and its sisters with sentences – Using Kaana and its sisters with sentences – Using prepositions with sentences.

MODULE IV **5**

Making sentences using frequently used phrases: Awwalan, al-aan, ilal aan, Laa budha, badhalam min, Fee haajah, Indhal Haajah, Min ghairi Haajah, Fil Haal, Alaa kulli Haal, Mundhu, Huna wa Hunaak etc.

MODULE V **5**

Translation skill: Arabic to English and vice versa - Diary writing - Paragraph writing for various situations: In a beach, In a bus, In a train, In a classroom, In a medical shop, In a hotel etc.

MODULE VI **5**

Letter writing for various situations: *Personal Letters*: Letter to a Father, Mother, Brother, Friend etc. *Official Letters*: Letter to a principal seeking admission in the school / college – Letter to the Manager of company seeking job etc.

Total Hours –30

TEXT BOOKS:

Mahaaraat al Kitabah al Arabiyya, Dr. Naif Kharma, Dr. Abdur Rawoof Zuhdi, Dr.Saamy Abu Zaid, Jamia Isra, Jordan.

REFERENCES:

1. Muallim al Insha (Part II & III), Syed Mohammed Rabi Hasani Nadwi, Nadwatul Ulama, Lucknow, India.

OUTCOMES:

On successful completion of the course, students will be able to:

- Put the ideas in Arabic writing.
- Write paragraphs and essays in Arabic.
- Identify the grammatical errors and rectify it.

SEMESTER II

ISC 1211	**COMMUNICATIVE ARABIC**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

The course aims to:

- Enable the students to develop the interpersonal and communicative skills in Ara Language through learning basic vocabulary and phrase/sentence structures.
- Familiarize the student the use of the language according to context, purpose an audience.

MODULE I **8**

AL Mujizal Khalidha – Kaana wa Akhawathuha - Inna wa akhawathuha - yawmun fi hayathi nashi

MODULE II **7**

Anwa'ul khabar - thaqdheem khabarul mubthadha- Aqalliyathuna fil Aalam

MODULE III **8**

Adhawathus sharthi ghairul jazima - As sunna An nabawiya - Iqthiran jawabis sarth bilfa'

MODULE IV **7**

Al Athfalu wal qira'th - dhanna wa akhawathiha - Al Afa'al allathi thansibu mafuoolin

MODULE V **8**

Hijrathul Uqool - hamzathul wasl - Thaba nawmukum wathaba yawmukum - Al Mamnou minas sarf

MODULE VI **7**

Nawadir wathuraf – Al Badl – At Tawkeed

Total Hours –45

TEXT BOOKS:

1. Al Lugathul Arabiyya, Volume III, Part II, Kilakarai Bukhari Aalim Arabic College, 2017.

REFERENCES:

1. Al Arabiya Lin Nashiyeen (Education Ministry, K.S.A.), Bukhari Aalim Arabic College, 2005.

2. Durus Al Lugathil Arabiyya by Dr. F. Abdur Raheem, Published by Islamic Foundation Trust, Chennai, 2002.
3. Al Qirathul Arabiyya Lil Mubtadiyeen (Ummul Qura University, Makkah), Bukhari Aalim Arabic College, 2005.

OUTCOMES:

At the end of the course the student is expected to:

- Read and understand Arabic language elements that have been recombined in new ways to achieve different meanings at a similar level of simplicity.
- Articulate minimum courtesy requirements and maintain very simple face-to-face conversations.
- Formulate and respond to simple questions.

ISC 1212 ADVANCED COMMUNICATIVE ENGLISH L T P C
3 0 0 3

OBJECTIVES:

The course aims to:

- Enable students to develop awareness and understanding of thoughts, ideas, feelings and emotions are formed and dealt with by the writers.
- Enable students to study and understand human behaviour.
- Develop reading comprehension skills and enhance their ability to read literary texts effectively.

MODULE I **8**

Prose (Detailed) I: Words of Wisdom (Lessons 1 to 8)

Spoon Feeding - Reading for Pleasure - The Challenge of Our Time - Woman not the weaker sex - Human values in education - Human rights - The complete man – Try prayer power.

MODULE II **8**

Prose (Detailed) II: Words of Wisdom (Lessons 9 to 12)

On not answering the telephone - Science, Humanities and Religion - Ecology - The reason.

Poetry (Detailed) I: Symphony (Poems 1 to 4)

The tables turned - The dying gladiator - The lake isle of Innisfree - The soldier.

MODULE III **8**

Poetry (Detailed) II: Symphony (Poems 5 to 12)

Brahma - Stopping by woods on a snowy evening - Prometheus unbound - The Company of lovers - I ask for a moment’s indulgence - Urban - *Looking* for cousin on a swing - My grandmother’s house.

MODULE IV **7**

Extensive Reader: Spectrum of Short Stories (Stories 1 to 10)

The gift of the magi - A cup of tea - The refugee - A friend in need - The sparrows - A devoted son - The astrologer’s day - Search for a stranger - The model millionaire - The interview

MODULE V **7**

Value Education I - Touchstone: Synergy of values

Building self-confidence - Living excellence - Use goals to help you grow - Kinds of values - If - What is ethics?

MODULE VI **7**

Value Education II- Touchstone:

Essential characteristics of human rights - A Negro labourer in Liverpool - Adams and Eves - Can woman truly change India? - Forests in the service of mankind - Exploiting the sea.

Total Hours –45

REFERENCES:

1. S.Subramaniam- Words of wisdom
2. S.Deva Prasad, Symphony, Allied publishers, Chennai.
3. K.V.Raghava Rao, Spectrum of short stories, University publishing house, Hyderabad.
4. Touchstone: Synergy of values. Chennai: Madras University Publication, 2003.

OUTCOMES:

At the end of the course, the student is expected to:

- Understand human behaviour practically and learn how thoughts, ideas, feelings and emotions are formed by writers creatively in literary texts.
- Read and interpret literary texts to become emotionally intelligent.

ISC 1213	QURAN EXEGESIS: AL BAQARA	L	T	P	C
		4	0	0	4

OBJECTIVES:

The course aims to:

- Introduce the student the methodology followed by Imam Ibn Kathir.
- Familiarize the student with the Interpretation of Chapter Al Baqara.
- Learn the Quranic guidance on family structure, commercial dealings and other matters in the later part of Chapter Al Baqara.

MODULE I **10**

Sura al Baqarah: Verse no. 130 – 156

MODULE II **10**

Sura al Baqarah: Verse no. 157 – 182

MODULE III **10**

Sura al Baqarah: Verse no. 183 – 208

MODULE IV **10**

Sura al Baqarah: Verse no. 209 – 236

MODULE V **10**

Sura al Baqarah: Verse no. 237 – 265

MODULE VI **10**

Sura al Baqarah: Verse no. 266– 282

Total Hours –60

TEXT BOOKS:

Tafseer Ibn Katheer by Al Hafiz Ibn Katheer, 2nd Edition 98, Beirut, Lebanon.

REFERENCES:

Tafseer Al waseeth by Dr. Muhammad Syed Tanthavi, 1996, Egypt

OUTCOMES:

At the end of the course, the student will be able to

- Analyze the Tafseer methodology of Imam Ibn Kathir.

- Demonstrate the different interpretations supported by Hadiths and other evidences.
- Explain the Quranic guidance on family structure, commercial dealings and other matters.

ISC 1214	HADEETH – TEACHINGS OF PROPHET (PBUH)	L	T	P	C
		4	0	0	4

OBJECTIVES:

The course aims to:

- Introduce the Chapter Iman – Faith and Ilm – Knowledge.
- Learn the guidance of Prophet (PBUH) on faith, halal, haram, Qadr – destiny. Highlight the significance of knowledge in Islam as per the guidance of the Prophet (PBUH).

MODULE I (Hadith No: 1-48) **10**

Intention – Branches of Faith – Love of Prophet (PBUH) – Basics of Faith– Conditions of Faith – Excellence of the word La Ilaha Illallah – Definiton of Faith.

MODULE II (Hadith No: 49-78) **10**

Grave Sins – Charactersitics of Hypocrites – Pertaining to evil suggestions or promptings – Shaitan circulates in the body of a man – Affairs of Shaitan.

MODULE III (Hadith No: 79-112) **10**

Kitab al Qadr (Destiny) – Allah turns the hearts – Creation of Adam – Prophet's prohibition against argument about destiny – Al Qadriyya.

MODULE IV (Hadith No: 113- 160) **10**

Allah's ordinance for every servant – Nothing will happen without Allah's will – Confirmation of the torment in the grave – Happenings inside the grave – Punishment inside the grave – Adhering strictly to the Holy book and the Sunnah – Prophet's prohibition against the disputations.

MODULE V (Hadith No: 161- 197) **10**

Halal and Haram – Bid'ah (Innovation) in religion - Only one sect will enter the Paradise – Follow the great mass – Prophet's warning against separation from Ummah.

MODULE VI (Hadith No: 198 - 280) **10**

Kitab al Ilm – Benefits of Knowledge – Superiority of a Scholar – Excellence of searching for knowledge – Prophet's warning against personal opinion in religion – Acquiring religious knowledge – Useful Knowledge

Total Hours –60

TEXT BOOKS:

Mishkaatul Masaabeeh by Shaikh Waliyuddin al Tabrezi, Maktabah Ashrafiya, Deoband, India.

REFERENCES:

Mirqaat al Mafaateeh by Allama Ibn Sulthan Mohamed (Mullah Ali Qari)
Darul Fikr, Lebanon, 1994.

OUTCOMES:

At the end of the course, the student will be able to

- Explain the various stages of faith.
- Define faith, Qadr – destiny, halal, haram.
- Analyze the importance of knowledge in Islamic perspective.

ISC 1215 ISLAMIC DOCTRINE - AQEEDAH

L	T	P	C
3	0	0	3

OBJECTIVES:

The course aims to:

- Introduce the Islamic doctrines and creeds.
- Learn the oneness of God, his attributes, the messenger, revelation, sacred book the angels, proper belief on the hereafter.
- Acquaint the student with the proper moderate methodology of Islamic Aqeedah.

MODULE I TITLE **8**

An Introduction to Islamic Aqeedah - Oneness of God - Attributes (Sifaat) of Allah - Al Qidam walBaqaa - Al Hayah.

MODULE II **7**

Al Khalq wal Rizq - Al Imaatah wal Ba’s - Al Aajaal - Definition of Huda wal Dhalal - The final Messenger of Allah - The Holy Quran: Words of Allah not created.

MODULE III **7**

Al Israa’ wal Mi’raaj - AlShafa’a- Al Arsh wal Kursi - Al Lawhul Mahfoodh - The Angels

MODULE IV **8**

The previous Messengers and secret books - Awliya al Rahman - The six pillars of Iman - Ahlul Kabair - Al Sunnah wal Jama’h.

MODULE V **7**

Al Kiraam al Kaatibeen - Malakul Mawt - Adhab al Qabr- Al ba’s wal Hisaab wal Sirathu and Meezaan - Heaven and Hell - Af’aalul Ibaad.

MODULE VI **8**

Love of Prophet - The four righteous Khulafa) - Al ba’s wal Hisaab wal Sirathu and Meezaan - Heaven and Hell - Af’aalul Ibaad - Love of Prophet - The four righteous Khulafa).

Total Hours –45

TEXT BOOKS:

Al Aqeedah al Thahaawiya by Imam Thahawi, Dar ibn Hazm, Beirut 1998.

REFERENCES:

1. Sharah Tahawiyya by Al Gamidi, Darul Nashr wat Tawzee', First Edition, K.S.A., 2000.
2. Sharah Aqaeedun Nasafiyya by Sa'duddin Taftazani, Deoband, India.

OUTCOMES:

At the end of the course, the student is expected to

- Define the Islamic doctrines and creeds.
- Describe the characteristics of God, the messenger, the angels and other basic creeds.
- Examine the moderate methodology of Islamic Aqeedah.

ISC 1216 ADVANCED ARABIC GRAMMAR L T P C

3 0 0 3

OBJECTIVES:

The course aims to:

- Familiarize the students with the advanced rules of grammar.
- Learn grammatical rules of Naaib Faayil, Masdhar, Qasam, Idhafah etc.

MODULE I TITLE 7

Al Meezan al Sarfi - Asmaa al afa'al - Al Fi'l al Mu'thal and its rules - Tawkeed al Fi'l - Ni'ma, Bi'sa & Fi'laa al Ta'ajjub - Thanees a Fi'l Lil faail

MODULE II 8

Naaib al Faail -Al Mubtadha & Al Khabar – Hadhf Al Mubtadha - Hadhf Al Khabar – Taqdeemul Mubtadha – Taqdeemul Khabar- In, Maa, Laa and Laata Al Mushabbahaath bi laisa.

MODULE III 8

Ziyadah al Baa fee Khabar Laisa Af'aal al Muqaaraba - Thakhfeef Inna and its sisters Kaffu Inna minal Amal Laa al naafia lil jins – Laa siyyamaa - Niyabah anil Masdhar

MODULE IV 7

Al Idhafah - Al Idhafah Ma-naviyya & Lafliyya - Al Idhafah Elaa Yaail Muthakallim - Al Mabni wal Mu'rab - Al Mabni Minal Af'aal – Al Mu'rab minal af'aal- Al Mabni Minal Asma' yee

MODULE V 7

Iqthiran Jawab al Shart bil faa - Al Athf - Ijthima al Shart & Al Qasam - Hadhf al Al Shart & Al Javab- Jazm al Fi'l al Mudhari' - Adhawaat al Shart al Jazima & Ghairul Jazima ,Jamidh & Mushtaq

MODULE VI 7

Al Masdhar – Masa'dhirul Afaalil tulatiya - Masa'dhirul Af'aalil Rubayi'a - I'maal Al Masdhar - Al Masdhar al Meemi - Al Marrah wal Hai'a.

Total Hours –45

TEXT BOOKS:

1. Al Nahw Al Wadhih by Ali Al Jarim & Mustafa Ameen (Secondary- Part: I

(Second Half)) & II (First Half), Danish Book Depot, Delhi, India

REFERENCES:

1. Al Qawaid al Asaasiya Lillughathil Arabiya, Ahmed Ibn Ibrahim Musthafa Al Hashimi, KSA, 2000.

OUTCOMES:

On successful completion of the course, students will be able to:

- Explain the various advanced rules of Arabic grammar in a proper manner.
- Apply the grammatical rules like Naaib Faayil, Masdhar, Qasam, Idhafah etc on Arabic writing and speaking.

ISC 1217	ISLAMIC HISTORY: SEERAH & CALIPHATE PERIOD	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course aims to

- Impart the biography of Prophet Muhammad (Pbuh).
- Introduce the Caliphate in Islamic History, its concept and procedure.
- Familiarize the students with the Four Khulafas and the important events & the achievements in their period.
- Provide the students the developments happened in the Caliphate period.

MODULE I **8**

Early life of Muhammad (Pbuh) – Prophethood – Impact of revelation in the Meccan Society – Migration to Habasha – Migration to Medina – Establishment of Muslim Ummah – Military conflicts with Quraish, Romans and Persians – Hajjathul Wida.

MODULE II **7**

Beginning of Caliphate – Selection of Abu Bakr (ra) – Brief biography of Abu Bakr (Ra) – Special qualities of Abu Bakr (Ra) – Usama's Army – The War against the Apostates - Fight against false prophets - Compilation of Quran.

MODULE III **7**

Conquests of Iraq and Shaam in the period of Abu Bakr (Ra) – Demise of Abu Bakr (Ra) – Selection of Umar Ibn Khattab (Ra) as caliph – Brief biography of Umar Ibn Khattab (Ra) - Achievements of Umar Ibn Khattab (Ra).

MODULE IV **8**

Conquests of Umar Ibn Khattab (Ra) – Special attributes of Umar Ibn Khattab (Ra) – Examples for Justice of Umar Ibn Khattab (Ra) – Assassination of Umar Ibn Khattab (Ra) - Usman Ibn Affan (Ra) as Caliph – Special qualities of Usman Ibn Affan (Ra).

MODULE V **7**

Brief biography of Usman Ibn Affan (Ra) - Victories in the period of Usman Ibn Affan (Ra) – Trial of Saba – Spreading of the trial - Siege of Usman Ibn Affan (Ra) – Murder of Usman Ibn Affan (Ra) – Ali Ibn Abi Talib (Ra) as Caliph.

MODULE VI **8**

Specialties of Ali Ibn Abi Talib (Ra) – Brief biography of Ali Ibn Abi Talib (Ra) - War of

Jamal – Emergence of Khawarij – Siffin War – Killing of Ali Ibn Abi Talib (Ra) – Developments during the Caliphate – Summary of the Caliphate.

Total Hours –45

TEXT BOOKS:

1. Al Mukhtasar Fee Taareekhil Khulafa, Bukhari Aalim Arabic College, 2017.

REFERENCES:

1. Duroosut Taareekhil Islami, Hasan Muhyideen Al Khayyat.
2. Taareekhul Khulafa, Jalaludeen As Suyooti.

OUTCOMES:

At the end of the course, the student is expected to:

- Describe the Islamic history in detail especially the Seerah and Caliphate history.
- Compile the factors behind the establishment of Caliphate and the Khulafas.
- Discuss the social, economic, cultural and political developments happened during the Umayyad period.
- Analyze the important factors for the establishment of Umayyad dynasty.

SEMESTER III

		L	T	P	C
ISC 2101	**ADVANCED COMMUNICATIVE ARABIC**	**2**	**0**	**0**	**2**

OBJECTIVES:

The course aims to

- Enable the students to develop the interpersonal and communicative skills in Arabic Language through learning advanced and technical vocabulary and phrase / sentence structures.
- Familiarize the student the use of the language according to context, purpose and audience using modern Arabic phrases from language sources.

MODULE I **5**

Al Musawathul Haqqah - Al Mafuoolul Muthlaq - Al Rifq Bilhaiwan - Al Thamyeez

MODULE II **5**

Al Amsalul Arabia - Al Musthasna bi Illa

MODULE III **5**

Al Khilafathu Azzawjiya- Al fi'lul Mujarrad

MODULE IV **5**

Al Alaaqath baina Aa'ba wal abna' - nunul wiqaya

MODULE V **5**

Al ma'u aslul hayathi wa sirruha - Masaadirul Afa'lur Ruba'ia

MODULE VI **5**

wasiyyath Abin - Ismul Fayil - Min Yawmiyathi waleed - nayibul Fayil

L – 30; Total Hours –30

TEXT BOOKS:

1. Arabic Language , Fourth Year, Part 1, Kilakarai Bukhari Aalim Arabic College, Chennai.

REFERENCES:

1. Al Arabiyya Baina Yadhaika, Riyadh, Saudi Arabia.

OUTCOMES:

At the end of the course, the student is expected to:

- Read and understand advanced Arabic language elements that have been

recombined in new ways to achieve different meanings at a similar level of simplicity.

- Articulate minimum courtesy requirements and maintain advanced level face-to-face conversations.
- Formulate and respond to questions and converstations.

ISC 2102	QURAN EXEGESIS: AN NISA	L	T	P	C
		4	0	0	4

OBJECTIVES:

The course aims to:

- Introduce the Students the guidance of Quran related to Marriage, divorce and inheritance.
- Familiarize the students with the message of Quran in Chapter An Nisa.

MODULE I **Sura al Nisa** **10**

Verses 1 – 30

MODULE II **Sura al Nisa** **10**

Verses 31 – 58

MODULE III **Sura al Nisa** **10**

Verses 59 – 87

MODULE IV **Sura al Nisa** **10**

Verses 88 – 116

MODULE V **Sura al Nisa** **10**

Verses 117 – 146

MODULE VI **Sura al Nisa** **10**

Verses 147 – 176

L – 60; Total Hours –60

TEXT BOOKS:

1. Tafseer Ibn Katheer by Al Hafiz Ibn Katheer, 2nd Edition 98, Beirut, Lebanon.

REFERENCES:

1. Tafseer Al waseeth by Dr. Muhammad Syed Tanthavi, 1996, Egypt.
2. Tafseer Al Qurtubi by Mohammed Ibn Ahmad Al Qurtubi, Darul Kutubul Arab, Beirut, 2002.

OUTCOMES:

At the end of the course, the student is expected to:

- Explain the guidance of Holy Quran related to Marriage, divorce and

inheritance in sura al Nisa.

- Describe the the message of Holy Quran in Chapter An Nisa.

ISC 2103	A STUDY ON ABU DAWOOD	L	T	P	C
		4	0	0	4

OBJECTIVES:

The course aims to:

- Introduce the significance of Hadith collection of Abu Dawood, particularly in Bab Al Adaab.
- Explain various characters like thanking, tolerance, forgiving, refrain from anger, backbiting, slandering etc as per the guidance of Prophet.
- Familiarize the students with the good manners like getting permission, salutation, shaking hands, loving children etc.

MODULE I **10**

Tolerance - Anger forgiveness - Good living - Modesty – Gentleness - Thanking - Sitting in the road – Spaciousness in meetings – Sitting manners.

MODULE II **10**

Placing one leg over the other while lying on the back- Publishing secrets – Mischief Maker - Two-faced Man - Back-Biting – Slandering - Searching for faults- Concealing the faults.

MODULE III **10**

Brotherhood - Humbleness - Taking revenge - Abusing the dead -Envy - Cursing - Suspicion - Sincerity and Protection - Sinning - Mukhannathun - Playing with dolls.

MODULE IV **10**

Swing - Playing back gammon - Playing with pigeons - Mercy - Sincere contact - Helping a Muslim - Change of Names – Nickname.

MODULE V **10**

Surname (Kunyah) – Promise – Joking – Eloquence – Poetry – Visions- Yawing - Sneezing - Sleeping Manner - Moon sighting

MODULE VI **10**

Going out of Home - Asking Permission – Salutations - Shaking Hands – Embracing - Standing up in Honor of some person - Kissing children.

L – 60; Total Hours –60

TEXT BOOKS:

1. Sunan Abi Dawood by Imam Hafiz Abu Dawood Sulaiman bin Ash'ath al Sajasthani, Darul Hadeeth, Syria, 1st edition, 1969.
2.

REFERENCES:

1. Awnul Ma'bood by Mohamed Ashraf Siddiqui Azeemabadi, 1st edition, 2000.
2.

OUTCOMES:

At the end of the course, the student will be able to:

- Describe the significance of Hadith collection by Imam Abu Dawood.
- Analyze the various characters taught by the Prophet (PBUH) and compiled by Imam Abu Dawood.

ISC 2104	ISLAMIC FIQH: AL MUAMALATH	L	T	P	C
		4	0	0	4

OBJECTIVES:

The course aims to:

- Introduce the Fiqh Al Muamalath – various financial dealings.
- Explain the nature of commercial contract, the ethics of business.
- Teach the methods of lending, leasing, mortgage, employment and agencies etc.

MODULE I **10**

Sales- Pillars of sales- Conditions of sales- Sales music equipments- Certification of the sales contract- Sales on sales- From the two men sold it for the first of them- Brokerage permissible- Sale impeller.

MODULE II **10**

Sale of the destitute- Sale gharar- Selling grapes to make wine and selling arms in fithna period - Buying and selling in the mosque- Selling on adhaan of juma- Selling water- Selling fruits and crops- Conditions of sale- The difference between the buyer and seller- Pricing.

MODULE III **10**

Monopoly- Option- Difference between Al'muthathabiyeen- Buying rotten eggs- Abscess warranty - Usury- Wisdom in the prohibition of usury- Sections of usury- Illathu at'thahrim- Conclusion.

MODULE IV **10**

Loan- Loan contract- Accelerate spending debt before death- Mortgage- Definition- Legitimacy- Terms of authenticity- Mortgage is amana- Foreclosure- Agriculture- Revival of disused land- Leasing.

MODULE V **10**

Payment for worship- Employee- Private and public Employee- Joint employee- Terminate the lease and its expire- Speculation- Definition- Its rule- Wisdom of speculation- Hawala, Definition - As'shafa, Definition- Wisdom of As'shafa.

MODULE VI **10**

As'shafa'thu baina as'shufa'a- Vara'athu as'shafa'a- Almasalaha an isqathi ash'shfa'thi- Al'vakalah- Arkanuha- Shuruthu al'vakeel- Al'aariyah- Lamanu

al'mustheer- Alvadeeya'ah- Al'gasab- Hukmuhu- Al'laqeeth- Hukmu ilthiqathuhu- Man al'ulaa bi al'qaithi- An'nafaqathu alaihi- Meerasu al'laqeeth- Ida'au nasabihi.

L – 60; Total Hours –60

TEXT BOOKS:

1. Fiqh Al Sunnah by Syed Sabiq, Darul Fath, Cairo 1999.
2.

REFERENCES:

1. Nailul Awtaar by Shawkani- Dar Al Fikr, Beirut,2000.
2. Al Hidhayah by Burhanuddin Al Murgheenani, Makthabah Ashrafiya, Deoband, India.

OUTCOMES:

At the end of the course, the student is expected to:

- Discuss about Fiqh Al Muamalath – various financial dealings and business ethics.
- Classify various commercial contracts and dealings.
- Illustrate the methods of lending, leasing, mortgage, employment and agencies in Islamic Shariah.

ISC 2105	PRINCIPLES OF JURISPRUDENCE: AL ADILLAH	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course aims to

- Introduce Usool – Al – Fiqh referring to the distinction between Fiqh and Usool – Al - Fiqh.
- Familiarize the students with historical development of Usool – Al – Fiqh.
- Provide the students with knowledge of Dalayil – Sources of Islamic law (Quran, Sunnah, Ijma'h, Qiyas and other six sources).

MODULE I Introduction **8**

Introduction, Defintion of Fiqh (Jurisprudence), Usulul fiqh, Objectives, the Two Methodologies, Adillah and orders of Adillah

MODULE II Dhaleel 1: Kitab **7**

Daleel-I: Holy Quran, Khawas, Dalalat Qatayiah, Dalalat Danniyah, Ejaz, Classification of Ahkam – Rulings.

MODULE III Dhaleel 2 & 3: Al Sunnah & Al Ijma' **8**

Defintion of Sunnah: Classification, Qatayiah, Dhanniyah,

Definition of Ijma': Four Pillars of Ijma', Possibility and Practicable Ijma, Two types of Ijmah

MODULE IV Dhaleel 4: Al Qiyas **7**

Al Qiyas: Definition, Examples, Proof from Holy Quran, Sunnah, Companions And logical Proof, Pillors of Qiyas

MODULE V Illath **8**

Definition of Illath, Conditions & Classification of Illath & Masalik al-Illath

MODULE VI Other Dhaleels **7**

Al Isthihsan, Al Maslaha al Murslah, Al Urf, Al Isthishab, The Sharia of Previous nations and Opinion of Sahabah.

L – 45; Total Hours –45

TEXT BOOKS:

1. Ilm Usool Al Fiqh by Abdul Wahhab Khallaf, Cairo, 2002.

REFERENCES:

1. Usool Al Fiqh by Abu Zuhra, Demascas, II Edition 1998.
2. Al Wajeez fee Usulil Fiqh by Wahba al Zuhaili, Darul Fikr, Damascus.

OUTCOMES:

At the end of the course, the student is expected to:

- Define Usool – Al – Fiqh and distinguish it from Fiqh.
- Describe historical development and defend schools of thoughts in Usool – Al – Fiqh.
- Discuss all ten sources of Islamic law and their applications on modern issues.

ISC 2106	ARABIC LANGUAGE: GRAMMAR & RHETORIC	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course aims to

- Introduce the student the Balaga (Rhetoric) in Arabic language.
- Familiarize the students with the classifications of Arabic Rhetoric and its impact in Arabic literature.
- Provide the students various topics in Balaga with suitable examples.
- Train the students important rules of advanced Arabic grammar.

MODULE I **8**

Introduction to Arabic Rhetoric – Classifications of Rhetoric – Ilmul Bayan and its impact in Arabic literature – Tashbeeh and its pillars – Kinds of Tashbeeh – Explanation of Tashbeehut Tamseel – At Tashbeehul Limniy.

MODULE II **8**

Purposes of Tashbeeh – At Tashbeehul Maqloob – Al Majazul Lugawi – Al Isti'rah (Metaphor) Tasreehiyya and Makniyya – Isti'rah Asliyya and Tabayiyyah – Classification of Isti'arah into Murasshaha, Mujarradah and Mutlaqah – Al Isti'arah at Tamseeliyyah (Proverbs).

MODULE III **8**

Al Majazul Mursal and its relations – Al Majazul Aqli – Explanation of Al Kinaya – Introduction to Ilmul Badi' – Al Muhassinathul Lafliyya - Al Jinas – Al Iqtibas – As Saja' – Al Muhassinathul Ma'nawiyya - At Tawriyya – At Tibaq.

MODULE IV **7**

Al Muqabalah – Husnut Ta'leel – Ta'keedul Madh biba ushbihu Damm and vice versa – Usloobul Hakeem – Examples of Rhetoric from Holy Quran and Hadeeth.

MODULE V **7**

Al Tasgeer – Al Nasab wa Arkaanuhu – Al Igra' wa Tahdheer – Al Ikhtisas – Al Ishtigal

MODULE VI **7**

Al Nadba – Al Istigasa – Al Waqf – I'rabul Jumal.

L – 45; Total Hours –45

TEXT BOOKS:

1. Al Balagathul Wadhiha by Ali Jarim and Mustafa Amin, Published by Ashrafi Book Depot, Deoband, Uttarpradesh.

REFERENCES:

1. Asrarul Balaga by Abdul Qahir Al Jurjani, Published by Al Maktabathul Asriyya, Beirut.
2. Al Balagathul Quraniyya by Mohammed Hasan Nadwi, Published by Ittihad Book Depot, Deoband, Uttarpradesh, India.

OUTCOMES:

At the end of the course, the student is expected to:

- Describe the concept of Balaga (Rhetoric) in Arabic language.
- Discuss the various topics of balaga used in Arabic texts such as Quran and Hadith.
- Apply the rhetorical and advanced grammatical rules in speaking and writing Arabic.

ISC 2107 ISLAMIC HISTORY: UMAYYAD & ABBASIDS PERIOD

L	T	P	C
3	0	0	3

OBJECTIVES:

The course aims to

- Introduce the Islamic History, specially the contribution of Umayyad & Abbasids to civilization, Culture and social life.
- Familiarize the students with the Umayyad & Abbasids Khulafas and the important events & the achievements in their period.

MODULE I **8**

Factors by which Mua,aviya declared himself as Ameer in Syria (Shame) while Ali Bin Abeethalib was elected Khalfa in Medin ?. Ameer Muaviya (First Ameer of Umayyad regime) - His conquests and administration . Ali Bin Abee thaalib and Muavia in Siffeen battle and it's effect. Murder of . Ali Bin Abeethaalib.

MODULE II **7**

The way by which Yazeed Bin Muaviya became as successor of Muaviah - View of Hasan, Husain, Abdullah Bin Zubar and Abdullah Bin Omer in yazeed;s succession. Events of Karbalah battle and murder of Husain. Raise of Kharijeens

MODULE III **8**

Wars inside Holy cities of Mecca and Medina. Murder of Abdullah Bin Zubair. Umar Bin Abdul Azeez and his reforms. Reasons of downfall of Umayyad Regime. (Abbasid Period)

MODULE IV **7**

Propaganda for Abbasid regime. Features of Abbasid regime.Abul Abbas Abdullah Bin Mohamed Al saffah. The important works of Abul Abbas. Abu Jaafer Al Mansoor. His freedom from his uncle. His freedom from Abu Muslim Al Khuraasani

MODULE V **8**

Mohamed Al Mahdhi, Moosa Al Hadhi. Abu Muslim Al khuraasaani, his achievements and his end. Haroon Al Rasheed, Al Baraamikah. Formation of Baghdad city. Selection of Abbasids black color as their political symbol. Abbasid regime in the hands of Persians and Turks

MODULE VI **7**

Revolution in the cities – movement of Mu,thazilas – ma,amoon and the Mu,thazilas – overcome of Turks on the Abbasid rule - Period of Seljuk and Mongols. Fall of Abbasid regime. Period of Seljuk and Mongols. Fall of Abbasid regime

L – 45; Total Hours –45

TEXT BOOKS:

1. Al Mukhtasar fee tareekh al Dawlah al Umawiya (Edition: Bukhari Aalim Arabic College), Year 2005.

REFERENCES:

1. Concise History of Muslim World by Rafi Ahmad Fidai, Kitab Bhavan, New Delhi, 2004
2. History of Arab by Philip K Hitti, Palgrave Macmillan Publishers, 2002.
3. Thaareekhul Umamul Islamiyyah By Al sheikh Muhammad Al Khulur.
4. Al Daulathul Abbasiyyah By Dr.Ahmad Al Mukhtaar Al Ubaadi

OUTCOMES:

At the end of the course, the student is expected to:

- Describe the Islamic history in detail especially the Umayyad & Abbasids history.
- Compile the factors behind the establishment of Umayyad dynasty.
- Discuss the social, economic, cultural and political developments happened during the Umayyad & Abbasids period.

SEMESTER IV

		L	T	P	C
ISC 2211	**QURAN EXEGESIS: SELECTED CHAPTERS**	**4**	**0**	**0**	**4**

OBJECTIVES:

The course aims to:

- Learn the proper interpretation of the Quran on fundamentals of faith, tawheed, Prophet hood, resurrection and the supreme judgment of Allah in the Chapter Al Mu'minoon.
- Explain the prohibition of prostitution and rules related to gender relationship as per the interpretation and commentary of Quran by Ibn Katheer.
- Introduce the commentary of Quran on Chapter Al Hujurath.

MODULE I **Sura al Muminoon** **10**

Verses: 1 – 36

MODULE II **Sura al Muminoon** **10**

Verses: 37 – 75

MODULE III **Sura al Muminoon** **10**

Verses: 76 – 118

MODULE IV **Sura al Noor** **10**

Verses: 1 – 34

MODULE V **Sura al Noor** **10**

Verses: 35 – 64

MODULE VI **Sura al Hujuraat** **10**

Verses: 1-18

L – 60; Total Hours –60

TEXT BOOKS:

1. Tafseer Ibn Katheer by Al Hafiz Ibn Katheer, 2nd Edition 98, Beirut, Lebanon.

REFERENCES:

1. Tafseer Al Qurtubi by Mohammed Ibn Ahmad Al Qurtubi, Darul Kutubul Arab, Beirut, 2002.

2. Meanings of the Quran by Abdullah Yusuf Ali, Amana Corp., Maryland, USA, 1983.
3.

OUTCOMES:

At the end of the course, the student will be able to:

- Debate the interpretation of texts of Chapter Al Muminoon.
- Discuss about the interpretation of chapter Al Noor on illegal sexual relationship, rules related to gender relationship.
- Analyze the ethical contents of the chapter Al Hujurath.

ISC 2212	HADEETH: SUNAN AL TIRMIDHI	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course aims to:

- Introduce the Chapters On Food & Drinks From The Messenger of Allah.
- Learn the guidance of Prophet (PBUH) On Eating & Drinking..
- Enable the students to know the guidance of the prophet (PBUH) mentioned in Chapters On food & drinks.

MODULE I The Chapters On Food From The Messenger of Allah 8

1. What has been related about What the prophet (SAL) ate upon– 2. What had been related about eating rabbit - 3. What has been related about eating Mastigure - 4. What has been related about eating Badger - 5. What has been related about eating Horse Meat- 6. What has been related about the Meat of Domesticated Donkey - 7. What has been related about eating from Utensils of the disbelievers- 8. What has been related about the mouse that dies in cooking fat - 9. What has been related about prohibition of eating and drinking with the left hand - 10. What has been related about licking the fingers(after the meal) – 11. What has been related about fallen Morsel –12 What has been related about It Being Disliked to eat from the middle of the food –

MODULE II The Chapters On Food From The Messenger of Allah 7

13. What has been related about It Being Disliked to eat garlic and onion- 14. What has been related about the permission to eat cooked garlic. - 15. What has been related about Covering the vessels and extinguishing the Torches and fires prior to sleeping - 16. What has been related about It Being Disliked Two take to dates at once - 17. What has been related about Recommending Dates- 18. What has been related about praising Allah for the food when one is finished eating from it - 19. What has been related about eating with a leper - 20. What has been related about the believer eats with one intestine (and the disbeliever eates with seven intestines - 21. What has been related about food for one is sufficient for two - 22. What has been related about eating locusts - 23. What has been related about supplicating against locusts – 24. What has been related about consuming the flesh of the jallalah and milking it –

MODULE III The Chapters On Food From The Messenger of Allah 8

25. What has been related about eating Chicken- 26. What has been related about

eating bustard - 27. What has been related about eating roasted meat- 28. What has been related about It Being Disliked to eat while reclining - 29 What has been related about the prophet (SAL) liked sweets and honey - 30. What has been related about increasing (the water in) the broth- 31. What has been related about the virtue of Tharidh - 32. (That He said:) “Tear The Meat (with your teeth)” - 33. What has been related from the prophet (SAL) permitting one to cut meat with a knife - 34. What has been related about which meat The Messenger of Allah used to like most- 35. What has been related about Vinegar- 36. What has been related about eating milon with fresh dates

MODULE IV The Chapters On Food From The Messenger of Allah 7

37. What has been related about eating snake cucumber with fresh dates - 38. What has been related about drinking camel urine - 39. What has been related about wudu before meals and afterwards - 40. About not performing wudu` before eating - 41. What has been related about the Thasmiah for eating - 42. What has been related about eating Gourd - 43. What has been related about eating Olive oil- 44. What has been related about eating with slaves (and dependants) - 45 What has been related about the virtues of feeding others - 46. What has been related about virtue of Al Asha`- 47. What has been related about the Thasmiah Over Food- 48. What has been related about It Being Disliked to spend the night while one has a smell on his hand.

MODULE V The Chapters On Drinks From The Messenger of Allah 8

1. What has been related about drinking khamr`- 2. What has been related about “Every Intoxicant is unlawful”- 3. What has been related about “whatever a lot of Intoxicates, A Little of it is unlawful”- 4. What has been related about Nabidh` prepared in earthenware containers- 5. What has been related about it is disliked to prepare Nabidh` in Ad-Dubba`, An – Naqir,and Al- Hantam, - 6. What has been related permitting that Nabeedh`be prepared in containers - 7. What has been related about preparing Nabidh`in a water- skin - 8. What has been related about Grains (and Berries) from which khamr` is derived- 9. What has been related about mixing unripe dates and dates - 10. What has been related about it being disliked to drink from Gold and Silver vessels- 11. What has been related about the prohibition of drinking while standing.

MODULE VI The Chapters On Drinks From The Messenger of Allah 7

12. What has been related about the permission of drinking while standing - 13. What has been related about breathing into the vessel.14.What has been related about

drinking with two breaths - 15. What has been related about breathing into the vessel. 16. What has been related about it being disliked to breath into the vessel- 17. What has been related about (the prohibition of) bending the mouths of water-skin- 18. What has been related permitting that- 19. What has been related about those on the right have more right to the drink – 20. What has been related about the one providing water for people is the last of them to drink- 21. What has been related about which drink was the most beloved to the messenger of Allah.

L – 45; Total Hours –45

TEXT BOOKS:

1. Sunan Thirmidhi by Imam Abu Eisa al Thirmidhi,

REFERENCES:

1. Thuhfatul Ahwadhi, Sharah Thirmidhi by Abdur Rahman al Mubarakpuri, India

OUTCOMES:

At the end of the course, the student is expected to:

- Explain the guidance of the prophet (PBUH) mentioned in Chapters On food & drinks.
- Define Halal, Haram related about Eating & Drinking as described by the prophet (PBUH)
- Elaborate Eating and drinking statuses from Imam Thirmidhi`s Hadith collection about food, eating, drinking.

ISC 2213	MUSLIM PERSONAL LAW: INHERITANCE & WAQF	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course aims to:

- Introduce the student the Islamic knowledge of inheritance.
- Familiarize the student the rules related to division of properties among the eligible family members.
- Brief the student the Waqf – Immovable properties and procedures to set right the waqf.

MODULE I **8**

Introduction – Quranic verses on inheritance – System of inheritance in Islam - Introduction of Shares defined in the Holy Quran -

MODULE II **7**

Residuiraries and their classification (Al Furoodh al Muqaddhara fil Quran), Al Asabah and its Kinds - Exclusion (Al-Hujb)

MODULE III **8**

Grandfather along with brother (Al Jadh Ma'al Ikhwah) - The doctrine of return (Al Radh wal A'wl) Tashih: Process and rulings of distribution of hires.

MODULE IV **8**

Rules of devolution of vested inheritance (Al Munasakhaat) - Distant Kindred (Dhavil Arhaam) – Al Mafqood, Al Gharqaa, Al Hadhma.

MODULE V **7**

Waqf - Saying of Abu Hanifa – Waqf – Waqf al Iqaar – Sihhatul Waqf – Idha Ja'alal Waaqif.

MODULE VI **7**

Idha Banaa Masjidan – Man Banaa Siqaayah.

L – 45; Total Hours –45

TEXT BOOKS:

1. Al Mawaarees fee al Shareeathil Islamiyyah fil Kitabi wa al Sunnah,

REFERENCES:

1. Fiqh Al Sunnah by Syed Sabiq, Darul Fath, Cairo, 1999.
2. Nailul Awtaar by Shawkani - Dar Al Fikr, Beirut, 2000.

OUTCOMES:

At the end of the course the student will be able to

- Describe the Islamic law of inheritance in detail.
- Divide the properties to the family members as per the rules of Shariah when the property holder dies
- Apply and implement the rules of creating the Waqf institution and maintain the Waqf as per Shariah law.

ISC 2214	PRINCIPLES OF JURISPRUDENCE: AL QAWAYID	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course aims to:

- Introduce the Usool Al Fiqh related to Qawayid.
- Explain various types of Dilalah, Aam and Khaas, Mutlaq, Muqayyad, Wadhih Dalalah.
- Familiarize the student with Maqasid Shariah – Objectives of Shariah and its applications to modern issues.

MODULE I **8**

Dilalah: Indication of word and its various types – Ibarat Annass

MODULE II **8**

Isharat Annass – Dilalat Annass & Iqtidha Annass - Division -1: Al-Sahir, Al-Nass, Al-Mufassir, Al-Muhkam

MODULE III **8**

Division-2: Al-Khafi, Al-Mushkil, Al-Mujmal & Al-mutashabin, Al-Mushtarak) Words and their Collective meanings – Definition, Reasons for Collective meanings and their rulings.

MODULE IV **7**

Terminology of Al-Aam: Definition - Form of Aam - Inidcations of Aam

MODULE V **7**

Three types - Reservation of Meaning Terminology of Al-Khas: Definition - Mutlaq - Muqayyad Al Amru (Order) – Annahyu – Forms of Amru and Nahuyu

MODULE VI **7**

Al Maqaasid: Objectives of Shariah – Al Mashlish – Al-Dharuriyah – Al-Hujiyyah – Al Tahseeniyyat

L – 45; Total Hours –45

TEXT BOOKS:

1. Usool Al Fiqh Al Islami by Wahba Al Zuhaili - 2nd edition1998. Damascas.

REFERENCES:

1. Ilm Usool Al Fiqh by Abdul Wahhab Khallaf, Cairo, 2002.
2. Usool Al Shashi by Al Khamseen, Kutub Khana, Deoband, India.

OUTCOMES:

At the end of the course, the student is expected to:

- Describe the Qawayid Usooliyyah.
- Discuss about the various elements of Dilalah.
- Analyze the Objectives of Shariah in order to apply them to modern issues.

ISC 2215	DEVELOPMENT OF ISLAMIC RELIGIOUS SCIENCES: TAFSEER & HADEETH	L	T	P	C
		4	0	0	4

OBJECTIVES:

The course aims to:

- Introduce the students the Quranic science – Usool Al Tafseer and Science of Hadith – Usool Al Hadith.
- Teach the basic themes of Quran classified into five points.
- Provide the student with classification of authenticity of Hadiths.
-

MODULE I **10**

Al Uloom al Khamsah – Ilmul Jadhal – Al Jadhalul Quraani Ma'al Mushrikeen, Ma'al Yahood, Ma'annasaara, Ma'al Munafeqeen - Al Baqiyah al-Uloom al-khamsa

MODULE II **10**

Bayanu Ujood al Dhiqqah wal Khafa fee ma'ani nadhm al-Quarnil Kareem - Gharib al-Quran - Al Nasikh wal Mansookh - Asbabu al Nuzool - Baqiyah al Mabahis - Al-muhkam wal Muthashabih wal Qinayah wal Tha'reedh wal Majaz al-Aqali.

MODULE III **10**

Usloob al-Qura'n al-badhee' – Thartheeb al-Qura'n al-Kareem & Usloob al Suvar – Thaqsim al suvar Ilal ayaat.- Dhaahirah al Thakrar fil Qura'nil Kareem.

MODULE IV **10**

Ujuhul Ijaz fil Qura'n al Kareem - Funun al-Tafseer – Asnaaful Mufassireen wa Manahiju Tafseerihim – Gharaaib al Qur'anul Kareem – Dhahrul Qur'ani wa bathnuhu.

MODULE V **10**

Al Hadeeth & Al Sunnah - Al Sanad & Al Matan - Al Hadetth al Qudsi & Al Hadeeth al Nabawi - Al Sahabi & Al THabiyee - Definition of Science of Hadeeth - Writing of Hadeeth - Compiling of Hadeeth - Narration of Hadeeth word by word

MODULE VI **10**

Al Mutawaatir - Al Aahaad - Al Ghareeb - Al Azeez - Al Mash-hoor - Al Isnaad: al Aali, al Naazil - Al Marfoo' - Al Mawquuf - Al Maqthoo' - Al Hadeeth al Saheeh (Definition) - The Books of Hadeeth: Bukhari, Muslim - Al Hadeeth al Hasan - An Introduction to Four Sunans - Al Dha'eef : Al Mursal, Al Munqathi', Al Mu'dhal, Al Mudhallas, Al

Mudhtharib, Al shaz, Al Munkar, Al Mudhraj, Al Maqlub, Al Muallal.

L – 60; Total Hours –60

TEXT BOOKS:

1. Al Fawz al Kabeer by Shah Waliullah al Dehlawi, Dar al Sunnah, Luknow, India.
2. Al Thamheed fee Uloom al Hadeeth by Dr.Hammam Abdur Raheem, Dar Al Basheer, Dantha, 4th Edition, 1999, Egypt.

REFERENCES:

1. Dhiraasat fee Uloom Al Tafseer wal Hadeeth Al Nabawi by Dr. Nisar Ahmad, Chennai, India.
2. Nukhbah al Fikr by Ibn Hajar al Asqalaani, Deoband, India.

OUTCOMES:

At the end of the course the student will be able to:

- Classify the Quranic science – Usool Al Tafseer and Science of Hadith – Usool Al Hadith.
- Analyze the five points which are considered as basic themes of Holy Quran.
- Explain the various kinds of authenticated and unauthenticated Hadiths.

ISC 2216 ARABIC LITERATURE: PROSE & POETRY

L	T	P	C
4	0	0	4

OBJECTIVES:

The course aims to:

- Introduce Prose and poetry in Arabic Literature.
- Learn samples of Arabic literature composed by a number of classical and modern writers.
- Familiarize with the number of samples of Poems composed by classical and modern poets.

MODULE I **9**

Introduction to Arabic Literature- Introduction to Mukhtaaraat min Adab al Arab- Ibaadur Rahman – Syeduna Moosa – Jawami' al Kalim – Al Khatabah Al Mu'jizah – Fee bane Sa'd.

MODULE II **9**

Kaifa Haajara al Nabi – Ibthilaa' Ka'b bin Malik – Maqtal Umar bin Khattab – Akhlaq al Mumin – Ikhwan al Safa

MODULE III **9**

Wasf al Zahid – Baina al Syedah Zubaidah wal Mamoon – Baina Qadhi Waqoor wa Dhubab Jasoor.Al Qamees al Ahmar - Kaifa Kaana Muaviya – Isthiqaamah al Imam Ahmed – Ash'ab wal Bakheel .

MODULE IV **9**

Risalah al Ithaab – Hadeeth al Naas – Fee Sabeel al Sa'adah wal Yaqeen – Wafah al Sultan Salahuddin Ayyubi – Ulu al Himmah – Syed al Thaabieen Sayeed bin al Musayib.

MODULE V **12**

9, 8, 7 & 6th Centuries: Raja'thu Li Nafsee: Hafiz Bak Ibrahim - Idha Naama Ghirrun: Abdulla Basha Fikri - Biyadhil Afaafi: Ayesha Thaimooriyah - Al Jiddhu Fil Jiddhi: Salahuddin Khaleel - Laa Yamthathi al Majdha: Safiyuddin – Uwadhiuka ar Rahman: Ibn Sayeed al Maghribi – Siwaaya yahabul Mauthu: Ibn Sina al Malik - Wala Thahthaqir: Abu Mohamed al Yamani - Saamih Akhaka: Hareeri - Isma' Akhi: Hareeri.

MODULE VI **12**

5, 4, 3, 2 &1st Centuries: Man Arafallaha:Shareef Abbasi - Alaa fee sabeelil Majdi: Abul Ala al Ma'rri - Wa Innee wa In Kunthu: Abul Ala al Ma'rri - Al Ra'yu qabla shaja'h:Muthanabbi - Lakal Qalamu: Abu Thammam - Maa fil Muqaami:Imam Shafi - Idha Balaghar Ra'yu: Bashshar bin Burdh - Idha Kuntha fee haajathin: Abdullah bin Jafar - Lisaani wa saifi: Hassan bin Thabith.

L – 60; Total Hours –60

TEXT BOOKS:

1. Mukhtaaraat min Adab al Arab by Syed Abul Hasan Ali Nadwi, Lucknow, India.
2. Majmua min al Nadhm by Mohamed Sharif Saleem, Maktabah Nadwiyah, Lucknow, India.
3.

REFERENCES:

1. Tareekhul Adabil Arabi, Hasan Zayyat, Darul Hikmah, Lebanon.

OUTCOMES:

At the end of the course, the student will be able to:

- Demonstrate the significance of prose and poetry in Arabic literature.
- Analyze the different types of prose literature.
- Explain the poems and differentiate between classical and modern poems.

ISC 2217	MODERN ISLAMIC FINANCE	L	T	P	C
		2	0	0	2

OBJECTIVES:

The course aims to:

- Introduce the students the basic concepts of Islamic financial system in modern scenario.
- Enable the students to understand the significance of historical changes that take place in global economy
- Teach the students to use appropriate Islamic financial transaction concepts to provide solutions to the modern economic crisis
- Familiarize with the various kinds of financial products

MODULE I **5**

Sources and principles of Islamic law: Quran, Sunnah, Ijma and Qiyas

MODULE II **5**

Gharar & Riba

MODULE III **5**

Muqayadah - Bay Mutlaq – Sarf - Salam Contract.

MODULE IV **5**

Murabaha (cost plus sale): Conditions of Murabaha - Modern application of Murabaha - Ijarah (leasing): Definition – Legitimacy - Ijarah al-Ashya - Ijarah al-Ashkhas - Modern application of Ijarah.

MODULE V **5**

Definition – Legitimacy - Ijarah al-Ashya - Ijarah al-Ashkhas - Modern application of Ijarah - Ijarah al-Ashya - Ijarah al-Ashkhas - Modern application of Ijarah.

MODULE VI **5**

Musharakah: Definition - Sharikat-al-Milk – Sharikat al Aqd – Conditions.
Mudharabah: Definition - Legitimacy – Conditions - Dissolutions of Mudharabah.

L-30; Total Hours –30

TEXT BOOKS:

1. Islamic Law of Contracts and Business Transactions by Dr.M.Tahir Mansuri, New Delhi.

REFERENCES:

1. Al Fiqh al Islami wa Adhillathuhu by Wahbah Zuhaily, Dar al Fikr, 1997.
2. An Introduction to Islamic Finance by Mufti Mohamed Taqi Usmani, Karachi, 1998.

OUTCOMES:

At the end of the course the student will be able to:

- Describe the concept of Islamic financial system in modern scenario.
- Distinguish the Islamic financial concepts from conventional financial system
- Relate the concepts of Islamic interest free finance in modern financial transactions
- Apply the various Islamic finance instruments to modern transactions.

SEMESTER V

		L	T	P	C
ISC 3101	**SHARIAH RULINGS IN CHAPTER AL MAIDAH**	**4**	**0**	**0**	**4**

OBJECTIVES:

The course aims to

- Enable the students to know the Shariah rulings mentioned in Chapter Al Maidah.
- Familiarize the student with the methodology of Quranic science applied by Imam Tantawi.
- Provide the students with the characters and attitudes of Jews and Christians in the light of Quran.
- Enable them to derive rules and regulations from the verses applicable in day to day life.

MODULE I Sura Al Ma'idah: Verse no. 1 – 7 10

Introduction to Surah Al Maidah - Explaining the Lawful and the Unlawful Beasts - The Necessity of Preserving the Sanctity and Safety of those who intend to Travel to the Sacred House - Islam Has Been Perfected for Muslims - Clarifying the Lawful - Rules related to Performing Wudu (Ablution)

MODULE II Sura Al Ma'idah: Verse no. 8 – 26 10

Reminding the Believers of the Bounty of the Message and Islam – Warning against the errors of the Jews - Breaking the Covenant - Explaining the Truth through the Messenger and the Qur'an - The Polytheism and Disbelief of the Christians. - The story of Musa (PBUH) and the Jews related to the Holy land.

MODULE III Sura Al Ma'idah: Verse no. 27 – 43 10

The Story of Habil (Abel) and Qabil (Cain) - Human Beings Should Respect the Sanctity of Other Human Beings - Commanding Taqwa, Wasilah, and Jihad - The Necessity of Cutting off the Hand of the Thief.

MODULE IV Sura Al Ma'idah: Verse no. 44 – 63 10

Chastising the Jews for Their Evil Lusts and Desires, While Praising the Tawrah - Allah Mentions `Isa and Praises the Injil - Praising the Qur'an; the Command to Refer to the Qur'an for Judgement - The Prohibition of Being Loyal Friends with Disbelievers – Bad attitudes of Jews.

MODULE V Sura Al Ma'idah: Verse no. 64 – 88 10

The People of the Scriptures Deserve the Worst Torment on the Day of Resurrection- Criticizing Rabbis and Learned Religious Men for Giving up on Forbidding Evil- Isa is Allah's Servant and His Mother is a Truthful Believer - The Prohibition of Shirk (Polytheism) and Exaggeration in the Religion.

MODULE VI Sura Al Ma'idah: Verse no. 89 – 120 10

Expiation for Breaking the Oaths- Prohibiting Khamr (Intoxicants) and Maysir (Gambling) - Prohibiting Hunting Game in the Sacred Area and During the State of Ihram - Unnecessary Questioning is Disapproved of - One is Required to Reform Himself First - Reminding `Isa of the Favors that Allah Granted him - Sending Down the Ma'idah - Only Truth will be of Benefit on the Day of Resurrection.

L-60; Total Hours –60

TEXT BOOKS:

1. Tafseer Al waseeth by Dr.Muhammad Syed Tanthavi, 1996, Egypt.

REFERENCES:

1. Tafseer Al Baghavi by Abu Muhammad Al Hussain Al Baghavi, Riyadh, K.S.A.
2. Meanings of the Quran by Abdullah Yusuf Ali, Amana Corp., Maryland, USA, 1983.

OUTCOMES:

At the end of the course, the student is expected to:

- Describe the Shariah rulings mentioned in the chapter Al Maidah.
- Discuss the linguistical and theoretical aspects of Tafseer Al Wasith.
- Distinguish between the basic doctrines and principles of Jews and Christians.
- Derive Shariah rules and regulations from the verses.

ISC 3102	A SPECIAL STUDY ON SAHEEH MUSLIM	L	T	P	C
		4	0	0	4

OBJECTIVES:

The course aims to:

- Introduce the author Imam Muslim and his methodology of collection of Hadith.
- Learn texts of Hadith and their different interpretations related to signs and events pertaining to end of the world, especially arrival of Ya'juj, Ma'juj, Dajjal and Mahdi Maseeh.
- Learn ideology of renunciation (leading simple life) from the material life described by the Prophet.

MODULE I **10**

Introduction to Saheeh Muslim – Biography of the Author, Imam Muslim Ibn Hajjaj (Rah) – Collection of Hadith – Methodology.

MODULE II **10**

Kitab Al Fitan – Chapters from Iqtirab Fitan and Y'juj, M'juj till Chapter Conquest of Constantinople, Coming of Dajjal and Jesus.

MODULE III **10**

From Chapter ten, the last day and Rome Majority till Chapter Description (Sifat) of Dajjal and prevention (Tahreem) Madeenah Munawwara.

MODULE IV **10**

From Chapter 22, Dajjal Huwa ahwan ala Allah till Chapter 28, between two Soors (trumpet).

MODULE V **10**

Kitab Al Zuhd – Al Riqaq – From Chapter 1 to 7.

MODULE VI **10**

Continuation of above Kitab from Chapter 8 to 15.

L-60; Total Hours –60

TEXT BOOKS:

1. Saheeh Muslim by Muslim Al Hajjaj, Ashrafia Book Depot, Delhi, India.

REFERENCES:

1. Al Minhaj, Sharah Saheeh Muslim by Imam Nawawi, Darul Ma'rifa, Beirut, 2001.

OUTCOMES:

At the end of the course, the student is expected to:

- Describe the methodology followed by Imam Muslim in his Hadith collection.
- Outline the signs and events of the last day of the world as described by the Prophet (PBUH).
- Analyze the Hadith texts related to ideology of renunciation from the material life.

ISC 3103	MUSLIM FAMILY LAW	L	T	P	C
		4	0	0	4

OBJECTIVES:

The course aims to:

- Introduce the Islamic Family law.
- Familiarize the student with the concept of marriage procedure, family life, duties of husband and wife, rules of divorce etc in the Shariah perspective.
- Provide the student clear insights about the matters related to Mahar, Valeema, Khula etc.

MODULE I **10**

Introduction to Marriage – Case Studies related to Divorce and maintenance particularly in India - Al Ziwaj- ankihathalhi hadamaha al Islam- athargeeb fi ziwaj- hikmathu ziwaj- hukumu ziwaj-ikthiyaru zawji wazaja-al khithba- aqdu ziwaj

MODULE II **10**

Sigathu aqdil muqtharinathi bi shruth- shruth sihhathi ziwaj- shruth nafadil aqd- hruthu luzumi aqdi ziwaj- al muharramathu minanisa- al muharramthu mu abbadan- al muharramathu mu waqqathan

MODULE III **10**

Ziwaju nisayi ahlil kithab- ziwaju sayiba- al wilathu al ziwaj- al wakalathu fi ziwaj- al kafaathu fi zawaj- al huququ zawjiyya- al huququl mushtaraka baina zawjan- al huququl wajibiyyah lizawjathi ala zawjiha

MODULE IV **10**

Al mahr – al khithba kabla zawaj- al waleema- ziwaju gayral muslimeen- thalaq- athalaq bil lafz- athalaqu bil kithaba- isharathul akhras-irsalurassul- athalaqusuunyyi wa bidayyi

MODULE V **10**

Adadu thalaq- thalaqul batha- thalqu rajaee wal bayin- thalaqu mareedhi mardil mawth- athafweed wathawkeel fi thalaq- al halath alathi yuthlaqu fiha athalaq

MODULE VI **10**

Al khulua- nsushuzu rajul- alihar- al faskh- alliaan- al iddah

L-60; Total Hours –60

TEXT BOOKS:

1. Fiqh Al Sunnah by Syed Sabiq, Darul Fath, Cairo, 1999.

REFERENCES:

1. Al Ahwal Al Shakhsiyya by Imam Mohammed Abu Zahra, Egypt.
2. Hidayah by Burhanuddin al Murgheenanani, Maktabah Ashrafiya, Deoband, India.

OUTCOMES:

At the end of the course, the student is expected to:

- Understand the basic ideology of family and contract of marriage in Shariah.
- Discuss about the Islamic rulings connected to marriage and divorce.
- Categorize the duties of husband to his wife and vice versa in detail.

ISC 3104	COMPARATIVE FIQH	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course aims to:

- Compare the fiqh rulings as per the four madhabs.
- Familiarize the student with the concept of rulings in Islamic Shariah.

MODULE I **8**

Opinion of Imaams if the intention (Niyyath) is one of the conditions in ablution (Udhou) and in all compulsory religious activities? Their evidence from Quraan and Hadeeth for their claim

Opinion of Imaams on washing forehands before putting them into the ` ablution water. The reasons for their differences

Opinion of Imaams on washing inside of mouth and nose. . The reasons for their differences.

MODULE II **8**

Opinion of Imaams on the limit of head for Mus'h. Is both ears are included in the head or not. The reasons for their differences - Opinions of Imaams on the type of washing legs, washing is obligatory, or rubbing with water is enough. Their evidence from Quran - Opinions of Imaams on doing the acts of Udhu in order, Is it is obligatory, or not. Their justification from Quraan fro thier claims - Opinions of Imaams on touching the socks (Mushul Khuffain) with water instead of washing them in the time of ablution and Bath. Their evedance from Quraan and Hadeeth - Opinions of Imaams on Mushul Khuffain, when it is allowed? in all times, or in travel only. Their proof from Hadeeth- Kinds of water to be used for religious purifying. Different opinions of Imaam with their evidences - More water and less water. Different definition of Imaams about it.

MODULE III **8**

Ablution Breakers. (Navaaqil –ul- Ulou) sleeping, dispose of urine, motion, back air, vomit, more blood, touching to marriageable women and touching to genetic parts are breaking the Udhu. Different opinions of Imaams on it and their evidences.

Different opinions of Imaams on rubbing the whole body with hand while doing religious bath (Ghusl) and their evidences - The matters that will make the bath (Ghusl) compulsory. (Exit of sperm for male and menstruation blood for female) The rules of Isthihaala (disorder in menstruation period for female)

The religious acts which are prohibited with Janaabath (Major Impurity) and Hadath

(minor Impurity).

MODULE IV Salaah 7

Obligation of Salaahs by Quraan and Hadeeth. Number of compulsory prayers. Opinion of Imaams on it. on whom the prayers are compulsory ? Eight conditions of prayers. Different opinions of Imaams on them. The times that the prayer is prohibited. The conditions for Mu,athin. Qiblah and it's related matters. Body portion of man and woman that should be covered . (Aurath).

MODULE V 7

Cleanliness of body and dress. Places where one can pray on them. Congregational prayers (Salaathul Jamaa,ath). Qualification of Imaam. Who is Imaam and who is Ma,umoom ? The duty of a Ma,umoom while following the Imaam. Jumaa prayer and on whom it is obligatory? Traveler,s prayer (Salaathul Musaafir)

MODULE VI 7

Combined prayers (salaathul Jam,u) concessional prayer. (salaathul Qasr Eid prayers When the prayers are to be re performed ? – what are the things that will spoil the prayer while praying ? Qalaaus salath (re completing the prayer) – Sujoodus sahvu - Salathul Vitr - Salathun Navaafil – SalaathutTharaaveeh.

L-45; Total Hours –45

TEXT BOOKS:

1. Bidayathul Mujthahid va Nihaayathul Muqthasid, By Muhammad bin Ahmad bin Rushd Al qurthubi, Volume 1.

REFERENCES:

1. Al Hidayah – By Burhanuddin Al murghinanai, Volume 1.
2. Fathhul Muieen – By Zainuddin Makhdoom, Al ponnani Al Malabari, Volume 1.

OUTCOMES:

At the end of the course, the student is expected to:

- Understand the basic ideology of four Madhabs
- Discuss about the Islamic rulings and their framework.

ISC 3105	HISTORY OF ISLAMIC THOUGHT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course aims to:

- Introduce the student the historical Islamic revolution in the field of education.
- Familiarize the student with the contribution of Sahabas and the famous Islamic centres of education towards educational development.
- Provide the student with the development of different sects, schools of thought and biographies of the intellectuals in Islamic history.
-

MODULE I Introduction 7

Importance of knowledge in Islam - Religious movements - Companions - Mawaali.

MODULE II 8

Centers of knowledge - Mecca - Medina - Iraq - koofa - Basara - Damascus and Egypt.

MODULE III Religious groups 8

Khawariji and its teachings - Shia and their ideological developments - Murji'ah- Mutazilah - Imam Hasan Basari and Imam Ash'ari.

MODULE IV Educational Institutions 7

Kuttab - Masaajid - Debate centers - Library.

MODULE V Religious science and four Imaams 7

Imaam Abu Haneefa - Imaam Malik - Imaam Shaafi - Imaam Ahmed bin Hanbal.

MODULE VI Philosophy and Science 8

Astronomy - Medicine and mathematics biography of Raazi - Faraabi - Ghazzali - Ibnu Seena and Al biruni.

L-45; Total Hours –45

TEXT BOOKS:

1. Tareekh al Fiqr al Islami, Bukhari Aalim Arabic College, 2009

REFERENCES:

1. Fajr al Islam by Ahmad Ameen, Darul Kutubul Arabi, Beirut, 1975.
2. Taareekh al Fikr Al Arabi by Umar Farrookh, Beirut, 3rd edition, 1981.

OUTCOMES:

At the end of the course, the student is expected to:

- Explain the Islamic revolution in the field of education.
- Estimate the service and contribution of the Islamic scholars and educational centres in the history of Islamic civilization.
- Evaluate the evolution of Islamic thought with reference to the different sects and schools of thought.

ISC 3106	MUSLIMS IN INDIA & PLURAL SOCIETY	L	T	P	C
		2	0	0	2

OBJECTIVES:

The course aims to:

- Introduce the role of Muslims in Indian culture.
- Learn the major contribution of Muslim intellectuals to various fields including Arabic language, Intellectual Heritage of Muslim Scholars in India.
- Familiarize the concept of Meditation, Thawheed, Sufism in India and its impact on the society
- Enlighten the students with the concept of Plural society in Islamic perspective in Indian scenario.

MODULE I **5**

Role of Muslims in Indian Culture – Medical Services – Intellectual Heritage of Muslim Scholars in India and Importance of Arabic Language – Prominent Scholars among Indian Muslims

MODULE II **5**

The Impact of Arabic Language on Indian Languages - Islamic Culture in India – Two main Elements for Shaping the Culture – Three Abrahamic Characteristics. Meditation – Thawheed: Global Characteristic – Human Equality and Dignity –

MODULE III **5**

Education system - Centers of Education: Sind, Multan, Delhi, Lahur, Gujarat, Lucknow – Different stages of Educational System. Salient Features of Methodology – Centers of knowledge and Islamic Culture in India: Darul Uloom Deoband Seminary, Salafi Madrasa, Banaras.

MODULE IV **5**

Modern schools and Universities: Aligarh Muslim University, Jamia Millia, Usmania University, Nadwatul Ulama, Madrasatul Islah - Sufism in India and Its impact on the Society.

MODULE V **5**

Role played by Muslims in Indian Independence Movement – Indian National Congress – Khilafath Movement – Jamiyatul Ulama.

MODULE VI **5**

Plural Society in Islamic Perspective: Rights – Duties – Historical evidence – Doubt clearing

L-30; Total Hours –30

TEXT BOOKS:

1. Al Muslimoona Fil Hind by Syed Abul Hasan Ali, Nadwatul Ulama, Lucknow, 1986

REFERENCES:

1. Ghair al Muslimeen fil Mujtama' al Islami by Dr.Yusuf Qardhawi, Beirut, 2nd edition, 1983.

OUTCOMES:

At the end of the course, the student is expected to:

- Define the role of Muslims to be played in Indian culture.
- Analyze the contribution of Muslim intellectuals in various fields including Arabic language.
- Discuss the various aspects related to Islam like meditation, tawheed, Sufism etc.
- Demonstrate the concept of Plural society in Islamic perspective in Indian scenario.

ISC 3107	BUSINESS ARABIC & SECRETARIAL PRACTICE	L	T	P	C
		2	0	0	2

OBJECTIVES:

The course aims to

- Teach the significance of Arabic communication.
- Train for communication in various situations.
- Develop reading, writing and translation skills.
-

MODULE I Comprehension – Letter writing **5**

Personal, Official & Commercial letters.

MODULE II Audio and video listening **5**

Introducing technical terms in Arabic.

MODULE III Situational communication **5**

In Commercial field, administrative field Vocabularies and examples of usage.

MODULE IV Situational communication **5**

In Engineering field and various work fields.

MODULE V Introduction to Translation **5**

Translation Method, Comparison of Arabic and English sentence structures, Sample Study.

MODULE VI Translation skill development **5**

Arabic to English and vice versa.

L-30; Total Hours –30

TEXT BOOKS:

1. Arabic for professional and employees, Bukhari Aalim Arabic College, 2013.

REFERENCES:

1. Secretarial Practice in Arabic by Haneef Palliyath, Darul Huda Book Stall, Calicut, 1996.

OUTCOMES:

At the end of the course, the student is expected to:

- Describe the importance of commercial communication in Arabic.
- Communicate in Arabic in different working fields.

- Write letters and translate texts from Arabic to English and vice versa.

ISC 3108 INDIAN CONSTITUTION: MINORITY RIGHTS

L	T	P	C
1	0	0	1

OBJECTIVES:

The course aims to

- Describe the rights of ethnic, religious and linguistic minorities in the Indian constitution.
- contribute to the political and social stability of States

MODULE I **2**

Concept of Minority - Sociology of minority groups

MODULE II **3**

Racial or ethnic minorities - Religious Minorities - Gender and Sexual Minorities

MODULE III **2**

Age Minorities- Disabled Minorities - Minorities according to law

MODULE IV **3**

Minority as per international law - Minority as per the Constitution of India - Religious Composition of the Indian Population - Linguistic Minority

MODULE V **2**

Constitutional Assembly Debates on Minority Rights - Minority as Per Judicial Trends

MODULE VI **3**

Constitutional Provisions related to minority rights - Cultural and Educational Rights Article 29. Protection of interests of minorities - Why Minority Rights?

L – 15; Total Hours –15

TEXT BOOKS:

1. Minority rights in Indian constitution, Sodhganga, New Delhi.

REFERENCES:

1. Constitutional rights of minorities: A critical Analysis, Saika Sabir.

OUTCOMES:

At the end of the course, the student is expected to:

- Define the rights of ethnic, linguistic and ethnic minorities.
- Analyze the minority rights in the Indian Constitution.

SEMESTER VI

ISC 3211	**THEMATIC STUDY OF QURAN**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

The course aims to:

- Introduce the Thematic tafseer.
- Teach the contents of Chapter Ar Ra'd, An Nahl and Al Kahf based on the theme of the chapters.
- Acquaint the student with the message of Chapters Luqman, Ar Rahman and Al Mulk based on the theme of the chapters.

MODULE I **8**

Chapter: 13 Al Ra'd

MODULE II **7**

Chapter: 16 Al Nahl

MODULE III **8**

Chapter: 18 Al Kahf - Chapter: 26 Al Shu'arah

MODULE IV **7**

Chapter: 31 Al Luqman - Chapter: 36 Al Yaaseen

MODULE V **8**

Chapter: 54 Al Rahman- Chapters: 55 Al Waqia'

MODULE VI **7**

Chapter: 67 Al Mulk - Chapter: 78 Al Naba'

L – 45; Total Hours –45

TEXT BOOKS:

1. Nahwa Tafseer Mawdhuyi li Suwar Al Quran by Sheik Mohammed Ghazzali. (Text prepared by Bukhari Aalim Arabic College, 2012).

REFERENCES:

1. At Tafseerul Mawdooyi Li Suwar Al Quran Al Kareem, Nukhbathun Min Ulamayit Tafseer Wa Uloomul Quran, University of Sharjah.

OUTCOMES:

On successful completion of the course, the student will be able to:

- Define the concept of Thematic Tafseer.
- Analyze the main and sub themes in Chapters Ar Ra’d, An Nahl and Al Kahf.
- Discuss about the themes of Chapters Luqman, Ar Rahman and Al Mulk

ISC 3212	A SPECIAL STUDY ON SAHEEH AL BUKHARI	L	T	P	C
		4	0	0	4

OBJECTIVES:

The course aims to:

- Introduce the biography of author Al Bukhari and highlight the significance and method of Sahih Al Bukhari
- Define Wahi - The revelation and its different kinds.
- Learn Hadith texts pertaining to Iman, Haya (Modesty) and importance of search of knowledge in Islam with special reference to journey of Moosa (Pbuh) and questioning for religious learning.

MODULE I BOOK OF REVELATION 10

Introduction to Saheeh Al Bukhari – Biography of the Author, Imam Mohamed Ismail Al Bukhari (Rah) – Collection of Hadith – Methodology – Special features.

How the divine Revelation started to be revealed to Prophet Muhammad (sal) – Types of revelation – Revelation and good righteous dreams – Story of Waraqa bin naufal with Prophet.

MODULE II BOOK OF BELIEF (IMAN) 10

Revelation in starting prophet period – Revelation with great stress and hardness. Islam and Five principles – Invocation and faith – Deeds of faith – The feed is a part of Iman – Love the messenger from the faith – Sweetness of faith.

MODULE III PARTS OF FAITH 10

Love the Ansar from Iman – To run away from Al – Fitan – The grades in superiority of the belivers. Al Haya (Self respect, modesty) – Faith and Action – To greet is a part of Iman – Zulm (wrong) and Iman – The signs of hypocrite – In Allah’s cause is a part of faith.

MODULE IV BOOK OF KNOWLEDGE (Ilm) 10

Observe fasting and faith – Religion is very easy – Offering prayer is a part of faith – Faith increase and decrease – Zakath and Iman – Accompany the funeral procession from faith – Dialogue between Prophet and Jibril (Alai) about Iman. Superiority of Knowledge.

MODULE V SEARCH FOR KNOWLEDGE 10

Raising Questions and Voices for knowledge – Imam Questioning his companion-

Testing of Knowledge – Religious talk to students – Comprehend (Faiqh) in religion – Comprehending knowledge – Knowledge and wisdom. Journey of Prophet Moosa (Ala) – To go out in search of knowledge.

MODULE VI SEARCH FOR KNOWLEDGE 10

Religious knowledge and ignorance- superiority of knowledge – Rotation for learning knowledge – Knowledge from religious preacher – Repeating knowledge for understanding – Man teaching to his family – Eagerness to learn the prophet Hadith – Convey knowledge to absentees – Writing of knowledge – Memorization – Questioning for religious learning – Shy while learns.

L – 45; Total Hours –60

TEXT BOOKS:

1. Sahih al Bukhari By Imam Bukhari, Maktaba Asriya, Beirut, 2001.

REFERENCES:

1. Fat-hul Baari by Imam Ibn Hajar al Asqalani, Maktaba Ashrafiya, Deoband, India.

OUTCOMES:

At the end of the course, the student is expected to:

- Outline the life of the author and the significance of his methodology.
- Discuss about the revelation and its various types.
- Elaborate the status of Iman, Haya (Modesty) and importance of search of knowledge in Islam with special reference to journey of Moosa (Pbuh) and questioning for religious learning.

ISC 3213	QURAN AND MODERN ISSUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course aims to

- Introduce the importance of Fatwa and various fatwa centers in modern days.
- Explain modern issues related to Shariah and their solutions.
- Train the students to find solutions of certain issues based on Quran and Sunnah.

MODULE I **7**

Introduction to Modern Fatawa – Fiqh Academy of World Islamic Organization – Al Rabita – Research Academy of Egypt – Islamic Fiqh Academy in India – Shariah Scholars' Academy, USA - European council for research and fatwa.

MODULE II **8**

Modern Issues on divorce and maintenance.

MODULE III **7**

Modern issues on medical field – Brain death – Test tube baby – Organ transplantation.

MODULE IV **7**

Cloaning – Milk Bank – Blood Bank – Sperm bank.

MODULE V **8**

Bank transactions – Share Market – Insurance.

MODULE VI **8**

Research works carried out in the topic subject.

L – 45; Total Hours –45

TEXT BOOKS:

1. Quran and Modern Issues, Text book of Kilakarai Bukhari Aalim Arabic College,2017.

REFERENCES:

1. Fatawa Mu'sirah by Yousuf Al Qardhawi, Darul Wafa, Egypt, 1994.
2. Al Fiqh III, Al Manahij Al Dirasiyya, Ministry of Education, KSA, 2012. (E

Book).

OUTCOMES:

At the end of the course, the student is expected to:

- List out the authenticated Fatwa centres and Mufthis in modern days.
- Demonstrate solution of Modern issues published by Muftees.
- Find solution of certain issues in the light of Quran and Sunnah.

ISC 3214 DA'WAH & COMPARATIVE RELIGION L T P C

3 0 0 3

OBJECTIVES:

The course aims to:

- Introduce the student the science of comparative religion with an emphasis on the differences between Islam and other religions.
- Provide the student with an understanding of the beliefs of the nations from the beginning of creation until today.
- Familiarize the concept of various religions and their doctrines.
- Enlighten the students with the various issues related with religion and secularism.

MODULE I **7**

Introduction to Comparative religion- Definition of religion- Various types of people and religions in current scenario - Semitic and Non Semitic religions - Judaism – Definition and its origin - Basic beliefs in Judaism - Old Testament, Tanakh (Jewish Bible) and Torah – A brief study.

MODULE II **8**

Distorted doctrines of Jews - Mention of Prophet Muhammad (PBUH) in Jewish scriptures – The worst characters and behavior of Jews - Goals and objectives of today's Jews - Introduction to Masonic (Free Masonry) religion and its basics - History of Masonic religion and its founders

MODULE III **7**

Objectives and activities of Masonic followers throughout the history - Plans and means of Masonic religion in today's context - Proving that Masonic religion is a part of Judaism - Definition of Zionism and its origin - Evolution of Zionism and its goals - Introduction to Christianity and its nature - Differences between Judaism and Christianity.

MODULE IV **7**

Similarities between Islam and Christianity - Basic beliefs of Christianity - Differences between Quran and Bible - Concept of Trinity - What Bible says about Prophet Muhammad (PBUH)?- Sects of Christianity - Goals and objectives of today's Christians.

MODULE V **8**

Introduction to Hinduism - Basic Beliefs in Hinduism - Concept of God in Hinduism - Hindu Scriptures: Vedas, Upanishads, Puranas and Ithihas - Prophet Muhammad (PBUH) in Hindu scriptures - Similarities between Islam and Hinduism - Comparison: Prophet and Sages, Angels and Devas - Introduction to Buddhism and its principles.

MODULE VI **8**

Buddhist concepts: Eight fold path and Nirvana - Introduction to Sikhism and its concepts, Comparison between Islam and Sikhism - A brief study about communism and its concepts - Differences between Islam and communism - A clear explanation of nullifying the concept of Atheism - An introduction to Qadianism and its fallacies - A brief study about other faiths: Ismailism, Nuzairism, Bahaism, Tijanism etc.

L – 45; Total Hours –45

TEXT BOOKS:

1. Mukhtasarul Bayan Fee Muqaranathil Adyaan, Kilakarai Bukhari Aalim Arabic College, 2013.

REFERENCES:

1. Al Mujaz fee al Adhyan wal Madhahib al Muaasirah by Nasir bin Abdullah Qaffari& Nasir bin Abdul Kareem, 1st edition, Riyadh, 1992.
2. Muqaaranatul Adhyan by Mohamed Abu Zahrah, Cairo, 1974.
3. Islam, Christianity and Hinduism by Sandeela, Taj Publishers, 1998.

OUTCOMES:

At the end of the course, the student is expected to:

- Compare Islam with other religions in broader vision.
- Estimate the doctrines and principles of major religions.
- Analyze the differences between Islam and other religions in the aspect of Oneness of God, belief in the Day of resurrection etc.
- Demonstrate the concept of secularism in Islamic perspective.

ISC 3215 HISTORY OF MODERN ARABIC LITERATURE

L	T	P	C
3	0	0	3

OBJECTIVES:

The course aims to:

- Introduce the history of Arabic literature in the modern period.
- Highlight the development of modern prose and poetry.
- Learn biography and contribution of modern writers and poets.

MODULE I **7**

Impact of printing and journalism on Modern Arabic in 19th century - Contribution of Shaik Muhammad Abduhu - Jamaluddin Afghani.

MODULE II **8**

Mustafa Manfluthi and his writings - Mustafa Saadiq Rafi - Hussain Haikal - Ahmed Lutfi Syed and their contribution to Modern Arabic prose.

MODULE III **7**

Dr.Thaha Husain - Thoufeeq Hakeem.

MODULE IV **8**

Development of Modern Poetry - Shaa'ira Nahdha - Jail Jadeed.

MODULE V **7**

Shua'ra Mahjar - Jamaa'ath Abu lulu - Contribution of Al Baaroody - Ahmed Shouqi - Hafiz Ibraheem - Khaleel Mutran and their works.

MODULE VI **8**

Modernization of Arabic Poetry in the works of Al Aqqaad - Shukri and Al Maazini.

L – 45; Total Hours –45

TEXT BOOKS:

History of Modern Arabic literature by Bukhari Aalim Arabic College, 2008.

REFERENCES:

Thareekh al Adabil Arabi by showqi Dhaif - Dar al ma'arif, Cairo, 1960.

OUTCOMES:

At the end of the course, the student is expected to:

- Summarize the history of Modern Arabic literature.
- Analyze the development of modern prose and poetry.
- Criticize the works of modern writers and poets.

ISC 3216 ISLAMIC PHILOSOPHY & DOCTRINE

L	T	P	C
4	0	0	4

OBJECTIVES:

The course aims to:

- Introduce the Islamic philosophy and doctrine.
- Discuss about the death, visiting the graveyards, Munkar - Nakeer and after death.
- Learn about Mahshar, Sirathul Mustakeem, Meezan, Judgement, Heaven and hell.
- Teach the fate (Al Qaza wal Qadr), Faith and repentance.

MODULE I **10**

Zikr-il-mouth - Fazlu zikr-il-mouth- Bayanu Turki-fi Thahqeeki zikr il mouth fil khalb- Toolal amali wa faleezhilatu kasrul amali wa sababu kaifiyahu wa mua'alajathihi - Fazhilathu kasrul amali- Bayanu sababi fi toolal amali wa ilajihi- Bayanu murathibu na'asi fi toolal amali wa kasrihi- Bayanul mubadarathi ilal amali wa hadri A'afa'athi tha'kheer- Sacra'athul mouthi wa shiddathu wama yasthahibbu minal ahwali indhahu - Bayanul hasrathi indha liqa'au malikul mouthi bihikaayathi yu'rabu lisaanil haali anha

MODULE II **10**

Wafaathu rasoolullah(sas) wal khulafaaur rashideen min ba'dhihi- Wafaathu rasoolullah(sas) - Wafaathu Abi backar siddiq (rali) - Wafaathu Umar bin khatthab(rali)- Wafaathu Usman (rali) - Ali karramallahu wajhu - Kalaamul muhthazharewen minal khulafaa'i wal umaraai wal saliheen - Bayanu ahwalil jama'athi min khususi saaliheen mina sahabah wa tabiyeen wa min ba'adhihim min ahli thasuf(rali) - Akaawilul aarifeen alal janaayizi wal maqabir wa hukmu jiyarathil kuboor - Bayaanu haalil kabri wa akaawiluhum indhal kuboor - Bayaanu akaawilahum indhal mouthil waladhi

MODULE III **10**

Bayanu ziyaarathul kuboori wa dua'u lil mayitthi - Hakikathul mouthi wa ma yalhakaahul mayyithi fil kabri ila nafakhathi soori - Bayaanu hakikathil mouth - Bayaanu kalaamul kabri lil mayyithi wa kalaamul mouthaa imma bi lisaanil mukaal aau bi lisaanil haal - Bayaanu adhaabil kabri wa sua'alu munkar wa nakeer - Feema arafa min akhwaalil mouthaa bil mukaashafathi fil manaam - Bayaanu manaamathul mashaayikh(rah) - Kitabu zikrul mouth fi Ahwaalil mayyithi min wakthi nafakhathi soori ila aakhar isthikraar fi jannathi wa naar wa tafseel ma baina yadihi minal ahwaali wa akthaari wa feehi nafakathi soor - Sifaathu nafakathi soor

MODULE IV **10**

Sifaathu arlul mahshar wa ahlahu - Sifaathul irk - Sifaathu toola yaumul kiyamathi - Sifaathu yaumal kiyaamathi wadahihi wa asaamihi - Sifaathu mas'alath - Sifaathu meezan- Sifaathu khusama'u wardul muzham - Sifaathu sirath - Sifaathu shafaa'ath - Sifaathu hawzh - Fi sifaathi jahannam wa ahwaluha wa ankaaluha- Fi sifaathil jannathi wa asnaafu nayeenuha.

MODULE V **10**

Belief in Al Qaza and Al Qadr- free will of human being

MODULE VI **10**

Faith & Deed – Faith and sinful deed- repentants

L – 60; Total Hours –60

TEXT BOOKS:

1. Ihya Ulum al Deen by Imam Ghazzali, Beirut, 1999.
2. Aqeedah al Muslim by Sheik Muhammad Al Ghazzali, 8th edition, Jeddah 1996.

REFERENCES:

1. Hujjathullahil Baaliga, Shah Waliullah Dehlavi, Maktaba Deoband, New Delhi.

OUTCOMES:

At the end of the course, the student is expected to:

- Summarize the Islamic philosophy and doctrine.
- Describe the death and human destination after the death.
- Clarify Mahshar, Sirathul Mustakeem, Meezan, Judgement, Heaven and hell.
- Explain the fate (Al Qaza wal Qadr), Faith and repentance.

ISC 3217	Journal Arabic, Web Translation & SAP	L	T	P	C
		1	0	0	1

OBJECTIVES:

The course aims to:

- Introduce the Arabic usages in journals and magazines.
- Teach the various aspects of SAP translation.

MODULE I **2**

News clippings – Advertisements

MODULE II **3**

Memorandum of Understanding (MOU) – Rental Agreements

MODULE III **3**

Commercial Claims – Political Reports

MODULE IV **2**

Ministries approval request for cable laying work in the GCC region - Minutes of Meeting

MODULE V **2**

Material Management - HR & Staff Affairs

MODULE VI **3**

Webpage Translation - Payment gateways

L – 15; Total Hours –15

TEXT BOOKS:

1. Journal Arabic, Haneef Palliyath, Al Huda Book Stall, Calicut.

REFERENCES:

1. SAP Translation, Arabic – English, Saudi Arabia.

OUTCOMES:

At the end of the course, the student is expected to:

1. Understand the Arabic terms in Journals and magazines.
2. Translate the documents especially related to SAP projects.

ISC 3218	Project	L	T	P	C
		0	0	2	2

OBJECTIVES:

The course aims to:

- Teach the student to do a project on any topic related to Islamic Studies.
- Train him the research methodology and practices.

OUTCOMES:

At the end of the course, the student is expected to:

- Do a project on a relevant topic.
- Analyze the various aspects of the research.

VISION AND MISSION OF THE SCHOOL OF LIFE SCIENCES

VISION

To attain new heights in biotechnology research, shaping life sciences into a premier precision tool for the future for creation of wealth and ensuring social justice-specially for the welfare of the poor

MISSION

The mission of the school of life sciences and Technology is to maximize the benefits of biotechnology to the University, the nation and the globe by being an excellent quality, comprehensive, multidisciplinary school that supports, coordinates, disseminates and advances biotechnology in the areas of social welfare and entrepreneurship.

PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES
B.Tech BIOTECHNOLOGY

PROGRAMME EDUCATIONAL OBJECTIVES

- "This course will facilitate the graduates to be professionally competent in Biotechnology to solve the problems in environmental, food, biochemical and biomedical engineering.
- This course will offer students with a solid foundation in Chemical engineering and Biological Sciences, to enable them to work on engineering applications in biotechnology as per the requirement of the industries, and also will enable the students to pursue higher studies and research.
- This course will enable students to acquire knowledge on the fundamentals of Biochemistry, Cell biology, Microbiology and Molecular biology to enable them to understand basic concept in modern biology and help them to build their carrier in this field.
- This course will facilitate the students to acquire knowledge in fields such as genetic engineering, protein engineering, and Bioprocess engineering and associated downstream processing enabling their application through Bioprocess technology.
- This course will aid the students to learn the recent developments in the field of Genomics, Proteomics, Cancer Biology and modern drug discovery approaches. It will also empower the students to have advanced focus on the molecular basis of diseases and development of advanced therapeutics.
- This programme will teach students the importance of Bioethics, entrepreneurship, communication and management skills.
- This course will also offer the graduates to demonstrate their proficiency in theory and practice of bio-techniques through life-long learning and provide confidence to perform as an individual and / or member of a team with professional and ethical behavior.

PROGRAMME OUTCOMES

- Graduates of the course will have strong background in the interface of modern biology and advanced bioprocess technology and be able to use these tools in industry and/or institutes wherever necessary.

- Graduates will identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural science, and engineering sciences.
- Graduates will demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- Graduates of the course will have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
- Graduates of the course will function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- Graduates of the course will communicate effectively on complex engineering activities with the engineering community and with the society at large.
- Graduates of the course will apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering and technology practice.
- Graduates of the course will design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.

SCHOOL OF LIFE SCIENCES (SLS)

B.TECH (BIOTECHNOLOGY)

REGULATIONS 2013 - 2014

COURSE DURATION: 4 YEARS (8 SEMESTERS)

CURRICULUM

SEMESTER I

Sl. No.	Course Code	Course Title	L	T	P	C
1.	ENB1181	English	3	0	0	3
2.	MAB1182	Fundamentals in Mathematics	3	1	0	4
3.	PHB1181	Physics	3	0	0	3
4.	CHB1181	Chemistry	3	0	0	3
5.	BTB 1101	Fundamentals in Biotechnology	4	0	0	4
6.	SSB 1181	Introduction to Economics	3	0	0	3
7.	PHB1182	Physics Laboratory	0	0	2	1
8.	CHB1182	Chemistry Laboratory	0	0	2	1
9.	GEB1103	Computer Programming & Applications Laboratory	2	0	2	3
		Total Credits				**25**

SEMESTER II

Sl. No.	Course Code	Course Title	L	T	P	C
1.	BTB1211	Biochemistry	3	0	0	3
2.	BTB1212	Cell Biology	4	0	0	4
3.	BTB1213	Microbiology	3	0	0	3
4.	BTB1214	Bio-Organic Chemistry	3	0	0	3
5.	BTB1215	Biophysics	3	0	0	3
6.	SSB1182	Sociology, Ethics and Human Values	3	0	0	3
7.	BTB1216	Biochemistry – Lab	0	0	4	2

8.	BTB1217	Cell Biology– Lab	0	0	3	1
9.	BTB1218	Microbiology – Lab	0	0	2	1
10.	ENB2182	Communication Skills - Lab	0	0	2	1
			Total Credit			**24**

SEMESTER III

Sl. No.	Course Code	Course Title	L	T	P	C
1.	BTB2101	Enzyme Technology	4	0	0	4
2.	BTB2102	Bioinformatics	3	0	0	3
3.	BTB2103	Fundamentals of Chemical Engineering	4	0	0	4
4.	BTB2104	Biostatistics	3	1	0	4
5.	BTB2105	Molecular Biology	3	0	0	3
6.	BTB2106	Basic Bioanalytical Techniques	3	0	0	3
7.	BTB2107	Bioinformatics- Lab	0	0	3	1
8.	BTB2108	Molecular Biology – Lab	0	0	3	1
9.	BTB2109	Bioanalytical Techniques – Lab	0	0	3	1
			Total Credit			**24**

SEMESTER IV

Sl. No.	Course Code	Course Title	L	T	P	C
1.	BTB2211	Genetic Engineering	4	0	0	4
2.	BTB2212	Immunotechnology	3	0	0	3
3.	BTB2213	Animal Biotechnology	3	0	0	3
4.	BTB2214	Plant Biotechnology	3	0	0	3
5.	BTB2215	Industrial Biotechnology	3	1	0	4
6.	GEB3201	Environmental Science and Engineering	3	0	0	3
7.	BTB2216	Genetic Engineering–Lab	0	0	3	1
8.	BTB2217	Immunology–Lab	0	0	3	1
9.	BTB2218	Animal and Plant cell culture- Lab	0	0	3	1
			Total Credit			**23**

SEMESTER V

Sl. No.	Course Code	Course Title	L	T	P	C
1.	BTB3101	Molecular Pathology	3	0	0	3
2.	BTB3102	Chemical and Bio Thermodynamics	3	0	0	3
3.	BTB3103	Food Biotechnology	4	0	0	4
4.	BTB3104	Bioprocess Engineering	4	0	0	4
5.	BTB3105	Protein Engineering	3	0	0	3
6.	BTB3106	Chemical Reaction Engineering	4	0	0	4
7.	BTB3107	Bioprocess Lab	0	0	3	1
8.	BTB3108	Chemical Reaction Engineering Laboratory	0	0	3	1
9.	BTB3109	Protein Engineering Lab	0	0	3	1
		Total Credit				**25**

SEMESTER VI

Sl. No.	Course Code	Course Title	L	T	P	C
1.	BTB3211	Structural Biology	4	0	0	4
2.	BTB3212	Tissue Engineering	4	0	0	4
3.	BTB3213	Developmental Biology	4	0	0	4
		Group 1 (Elective)	3	0	0	3
		Group 1 (Elective)	3	0	0	3
4.	BTB3214	Cancer Biology	3	0	0	3
5.	BTB3215	Gene Manipulation lab	0	0	3	1
6.	ENB2282	Confidence Building and Behavioural Skills	0	0	2	1
		Total Credit				**23**

SEMESTER VII

Sl. No.	Course Code	Course Title	L	T	P	C
1.	BTB4101	Biomedical Instrumentation	4	0	0	4
2.	BTB4102	Proteomics & Genomics	4	0	0	4
3.	BTB4103	Fermentation Technology	4	0	0	4
4.	BTB4104	Nano Biotechnology	4	0	0	4
5.		Group 2 (Elective)	3	0	0	3
6.		Group 2 (Elective)	3	0	0	3
7.	BTB4105	Fermentation- Lab	0	0	3	1
8.	BTB4106	Biomedical Instrumentation Lab	0	0	3	1
			Total Credit			**24**

SEMESTER VIII

Sl. No.	Course Code	Course Title	L	T	P	C
1.		Group 3 (Elective)	3	0	0	3
2.	BTB4211	Project work/Viva-voce	0	0	18	9
			Total Credit			**12**
			Total Credits			**180**

ELECTIVES (Group 1, Group 2 & Group 3)

Group 1 (Elective)

(Two to be opted)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	BTBX01	Pharmaceutical Biotechnology	3	0	0	3
2.	BTBX02	Medical Biotechnology	3	0	0	3
3.	BTBX03	Drug Design and Development	3	0	0	3
4.	BTBX04	Intellectual Property Rights	3	0	0	3
5.	BTBX05	Recombinant DNA Technology	3	0	0	3

Group 2 (Elective)

(Two to be opted)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	BTBX06	Bioreactor Design and Analysis	3	0	0	3
2.	BTBX07	Molecular & Cellular Diagnostics	3	0	0	3
3.	BTBX08	Biomedical Engineering	3	0	0	3
4.	BTBX09	Biosafety and Bioethics	3	0	0	3
5.	BTBX10	Healthcare Biotechnology	3	0	0	3

Group 3 (Elective)

(Two to be opted)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	BTBX11	Molecular Farming	3	0	0	3
2.	BTBX12	Stem Cells in Health Care	3	0	0	3
3.	BTBX13	Transport phenomena in Bioprocess	3	0	0	3

GENERAL ELECTIVES

1.	GEBX22	National Service Scheme	0	0	3	1

SEMESTER I

ENB1181	ENGLISH	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To enable students to use language appropriately and effectively
- To help learners improve their vocabulary and to enable them speak fluently and appropriately in different contexts.
- To help students develop listening skills for academic and professional purposes
- To develop reading comprehension skills and enhance their ability to read official documents.
- To develop their creative thinking and practice creative writing.

MODULE I BASIC LANGUAGE SKILLS AND GRAMMAR 4

Conducting a language proficiency test in the language laboratory to assess the use of various parts of speech, vocabulary, phrasal verbs and idiomatic expressions of students.

MODULE II LISTENING 8

Listening to BBC radio plays and VOA special lessons to teach Phonetics, accent and intonation of spoken English, Appreciation and critical review of popular movies like 'My Fair Lady', 'Sound of Music'. (Excerpts from the movies) - Historical/popular speeches made by Winston Churchill, Abraham Lincoln (Gettysberg's Address), Swami Vivekananda.

MODULE III SPEAKING 8

(a) Self introduction – pair work – introducing one another – short conversations – exchanging opinions – agreement /disagreement

(b) Short presentation (extempore speech) based on visuals – Personal narrations

MODULE IV READING 8

Newspaper articles, circular, notices – Note making – vocabulary extension – Critical review of newspaper articles, Science fiction- Issac Asimov's "The

Dead Past"(Abridged version) - Wings of Fire – Creative thinking – retelling a story with different ending; critical appreciation of plot and characters

MODULE V CREATIVE WRITING 8

(a) Writing slogans for Advertisements

(b) Writing descriptive paragraphs based on visuals

MODULE VI ENGLISH FOR ACADEMIC AND BUSINESS PURPOSES 9

(a) English for academic purpose: letters to the editor, letter seeking permission for industrial visit, letter inviting a dignitary for technical symposium

(b) English for Business purpose: Telephone etiquette – telephone conversations – taking and leaving phone messages.

Total: 45

REFERENCES:

1. Mohan, Krishna, Meera Bannerjee, 'Developing Communication Skills', Macmillan India Ltd. Chennai (2001).
2. Sen , Leena 'Communication Skills' Prentice Hall, New Delhi (2004).
3. Rutherford , Andrea J. 'Basic Communication Skills For Technology' Pearson Education Asia (2002).
4. Grant Taylor, ' English Conversation Practice' Tata Mcgraw Hill , New Delhi (2001)
5. P.K.Dutt, G. Rajeevan and C.L.N. Prakash, 'A Course in Communication Skills', Cambridge University Press, India (2007).

OUTCOME:

- After completion of the course, students will have the ability to communicate correctly and effectively in academic and professional contexts through exposure and practice in LSRW skills.

MAB1182 FUNDAMENTALS IN MATHEMATICS

L	T	P	C
3	1	0	4

OBJECTIVES:

The course is aimed a developing the skills in additional areas of Engineering Mathematics, necessary for grooming them into successful engineers. The topics introduced will serve as basic tools for specialized studies in many Engineering fields.

MODULE I MATRICES **12**

Eigenvalue Problems – Eigenvalues and Eigenvectors of a real matrix, Engineering Applications – Properties of Eigenvalues and Eigenvectors – Cayley Hamilton Theorem (without proof) – Orthogonal matrices – orthogonal transformations of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation.

MODULE II TRIGONOMETRY **12**

Expansions of $\sin^n\theta$ and $\cos^n$ in powers of sin and cos – Expansions of $\sin^n$ and $\cos^n$ interms of sines and cosines of multiples of – Hyperbolic and inverse hyperbolic functions – Logarithm of complex numbers – Separation of complex functions into real and imaginary parts – Simple problems.

MODULE III THEOR Y OF EQUATIONS **12**

Introduction - surds and irrational roots – simple problems – equations whose roots are in A.P, G.P and in H.P – Relations between the roots and coefficients – Symmetric functions – Formation of equations – Decreasing and Increasing the roots – Transformation of equation – Reciprocal equations.

MODULE IV DIFFERENTIAL CALCULUS **12**

Differentiation and Derivatives of simple functions – Successive Differentiation – Various forms of Algebraic and Trigonometric functions – Simple problems.

MODULE V INTEGRAL CALCULUS **12**

Various types of Integration – Reduction formula for $e^{ax}x^n$, $\sin^n x$, $\cos^n x$, $\sin^n x \cos^m x$ (without Proof) – Simple Problems.

Total: 60

REFERENCES:

1. Veerarajan.T., “Engineering Mathematics “(5th edition) Tata Mc Graw Hill Publishing Co. New Delhi, 2012.
2. Grewal B.S., “Higher Engineering Mathematics” (42nd edition), Khanna Publishers, New Delhi, 2012.
3. Kreyszig, E., “Advanced Engineering Mathematics“, 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
4. Peter V. O'Neil, “Advanced Engineering Mathematics”, 7th edition, Cengage Learning, 2011.
5. Dennis G. Zill, Warren S. Wright, “Advanced Engineering Mathematics”, 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
6. Alan Jeffrey, “Advanced Engineering Mathematics”, Academic Press, USA, 2002.
7. Ramana, B.V, “Higher Engineering Mathematics” Tata Mc Graw Hill Publishing Co. New Delhi, 2006.
8. Venkataraman, M.K., “Engineering Mathematics”, Volume I, 2nd edition, National Publishing Co., Chennai, 2003.

OUTCOMES:

On completion of the course the students will be able to

- solve Eigenvalue and Eigenvector problems
- solve trigonometry problems
- use differential calculus and integral calculus for solving problems pertaining to Engineering applications.

PHB1181	PHYSICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce basic physics concepts relevant to Engineering and Technology students.
- To get familiarize with solving problems in basic physics.
- To acquaint applications of physics for Engineering issues.

MODULE I PROPERTIES OF MATTER **7**

Elasticity – Stress strain diagram – Factors affecting elasticity – Twisting couple on a wire – Shaft – Torsion pendulum – Depression on a cantilever – Young's modulus by cantilever – Uniform and non-uniform bending – Viscosity.

MODULE II CRYSTAL PHYSICS **6**

Introduction – Space lattice – unit cell – Bravais lattices – Miller Indices for cubic crystals – Inter planar spacing in cubic lattice – Simple crystal structures – SC, BCC, FCC and HCP structures – Atomic radius, coordination number, Packing factor calculation – Crystal imperfections.

MODULE III QUANTUM PHYSICS **7**

Black body radiation – Planck's theory of radiation – Deduction of Wien's displacement law and Rayleigh – Jeans law from Planck's theory – Compton effect – Theory and experimental verification – Dual nature of matter – de Broglie's wavelength- Physical significance of wave function – Schroedinger wave equation – Time independent and time dependent wave equation – Particle in one dimensional box.

MODULE IV WAVE OPTICS **9**

Interference theory – Air wedge – Michelson interferometer – Diffraction – Fresnel and Fraunhofer diffraction - Polarization – Double refraction – Theory of plane polarized, circularly polarized and elliptically polarized light – Quarter wave plate, Half wave plate – Production and detection of plane, circularly and elliptically polarized lights – Photoelasticity – Photo elastic effect – Stress optic law – Effect of stressed model in a plane polariscope (qualitative) –Photo elastic bench.

MODULE V LASER & FIBER OPTICS **9**

Principle of spontaneous emission and stimulated emission - Characteristics of laser light -Einstein's A & B coefficients (derivation) – Population inversion - pumping - Nd:YAG laser – CO_2 laser – Applications – Material processing and holography (construction and reconstruction of hologram)- Optical fiber – Principle and propagation of light in optical fibers – Numerical aperture and acceptance angle – Types of optical fibers - applications – Fiber optic communication system (block diagram only)- Fiber optic sensors (displacement and pressure sensors (qualitative), Medical endoscope.

MODULE VI ULTROSONICS AND NDT **7**

Ultrasonics – Production – Magnetostriction and piezo electric methods – Properties of ultrasonic waves – Detection of ultrasonic waves – Applications –Ultrasonic interferometer- Acoustical grating – SONAR – Depth of sea – Measurement of velocity of blood flow – Non Destructive Testing (NDT) methods – Ultrasonic flaw detector – A,B & C scanning methods.

TOTAL: 45

REFERENCES:

1. Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2003.
2. Palanisamy P.K., Physics for Engineers, Vol1 & Vol2, 2nd Edition, Scitech Publications, 2003.
3. Uma Mukherji, "Engineering Physics", Narosa Publishing House, New Delhi, 2007.
4. Charles Kittel, "Introduction to solid state physics", 7th Edition, John Wiley & sons (ASIA) Pvt. Ltd, 2008.
5. Avadhanulu M.N., "Engineering Physics", 1st Edition, S.Chand & Company Ltd., New Delhi, 2007.
6. Schiff, "Quantum Mechanics", 3rd Edition, Tata McGraw-Hill Education, 2010.
7. Rajendran V. and Marikani A., "Applied Physics for Engineers", 3rd Edition, Tata McGraw Hill Pub. Co. Ltd, New Delhi, 2003.
8. William T. Silfvast, "Laser Fundamentals", 2nd edition, Cambridge University Press, 2004.

OUTCOMES:

At the end of the course, the students will be able to

- Apply the knowledge of properties of matter in Engineering Mechanics and Fluid Dynamics.
- Characterize Engineering materials
- Use Lasers for Fiber Optics Technology and Material Processing
- Do non-destrictive testing using Ultrasonic Techniques

CHB1181	CHEMISTRY	L	T	P	C
		3	0	0	3

OBJECTIVES:

To make students conversant with the

- Water quality for potable and industrial purposes.
- Different engineering materials, their physico-chemical properties and specific applications.
- Concept of electrochemistry, corrosion and theories of corrosion.
- Principles of spectroscopy and applications.
- Basic principles of green chemistry and the need for green processes in industries.

MODULE I WATER TECHNOLOGY **8**

Introduction – Impurities present in water – Hardness, Types of Hardness, Estimation of Hardness (EDTA method) (Problems) – Alkalinity, Estimation of Alkalinity – Disadvantages of hard water in industries – Conditioning methods: external treatment method: Ion exchange method – internal treatment: colloidal, phosphate, calgon, carbonate methods – drinking water standards (BIS) – treatment of domestic water: screening, sedimentation, coagulation, filtration, disinfection: by chlorination, UV treatment, ozonization – desalination and reverse osmosis (principle only).

MODULE II ENGINEERING MATERIALS **8**

Abrasives: Moh's scale of hardness – natural abrasives: diamond, corundum, emery, garnets and quartz – artificial abrasives: silicon carbide, boron carbide; Refractories: characteristics, classification – acidic, basic and neutral refractories, properties – refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling – general method of manufacture of refractories, properties and uses of high alumina bricks, magnesite and zirconia bricks; Nanomaterials: Definition – types of Nanomaterials; nanofilms, nanowires, carbon nanotubes, quantum dots and fullerenes (C60) – Size and shape dependent optical, electrical, thermal and mechanical properties; Synthesis of nanomaterials – Top down and bottom up approach; Applications of nanomaterials – Catalysis, Electronics and Telecommunication, Medicines, Composites and Energy.

MODULE III ELECTROCHEMISTRY AND CORROSION 9

Construction of a cell – Standard and single electrode potential – electrochemical series – EMF and its measurement – Nernst equation, application and problems – Types of electrodes: standard hydrogen electrode, calomel electrode, ion selective electrode - glass electrode and determination of pH using glass electrode – polarization, overvoltage, decomposition potential (statements only) – Conductometric and potentiometric titrations; Corrosion: Definition – Dry corrosion and Wet corrosion with mechanisms – Factors influencing corrosion.

MODULE IV CHEMISTRY OF POLYMERS 6

Monomers – functionality – polymer – degree of polymerization – classification – polymerization techniques: addition, condensation and co-polymerization with example – mechanism of polymerization: free radical, cationic and anionic mechanism – thermoplastics and thermosetting plastics with examples – compounding and moulding of plastics: injection moulding and compression moulding.

MODULE V SPECTROSCOPY 9

Electromagnetic spectrum – absorption of radiation – electronic, vibrational, translational and rotational – intensities of spectral lines – Beer-Lambert's Law (Problems) – Colorimetric analysis: estimation of concentration of a solution – Flame photometry: theory, instrumentation (block diagram only) and application – UV-Visible spectroscopy: Principles, instrumentation (block diagram only) and simple applications – IR spectroscopy – simple applications only.

MODULE VI GREEN CHEMISTRY 5

Introduction – Significance – Industrial applications of green chemistry; Green technology – Latest green laboratory technique for saving experimental resources and infrastructural framework; Principles of green chemistry – R4M4 model (Reduce, Reuse, Recycle, Redesign; Multipurpose, Multidimensional, Multitasking, Multi-tracking) – Life cycle analysis technique (cradle to grave approach)

TOTAL: 45

REFERENCES:

1. Jain P.C and Renuka Jain, 'Physical Chemistry for Engineers', Dhanpat Rai and Sons, New Delhi. (2001).
2. Paul T. Anastas, John C. Warner, 'Green Chemistry: Theory and Practice', Oxford University Press, (1998).
3. Bahl B.S., Tuli and Arun Bahl, 'Essentials of Physical Chemistry', S. Chand and Company Ltd., New Delhi, (2004).
4. Kuriacose J.C. and Rajaram J, 'Chemistry in Engineering and Technology', Volume1, Tata McGraw- Hill publishing company, New Delhi, (1996).
5. Puri B.R., Sharma L.R. and Madan S. Pathania, 'Principles of Physical Chemistry', Shoban Lal Nagin Chand and Co., Jalandhar, (2000).

OUTCOMES:

At the end of the course, students will be able to

- Estimate the degree of hardness in water; solve related problems and treatment methods for potable water.
- Select materials for specific engineering applications.
- Use electrochemistry principles to understand the mechanism of corrosion.
- Analyze trace quantity of metals using instrumental methods.
- Realize the need of green practices in industries.

BTB1101 FUNDAMENTALS IN BIOTECHNOLOGY

L	T	P	C
4	0	0	4

OBJECTIVES:

- Provide a breadth of knowledge of basic principles and concepts of biological sciences.
- Provide knowledge content across the full range of biology.
- Demonstrate knowledge of form, function, mechanism, organization, scale, hierarchy, diversity and evolution.

MODULE I INTRODUCTION TO BIOTECHNOLOGY **10**

Definitions, Historical perspectives, Scope and Importance, Commercial potential, An interdisciplinary challenge, A Quantitative approach, Classical vs. Modern concepts, Manufacturing quality control, Product Safety, Good manufacturing practices, Good laboratory practices, Marketing, Biotechnology in India and Global trends

MODULE II MICROBIAL CULTURE AND APPLICATIONS **10**

Introduction, Microbial Culture Techniques, Measurement and Kinetics of Microbial Growth, Scale up of Microbial Process, Isolation of Microbial Products, Strain Isolation and Improvement, Applications of Microbial Culture Technology, Bioethics in Microbial Technology.

MODULE III PROTEIN ENGINEERING **10**

Introduction to the world of Proteins, 3-D Shape of Proteins, Structure Function relationship in Proteins, Purification of Proteins, Characterization of Proteins, Protein based products, Designing Proteins, Proteomics.

MODULE IV BASICS OF RDNA TECHNOLOGY **10**

Introduction, Tools of rDNA Technology, Making Recombinant DNA, DNA Library, Introduction of Recombinant DNA into host cells, Identification of Recombinants, Polymerase Chain Reaction (PCR), DNA Probes, Hybridization Techniques, DNA Sequencing, Site-directed mutagenesis.

MODULE V GENOMICS AND PROTEOMICS **10**

Introduction, Genome Sequencing Projects, Gene prediction and Counting,

Genome similarity, SNPs and comparative genomics, Functional Genomics, History of Bioinformatics, Sequences and Nomenclature, Information Sources, Analysis using Bioinformatics tools.

MODULE VI PLANT AND ANIMAL CELL CULTURE AND APPLICATION 10

Introduction, Cell and Tissue Culture Techniques, Applications of Cell and Tissue Culture, Gene Transfer Methods in Plants, Transgenic Plants with Beneficial Traits, Animal Cell CultureTechniques, Characterization of Cell Lines, Scale-up of Animal Culture Process,Applications of Animal Cell Culture

TOTAL: 60

REFERENCES

1. Concepts in Biotechnology,C.F. Bryce,D. Balasubramanian,Universities Press.
2. Biotechnology by Smith, Cambridge Press.

OUTCOMES:

At the end of the course students will be able to

- Understand and apply fundamental biological principles from the major areas of biology (ecology, genetics, evolution, cell and molecular biology, and organism biology).
- Describe basic biological concepts and principles.
- Understand that biology has a chemical, physical, and mathematical basis.
- Explain the importance of the scientific method to understanding natural phenomena.

SSB1181 INTRODUCTION TO ECONOMICS

L	T	P	C
3	0	0	3

OBJECTIVES:

Primarily to give an overview of fundamentals of economics to the engineering students in particular

- To introduce the basic concepts of demand, supply and equilibrium.
- To familiarize on National Income concepts.
- To provide fundamental concepts of money, banking and exchange.
- To give an idea on industrial sector, markets and trade.
- To give an overview on five year plans, budget, policies and taxation.
- To provide an overview of Indian economy and the role of engineers in economic development.

MODULE I INTRODUCTION **8**

Classification of economy – open and closed economy – sectors of economy – Basic principles of micro economics – supply, demand and equilibrium, elasticity of demand- pricing models.

MODULE II NATIONAL INCOME DETERMINATION **7**

National Income concepts – GNP, GDP, disposable Income; Aggregate demand and Aggregate supply, macroeconomic equilibrium - concepts of MPS, APS, MPC APC, Inflation – prices indices WPI, CPI and Inflation control.

MODULE III MONEY AND BANKING **7**

Monetary system - Role of Central Bank – Monetary policy – Commercial banks, Development banks; Money market – the role of money.

MODULE IV INDUSTRY, MARKET AND TRADE **7**

Public and private sectors – Contribution to the national economy, Industrial policy. Markets – labor, capital and debt market. Trade: domestic and International trade.

MODULE V BUDGET, POLICIES AND INDICATORS 8

Economic development – Five year plans, Macro-economic indicators; Central budget: Government revenue-tax and non-tax revenue, government expenditures-plan and non-plan expenditures – Fiscal policy – The impact of the budget on the economy.

MODULE VI ECONOMIC GROWTH AND THE ROLE OF ENGINEERS 8

India Economy – the role of market in the Indian economy – Development in the post independence era – Growth of the economy, Globalization and liberalization – reforms made and their effects, challenges and opportunities, Engineers – Engineers' contributions to the economic growth.

TOTAL: 45

REFERENCES:

1. Vanitha Agarwal, 'Macroeconomics: Theory and Practice', Pearson, (2010).
2. Dwivedi D.N, 'Macroeconomics: Theory and Policies', 3rd edition; McGraw Hill, (2010).
3. Samuelson,Paul A., 'Macroeconomics', 19th edition., TMH, (2009).
4. Gupta G.S, 'Macroeconomics: Theory and Applications', 3rd edition; TMH, (2007).

OUTCOMES:

- Students will have an exposure to the basic concepts of microeconomics and macroeconomics.
- Students will have gained knowledge in government budget, economic planning and its implementation, money, banking and trade.
- They will have learnt about the economic reforms introduced in Indian economy and the role of engineers towards the economic growth and development of the country.

PHB1182	PHYSICS LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To understand the basic concepts of properties of matter, wave optics
- To understand the properties of ultrasonic and Laser.
- To understand the crystal growth technique.
- To correlate the experimental results with the theoretical values.

LIST OF EXPERIMENTS:

1. Torsional Pendulum- Determination of rigidity modulus of a given wire.
2. Determination of coefficient of viscosity of a liquid by Poiseuille's method.
3. Determination of Young's modulus of a beam using non – uniform bending method.
4. Determination of a thickness of a given wire – Air wedge.
5. Spectrometer- determination of wavelength of given source by using grating.
6. Determination of velocity of ultra sonic waves – Ultrasonic Interferometer.
7. Determination of numerical aperture and acceptance angle of an optical fiber.
8. Determination of particle size using Laser.
9. Growth of crystal by slow evaporation technique.
10. Determination of angle of divergence of Laser beam.
11. Photo electric effect experiment.

REFERENCE

Laboratory Manual

OUTCOMES:

On completion of this course, the student will know

- Properties of matter, wave optics and quantum physics
- Properties and application of Ultrasonic and Laser
- Principle and concept of crystal growth technique.

CHB1182	CHEMISTRY LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

To make students conversant with the

- Estimation of hardness and TDS in water samples.
- Construction of cell and determination of EMF.
- Estimation of pH of solutions.
- Verification of Beer Lambert's law.

LIST OF EXPERIMENTS:

1. Estimation of hardness in domestic water.
2. Estimation of total dissolved solids (TDS) in domestic water
3. Construction and determination of emf of a cell.
4. Determination of single electrode potential.
5. Estimation of strong acid in the industrial effluents
6. Estimation of Fe2+ present in unknown sample – by Potentiometry
7. Verification of Beer-Lambert's law and estimation of Cu2+ present in unknown sample.
8. Estimation of Na and K present in the agricultural field – by flame photometry.
9. Study of effect of inhibitors in free radical polymerization (Demo)

REFERENCE

Laboratory Manual

OUTCOMES:

At the end of the course, students will be able to

- Estimate the degree of hardness and TDS in water samples.
- Construct and calculate EMF of cell.
- Apply the concept of Beer lamberts law.

GEB1103	COMPUTER PROGRAMMING AND APPLICATIONS LABORATORY	L	T	P	C
		2	0	2	3

OBJECTIVES:

- Expose fundamental concepts and techniques in programming
- Give coverage on application logic in programming
- Focus on solving practical problems based on analyzing, designing, and implementing computer programs

MODULE I FUNDAMENTALS OF COMPUTERS **5**

Evolution - Generations - Classifications - Applications - Computer organization -Hardware in a typical computer Identification - Booting - Booting error messages - Number system - Number system conversions

MODULE II BASIC PROGRAMMING AND DEBUGGING **5**

Software types - Types of Operating systems - Software development steps - Information technology and internet - The programming tool - Structure of a basic program - Hello world program - Debugging it - Character set - Delimiters - Keywords, identifiers - Constants - Variables -- Tools and help features - Comments in a program

MODULE III INPUT AND OUTPUT **5**

Data types - Type conversions - Input/Output: Formatted functions - Unformatted functions - Library functions - Debugging the code - Systems software: Compiler - interpreter- linker - loader - Finding the correct answer given a code snippet and justifying it

MODULE IV PROBLEM SOLVING **5**

Problem solving techniques: Algorithm, flowchart - Pseudo-code - Examples of simple problems in algorithms and flowcharts - Sorting and Searching - Characteristics of a good program - Generations of programming language

MODULE V OPERATORS AND DECISION STATEMENTS **5**

Properties of operators - Priority of operators - Arithmetic relational logical and bitwise operators - If -if else- nested if else- goto- switch case - nested switch case - for loops - nested for loops - while loop - do-while loop - break and continue statement

MODULE VI ARRAYS AND LOOP CONTROL STATEMENTS 5

Arrays - Initialization - Definition - Characteristics - One dimensional array - Two dimensional arrays - Multi dimensional arrays - Predefined streams - Operation with arrays - Sorting and searching - Structures - Operations on structures

LIST OF EXPERIMENTS:

1. Computer organization -Hardware in a typical computer Identification - Booting - error messages and what it means
2. Types of Operating systems - Windows and Linux
3. Structure of a basic program - Hello world program - Debugging it
4. Data types Type conversions
5. Input/Output: Formatted functions - Unformatted functions - Library functions
6. Properties of operators - Priority of operators - Arithmetic relational logical and bitwise operators
7. If - if else- nested if else- goto- switch case - nested switch case - for loops - Nested for loops - while loop - do-while loop - break and continue statement
8. Arrays - Operation with arrays
9. Sorting and searching

REFERENCES:

1. Ashok N Kamthane, "Computer Programming", 2nd Edition, Pearson Education, 2012.
2. Paul J. Deitel, Deitel& Associates, "C How to Program", 7th Edition, Pearson, Education, 2012.

OUTCOMES:

Students who complete the course will be able to

- Understand Modular design, logic flow, data abstraction
- Describe basic programming constructs, functions and I/O
- Write down programs for sorting and searching Algorithms
- Write down programs for developing cycle for different applications
- Debug programs while solving practical problems in programming.

SEMESTER- II

BTB1211 BIOCHEMISTRY L T P C
3 0 0 3

OBJECTIVES:

The course aims to provide an advanced understanding of the core principles and topics of Biochemistry and their experimental basis, and to enable students to acquire a specialized knowledge and understanding of selected aspects by means of a stem/branch lecture series and a research project.

MODULE I AMINO ACIDS, CARBOHYDRATES AND LIPIDS 7

Structure, Function, Methods of Characterization, Separation Techniques based on the structure and properties of amino acids, Classification, Structure, Function, Separation and Characterization Techniques of mono and polysaccharides and lipids.

MODULE II NUCLEIC ACIDS AND VITAMINS 7

Nucleic Acids and Polynucleotides, Classification, Structure, Function, Separation and Characterization Techniques, Clinical Significance.Vitamins: classification, Structure, Function, Separation and Characterization Techniques, Clinical Significance.

MODULE III METABOLISM OF AMINO ACIDS 8

Nitrogen metabolism and urea cycle - Biosynthesis of amino acids (Gly, Ser, Cys, Met, Thr, Lys, Ile, Val and Leu) - Regulation of branched chain amino acids (concerted inhibition, allosteric regulation and enzyme multiplicity, sequential feed back) from oxaloacetate and pyruvate - Biosynthesis of aromatic amino acids - Metabolic disorders associated with branched chain and aromatic amino acid degradation - Important molecules derived from amino acids (auxins, DOPA, Serotonian, porphyrins, T3, T4, Adrenaline, Noradrenaline, histamine, GABA, polyamines).

MODULE IV METABOLISM - NUCLEIC ACIDS, POLYSACCHARIDES AND LIPIDS 8

Biosynthesis of nucleotides - de novo and salvage pathways for purines and pyrimidines - Regulatory mechanisms - Degradation of nucleic acid by exo and endo nucleases - Biosynthesis and degradation of starch and glycogen -

Biosynthesis and degradation of Lipids -Fatty acid synthesis and oxidative degradation - Triacylglycerol and phospholipid biosynthesis and degradation - Cholesterol biosynthesis and regulation and targets and action of cholesterol lowering drugs.

MODULE V BIOMEMBRANE, TRANSPORT AND ELECTRICAL CONDUCTIVITY 8

Micelles - Lipid bi-layer structure of membranes - Membrane proteins - Passive - Careermediated and active transport - Ion-selective channels - Trans-membrane potential coupled ATP generation - Receptors - Acetylcholine receptor as a ligand gated ion-channel - Neuronal sodium channel as voltage-gated ion channel - Neurotransmitters and their mechanism of action - Action potential - Depolarization and nerve conduction - Ion-channel agonists and antagonists as drugs - Ion channel defects (Cystic Fibrosis)

MODULE VI BIOCHEMICAL ENERGETICS 7

Energy Yielding and Energy Requiring Reactions, Calculations of Equilibrium Concentrations, Oxidation-Reduction Reactions, Metabolism and ATP Yield. Photosynthetic Phosphorylation, Active Transport, Second Law of Thermodynamics, Enthalpy and Entropy, Activation Energy.

TOTAL : 45

REFERENCES:

1. Biochemistry by Lubert Stryer. W. H. Freeman & Company, NY
2. Biochemistry by Lehninger. McMillan publishers
3. Biochemistry by Zubey. Wm. C. Brown publishers

OUTCOMES:

At the end of the course students will be able to

- demonstrate broad knowledge of the biomolecules, machinery and information flowwithin living cells, and an appreciation of how these underpin all biological processes, in both normal and diseased states
- demonstrate knowledge of key facets of modern biochemistry including: proteins andstructural biology, bioinformatics, advanced molecular biology, cell organisation,signal transduction and its role in diseases such as cancer; and the identification of drug targets

- demonstrate proficiency in core biochemical laboratory techniques, understandingboth the principles and applications of these methods within the molecular biosciences.
- demonstrate familiarity with the risk assessment process, and use this information to operate safely in the laboratory environment.
- collect, organise, analyse, evaluate and interpret biochemical data using appropriate quantitative, technological and critical thinking skills.

BTB1212 CELL BIOLOGY L T P C
4 0 0 4

OBJECTIVES:

This course seeks to achieve the following goals: introduce the four basic areas of cell biology. A successful student will gain an in-depth knowledge about cell organelles, structure and functions.

MODULE I INTRODUCTION TO CELL & ITS COMPONENTS 12

Basic properties of cell, different classes of cell: Prokaryotic and eukaryotic cell, their characterstics, cell wall, composition, function of bacterial cell wall. Physical structure of the cell-brief introduction to the Cell Membrane

MODULE II CELL PHYSIOLOGY 12

Transport of substances through cell membrane- osmosis, diffusion and its types, Active transport (sodium pump) and passive transport; membrane potential, measuring membrane potential, action potential, electrocardiogram (ECG), electromyography (EMG), electroencephalography (EEG).

MODULE III CELL ORGANELLE 12

Cellular organelles - structure and function of cell wall, plasma membrane nucleus, Mitochondria, Chloroplast, Nucleus, lysosomes, peroxisomes, golgi bodies, and transport across membranes.

MODULE IV CYTOSKELETON 12

Eukaryotic cytoskeleton - Actin - Myosin - Actin polymerization - Acto-myosin complexes - Mechanism of myosin ATPase activity - Excitation-contraction coupling and relaxation - Microtubules - Microfilaments - Intermediate filaments and their role in organelle movements - Prokaryotic cytoskeleton - FtsZ - MreB - ParM - Crescentin.

MODULE V DNA REPLICATION, TRANSCRIPTION AND TRANSLATION 12

DNA replication- Prokaryotic and eukaryotic DNA replication, mechanism of replication. Transcription - Prokaryotic and eukaryotic Transcription; Translation- Genetic code- Prokaryotic and eukaryotic translation- translational machinery- Mechanism of initiation- elongation and termination.

TOTAL: 60

REFERENCES:

1. Molecular Biology of Cell by Albert et.al. John Wiley & Sons
2. The Cell by Cooper. ASM Press
3. Cell and Molecular Biology by Karp. John Wiley & Sons

OUTCOMES:

At the end of this course students will be able to:

- Define components of a cell
- Understand cellular structure and functions
- Understand the mechanisms of DNA replication and protein synthesis

BTB1213 MICROBIOLOGY L T P C
3 0 0 3

OBJECTIVES:

To provide an introduction to the science of microbiology, particularly medical microbiology, to the student with both limited background in the biological sciences and limited interest in pursuing this field further.

MODULE I MICROBES AND FUNCTIONAL ANATOMY 7

Types of microorganisms. Brief history of microbiology. Microbes& human warfare. Microbes & human disease, Classification of microorganism and methods of classifying and identification of microorganism. Size, shape, and arrangement of bacterial cells. Structures external to cell wall, structures internal to cell wall. Microbial Metabolism.

MODULE II OBSERVING MICROORGANISMS THROUGH A MICROSCOPE 7

Types of Microscopy, Light, electron, scanned-probe, microscopy. Confocal Microscopy, Simple, differential and special stains.

MODULE III CATABOLIC & ANABOLIC REACTIONS 8

Enzymes, energy production and carbohydrate metabolism. Lipid & protein catabolism, bacterial identification and photosynthesis. Energy production mechanism, metabolic diversity & pathways of energy use. Integration of metabolism.

MODULE IV MICROBIAL GROWTH 9

Growth requirements, culture media, obtaining pure cultures and preservation of cultures, growth of bacterial cultures, Control of Microbial Growth, Action of microbial control agents, physical and chemical methods of microbial control. domain bacteria, proteobacteria, nonproteobacteria Gram-ve and Gram+ve bacteria. Bacterial diversity. lichens, algae, protozoa, helminthes, arthropods as vectors. viral structures, isolation, cultivation and identification of viruses, viral multiplication.

MODULE V APPLIED & INDUSTRIAL MICROBIOLOGY 7

Industrial fermentation, primary and secondary metabolites, Role of

microorganisms in the production of industrial chemicals and pharmaceuticals, Microbes as alternative energy sources and as industrial products.

MODULE VI MICROBIAL GENETICS 7

Recent advances in molecular genetics of viruses and bacteria. Transformation, conjugation and transduction, complementation.

TOTAL: 45

REFERENCES:

1. Microbiology: An Introduction: Tortora, Funke & Case. 7th edition, 2001
2. Microbiology: Davis, Dulbecco, Eisen and Ginsburg.
3. Introduction to Microbiology: Ross
4. General Microbiology: Stainier, Adelberq and Ingraham.

OUTCOMES:

At the end of the course the students will be able to

- demonstrate a broad understanding of the diversity and range of microorganisms, the interactions between humans and microorganisms, the role of microorganisms in industrial and environmental processes, and their role in the development of the techniques that underpin modern molecular biology
- demonstrate proficiency in a set of core microbiological and molecular biologicaltechnical methods, including both an understanding of the principles of the methods and their utilisation in laboratory settings
- demonstrate familiarity with the risk assessment process, and use this information to operate safely in the laboratory environment
- collect, organise, analyse, evaluate and interpret experimental data using appropriate quantitative, technological and critical thinking skills
- critically evaluate relevant scientific data and literature and comprehend the natureand scope of the scientific literature in microbiology and related areas
- communicate microbiological principles and information effectively to diverse audiences, using a variety of formats

BTB1214 BIO ORGANIC CHEMISTRY L T P C
3 0 0 3

OBJECTIVES:

The course aims to develop skills of Students in the area of Organic Chemistry and its applications in Biology.

MODULE I INTRODUCTION TO ENZYMES 9

Classification of enzymes. Mechanisms of enzyme action; concept of active site and energetics of enzyme substrate complex formation; specificity of enzyme action; Stereochemistry - R,S notation - re-si faces - e,z isomerism-conformers- ethane - cyclopean - reactivates- mechanisms of sn1 sn2 reactions, e1 e2 reactions - ester formation and hydrolysis, reaction rates - hammond's postulate - h/d effects. Catalysis - general acid - base and covalent catalysis.

MODULE II ENZYME KINETICS 9

Allosteric regulation of enzymes, Monod changeux wyman model, ph and temperature effect on enzymes & deactivation kinetics - Stereospecific enzymatic reactions - Stereochemistry of nucleophilic reactions - chiral methyl group - chiral phosphate.

MODULE III ENZYME IMMOBILIZATION & CASE STUDIES 9

Physical and chemical techniques for enzyme immobilization - adsorption, matrix entrapment, encapsulation, cross-linking, covalent binding etc., - examples, advantages and disadvantages. Case studies include dehydrogenases, proteases - lysozyme- stability of proteins

MODULE IV PROTEIN FOLDING 9

Kinetics of single substrate reactions; estimation of Michelis - Menten parameters, multisubstrate reactions- mechanisms and kinetics; turnover number; types of inhibition & models -substrate, product - folding of peptides.

MODULE V FOLDING PATHWAYS & ENERGY LANDSCAPES 9

Folding of ci2 - nucleation condensation mechanism - folding of barnase - time resolution - insights from theory - optimization of folding rates - molecular chaperones. Production and purification of crude enzyme extracts from plant,

animal and microbial sources; methods of characterization of enzymes; development of enzymatic assays.

TOTAL : 45

REFERENCES:

1. Structure and Mechanism In Protein Science: A Guide To Enzyme Catalysis and Protein Folding; A. R. Fersht, W.H. Freeman, 1999.
2. Bioorganic Chemistry; H. Dugas, Springer Verlag, 1999.

OUTCOMES:

At the end of this course students will be able to:

- Understand enzyme actions
- Understand enzyme kinetics
- Understand the mechanisms of protein folding

BTB1215 **BIO-PHYSICS** **L T P C**
3 0 0 3

OBJECTIVES:

This course aims to introduce the theories and concepts of biophysics of bio molecules which are considered important in biotechnology applications. To Learn the structures of biological molecules and to understand the concept of structural analysis.

MODULE I MOLECULAR STRUCTURE OF BIOLOGICAL SYSTEMS 7

Intermolecular bonds - Covalent - Ionic and hydrogen bonds -Biological structures -General features - Water structure - Hydration - Interfacial phenomena and membranes - Self assembly and molecular structure of membranes.

MODULE II CONFORMATION OF NUCLEIC ACIDS 7

Primary structure -Bases, sugars , phosphodiester bonds - Double helical structure, A,B and Z forms - Properties of circular DNA - Topology - Polymorphism and flexibility of DNA - Structure of ribonucleic acids - Hydration of nucleic acids - Thermodynamics of DNA denaturation - Changes in nucleic acid structures during biochemical processes.

MODULE III CONFORMATION OF PROTEINS 7

Conformation of the peptide bond - Secondary structures - Ramachandran's plots - Use of potential functions - Tertiary structure - Dynamics of protein folding - Hydration of proteins - Hydropathy index - Effect of amino acids on the structure of proteins - Energy status of a protein molecule - Helix coil transformation of proteins.

MODULE IV CELLULAR PERMEABILITY AND ION - TRANSPORT 8

Ionic conductivity - Transport across ion channels - Mechanism - Ion pumps - Proton transfer - Nerve conduction - Techniques of studying ion transport and models.

MODULE V ENERGETICS AND DYNAMICS OF BIOLOGICAL SYSTEMS 8

Concepts in thermodynamics - Force and motion - Entropy and stability -

Analyses of fluxes - Diffusion potential - Basic properties of fluids and biomaterials - Laminar and turbulent flows.

MODULE VI METHODS IN BIOPHYSICS **8**

Fractionation of proteins using: PAGE, PAPER electrophoresis, TLC: Amino acids/ sugars/ fruit juice/oil, Column chromatography for protein /pigment, study of conformational changes in biomolecules using Ostwald viscometer Refractoemetry: study of sugars/proteins/amino acids.

TOTAL : 45

REFERENCES :

1. Cantor, C.R. and Schimmel, P.R., Biophysical Chemistry, W.H Freeman and Company, Press, New York, 4th Edition, 1999.

2. Glaser, R., Biophysics, Springer Verlag, London, 2nd Edition, 2004.

OUTCOMES:

At the end of the course the students will be able to

- Develop a conceptual framework for understanding the system by identifying the key physical principles, relationships, and constraints underlying the system.
- If required, develop a physical experiment to analyze the system withint h e framework which includes : designing the experiment; making basicorder-of-magnitude estimates; working with standard data-measuringd e v i c e s such as oscilloscopes, digital multi-meters, signal generators, etc.;
- Identify and appropriately address the sources of systematic error and statistical error in their experiment.

SSB1182 SOCIOLOGY, ETHICS AND HUMAN VALUES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To give an overview of the fundamental of sociology.
- To expose how society developed in India, classes and impact.
- To introduce sociological aspects relating to industry
- To provide some basic concepts on ethics and human rights.
- To stress the role of engineer to the society, environment and sustainability.

MODULE I FUNDAMENTALS OF SOCIOLOGY **7**

Sociology - definition, evolution - scope - basic concepts - social process, sociological theories, social institutions, culture and social stratification - family - economic - politics - religion - education, state and civil society - social control.

MODULE II SOCIOLOGY IN INDIAN CONTEXT **7**

Development - Institutions, classes - women and society - impact of social laws, social change in contemporary India - secularism and communalism - social exclusion and inclusion.

MODULE III INDUSTRIAL SOCIOLOGY **7**

Definition and perspectives - industry in India - social groups in industry, behaviour pattern - group dynamics - focus groups - team - enhancing group behaviour.

MODULE IV INDUSTRIAL - SOCIETY INTERFACE **8**

Perspectives - social responsibilities - sociological effect on industrialization - urbanization, child labour, psychological impact, Impact of technology, modernization - globalization - challenges - role of engineers.

MODULE V ETHICS AND HUMAN VALUES **8**

Ethics and values - organizational values - personal worth, ethical behavior, professional ethics, whistle blowing, international ethics, corruption.

MODULE VI ENGINEERS AND SOCIETY **8**

Quality of life and society - engineer in economic development, technology development - invention, innovation and diffusion - appropriate technology - engineer's contribution, ecology and environment - sustainability - role of engineers.

TOTAL: 45

REFERENCES:

1. Samir Das Gupta and Paulomi Saha, An Introduction to Sociology, Pearson, Delhi, 2012.
2. Narender Singh, Industrial Sociology, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2012.
3. Vidya Bhushan and D.R. Sachdeva, Fundamental of Sociology, Pearson, Delhi, 2012.
4. Deshpande, Satish, Contemporary India : A Sociological view, Viking (2002)
5. Thopar, Romila, Early India, Penguin (2003).
6. Mike Martin and Roland Schinzinger, Ethics in Engineering, McGraw Hill, New York, 1996.

OUTCOMES:

At the end of the course students will

- Have an exposure to the fundamentals and basic concepts of Sociology.
- Gain knowledge in Industrial Sociology.
- Have gained knowledge about the impact of technology, modernization, globalization and their contribution towards society.

BTB1216 BIOCHEMISTRY LABORATORY L T P C
0 0 4 2

OBJECTIVES :

Provides opportunities to experimentally verify the theoretical concepts already studied. It also helps in understanding the theoretical principles in a more explicit and concentrated manner. The students should be able to understand and develop their skills in

- Accuracy and Precession of analysis
- Qualitative testing of Carbohydrates
- Identification of amino acids and proteins
- Quantitative analysis of nucleic acids and enzymes.

LIST OF EXPERIMENTS

1. pH measurements and preparation of buffers.
2. Qualitative tests for Carbohydrates.
3. Estimation of sugars.
4. Estimation of proteins by Lowry's method / Biuret method.
5. Estimation of cholesterol by Zak's method.
6. Determination of saponification number of lipids.
7. Separation of amino acids - Thin layer chromatography.
8. Separation of sugars - Paper chromatography
9. Biochemical estimation of DNA /RNA using Spectrophotometer

BOOKS:

Laboratory Manual

OUTCOMES

Students will learn about the biomolecules, estimation of biomolecules and analytical techniques including spectrophotometer and chromatography.

BTB1217	CELL BIOLOGY LABORATORY	L	T	P	C
		0	0	3	1

OBJECTIVES:

Provides an opportunity to experimentally verify the theoretical concepts already studied. It also helps in understanding the theoretical principles in a more explicit and concentrated manner. The students should be able to

- Understand explicitly the concepts
- Develop their skills in the preparation and identification of cell structures and their functions.

LIST OF EXPERIMENTS:

1. Microscopic study of cell and cell organelles
2. Cell fractionation
3. Fixation, Dehydration, embedding and sectioning of tissues
4. Histology of extracellular matrix
5. Isolation of microtubules
6. Isolation of actin and Myosin filaments
7. Isolation of Mitochondria
8. Nuclear staining

REFERENCE:

Laboratory Manual

BTB1218 MICROBIOLOGY LABORATORY L T P C
0 0 2 1

OBJECTIVES:

Provides an opportunity to experimentally verify the theoretical concepts already studied. It also helps in understanding the theoretical principles in a more explicit and concentrated manner. The students should be able to

- Understand explicitly the concepts
- Develop their skills in the preparation, identification and quantification of microorganisms

LIST OF EXPERIMENTS:

1. Sterilization techniques
2. Media preparation
3. Microscopy and Micrometry
4. Isolation, enumeration and purification of microbes from a given sample
5. Staining Techniques (Simple, Gram staining, spore staining)
6. Motility test by Hanging drop method
7. Biochemical Characterization of Bacteria Oxidation/Fermentation Test, Catalase, Oxidase and Urease Tests, IMViC test, Hydrogen Sulfide Test and Nitrate Reduction Test. Casein and Starch Hydrolysis
8. Antibiotic Assay - Antimicrobial Sensitivity Test (Disc Diffusion Method)
9. Growth Kinetics (Bacterial Growth Curve)
10. Isolation of antibiotics producing bacteria
11. Isolation and characterization of plant microbes

REFERENCE:

Laboratory Manual

OUTCOME:

Students will learn about

- Basic methods in microbiology
- Characterization and isolation of bacteria isolated from various sources
- Growth kinetics of Bacteria

ENB2182 COMMUNICATION SKILLS LABORATORY

L	T	P	C
0	0	2	1

OBJECTIVES:

- To help the students acquire efficiency in Spoken English with due importance to Stress, Accent and Pronunciation
- To enable them to make Presentation effectively
- To prepare them for Interviews and Group Discussions
- To train them in writing official letters , resume'writing and reports.

MODULE I **4**

Theory: Oral and Written Communication – implications in real life and workplace situations

Lab: Listening to ESL Podcast- Viewing Multimedia- Listening to BBC News- Received Pronunciation (RP/VOA/NDTV) – exposure to paralinguistic features.

MODULE II **6**

Theory:

(i) One–minute Presentations (JAM) on concrete and abstract topics that test their creative thinking

(ii) Prepared presentations and extempore presentations

Lab: viewing Presentation Tips, Interviews Skills

(iii) Group project – presentation on any social issue. The group will have to research on the history of the problem, its cause, impact and outcome hoped for and then make a presentation

MODULE III **4**

Theory: Developing persuasive skills – establishing a point of view - convincing some one on social issues such as preservation of water, fuel, protection of environment, gender discrimination.

Lab: Negotiating Skills, Expressing Opinion

MODULE IV **4**

Theory: Brainstorming – Think, pair and share activity – Discussion etiquette

– Assigning different roles in a GD (Note-taker, Manager, Leader and Reporter)

Lab: Viewing Group Discussion

MODULE V **8**

Theory: Written correspondence - Letter of Application and CV - e-mail writing - writing instructions and recommendations – Lab reports

Lab: Resume' writing – viewing different types – Functional, Chronological- Writing one's resume using wiki, viewing e-mail etiquette, format and style.

MODULE VI **4**

Theory: Technical Writing –Writing a technical Proposal – format- cover page, executive summary, time line chart, budget estimate, drafting, conclusion.

TOTAL : 45

REFERENCES:

1. Anderson, Kenneth & et.al. "Study Speaking : A Course in Spoken English for Academic Purposes" (Second Edition). Cambridge University Press, UK. 2004.
2. Sharma, R.C. & Krishna Mohan, "Business Correspondence and Report Writing". Tata MacGraw – Hill Publishing Company Limited, New Delhi. 2002.
3. Hurlock, B. Elizabeth. "Personality Development". Tata McGraw Hill, New York. 2004.
4. M. Ashraf Rizvi 'Effective Technical Communication". Tata McGraw – Hill Education, 2005.
5. 6.Gerson, Sharon & Steven M. Gerson, " Technical Writing : Process and Product" Pearson Education, New Delhi, 2004.
6. Riordan & Pauley. 'Report Writing Today'. 9th Edition. Wadsworth Cengage Learning, USA. 2005.

OUTCOME:

On completion of the course, the students will have the ability to speak effectively and write official letters, reports and proposals.

SEMESTER-III

BTB2101 ENZYME TECHNOLOGY L T P C
4 0 0 4

OBJECTIVES:

The course aims to present the current methods of enzyme characterization, detailing the structures and kinetic properties of the enzymes, the biotechnological strategies to improve the stability and activity of the enzymes and to study the applications of enzyme technology.

MODULE I ENZYMES AND STRUCTURE 10

Enzymes, brief history of enzymes, nomenclature and classification of enzymes.Chemical nature of Enzymes: amino acids, the building blocks of protein, Levels of protein Structure: Primary, secondary, tertiary and quaternary structure, Specificity of Enzymes: Types of specificity, the Koshland “induced fit” hypothesis,Strain or transition – state stabilization hypothesis.

MODULE II ENZYME CATALYSIS AND KINETICS 12

Factors affecting the rate of chemical reactions, kinetics of uncatalyzed chemical reactions, kinetics of enzyme-catalyzed reaction, methods for investigating the kinetics of enzyme-catalyzed reactions, nature of enzyme catalysis, inhibition of enzyme activity,The identification of binding sites and catalytic site, three dimensional structure of active site, mechanism of catalysis, mechanism of reaction catalyzed by enzyme without cofactors, metal-activated enzyme and metalloenzyme, coenzymes in enzyme catalyzed reactions.

MODULE III IMMOBILIZATION OF ENZYMES 8

Concept, methods of immobilization, Kinetics of immobilized enzymes, effect of solute partition and diffusion on kinetics of immobilized enzymes, use of immobilized enzymes, bioreactors using immobilized enzyme. Prediction of enzyme structure, design and construction of novel enzymes.

MODULE IV INDUSTRIAL USES OF ENZYMES 10

Industrial enzymes: Sales value of industrial enzymes, traditional (non-recombinant) sources of industrial enzymes, The impact of genetic engineering on enzyme production, Engineered enzymes, Extremophiles: hyperthermophiles, enzymes from hyperthermophiles, enzymes from additional extremophiles, enzymes in organic solvent.

MODULE V INDUSTRIAL ENZYMES PROTEASES AND CARBOHYDRASES **10**

Proteolytic enzymes: Carbohydrases, Lignocellulose degrading enzymes, Pectin and pectic enzymes, Lipases, Penicillin acylase, Amino acylase and amino acid production, cyclodextrins and cyclodextrin glycosyl transferase, enzymes in animal nutrition, Oxidoreductases, Enzymes in molecular biology.

MODULE VI BASIC TOXICOLOGY **10**

Introduction to Toxicology, Definition of toxicology, toxicant, toxicity, LC50, LD50; Measurements of toxicants and toxicity, Class of chemicals of toxic importance, Sources of toxic compounds, Absorption and distribution of toxicants, Routes of absorption in mammals, Distribution of a Toxicant, Toxicodynamics, Metabolism of toxicants, Applications of toxicology, Toxicity studies of liver in animals.

TOTAL : 60

REFERENCES:

1. Enzymes by Palmer (2001): Horwood Publishing Series.
2. Fundamentals of Enzymology by Price and Stevens (2002): Oxford University Press.
3. Enzyme Technology by Helmut uhling (1998): John Wiley
4. Introduction to Proteins Structure by Branden and Tooze (1998): Garland Publishing Group.

OUTCOMES:

At the end of the course the students will be able to

- Discuss enzyme properties, enzyme nomenclature, enzyme mechanism as well as kinetics of enzyme-catalysed reactions
- Describe the methods for production and purification of recombinant enzymes as well as discuss how enzymes can be utilized in the laboratory and industrially
- Conduct experimental work to assay enzymatic activity as well as carry out protein purification of an enzyme
- Evaluate the current application of enzymes in the field of biotechnology

BTB2102 BIOINFORMATICS L T P C
3 0 0 3

OBJECTIVES:

The course aims to provide the students with an experimental and computational knowledge to embrace a systems biology approach and experience authentic systems genetics research by designing and conducting independent research projects.

MODULE I INTERNET AND BIOINFORMATICS 7

Internet basics, FTP, Gopher, World-wide web, Information Retrieval from Biological Databases: Retrieving database entries, integrated information retrieval: The entrez system, sequence databases beyond NCBI, Medical Databases.

MODULE II DATABASES 8

Introduction, Primary & Secondary database, Format vs content: computer vs humans, GenBank Flat File dissection, GCG, ACDEB. Introduction, SeqIDS, Bioseq: Sequences, Bioseqsets: Collections of sequences, Seq. Annot: Annotating the sequence, Seqdiscr: Describing the sequence, Structure Databases: Introduction to structures, PDB, MMDB, Structure file formats, Visualizing structural information, Database structure viewers.

MODULE III SEQUENCE ALIGNMENT AND DATABASE SEARCHING 8

Introduction, Evolutionary basis of sequence alignment, Optimal alignment methods, Substitution scores & gap penalties, Statistical significance of alignments, Database similarity searching, FASTA, BLAST, Low complexity regions, Repetitive elements, Multiple Sequence Alignment: Progressive alignment methods, Motifs and patterns,Hocks, MOST, Probe, Presentation methods, Abscript.

MODULE IV PHYLOGENETIC ANALYSIS 7

Elements of phylogenetic models, data analysis: Alignment, substitution model building, tree building and tree evaluation, building methods, searching for trees, hooting trees, Evaluating trees and data, phylogenetic software Some simple practical consideration

MODULE V PREDICTIVE METHODS **8**

Framework, marking repetitive DNA, Database search, Codon bias detection, Detecting function sites in the DM, Integrated gene passing, Finding tRNA genes, Protein identity based on composition, Propsearch, Physical properties based on sequences, secondary structure and folding classes, spread sopma, Specialized structures of features, Tertiary structure.

MODULE VI ADVANCED BIOINFORMATICS **7**

Further applications on the design of new molecules 3D data base searching and virtual screening, Sources of data, molecular similarity and similarity searching, combinatorial libraries-generation and utility.

TOTAL: 45

REFERENCES:

1. Bioinformatics: A practical guide to the analysis of genes and proteins A.D. Baxevanis and B.F.F. Ouellette (Eds). 2002 John Wiley and Sons.

2. Bioinformatics: Sequence and Genome Analysis by D.W. Mount, 2001, Cold Spring Harbor Laboratory Press.

OUTCOMES

At the end of the course students will be

- Familiar with principles used in modelling dynamic phenomena in cells and methods that are used to analyze computational models
- Able to understand basic research methods in bioinformatics
- Able to understand the data structure (databases) used in bioinformatics and interpret the information (especially: find genes; determine their functions), understand and be aware of current research and problems relating to the area of their research project, to be able to critically evaluate the literature and identify the most important body of work
- Aware of the range of technologies available to computer scientists in bioinformatics
- Able to carry out data mining gene and protein expression patterns and modelling cellular interactions and processes

BTB2103 FUNDAMENTALS IN CHEMICAL ENGINEERING **L T P C**
4 0 0 4

OBJECTIVES:

- to prepare students for challenging careers in the chemical, petroleum, petrochemical, pharmaceutical, food and other related industries, and in the emerging areas such as biotechnology, microelectronics, energy and nanomaterials processing;
- to provide students with an appreciation of the role of chemical technology in society, and the skills of analyzing and solving related industrial problems;
- to prepare students for graduate study in chemical engineering and related
- disciplines; and
- to nurture engineer leaders with a global outlook.

MODULE I OVERVIEW OF PROCESS INDUSTRY **10**

Mass and energy conservation – Process automation – Environment – SI Modules – Conservation factors – Applied mathematics for experimental curve fitting – Numerical differentiation – Integration.

MODULE II MATERIAL BALANCES **10**

Overall and component balances – Material balances without and with chemical reactions – Degrees of freedom – Steady and unsteady state – Module operations – Recycle and by pass – Humidity calculations.

MODULE III FIRST AND SECOND LAWS OF THERMODYNAMICS **10**

Energy balances – Sensible heat – Latent heat – Vapour pressure – Steady and unsteady state calculations.

MODULE IV FLUID MECHANICS **10**

Fluids – Fluid statics and applications in chemical engineering – Fluid flow – Laminar – Turbulent – Pressure drops – Compressible fluid flow concepts – Multiphase flow concepts.

MODULE V FLOW THROUGH PACKED COLUMNS **10**

Fluidization – Centrifugal and piston pumps – Characteristics – Compressors – Work.

MODULE VI REACTORS **10**

Batch Reactors, Continuous reactors and Fed batch Reactors, Kinetics of Reactions and Scale-up of Reactors.

TOTAL : 60

REFERENCES:

1. Bhatt, B.I. and Vora S.M., "Stoichiometry", 4th Edition, Tata McGraw-Hill, 2004.
2. McCabe W.L., Smith J.C. and Harriot P., "Module Operations in Chemical Engineering", 7th Edition, McGraw-Hill Professional, 2005.
3. Geankoplis C.J., "Transport Processes and Unit Operations", 4th Edition, Prentice Hall, 2007.
4. Coulson J.M. and Richardson J. F., "Coulson and Richardson's Chemical Engineering", Vol-I, 3rd Edition, Butterworth – Heinemann Publishers, 2004.
5. Venkataramani, V. and Anantharaman, N., "Process Calculations", Prentice Hall, 2004.

OUTCOMES:

At the end of the course students will be able to demonstrate good knowledge and understanding of

- Mathematics, science and engineering principles (including ITC), relevant to the Process Industries.
- Economic evaluation principles relevant to engineering and engineers.
- The essential concepts, principles and theories in subjects of the student's own choice.
- The role of the engineer in society and as a team player, and the constraints within which their engineering judgement will be exercised.
- The professional and ethical responsibilities of engineers.

BTB2104 **BIOSTATISTICS** **L T P C**
3 1 0 4

OBJECTIVES:

This course aims to provide students with fundamental knowledge of the design and analysis of clinical trials and epidemiological studies, of statistical issues arising in biomedical research, and of important methods for the analysis of biostatistical data, including data from microarray experiments.

- Students will be able to make informed decisions based on data
- Students will be able to correctly apply a variety of statistical procedures and tests
- Students will know the uses, capabilities and limitations of various statistical procedures
- Students will be able to interpret the results of statistical procedures and tests.

MODULE I INTRODUCTION **10**

Introduction, Exploratory Data Analysis-Motivation, Population vs. Sample, "Scientific Method"- Definitions, Examples, Medical Study Designs - Graphical Displays: Dotplots, Stemplots, Histograms- Summary Statistics: Measures of Center - Summary Statistics: Measures of Spread.

MODULE II DATA MEASURE AND LOCATION **10**

Frequency distribution, graphical presentation of data by histogram,frequency curve and cumulative frequency curves,Mean, Medium, Mode and their simple properties(without derivation) and calculation of median by graphs: range, mean deviation,Standard deviation, Coefficient of variation.

MODULE III PROBABILITY AND DISTRIBUTION **10**

Random distributions, events-exhaustive, mutually exclusive and equally likely, definition of probability (with simple exercises), definition of binomial, Poisson and normal distributions and their inter-relations, Simple properties of the above distributions (without derivation).

MODULE IV CORRELATION AND REGRESSION **10**

Bivariate data – simple correlation and regression coefficients and their relation, Limits of correlation coefficient, Effect of change of origin and scale on correlation coefficient, Linear regression and equations of line of regression, Association and independence of attributes.

MODULE V SAMPLING **10**

Concept of population and sample, Random sample, Methods of taking a simple random sample, Tests of Significance: Sampling distribution of mean and standard error, Large sample tests (test for an assumed mean and equality of two population means with known S.D.);small sample tests (t-test for an assumed mean and equality of means of two populations when sample observations are independent, Paired and unpaired t-test for correlation and regression coefficients, T-test for comparison of variances of two populations, Chi-square test for independence of attributes, Goodness of fit and homogeneity of samples.

MODULE VI EXPERIMENTAL DESIGNS **10**

Principles of experimental designs, Completely randomized, Randomized block and latin square designs, Simple factorial experiments of 22, 23, 24 and 32 types, Confounding in factorial experiments (mathematical derivations not required); Analysis of variance (ANOVA) and its use in the analysis of RBD.

TOTAL : 60

REFERENCE:

1. Statistical methods in biology by Norman T.J. Bailey (3rd Edition), Cambridge University Press (1995).

OUTCOMES:

At the end of the course students will be able to

- Explain how the Central Limit Theorem applies in inference
- Interpret the meaning of con?dence intervals in context
- Interpret the results of hypothesis tests
- Make an informed decision, based on the results of inferential procedures

BTB2105 MOLECULAR BIOLOGY L T P C
3 0 0 3

OBJECTIVE:

The aim is to extend understanding of the molecular mechanisms via which genetic information is stored, expressed and transmitted among generations.

MODULE I DNA REPLICATION AND REPAIR 9

Mechanism of Prokaryotic and Eukaryotic DNA replication, Enzymes and accessory proteins involved in DNA, replication, DNA repair Mechanism.

MODULE II TRANSCRIPTION 9

Prokaryotic transcription, Eukaryotic transcription, RNA polymerase, General and specific transcription factors, Regulatory elements.

MODULE III MODIFICATIONS IN RNA 9

5'-cap formation, transcription termination, 3 '-end processing and polyadenylation, Splicing, Editing, Nuclear export of mRNA and mRNA stability.

MODULE IV TRANSLATION 9

Prokaryotic and Eukaryotic translation, the translation Machinery; Mechanisms of initiation, elongation and termination, regulation of translation, co-and post-translational modifications of proteins.

MODULE V REGULATION OF GENE EXPRESSION & ANTISENSE TECHNOLOGY 9

Lac operon, Ara operan, regulation in Eukaryotes; Molecular mechanism of antisense molecules, inhibition of spilicing, polyadenylation and translation, disruption of RNA structure and capping,

TOTAL : 45

REFERENCES:

1. Lodish H. F.Cell and Molecular Biology. W.H. Freeman & Co Ltd, 2000.
2. Cooper G. M. Cell: a Molecular Approach.Sinauerassociates,USA2000.
3. Lewin B. Gene VIII. Prentice Hall, USA 2003.
4. Jeremy M Berg, John L Tymoczko, and LubertStryer. Biochemistry 5th edition

OUTCOMES:

On the completion of the above objectives student will be able to get the overview of classes Molecular Biology and understand the process involved in replication, transcription and translation and regulation of gene expression.

BTB2106 BASIC BIOANALYTICAL TECHNIQUES

L	T	P	C
3	0	0	3

OBJECTIVES:

The students will be exposed to basic concepts related with techniques and instrumentation widely used in Biotechnology.

MODULE I CALORIMETRY AND SPECTROSCOPY 9

Properties of electromagnetic radiations, interaction with matter. Ultraviolet spectroscopy: Origin of UV spectra, types of transition, chromophore & related terms, choice of solvent, instrumentation and applications Infra-red spectroscopy: Origin of infra-red spectra, modes of vibrations, instrumentation, sampling technique and applications; Nuclear magnetic resonance spectroscopy: Mass Spectroscopy: Origin, Instrumentation, types of ions produced, interpretation and applications of mass spectra GCMS, LCMS & MSMS.

MODULE II CENTRIFUGATION AND MICROSCOPY 9

Principle of centrifugation, rotors, different types of centrifuges, preparative and analytical centrifugation, ultra centrifugation. Optical microscopy, Bright field, Dark field, phase contrast and fluorescence microscopy. Electron microscopy: Transmission and scanning electron microscopy, Atomic force microscopy.

MODULE III ELECTROPHORESIS 9

General principle, support media. Agarose gels, polyacrylamide gels. SDS PAGE, 2D PAGE Pulsed field gel electrophoresis Iso-electric focusing Capillary electrophoresis

MODULE IV RADIOISOTOPE TECHNIQUES 9

Study of radioisotopes in biological samples, proportional and GM counter, scintillation counters, autoradiography, radio –immunoassay.

MODULE V CHROMATOGRAPHY 9

Introduction: Chromatography theory and practice. Paper chromatography. Thin layer chromatography. Ion exchange chromatography. Affinity

chromatography. Partition chromatography. Adsorption chromatography. Introduction to gas chromatography and HPLC. Permeation.

TOTAL : 45

REFERENCES:

1. Pierre C. ORD and CD in chemistry and biochemistry: An Introduction. Academic Press, 1972.
2. Paddock S. W. Confocal Microscopy methods & protocols.1st Edition, Human Press, 1999.
3. Murphy D. B. Fundamental of Light Microscopy & Electron Imaging. 1st Edition, Wiley-Liss, 2001.

OUTCOME:

- At the end of the course, the students will have sufficient scientific understanding of the basic concepts of molecular biology.
- Good understanding of protein synthesis and gene expression

BTB2107	BIOINFORMATICS LABORATORY	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To understand the sequence of protein and nucleic acids
- To understand the structural prediction of protein primary secondary, tertiary and quaternary structures.

LIST OF EXPERIMENTS

1. Study of internet resources in Bioinformatics
2. Internet protocols
3. Basic programming tags with XML, HTML and CML.
4. Algorithm used in data base
5. BLAST
6. FASTA
7. Prediction of DNA sequence
8. Prediction of protein sequence
9. Perl
10. Bioperl

DEMO (OPTIONAL)

1. Phylogenetic analysis
2. Shell Programming

REFERENCE:

Laboratory Manual

OUTCOME:

Students will get complete knowledge about sequence alignment, structure prediction, Phylogeny and algorithms

BTB2108 MOLECULAR BIOLOGY LABORATORY

L	T	P	C
0	0	3	1

OBJECTIVES:

- To learn basic techniques in molecular biology
- To study and to differentiated the electrochemical properties of nucleic acids

LIST OF EXPERIMENTS **30**

1. Agarose gel electrophoresis of chromosomal & plasmid DNA
2. Extraction of genomic DNA from bacteria
3. Extraction of plasmid DNA from bacteria
4. Extraction of genomic DNA from yeast cells
5. Isolation of RNA from bacteria
6. Isolation of DNA fragment from agarose gel

REFERENCE:

1. Michel R. G and Sambrook J. Molecular Coning- A laboratory manual. Cold spring harbor laboratory press, 2012.

OUTCOMES:

On the completion of the above experiments students will be able to handle DNA samples and also to isolate, purify and visualize nucleic acid.

BTB2109 BIOANALYTICAL TECHNIQUES LABORATORY

L	T	P	C
0	0	3	1

OBJECTIVES:

Provides an opportunity to experimentally verify the theoretical concepts of bioenergetics and protein engineering already studied. It also helps in understanding the theoretical principles in a more explicit and concentrated manner.

LIST OF EXPERIMENTS

1. Preparation of Acetate, Tris and Phosphate Buffer systems and validation of Henderson-Hasselbach equation.
2. Reactions of amino acids – Ninhydrin, Pthaldehyde, Dansyl chloride – measurement using colorimetric and fluorimetric methods.
3. Differential estimations of carbohydrates – reducing vs non-reducing, polymeric vs oligomeric, hexose vs pentose
4. DNA determination by UV-Vis Spectrophotometer – hyperchromic effect Separation of lipids by TLC.
5. Enzyme Kinetics: Direct and indirect assays – determination of Km, Vmax and Kcat, Kcat/ Km
6. Restriction enzyme – Enrichment and Module calculation
7. Ion-exchange Chromatagraphy – Purification of IgG and Albumin
8. Gel filtration – Size based separation of proteins
9. Affinity chromatography – IMAC purification of His-tagged recombinant protein
10. Assessing purity by SDS-PAGE Gel Electrophoresis
11. Chemical modification of proteins – PITC modification of IgG and Protein immobilization

REFERENCES:

1. Biochemical Methods: A Concise Guide for Students and Researchers, Alfred Pingoud, Claus Urbanke, Jim Hoggett, Albert Jeltsch, 2002 John Wiley & Sons Publishers, Inc,

2. Biochemical Calculations: How to Solve Mathematical Problems in General Biochemistry, 2nd Edition, Irwin H. Segel, 1976 John Wiley & Sons Publishers, Inc,

3. Principles and Techniques of Practical Biochemistry- Wilson, K. and Walker, J. Cambridge Press.

OUTCOME:

On the completion of the above objectives student will be able to perform biochemical assays, electrochemical techniques, spectrophotometry and chromatography.

SEMESTER-IV

BTB2211 GENETIC ENGINEERING

L	T	P	C
4	0	0	4

OBJECTIVES:

The course aims to provide an advanced understanding of the core principles and topics of Cell and Organism reproduction and the Principles of heredity and their experimental basis, and to enable students to be able to apply these principles in assessment of pedigrees to identify genotypes and predict the mating outcomes.

MODULE I GENETICS AND ORGANISM 10

Genetics and human affairs, Genetics and Biology, Genes and Environment, Techniques of genetic analysis, The chromosome theory of heredity, Sex chromosomes, Sex linkage, The parallel behaviour of autosomal genes and chromosomes.

MODULE II MENDELISM AND LINKAGE 12

Mendel's laws of inheritance, Interaction of genes, Variations on dominance, Multiple alleles, Lethal alleles, Several genes affecting the same character, Penetrance and expressivity, Linkage- Basic eukaryotic chromosome mapping, The discovery of linkage, Recombination linkage symbolism, Linkage of genes on X chromosomes, Linkage maps, Examples of linkage maps.

MODULE III FINE STRUCTURE OF GENES 10

The concept of promoter, Coding sequence, Terminator, Induction of gene for expression. The concept of extranuclear genome in higher plants and animals, Overview of mitochondrial genome, Chloroplast genome.

MODULE IV RECOMBINATION IN BACTERIA AND VIRUSES 10

Conjugation recombination and mapping the E.coli chromosomes, Transformation, Transduction, Chromosome mapping. Population genetics: Darwin's revolution, Variation and its modulation, The effect of sexual reproduction on variation, The sources of variation, Selection quantitative genetics

MODULE V PRINCIPLES OF PLANT BREEDING **9**

Objectives, Selfing and crossing techniques, Male sterility,Incompatability, Hybrid vigour.

MODULE VI HUMAN GENOME PROJECT **9**

Genetic diseases in humans, Genetics and society

TOTAL : 60

REFERENCES:

1. In Introduction to genetic analysis, Griffiths, Miller, Suzuki, Lewontin and Gelbart, Freeman and Company.
2. Genetics, A.V.S.S. Sambamurty, Narosa Publishing House.
3. Concepts of Genetics, Klug & Cummings, Prientice Hall.
4. Molecular Cloning, Moniatisetal, Cold Spring Harbor Laboratory

OUTCOMES:

At the end of the course students will be able to

- Describe the structure, function and replication of DNA as the genetic material
- Describe gene structure, expression and regulation
- Describe the chromosomal basis of inheritance and how alterations in chromosome number or structure may arise during mitosis and meiosis

BTB2212 IMMUNOTECHNOLOGY L T P C
3 0 0 3

OBJECTIVES:

The course is aimed at introducing the science of immunology and detailed study of various types of immune systems and their classification structure and mechanism of immune activation.

MODULE I INTRODUCTION TO IMMUNOLOGY 8

Properties of immune response, Innate and acquired immunity, active and passive immunity, Cells & Tissues of Immune System: Lymphocytes, Classes of lymphocytes, antigen presenting cells, NK Cells, Mast Cells, Dendritic Cell, Organs of the Immune System,Bone marrow, Thymus, Lymph node, Spleen, CALT, MALT.

MODULE II MOLECULAR IMMUNOLOGY 8

Molecular structure of antibody, Classification, Isotypes, Synthesis assembly and expression of immunoglobulin molecules, Nature of antigens, function and diversity, Generation of anti-body diversity, Antigens: Different characteristics of antigens, mitogens, Hapten, Immunogen, Adjuvants.

MODULE III MHC 8

Discovery of MHC complex, Role of MHC, Structure of MHC molecule, Binding of peptides to MHC molecules, MHC restriction, Effector Mechanism of Immune Response: Cytokines, T- cell receptors, cell activation, complement system, antigen processing and presentation, regulation of immune response.

MODULE IV IMMUNOLOGICAL TECHNIQUES 7

Antigen- antibody reactions, Immuno diffusion, immunoelectrophoresis, ELISA, RIA, fluorescence activated cell sorter.

MODULE V APPLIED IMMUNOLOGY 7

Immune system in health and disease, autoimmunity, hypersensitivity,tumor immunity, tissue and organ transplant, Synthetic vaccines.

MODULE VI HYBRIDOMA TECHNOLOGY **7**

Fusion of myeloma cells with lymphocytes, production of monoclonal antibodies and their application.

TOTAL: 45

REFERENCES:

1. Kuby- Immunology (4th Edition) by R. A. Goldsby, T.J. Kindt, B.A. Osborne.
2. Essentials of Immunology (6th Edition): Ivan Riot- Blakswell Scientific Publications, Oxford, 1988.
3. Fundamentals of Immunology: Paul W.E. (Eds.) Raven Press, New York, 1988.
4. Antibodies A laboratory Manual: Harlow and David Lane (1988), Cold spring harbor laboratory.

OUTCOMES:

At the end of the course students will be able to

- describe and explain the fundamental principles of modern immunology
- understand and apply related immunological techniques in medical laboratory profession
- relate and apply medical laboratory science knowledge to immunological changes in healthy and disease contexts

BTB2213 ANIMAL BIOTECHNOLOGY L T P C
3 0 0 3

OBJECTIVES:

The course aims to provide the students with the theoretical basis of the main mechanism of cell, tissues, organs and apparatus functionality and the current methods of animal cell culture and its application in research.

MODULE I INTRODUCTION TO ANIMAL TISSUE CULTURE 8

Background, Advantages, Limitations, Application, Culture Environment, Cell Adhesion, Cell Proliferation, Differentiation. Planning, Construction, Layout, Essential Equipments, Aseptic Technique, Objectives, Elements, Sterile Handling, Safety, Risk Assessment, General Safety, Fire, Radiation, Biohazards.

MODULE II MEDIA 7

Physicochemical Properties, Balanced Salt Solutions, Complete Media, Serum, Serum-Free Media, Disadvantages of Serum, Advantages of Serum-Free media, Primary Culture: Isolation of Tissue, Steps involved in primary cell culture, Cell Lines, Nomenclature, Subculture and Propagation, Immortalization of cell lines, Cell line designations, Routine maintenance

MODULE III CHARACTERIZATION & QUANTITATION OF CELL LINE 7

Need for characterization, Morphology,Chromosome Analysis, DNA Content, RNA and Protein, Enzyme Activity, Antigenic Markers, Transformation, Immortalization, Aberrant Growth Control, Tumorigenicity, Cellcounting, DNA content, Protein, Rates of Synthesis, Cell Proliferation, Plating Efficiency, Labeling Index, Generation Time.

MODULE IV CRYOPRESERVATION 8

Need of Cryopreservation, Preservation, Cell banks, Transporting Cells, Cytotoxicity: Introduction, In vitro limitations, Nature of assay, Viability assay, Survival assay, Microtitration assay, Transformation assay, In Vitro Fertilization and Embryo Transfer: Composition of IVF media, Steps involvedin IVF, Fertilization by means of micro insemination, PZD, ICSI, SUZI, MESA

MODULE V TRANSGENIC ANIMALS **7**

Methodology, Embryonic Stem Cell method, Microinjection method, Retroviral vector method, Applications of transgenic animals.

MODULE VI GENE THERAPY **8**

Ex-vivo gene therapy, In vivo gene therapy, Viral gene delivery system, Retrovirus vector system, Adenovirus vector system, Adeno-Associated virus vector system, Herpex simplex virus vector system, Non-viral gene delivery system, Prodrug activation therapy, Nucleic acid therapeutic agents

TOTAL: 45

REFERENCES:

1. Animal Cell Culture by John R.W. Masters Oxford University Press
2. Introduction to Cell and Tissue Culture by Jennie P. Mather and Penelope E. Roberts, Plenum Press, New York and London
3. Molecular Biotechnology: Primrose.
4. Animal Cell Biotechnology: R.E. Spier and J.B. Griffiths (1988), Academic press.

OUTCOMES:

At the end of the course students will be able to

- Apply biotechnological methods for basic research;
- Apply bimolecular methods to veterinary pharmacology, to the design, correct use and traceability of medicines;
- Apply reproduction methods with particular reference to gamete and embryo manipulation techniques, production of transgenic animals and cloning;
- Apply biomolecular techniques for the diagnosis and study of epidemiology andetiopathogenesis of infective and parasitic animal diseases, as well as for the production of biotechnological vaccines for veterinary use;

BTB2214 PLANT BIOTECHNOLOGY L T P C
3 0 0 3

OBJECTIVES:

The purpose of the course is to provide training in the science behind plant biotechnology, an appreciation of the current scope and limits to its industrial application, and the implications of modern methods of genetic modification for plant industries.

MODULE I HISTORY AND IMPORTANCE 7

Important events in the history of plant tissue culture, Cellular Totepotency: Introduction, cyto-differentiation, orgemogenic differentiation, loss of morphogenic potential in long-term cultures, practical applications of cellular totipotency.

MODULE II TISSUE CULTURE MEDIA 8

Introduction, media constituents, media selection, media preparation, Cell and Suspension Culture: Introduction, isolation of single cells, suspension cultures, culture of single cells, plant cell reactors, applications of cell culture, Proloplast Culture: Proloplast isolation, culture and regeneration.

MODULE III SOMATIC EMBRYOGENESIS 8

Introduction, some examples of formatic embryogenesis, factors affecting somatic embryogenesis, induction and development, maturation, Haploid Production: Introduction, techniques, factor affecting androgenesis, ontogeny ofandrogenic haploids, plant regeneration from pollen embryos, gynogeresis, haploidproduction through disport hybridization idiptridization to raise homozygous diploids,applications, limitations, Triploid Production: Introduction, callusing, histology and cytology of cells, organogenesis,applications of endosperm culture.

MODULE IV EMBRYO CULTURE 8

Introduction, techniques, culture requirements role of the suspensor in embryo culture, precocious germination, morphogenesis in the culture of seeds with partially differentiated embryos, micronugical experiments, embryo and seed culture of parasitic angiosperms, morphogenic potential of the embryo callus,

practial applications. In-vitro pollination and fertilization: Introduction, terminology, in vitro pollination, in vitro fertilization, applications.

MODULE V MICROPROPAGATION 7

Introduction, techniques, applications, production of pathogen free Plants, Production of secondary metabolites-Introduction, strategies used to optimize product yield, commercial aspects

MODULE VI GERMPLASM STORAGE 7

Introduction, long-term storages, short or medium term storage

TOTAL: 45

REFERENCES:

1. Experiments in Plant Tissue Culture by John H. Dodds & Lorin W. Robert.
2. Plant tissue Culture : Theory and Practice by S.S. Bhojwani and M.K. Razdan (1996) Elsevier, Amsterdam.
3. An Introduction to Plant Biotechnology by H C Chawla Oxford and IBH 2002

OUTCOMES:

At the end of the course the students will acquire:

- An understanding of the theoretical background knowledge in molecular, biochemical and plant sciences needed for an understanding of plant biotechnology.
- A working knowledge of laboratory techniques used in plant biotechnology.
- An appreciation of the issues associated with growing and using transgenic plants as food crops.
- An understanding of the aims and needs of industrial enterprises using plant biotechnology techniques to develop new products.
- A capacity to undertake research in plant biotechnology

BTB2215 INDUSTRIAL BIOTECHNOLOGY

L	T	P	C
3	1	0	4

OBJECTIVES:

This course helps the students to provide biologically trained students with appropriate academic studies and industrial experience to enable them to contribute to the field of biotechnology.

- To update students knowledge of new developments in biology of industrial relevance.
- To give students a broad understanding and experience, of technological processes involved in biotechnological industries.

MODULE I INTRODUCTION TO BIOTECHNOLOGY 10

Biotechnology, An interdisciplinary pursuit, A three-component central core, Product safety, Public perception of biotechnology, Biotechnology and the developing world.

MODULE II BIOCHEMICAL ENERGETICS 10

Energy Yielding and Energy Requiring Reactions, Calculations of Equilibrium Concentrations, Oxidation-Reduction Reactions, Metabolism and ATP Yield. Photosynthetic Phosphorylation, Active Transport, Second Law of Thermodynamics, Enthalpy and Entropy, Activation Energy.

MODULE III METABOLIC STRATEGIES 10

General Principles of Intermediary Metabolism, Regulation of Pathways, Strategies for Pathway Analysis,Bioprocess/fermentation technology: Bioreactor, Scale-up, Media design,Technology for microbial, mammalian and plant cell culture, Downstream processing.

MODULE IV ENZYME TECHNOLOGY & BIOPHARMACEUTICALS 10

Nature, Application, Genetic engineering & protein engineering, Immobilised enzymes and Technology of enzyme production, Introduction to genetic engineering, Antibiotics, Therapeutic proteins, Vaccines & monoclonal antibodies, Gene therapy.

MODULE V APPLICATIONS **10**

Introduction, Fermentation, Food processing, Sweeteners, Food wastes, Rapid diagnostics, Public acceptance & safety, Plant biotechnology, Forestry, Biological control, Animal biotechnology, Diagnostics in agriculture, Bioremediation. IPR, Safety, Social, moral and ethical aspects of Biotechnology

MODULE VI PRODUCTION MODERN BIOTECHNOLOGY PRODUCTS 10

Production of recombinant proteins having therapeutic and diagnostic applications, production of vaccines. Production of monoclonal antibodies. Products of plant andanimal cell culture.

TOTAL : 60

REFERENCES:

1. Biochemistry by Lubert Stryer. W. H. Freeman & Company, NY
2. Biochemistry by Lehninger. McMillan publishers
3. Biochemistry by Zubey. Wm. C. Brown publishers
4. Biotechnology, John E. Smith
5. Bioprocess Engineering Principles, Pauline M. Doran

OUTCOMES:

At the end of the course students will be able to acquire knowledge on

- The facts, concepts, principles and theories relevant to the broad area of Biotechnology.
- The professional and ethical responsibilities of the Biotechnologist.
- Current themes and/or insights, at/or informed by, the forefront of the Biotechnology Industry and its related disciplines.
- The techniques applicable to the area of Biotechnology.
- Processes which facilitate the critical evaluation of research, scholarship and methodologies within the area of Biotechnology.

GEB3201 ENVIRONMENTAL SCIENCE AND ENGINEERING **L T P C**
3 0 0 3

OBJECTIVES:

To impart the basic scientific knowledge on the environment and human impacts on various elements of environment and assessment tools.

MODULE I PHYSICAL ENVIRONMENT **8**

Earth's surface - the Interior of Earth - Plate Tectonics - Composition of the Crust: Rocks - formation and types, Soils - formation and components - soil profile. Atmosphere - structure and composition - weather and climate - tropospheric airflow; Hydrosphere - water budget - hydrological cycle - Rainwater and precipitation, River Water and solids, Lake Water and stratification, Seawater and solids, soil moisture and groundwater. Bioelement cycling - The Oxygen cycles - the carbon cycle - the nitrogen cycle - the phosphorous cycle - the sulfur cycle sodium, potassium and magnesium cycles.

MODULE II BIOLOGICAL ENVIRONMENT **7**

Cellular basis of life - prokaryotes and eukaryotes - cell respiration - photosynthesis - DNA and RNA - genetically modified life, Population dynamics - population - population growth - survival and growth curves - population regulation - future of human population, Biological communities - Five major interactions: competition, predation, parasitism, mutualism and commensalism - Concepts of habitat and niche - natural selection - species richness and species diversity - ecological succession and climax. Ecosystem and Biomes - Food Chains and food webs - biomagnifications - ecological pyramids - Trophic levels - Energy flow in ecosystem - ecosystem stability - Terrestrial and aquatic biomes.

MODULE III IMPACTS ON NATURAL RESOURCES AND CONSERVATION **9**

Biological resources - nature and importance - direct damage - introduced species - Habitat degradation, loss and fragmentation - Values of biodiversity - hotspots of biodiversity, threats to biodiversity- endangered and endemic species of India- conservation of biodiversity, in-situ and ex-situ conservation; Land Utilization - past patterns of land use - Urban and Industrial development

- deforestation, salinisation, soil erosion, and desertification - Modern Agriculture and Impacts; Waste management - types of solid wastes: domestic, municipal, industrial and e-wastes - disposal options - reduce, recovery, reuse - waste minimization, cleaner production technology.

MODULE IV IMPACTS ON WATER AND AIR AND CONSERVATION 8

Water pollution - organic oxygen demanding wastes - anthropogenic phosphate and eutrophication - Ground water contamination - Usage of fertilizer and pesticides- acid rain -acid mine discharges - toxic metals - organochlorines - endocrine disrupting substances- treatment process - Rain water harvesting and watershed management- manmade radionuclide's - thermal pollution; Atmospheric pollution - primary and secondary pollutants - anthropogenic, xenobiotic, synergism, sources and sink, residence time, levels and impacts of major pollutants - processes leading to smog, acid rain, global warming, stratospheric ozone depletion - Noise pollution and abatement.

MODULE V IMPACTS ON ENERGY AND CONSERVATION, ENVIRONMENTAL CRISIS 8

Energy - Renewable and non renewable energy resources - thermal power plants - nuclear fuels, fossil fuels, solar energy, wind energy, wave energy, tidal energy, ocean thermal energy, hydropower, geothermal energy, biomass energy; Environment crisis - state of environment in developed and developing countries- managing environmental challenges for future - disaster management, floods, earthquake, cyclone and landslides.

MODULE VI ENVIRONMENTAL IMPACT ASSESSMENT AND SUSTAINABILITY 5

Environmental Impact Assessment - Impacts: magnitude and significance - steps in EIA - methods - precautionary principle and polluter pays principle - role of NGOs and Public - value education - Environment protection act (air, water, wild life) and forest Conservation act; Concept of Sustainability - Sustainable Development - Gaia Hypothesis - Traditional Knowledge for sustainability.

TOTAL: 45

REFERENCES:

1. Environmental Science (The Natural Environment and Human Impact), Andrew R. W. Jackson and Julie M. Jackson, Pearson Education Limited, Harlow, Essex, England, 2000.
2. Environmental Science (Working with the Earth), G Tyler Miller, Jr., Thomson Brooks/Cole, 2006.
3. Physical Geology, Earth Revealed, David McGeary and Charles C Plummer, WCB McGraw Hill, 1998.
4. Sustainability: A Philosophy of Adaptive Ecosystem Management, Bryan G. Norton, 2005.
5. Environmental Impact Assessment, Larry W. Canter, McGraw-Hill, 1996.
6. The Revenge of Gaia: Why the Earth is Fighting Back and How We Can Still Save Humanity, James Lovelock, Penguin UK, 2007.

OUTCOME:

Students will be able to gain the basic scientific knowledge on the environment, human impacts on various elements of environment and their assessment tools.

BTB2216 GENETIC ENGINEERING LABORATORY

L	T	P	C
0	0	3	1

OBJECTIVES:

Provides an opportunity to experimentally verify the theoretical concepts already studied. It also helps in understanding the theoretical principles in a more explicit and concentrated manner. The students should be able to develop their skills in the

- Isolation of plasmid DNA, genomic DNA and RNA
- Electrophoresis and restriction digestion of DNA
- Phage titration

LIST OF EXPERIMENTS:

1. Preparation of Agarose Gel
2. Isolation of Plasmids
3. Isolation of Genomic DNA from blood, plant cell and bacteria
4. Isolation of RNA
5. Formaldehyde gel electrophoresis of RNA
6. Polyacrylamide gel electrophoresis of DNA
7. Restriction digestion of DNA
8. Ligation of digested of DNA
9. UV mutation
10. Phage Titration

REFERENCE:

Sambrook et al, "Molecular Cloning-A laboratory Manual"

OUTCOME:

Students will learn about

- Isolation of DNA, RNA,
- digestion and ligation of nucleic acids,
- mutation and phage titration

BTB2217	IMMUNOLOGY LABORATORY	L	T	P	C
		0	0	3	1

OBJECTIVES:

Provides an opportunity to experimentally verify the theoretical concepts already studied. It also helps in understanding the theoretical principles in a more explicit and concentrated manner. The students should be able to develop their skills in

- Antigen - Antibody interaction
- Electrophoresis techniques

LIST OF EXPERIMENTS:

1. Blood grouping
2. Antigen-antibody reaction-Haemagglutination, precipitation-Widal and VDRL
3. Immunodiffusion, Immunoelectrophoresis.
4. Affinity chromatography for antibody purification.
5. ELISA-DOT and plate ELISA
6. Western blotting

REFERENCE:

Laboratory manual

OUTCOME

Students could independently perform diagnostics assays involving antigen-antibody reaction. They also learn to perform the qualitative and quantitative analysis using antibody.

BTB2218	ANIMAL AND PLANT CELL CULTURE LABORATORY	L	T	P	C
		0	0	3	1

OBJECTIVES:

Provides an opportunity to experimentally verify the theoretical concepts already studied. It also helps in understanding the theoretical principles in a more explicit and concentrated manner. The students should be able to

- Understand explicitly the concepts
- Develop their skills in the animal and plant cell culture techniques

LIST OF EXPERIMENTS:

1. Preparation of culture media and sterilization
2. Fibroblast culture.
3. Study of effect of anti cancer agent in cell culture.
4. Live cell counting
5. Callus Induction
6. Shoot tip culture
7. Embryo / Endosperm Culture

REFERENCE:

Laboratory Manual

OUTCOME:

On the completion of the above objectives student will be able to explorethemselves about pre -requisites for animal as well as plant tissue culture.They will be able to understand cell cycle and alsotechnical applications of cell culture.

SEMESTER-V

BTB3101 MOLECULAR PATHOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

The course aims to provide the students with the theoretical basis of the main mechanism of cell, tissues, organs and apparatus functionality and the current methods of animal cell culture and its application in research.

MODULE I INTRODUCTION TO MOLECULAR BASIS OF DISEASE 9

Mechanisms of cell death, apoptosis, necrosis, pathways to apoptosis, acute and chronic inflammation, infection and host response, neoplasia

MODULE II MOLECULAR BIOLOGY AND GENETICS 9

Structure and organization of human genome, human genome project, genetic diseases, gene expression profiling, microarrays-applications in basic research and translational medicine

MODULE III PRINCIPLES OF MOLECULAR PATHOLOGY 9

History of approaches to disease, current practice and future prospect, pathogenesis of Hepatitis C, Acute myeloid leukemia and cystic fibrosis

MODULE IV MOLECULAR BASIS OF HUMAN DISEASES 9

Cardiovascular diseases-atherosclerosis, ischemic heart diseases, cardiomyopathies; lymphoid and myeloid diseases; diseases of immune system, major syndrome, pulmonary diseases, diseases of gastrointestinal tract, neuropathological disorders

MODULE V MOLECULAR THERAPEUTICS 9

Pharmacogenetics, SNPs, cytochrome P450 system, High throughput screening techniques, Gene therapy, Immunotherapy, recombinant drugs, embryonic stem cells.

TOTAL: 45

REFERENCES:

1. Animal Cell Culture by John R.W. Masters Oxford University Press
2. Introduction to Cell and Tissue Culture by Jennie P. Mather and Penelope E. Roberts
3. Plenum Press, New York and London
4. Molecular Biotechnology: Primrose.
5. Animal Cell Biotechnology: R.E. Spier and J.B. Griffiths (1988), Academic press.

OUTCOMES:

At the end of the course students will be able to

- Apply biotechnological methods for translational research;
- Apply bimolecular methods to pharmacology, to the design, correct use and traceability of medicines;

BTB3102 CHEMICAL AND BIO-THERMODYNAMICS

L	T	P	C
3	0	0	3

OBJECTIVES:

The course aims at making the students understand the fundamental principles and concepts of chemical and bio thermodynamics.

MODULE I THERMODYNAMIC PROPERTIES OF FLUIDS 7

Volumetric properties of fluids exhibiting non ideal behavior – Residual properties – Estimation of thermodynamic properties using equations of state – Calculations involving actual property exchanges – Maxwell's relations and applications.

MODULE II SOLUTION THERMODYNAMICS 7

Partial molar properties – Concepts of chemical potential and fugacity – Ideal and non-ideal solutions – Concepts and applications of excess properties of mixtures – Activity coefficient – Composition models – Gibbs Duhem equation.

MODULE III PHASE EQUILIBRIA 7

Criteria for phase equilibria – VLE calculations for binary and multi component systems – Liquid-liquid equilibria (LLE) and solid-solid equilibria (SLE).

MODULE IV CHEMICAL REACTION EQUILIBRIA 8

Equilibrium criteria for homogeneous chemical reactions – Evaluation of equilibrium constant – Effect of temperature and pressure on equilibrium constant – Calculation of equilibrium conversion and yields for single and multiple reactions.

MODULE V THERMODYNAMIC ANALYSIS OF PROCESSES 8

Concept of lost work – Entropy generation – Calculation of real irreversible processes – Power cycle – Liquefaction.

MODULE VI BIOCHEMICAL THERMODYNAMICS 8

Energetics of metabolic pathways energy coupling (ATP and NADH), stoichiometric and energetic analysis of cell growth and product formation-elemental balances, degree of reduction concepts-available –electron balance,

yield coefficients, oxygen consumption and heat evolution in aerobic cultures, thermodynamics efficiency of growth.

TOTAL : 45

REFERENCES

1. Smith, J.M., Van Ness H.C. and Abbott M., "Introduction to Chemical Engineering Thermodynamics", 6th Edition, Tata McGraw- Hill, 2001.
2. Narayanan, K.V., "A Text Book of Chemical Engineering Thermodynamics", Prentice Hall India, 2001.
3. Sandler, S.I., "Chemical, Biochemical and Engineering Thermodynamics", 4th Edition, John Wiley and Sons Inc., 2006.
2. Haynie, D.T., "Biological Thermodynamics", 2nd Edition, Cambridge University Press, 2008.
3. Nicholls, D.G. and Ferquson, S.J., "Bioenergetics 3", 2nd Edition, Elsevier Science Ltd., 2002.

OUTCOMES:

At the end of the course the students will be well versed with the behavior of fluids under PVT conditions and also apply them for practical purpose, aim advantage will be to deal with power production and refrigeration processes. The study further provides a comprehensive exposition to theory and application of solution thermodynamics.

BTB3103 FOOD BIOTECHNOLOGY L T P C
4 0 0 4

OBJECTIVES:

The course aims to

- Provide a programme of education which can enable its graduates to enter a career in the food industry as technologists capable of ensuring the production and marketing of safe and quality foods.
- Provide a broadly based technological education whose graduates can also enter into employment in other sectors of the food chain, or related technical sectors, where they can apply their technological skills.
- Allow individuals to develop their capacity to undertake research into problems relating to the production and marketing of safe and quality foods.

MODULE I HISTORICAL BACKGROUND 12

History of Microorganisms in food, Historical Developments, Taxonomy, role and significance of microorganisms in foods. Intrinsic and Extrinsic Parameters of Foods that affect microbial growth, Microorganisms in fresh meats and poultry, processed meats, seafood's, fermented and fermented dairy products and miscellaneous food products, Starter cultures, cheeses, beer, wine and distilled spirits, SCP, medical foods, probiotics and health benefits of fermented milk and foods products.

MODULE II FERMENTATION 10

Brewing malting, mashing, hops, primary & secondary fermentation: Biotechnological improvements: catabolic repression, High gravity brewing, B-glucan problem, getting rid of diacetyl. Beer, wine and distilled spirits.

MODULE III NUTRITIONAL BOOSTS AND FLAVOR ENHANCERS 10

Emerging processing and preservation technologies for milk and dairy product, Microbiological Examination of surfaces, Air Sampling, Metabolically Injured Organisms,Enumeration and Detection of Food-borne Organisms. Bioassay and related Methods.

MODULE IV FOOD PRESERVATION 10

Food Preservation Using Irradiation, Characteristics of Radiations of Interest

in Food Preservation. Principles Underlying the Destruction of Microorganisms by Irradiation, Processing of Foods for Irradiation, Application of Radiation, Radappertization, Radicidation, and Radurization of Foods Legal Status of Food Irradiation, Effect of Irradiation of Food constituents.

MODULE V STORAGE 9

Stability Food Preservation with Low Temperatures, Food Preservation with HighTemperatures, Preservation of Foods by Drying, Indicator and Food-borne Pathogens, Other Proven and Suspected Food-borne Pathogens.

MODULE VI FOOD QUALITY AND CONTROL 9

Analysis of food, major ingredients present in different product, Food additives colour, flavour, vitamins, Microbial safety of food products, Chemical safety of food products, heavy metal, fungal toxins, pesticide and herbicide contamination.

TOTAL: 60

REFERENCES:

1. Modern Food Micro-Biology by James M. Jay, (2000), 6th edition, An Aspen Publication, Maryland, USA.
2. Food Microbiology: Fundamentals and frontiers by M.P. Doyle, L.R. Beuchat and Thoma J. Montville, (2001), 2nd edition, ASM press, USA.
3. Food Science and Food Biotechnology by G.F.G. Lopez & G.V.B. Canovas (2003), CRCPress, Florida, USA.

OUTCOMES:

At the end of the course students will be able to

- Integrate the scientific disciplines relevant to food
- Apply and communicate technological knowledge to meet the needs of industry andthe consumer for the production and marketing of safe and quality foods.

BTB3104 BIO PROCESS ENGINEERING L T P C
4 0 0 4

OBJECTIVES:

The course aims to provide the students with the theoretical basis Bioprocess principles and the integration of biochemistry, microbiology, cell biology and process engineering. It aims to exploit the potential of microorganisms and cells by technical means.

MODULE I INTRODUCTION TO ENGINEERING CALCULATION, PRESENTATIONS AND ANALYSIS OF DATA 7

Physical variables, dimensions, Modules, errors in data and calculations, testing mathematical models, process flow diagram

MODULE II MATERIAL & ENERGY BALANCES 10

Thermodynamics Law of conservation of mass, types of material balance products, electron balances, biomass yield, theoretical oxygen demand. Problems, Basic concepts, General Energy balance equations, Enthalpy calculations, Enthalpy changes in non-reactive processes, Types of energy balance calculations, Types of heat reactions, problems.

MODULE III UNSTEADY STATE MATERIAL AND ENERGY BALANCES 10

Material balance equation for CSTR, Energy balance equations, solving differential equations, solving mass balances, solving energy balances, problems.

MODULE IV FLUID FLOW AND MIXING 10

Classification of fluids, Reynolds number, Momentum transfer, Non – Newtonian fluids, Two-Parameter models, rheological properties of fermentation broths, mixing, power requirements for mixing, scale-up of mixing systems, role of shear in stirred fermentors, problems.

MODULE V HEAT& MASS TRANSFER 10

Equipments, mechanism of heat transfer, conduction, heat transfer between fluids, design equation for heat transfer systems, applications of design equations, problems, Mass transfer: Molecular diffusion, role of diffusion in

bio-processing, film theory, convective mass transfer, oxygen uptake and transfer in cell cultures, kLa determination, problems.

MODULE VI REACTOR ENGINEERING **13**

Bioreactor configurations, practical considerations for bioreactor construction, monitoring and control of bioreactors, ideal reactor operations, batch operation of a mixed reactor, case study of penicillin production. Homogeneous reactions: Basic reaction theory, calculation of reaction rates, general reaction kinetics for biological systems, yields in cell culture, cell growth kinetics,production kinetics, kinetics of cell death, problems, Heterogeneous reactions: Concentration gradients and reaction rates in solid catalysts,internal mass transfer and reaction, the Thiele modulous and effectiveness factor, external mass transfer, problems

TOTAL: 60

REFERENCES:

1. Bioprocess Engineering - Basic concepts by M. L. Schuler & F. Kargi, Entice Hall 1992.
2. Bioprocess Engineering Principles by Pauline M. Doran, Academic Press 1995.
3. Fermentation & Biochemical Engineering Hand Book (1983), Principles, Process
4. Design and Equipment. HC Vogel, Noyes.
5. Principal of Microbe & Cell Cultivation (1975), SJ Prit, Blackwell Scientific co.).
6. Bioprocess Computations in Biotechnology (Vol. 1) TK Ghose, Ellis howard Ltd.

OUTCOMES:

At the end of the course the students will be able to

- Understand the basic role of engineering in bio-processing applications
- Obtain a basic understanding of how cells work and become familiar with theenvironmental conditions (i.e. nutrients, pH, etc.) required for applications ofbiological components (cells or enzymes) to bio-processing systems.

- Understand and model enzyme kinetics and apply the models for analysis of immobilized enzymatic bioreactors.
- Utilize material balances to evaluate cell growth and substrate/product utilization in bioreactors.
- Design bioreactors to achieve desired results (i.e. specified cell concentration, production rates, etc.).
- Understand and apply scale-up methods for designing bioreactors.
- Become familiar with principles of recovery and purification techniques of bioprocesses.

BTB3105 PROTEIN ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

The course aims to provide the students with a knowledge on the biosynthesis, structure and function of proteins and furthermore, the techniques associated with gene cloning and the expression of recombinant proteins. To provide knowledge about the design of proteins with specific properties.

MODULE I PROTEIN STRUCTURE 7

Introduction, Overview of protein structure, Higher level structure, Protein post-translational modification, Protein stability and folding, Protein Sources: Introduction, Microorganisms as sources of proteins, Proteins from plants, Animal tissue as a protein source, Direct chemical synthesis, Conclusion.

MODULE II PROTEIN PURIFICATION AND CHARACTERIZATION 8

Introduction, Initial recovery of proteins, Removal of whole cells and cell debrisConcentration and primary purification, Column chromatography, Protein inactivation and stabilization, Protein characterization, Large-Scale Protein Purification: Some general principles, Therapeutic protein production: some special issues, Range and medical significance of impurities potentially present in protein-based therapeutic products, Labelling and packing of finished products.

MODULE III THERAPEUTIC PROTEINS 8

Introduction, Blood products, Haemophilia A and B, Anticoagulants, Thrombolytic agents, Additional blood-related products, Vaccine technology, Vaccines for AIDS, Therapeutic Antibodies and Enzymes: Introduction, Antibodies for in vivo application, Therapeutic enzymes.

MODULE IV HORMONES AND GROWTH FACTORS USED THERAPEUTICALLY 8

Introduction, Insulin, Glucagon, Gonadotrophins, Growth hormone, Erythropoietin, Other growth factors, Thyrotrophin, Corticotrophin, Prolactin, Peptide Regulatory Factor, Interferons, Interleukins and Additional Regulatory Factors: Regulatory factors; cytokines versus hormones, Interferons, Interleukins, Tumour necrosis factors, Colony stimulating factors, Cytokine toxicity.

MODULE V PROTEINS USED FOR ANALYTICAL PURPOSES 7

Introduction, Enzymes as diagnostic/analytical reagents, Biosensors, Antibodies as analytical reagents.

MODULE VI NON-CATALYTIC INDUSTRIAL PROTEINS 7

Introduction, Functional properties of proteins, Milk and milk proteins, Animal and microbial proteins, Sweet and taste modifying proteins.

TOTAL: 45

REFERENCES:

1. Proteins: Biochemistry and Biotechnology by Gary Walsh. (2002): John Wiley & Sons Ltd.
2. Fundamentals of Protein Biotechnology: Edited by Stanley Stein (1990): Marcel Dekker, Inc.

OUTCOMES:

This Course will provide theoretical and methodological knowledge in Protein Engineering. In particular, the student will get acquainted with enzyme kinetics, rational protein engineering, and directed evolution of enzymes. In addition, expertise in enzyme immobilization and in enzymology in non conventional media will also be credited.

BTB3106 CHEMICAL REACTION ENGINEERING

L	T	P	C
4	0	0	4

OBJECTIVES:

To impart knowledge to design different types of chemical reactors. Students gain knowledge on different types of chemical reactors, the design of chemicalreactors under isothermal and non-isothermal conditions

MODULE I REACTION KINETICS **10**

Rate equation, elementary, non-elementary reactions, theories of reaction rate andtemperature dependency; Design equation for constant and variable volume batch reactors,analysis of experimental kinetics data, integral and differential analysis.

MODULE II DESIGN OF CONTINUOUS REACTORS **10**

Design of continuous reactors - stirred tank and tubular flow reactor, recycle reactors,combination of reactors, size comparison of reactors.

MODULE III MULTIPLE REACTIONS **9**

Design of reactors for multiple reactions - consecutive, parallel and mixed reactions - factorsaffecting choice, optimum yield and conversion, selectivity, reactivity and yield.

Module IV KINETICS OF COMPLEX REACTIONS **11**

Non-isothermal homogeneous reactor systems, adiabatic reactors, rates of heat exchangesfor different reactors, design for constant rate input and constant heat transfer coefficient,operation of batch and continuous reactors, optimum temperature progression.

MODULE V RESIDENCE TIME DISTRIBUTION **10**

The residence time distribution as a factor of performance; residence time functions andrelationship between them in reactor; basic models for non-ideal flow; conversion in non-ideal reactors.

MODULE VI CHEMICAL REACTOR DESIGN **10**

Transient and steady state analysis, Optimal design of reactors, Multiphase

reactors: fixed, fluidized, trickle bed, slurry etc, Non-ideal continuous flow reactors.

TOTAL: 60

REFERENCES:

1. Levenspiel O, "Chemical Reaction Engineering", Wiley Eastern Ltd., IInd Edition, 2000.
2. Smith, J.M, "Chemical Engineering Kinetics", McGraw Hill, IIIrd Edition, 1981.
3. Fogler.H.S., "Elements of Chemical Reaction Engineering", Prentice Hall of India Ltd.,IIIrd Edition, 2000.
4. Froment. G.F. & K.B.Bischoff, "Chemical Reactor Analysis and Design",John Wiley andSons, 1979

OUTCOMES:

At the end of the course students will be able to:

- Develop rate laws for use in reactor design based on reaction data from a reactor or set of reactors.
- Make comparisons of ideal reactor types (batch, plug flow, mixed flow, etc.) and be able to determine the best choice for simple objectives when using a single reactor or a set of reactors.
- Predict reactor performance in situations where a reacting gas has a significantly changing density, including the case of variable pressure within an ideal plug flow reactor.
- Determine optimal ideal reactor design for multiple reactions for yield or selectivity.
- Predict reactor performance for reactors when the temperature is not uniform within the reactor.
- Predict reactor performance in situations where the observed reaction rate is significantly influenced by internal mass transfer in porous heterogeneous catalysis (the iso-thermal effectiveness factor).

BTB3107	BIOPROCESS LABORATORY	L	T	P	C
		0	0	3	1

OBJECTIVES:

Enables the student to develop their skills in the field of enzyme isolation its assay, enzyme kinetics and microbial fermentation. The students will be able to

- Develop their practical skills in enzyme isolation and purification.
- Evaluate enzyme kinetics
- Carry out enzyme immobilized reaction and microbial culture
- Develop practical skill in submerged and solid state fermentation.

LIST OF EXPERIMENTS:

1. Isolation of proteolytic organism from soil sample
2. Glucose assay by DNS method
3. Evaluations of enzyme kinetic parameters
4. Enzyme activity calculation
5. Determination of optimum pH for enzyme
6. Determination of optimum temperature for an enzyme
7. Enzyme immobilized by alginate gel method
8. Hydrolysis of starch by immobilized method
9. Effect of substrate concentration on biomass yield
10. Solvent extraction techniques for product recovery

REFERENCE:

Laboratory Manual

OUTCOMES:

At the end of the syllabus student will be able to understand the fundamentals of bioprocess techniques. Students will be familiar with techniques involved in downstream process.

BTB3108 CHEMICAL ENGINEERING LABORATORY

L	T	P	C
0	0	3	1

OBJECTIVES:

This course helps the students to experimentally verify the theoretical concepts they learnt in the course. To make the students to experimentally

- Determine the percentage extraction .
- Determine overall stage efficiency of a continuous counter current leaching unit.
- Verify the applicability of Freundlich equation for adsorption of acetic acid on activated carbon.
- Verify Rayleigh's equation.

LIST OF EXPERIMENTS:

1. Simple distillation
2. Steam distillation
3. Leaching
4. Batch adsorption
5. Diffusion
6. Air drying
7. Continuous absorption
8. Extraction
9. Vacuum drying
10. Infra red drying

REFERENCE:

1. Laboratory Manual

OUTCOMES:

At the end of the syllabus student will be able to understand the fundamentals of chemical engineering techniques. Students will be familiar with techniques involved in chemical engineering by performing distillations, adsorption and drying experiments.

BTB3109 PROTEIN ENGINEERING LABORATORY

L	T	P	C
0	0	3	1

OBJECTIVES:

Course aims to provide a detail understating of the concepts in protein engineering by providing hands on exposure to the methods in protein engineering.

LIST OF EXPERIMENTS:

1. Production of protein hydrolysates using enzymes.
2. Amino Acid Analysis by Precolumn Derivatization with 1-Fluoro-2,4-Dinitrophenyl-5-L-Alanine Amide.
3. Estimation of Disulfide Bonds Using Ellman's Reagent.
4. Quantitation of Cysteine Residues and Disulfide Bonds by Electrophoresis.
5. Protein Ladder Sequencing.
6. Isolation of Proteins Cross-linked to DNA by Formaldehyde
7. Chemical Methods of Analysis of Glycoproteins.
8. Monosaccharide Analysis by Gas Chromatography (GC)
9. Performic Acid Oxidation.
10. Modification of Arginine Side Chains with p-Hydroxyphenylglyoxal.
11. Amidation of Carboxyl Groups.
12. Modification of Sulfhydryl Groups with DTNB.
13. Chemical Cleavage of Proteins at Methionyl-X Peptide Bonds.
14. Chemical Cleavage of Proteins at Cysteinyl-X Peptide Bonds.
15. Enzymatic Digestion of Proteins in Solution and in SDS Polyacrylamide Gels.

REFERENCE:

The protein protocols hand book, 2nd edition by John M. Walker

OUTCOME:

On the completion of the above objectives student will be able to explore themselves about chemical methods to modify protein of interest. They will be able to understand techniques involved in qualitative and quantitative analysis of protein.

SEMESTER VI

BTB3211 STRUCTURAL BIOLOGY

L	T	P	C
4	0	0	4

OBJECTIVES:

The course aims to provide the students with a detailed understanding of the behavior of proteins in solution and how their properties may be altered by changing the physical surroundings. To provide an understanding of the theory and practical techniques involved in developing a purification process.

MODULE I METHODS FOR STRUCTURE DETERMINATION 10

Diffraction methods, X-ray crystallography, crystallization, resolution, temperature factors, electron density maps, NMR methods for protein structure determination

MODULE II PROPERTIES OF MACROMOLECULES IN CRYSTALLINE STATE 10

Protein crystal, physical properties, chemistry of crystalline proteins, enzymatic and biological activities, structural heterogeneity in protein crystals

MODULE III STRUCTURAL STATES OF PROTEINS 14

Secondary structure, chemical nature of polypeptide chains, beta structure, collagen triple helix, prediction of secondary structure, helical protein structures, quaternary structures, oligomeric enzymes, biological implications of quaternary structure, surface accessibility.

MODULE IV CONFORMATIONAL STATES AND HYDROGEN BONDS 13

Oxygenation of hemoglobin: two crystal conformation, hydrogen bonds and water molecules in crystalline proteins, hydrogen bonding positions, distribution of protein bound water, water networks in crystalline proteins

MODULE V PROTEIN COMPLEXES 13

Protein and nucleic acid complex, DNA binding motifs, helix-turn-helix, leucine zipper, metalloproteins, membrane protein structure by electron microscopy and X ray methods

TOTAL: 60

REFERENCES:

1. Protein: Biochemistry and Biotechnology by Gary Walsh (2002 John Wiley & Sons Ltd.)
2. Foundations of Structural Biology by Leonard J. Banaszak (2000) Academic Press.

OUTCOMES:

At the end of this course, students will be able to understand methods to determine and study protein structures

BTB3212 TISSUE ENGINEERING L T P C
4 0 0 4

OBJECTIVES:

The course aims to provide the students with an experimental knowledge to embrace a cell culture approach and experience authentic systems genetics research by designing and conducting independent research projects.

MODULE I INTRODUCTION 10

Basic definition, Structural and organization of tissues: Epithelial, connective; vascularity and angiogenesis, basic wound healing, cell migration, current scope of development and use in therapeutic and in-vitro testing.

MODULE II CELL CULTURE 11

Different cell types, progenitor cells and cell differentiations, different kind of matrix, cell-cell interaction. Aspect of cell culture: cell expansion, cell transfer, cell storage and cell characterization, Bioreactors.

MODULE III MOLECULAR BIOLOGY ASPECTS 12

Cell signaling molecules, growth factors, hormone and growth factor signaling, growth factor delivery in tissue engineering, cell attachment: differential cell adhesion, receptor-ligand binding, and Cell surface markers.

MODULE IV SCAFFOLD AND TRANSPLANT 13

Engineering biomaterials for tissue engineering, Degradable materials (collagen, silk and polylactic acid), porosity, mechanical strength, 3-D architecture and cell incorporation. Engineering tissues for replacing bone, cartilage, tendons, ligaments, skin and liver. Basic transplant immunology, stems cells: introduction, hepatopoiesis.

MODULE V CASE STUDY AND REGULATORY ISSUES 14

Case study of multiple approaches: cell transplantation for liver, musculoskeletal, cardiovascular, neural, visceral tissue engineering. Ethical, FDA and regulatory issues of tissue engineering.

TOTAL : 60

REFERENCES:

1. Principles of tissue engineering, Robert. P.Lanza, Robert Langer & William L. Chick, Academic press (2007).

2. The Biomedical Engineering –Handbook, Joseph D. Bronzino, CRC press (2006).

OUTCOMES

At the end of the course students will be

- Familiar with principles used in generating cell culture models as well as in manipulation of the same for basic and translational research

BTB3213 DEVELOPMENTAL BIOLOGY L T P C
4 0 0 4

OBJECTIVES:

This course aims to provide a thorough grounding in animal and plant developmental biology with particular emphasis on the role of cell-cell interactions.

Three major themes are highlighted in the lecture

- The genetic regulation of cell behaviour as the main determinant of development.
- The molecular mechanisms by which cells interact and are recruited to achieve complex morphogenesis.
- The significant role of post-embryonic regulation and environmental signals in the control of plant development.

MODULE I HISTORY & BASIC CONCEPTS 10

The origins of developmental biology, Concepts in development – Developmental signals in cell division & differentiation, Role of gene expression in development, Identifying developmental genes, Cell commitment & differentiation, Determination & induction of cell fate, Concept of morphogen & positional information.

MODULE II AN INTRODUCTION TO MODEL SYSTEMS 12

Model vertebrate organisms: X. laevis, Chicken, Mouse, Zebrafish, Model invertebrate organisms: D. melanogaster, C. elegans, Model plant: A. thaliana, Germ Cells & Sex, Genotypic & phenotypic sex-determiantion in mammals, D. melanogaster and C. elegans, Structure & Formation of germ cells, Fertilization, Patterning the Vertebrate Body Plan : Axes & Germ Layers, Setting up the body axes, The origin & specification of the germ layers, The Mesoderm & Early Nervous System, Somite formation & Patterning, Role of the organizer region & neural induction

MODULE III DEVELOPMENT OF THE DROSOPHILA 12

Body Plan, Specification of body axes & role of maternalgenes, Polarization of body axes during oogenesis, Patterning of early embryo & role of zygotic genes, Segmentation & role of pair-rule genes, Compartments & role of segment polarity genes, Selector & Homeotic genes, Development of Nematodes &

Cellular Slime Molds: Developmental axes determination in C. elegans, Cell-fate specification in C. elegans, Larval development in C. elegans, Vulva development in C. elegans, Patterning of the slug in slime mold, Cell differentiation in slime mold, Aggregation.

MODULE IV MORPHOGENESIS 9

Kinds of cleavage & blastulation, Types of tissue movement in gastrulation, Gastrulation in amphibians & mammals, Neural tube formation & neural crest migration.

MODULE V CELL DIFFERENTIATION & ORGANOGENESIS 8

Models of cell differentiation, Insect imaginal disc & wing development.

MODULE VI MOLTING & METAMORPHOSIS 9

Amphibian metamorphosis, Insect metamorphosis,Plant Development: Pattern development in early embryogenesis of angiosperms, Floral development.

TOTAL: 60

REFERENCE:

1. Developmental Biology, by Scott F. Gilbert (1997), Sinauer Associates, Inc.

OUTCOMES

At the end of the course students should be able to:

- Describe how regulation of gene expression is fundamental in cell differentiation.
- Describe developmental processes in animal model systems and recognise the importance of cell-cell interactions.
- Recognize the interplay between development and evolution.
- Describe the life cycle and particular advantages of using Arabidopsis thaliana as a model species for studying plant development.
- Recognize embryonic polarity systems and the importance of cell lineage and position in embryonic pattern formation.
- Describe genetic approaches to study plant development and molecular techniques used to localize gene expression.
- Recognize the ways in which analysis of plant morphogenesis is being used to manipulate the growth and development of crop plants.

BTB3214 CANCER BIOLOGY L T P C
3 0 0 3

OBJECTIVES:

This course will cover the origins of cancer and the genetic and cellular basis for cancer. It will examine the factors that have been implicated in triggering cancers; the intercellular interactions involved in cancer proliferation; current treatments for cancer and how these are designed; and future research and treatment directions for cancer therapy.

MODULE I FUNDAMENTALS OF CANCER BIOLOGY 7

Regulation of cell cycle, mutations that cause changes in signal molecules - Effects on receptor, signal switches, tumour suppressor genes - Modulation of cell cycle in cancer, different forms of cancers, diet and cancer.

MODULE II CANCER SCREENING METHODS 7

Cancer screening and early detection, detection using biochemical assays, tumor markers - Molecular tools for early diagnosis of cancer.

MODULE III PRINCIPLES OF CARCINOGENESIS 7

Theory of carcinogenesis - Chemical carcinogenesis, metabolism of carcinogenesis, principles of physical carcinogenesis, x-ray radiation - Mechanisms of radiation carcinogenesis.

MODULE IV PRINCIPLES OF MOLECULAR CELL BIOLOGY OF CANCER 8

Signal targets and cancer, activation of kinases - Oncogenes, identification of oncogenes, retroviruses and oncogenes – Detection of oncogenes, oncogenes and proto oncogene activity – Growth factors related to transformation - Telomerases.

MODULE V PRINCIPLES OF CANCER METASTASIS 8

Clinical significances of invasion, heterogeneity of metastatic phenotype - Metastatic cascade, basement membrane disruption - Three step theory of invasion, proteinases and tumour cell invasion.

MODULE VI NEW MOLECULES FOR CANCER THERAPY 8

Different forms of therapy - Chemotherapy, radiation therapy, detection of cancers, prediction of aggressiveness of cancer, advances in cancer detection, use of signal targets towards therapy of cancer - Gene therapy

TOTAL: 45

REFERENCES:

1. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter. Molecular Biology of the Cell 5Edition, Garland Science; 2008.
2. Robert A. Weinberg. The Biology of Cancer 2nd Edition Garland Science, 2013

OUTCOMES:

At the end of the course students will be able to

- Explain how scientists Hippocrates and Galen coined the terms cancer and oncology.
- Describe how surgeon John Hunter and microscopic researcher Rudolf Virchow connected their observations to the pathology and treatment of cancer.
- List the common theories used to describe the cause of cancer.
- Overview the impact that the discovery of DNA by scientists Watson and Crick had on the cancer community.
- Discuss the finding of Nobel Prize winner Peyton Rous, that certain viruses can cause cancer.
- Differentiate between carcinoma, sarcoma, leukemia, and lymphoma and how these terms are used to name cancer types.
- Summarize why it is important to understand basic biology in the study of cancer.
- Name the six hallmarks of cancer.
- Outline how cancer starts and how it spreads.
- Identify common causes of cancer.

BTB3215	GENE MANIPULATION LABORATORY	L	T	P	C
		0	0	3	1

OBJECTIVE:

To provide an opportunity to experimentally verify the theoretical concepts of genetic engineering already studied. it also helps in understanding the theoretical principles in a more explicit and concentrated manner.

LIST OF EXPERIMENTS:

1. Isolation and Restriction enzyme digestion of bacterial genomic DNA
2. Purification of digested DNA
3. Ligation of DNA fragment with cloning vector
4. Preparation of competent cells
5. Transformation in E.coli with recombinant vector
6. Isolation of recombinants and confirmation of insert DNA in vector

OUTCOME:

The student will be able to understand and develop the concept of recombinant DNA technique.

ENB2282 CONFIDENCE BUILDING AND BEHAVIOURAL SKILLS **L T P C**
0 0 2 1

OBJECTIVES:

To enable the students to develop communication skills for verbal communication in the work place.

TOPICS OUTLINE:

This course is practical oriented one and exercises will be given to the students group users /individually depending upon the aspect considered. The following aspect will form the broad outline content of the syllabi. The exercises will be designed by the faculty member and coordinated by the overall course coordinator.

LAB ACTIVITIES:

- Introduction: Soft skills definition, examples
- Verbal communication: Case study, communication and discussion
  - Prepared speech
  - Impromptu speech
  - Debate: Case studies - Attitude and Behavior: role play and exploration
  - Ability to ask for help – communication and team work
- Manners and etiquette
  - Organization and Planning
  - Time keeping
  - Conduct in workplace
  - Conscientiousness
  - Work output
  - Professionalism
  - Motivation
- Ownership of tasks
- Adaptability/flexibility

ASSESSMENT:

The assessment will be continuous and portfolio based. The students must produce the record of the work done through the course of the semester in the individual classes. The portfolio may consist of a) the individual task outline and activities, b) worked out activities c) Pre-designed sheets which may be provided by the Faculty member. The portfolio will be used by the Faculty member for assessment. The course coordinator in consultation with the course committee shall decide at the beginning of the semester, the number of exercises, method of assessment of each and the weightage for the end semester assessment.

OUTCOMES :

The students should be able to:

- develop verbal communication skills
- debate with other students confidently
- communicate effectively their ideas

SEMESTER VII

BTB4101 BIOMEDICAL INSTRUMENTATION L T P C
4 0 0 4

OBJECTIVES:

- To provide an acquaintance of the physiology of the heart, lung, blood circulation and circulation respiration. Biomedical applications of different transducers used.
- To introduce the student to the various sensing and measurement devices of electrical origin. To provide awareness of electrical safety of medical equipments
- To provide the latest ideas on devices of non-electrical devices.
- To bring out the important and modern methods of imaging techniques.
- To provide latest knowledge of medical assistance / techniques and therapeutic equipments.

MODULE I PHYSIOLOGY AND TRANSDUCERS 13

Cell and its structure – Resting and Action Potential – Nervous system: Functional organisation of the nervous system – Structure of nervous system, neurons - synapse –transmitters and neural communication – Cardiovascular system – respiratory system – Basic components of a biomedical system - Transducers – selection criteria – Piezo electric, ultrasonic transducers – Temperature measurements - Fibre optic temperature sensors.

MODULE II ELECTRO – PHYSIOLOGICAL MEASUREMENTS 13

Electrodes –Limb electrodes –floating electrodes – pregelled disposable electrodes - Micro, needle and surface electrodes – Amplifiers: Preamplifiers, differential amplifiers, chopper amplifiers – Isolation amplifier. ECG – EEG – EMG – ERG – Lead systems and recording methods – Typical waveforms. Electrical safety in medical environment: shock hazards – leakage current- Instruments for checking safety parameters of biomedical equipments.

MODULE III NON-ELECTRICAL PARAMETER MEASUREMENTS 12

Measurement of blood pressure – Cardiac output – Heart rate – Heart sound – Pulmonary function measurements – spirometer – Photo Plethysmography,

Body Plethysmography – Blood Gas analysers : pH of blood –measurement of blood pCO_2, pO_2, finger-tip oxymeter - ESR, GSR measurements.

MODULE IV MEDICAL IMAGING 12

Radio graphic and fluoroscopic techniques – Computer tomography – MRI – Ultrasonography – Endoscopy – Thermography – Different types of biotelemetry systems and patient monitoring – Introduction to Biometric systems.

MODULE V ASSISTING AND THERAPEUTIC EQUIPMENTS 10

Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Heart – Lung machine – Audio meters – Dialysers – Lithotripsy

TOTAL : 60

REFERENCES:

1. R.S. Khandpur, 'Hand Book of Bio-Medical instrumentation', Tata McGraw Hill Publishing Co Ltd., 2003.

2. Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer, 'Bio-Medical Instrumentation and Measurements', IInd edition, Pearson Education, 2002 / PHI.

OUTCOMES:

The course will help the student to acquire an adequate knowledge of the physiological systems of the human body and relate them to the parameters that have clinical importance.

BTB4102 PROTEOMICS & GENOMICS

L	T	P	C
4	0	0	4

OBJECTIVES:

This course offers advanced level training on gene expression and gene therapy by covering topics such as genome mapping, proteomic techniques and new targets for drug discovery. To familiarize and expose the students to the Principle of gene expression, Concepts of functional genomics in biopharmaceutical industry, Application of gene therapy, Principles of proteomics and the role of models in genetic disorder.

MODULE I OUTLINE ABOUT GENOME 10

Genome organization (prokaryotes and Eukaryotes) – Physical mapping of genome - Whole genome sequencing - Various strategies of sequencing - Mass spectroscopy – Shotgun - Automation in sequencing finding genes and mutations - Genome sequence annotation.

MODULE II FUNCTIONAL GENOMICS 10

Construction and screening of cDNA libraries, PCR, yeast two hybrid systems - Serial analysis of gene expression (SAGE) – SAGE adaptation fro down sized extracts (SADE) – Pharmacogenomics.

MODULE III PROTEOME 10

Introduction - Methods exists to tackle the proteome complexity - Imaging mass spectroscopy - Protein chip array - Methods for protein interaction analysis - Multi dimensional chromatography.

MODULE IV PROTEIN STRUCTURAL GENOMICS 10

Determining gene function by sequence comparison – Determining gene function through conserved protein structure - Approaches to protein structural genomics.

MODULE V PROTEOMICS IN DRUG DEVELOPMENT 10

Role of Proteomics in Drug Development - Diagnosis of disease by Proteomics - Separation and identification techniques for protein analysis - Development of antibody based protein assay for diagnosis

MODULE VI ADVANCE TOPICS **10**

Proteomics in vaccine discovery from genome sequence to vaccine discovery, the case study, omics approaches of discovery

TOTAL: 60

REFERENCES:

1. Saccone, C., Pesole, G., Hand book of Comparative Genomics – Principles and Methodology, John Wiley and Sons Publication, New Jersey, 1st Edition, 2003.
2. Lesk, A.M., Introduction to Protein Science. Architecture, Function and Genomics, Oxford University press, New York, 2nd Edition, 2004.
3. Creighton, T.E., Protein Structure – A Practical Approach, Oxford University Press, New York, 4th Edition, 2004.
4. Brown, T.A., Genomes III, Garland Science, Taylore and Francis Group, New York, 3rd Edition, 2007.

OUTCOMES:

At the end of the course students will be able to

- Describe DNA sequencing technologies and recent advances for high throughput genomic sequencing.
- Compare and contrast different methods for functional genomic analysis.
- Provide examples of how genomics technologies have been applied to improve our understanding of biological systems.
- Compare and contrast classical approaches to understanding protein structure and function with recent proteomic approaches.
- Describe proteomic approaches and techniques used to investigate protein structure and function.
- Explain how specific proteomics techniques can contribute to understanding of biological systems.

BTB4103 FERMENTATION TECHNOLOGY L T P C
4 0 0 4

OBJECTIVES:

1. To educate the students about microorganisms, development of media, and anaerobic digesters
2. To make the students understand the fermentation process using these tools and its combination of bioprocess engineering

MODULE I PILOT PLANT FERMENTATION 10

Microbial fermentation, Mammalian cell culture system, Plant cell tissue and organ cultures.

MODULE II FERMENTATION DESIGN 11

Fermentation department, equipment and space requirements, the design of large fermenters (based on aeration), Statistical Methods for Fermentation Optimization.

MODULE III ENVIRONMENTAL CONCERNS ABOUT FERMENTATION 13

Environmental regulations and technology, laws and regulations, Technology (waste water), Waste water treatment strategy, Air (emissions of concerns), Selecting a Control Technology, Inorganics, and volatile Organic Compound Emission Control.

MODULE IV ANAEROBIC DIGESTERS 12

An overview of aerobic and anaerobic fermentation. Substrates, Products and Biogas, Operational Conditions, Types of anaerobic digesters.

MODULE V BIOREACTOR FOR PLANT CELL CULTURE 14

Biochemical Engineering of the Production of Plant – specific Secondary metabolites by Cell Suspension Cultures, Gas Concentration Effects on Secondary Metabolite Production by Plant Cell Cultures, Integrated Bioprocessing for Plant Cell Cultures and Large – Scale plant micro propagation.

TOTAL : 60

REFERENCES:

1. Fermentation and biochemical engineering handbook by Henry C. Ogal, 2nd edition, Noyes Publications.
2. Advances in Biochemical Engineering Biotechnology by T. Sceper and J.J Zhong; Springer Publication.
3. The Microbiology of anaerobic digesters by Michael H. Gerardi, A John Wiley & Sons, Inc., Publication, 2003.

OUTCOMES:

- This course will give a basic understanding of the types of fermentation process, bioprocess, and the preparation of media, and anaerobic digesters.
- This course is taught to give a basic understanding of the types of fermentation process, bioprocess, and the preparation of media, and anaerobic digesters.

BTB4104 NANO-BIOTECHNOLOGY L T P C
4 0 0 4

OBJECTIVES:

The course aims at introducing the underlying principles and applications of the emerging field of nanotechnology and nanoscience intended for a multidisciplinary audience with a variety of backgrounds. Introduces tools and principles relevant at the nanoscale dimension and discusses current and future nanotechnology applications in engineering, materials, physics, chemistry, biology, electronics and energy.

MODULE I INTRODUCTION 10

Technological impact of nano-scale systems, Micro and nano-systems and technologies - Overview of nano-devices and techniques.

MODULE II NANOSCALE MATERIALS 10

Strategies for nano architecture (top down and bottom up approaches) - Fabrication technologies and characterizations – Selfassembly systems, some aspects of nanofluidics- Surfactants, polymers, emulsions and colloids.

MODULE III INORGANIC NANOSCALE SYSTEMS FOR BIOSYSTEMS 10

Nano-structured materials, fullerenes - Properties and characteristics, carbon nanotubes - Characteristics and applications quantum dots and wires, gold nanoparticles and nanopores.

MODULE IV APPLICATIONS OF NANO-MOLECULES IN BIOSYSTEMS 10

Molecules of life - Proteins, lipids, RNA and DNA – Nanoscale elements for delivery of materials into cells, peptides coupled nanoparticles - DNA based artificial nanostructure proteins as components in nanodevices.

MODULE V APPLICATION OF NANO-BIOTECHNOLOGY IN DRUG DELIVERY 10

Nanoscale devices for drug discovery Micelles for drug delivery protein targeting - Small molecule - Protein interactions, microarray and genome chips.

MODULE VI NANOTECHNOLOGY FOR CANCER DIAGNOSIS 10

Nanobiosensors and nanobiochips, Nanomedicines, Drug targeting, Nanotechnology for cancer diagnosis and treatment – tumour targeted drug delivery system –nanotechnology for imaging and detection .Nanotechnology for cell destruction

TOTAL : 60

REFERENCES:

1. Mick Wilson, Kamali Kannangra, Geoff Smith., Nanotechnology, Oversees Press India Private Ltd, New Delhi, 2nd Edition, 2005.
2. Jain, K.K., Nanobiomolecular Diagnostics: Current Techniques and Application, Taylor and Fransis Publishers, New York, 1st Edition, 2006.
3. Kimball Nill., Glossary of Biotech and Nanobioterms, CRC Publisher, California, 4th Edition, 2005.

OUTCOMES:

At the end of the course students will be able to

- Use knowledge of nano science and mathematics to: Follow protocols, Conduct science or engineering procedures, Fabricate products, Make conclusions about results, Troubleshoot, Discover
- Function effectively in a laboratory environment using complex instrumentation machinery and protocols
- Independently seek out innovations in the rapidly changing field of nano-technology
- Compile and analyze data and draw conclusions at the nano level.
- Design, implement and document experiments
- Collaborate and communicate effectively in a high tech environment

BTB4105 FERMENTATION LABORATORY L T P C
0 0 3 1

OBJECTIVES:

Provides an opportunity to experimentally verify the theoretical concepts already studied. It also helps in understanding the theoretical principles in a more explicit and concentrated manner. The students will be able to

- Develop the skills of large scale production of secondary metabolites.
- Identify the growth factors
- Study the batch and continuous culture growth
- Evaluate the temperature effect on culture growth

LIST OF EXPERIMENTS:

1. Temperature effect on growth-estimation of energy of activation and Arrhenius constant for microorganisms. Batch, fed batch and continuous cultures a) Estimation of Monod parameters b) Pure and mixed cultures.
2. Production of secondary metabolite by plant cells in a photobioreactor. Production of secondary metabolites in synthetic and complex industrial media.
3. Production of wine by yeast.
4. Production of Aminoacid.
5. Screening of process variables single dimensional search, Plackett Burman design, design expert etc.
6. Study of rheology of fermentation broth and power determination.

REFERENCE:

Laboratory manual

OUTCOMES:

On the completion of the above objectives student will be able to perform production and analysis fermented products.

BTB4106 BIOMEDICAL INSTRUMENTATION LABORATORY **L T P C**
0 0 3 1

OBJECTIVES:

- To acquire knowledge on immunological techniques
- To learn and perform antibody production in rabbit
- To train in various techniques involving antigen and antibody reactions

LIST OF EXPERIMENTS **30**

1. Blood pressure measurement
2. Determination of percentage Transmittance, Absorbance & Concentration of given solutions using Spectrophotometer
3. Demonstration of direct agglutination reactions
4. Estimation of Haemoglobin content by Sahli's method
5. Erythrocyte sedimentation rate – Wintrobe's method
6. Packed cell volume
7. ELISA
8. Blood group mapping
9. Slide and tube agglutination reaction
10. SDS-PAGE and Immunoblotting

REFERENCE:

1. Laboratory Manual

OUTCOME:

Students could independently perform diagnostics assays involving antigen-antibody reaction. They also learn to perform the qualitative and quantitative analysis using antibody.

BTBX01 PHARMACEUTICAL BIOTECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

The course aims to provide the students with the important principles and techniques that are used in the design and analysis of biopharmaceutical engineering processes.

MODULE I INTRODUCTION **7**

Development of drug and pharmaceutical industry – Therapeutic agents, their use and economics Regulatory aspects.

MODULE II DRUG METABOLISM AND PHARMACOKINETICS **7**

Drug metabolism - Physico chemical principles - Radio activity - Pharma kinetic action of drugs on human bodies.

MODULE III IMPORTANT UNIT PROCESSES AND THEIR APPLICATIONS **7**

Bulk drug manufacturers - Type of reactions in bulk drug manufacture and processes - Special requirement for bulk drug manufacture.

MODULE IV MANUFACTURING PROCESSES **8**

Compressed tablets, wet granulation - Dry granulation or slugging -Direct compression - Tablet presses, coating of tablets, capsules, sustained action dosage forms -Parental solution - Oral liquids – Injections – Ointment - Topical applications – Preservation -Analytical methods and test for various drug and pharmaceuticals - Packing techniques -Standard of hygiene and GMP.

MODULE V PHARMACEUTICAL PRODUCT AND THEIR CONTROL **8**

Therapeutic categories - Vitamins, laxatives, analgesics, nonsteroidal contraceptives - External antiseptics - Antacids and others, antibiotics, biological hormones - Quality management and control.

MODULE VI DRUG MANUFACTURE AND MARKET SPECIFICATIONS **8**

Principles of monoclonal antibodies production, design and development of ELISA kit. Monoclonal antibodies in diseases detection and treatment. Role of PCR in microbial, plant and animal cell/ virus detection. Principles of drug

manufacture- solutions, suspensions and emulsions. Topical application of ointments, creams, suppositories. Solid dosage forms-powders, granules, capsules, coating of tablets, aerosols. Preservation, packing techniques. Indian pharmacopoeia, Guide to good manufacturing practice. Preclinical and clinical trials, Role of regulatory agencies.

TOTAL : 45

REFERENCES:

1. Leon Lachman., Theory and Practice of Industrial Pharmacy, Lea and Febiger, USA, 3rd Edition, 1986.
2. Remington., Pharmaceutical Science, Mark Publishing and Company, 2nd Edition, 1990.
3. Katzung, B.G., Basic and Clinical Pharmacology, Prentice Hall, New Delhi, 10th Edition, 2006.

OUTCOMES:

At the end of the course, students should be able to :

- describe the principles underlying the discovery, development and application of drugs of the future integrate the knowledge in explaining and evaluating the impact of biotechnology on modern medicine.
- discuss ideas and reach an agreement to the current and future prospect of pharmaceutical biotechnology and drug development in the global market

BTBX02 MEDICAL BIOTECHNOLOGY L T P C
3 0 0 3

OBJECTIVES:

The course aims to build on previous study and, through team-based research, student-led journal clubs and critical evaluation of scientific literature, challenge you to investigate new developments in selected, medical applications of biotechnology.

MODULE I SIMPLE PROTEINS AND THERAPEUTIC AGENTS 8

Proteins as therapeutic agents - Choice of expression systems and optimizing gene expression - Applications, delivery and targeting of therapeutic proteins - Engineering human interferons and human growth hormones - Regulatory aspects of therapeutic proteins - Enzymes as therapeutic agents - Use of genetically engineered DNase I and alginate lyase for treatment of Cystic Fibrosis.

MODULE II MONOCLONAL ANTIBODY AS THERAPEUTIC AGENT 8

Production of monoclonal antibodies - Human monoclonal antibodies, its scope and limitations - Hybrid human – Mouse antibodies - Production of antibodies in E. coli -Approaches for producing HIV therapeutic agents.

MODULE III HUMAN DISEASES 8

Viral and bacterial diseases - Diseases caused by protozoan and parasitic worms (helminths) - Emerging infectious diseases – Active and passive immunity – Autoimmunity- Rational of immunization - Diseases controllable by vaccination – Vaccines, designing vaccines adjuvants - Whole organisms vaccines - Attenuated viruses and bacteria - Inactivation of pathogenic organisms by heat and chemical treatment.

MODULE IV VACCINES 7

Bacterial polysaccharides, proteins and toxins as vaccines -Recombinant vaccines- subunit, attenuated and vector vaccines -Multivalent vaccine development against AIDS - Commercial and regulatory aspects of vaccine production and its distribution

MODULE V APPLICATION OF GENETIC ENGINEERING IN HEALTH CARE 7

Production of Recombinant Proteins having therapeutic and diagnostic applications, recombinant vaccine.

MODULE VI DIAGNOSIS AND KIT DEVELOPMENT 7

Use of enzymes in clinical diagnosis - Use of biosensors for rapid clinical analysis - Diagnostic kit development for microanalysis

TOTAL : 45

REFERENCES:

1. Glick, B.R., Pasternak, J. J., Molecular Biotechnology, Principles and Application of Recombinant DNA, ASM press, Washington, 2nd Edition, 1998
2. Ratledge, C., Kristiansen, B., Basic Biotechnology, Cambridge University Press, USA, 2nd Edition, 2001.
3. David, E., Technology and Future of health care, Preparing for the Next 30 years, Jhon Wiley, Singapore, 2nd Edition, 2000.

OUTCOMES:

At the end of the course students will be able to

- Research, evaluate and critically assess the theoretical basis and practical application of selected medical biotechnologies
- Demonstrate knowledge and understanding of selected medical biotechnologies
- Describe in detail essential facts and theory in molecular biology and biotechnology when applied to medicine
- Describe and critically evaluate aspects of current research in the biosciences with reference to reviews and research articles
- With limited guidance, deploy established techniques of analysis and enquiry within the biosciences

BTBX03 DRUG DESIGN AND DEVELOPMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

The course aims to provide the students with an understanding of all aspects of the drug design concepts: genomics, bioinformatics, drug target selection, structural biology, molecular modeling, intellectual property and marketing.

MODULE I DRUG DISCOVERY AND DEVELOPMENT 9

Organized drug discovery and development – Pharmacology -Microbial, recombinant - Biochemical and molecular level screeningsystems and their construction strategies - Alternative strategies inlead identification - Lead optimization.

MODULE II DRUG DESIGNING 9

Rational basis of drug designing, criteria for synthesizing drugs -Drug designing approaches - Pharmacophore based drug design -Lead and target tissues - Lead finding and lead optimization - Action and reaction, structure based drug design process of structure based design - Receptor based design - Drug designing using known receptor structure - Design of energy inhibitors.

MODULE III COMPUTATION FOR DRUG DESIGNING 9

Overview of computer based tools for drug designing - Ludi, Ludi/CAP, auto dock, GRAMM, CAMD tools - Scoring and Docking mode-QSAR principles and methods in drug designing -Current research in drug designing , a case study - Drug design by receptor site fit, active site simulations using PDB structure data and homology modeling - Concept of perturbation free energy and its practical applications - Rational design of enzyme inhibitors - Enzyme catalytic principles - Recapitulation affinity labels - Illustrative examples - Principle of suicide inactivation – Design strategies - Scope and limitations.

MODULE IV MIMICING IN DRUG DESIGNING 9

Principles and practice of transition state mimicry – Illustrative examples - ACE, renin and HIV protease inhibitors – Collected substrate analog inhibitors and design strategies, illustrative examples - Combinatorial approach to compound libraries

MODULE V CURRENT STATUS AND FUTURE PROSPECTS 9

Synthetic peptide libraries - Peptide libraries through phage display - Applications in epitope and agretope mapping, synthetic vaccine design - Artificial combinatorial - Peptides, bezodiazepines and other current examples - Selection strategies and screening methodologies - Perspectives in gene therapy

TOTAL : 45

REFERENCES:

1. Walsh, G., Biopharmaceuticals-Biochemistry and Biotechnology, Wiley, Singapore, 2nd Edition, 2003.
2. Perun, T. J. and Propst, C. L., Computer Aided Drug Design, Dekker, 1st Edition, 1989.
3. Scolnick, J., Drug Discovery and Design, Academic Press, London, 1st Edition, 2001.

OUTCOMES:

At the end of the course students will be able to

- Effectively and critically evaluate each stage of the drug development process and predict future bottlenecks
- Critically evaluate validation of drug targets
- Manage and develop complex work situations related to drug discovery and development
- Critically evaluate chemical process development projects
- Independently initiate and carry out discipline-specific and interdisciplinary collaboration related to drug development
- Initiate, plan, implement and assume professional responsibility for drug development projects from discovery to clinical trials and registration
- Organise the elements of a drug development programme
- Liaise and communicate professionally, using scientific terminology, with other specialist groups within the drug development industry
- Take independent responsibility for own professional development.

BTBX04 INTELLECTUAL PROPERTY RIGHTS

L	T	P	C
4	0	0	4

OBJECTIVES:

This course creates awareness on the Biosafety, bioethics, Intellectual property rights and patenting of biotechnological processes. It introduces the biosafety regulations and ethical concepts in biotechnology and emphasizes on IPR issues and need for knowledge in patents in biotechnology.

MODULE I WTO **9**

As an international agency controlling trade among nations. WTO with refernce to biotechnological affairs, TRIPs.

MODULE II GENERAL INTRODUCTION TO PATENT **9**

Patent claims, the legal decision – making process, ownership of tangible and intellectual property. Basic Requirements of Patentability, Patentable subject matter, novelty and the public domain, non obviousness.

Module III SPECIAL ISSUES IN BIOTECHNOLOGY PATENTS **9**

Disclosure requirements, Collaborative research, Competitive research, plant, Plant biotechnology Indian patents and Foreign patents, Plant variety protection act, The strategy of protecting plants.

MODULE IV PATENT LITIGATION **9**

Substatritive aspects of patent litigation, Procedural aspects of patent litigation, different Doctrines, Recent Developments in Patent System and Patentability of biotechnological inventions.

MODULE V IPR ISSUES IN INDIAN CONTEXT **9**

Role of patent in pharmaceutical industry, computer related innovations, Case studies Rice, Haldi, neem, etc. and challenges ahead

TOTAL : 45

REFERENCES:

1. The law and strategy of Biotechnological patents by Sibley. Butterworth publications.

2. Intellecutla property rights – Ganguli – Tat McGrawhill

3. Intellectual property right – Wattal – Oxford Publishing House.

OUTCOMES:

At the end of the course students will be able to

- Communicate in depth knowledge on selected topics within the area of biotechnology
- Identify current technical problems within the area of biotechnology
- Describe the relationship between patenting and scientific discovery
- Describe the patenting process and how it relates to the international patent authorities and organizations.
- Understand patents as strategic tools in business development
- Understand how intellectual property rights relates to and handles genetic sequences and other biological material

BTBX05 RECOMBINANT DNA TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

The aim of the course is to enable students:

- To establish an understanding of DNA manipulation strategies
- To establish an appreciation of the advantages and disadvantages of novel methods for DNA purification, sequencing and mutagenesis
- To be aware of ethical issues associated with DNA engineering and cloning

MODULE I TOOLS OF GENETIC ENGINEERING 7

Cloning vehicles, Restriction enzymes, Modifying enzymes, DNA ligase, Polymerase etc, Cloning Vectors: Plasmids, Lambda phage, Phagemids, Cosmids, Artificial chromosomes (BACs, YACs), Shuttle vectors, and virus based vectors.

MODULE II METHODS OF GENE TRANSFER 7

Transformation, transduction, Particle gun, Electroporation, liposome mediated, microinjection, Agrobacterium mediated gene transfer, Preparation and application of molecular probes: DNA probes, RNA probes, Radioactive labeling, Non radioactive labeling, use of molecular probes, DNA fingerprinting.

MODULE III ANALYSIS AND EXPRESSION OF CLONED GENE IN HOST CELLS 8

Expression vectors, Restriction enzyme analysis, Southern blotting, Northern blotting, Western blotting, In-situ hybridization. Colony and plaque hybridization, Factors affecting expression of cloned genes, Reporter genes, Fusion proteins.

MODULE VI GENE LIBRARIES 8

cDNA synthesis, Genomic DNA libraries, Amplification of gene libraries, Identifying the products of cDNA clones, Isolation, Sequencing and synthesis of gene: Different methods of gene isolation,Techniques of DNA sequencing, Artificial DNA synthesis.

MODULE V MODIFYING GENES 7

Site-directed mutagenesis, Insertion & Deletion Mutagenesis, Polymerase Chain reaction (PCR): Basic principles, modifications, applications.

MODULE VI APPLICATION OF RDNA TECHNOLOGY 8

Antisense and ribozyme technology, Human genome project and its application, Gene therapy prospect and future, DNA vaccine, Transgenic plants, Current production of rDNA products, Bio-safety measures and regulations for rDNA work.

TOTAL : 45

REFERENCES:

1. From Genes to Clones by Winnacker. PANIMA
2. Molecular Biotechnology by Pasternack and Glick.
3. From Genes to Genomes: Concepts & Applications of DNA Technology by J.W. Dale & M.V. Schartz.
4. Gene Cloning & DNA Analysis: An Introduction (4th edition) by T.A. Brown.
5. Molecular Cloning by Sambrook, et al.
6. Principles of Gene Cloning by Old and Primrose.

OUTCOMES:

At the end of the course students will be able to

- Define recombinant DNA technology and explain how it is used to clone genes.
- Compare and contrast different types of vectors and describe practical features of vectors and their applications in molecular biology.
- Discuss how DNA libraries are created and screened to clone a gene of interest.
- Describe how agarose gel electrophoresis, restriction enzyme mapping, and DNA sequencing can be used to study gene structure.
- Explain common techniques used to study gene expression.
- Be familiar with RNA interference (RNAi) as a powerful new technique for silencing gene expression.
- Understand potential scientific and medical consequences of the Human Genome Project, and discuss its ethical, legal, and social issues.
- Define bioinformatics and explain why this new field is important.

BTBX06 BIOREACTOR DESIGN AND ANALYSIS

L	T	P	C
3	0	0	3

OBJECTIVES:

The course imparts advanced knowledge on bioreactor design for efficient utilization of the principles in bioprocess technology. To familiarize the Basic concepts of bioreactor design , Bioreactor instrumentation and control, Methods and strategies for fermentation control, Modelling and simulation of fermentation processes and Plant and animal cell bioreactors.

MODULE I REACTION KINETICS **8**

Definitions of rate constant, reaction order - Elementary and nonelementary reactions - Mechanisms and kinetics - Reactions with constant volume and variable volume-Conversion yield - Kinetics of chemical reactions - Elementary and non - elementary reactions, nth order kinetics - Rate equations with multiple rate constants, shifting - Order kinetics, interpretation of batch reactor data for simple and complex reactions, dependence of reaction rate on environmental conditions – Arrheniu's equation.

MODULE II IDEAL REACTORS **7**

Introduction to ideal reactors - Performance equations for ideal reactors and non-isothermal reactors - Rate data analysis – Multiple reactors and multiple reactions -Polymerization reactions, enzymatic reactions, microbial growth and bioreactors.

MODULE III NON-IDEALITY IN REACTORS **7**

RTD studies - Dispersion effects, models for non-ideal reactors – Non isothermal reactors - External diffusion effects on heterogeneous reactions - Diffusion and reaction in porous catalysts.

MODULE IV BIOREACTOR **7**

Definition of bioreactor, basic principles of bioreactor – Interaction of heat and mass transfer in the microbial processes – Classification of bioreactors and their configurations - Analysis of batch, continuous, fed batch and semi-continuous bioreactors, non-ideal effects, mechanical design of bioreactors and its components

MODULE V BIOREACTOR SCALE – UP **8**

Regime analysis of bioreactor processes, oxygen mass transfer in bioreactors - Microbial oxygen demands, methods for the determination of mass transfer coefficients, mass transfer correlations - Scale up criteria for bioreactors based on oxygen transfer, power consumption and impeller tip speed.

MODULE VI SIMULATION AND OPTIMIZATION OF BIOPROCESSES **8**

Simulation techniques (Numerical Methods): Programs based on numerical methods like algebraic equations, Newton-Raphson method for algebraic convergence, interpolation, arbitrary function generation (FUN1, FUN2 subroutines). Programs based on solution of differential equations: Euler method for 1st and 2nd order integration, subroutines INT and INTI; Fourth order Runga –Kutta method: stability of numerical integration variable slip size method. Case studies, Numerical problems

TOTAL : 45

REFERENCES:

1. Levenspiel, O., Chemical Reaction Engineering, Wiley Easter Ltd, New York, 5th Edition, 1999
2. Fogler, H. S., Elements of Chemical Reaction Engineering, Prentice Hall Pvt Ltd, 4th Edition, 2006
3. Smith, J.M., Van Ness, H.C., Abbott, M. M., Introduction to Chemical Engineering Thermodynamics , McGraw Hill, New York, 6th Edition, 2001

OUTCOMES:

At the end of the course students will be able to

- Design reactors with mass transfer between two ideally mixed fluid phases, for continuous, fed-batch, batch operation.
- Design reactors with mass transfer between an ideally mixed fluid phase and a fluid phase moving in ideal plugflow, for continuous, fed-batch, batch operation design reactors with mass transfer between two ideally mixed fluid phases and an ideal plugflow compartment with conversion, for continuous, fed-batch, batch operation.
- Design reactors with diffusion into cell aggregates surrounded by an ideally

mixed fluid phase which exchanges mass with a second ideally mixed fluid phase. The equation for the penetration depth of the rate-limiting reactant/ product is given; its derivation is not included. Continuous, fed-batch, and batch operation are included.

- Design reactors with diffusion into cell aggregates surrounded by one fluid phase moving in ideal plugflow. The equation for the penetration depth of the rate-limiting reactant/product is given; its derivation is not included. Only continuous, operation is included.
- Design photo-bioreactors with mass transfer between two ideally mixed fluid phases and an ideal plugflow compartment with conversion, only for continuous reactors in steady state.

BTBX07 MOLECULAR AND CELLULAR DIAGNOSTICS

L	T	P	C
3	0	0	3

OBJECTIVES:

The course aims to provide the students with an understanding on the principles and modern day applications of molecular diagnostics in a biotechnology based industry.

MODULE I GENERAL LABORATORY TECHNIQUES & PROCEDURE 8

Chemical & Related substrates, volumetric analysis, Balancing & Weighing, Concept of solute & solvent, Units of measurement, Specimen Collection & Processing: Specimen collection (Blood, urine, spinal fluid,saliva synovial fluid, Amniotic fluid), Preservation, transportation, Selection & Interpretation of Lab. Procedure: Classification of BIAS, Sensitivity and specificity, Receiver Operator Characteristics, Interpretation a test, Quality Management: Fundamentals of total quality management, Element of QAP,External quality assessment and proficiency testing programme.

MODULE II CLINICAL ENZYMOLOGY 7

Principle of diagnostic enzymology, Liver, cardiac and skeletal enzyme, Digestive enzyme, Miscellaneous enzyme, General Function Tests: Liver function test, Cardiac Function Test, Renal Function Test, Thyroid Function test, Reproductive endocrine function test.

MODULE III IMMUNODIAGNOSTICS 7

Introduction, Antigen-Antibody Reactions, Conjugation Techniques, Antibody Production, Enzymes and Signal Amplification Systems, Separation and Solid-Phase Systems, Case studies related to bacterial, viral and parasitic infections.

MODULE IV PRODUCT DEVELOPMENT 7

Immunoassay Classification and Commercial Technologies, Assay Development, Evaluation, and Validation, Reagent Formulations and Shelf Life Evaluation, Data Analysis, Documentation, Registration, and Diagnostics Start-Ups.

MODULE V DNA BASED DIAGNOSTICS 8

PCR, RFLP, SSCP, Microarrays, FISH, In-situ hybridization, Case studies

related to bacterial, viral and parasitic infections, Cell based diagnostics: Antibody markers, CD Markers, FACS, HLA typing, Bioassays.

MODULE VI BIOSENSORS **8**

Concepts and applications, Biosensors for personal diabetes management, Noninvasive Biosensors in Clinical Analysis, Introduction to Biochips and their application in modern Sciences, Introduction to Nanotechnology.

TOTAL : 45

REFERENCES:

1. Tietz Textbook of Clinical Chemistry, Carl A. Burtis, Edward R. Ashwood, HarcourtBrace & Company Aisa Pvt. Ltd.
2. Commercial Biosensors: Graham Ramsay, John Wiley & Son, INC. (1998).
3. Essentials of Diagnostic Microbiology, Lisa Anne Shimeld. Diagnostic Microbiology, Balley & Scott's.
4. Tietz Text book of Clinical Biochemistry, Burtis & Ashwood.
5. The Science of Laboratory Diagnosis, Crocker Burnett.

OUTCOMES:

At the end of the course students will be able to

- List the key historical developments in the field of molecular diagnostics
- Identify the role and importance of molecular diagnostics such as real-time PCR, epidemiological genotyping, microfluidics, bio-imaging and sequencing technologies
- Assess the benefit of research and development practices within a biotechnology company
- Incorporate both in silico and lab based techniques as part of a combined molecular diagnostics strategy.
- Perform selected laboratory techniques, interpret results and prepare reports.

BTBX08 BIOMEDICAL ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

The course aims to provide education that prepares students to lead, innovate, and self-educate throughout their careers in bioengineering and biomedical professions and industries.

MODULE I INTRODUCTION **8**

Introduction to cell structure and components, protein structure, cell membranes, chromosomes, cytoskeleton, actin filaments, microtubules, cell signaling and ECM, biomembrane and action potentials - Transducers and electrodes, types of transducers and their selection for biomedical applications - Biosensors based on electrochemical transducers.

MODULE II MOLECULAR BASIS OF METABOLIC DISORDERS **7**

Biochemistry and molecular basis of different disorders related to carbohydrate, protein fat and nucleic acids, In-born errors of metabolism, Clinical manifestations and their precautions by nutritional management.

MODULE III CARDIAC SYSTEMS AND ITS FUNCTION **8**

Cardiovascular systems, the heart and other cardiac systems, circulation and blood flow, blood pressure, cardiac output, cardiac rate, cardiac shock and response to exercise, magnet cardiography, cardiac pacemaker, computer applications - Measurement of electrical activities in muscles and brain - Electromyography, electro encephalographs and their interpretation.

MODULE IV BIOSYSTEM MODELING **7**

Electrical impedance encephalography, biotelemetry, Biosignal analyzer, biosystem modeling.

MODULE V BIOMEDICAL TESTS **8**

Biomedical tests - measurement of sugar, pH, sodium potassium ions, haemoglobin, oxygen and carbondioxide concentration in blood, medical imaging, ultrasound imaging, radiography, biophysics of signal transmission and reception of biological signals, telemedicine.

MODULE VI ULTRASOUND IN DIAGNOSIS **7**

Ultrasound in diagnosis, limb prosthetics and Orthotics, sensory aids for the blinds, assisting the heart and kidney, ECG, EEB, physiological equipments

TOTAL : 45

REFERENCES:

1. Atilla Hincal, A., Suheylakas, H., Biomedical Science and Technology, Plenum Press, New York, 1st Edition, 2001.
2. Khandpur, R.S., Handbook of biomedical Instrumentation, McGraw Hill, USA, 1st Edition, 2004
3. Manz and Becker., Microsystem technology in Chemistry and Life Sciences, Springer Verlag, London, 1st Edition, 1999.

OUTCOMES:

At the end of the course students

- Will have in-depth knowledge of the analysis techniques applied to complex biological systems, assessing the most appropriate mathematical and simulation tools and suitable data and signal processing techniques.
- Will know the techniques and instruments used to design conventional and innovativebiomedical equipment, image processing techniques, advanced methods for the design and use of prostheses.
- Will be able to interact with doctors and biologists to analyse complex problems,recommend the correct management of equipment, and provide advice on the innovative use of diagnostic systems and equipment.
- Will be able to participate autonomously in biomedical experimentation, research and development activities.
- Will be able to skilfully participate in the sale of biomedical equipment together with sales staff, suggesting improvements and adaptations, taking autonomous initiatives and competently interpreting the needs of the purchaser in order to transform them into appropriate design specifications.

BTBX09 BIOSAFETY AND BIOETHICS L T P C
3 0 0 3

OBJECTIVES:

The aim of this course is to teach biosafety issues, biosafety and biotechnological applications, biosafety in laboratory, waste management, registration, national and international regulations, bio-ethical issues in medicine, environment and genetics, related regulations and laws.

MODULE I BIOTECHNOLOGY AND SOCIETY 7

Introduction to science, technology and society, biotechnology and social responsibility, public acceptance issues in biotechnology, issues of access, ownership, monopoly, traditional knowledge, biodiversity, benefit sharing, environmental sustainability, public vs. private funding, biotechnology in international relations, globalisation and development divide.

MODULE II BIOETHICS 8

Legality, morality and ethics, the principles of bioethics: autonomy, human rights, beneficence, privacy, justice, equity etc, Biotechnology and Bioethics: The expanding scope of ethics from biomedical practice to biotechnology, ethical conflicts in biotechnology - interference with nature, fear of unknown, unequal distribution of risks and benefits of biotechnology, bioethics vs. business ethics, ethical dimensions of IPR, technology transfer and their global biotech issues.

MODULE III BIOSAFETY CONCEPTS AND ISSUES 7

Rational vs. subjective perceptions of risks and benefits, relationship between risk, hazard, exposure and safeguards, biotechnology and biosafety concerns at the level of individuals, institutions, society, region, country and the world.

MODULE IV BIOSAFETY IN THE LABORATORY INSTITUTION 8

Laboratory associated infections and other hazards, assessment of biological hazards and levels of biosafety, prudent biosafety practices in the laboratory/ institution, Biosafety regulations in the handling of recombinant DNA processes and products in institutions and industries, biosafety assessment procedures in India and abroad

MODULE V BIOTECHNOLOGY AND FOOD SAFETY 7

The GM-food debate and biosafety assessment procedures for biotech foods & related products, including transgenic food crops, case studies of relevance.

MODULE VI ECOLOGICAL SAFETY ASSESSMENT 8

Recombinant organisms and transgenic crops, case studies of relevance (Eg. Bt cotton), Biosafety assessment of biotech pharmaceutical products such as drugs/vaccinesetc, International dimensions in biosafety: Catagena protocol on biosafety, bioterrorism and convention on biological weapons

TOTAL : 45

REFERENCES:

1. Thomas, J.A., Fuch, R.L. (2002). Biotechnology and Safety Assessment (3rd Ed). Academic Press.
2. Fleming, D.A., Hunt, D.L., (2000). Biological safety Principles and practices (3rd Ed). ASM Press, Washington.
3. Biotechnology - A comprehensive treatise (Vol. 12). Legal economic and ethical dimensions VCH.
4. Encyclopedia of Bioethics

OUTCOMES:

At the end of the course students will be able to

- Explain the international and national controls with regards to biosafety, biosecurity and bioethics applicable to facilities and associated scientists handling pathogens.
- Apply a framework for risk assessment to biosafety, biosecurity and dual-use risks and hazards associated with pathogens.
- Analyse the ethical and social responsibilities of life scientists with reference to the responsible conduct of research and other work
- Integrate dual-use biosecurity, biosafety and bioethical issues and concerns into their program.
- Contribute to the development and implementation of relevant country-specific and institutional mechanisms, guidelines, regulations and legislation.

- Explain the key components of administrative controls that a facility has to put in place to mitigate biosafety and biosecurity risks.
- Develop a strategy for the implementation of a biosafety management program in a facility handling pathogens
- Organize and synthesize ideas and questions on dual-use bio-security, biosafety and bioethics relevant to the conduct of research and other work with pathogens.

BTBX10 HEALTHCARE BIOTECHNOLOGY L T P C
3 0 0 3

OBJECTIVES:

- To introduce the underlying principles and applications in the emerging field of Health care biotechnology
- To analyze the key concepts used in the debate about health and its issues.
- To list the properties that defines a therapeutic agent and human diseases.
- To list the common and extrapolated potential clinical uses and applications of various modules of health care.

MODULE I SIMPLE PROTEINS AND THERAPEUTIC AGENTS 8

Proteins as therapeutic agents - Choice of expression systems and optimizing gene expression - Applications, delivery and targeting of therapeutic proteins - Engineering human interferons and human growth hormones - Regulatory aspects of therapeutic proteins - Enzymes as therapeutic agents - Use of genetically engineered DNase I and alginate lyase for treatment of Cystic Fibrosis.

MODULE II MONOCLONAL ANTIBODIES AS THERAPEUTIC AGENTS 8

Production of monoclonal antibodies - Human monoclonal antibodies, its scope and limitations - Hybrid human – Mouse antibodies - Production of antibodies in E. coli -Approaches for producing HIV therapeutic agents.

MODULE III HUMAN DISEASES 8

Viral and bacterial diseases - Diseases caused by protozoan and parasitic worms (helminths) - Emerging infectious diseases – Active and passive immunity – Autoimmunity- Rational of immunization - Diseases controllable by vaccination – Vaccines, designing vaccines adjuvants - Whole organisms vaccines - Attenuated viruses and bacteria - Inactivation of pathogenic organisms by heat and chemical treatment.

MODULE IV VACCINES 7

Bacterial polysaccharides, proteins and toxins as vaccines -Recombinant vaccines- subunit, attenuated and vector vaccines -Multivalent vaccine

development against AIDS - Commercial and regulatory aspects of vaccine production and its distribution.

MODULE V ENDOCRINE DISORDERS 7

Disorders of pituitary, adrenal, pancreas, gonads, thyroid and their metabolic effects. Possible and respective clinical manifestations.

MODULE VI APPLICATION OF GENETIC ENGINEERING IN HEALTH CARE 7

Production of Recombinant Proteins having therapeutic and diagnostic applications, recombinant vaccine

TOTAL : 45

REFERENCES:

1. Glick, B. R., Pasternak, J. J., Molecular Biotechnology, Principles and Application of Recombinant DNA, ASM press, Washington, 2nd Edition, 1998
2. Ratledge, C., Kristiansen, B., Basic Biotechnology, Cambridge University Press, USA, 2nd Edition, 2001.
3. David, E., Technology and Future of health care, Preparing for the Next 30 years, Jhon Wiley, Singapore, 2nd Edition, 2000.

OUTCOMES:

At the end of the course students should be able to:

- Search and read current health care literature and apply to a particular problem
- Classify various diseases and treatment strategies.
- Outline how therapeutic agents are currently being used in the clinic and what kinds of future treatments lie on the horizon.
- To demonstrate an interdisciplinary understanding of central concepts in tissue engineering, biomaterials and health care, and critically evaluate different methods and techniques used.

BTBX11 MOLECULAR PHARMING L T P C
3 0 0 3

OBJECTIVES:

- To introduce molecular pharming.
- To create complete knowledge about the recombinant protein production.
- To create awareness about the production of pharmaceutical proteins in plants.

MODULE I INTRODUCTION AND FOREIGN PROTEIN EXPRESSION 9

Introduction, foreign protein production systems- plant tissue culture, suspended cultures, hairy root cultures, shoot teratoma cultures. Strategies for improving FP production in tissue culture, expression systems, modifications to existing expression constructs, secretion of foreign proteins, foreign protein stability, stability inside the cells.

MODULE II NOVEL SPROUTING TECHNOLOGY FOR RECOMBINANT PROTEIN PRODUCTION 9

Biology of sprouting, dicotyledonous seeds, germination, sprout, rubisco synthesis, rubisco promoters, inhibition of endogenous gene expression, expression cassette design, sprouting- equipments, conditions, sterilization, time and temperature, light, inhibition of endogenous gene expression, growth regulators, nitrogen fertilizer, seed production, quality and environmental aspects.

MODULE III MONOCOT AND PLANT VIRAL EXPRESSION SYSTEMS 10

Cereal production crops, Technical aspects, cereal transformation, expression construct design, Prodigene and Maize. Recombinant proteins expressed in Rice, Wheat, Barley. Plant RNA viruses as expression vectors- TMV, PVX, CPMV, AIMV. Biological activity of target molecules, efficacy of plant virus antigens, vaccine antigens- particle based.

MODULE IV CHLOROPLAST DERIVED ANTIBODIES, BIOPHARMACEUTICALS AND EDIBLE VACCINES 10

Introduction, expression of therapeutic and human proteins in plants, transgenic chloroplast system, chloroplast derived human antibodies, biopharmaceuticals, Human Serum Albumin, Human insulin like growth factor-1, Human interferon,

Antimicrobial peptides, chloroplast derived vaccine antigens, cholera toxin B subunit, Bacillus anthracis protective antigen, Yersinia pestis F1-V fusion antigen, Canine Parvovirus VP2 protein.

MODULE V DOWNSTREAM PROCESSING OF PLANT DERIVED RECOMBINANT THERAPEUTIC PROTEINS 7

Similarities and differences in the processing of pharmaceutical proteins from different sources, process scale, individual steps of a Downstream process, Initial processing and extraction, chromatographic purification, regulatory requirements for downstream processing of plant derived products.

TOTAL : 45

REFERENCE:

1. Molecular Farming – Plant-made Pharmaceuticals and Technical Proteins, Rainer Fischer and Stefan Schillberg. Wiley.VCH Verlag GmbH and Co. KGaA. 2004.

OUTCOME:

The student will be aware about the basics of molecular farming

BTBX12 STEM CELLS IN HEALTHCARE

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the underlying principles and applications in the emerging field of Stem Cell Technology
- To analyze the key concepts used in the debate about stem cell research
- To list the properties that define a stem cell and explain hoe stem cells are derived for scientific research
- To list the common and extrapolated potential clinical uses of stem cells

MODULE I INTRODUCTION **7**

Stem Cell Biology, Fate Mapping of Stem Cell, Stem Cell Pattern, differentiated parental DNA chain causes stem cell pattern of cell type switching in Schizosaccharomyces pombe.

MODULE II CELL CYCLE CONTROL **7**

Checkpoints, and Stem Cell Biology, Senescence of Dividing Somatic Cells, The Drosophila Ovary, An In Vivo Stem Cell System, Male Germ-line Stem Cells.

MODULE III PRIMORDIAL GERM CELLS **8**

Primordial Germ Cells as Stem Cells, Embryonic Stem Cells, Embryonal Carcinoma Cells as Embryonic Stem Cells, Trophoblast Stem Cells.

MODULE IV HEMATOPOIETIC STEM CELLS **8**

Repopulating Patterns of Primitive Hematopoietic Stem Cells,Molecular Diversification and Developmental Interrelationships, Hematopoietic Stem Cells:Lymphopoiesis and the Problem of Commitment Versus Plasticity, Hemangioblast, Mesenchymal Stem Cells of Human Adult Bone Marrow.

MODULE V TYPES OF STEM CELLS **7**

Stem Cells and Neurogenesis, Epidermal Stem Cells: Liver Stem Cells, Pancreatic Stem Cells, Stem Cells in the Epithelium of the Small Intestine and Colon

MODULE VI APPLICATIONS OF STEM CELLS 8

Cell based therapy, organ factories, drug discovery and development, understanding developmental biology, Medical applications in Leukemia, Immune deficiencies, diabetes, liver diseases, cardiovascular diseases, Neurological disorders

TOTAL : 45

REFERENCES:

1. Developmental Biology, 6th Edition, Scott F. Gilbert
2. Hematology, William J. Williams, Ernest Beutler, Allan JU. Erslev, Marshall A. Lichtman
3. Molecular Biology of the Cell, 3rd Edition, Bruce Alberts, Dennis Bray, Julian Lewis,
4. Martin Raff, Keith Roberts, James D. Watson
5. Stem Cell Biology by Marshak, 2001, Cold Spring Harbar Symposium Pulblication.

OUTCOMES:

At the end of the course students should be able to:

- Search and read current stem cell technology literature applied to a particular problem domain (To treat Parkinsons Disease etc.)
- Classify tumor stem cells which give rise to metastases and treatment-resistant remnant cells that cause relapse, and how this impacts on the development of future cancer treatment strategies.
- Outline how stem cells are currently being used in the clinic and what kinds of future treatments lie on the horizon. Students will also be exposed to current Norwegian projects lying at the frontier of stem cell research.
- To demonstrate an interdisciplinary understanding of central concepts in tissue engineering, biomaterials and stem cell science, and critically evaluate different methods and techniques used.

BTBX13 TRANSPORT PHENOMENA IN BIOPROCESS

L	T	P	C
4	0	0	4

OBJECTIVES:

The course aims to provide the students with an introduction to the multidisciplinary nature of biotechnology and how bioprocesses are planned, organised and how they develop from basic cell structure and function through bioreactor to DSP.

MODULE I BIOREACTORS **7**

Introduction to bioreactor systems - Principles and practices of fermentation - Fermentation organisms - Basic bioreactor design

MODULE II FLUID RHEOLOGY **7**

Rheology - Review of fluid rheology - Experimental viscometry of biofluids- Effects of cell morphology on broth rheology

MODULE III BUBBLES AND DROPS **7**

Bubbles and drops - Bubble formation, break-up and coalescence - Bubble rise velocities - Interfacial area and hold-up in agitated and non-agitated systems - Behaviour of bubbles in beverages – Drop dispersion

MODULE IV SCALE UP OF BIOREACTORS **9**

Aeration and Agitation - Achieving mixing and mass transfer in bioreactors - Specification of equipment - Flow regimes – Power requirements - Oxygen mass transfer in bioreactors – Microbial oxygen demands - Methods for the determination of mass transfer coefficients - Mass transfer correlations - Scale-up of stirred tank bioreactors - Principle of similarity - Criteria for scale-up in biological systems

MODULE V HEAT TRANSFER **7**

Heat generation and heat transfer in bioreactors - Sources of heat generation - Heat removal - Specification of heating and cooling systems - Heat transfer coefficients in agitated systems.

MODULE VI PROCESS DESIGN **8**

Process design of distillation columns, extraction equipments and tray dryers.

Mechanical design of pressure vessels under internal pressure, Mechanical design of stirred batch fermenter.

TOTAL : 45

REFERENCES:

1. Van Den Akker, H.E.A., Heijnen, J.J.C., Leach, K., Mudde, R.F., Bioprocess Technology, Modelling and Transport Phenomena (Biotol Series), 1st Edition, 1990

2. Byron, R.Bird., Warren, E. Stewart., and Edwin, N. Lightfoot., Transport Phenomena, John Wiley and Sons, New York, 1st Edition, 2000

3. Sissom, L.E. and Pitts, D.R., Elements of Transport Phenomena, McGraw Hill, New York, 2nd Edition, 1972

4. Brodkey, R.S. and Hershey, H.C., Transport Phenomena – A Moduleed Approach, McGraw Hill, New York, 1st Edition, 1987

OUTCOMES:

At the end of the course students will be able to

- Have the information about recognition and modelling of bioprocesses.
- Identify problems faced with bioprocess applications, have the knowledge and ability of analyzing and solving those problems.
- Gain knowledge about management of bioprocess waste.
- Able to design of a bioprocess.
- Develop the ability of written and oral communication, preparing technical design report.

GEBX22 NATIONAL SERVICE SCHEME L T P C
(Paper: 01 - As per Ministry of Youth Affairs and Sports) 0 0 3 1

OBJECTIVES:

- understand the community in which they work
- understand themselves in relation to their community
- identify the needs and problems of the community and involve them in problem-solving
- develop among themselves a sense of social and civic responsibility
- utilise their knowledge in finding practical solutions to individual and community problems
- develop competence required for group-living and sharing of responsibilities
- gain skills in mobilising community participation
- acquire leadership qualities and democratic attitudes
- develop capacity to meet emergencies and natural disasters and
- practise national integration and social harmony

MODULE I INTRODUCTION AND BASIC CONCEPTS OF NSS 4

History, philosophy, aims & objectives of NSS – Emblem, flag, motto, song, badge, etc. – Organizational structure, roles and responsibilities of various NSS functionaries.

MODULE II NSS PROGRAMMES AND ACTIVITIES 10

Concept of regular activities, special camping, Day Camps – Basis of adoption of village/slums, Methodology of conducting Survey – Financial pattern of the scheme – Other youth programme/schemes of GOI – Coordination with different agencies – Maintenance of the Diary.

MODULE III UNDERSTANDING YOUTH 5

Definition, profile of youth, categories of youth – Issues, challenges and opportunities for youth – Youth as an agent of social change.

MODULE IV COMMUNITY MOBILISATION **9**

Mapping of community stakeholders – Designing the message in the context of the problem and the culture of the community – Identifying methods of mobilisation – Youth-adult partnership.

MODULE V VOLUNTEERISM AND SHRAMDAN **7**

Indian Tradition of volunteerism – Needs and importance of volunteerism – Motivation and Constraints of Volunteerism – Shramdan as a part of volunteerism.

Total Hours: 35

REGULATIONS 2016

CURRICULUM AND SYLLABI

B.Sc

Computer Science

VISION AND MISSION OF THE DEPARTMENT OF COMPUTER APPLICATIONS

VISION

Aspires to provide quality education in the field of computer applications with state of the art computational facilities and undertake quality research in collaboration with industries and universities to produce committed professionals and academicians to meet the needs of the industries and society.

MISSION

The Department of Computer Applications, endeavors

- To disseminate knowledge through education and training of graduates in the field of computer applications.
- To focus on teaching - learning, research and consultancy to promote excellence in computer applications.
- To foster graduates with opportunities required to explore, create and face challenges of IT related industries.
- To equip the graduates with the necessary skills in communication, team work and leadership qualities to meet the needs of the IT related sector globally.
- To disseminate the outcome of projects and research work undertaken by the department through appropriate measures for the benefit of society and industry.

PROGRAMME EDUCATIONAL OBJECTIVES:

The students of B.Sc Computer science Programme would be able to

- Communicate computing concepts and solutions to bridge the gap between industry and academic institution.
- Utilize their knowledge of computing principles to develop solutions to current and future computing problems.
- Understand professional, ethical, legal, security, and social issues and responsibilities.
- Use current techniques, skills, and tools necessary for computing practices
- apply design and development principles in the construction of software systems of varying complexity.

PROGRAMME OUTCOMES:

On successful completion of the programme, the graduates will have

- Have knowledge of computing and mathematics appropriate to the discipline
- Identify analyze a problem and define the computing requirements appropriate to its solution;
- Have use current techniques, skills, and tools necessary for computing practices;
- Be prepared for career in Information Technology oriented business or industry for graduate study in technical fields.

B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE & TECHNOLOGY

B.S.c (COMPUTER SCIENCE)

CURRICULUM & SYLLABUS, REGULATIONS 2016

SEMESTER I

Sl. No.	Course Code	Course Title	L	T	P	C	
1	ENC1182	General English - I	3	0	0	3	
2	MAC1187	Algebra, Calculus and Trigonometry	3	1	0	4	
3	CAC1151	Computer Fundamentals & Organization	3	0	0	3	
4	CAC1152	Problem Solving Techniques and Programming in C	3	1	0	4	
5	CAC1153	Introduction to Linux	3	0	0	3	
6	CAC1154	Problem Solving Techniques and Programming in C Lab	0	0	4	2	
7	CAC1155	Linux Lab	0	0	4	2	**23**

SEMESTER II

l. No.	Course Code	Course Title	L	T	P	C
1	ENC1283	General English - II	3	0	0	3
2	MAC1288	Probability and Statistics	3	1	0	4
3	CAC1251	Operating Systems	3	0	0	3
4	CAC1252	OOPS with C++	3	1	0	4
5	CAC1253	Data Structures Using C	3	0	0	3
6	CAC1254	OOPS with C++ Lab	0	0	4	2

7	CAC1255	Data Structures Using C Lab	0	0	4	2	
8	CAC1256	Environmental Studies	2	0	0	2	**21**

SEMESTER III

Sl. No.	Course Code	Course Title	L	T	P	C	
1	CAC2151	Database Management Systems	3	1	0	4	
2	CAC2152	Digital Electronics	3	0	0	3	
3	CAC2153	Computer Networks	3	0	0	3	
4	CAC2154	Fundamentals of Algorithms	3	0	0	3	
5	CAC2155	Multimedia and its Applications	3	0	0	3	
6	CAC2156	Database Management Systems Lab	0	0	4	2	
7	CAC2157	Multimedia Lab	0	0	4	2	
8	CAC2158	Communication Skills	0	0	4	2	**22**

SEMESTER IV

Sl. No.	Course Code	Course Title	L	T	P	C	
1	CAC2251	Programming in Java	3	1	0	4	
2	CAC2252	Computer Security	3	0	0	3	
3	CAC2253	Software Engineering	3	0	0	3	
4	CAC2254	Information Storage and Management	3	0	0	3	
5		Elective I	3	0	0	3	

6	CAC2255	Programming in Java Lab	0	0	4	2	**20**
7	CAC2256	Soft Skills and Personality Development	0	0	4	2	

SEMESTER V

Sl. No.	Course Code	Course Title	L	T	P	C	
1	CAC3151	C# and .NET Programming	3	1	0	4	
2	CAC3152	Web Designing	3	0	0	3	
3	CAC3153	Software Testing	3	0	0	3	
4		Elective 2	3	0	0	3	
5		Elective 3	3	0	0	3	
6	CAC3154	C# and .NET Programming Lab	0	0	4	2	
7	CAC3155	Web Designing Lab	0	0	4	2	**20**

SEMESTER VI

Sl. No.	Course Code	Course Title	L	T	P	C	
1	CAC3251	Network Security	3	1	0	4	
2	CAC3252	Data Mining and Warehousing	3	1	0	4	
3		Elective 4	3	0	0	3	
4		Elective 5	3	0	0	3	
5	CAC3253	Project	0	0	12	6	**20**

TOTAL CREDITS – 124

LIST OF PROGRAMME ELECTIVES

SEMESTER IV

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	CACX01	Advanced Computer Architecture	3	0	0	3
2.	PE	CACX02	Compiler Design	3	0	0	3
3.	PE	CACX03	Database Design	3	0	0	3
4.	PE	CACX04	E-Commerce	3	0	0	3
5.	PE	CACX05	High Performance Computer Systems	3	0	0	3
6.	PE	CACX06	Internet and Web Programming	3	0	0	3
7.	PE	CACX07	Management Information Systems	3	0	0	3
8.	PE	CACX08	Parallel Algorithms	3	0	0	3
9.	PE	CACX09	Wireless Networks	3	0	0	3

SEMESTER V

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	CACX10	Artificial Intelligence	3	0	0	3
2.	PE	CACX11	Client / Server Technology	3	0	0	3
3.	PE	CACX12	Distributed Operating System	3	0	0	3
4.	PE	CACX13	Embedded Systems	3	0	0	3
5.	PE	CACX14	Enterprise Resource Planning	3	0	0	3
6.	PE	CACX15	Mobile Commerce	3	0	0	3
7.	PE	CACX16	Mobile Computing	3	0	0	3
8.	PE	CACX17	Software Project Management	3	0	0	3
9.	PE	CACX18	Web Technology	3	0	0	3

SEMESTER VI

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	CACX19	Big Data Analytics	3	0	0	3
2.	PE	CACX20	Human Computer Interaction	3	0	0	3
3.	PE	CACX21	Software Quality Assurance	3	0	0	3
4.	PE	CACX22	Web Services and Service Oriented Architecture	3	0	0	3

ENC1181 **GENERAL ENGLISH – I** **L T P C**

4 1 0 4

OBJECTIVES:

- To help the students acquire efficiency in Spoken English through role plays.
- To enable them to make Presentation effectively.
- To develop reading skills among students through extensive readers.
- To orient them in writing letters.
- To train them in appreciating and interpreting English literature.

MODULE I **7**

Oral and Written Communication – implications in real life and workplace situations
Essential English Grammar - 1-6 units

MODULE II **8**

One–minute Presentations (JAM) on concrete and abstract topics that test their creative thinking (ii) Prepared p and extempore presentations
Short Story; O Henry - “Robe of Peace” (Extensive Reading)

MODULE III **8**

Role-Play – establishing a point of view - convincing someone on social issues such as preservation of water, fuel, protection of environment, gender discrimination.
Poetry: William Shakespeare - “All the World’s a Stage”

MODULE IV **8**

Letter Writing- Letter of Invitation & Permission Developing story from hints- Short Story: John Galsworthy - “Quality” (Extensive Reading)

MODULE V **8**

Précis Writing- Writing instructions and recommendations Reading Comprehension: Short Story**--**Rudyard Kipling – “The Miracle of Puran Bhagat”(Extensive Reading)
Written correspondence - - e-mail writing Prose : Education, Employment, Unemployment

MODULE VI **6**

Written correspondence - - e-mail writing
Prose : Education, Employment, Unemployment

TOTAL HOURS – 45

REFERENCES:

1. Anderson, Kenneth & et.al. “Study Speaking : A Course in Spoken English for Academic Purposes” (Second Edition). Cambridge University Press, UK. 2004.
2. Sharma, R.C. & Krishna Mohan, “Business Correspondence and Report Writing”.
3. Tata MacGraw – Hill Publishing Company Limited, New Delhi. 2002
4. Hurlock, B. Elizabeth “Personality Development”. Tata McGraw Hill, New York, 2004.
5. Krishnaswamy. N, Sriraman T. Current English for Colleges. Hyderabad: Macmillan Indian Ltd, 2006.
6. Dahiya SPS. Ed. Vision in Verse- An Anthology of Poems. New Delhi: Oxford University Press, 2002
7. Murphy, Raymond. Essential English Grammar. New Delhi: Cambridge University Press, 2009.
8. Seshadri, K G Ed. Stories for Colleges. Chennai: Macmillan India Ltd, 2003.

OUTCOMES:

Students would be able to

- Actively take part in role plays
- Make effective presentation s
- Read and comprehend various texts.
- Write letters without making mistakes.
- Analyse literary texts.

MAC1187	ALGEBRA, CALCULUS AND TRIGONOMETRY	L	T	P	C
		3	1	0	4

OBJECTIVES:

The course is aimed at

- Developing the skills of students in applying basic concepts in chosen topics of mathematics that are imperative for effective understanding of application oriented topics.
- Laying the foundation for learning concepts of Differentiation, Integration and Trigonometry.

MODULE I MATRICES **(9+3)**

Symmetric – Skew-Symmetric - Orthogonal and Unitary matrices - Rank of a Matrix -Consistency - Characteristic equation - Eigenvalues and Eigenvectors - properties -Cayley Hamilton’s Theorem (proof not needed) - Simple applications.

MODULE II THEORY OF EQUATIONS **(9+3)**

Partial Fractions - Theory of equations- Polynomial Equations with real Coefficients -Irrational roots - Complex roots - Symmetric functions of roots - Transformation of equation by increasing or decreasing roots by a constant - Reciprocal equations.

MODULE III DIFFERENTIAL CALCULUS **(9+3)**

Rules of differentiation - Derivative of implicit function - Successive differentiation nth derivatives - Leibnitz theorem (without proof) and applications - maxima and minima of functions of two variables - Partial differentiation - Euler’s Theorem.

MODULE IV INTEGRAL CALCULUS **(9+3)**

Integration of rational functions - algebraic expressions involving only one irrational quantity- rational functions of sinx and cosx - Trigonometric substitutions - Bernoulli's formula for integration by parts - reduction formulae - properties of definite integral -Evaluation of double and triple integrals.

MODULE V TRIGONOMETRY **(9+3)**

De Moivre's theorem and its application - Circular and Hyperbolic functions – Inverse circular and hyperbolic functions - Expansion of trigonometric functions in terms of power and multiples - Separation of real and imaginary parts of logarithmic -trigonometric and inverse trigonometric functions - Summation of series including C+iS method.

TOTAL HOURS – 60

TEXT BOOKS:

1. Narayanan, S. and Manicavachagom Pillay, T.K. (2015) Calculus Vol. I,II &III S.Viswanathan (Printers & publishers) Pvt. Ltd., Chennai.
2. Venkataraman, M.K., "Higher Mathematics for Engineering and Science", Third Edition, The National Publishing Co., Madras, 1986.
3. Kandasamy P, K. Thilagavathi and K. Gunavathy- Allied Mathematics aper-I, First semester, 1/e, S. Chand & Co., New Delhi, 2003

REFERENCES:

1. Stewart J - Single Variable Calculus (4th edition) Brooks / Cole, Cenage Learning 2010.
2. Tom M. Apostol - Calculus, Vol. I (second edition) John Wiley and Sons, Inc., Jan 2007.
3. Burnside W.S. and A.W. Panton - The Theory of Equations, Dublin University Press, 1954.
4. MacDuffee, C.C. - Theory of Equations, John Wiley & Sons Inc., 1954.
5. Ushri Dutta, A.S.Muktibodh and S.D. Mohagaonkar: Algebra and Trigonometry, PHI India, 2006.

OUTCOMES:

On completion of the course the students will be able to

- solve eigenvalue and eigenvector problems
- classify and solve polynomial equations of different types.
- differentiate different types of functions.
- integrate rational and trigonometric functions and to evaluate definite integrals (double and triple).
- demonstrate the application of Demoivre's theorem and find the sum of series of trigonometric functions.

CAC1151	COMPUTER FUNDAMENTALS &ORGANIZATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- The basic knowledge of how a computer works is very important for any fresh networking or operating system professional.
- The functional knowledge of a computers working and its main building parts are paramount.
- The computers of today may come with variety of features but the basic working principles remain the same.
- Students will explore the fundamentals of organization of a computer and the principles and building units of a computer (its hardware).
- Also, they will be introduced to the basics of networking and MS Office

MODULE I GENERAL FEATURES OF A COMPUTER **9**

General features of a computer, Generation of computers, Personal computer, workstation, mainframe computer and super computers. Computer applications – data processing, information processing, commercial, office automation, industry and engineering, healthcare, education, graphics and multimedia.

MODULE II COMPUTER ORGANIZATION **9**

Computer organization, central processing unit, computer memory – primary memory and secondary memory, Secondary storage devices – Magnetic and optical media, Input and output units, OMR, OCR, MICR, scanner, mouse, modem.

MODULE III COMPUTER HARDWARE AND SOFTWARE **9**

Computer hardware and software, Machine language and high level language, Application software, computer program, operating system, Computer virus, antivirus and computer security, Elements of MS DOS and Windows OS, Computer arithmetic, Binary, octal and hexadecimal number systems, Algorithm and flowcharts, illustrations, elements of a database and its applications, Basic Gates (Demorgans theorems, duality theorem, NOR, NAND, XOR, XNOR gates), Boolean expressions and logic diagrams, Types of Boolean expressions

MODULE IV MS OFFICE 9

Word processing and electronic spread sheet, An overview of MSWORD, MSEXCEL and MSPOWERPOINT

MODULE V INTRODUCTION TO NETWORKING 9

Network of computers, Types of networks, LAN, Intranet and Internet, Internet applications, World Wide Web, E-mail, browsing and searching, search engines, multimedia applications

TOTAL HOURS – 45

TEXT BOOKS

1. M. Morris Mano and Michael D.Ciletti, "Digital Design with an introduction to the Verilog HDL", Pearson Education, Fifth Edition, ISBN-13: 978-0-13-277420-8, 2012.
2.

REFERENCES

1. Charles H.Roth, Jr., Kinney," Fundamentals of Logic Design", Brooks Publications, Seventh Edition,. ISBN-13 :978 -1-133-62848-4,2013
2. Ashok N Kamthane, "Computer Programming", Pearson Education, 2nd Edition, ISBN 13: 9788131704370, 2012

OUTCOMES:

- Students will get in-depth knowledge about the general features of a computer.
- Student which will allow introduce them to various features of computer,
- Understand the computer concepts on which they can base their learning and design.
- Student will be able to understand the basic MS- office.
- To get a better knowledge on networking aspects
- An insight to the different software and hardware components of a computer will take them a step ahead in terms of what they can accomplish from their learning.

CAC1152	PROBLEM SOLVING TECHNIQUES AND PROGRAMMING IN C	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aims of the course are as follows

- This course is designed to provide a comprehensive study of the C programming language. It stresses the strengths of C, which provide students with the means of writing efficient, maintainable, and portable code.
- To learn and acquire art of computer programming.
- Programming language for solving a problem
- To gain experience about structured programming
- To understand various features in C

MODULE I INTRODUCTION TO COMPUTER PROBLEM SOLVING 9

Problem Solving Process - Hierarchy charts to plan the program design - Algorithms - Iterative versus recursive style - Modular Programming - Structured Programming - Algorithm representation using Psuedocode, Algorithm Testing, brief introduction to Efficiency of Algorithms - Data Verification v/s Validation – Module design – Cohesion – Coupling – Fan-in – Fan-out concepts

MODULE II FUNDAMENTAL ALGORITHMS FOR PROBLEM SOLVING 9

Algorithms for Exchanging the values – Counting – Factorial Computation – some trigonometric functions computation as a sum of series – Base Conversion of numbers – Factoring Methods – Array Techniques – Sorting Algorithms - Bubble, Selection, Insertion, Merge Sort, Quick Sort–Sequential and Binary Search Algorithms. Algorithms for implementing numerical methods such as Newton Raphson and RungaKutta Methods.

MODULE III INTRODUCTION TO 'C' 9

Overview of C – Constants, Variables and Data Types; Operators and Expressions; Managing Input/Output Operations – Formatted I/O; Decision Making – Branching - IF, Nested IF – Switch – goto; Looping- While, do, for statements

MODULE IV ARRAYS, FUNCTIONS, STRUCTURES AND UNIONS 9

Arrays – static, dynamic and multi-dimensional arrays - Character arrays and Strings – String handling Functions - User defined Functions – Recursion; Structures and Unions – Array of Structures – Structures and Functions

MODULE V POINTERS AND FILE MANAGEMENT 9

Pointers– Declaration, Accessing a variable, character strings, pointers to functions and structures; File Management in ‘C’ any programming language; Dynamic Memory allocation– Linked Lists; Preprocessor Directives; Storage Classes, Command-line Arguments, multi-file programs and use of make utility.

TOTAL HOURS – 45

TEXT BOOKS:

1. Jeri R. Hanly and Eliot B. Koffman “Problem Solving and Program Design in C” Pearson Education, VII Edition, 2012
2. R.G.Dromey "How to Solve it by Computer ", PHI, 2006.

REFERENCES:

1. Paul J. Deitel, Deitel & Associates, “C How to Program”, Pearson Education, 7th Edition, ISBN-13: 978-0132990448, 2012
2. E.Balagurusamy " Programming in ANSI C " , Sixth Edition, 2004

OUTCOMES:

At the completion of this course, the student will able to

- Study, analyze, understand logical structure and compare various programming methodologies of a computer program, and different construct to develop a program in ‘C’ language
- Write small programs related to simple/ moderate mathematical, and logical problems in ‘C’.
- Study, analyze and understand simple data structures, use of pointers, memory allocation and data handling through files in ‘C’.

CAC1153	INTRODUCTION TO LINUX	L	T	P	C
		3	0	0	3

OBJECTIVES:

At the end of this course the learner is expected:

- To gain knowledge on the basic Linux commands.
- To have a hands on experience in open office
- To have clear understanding in open source softwares

MODULE I - INTRODUCTION TO LINUX 9

What Is Linux? -The Problems with Windows -The Benefits of Linux - Proprietary Software and the GPL- GNU and Linux Together- Different Flavors of Linux- Who Uses Linux?- Understanding How Linux Differs from Windows- Using Ubuntu

MODULE II BASH SHELL 9

What Is the BASH Shell? -Working with Files-Listing Files-Copying Files and Directories -Moving Files and Directories -Deleting Files and Directories -Changing and Creating Directories-Real Files and Virtual Files. -Users and File Permissions - The File System Explained -File Searches -Using the find Command -Using the locate Command -Using the whereis Command-File Size and Free Space -Viewing File Sizes -Finding Out the Amount of Free Space.

MODULE III INITIALIZATION 9

Linux kernel and kernel initialization - system initialization – hardware support - boot loaders.

MODULE IV DEVICE HANDLING 9

Device driver basics - module utilities - file systems - MTD subsystems – busybox.

MODULE V DEVELOPMENT TOOLS 9

Embedded development environment - GNU debugger - tracing & profiling tools - binary utilities - kernel debugging - debugging embedded Linux applications - porting Linux - Linux and real time - SDRAM interface.

TOTAL HOURS – 45

TEXT BOOKS:

1. Keir Thomas and Andy Channelle with Jaime Sicam (2009), “Beginning Ubuntu
2. Karim Yaghmour, Jon Masters, Gillad Ben Yossef, Philippe Gerum, “Building

embedded Linux systems", O'Reilly, 2008.

REFERENCES:

1. Christopher Hallinan, "Embedded Linux Primer: A practical real world approach", Prentice Hall, 2007.
2. Craig Hollabaugh, "Embedded Linux: Hardware, software and Interfacing", Pearson Education, 2002.

OUTCOMES:

Students are provided learning experiences that enable them to:

- Use Linux desktop and GNU tool chain with Eclipse IDE.
- Cross compile Linux kernel and port it to target board.
- Add applications and write customized application for the Linux kernel in the target board.

CAC1154	PROBLEM SOLVING TECHNIQUES AND PROGRAMMING IN C LAB	L	T	P	C
		0	0	4	2

OBJECTIVES:

The aims of the course are as follows

- To make the student learn C programming language.
- To teach the student to write programs in C to solve the problems.
- To introduce the student to simple linear and non linear data structures such as lists, stacks, queues, trees and graphs and use the efficient for problem solving

LIST OF PROGRAMS

1. Write a C program to find the sum of individual digits of a positive integer.
2. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
3. Write a C program to calculate the following Sum:

   $Sum=1+x^2/2! +x^4/4!+x^6/6!+x^8/8!+x^{10}/10!$
4. Write a C program to find the roots of a quadratic equation.
5. Write C programs that use both recursive and non-recursive functions
   i) To find the factorial of a given integer.
   ii) To find the GCD (greatest common divisor)of two given integers.
   iii) To solve Towers of Hanoi problem.
6. Write a C program, which takes two integer operands and one operator form the user, performs the operation and then prints the result. (Consider the operators +,-,*,/,% and use Switch Statement)
7. Write a C program to find both the larges and smallest number in a list of integers.
8. Write a C program that uses functions to perform the following:
   i)Addition of Two Matrices
   ii)Multiplication of Two Matrices
9. Write a C program that uses functions to perform the following operations:
   i)To insert a sub-string in to given main string from a given position.
   ii)To delete n Characters from a given position in a given string.
10. Write a C program to determine if the given string is a palindrome or not
11. Write a C program that displays the position or index in the string S where the string T begins, or - 1 if S doesn't contain T.
12. Write a C program to count the lines, words and characters in a given text and C program to generate Pascal's triangle.

13. Write a C program to construct a pyramid of numbers.
14. 2's complement of a number is obtained by scanning it from right to left and complementing all the bits after the first appearance of a 1. Thus 2's complement of 11100 is 00100. Write a C program to find the 2's complement of a binary number.
15. Write a C program to convert a Roman numeral to its decimal equivalent.
16. Write a C program that uses functions to perform the following operations:
    i) Reading a complex number
    ii) Writing a complex number
    iii) Addition of two complex numbers
    iv) Multiplication of two complex numbers

TOTAL HOURS :45

TEXT BOOKS:

1. Reema Thareja, Computer Fundamentals and Programming in C, Oxford Press, 2012

REFERENCES:

1. Programming in C by Pradip Dey, Manas Ghosh 2nd edition Oxford University Press.
2. E.Balaguruswamy, Programming in ANSI C 5th Edition McGraw-Hill

OUTCOMES:

At the completion of this course, the student will able to

- Able to write, compile and debug programs in C language.
- Able to use different data types in a computer program.
- Able to design programs involving decision structures, loops and functions.
- Able to understand the dynamics of memory by the use of pointers.
- Able to use different data structures and create/update basic data files.

CAC1155	LINUX LAB	L	T	P	C
		0	0	4	2

OBJECTIVES:

The main objective of this course is to

- Learn and get familiar with the Unix operating system through Red hat
- Linux. UNIX basic commands working and their purpose will be defined.

LIST OF PROGRAMS

1. Write programs using the following system calls of UNIX operating system: fork, exec, getpid, exit, wait, close, stat, opendir, readdir
2. Write programs using the I/O system calls of UNIX operating system (open, read, write, etc)
3. Write C programs to simulate UNIX commands like ls, grep, etc.
4. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for FCFS and SJF. For each of the scheduling policies, compute and print the average waiting time and average turnaround time.
5. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for Priority and Round robin. For each of the scheduling policies,
6. compute and print the average waiting time and average turnaround time.

TOTAL HOURS –30

TEXT BOOKS:

1. The Design of Unix Operating System, Maurice J. Bach, Pearson Education, 2010

REFERENCES:

1. Advance UNIX, a Programmer’s Guide, S. Prata, BPB Publications, and New Delhi, 2011
2. Unix Concepts and Applications, Sumitabh Das, 2010

OUTCOMES:

- To use Linux desktop and GNU tool chain with Eclipse IDE.
- Cross compile Linux kernel and port it to target board.
- Add applications and write customized application for the Linux kernel in the target board.

SEMESTER II

ENC1283	GENERAL ENGLISH-II	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To prepare students for Interviews and Group Discussions
- To train them in writing official letters, resume' writing and reports.
- To train them in analysing different genre of literature.

MODULE I **7**

Filling Money Order Challan and Bank Challan
Short Story :G.K.Chesterton – The Hammer of God (Extensive Reading)
Essential English Grammar – 7-12 units

MODULE II **8**

Brainstorming – Think, pair and share activity
Poetry **:** Walt Whitman- I Celebrate Myself

MODULE III **8**

Dialogue Writing- Discussion etiquette -Assigning different roles in a GD (Note-taker, Manager, Leader and Reporter)
Prose**:** Environment

MODULE IV **8**

Interview skills- SWOT Analysis
Letter Writing- Letter to the Editor- Letter of Application and CV

MODULE V **8**

Report Writing- feasibility report and survey report
Short Story : Katherine Mansfield—A Cup of Tea (Extensive Reading)

MODULE VI **6**

Technical reports –Writing a technical report – format and content

TOTAL HOURS – 45

REFERENCES:

1. M. Ashraf Rizvi ‘Effective Technical Communication”. Tata McGraw – Hill Education, 2005. Gerson, Sharon & Steven M. Gerson, “ Technical Writing : Process and Product”
2. Pearson Education, New Delhi, 2004. 6. Riordan & Pauley. ‘Report Writing Today’. 9th Edition. Wadsworth Cengage Learning, USA. 2005.
3. Krishnaswamy. N, Sriraman T. **Current English for Colleges.** Hyderabad:
4. Macmillan Indian Ltd, 2006.
5. Dahiya SPS. Ed. **Vision in Verse- An Anthology of Poems**. New Delhi: Oxford
6. University Press, 2002.
7. Murphy, Raymond. **Essential English Grammar**. New Delhi: Cambridge
8. University Press, 2009.
9. Seshadri, K G Ed. **Stories for Colleges.** Chennai: Macmillan India Ltd, 2003.

OUTCOMES:

Students would be able to

- Take part in group discussions and interviews with confidence.
- Write official letters, their application letter with CV and reports.
- Analyse various genre of literature.

MAC1288 PROBABILITY AND STATISTICS L T P C
3 1 0 4

OBJECTIVES:

- To impart knowledge about the basic concepts of probability in solving application oriented problems
- To provide an understanding on the concepts of statistics

Recap Introduction to Probability (4)

Sample space - events - algebraic operations on events - definition of probability - Conditional probability - addition and multiplication theorems of probability – Baye's theorem.

MODULE I RANDOM VARIABLES AND DISTRIBUTION FUNCTIONS (10+3)

Discrete and continuous random variables - distribution function and its properties - probability mass function and probability density function - discrete and continuous probability distributions - Binomial, Geometric, Poisson, Uniform, Exponential and Normal distributions.

MODULE II MOMENTS AND MOMENT GENERATING FUNCTIONS (8+3)

Expectation of a random variable – probability generating function – properties - moment generating function.

MODULE III TWO DIMENSIONAL RANDOM VARIABLES (6+3)

Joint, marginal and conditional distribution functions - independence of random variables.

MODULE IV DESCRIPTIVE STATISTICS (8+3)

Types of data - primary and secondary data - classification and representation of data -formation of frequency distribution - various measures of central tendency, dispersion - and their merits and demerits - concept of skewness and kurtosis.

MODULE V CORRELATION AND CURVE FITTING (9+3)

Correlation coefficient and regression - rank correlation - curve fitting by least square methods - fitting a straight line, parabola, power curve and exponential curves. (no derivation, numerical problems only)

TOTAL HOURS – 60

TEXT BOOKS:

1. Richard Arnold Johnson, Irwin Miller, John E. Freund , Miller & Freund's
2. Probability and Statistics for Engineers, Prentice Hall, 2011.
3. Dr. P. Kandaswamy, Dr. K. Thilagavathy and Dr. K. Gunavathy, Probability and Queuing Theory, Revised edition, S. Chand Publishing, 2013.
4. T. Veerarajan, Probability, Statistics and Random Processes, Tata McGraw Hill, 2nd edition.

REFERENCES:

1. Goon, A.M., M. K. Gupta and B. Das Gupta Fundamentals of Statistics- Vol. I, World Press Ltd, Kolkata, 2002.
2. Gupta, S.C. and V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi, 2002.
3. Hogg, R.V. and A. Craig, Introduction to Mathematical Statistics, McMillan Publishing co., Inc. 1978.
4. Mood A.M., F.A. Graybill and D.C. Boes, Introduction to Theory of Statistics McGraw Hill Book Co., 1974.
5. Sheldon M. Ross, Introduction to Probability and Statistics for Engineers and Scientists, Fourth Edition, Elsevier.

OUTCOMES:

On completion of the course the students will be able to

- solve basic problems in probability and fundamentals of statistics.
- solve problems using standard probability distributions.
- find the marginal and conditional distributions of two dimensional random
- variables.
- calculate rank correlation and fitting curves for the given data.
- use method of moments and moment generating functions.

CAC1251	OPERATING SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

To gain knowledge about operating system, memory management and scheduling concepts and to study about the basics of OS, process management, Synchronization, memory management and File management.

MODULE I INTRODUCTION: 9

What is an operating system – operating system concepts – system calls – operating system structure

MODULE II PROCESSES AND THREADS 9

Process – Inter process communication – Scheduling; Deadlocks: Resources – Introduction to deadlocks – Deadlock detection and recovery – deadlock avoidance – Deadlock Prevention.

MODULE III MEMORY MANAGEMENT: 9

Basic memory management – Swapping – Virtual Memory – Page replacement algorithms – Implementation Issues – Segmentation.

MODULE IV INPUT / OUTPUT: 9

Principles of I/O hardware – Principles of I/O software – I/O software layers – Disks – Character oriented terminals – Graphical user interfaces – Network terminals.

MODULE V FILE SYSTEMS: 9

Files – Directories – File System Implementation – Example file systems – Case study 1: Unix and Linux; Case Study 2 : Windows 2000.

TOTAL HOURS – 45

TEXT BOOKS:

1. Abraham Silberschatz and P. B. Galvin - Operating system concepts - Addison Wesley Publication, Eighth Edition.,2012

REFERENCES:

1. Stalling William, Operating Systems: Internals and Design Principles, 7th

Edition, Prentice Hall, 2011.
2. Dietel et al, Operating Systems, 3rd Edition, Pearson Education, 2004.
3. A.S. Tanenbaum, Modern Operating Systems, 3rd Edition, Prentice Hall, 2007.

OUTCOMES:

At the completion of this course, students will be able to

- Demonstrate understanding of the concepts, structure and design of operating
- Systems Demonstrate understanding of operating system design and its impact on application system design and performance
- Demonstrate competence in recognizing and using operating system features.

CAC1252	OOPS WITH C++	L	T	P	C
		3	0	0	3

OBJECTIVES:

The aim of the course is to

- Understand the concepts of classes and object
- Define classes for a given situation and instantiate objects for specific problem solving.
- Reuse available classes after modifications if possible
- Possess skill in object oriented thought process

MODULE I INTRODUCTION TO OBJECT ORIENTED PROGRAMMING 9

Concept of Object orientation – comparison with procedural and structured programming – Classes and objects – data Abstraction, encapsulation, dynamic binding, message passing. Advantages of object orientation -Basic data types and declarations.

MODULE II CLASSES AND OBJECTS 9

Classes and objects in C++, access modifiers, static members, friend functions, Constructors and Destructors, polymorphism, Operator Overloading and type conversion

MODULE III INHERITANCE 9

Inheritance - parent and child classes, private, public and protected inheritance, multiple inheritances and multi-level inheritance, Virtual base classes. new and delete operators, objects.

MODULE IV POLYMORPHISM AND EXCEPTION HANDLING 9

Binding & Polymorphism: Early binding, Late Binding, Pointers to derived class objects, virtual functions, Pure virtual functions, exception handling in C++: try, throw and catch.

MODULE V FILE STREAM CLASSES AND TEMPLATES 9

Study of File stream classes in C++. Templates – class and function templates, Templates versus macros, String objects in C++, Standard Template Library in C++ .

TOTAL HOURS – 45

TEXT BOOKS:

1. Bjarne Stroustrup, “ Programming: Principles and Practice Using C++ “, Addison Wesley, 2nd edition, ISBN-13: 978-0321992789, 2014.

REFERENCES:

1. Bjarne Stroustrup," The C++ Programming Language", Addison Wesley, 4 th edition, ISBN-13: 978-0321563842, 2013.
2. Herbert Schildt, "C++ The Complete Reference", Tata McGraw Hill fourth Edition, 2003

OUTCOMES:

After completion of this course, the students would be able to

- Understand concepts of objects and their significance in real world
- Learn to co-relate relationship among different entities involved in a system
- Develop software in terms of objects, associations, and integrity constraints
- Identify, understand and analyze various sample development models
- Design classes and inheritances
- Real life problem formulation in terms of objects and classes
- Data handling through files

CAC1253	DATA STRUCTURES USING C	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the fundamental concepts of data structure
- To understand the basic operations of stacks and queues for real time scenario
- To comprehend the significance of sorting algorithms
- To demonstrate the understanding of various searching algorithms

MODULE I INTRODUCTION TO DATA STRUCTURES 9

Definition, Classification of data structures : primitive and non primitive. Operations on data structures. Dynamic memory allocation and pointers: Definition Accessing the address of a variable, Declaring and initializing pointers. Accessing a variable through its pointer. Meaning of static and dynamic memory allocation. Memory allocation functions: malloc, calloc, free and realloc.

MODULE II INTRODUCTION TO STACK AND QUEUE 9

Stack – Definition, Array representation of stack, Operations on stack: Infix, prefix and postfix notations- Conversion of an arithmetic expression from Infix to postfix. Applications of stacks. Queue - Definition, Array representation of queue, Types of queue: Simple queue, circular queue, double ended queue (deque) priority queue, operations on all types of Queues

MODULE III LINKED LISTS 9

Definition, Components of Linked List, Representation of Linked List, Advantages and Disadvantages of Linked List. Types of Linked List: Singly Linked Lists – Doubly Linked Lists – Circular List – Representing Stacks and Queues in C using Arrays and Linked Lists, Infix to Postfix Conversion, Postfix Expression Evaluation. Applications of Linked Lists.

MODULE IV TREES 9

Trees – Binary Trees - Terminology – Representation – Traversals – Graphs – Terminology – Representation – Graph Traversals (DFS & BFS).

MODULE V SEARCHING AND SORTING 9

Searching - Linear Search Methods - Binary Search Methods, Sorting - Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort.

TOTAL HOURS – 45

TEXT BOOKS:

1. Narasimha Karumanchi, "Data Structures and Algorithms Made Easy: Data Structure and Algorithmic Puzzles", 2nd Edition, Create Space Independent Publishing Platform, 2011.
2. Ashok N. Kamthane, "Introduction to Data Structures in C", 2nd Edition, Wiley Publications, 2008.

REFERENCES:

1. Classic Data Structures, D. Samanta, PHI Learning , New Delhi 2011
2. Data Structure made simple, Sathish Jain, Shashi Singh, BPB Publications, New Delhi 2006

OUTCOMES:

On completion of this course, students will be able to

- Describe common applications for arrays
- Apply Stack and Queue data structures for real time applications
- Analyse, evaluate and choose appropriate abstract data types and algorithms to solve particular problems

CAC1254	OOPS WITH C++ LAB	L	T	P	C
		0	0	4	2

OBJECTIVES:

- Understand and solve logical & mathematical problems through C++ language
- Strengthen knowledge of a procedural programming language.
- Design and develop solutions to intermediate level problems
- Develop their skills in software development using a procedural language
- Get programming in skill the object oriented technology with the usage of C++.

LIST OF PROGRAMS

1. Creation of classes and use of different types of functions.
2. Programs using Constructor and Destructor
3. Count the number of objects created for a class using static member function.
4. Write programs using function overloading and operator overloading.
5. Programs using inheritance.
6. Program using friend functions.
7. Program using virtual function.
8. Program using exception handling mechanism.
9. Programs using files.
10. Programs using function templates.

TEXT BOOKS

1. Bjarne Stroustrup, " Programming: Principles and Practice Using C++ ", Addison Wesley, 2nd edition, ISBN-13: 978-0321992789, 2014.

REFERENCES:

1. Bjarne Stroustrup," The C++ Programming Language", Addison Wesley, 4 th edition, ISBN-13: 978-0321563842, 2013.
2. Herbert Schildt, "C++ The Complete Reference", Tata McGraw Hill Edition, 2003

OUTCOMES:

- After completion of this course, the students would be able to Create classes and objects in C++
- Implement inheritance, polymorphism and object relationship in C++

- Design methods and procedure
- Manipulate data through file in C++
- Debug and test software.
- Develop a minor software in C++ language

CAC1255	DATA STRUCTURES USING C LAB	L	T	P	C
		0	0	4	2

OBJECTIVES:

The objective of this course is to teach the students to

- Be familiar with writing recursive methods
- Implement stack and queue using array
- Implement circular queue using array
- Implement singly linked list and doubly linked list using dynamic variables and pointers
- Implement quick sort, selection sort, insertion sort and bubble sort techniques to sort a given list of integers.
- Implementation of binary search method for a given list of integers

LIST OF PROGRAMS

1. Write a C program to demonstrate the working of stack of size N using an array. The operations to be supported are 1. PUSH 2. POP 3. DISPLAY. The program should print appropriate messages for STACK overflow and Under flow.
2. Write a C program to simulate the working of an ordinary Queue using an array. Provide the operations QINSERT, QDELETE and QDISPLAY. Check the Queue status for empty and full.
3. Write a C program to simulate the working of an Circular Queue using an array. Provide the operations CQINSERT, CQDELETE and CQDISPLAY. Check the Circular Queue status for empty and full.
4. Using dynamic variables and pointers Write a C program to construct a singly linked list consisting of the following information in each node; Roll – No (Integer), Name (Character string). The operations to be supported are :
    - Inserting a node in the front of the list
    - Deleting the node based on Roll – No
    - Searching a node based on Roll-No
    - Displaying all the nodes in the list
5. Write a C program to implement doubly linked list
6. Write a C program to sort a list of N elements of integer type using quick sort Algorithm
7. Write a C program to sort a list of N elements using Bubble sort Technique

8. Write a C program to search for an element in an array using Binary search
9. Write a C program to implement insertion sort method to sort a given list of integers in descending order.
10. Write a C program to implement selection sort method to sort a given list of integers in descending order.

TOTAL HOURS –30

TEXTBOOKS:

1. Magnifying Data Structures, Aprita Gopal , First Edition , PHI Learning, New Delhi Data Structures in C, Horowitz, Sahni, Anderson-Freed, Universities Press
2. Narasimha Karumanchi, "Data Structures and Algorithms Made Easy: Data Structure and Algorithmic Puzzles", 2nd Edition, Create Space Independent Publishing Platform, 2011.

REFERENCES:

1. Ashok N. Kamthane, "Introduction to Data Structures in C", 2nd Edition, Wiley Publications, 2008.
2. DataStructures Using C - A.S.Tanenbaum, Y. Langsam, and M.J. Augenstein, PHI/Pearson education.

OUTCOMES:

The completion of this course the students will be able to

- Write and demonstrate recursive methods
- Implement stack and queue and evaluate various operations involved in it
- Implement and execute circular queue using array
- Develop an application using singly linked list and doubly linked list
- Implement and analyze various searching techniques and sorting techniques

CAC1256	ENVIRONMENTAL STUDIES	L	T	P	C
		2	0	0	2

OBJECTIVES:

To impart knowledge on

- Various natural resources, availability, utilization and its current scenario.
- Different ecosystems, energy transfer.
- Values, threats and conservation of biodiversity.
- Levels of different pollutants and its impact and the causes and effects of natural disasters

MODULE I NATURAL RESOURCES 8

Land resources: land degradation, soil erosion and desertification - Forest resources: use and over-exploitation, deforestation - Water resources: use and over-utilisation of surface and ground water, water conservation (rainwater harvesting and watershed management) - Food resources: world food problems, changes in land use by agriculture and overgrazing, modern agriculture and its effects - Energy resources: increasing energy needs, renewable and non-renewable, use of alternate energy sources.

MODULE II ECOSYSTEM 8

Ecosystem- energy flow in the ecosystem - food chains, food webs and ecological pyramids - characteristics, structure and function of (a) Terrestrial ecosystems (forest, grassland, desert) and (b) Aquatic fresh water ecosystems (pond, lake, river) (c) Aquatic salt water ecosystems (ocean, estuary) - ecological succession.

MODULE III BIODIVERSITY AND ITS CONSERVATION 8

Biodiversity - genetic, species and ecosystem diversity – hot-spots of biodiversity – bio geographic classification of India - endangered, endemic, extinct and invasive species of India - red data book - values of biodiversity: consumptive, productive, social, ethical, aesthetic and option values - threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts - conservation of biodiversity: in-situ and ex-situ conservation of biodiversity

MODULE IV ENVIRONMENTAL POLLUTION AND NATURAL DISASTER 6

Definition, cause, effects and control measures of (a) air pollution (b) water pollution

(c) soil pollution (d) marine pollution (e) noise pollution (f) thermal pollution (g) nuclear hazards - ill-effects of fireworks and upkeep of clean environment - solid waste management: types (urban, industrial, biomedical and electronic wastes), collection, processing and disposal (incineration, composting and land-fill).

Natural disaster and management: flood, cyclone, drought, landslide, earthquake and tsunami.

Case studies related to current situation.

TOTAL HOURS – 30

TEXT BOOKS:

1. Erach Bharucha, Textbook for Environmental Studies For Undergraduate Courses of all Branches of Higher Education for University Grants Commission, Orient Blackswan Pvt Ltd, Hyderabad, India, 2013.
2. Benny Joseph, Environmental Studies, Tata McGraw-Hill Education, India, 2009.
3. Ravikrishnan A, Environmental Science and Engineering, Sri Krishna Publications, Tamil Nadu, India, 2015.
4. Raman Sivakumar, Introduction to Environmental Science and Engineering, McGraw Hill Education, India, 2009.
5. Venugopala Rao P, Principles of Environmental Science and Engineering, Prentice Hall India Learning Private Limited; India, 2006.
6. Anubha Kaushik and Kaushik C.P., Environmental Science and Engineering, New Age International Pvt Ltd., New Delhi, India, 2009.
7. Rajah G, Basic Environmental Studies, Margham Publications, Chennai, 2016.

REFERENCE BOOKS:

1. Masters G.M. and **Wendell P.,** Introduction to Environmental Engineering and Science, **3rd** Edition, Prentice Hall, New Delhi, 2007.
2. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co. Boston, USA, 2016.

OUTCOMES:

At the end of the course the student will be able to

- Predict the scenario of various natural resources and suggest remedies to curb the exploitation of these resources.

- Identify food chain and web and its role in various ecosystems.
- Assess the impacts on biodiversity and provide solutions to conserve it.
- Analyze the impacts of pollutants in the environment and propose suitable method to alleviate the pollutants and the natural disasters.

SEMESTER III

CAC2151	**DATABASE MANAGEMENT SYSTEMS**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

OBJECTIVES:

The aim of the course is to

- Provide an introduction to the management of database systems.
- Understand the fundamentals of relational systems including data models, database architectures, and database manipulations.

MODULE I INTRODUCTION 12

Database Systems vs. File Systems - View of Data - Data Models- Database Languages -Transaction Management - Database Systems Structure - History of Database Systems - Database Systems Applications - Entity Relationship Model.

MODULE II RELATIONAL DATABASES 12

SQL - Basic Structure - Set Operations - Complex Queries - Joined Queries - DDL-Embedded SQL-Dynamic SQL-Other SQL Functions-Query by Example- Integrity and Security of searching-Relational Database Design.

MODULE III DATA STORAGE AND INDEXING 12

Storage & File Structure - Disks-RAID-File Organization - Indexing &Hashing- B+ TREE-B Tree-Static Hashing-Dynamic Hashing-Multiple Key Access.

MODULE IV QUERY EVALUATION & OPTIMIZATION 12

Query Processing-Selection Operation-Sorting-Join Operation-Evaluation of Expressions

MODULE V QUERY OPTIMIZATION 12

Query Optimization Overview - Transformation of Relational Expressions -Estimating Statistics of Expression Results - Choice of Evaluation Plans

Total Hours –60

TEXT BOOK:

1. Elmasri and Navathe, "Fundamentals of Database Systems", 6th Edition, Addison-Wesley, 2011

REFERENCES:

1. Raghu Ramakrishnan & Johannesgerhrke, “Data Base Management Systems”, Mc Graw Hill International Edition, 2000.
2. C.J. Date, A. Kannan, S. Swamynathan, "An Introduction to Database Systems", 8th Edition, Pearson Education, 2006.

OUTCOMES:

At the conclusion of the course, the student will be able to:

- Understand terms related to database design and management.
- Understand the objectives of data and information management.
- Develop physical data models for relational database management systems.
- Implement relational databases using a RDBMS retrieve data using SQL.

CAC2152 DIGITAL ELECTRONICS L T P C

3 0 0 3

OBJECTIVES:

The main objective of the Course Digital Electronics is the students will learn

- through the basic understanding of Boolean Algebra and Number systems,
- introduces the student to the fundamentals of combination logic design and then to sequential circuits(both synchronous and asynchronous)
- Understandings in Flip Flops, Multiplexers, ADC and DAC

MODULE I NUMBER SYSTEMS 9

Number Systems and Codes Decimal, binary, octal, hex numbers, conversion from one to another- codes, BCD, excess 3 , gray codes conversion from one to another - Error detection codes.

MODULE II BOOLEAN ALGEBRA AND THEOREMS 9

Boolean Algebra and Theorems : Basic, Universal logic gates - Boolean theorems - sum of products , products of sums expressions , simplification by Karnaugh Map method, simplification based on basic Boolean theorems - don't care conditions.

MODULE III COMBINATIONAL DIGITAL CIRCUITS 9

Combinational Digital Circuits Arithmetic Building blocks , Basic Adders and subtractors, BCD adders - Data of processing circuits, multiplexers, demulitiplexers, encoders, decoders - TTL, CMOS digital logic families.

MODULE IV SEQUENTIAL DIGITAL CIRCUITS 9

Sequential Digital Circuits : Flip-flops , RS, Clocked SR, JK, D, T, master-slave types-shift registers, ring counters - ripple counters - synchronous counters, timer IC 555, applications.

MODULE V DAC AND ADC 9

DAC and ADC : Parameters, Accuracy, resolution - DAC, variable resister network, R-2R ladder network types - ADC, counting continuous, successive approximation, dual - slope types - comparison of various types of DAC and ADC.

Total Hours –45

TEXT BOOKS:

1. M. Morris Mano and Michael D.Ciletti, "Digital Design with an introduction to the Verilog HDL", 5th Edition, Pearson Education, 2012.

REFERENCES:

1. Donald D. Givone, "Digital Principles and Design", 13th reprint, Tata McGraw Hill, 2003.
2. S.P. Bali, Solved Problems in Digital Electronic, Sigma Series, Tata McGraw-Hill,(2005)

OUTCOMES:

A student who successfully fulfills the course requirements will have demonstrated:

- An ability to understand basic parameters of a logic Gates.
- An ability to analyze and design a CMOS logic inverter.
- An ability to analyze a TTL and ECL logic inverter.
- An ability to understand the operation of latch circuit and flip-flop circuits.
- An ability to understand the operation of different types of semiconductor memories.

CAC2153	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

This course provides a comprehensive introduction to

- Understand the underlying Network model and Communication principles.
- Switching techniques and Multiplexing approaches
- knowledge in Internetworking Devices

MODULE I NETWORK FUNDAMENTALS

A communications model - Data Communications - Data Communications Networking - computer communication architecture - standards Data Transmission - Concepts and terminology - Analog and Digital - Transmission - Transmission Impairments - Transmission media.

MODULE II PHYSICAL LAYER

Data encoding - Digital data Digital signals ,Digital data Analog signals,, Analog data Analog signals Data Communications Interface : Asynchronous and synchronous Transmission - Line configuration - Interfacing.

MODULE III DATA LINK LAYER

Data link control: Flow controls - Error Detection - Error Control - High Level Data Link Control (HDLC) - MULTIPLEXING - Frequency Division multiplexing - Synchronous time - Division multiplexing - Statistical time division multiplexing.

MODULE IV NETWORK LAYER

Circuit switching: Circuit switching networks switching concepts - Routing in circuit switched networks - Packet switching principles - Routing in packet switching - Congestion control.

MODULE V HIGH PERFORMANCE NETWORKS

Frame relay: Frame relay Protocol Architecture - Frame relay call control user data transfer - Networks functions - Congestion control, ASYNCHRONOUS TRANSFER MODE (ATM) Protocol Architecture – ATM logical connection - ATM Cells – Transmission of ATM cells - ATM adaption layer - Traffic and congestion control.

TOTAL HOURS – 45

TEXT BOOKS:

1. Larry L. Peterson and Bruce S. Davie, "Computer Networks: A Systems Approach", 4th Edition, Elsevier, 2007.

2. Forouzan: Introduction to Data Communication & Networking, McGraw-Hill, 2007.

REFERENCES:

1. Andrew S. Tanenbaum, "Computer Networks", 4 th Edition, Prentice-Hall of India, 2003.

2. James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", 3rd Edition, Pearson Education, 2006.

OUTCOMES:

Upon completion of the subject, students will be able to

Explain the importance of data communications and the Internet in supporting business communications and daily activities.

- Understand how communication works in data networks and the Internet.
- Recognize the different internetworking devices and their functions.
- Explain the role of protocols in networking.
- Analyze the services and features of the various layers of data networks

CAC2154 FUNDAMENTALS OF ALGORITHMS

L	T	P	C
3	0	0	3

OBJECTIVES:

The aim of the course is to

- introduce mathematical aspects and analysis of algorithms
- analyze sorting and searching algorithms
- study various algorithmic techniques
- devise correct and efficient algorithms for solving a given problem
- explain the NP-Completeness and deal with NP-complete problems

MODULE I INTRODUCTION **9**

Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types – Fundamentals of the Analysis of Algorithm Efficiency – Analysis Framework – Asymptotic Notations and its properties – Mathematical analysis for Recursive algorithm and Non-recursive algorithms.

MODULE II DIVIDE-AND-CONQUER **9**

Brute Force – Closest-Pair and Convex-Hull Problems-Exhaustive Search – Traveling Salesman Problem – Knapsack Problem – Assignment problem. Divide and conquer methodology – Merge sort – Quick sort – Binary search – Multiplication of Large Integers – Strassen's Matrix Multiplication.

MODULE III DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE **9**

Computing a Binomial Coefficient – Warshall's and Floyd' algorithm – Optimal Binary Search Trees – Knapsack Problem and Memory functions. Greedy Technique– Prim's algorithm- Kruskal's Algorithm- Dijkstra's Algorithm.

MODULE IV BACKTRACKING **9**

Backtracking – N-Queens problem – Hamiltonian circuit problem – Subset sum problem

MODULE V BRANCH AND BOUND **9**

Branch and bound – Assignment problem – Knapsack problem – Traveling salesman problem.

TOTAL HOURS –45

TEXT BOOKS:

1. Baase,S., Gelder,A.V., Computer Algorithms: Introduction To Design And Analysis, 3rd Edition, Pearson India.
2. Anany Levitin, Introduction to the Design and Analysis of Algorithms, 3rd Edition, Pearson Education.

REFERENCES:

1. Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, Introduction to Algorithms, 2ndEdition, PHI, 2006.
2. Introduction to the Design and Analysis of Algorithms A Strategic Approach, R.C.T. Lee, S.S. Tseng, R.C. Chang & Y.T.Tsai, TMH, 2005.

OUTCOMES:

At the completion of this course, students will be able to

- Ability to decide the appropriate data type and data structure for a given problem.
- Ability to select the best algorithm to solve a problem by considering various problem characteristics, such as the data size, the type of operations, etc.
- understand NP-Completeness and deal with NP-complete problems.

CAC2155 MULTIMEDIA AND ITS APPLICATIONS L T P C

3 0 0 3

OBJECTIVES:

- Understand the Flash/Animate working environment and its terminology.
- Explore and implement the different types of animation Flash/Animate supports.
- Learn how to import and use sound and sound effects in animation programs.
- To edit images in Photoshop

MODULE I -INTRODUCTION 9

What is multimedia: Definitions - Where to use Multimedia - Introduction to making Multimedia- The stages of a Project - What You Need – Multimedia Skills and Training: Basic Tools :Text Editing and Word Processing Tools - Painting and Drawing Tools - 3- D Modeling and Animation Tools - Image Editing Tools - Sound Editing Tools - Animation, Video and Digital Movie Tools - Helpful Accessories

MODULE II VECTOR AND RASTER GRAPHICS 9

Adding multimedia to the web-Raster image editing software Introduction -Image Basics -File Formats -GIF -JPEG -Color Palette –Color models-Layers -Creating new Images - Brushes –Grids and guides-Gradients -Scaling Images -Moving and Merging Layers - Tool Palette -Dialogs -masking –Filters –Adding text to images – Designing icons and background images.

MODULE III IMAGE HANDLING 9

Introduction –Creating Simple Vector graphics –Creating banners -Images -Working with layers –Tweening -Motion guide –Masking –Frame by Frame animation –Onion Skin Effect –Creating special effects -Text effects and animation –Action scripts.

MODULE IV ANIMATIONS AND INTERACTION 9

Creating clippings - Animations with sound effects -Adding audio or Video - Windows Media Player ActiveX Control -Real Player ActiveX control- web site with a particular theme using all the utilities -Graphics -Animations and Interaction

.

MODULE V PROJECT PLANNING 9

Estimating -Designing - Producing - Content and Talent- Acquiring Content - Using content created by others - Using Content created for a Project - Using

Talent Delivering: Testing - Preparing for Delivery - Compact Disc Technology - Wrapping It Up - Delivering on the World Wide Web.

TOTAL HOURS –45

TEXT BOOKS:

1. Richard Schrand, Photoshop 6 Visual Jumpstart, Adobe Press 2000.(II)
2. James L. Mohles, Flash 5.0 Graphics, Animation & Interaction, Macromedia 2000. (III&IV)
3. Tay Vaughan, Multimedia: Making It Work, Fourth Edition - Tata McGraw Hill Edition, 1999.(I&V)

REFERENCES:

1. Tay Vaughan , "Multimedia:Making It Work,8th Edition", McGraw Hill, 2010.
2.John F Koegelbuford, Multimedia Systems Addison Wesley - First Indian Reprint, 2000.

OUTCOMES:

On completion of the course, Students will be able to

- Create Flash/Animate banners for websites that will capture and hold viewers attention
- Create animated photo galleries.
- Incorporate audio and video and learn how to edit it within Flash/Animate.
- Design icons and background images.

CAC2156	DATABASE MANAGEMENT SYSTEMS LAB	L	T	P	C
		0	0	4	2

OBJECTIVES:

The aim of the course is

- to learn SQL (Structured Query Language) which would provide functionality to:
- to learn how to create tables which are fundamental storage blocks of data.
- to learn how to place constraints on data that is entered on tables to ensure data integrity.
- to learn how to add, change and remove data from tables.
- to learn how to select a subset of the data you want to see from the collection of tables and data.
- to learn how to combine table and group multiple rows of data in table. to learn PL/SQL which would provide the ability to do iterative
- programming at database level to:
- to write programming blocks with conditional structure, assignment structure, loop structure, etc.
- use exception Handling, Transaction oriented programs, Stored procedures, functions, packages, etc.

LIST OF PROGRAMS

1. Execute a single line and group functions for a table.
2. Execute DCL and TCL Commands.
3. Create and manipulate various DB objects for a table.
4. Create views, partitions and locks for a particular DB.
5. Write PL/SQL procedure for an application using exception handling.
6. Write PL/SQL procedure for an application using cursors.
7. Write a DBMS program to prepare reports for an application using functions.
8. Write a PL/SQL block for transaction operations of a typical application using package.
9. Design and develop an application using any front end and back end tool (make use of ER diagram and DFD).

Typical Applications – Banking, Electricity Billing, Library Operation)

TOTAL HOURS –30

OUTCOMES

At the end of this course, a student will be able to

- Use in real time business activities.
- create and do manipulation on database in any domain.
- work with table by using PL/SQL Program.
- get a clear idea about database transaction activities.

TEXTBOOK:

1.Ramez Elmasri and Shamkant B. Navathe, “Fundamentals of Database Systems”, Fifth Edition, Pearson Education, 2008.

REFERENCES:

1.Abraham Silberschatz, Henry F. Korth and S. Sudharshan, “Database System Concepts”, Sixth Edition, Tata Mc Graw Hill, 2011.

2. C.J.Date, A.Kannan and S.Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.

CAC2157	MULTIMEDIA LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- Expose students to various interactive multimedia based software such as Flash
- Gain a working knowledge of all the Adobe Flash/Animate tools and their functions.

LIST OF PROGRAMS

Exercises Using Flash

1. Drawing a Semi Circle by snap tool, spokes on a wheel.
2. Placing a text along a curved path .
3. Changing on objects shape using shape tweening, text tweening.
4. Application using buttons, animating the button
5. Tweening a using the shape hints, motion tweening
6. An application to show the masking effect in Flash
7. Slide show presentation(minimum 5 slides)
8. Creating smudge effect for an image
9. Usage of textbox, dynamic text box, buttons with action scripts.

Exercises Using Photoshop

1. Working with the clone stamp tool , custom shape
2. Using the sponge Tool
3. Removing an element from an image
4. Creating an edge mask
5. Applying Transformations
6. Correcting brightness and contrast

TOTAL HOURS – 30

TEXT BOOKS:

1.Richard Schrand, Photoshop 6 Visual Jumpstart, Adobe Press 2000.

2. James L. Mohles, Flash 5.0 Graphics, Animation & Interaction, Macromedia 2000

REFERENCES:

1. John F Koegelbuford, Multimedia Systems Addison Wesley - First Indian Reprint, 2000.

2. Walter Worth John, A - Multimedia Technologies and Applications, Ellis Horwood Ltd., London,1991.

OUTCOMES:

On completion of the course, Students will be able to

- Draw simple images prepare them for animation and add motion.
- Animate a sequence with a soundtrack.

CAC2158	COMMUNICATION SKILLS	L	T	P	C
		0	0	4	2

OBJECTIVES:

The aim of the course is to

- enable the students to speak English with correct accent and pronunciation.
- interact effectively in real life situations and in workplace.
- develop the writing ability of students by providing them the required practice.
- improve the written communication skill so as to write reports, letters etc.

MODULE I

Introduction to Communication-Need for Effective Communication. The Process of Communication:Levels of communication- Flow of communication- Use of language in communication- Communication networks- Significance of technical communication.

MODULE II

Barriers to Communication:Types of barriers- Miscommunication- Noise- Overcoming measures. Listening Skills:Listening as an active skill- Types of Listeners- Listening for general content- Listening to fill up information- Intensive Listening- Listening for specific information-Developing effective listening skills- Barriers to effective listening skills.

MODULE III

Reading Skills :Previewing techniques- Skimming- Scanning- Understanding the gist of an argument-Identifying the topic sentence- Inferring lexical and contextual meaningrecognizing coherence and sequencing of sentences- Improving comprehension skills. Writing Skills:Sentence formation- Use of appropriate diction- Paragraph and Essay Writing- Coherence and Cohesion.

MODULE IV

Technical Writing:Differences between technical and literary style, Elements of styleCommon Errors. Letter Writing: Formal, informal and demi-official letters- business letters. Job Application :Cover letter, Differences between bio-data, CV and Resume. Group Discussion:Differences between group discussion and debate; Ensuring success in group discussions.

MODULE V

Non-verbal Communication and Body Language: Forms of non-verbal

communicationInterpreting body-language cues- Kinesics- Proxemics- Chronemics- Effective use of body language. Interview Skills:Types of Interviews- Ensuring success in job interviewsAppropriate use of non-verbal communication. Presentation Skills:Oral presentation and public speaking skills- business presentations

TOTAL HOURS –20

TEXT BOOKS:

1.Deparment of English,Anna University,Mindscapes,English for Technologists & Engineers,Orient Longman Pvt.Ltd,Chennai :2012.

2.M.Ashraf Rizvi,,Effective Technical Communication,Tata McGraw Hill Publishing Company Ltd,New Delhi,2009.

REFERENCES:

1. Sangeetha Sharma,Binod Mishra,'Communication Skills for Engineers & Scientists,PHI,Learning Pvt Ltd,New Delhi,2009.
2. Sumant S,Technical English, 2nd Edition,McGraw-Hill Education Pvt Ltd,2008.

OUTCOMES:

This course will enable students to use „good" English and perform the following
Gather ideas and information, to organise ideas relevantly and coherently.

- Engage in debates.
- Participate in group discussions.
- Make oral presentations.
- Write formal letters.
- Transfer information from non-verbal to verbal texts and vice versa.
- Take part in social and professional communication.

SEMESTER IV

CAC2251	PROGRAMMING IN JAVA	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aim of the course is to

- Learn the fundamentals of the capabilities of Java and to introduce encapsulation, polymorphism, and the Java language mechanism (classes and objects) to implement it.
- Develop Java computer programs that perform various problem-solving algorithms.
- Develop the programming skills to use the Java object oriented programming methodology to produce quality computer based solutions to real problems.

MODULE I INTRODUCTION TO JAVA 12

The Confidentiality, Integrity & Availability (CIA) Triad, Cryptographic concepts, methodologies &practices, Symmetric& Asymmetric cryptography, public& private keys, Cryptographic algorithms and uses, Construction& use of Digital signatures

MODULE II CLASS AND INHERITANCE 12

The Java Class- Inheritance, Deriving Classes, Method Over-riding, Method Overloading, Access Modifiers, Abstract Class and Method, Interfaces, Packages, Imports and Class Path.

MODULE III THREADS AND EXCEPTION HANDLING 12

Exception Handling, The Try-Catch Statement, Catching more than one Exception, Generating Exceptions, Threads: Introduction, Creating Threads in Applications-Thread Priority

MODULE IV : INPUT STREAM CLASSES 12

IO Packages, Java Input Stream Classes, Java Output Stream Classes, File Class.

MODULE V APPLETS AND AWT PACKAGES 12

Creating an Executable Applet, Applets Life Cycle, AWT and Graphic methods, Fonts, Loading and Viewing Images, Loading and Playing Sound, Event Handling, Layouts

TOTAL HOURS –60

TEXT BOOKS:

1. Hortsmann & Cornell, "Core Java Advance Features VOL II", 9th Edition,

Pearson Education, 2013.

REFERENCES:

1. Patrick Naughton, "Complete Reference: JAVA 2", 8th Edition, Tata McGrawHill, 2011.
2. Andrew Lee Rubinger, Bill Burke "Enterprise JavaBeans 3.1", 6th Edition, O'Reilly Publishers, 2010.

OUTCOMES:

Upon completion of this course, students would be able to:

- Develop Java computer programs that perform various problem-solving algorithms.
- Improve the programming skills in Object Oriented language.
- Understand the concept of OOP as well as the purpose and usage principles of inheritance,
- Develop programs using the Java Collection API as well as the Java standard class library

CAC2252 COMPUTER SECURITY L T P C

3 0 0 3

OBJECTIVES:

- To provide the student with a foundation covering computer security issues
- To determine appropriate mechanisms for protecting Computer systems.
- To help organizations increase awareness of security policies and procedures.

MODULE I INTRODUCTION 8

Physical Security – Viruses – Worms – Trojan Horses –Principles of Computer Security

MODULE II IDENTITY THEFT AND PRIVACY 9

Identity Theft- Shredding – Internet Cookies –Phishing – Homograph Threat – Privacy Issues- Trust.

MODULE III ELEMENTS OF CRYPTOGRAPHY 10

Principles of Cryptography - Modular Arithmetic - Integrity Check Functions - Kirchoff's Principle – Monoalphabetic -Polyalphabetic Cipher – One Time Pad – Key distribution Problem – Diffie Hellman Key Merkle Keys- Public Key Cryptography – RSA – SSL - Digital Signatures – Encryption - Strength of Mechanisms –Performance.

MODULE IV DATABASE SECURITY 9

Introduction - Relational Databases- Access Control - Statistical Database Security – Integration with the Operating System – Privacy

MODULE V COMMUNICATION AND WEB SECURITY 9

Basics of authentication, tokens, certificate-based and biometric authentication, Protocol Design Principles - IP Security - IPsec and Network Address Translation- SSL/TLS – Xtensible Authentication Protocol - Web Services Security.

TOTAL HOURS –45

TEXT BOOK:

1.Chuck Easttom, "Computer Security Fundamentals", 2nd Edition, Pearson Education, 2012.

REFERENCES:

1. Christof Paar, Jan Pelzl, Bart Preneel, "Understanding Cryptography: A Textbook for

Students and Practitioners", 1st Edition, Springer, 2010

2. Bruce Schneider, "Applied Cryptography Protocols, Algorithms, and Source Code in C", 2nd Edition, John Wiley & Sons, 2007.

OUTCOMES:

Students who complete this course will be able to

- identify fundamental concepts of computer security.
- use the World Wide Web to know the latest security alerts and information.
- compare and contrast types of malicious code, including worms, Trojan horses, and viruses.

CAC2253	SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The aims of the course are as follows

- to define software engineering and explain its importance
- to discuss the concepts of software products and software processes
- to solve problems in a team environment through effective use of written and oral communication skills.
- to practice the lifelong learning needed in order to keep current as new issues emerge.
- to develop software in at least one application domain.

MODULE I INTRODUCTION 9

Definition of software and software engineering – Software myths –Software Engineering paradigms: Linear Sequential Model & Prototyping Model Software Project Management – Software Metrics – Software Cost Estimation – Software Project Planning.

MODULE II SOFTWARE REQUIREMENT ANALYSIS 9

Software Risks – Software Configuration Management System Analysis – Modeling the System Architecture – System Specification –Fundamentals of Requirement Analysis – Software Prototyping – Prototyping methods and tools specification – Software requirements Specifications

MODULE III STRUCTURED ANALYSIS 9

Introduction – the elements of the analysis model – data objects, attributes and relationships – Cardinality and Modality – ERD – DFD – Classical Analysis Methods : DSSD, JSD, SADT.

MODULE IV SOFTWARE DESIGN 9

Software Design and Software Engineering – Design and Software Quality – Evolution of Software Design – Design Principles. Design Concepts, Abstraction, Refinement, Modularity – Effective Modular Design, Functional Independence, Cohesion, Coupling.

MODULE V SOFTWARE TESTING METHODS 9

Software Testing Fundamentals – White Box Testing – Black Box Testing – Debugging – Software Quality: McCall's Quality Factors

TOTAL HOURS – 45

TEXT BOOKS:

1. Stephen Withal, "Software Requirement Patterns", 3rd Edition, Microsoft Press, 2011.

REFERENCES:

1. Karl & Joy Beatty," Software Requirements", 3rd Edition, Microsoft Press, 2012..
2. S.K.Kataria, Rajiv Chopra, "Object Oriented Software Engineering", 3rd Edition, 2013.

OUTCOMES:

At the completion of this course students will be able to

- understand and apply foundations of software engineering practice and process within production constraints.
- get an awareness of current industry standards and practices.
- understand and apply principles of project management for single- paired, and team processes.
- have strong oral and written communication skills to help students in preparing good quality documentation.

CAC2254	INFORMATION STORAGE AND MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce advanced Storage System, Backup and Security Managements.
- The Concept of Cloud Computing, Virtualization and other related services.
- To Explain Storage networking Technologies
  Security in cloud Environment and cloud Service management activities

MODULE I STORAGE SYSTEM

Introduction to Information Storage, virtualization, and cloud computing, Data center environment, RAID, Intelligent Storage system

MODULE II STORAGE NETWORKING TECHNOLOGIES

Fibre Channel Storage Area Network (FC SAN), IP SAN and Fibre Channel over Ethernet (FCoE), Network Attached Storage (NAS), Object based and Unified Storage

MODULE III BACKUP. REPLICATION AND ARCHIVE

Introduction to Business Continuity, Backup and Archive, Local Replication, Remote Replication

MODULE IV CLOUD COMPUTING

Cloud Computing, benefits, characteristics, deployment models, and Services, cloud challenges and migration considerations

MODULE V SECURING AND MANAGING STORAGE INFRASTRUCTURE

Securing the Information Infrastructure, framework and domains of storage security, security Implementation at storage networking, security in virtualized and cloud environments, Managing the Information Infrastructure, infrastructure monitoring and management, information lifecycle management (ILM), cloud service management activities

TOTAL HOURS –45

TEXTBOOK:

1.G. Somasundaram, Alok Shrivastava, Information Storage and Management - Storing, Managing, and Protecting Digital Information EMC Education Services,2012.

REFERENCE:

1. John W.Rittinghouse and James F.Ransome, “Cloud Computing: Implementation, Management, and Security”, CRC Press, 2010.

OUTCOMES:

Upon completion of the subject, students will be able to

- A working understanding of the Storage, Backup, virtualization, and cloud computing
- Acquire knowledge in different technologies of Storage System and Backup System
- An awareness of Security in Cloud and cloud service management activities

CAC2255 PROGRAMMING IN JAVA LAB

L	T	P	C
0	0	4	2

OBJECTIVES

The aim of the course is to

- Develop the programming skills using the object oriented programming methodology to produce quality computer based solutions to real problems.
- Utilize the advance features of Java technology.
- Work with collection API and develop fast programs.
- Develop good multithreaded programs.

LIST OF EXERCISES

1. Programs using basic data types, operators and control structures.
2. Class definitions and usage involving variety of constructors and finalizes
3. Programs involving various kinds of inheritances,
4. Program to demonstrate creation and handling of packages, their imports and Class Path.
5. Programs involving a variety of Exception Handling situations
6. Program involving creating and handling threads in applications and applets.
7. Program to demonstrate AWT/Swing graphic methods
8. Program for Loading and Viewing Images, Loading and Playing Sound
9. Programs to demonstrate various Layouts
10. Programs to demonstrate event handling

TOTAL HOURS –30

TEXT BOOKS:

1. Patrick Naughton, "Complete Reference: JAVA 2", 8th Edition, Tata McGrawHill, 2011.

REFERENCES:

1. Keyur shah, “Gateway to Java Programmer Sun Certification”, Tata McGraw Hill 2002.
2. Herbert Schildt, The Complete Reference – Java 2 , 4th Edition, Tata McGraw Hill, 2007

OUTCOMES:

After completion of this course, the students would be able to

- Understand Java and object-oriented programming language concepts.

- Write, debug, and document well-structured Java applications
- Implement Java classes from specifications
- Effectively create and use objects from predefined class libraries
- Understand the behavior of primitive data types, object references, and arrays
- Implement interfaces, inheritance, and polymorphism as programming techniques
- Apply exceptions handling

CAC2256	SOFT SKILLS AND PERSONALITY DEVELOPMENT	L	T	P	C
		0	0	4	2

OBJECTIVES:

This course is designed to

- provide attitude Control and Personal Self Esteem Improvement
- interview Motivation effective Answering and Maintaining Fluent Communication
- positive Body Language
- effective Resume Creation
- leadership Skills, Team Player Skills

MODULE I INTRODUCTION 4

Awareness of Real World Industry and Situations - Conscious Self-Awareness - Practical Visualizations - Neuro- Linguistic Programming Basics

MODULE II MOTIVATION 4

Developing Self Esteem and Self Motivation - Confident Goal Setting - Positive Attitude Development and Positive Thinking - Developing Inner Achievement Mindset.

MODULE III LEADERSHIP SKILLS 4

Types of Leadership - Leadership Process and Thinking - Innovative Thinking - Role of Competency, Discipline, Planning and Ethics - Creating Cooperation and Trust in Team Building Process – Mentoring.

MODULE IV EFFECTIVE COMMUNICATION I 4

Eliminating Stage Fright - Increasing Fluency - Increasing Focus while Listening - How to communicate as a Follower - How to communicate as a Leader - Assertive and Polite Communication

MODULE V EFFECTIVE COMMUNICATION II 4

Fluency with increased vocabulary - Group Discussion Etiquette - Advanced Group Discussions - Giving a positive Body Language - Interviews: Clear Speaking - Interviews: Handling Pressure

TOTAL HOURS –20

REFERENCES:

1. Charles Faulkner and Steve Andreas, "NLP: The New Technology of Achievement", Harper Paperbacks publishers, 1996.
2. Sarvesh Gulati, "Corporate Soft Skills" , Rupa and Co publishers.

3. P.K.Dutt, G. Rajeevan and C. L. N. Prakash, “A Course in Communication Skills”, Cambridge University Press, India 2007.

OUTCOMES:

By the end of this course students will be able to develop the following:

Awareness of Real World Industry and Situations

- Role of Competency, Discipline, Planning and Ethics
- Advanced Group Discussions
- Giving a positive Body Language
- Interviews: Clear Speaking

SEMESTER V

		L	T	P	C
CAC3151	**C# AND .NET PROGRAMMING**	**3**	**1**	**0**	**4**

OBJECTIVES:

To enable the students to learn and develop Web and Windows application for the .NET platform.

MODULE I INTRODUCTION 12

Vision and goals of .NET, Building blocks of .Net, overview of .Net applications- .Net evolution- The .Net Framework Architecture- Intermediate Language(IL)- Common Language Runtime (CLR)- JIT Compilation- Common Type System (CTS)- Common Language System (CLS)- Assemblies- IL Disassembler (ILdasm.exe)- Namespaces. C# features Working with methods- understanding method structure- calling a method- understanding parameter types- overloading methods- virtual methods- overriding methods.

MODULE II C# CLASSES 12

Constants- fields- methods- properties- events- indexers- operators- constructors- destructors- static modifiers. Class Inheritance Compiling with multiple classes- virtual and override methods- abstract methods- sealed classes- Boxing and Unboxing- Working with namespaces- Understanding interfaces- handling exceptions.

MODULE III WINDOWS APPLICATIONS 12

Understanding Windows Forms Architecture- Windows controls: Common- Containers- Menus and Tool strips- Data- Reporting. Adding and using windows controls to the form.

MODULE IV DATABASE PROGRAMMING WITH ADO.NET II 12

Understanding the Dataset classes and their relatives- Understanding OLEDB and SQL Server Support- Understanding common database operations using ADO.NET – Operations that don’t return rows- Data operations that return single- row entities- data operations that affect single-row entities- data operations returning sets of rows- data operations affecting sets of rows- operations that return hierarchical data.

MODULE V CREATING WEB APPLICATIONS WITH WEB FORMS 12

[Asp.NET]Difference between ASP and ASP.Net- Defining a web application- ASP.NET architecture- ASP.net web forms- Code behind model- Validation controls in ASP.NET- Server controls and data binding- Grid view- data repeater- data list- Data binding in ASP.NET- Data source controls- sqldata source- Data controls – grid view and details view- Login controls.

TOTAL HOURS –45

TEXT BOOKS:

1. Jeff Ferguson, Brian Patterson, Jason Beres ,C# Programming Bible , Wiley Publishing Inc., Reprint 2006.

REFERENCES:

1. Jeff Prosise, Programming .Net, 2nd Edition, WP Publishers & Distributors Pvt. Ltd, 2009.
2. Kevin Hoffman & Jeff Gabriel, Professional .Net Framework, 1st Edition, Wrox Press Publishers, 2006.

OUTCOMES:

- Upon successful completion of the course, the students would be able to
- Update the students with the latest technologies thereby make them fit for the industry
- Make the students aware of a new development platform for internet and distributed applications
- Simplify application development and deployment

CAC3152 WEB DESIGNING

L	T	P	C
3	0	0	3

OBJECTIVES:

- Introduce the students to the concepts, terms and technologies used in web site design
- Highlight the theories underlying web site design.
- To understand the principles of creating an effective web page
- To use scripting languages to transfer data and add interactive components to web pages.

MODULE I INTRODUCTION 9

Introduction to WWW **-** Introduction to Network, Internet and Intranet, Application and Services, Internet Addressing – URL, Elements of Web – Web Page, Designing Principles-Web Site Building , Web Languages – HTML/DHTML, JavaScript, PHP.

MODULE II HTML 9

Building Web Based Application using HTML**-**Html Document Structure, Various HTML Tags – Text Formatting Tag, Link Tag, List Tag, Image Tag, Table Tag, Line Breaks, Frames, Forms.

MODULE III CASCADING STYLE SHEET 9

Introduction to Style sheet - Types of Style sheet, concept of class &ID - CSS Property– Background Property - Font property- Text - Borders -Margins-Padding.

MODULE IV CLIENT-SIDE SCRIPTING LANGUAGE 9

Types of Scripting language, Introduction to JavaScript-How to develop JavaScript-Operators- Conditional Structure & Looping Structure-Dialog Boxes- Arrays- Built-in Functions (String, Math, Date, Array)- Form Objects and events.

MODULE V SERVER SIDE SCRIPTING LANGUAGE 9

Introduction to PHP-Basic PHP syntax-PHP tags, PHP statements and whitespace, comments, Operators, Conditional and Looping Structure, User Define Functions, Arrays.

TOTAL HOURS –45

TEXT BOOKS:

1. HTML: The Complete Reference**,**Thomas A. Powell , 2000(I,II&III)
2. Beginning JavaScript 2nd Edition, Wrox, Nicholas C. Zakas, 2004(IV)
3. PHP Bible, Wiley Publication, Tim Converse, Joyce Park, 2002(V)

REFERENCES:

1. Developing Web Application, Wiley India Publication, Ralph Moseley, Wiley India, 2007.
2. Web Enabled Commercial Application Development Using HTML, DHTML, PERL, Java Script, BPB Publications, Ivan Bayross, 2005

OUTCOMES:

On completion of the course, Students will be able to

- Demonstrate the knowledge and ability to apply the design principles, techniques and technologies to the development of creative websites.
- Identify most HTML tags and CSS properties and use a text editor to construct the basic HTML and CSS structure for a webpage
- Apply markup languages for processing, identification and presentation of information in web pages.
- Incorporate concepts of layout and organization to design websites that effectively communicate using visual elements

.

CAC3153 SOFTWARE TESTING

L	T	P	C
3	0	0	3

OBJECTIVES:

The aims of the course are as follows

- To learn about purpose of testing.
- To understand various types of testing.
- To understand the metrics of testing

MODULE I : INTRODUCTION **9**

Basic Definitions – test cases –Identifying test cases –Error and fault taxonomies – Level of Testing.

MODULE II : FUNCTIONAL TESTING **9**

Functional Testing: Boundary value Testing, Equivalence class testing, Decision Table based testing, Retrospection.

MODULE III STRUCTURAL TESTING **9**

Role of Strategic Planning for IT, Strategic Direction and Alignment of Security Strategy with Business Objectives, Role of CISO, Security Metrics Program

MODULE IV INTEGRATION AND SYSTEM TESTING **9**

Levels of Testing, Integration Testing, System Testing, Interaction Testing.

MODULE V OBJECT ORIENTED TESTING **9**

Class Testing –GUI Testing – Object Oriented System Testing.

TOTAL HOURS – 45

TEXT BOOKS:

1. Ali Mili, FairouzTchier , “Software Testing: Concepts and Operations”, Wiley, ISBN: 978-1-118-66287-8, 2015.

REFERENCES:

1. .Glenford J. Myers, Corey Sandler, “The Art of Software Testing”, 3rd Edition, Wiley, ISBN 978-1-118-03196-4, 2011
2. Srinivasan Desikan and Gopalswamy Ramesh, “ Software Testing : Principles and Practice”, Pearson ,ISBN-13: 978-8177581218, 2014.

OUTCOMES:

At the completion of this course, the student will able to

- define, formulate and analyse a problem
- Identify the strengths and weaknesses of different types of testing
- choose the appropriate testing for a specified application.

CAC3154	C# AND .NET PROGRAMMING LAB	L	T	P	C
		0	0	4	2

OBJECTIVES:

To obtain overall view of .NET technologies and its programming with C#

LIST OF PROGRAMS

1. To implement the concept of indexers
2. To implement the concept of sealed class
3. To implement the concept of namespace
4. To implement the concept of interfaces
5. To implement the concept of events
6. To implement exception handling
7. To design a calculator in windows form
8. To implement data controls in windows form
9. To implement validation controls in web form
10. To implement Data controls in web form
11. To implement Sql DataReader in ADO.NET
12. To implement Dataset object in ADO.NET

TOTAL HOURS –30

TEXT BOOKS:

1. Jeff Ferguson, Brian Patterson, Jason Beres, C# Programming Bible , Wiley Publishing Inc., Reprint 2006.

REFERENCES:

1. Kevin Hoffman & Jeff Gabriel, Professional .Net Framework, 1st Edition, Wrox Press Publishers, 2006.
2. Jeff Prosise, Programming .Net, 2nd Edition, WP Publishers & Distributors Pvt. Ltd, 2009

OUTCOMES:

At the completion of this course, the student will be able to:

- Create and populate Windows Forms.
- Create and use user controls in a Windows Forms application
- Create menus in a Windows Forms application
- Add code to form and control event procedures in a Windows Forms application
- Create Multiple Document Interface (MDI) applications
- Validate user input in a Windows Forms application

- Bind Windows Forms applications to various data sources by using Microsoft ADO.NET
- Use .NET and COM components in a Windows Forms application

CAC3155	WEB DESIGNING LAB	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To develop webpages that present information, graphics and hypertext links to other webpages in a cohesive manner
- Identify most HTML tags and CSS properties and use a text editor to construct the basic HTML and CSS structure for a webpage
- To validate forms using Javascript.

LIST OF PROGRAMS

1. Create a webpage to illustrate text formatting tags, order and unordered list
2. Develop a web page to display table and frames
3. Create a web page to embed an image map in a web page.
4. Create a web page with all types of Cascading style sheets.
5. Design a web page using different CSS properties like border, background, text, and font.
6. Client Side Scripts for Validating Web Form Controls
7. Develop a simple calculator using JavaScript
8. Designing a digital clock using JavaScript
9. Demonstrate string and math objects predefined methods available in JavaScript
10. To create a html registration form and perform validation.

TOTAL HOURS – 30

TEXT BOOKS:

1. Developing Web Application, Wiley India Publication, Ralph Moseley, Wiley India, 2007.
2. Web Enabled Commercial Application Development Using HTML, DHTML, PERL, Java Script, BPB Publications, Ivan Bayross, 2005

REFERENCES:

1. HTML: The Complete Reference**,**Thomas A. Powell , 2000(I,II&III)
2. Beginning JavaScript 2nd Edition, Wrox, Nicholas C. Zakas, 2004(IV)
3. PHP Bible, Wiley Publication, Tim Converse, Joyce Park, 2002(V)

OUTCOMES:

On completion of the course, Students will be able to

- Demonstrate an understanding of basic HTML , CSS structures and JavaScript.
- Gain the skills needed for entry into web design and development careers.

SEMESTER VI

CAC3251	**NETWORK SECURITY**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

OBJECTIVES:

- Various types of ciphers, DES, AES, message Authentication, digital Signature and Security System.
- Network security, virus, worms and firewall.
- Encrypt and decrypt messages using block ciphers.
- Sign and verify messages using well-known signature generation and verification algorithms.
- The ethical issues related to the misuse of computer security

MODULE I **12**

Computer Security : Introduction, Need for security, Principles of Security, Types of Attacks Cryptography : Plain text and Cipher Text, Substitution techniques, Caesar Cipher, Mono-alphabetic Cipher, Polygram, Polyalphabetic Substitution, Playfair, Hill Cipher, Transposition techniques, Encryption and Decryption, Symmetric and Asymmetric Key Cryptography, Steganography, Key Range and Key Size, Possible Types of Attacks

MODULE II **12**

Symmetric Key Algorithms and AES: Algorithms types and modes, Overview of Symmetric key Cryptography, Data Encryption Standard (DES), International Data Encryption Algorithm (IDEA), RC4, RC5, Blowfish, Advanced Encryption Standard (AES)

MODULE III **12**

Asymmetric Key Algorithms, Digital Signatures and RSA: Brief history of Asymmetric Key Cryptography, Overview of Asymmetric Key Cryptography, RSA algorithm, Symmetric and Asymmetric key cryptography together, Digital Signatures, Knapsack Algorithm, Some other algorithms (Elliptic curve cryptography, ElGamal, problems with the public key exchange

MODULE IV **12**

Digital Certificates and Public Key Infrastructure (PKI): Digital Certificates, Private Key Management, The PKIX Model, Public Key Cryptography Standards (PKCS), XML,PKI and Security, Hash functions, Key Predistribution, Blom's Scheme, Diffie-

Hellman Key Predistribution, Kerberos, Diffie-Hellman Key Exchange, The Station-to-station Protocol

MODULE V **12**

Network Security, Firewalls and Virtual Private Networks: Brief Introduction to TCP/IP, Firewalls, IP Security, Virtual Private Networks (VPN), Intrusion Internet Security Protocols: Basic concepts, Secure Socket Layer (SSL), Transport Layer Security (TLS), Secure Hyper Text Transfer Protocol (SHTTP), Time Stamping Protocol (TSP), Secure Electronic Transaction (SET), SSL vs SET, 3-D Secure Protocol, Electronic Money, E-mail Security, Wireless Application Protocol (WAP) Security, Security in GSM, Security in 3G

Total Hours –60

TEXT BOOKS:

1. Cryptography and Network Security by Atul Kahate, 2nd Edition, Tata McGrawHill,2012

REFERENCES:

1. Cryptography and Network Security by William Stallings, Fifth Edition, Pearson Education,2008.
2. Cryptography: Theory and Practice by Douglas Stinson, CRC Press, CRC Press LLC,2010.

OUTCOMES:

- Understand the basic concept of Cryptography and Network Security, their mathematical models.
- Acquire knowledge in security issues, services, goals and mechanism.
- Understand mathematical foundation required for various cryptographic Algorithms.
- Identify and classify computer and security threats and develop a security model to prevent, detect and recover from attacks.
- Analyze key agreement algorithms to identify their weaknesses.
- Understand the SSL or firewall based solution against security threats.

CAC3252 DATA MINING AND WAREHOUSING

L	T	P	C
3	1	0	4

OBJECTIVES:

The aim of this course is to

- Provide an overview of data mining and warehousing.
- Learn the importance and use of preprocessing techniques
- Comprehend association rules
- Introduce data mining techniques such as Clustering and Classification
- Offer adequate knowledge to work with data warehouse

MODULE I INTRODUCTION 12

Introduction - What is Data mining, Data mining – Importance of Data mining - various kind of data: Relational databases – Data Warehouses - Transactional Databases – Advanced Data and Information Systems and Advanced Applications. Data mining Functionalities: Concept / Class Description, Characterization and Discrimination – Mining Frequent Patterns, Associations and Correlations – Classification and Prediction – Cluster Analysis – Outlier Analysis – Evolution Analysis.

MODULE II DATA PREPROCESSING and ASSOCIATION RULES 12

Why Preprocess Data – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization and Concept Hierarchy Generation **-** Mining– Frequent Patterns, Associations Correlations - Basic Concepts - Efficient and Scalable Frequent Item set Mining methods Mining

MODULE III CLASSIFICATION

What is Classification? – Issues regarding Classification - Classification by Decision Tree Induction – Bayesian Classification – Rule Based Classification - KNN Classifiers.

MODULE IV CLUSTERING

Clusters Analysis: Types of Data In Cluster Analysis- Categorization of Major Clustering Methods: Partitioning Methods: k-Means, k-Medoids – Hierarchical Methods: BIRCH, Chameleon – Density based Methods: DBSCAN, OPTICS. Applications.

MODULE V DATA WAREHOUSING

What is a Data Warehouse – A multidimensional Data Model – Data warehouse

Architecture - From Data Warehousing to Data Mining

L – 45; T – 15; Total Hours –60

TEXT BOOK:

1. Author : Jiawei Han and MichelineKamber Data Mining Concepts and Techniques, Second Edtion, Morgan Kaufmann Publishers (An imprint of Elsevier),2011

REFERENCES:

1. Author: Karguta, Joshi, Sivakumar&Yesha, Data Mining Next Generation Challenges and Future Directions, Printice Hall of India, 2007
2. G.K. Gupta, PHI Private limited, Introduction to Data mining with case studies, New Delhi, 2008. 2nd Edition, PHI , 2011

OUTCOMES:

On completion of this course students will be able to:

- Obtain the knowledge of data mining and data warehousing
- Recognize the preprocessing techniques in data mining
- Differentiate clustering and classification
- Make more effective use of data stored in databases
- Apply and analyze association rules
- Compare database and data warehouse

ELECTIVE COURSES

CACX01 ADVANCED COMPUTER ARCHITECTURE L T P C

3 0 0 3

OBJECTIVES:

- To gain knowledge about the concepts of CPU, ALU Design, I/O Instruction format
- Analyze architectures and computational designs.
- Understand the operation of modern CPUs, memory systems and buses.

MODULE I DIGITAL COMPONENTS 9

Integrated circuits -Decoders - Encoders - Multiplexers - Registers with Parallel Load - Shift Registers - Bidirectional Shift Registers with Parallel Load - Binary Counters with Parallel Load - Memory Unit - RAM - ROM - Types of ROMs.

MODULE II COMPUTER ORGANIZATION 9

Instruction codes - Operation codes - Indirect Address - Effective Address – Computer Registers - Common Bus System - Computer Instructions - Timing and Control - Clock Pluses -Control Unit - Instruction Cycle - Fetch and decode - Reference Instructions

MODULE III INPUT – OUTPUT ARCHITECTURE 9

Peripheral Devices – Input-Output Interface – Asynchronous Data Transfer – Modes Of Transfer – Priority Interrupt – DMA – IOP – Serial Communication- I/O Configuration - I/O Instructions - Program Interrupt - Interrupt Cycle.

MODULE IV CENTRAL PROCESSOR ORGANIZATION 9

Central Processor Organization- General Register Organization - Control Word - ALU - Stack Organization - Register Stack - Memory Stack - Stack Limits - Instruction Formats - Three Types of CPU Organization - RISC Instructions - Addressing Modes

MODULE V MEMORY ARCHITECTURE 9

Memory Hierarchy – Main Memory – Auxiliary Memory – Associative Memory – Cache Memory – Virtual Memory – Memory Management Hardware

Total Hours –45

TEXT BOOK:

1.William Stallings, "Computer Organization and Architecture - Designing for

Performance", 9th Edition, Pearson Education, 2012.

REFERENCE:

1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, "Computer organization", 5 th Edition, McGraw Hill, 2002.

OUTCOMES:

On completion of the course, Students will be able to

- Describe organization of digital computers and explain the basic principles and operations of different components
- Recall the internal organization of computers, CPU, memory unit and Input/Outputs and the relations between its main component

CACX02 **COMPILER DESIGN** **L T P C**

3 0 0 3

OBJECTIVES:

The aim of the course is to

- Develop the understanding of functioning of compilers and enable to write Compilers.
- Introduce the major concept areas of language translation and compiler design.
- Enrich the knowledge in various phases of compiler ant its use, code optimization techniques, machine code generation, and use of symbol table.
- Extend the knowledge of parser by parsing LL parser and LR parser.
- provide practical programming skills necessary for constructing a compiler

MODULE I INTRODUCTION TO COMPILER 9

Introduction to assembler, Compiler and linkers, Structure of Compiler, Overview of compilation Process, Compiler writing language, Compiler writing tools.

MODULE II LANGUAGES AND GRAMMAR 9

Programming Languages and grammar, Context free grammar, Ambiguity and Non ambiguity, Role of Lexical analyzer, Finite automat & regular expressions, Transformation of the grammar

MODULE III PARSING APPROACHES 9

Parsing : Top-down and bottom up approaches, Syntax Directed Translations Inherited and Synthesized attributes, Dependency graph, Top Down Parsing Implementation, Predictive Top down Parser, Recursive decent parsing, Table Driver Parser, Bottom up Parsing Implementation, LR Parser, SLR parser.

MODULE IV BRANCHING AND LOOPING 9

Translation of assignment - statement, Boolean expression, Unconditional branching, Conditional branching and looping, Code Optimization-Source of Optimization, Optimization of Basic Blocks, Loops, Error Handling

MODULE V CODE OPTIMIZATION 9

Code Optimization, Basics- Principle source of optimization, Loops in flow graph- Introduction to global data flow analysis- Code improving transformations.

Total Hours –45

TEXT BOOKS:

1.Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D Ullman ,"CompilersPrinciples, Techniques and Tools", 2nd Edition, Pearson Education, 2011.

REFERENCES:

1. Parag Himanshu Dave and Himanshu Bhalchandra Dave, "Compilers: Principles and Practice", 1st Edition, Pearson Education, 2012.
2. Keith Cooper and Linda Torczon, "Engineering a Compiler", 2nd Edition, Morgan Kauffman Publications, 2011.

OUTCOMES:

After completing this course students must be able to

- Design and conduct experiments for Intermediate Code Generation in compiler.
- Understand lexical, syntax and semantic analysis processes.
- Deal with different translators.
- Understand, and use Context free grammar, and parse tree construction
- apply error detection and correction methods
- Learn the new code optimization techniques to improve the performance of a program in terms of speed & space.

CACX03 **DATABASE DESIGN** **L T P C**

3 0 0 3

OBJECTIVES:

The aims of the course are as follows:

- To understand and use a relational database system.
- To design ER Diagrams
- To apply normalization techniques to create a database.

MODULE I : INTRODUCTION TO DATABASE SYSTEM CONCEPTS

Introduction – What is Database System – What is Database – Why Database – Data Independence – Relational Systems.

MODULE II DATA MODELING

Architecture – Three levels of Architecture – The External level –Conceptual Level – Internal Level –Client/Server Architecture- Introduction to ER Model –ER diagrams – Database Design with ER model – A brief Analysis of the ERModel

MODULE III NORMALIZATION

Introduction – Trivial and non-trivial Dependencies – Closure of a set of Dependencies – Closure of a set of attributes- Introduction – Nonloss Decomposition and Functional Dependencies – First, Second and Third Normal form – Dependency Preservation – Boyce/Codd Normal form –Relation Valued Attributes.

MODULE IV RELATIONAL DATABASE MODELS

The Relational Database Model: Types – Relations –Relational Algebra –Relational Calculus

MODULE V INTRODUCTION TO SQL

Introduction to SQL: Introduction- Overview – Catalog – Views – Transactions-EmbeddedSQL – Dynamic SQL and SQL /CLI-Data Definition Commands-Data Manipulation Commands.

Total Hours –45

TEXT BOOKS:

1. Elmasri and Navathe, "Fundamentals of Database Systems", 6th Edition, Addison-Wesley, 2011

REFERENCE:

1. AtulKahate, Introduction to Database Management Systems, Pearson Education (2006).

OUTCOMES:

At the completion of this course, the student will able to

- Able to master the basic concepts and understand the applications of database system.
- Able to construct a database using basic SQL queries.
- To identify strengths and weakness of database design.

CACX04 **E-COMMERCE** **L T P C**

3 0 0 3

OBJECTIVES:

The objective of the course are as follows

- To learn about e-commerce business models.
- To understand different techniques for web security.
- To understand the basics of Mobile E-Commerce.

MODULE I : FOUNDATIONS OF E-COMMERCE 9

Foundations of E-commerce - Business to consumer(B2C) Electronic Commerce - Business to Business(B2B)Electronic Commerce.

MODULE II NETWORK INFRASTRUCTURE FOR E-COMMERCE 9

Network Infrastructure for E-commerce - The Internet, Intranets and Extranets asE commerce Infrastructure

MODULE III WEB SECURITY 9

Web Security - Cryptography – Firewall.

MODULE IV ELECTRONIC PAYMENT SYSTEMS 9

Electronic Funds Transfer – types of Electronic payments – Electronic Payment Mechanisms – credit cards – smart cards –electronic cash – electronic checks.

MODULE V MOBILE E-COMMERCE 9

Mobile Commerce -WAP (Wireless Application Protocol) - Legal Requirements in E-commerce

Total Hours –45

TEXT BOOKS:

1. E-ommerce, MamtaBhusry, Firewall Media, An Imprint of Laxmi Publications Pvt. Ltd. Edition: First 2005

REFERENCES:

1. E-Commerce, P. T. Joseph, S. J. Third edition, Prentice Hall of India Pvt. Lt, NewDelhi, 2008.
2. Electronic Commerce, PeteLoshin/ JhonVacca Firewall Media,An Imprint of Laxmi Publications Pvt. Ltd, NewDelhi , FourthEdition: 2004.

3. David Whiteley, " E-Commerce", Tata McGraw Hill, 2000
4. Eframi Turban, Jae Lee, David King, K. Michale Chung, "Electronic Commerce", Pearson Education, 2000

OUTCOMES:

At the completion of this course, the student will able to

- Apply different strategies of E-Commerce.
- Identify the strengths and weaknesses of different Electronic payment systems.
- Apply different cryptographic techniques

CACX05 HIGH PERFORMANCE COMPUTER SYSTEMS L T P C
3 0 0 3

OBJECTIVES:

- To learn the concept of Parallel computing and High performance computing
- To provide in-depth knowledge of High performance computing concepts,
- design issues, challenges, technologies, architectures, and applications.
- To comprehend the technical capabilities and research benefits of High performance computing and learn how to measure and compare those benefits.

MODULE I PARALLEL PROCESSING CONCEPTS 9

Parallel Processing Concepts , Levels of parallelism, Models (SIMD, MIMD, SIMT, SPMD, Dataflow Models, Demand-driven Computation etc), Architectures: N-wide superscalar architectures, multi-core, multi-threaded

MODULE II PARALLEL PROCESSOR ARCHITECHTURE 9

Processor Architecture, Interconnect, Communication, Memory Organization, and Programming Models in high performance, computing architectures: , Memory hierarchy and transaction specific memory design, Thread Organization

MODULE III DESIGN ISSUES IN PARALLEL COMPUTING 9

Fundamental Design Issues in Parallel Computing, Synchronization, Scheduling, Job Allocation, Job Partitioning, Dependency Analysis, Mapping Parallel Algorithms onto Parallel Architectures, Performance Analysis of Parallel Algorithms

MODULE IV HPC CHALLENGES 9

Cache Coherence Problem - Invalidate vs. Update protocols – Bandwidth Limitations - Latency Limitations - Latency Hiding - Tolerating Techniques and their limitations

MODULE V HIGH PERFORMANCE COMPUTING IN THE CLOUD COMPUTING 9

Classification of scientific applications and services in the cloud – HPC Programming models - The Map Reduce programming model and Implementations

Total Hours –45

TEXTBOOKS:

1. Rajkumar Buyya, “High Performance Cluster Computing: Architectures and Systems”, Volume 1, Pearson Edition, 2008.

2. George Hager & Gerhard Wellein “Introduction to High Performance Computing for Scientists and Engineers”, CRC Press, 2012.

REFERENCES:

1. Ian Foster, “Designing and Building Parallel Programs”, Addison Wesley 1995.
2. David Culler, Jaswinder Pal Singh, Anoop Gupta Parallel Computer Architecture: A hardware/Software Approach, Morgan Kaufmann, 1999.
3. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, Mastering Cloud Computing, Tata McGraw Hill, 2013.

OUTCOMES:

After the completion of the course, the student will be able to

- Introduce the major scientific application areas and basic concepts of parallel computing
- Solid foundation in High Performance Computing (HPC) and its role in science and engineering.
- outlines the hardware design of modern HPC platforms and the parallel programming models.
- identify the key challenges and research issues in High performance Computing.

CACX06 INTERNET AND WEB PROGRAMMING L T P C

3 0 0 3

OBJECTIVES:

The aims of the course are as follows

- To introduce students to the concepts, terms and technologies in Internet.
- To provide students with basic knowledge of web page design and development.
- To highlight the issues in internet.

MODULE I INTRODUCTION TO INTERNET 9

Basics of Networks – Topologies of Networks – Layers in Networking – Switching in the Networks – Bridges, Routers and Gateways – Types of Networks. Evolution of the Internet.

MODULE II INTERNET CONNECTIVITY AND ISSUES 9

Growth of the World Wide, Web Browsers, Architecture of the Intranet/Internet /Extranet., Domain name, Access methods: dialup, ISDN, ADSL/2+, cable, LAN, WIFI,. Proxy servers. Security policies / Privacy/ Identification/Authentication/Access control. Hardware and Software, Risk assessment, vulnerabilities.

MODULE III ADVANCED INTERNET 9

Threats and attack methods Viruses, Spam, Root kits, “phishing”, Firewalls –spyware plug-ins. Performance: speed, reliability, downtime, bandwidth. Search engine, Client-Server model, Web and Big Data, Mobile & Satellite, Application areas.

MODULE IV BASIC WEB PROGRAMMING 9

Introduction to HTML– Introduction, Tags, Tables, Frames - Linking-Images-special characters and line breaks-unordered lists-simple HTML programs- Static and dynamic HTML., Style Sheet, Embedding Multimedia in Web Pages

MODULE V ADVANCED WEB PROGRAMMING 9

Fluency in at least one of the following client-side scripting languages: JavaScript or VBscript. DOM model, XML, CSS and XSL. Development tools: page and site authoring, delivery and maintenance tools

Total Hours –45

TEXT BOOKS:

1. Paul Deitel, Harvey Deitel and Abbey Deite, "Internet & World Wide Web: How to Program", 5th Edition, Prentice Hal, 2011.
2. Jennifer Niederst Robbins, "Learning Web Design: A Beginner's Guide to

HTML, CSS, JavaScript, and Web Graphics", 4th Edition, O'Reilly Media, 2012.

REFERENCE:

1. Robin Nixon, "Learning PHP, MySQL, JavaScript, and CSS: A Step-by-Step Guide to Creating Dynamic Websites", 2nd Edition, O'Reilly Media, 2012.

OUTCOMES:

At the completion of this course, the student will able to

- To demonstrate knowledge and ability to develop website
- To comprehend concepts in internet technologies.
- To understand various issues in internet.

CACX07 MANAGEMENT INFORMATION SYSTEMS L T P C
3 0 0 3

OBJECTIVES:

The aims of the course are as follows

- Provide students with comprehensive knowledge needed to successfully participate in and support the increasingly applied role of information technology in corporate decision making,
- Enable graduates to conceptualize and manage the specification, design and implementation of applied information systems,
- Provide the knowledge of contemporary issues related to the field of managing information systems,
- Develop knowledge and skills required to work effectively in a profession,
- Enhance self-confidence, ability to make proper decisions and effective communication, and Pursue lifelong learning and continuing education.

MODULE I INTRODUCTION 9

Overview – Structure of MIS – Survey of information System Technology – Hardware, Software and Communication or Information – Storage and Retrieval of Data – Transactions Processing, Office Automation and Information Processing Control Function.

MODULE II CONCEPTIONAL FOUNDATIONS 9

Design Making Process – Concept of Information – Human as Information Processors – System Concepts – Concepts of Planning and control – Organizational Structure and Management Concepts.

MODULE III INFORMATION BASED SUPPORT SYSTEMS 9

Support System for Planning, Control and Decision making – Support System for Management for Knowledge work – Decision Support Systems**.**

MODULE IV INFORMATION SYSTEM REQUIREMENTS 9

Developing a long range Information system – Plant Strategies for the determination of Information requirement – Database requirement – User interface requirements

MODULE V DEVELOPMENT, IMPLEMENTATION AND MANAGEMENT OF INFORMATION SYSTEM RESOURCES 9

Developing and Implementing Application Systems – Quality Assurance and

Evaluation of Information Systems – Organization and Management of the Information resources – further Development and their Organizational and social Implications

Total Hours –45

TEXT BOOKS:

1. Rahul De, MIS: Management Information Systems in Business, Government and Society, Wiley; 1st edition (2012)

REFERENCES:

1. David Kroenke, "Management Information systems", tenth Edition, Pearson Education.

OUTCOMES:

At the completion of this course, the student will able to

- Appreciate the use of IS for effective management,
- Analyze the impact of computing on individuals, organizations and society, including ethical, religious, legal, security and global policy issues.
- Function effectively on teams to accomplish a common goal.
- Understand professional, ethical and social responsibilities.
- Employ effective communication skills consistent with the professional environment, and Pursue lifelong learning and continued professional development

CACX08 **PARALLEL ALGORITHMS** **L T P C**

3 0 0 3

OBJECTIVES:

Students will be able to:

- Understand the scope, design and model of parallelism
- Know the parallel computing architecture.
- Know the Characteristics, model and design of parallel algorithms.

MODULE I **9**

Need for parallel computers, Modules of Computation, Analyzing Algorithms, Expressing Algorithms - Broadcast, All sum and selection algorithms on SIMD model - Searching a sorted sequence: EREW, CREW SMSIMD algorithms, Searching a Random sequence on shared memory SIMD, Tree and mesh interconnected computers.

MODULE II **9**

Sorting on a Linear Array, Sorting on a Mesh, Sorting on EREW SIMD computer, MIMD Enumeration sort, MIMD Quick sort. Sorting on other Networks.

MODULE III **9**

Matrix Transposition: Mesh Transpose, Shuffle Transpose, EREW transpose. Matrix by matrix Multiplication: Mesh multiplication, Cube multiplication. Matrix by vector Multiplication: Linear Array Multiplication, Tree Multiplication.

MODULE IV **9**

Solving Numerical problems, solving systems of Linear equations: An SIMD algorithm, An MIMD algorithm. Finding Roots of Nonlinear Equations: MIMD algorithm. Solving partial Differential Equations, Computing Eigen values.

MODULE V **9**

Solving Graph Theoretical problems, Computing the connectivity matrix. Finding connected components, All-Pairs shortest paths, Traversing combinatorial spaces, sequential tree traversal. The minimal alpha-Beta Tree, MIMD Alpha-Beta algorithm, parallel cutoffs. Storage requirements.

Total Hours –45

TEXT BOOKS:

1. Peter S. Pacheco, “An Introduction to Parallel Programming”, Morgan Kauffman/ Elsevier, ISBN 978-0-12-374260-5, 2011.

REFERENCES:

1. Yan Sohilin, Fundamentals of Parallel Multicore Architecture, Chapman and Hall/CRC Computational Science, ISBN 9781482211184, 2015

OUTCOMES:

At the completion of the course, students will be able to

- Compute speedup, efficiency, and scaled speedup of parallel computations, given appropriate data
- Explain the advantages and disadvantages of constructing parallel computers using commodity off-the-shelf components

CACX09 WIRELESS NETWORKS L T P C

3 0 0 3

OBJECTIVES:

The aims of the course are as follows:

- Introduction of an advanced element of learning in the field of wireless communication.
- The concepts of wireless devices and mobile computing.
- To introduce wireless communication and networking principles, that support connectivity to cellular networks, wireless internet and sensor devices.

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MODULE I **9**

Cellular systems- Frequency Management and Channel Assignment- types of handoff and their characteristics, dropped call rates & their evaluation - MAC – SDMA – FDMA –TDMA – CDMA

MODULE II DATA MODELING **9**

IEEE 802.11 Standards – Architecture – Services

MODULE III MOBILE COMMUNICATION SYSTEMS **9**

GSM-architecture-Location tracking and call setup- Mobility management- Handover-Security'

MODULE IV MOBILE NETWORK AND TRANSPORT LAYERS **9**

Mobile IP – Dynamic Host Configuration Protocol-Mobile Ad Hoc Routing Protocols– Multicast routing-TCP over Wireless Networks – Indirect TCP – Snooping TCP – Mobile TCP – Fast Retransmit / Fast Recovery – Transmission/Timeout Freezing-Selective Retransmission – Transaction Oriented TCP

MODULE V APPLICATION LAYER **9**

WAP Model- Mobile Location based services -WAP Gateway –WAP protocols – WAP user agent profile- caching model-wireless bearers for WAP - WML – WMLScripts

Total Hours –45

TEXT BOOKS:

1. Jochen Schiller, "Mobile Communications", Second Edition, Pearson Education, 2008.

2. Hansmann, Merk, Nicklous, Stober, "Principles of Mobile Computing", 2nd Edition,

Springer, 2007.

REFERENCES:

1. Kaveh Pahlavan, Prasanth Krishnamoorthy, “Principles of Wireless Networks”, First Edition, Pearson Education, 2003.
2. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, “Principles of Mobile Computing”, Springer, 2003.
3. C.K.Toh, “AdHoc Mobile Wireless Networks”, First Edition, Pearson Education, 2002.

OUTCOMES:

At the completion of this course, the student will able to

- Able to master the basic concepts and understand the applications of database system.
- Able to construct a database using basic SQL queries.
- To identify strengths and weakness of database design.

CACX10 ARTIFICIAL INTELLIGENCE L T P C

3 0 0 3

OBJECTIVES:

- Know the difficulties that arise from attempting to define "artificial intelligence."
- Know the three areas of research of AI, and give examples of problems from each area.
- Understand in a general way how a neural network is designed and trained.
- Know the components of a formal system.
- Use evaluation functions to expedite the search process.

MODULE I INTRODUCTION TO ARTIFICIAL INTELLIGENCE 9

Problems of AI, AI technique, Tic - Tac - Toe problem. Intelligent Agents: Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents. Problem Solving**-** Problems, Problem Space & search.Defining the problem as state space search, production system, problem characteristics, and issues in the design of search programs.

MODULE II SEARCHING TECHNIQUES 9

Search techniques: Solving problems by searching: problem solving agents, searching for solutions. Uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies. Heuristic search strategies: Greedy best-first search, A* search, memory bounded heuristic search

MODULE III SEARCH ALGORITHMS 9

Local search algorithms optimization problems: Hill climbing search, simulated annealing search, local beam search. Genetic algorithms: constraint satisfaction problems, local search for constraint satisfaction problems. Adversarial search: Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.

MODULE IV KNOWLEDGE REPRESENTATION 9

Knowledge: Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge representation. Using predicate logic: Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction. Representing

knowledge using rules: Procedural verses declarative knowledge, logic programming, forward verses backward reasoning, matching, control knowledge.

MODULE V REASONING & PLANNING 9

Reasoning- Probabilistic reasoning: Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Fuzzy sets & fuzzy logics. Planning: Overview, components of a planning system, Goal stack planning, Hierarchical planning, other planning techniques

Total Hours –45

TEXT BOOKS:

1. Stephen Lucci, Danny Kopec," Artificial Intelligence in the 21st Century", Mercury Learning and Information, 2012.

REFERENCES:

1. Kevin Warwick, "Artificial Intelligence: The Basics", Routledge Publications, 2011.

OUTCOMES:

On completion of this course, students will be able to

- Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem
- Apply knowledge representation, reasoning, and machine learning techniques to real-world problem
- Implement basic AI algorithms

CACX11 CLIENT / SERVER TECHNOLOGY L T P C

3 0 0 3

OBJECTIVES:

The aims of the course are as follows

- To learn about different kinds of client server technology
- To understand different components of Client Server Systems
- To understand architecture of Client/Server Systems.

MODULE I INTRODUCTION 9

Introduction to client/server technology-What is client/server technology-Benefits of client/server technology-Classification of Client/Server Systems-Development of Client/Server Systems- Client Server Standards- Client Server Technology

MODULE II ARCHITECTURE OF CLIENT/SERVER SYSTEMS 9

Components of C/S – Principles – Client Components – Server Components – Communication Middleware Components- Architecture for Business Information System- Existing Client Server Architecture.

MODULE III CLIENT SERVER APPLICATION COMPONENTS 9

Introduction – Technologies for Client/Server Application – Categories –Client Services-Server Services- Clint /Server Application: Connectivity- Layered Architecture

MODULE IV CLIENT /SERVER TECHNOLOGY AND WEB SERVICES 9

Introduction- Web Services – Role of Java for Client/Server on Web –Server Technology-Web Applications-Balanced Computing – Server's Changing Role

MODULE V FUTURE OF CLIENT/SERVER COMPUTING 9

Introduction – Technology of Next Generation –Enabling Technology – Client/Server Computing and Intranet – Future Perspectives – Transformational System

Total Hours –45

TEXT BOOKS:

1. Subash Chandra Yadav,Sanjay Kumar Singh,An Introduction to Client/Server Computing,New Age International Publisher,First Edition,January 2009.

REFERENCES:

1. Christophe Toulemonde, Anthony Button, Karen Harrison, Jae Hyung Lee, Stephen Longhurst, Luigi Walter Sartore,From Client/Server to Network Computing A Migration to Java., IBM, May 1998.
2. Douglas E.Comer& David L. Stevens: “Internetworking with TCP/IP – Vol. 3, Client-Server Programming and Applications”, BSD Socket Version with ANSI C, 2nd Edition, Pearson Education Asia, 2001

OUTCOMES:

At the completion of this course, the student will able to

- Comprehend the basic concepts of the client-server model for network programming
- Identify the strengths and weaknesses of different client server .
- Analyze the different components for developing client/server applications.

CACX12 DISTRIBUTED OPERATING SYSTEM L T P C

3 0 0 3

OBJECTIVES:

The aims of the course are as follows:

- This course provides an introduction to the fundamentals of distributed computer systems, assuming the availability of facilities for data transmission.
- To learn the principles, architectures, algorithms and programming models used in distributed systems.
- To examine state-of-the-art distributed systems, such as Google File System.
- To design and implement sample distributed systems.
- Through these objectives, the course will transform your computational thinking from designing applications for a single computer system, towards that of distributed systems.

MODULE I INTRODUCTION 9

Fundamentals – evolution – system Models – distributed Operating System – Issues – Distributed Computing environment- Message passing – Introduction – Features – Issues – Synchronization – Buffering – Message – Encoding – Decoding – Process addressing – Failure Handling.

MODULE II COMMUNICATION 9

Remote Procedure calls – Introduction – Model – Transparency – Implementation – Stub Generation – Messages – Marshaling Arguments and results – Server Management. Parameter passing Semantics – Call Semantics – Communication Protocols – Complicated RPC's – client – server Binding – Exception handling – Security distributed shared Memory - Introduction – Architecture – Issues – Granularity Structure – consistency Models – replacement Strategy – Thrashing

MODULE III COMMUNICATION II 9

Synchronization – Introduction – Clock Synchronization – Event ordering – Mutual Exclusion – Deadlock – Election Algorithms.

MODULE IV RESOURCE ALLOCATION 9

Resource Management – Introduction – features – task Assignment approach – Load Balancing approach – Load – Sharing Approach Process Management – Introduction – Process – Migration - Threads

MODULE V DISTRIBUTED FILE SYSTEMS

Distributed File systems – Introduction – Features – File Models – Accessing Models – sharing Semantics – Catching Schemes – file Replication – Fault Tolerance – Atomic Transactions – Design principles naming – Introduction – features – Terminologies – Concepts.

Total Hours –45

TEXT BOOKS:

1.A.D. Kshemkalyani, M. Singhal, "Distributed Computing: Principles, Algorithms and Systems", Paperback Edition, Cambridge University Press, 2011.

REFERENCES:

1. Andrew S Tanenbaum , Maartenvan Steen, "Distributed Systems - Principles and Pardigms",2nd Edition, Pearson Education, 2007.
2. Pradeep K. Sinha, "Distributed Operating Systems - Concepts, Systems and Applications", 3rd Edition, Prentice Hall India, New Delhi, 2008

OUTCOMES:

At the completion of this course, the student will able to

- Learn about distributed systems design and implementation.
- Exposed to various areas of research in distributed systems mobile computing systems.
- Learn about designing and implementing fault tolerant distributed systems.
- student completing this course successfully will be able to pursue independent research in distributed systems.
- Identify the core concepts of distributed systems: the way in which several machines orchestrate to correctly solve problems in an efficient, reliable and scalable way.
- Students will examine how existing systems have applied the concepts of distributed systems in designing large systems, and will additionally apply these concepts to develop sample systems.

CACX13 EMBEDDED SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

The purpose of the Embedded System course is to

- provide the students, knowledge and hands-on experience in the embedded computer system technology.
- students specializing in software and system design, giving most attention to hardware design, as understanding in this area is vital for most embedded software designers.

MODULE I INTRODUCTION TO EMBEDDED SYSTEMS 9

Definition and Classification – Overview of Processors and hardware units in an embedded system – Software embedded into the system – Exemplary Embedded Systems – Embedded Systems on a Chip (SoC) and the use of VLSI designed circuits.

MODULE II DEVICES AND BUSES FOR DEVICES NETWORK - PART - 1 9

I/O Devices - Device I/O Types and Examples – Synchronous – Isosynchronous and Asynchronous Communications from Serial Devices - Examples of Internal Serial-Communication Devices

MODULE III DEVICES AND BUSES FOR DEVICES NETWORK - PART - 2 9

UART and HDLC - Parallel Port Devices - Sophisticated interfacing features in Devices/Ports- Timer and Counting Devices - „12C", „USB", „CAN" and advanced I/O Serial high speed buses- ISA, PCI, PCI-X, cPCI and advanced buses.

MODULE IV EMBEDDED PROGRAMMING - PART - 1 9

Programming in assembly language (ALP) vs. High Level Language – C Program Elements, Macros and functions -Use of Pointers - NULL Pointers - Use of Function Calls – Multiple function calls in a Cyclic Order in the Main Function Pointers

MODULE V EMBEDDED PROGRAMMING - PART - 2 9

Function Queues and Interrupt Service Routines Queues Pointers – Concepts of EMBEDDED PROGRAMMING in C++ - Objected Oriented Programming – Embedded Programming in C++, „C" Program compilers – Cross compiler – Optimization of memory codes.

Total Hours –45

TEXT BOOKS:

1. Rajkamal, Embedded Systems Architecture, Programming and Design, TATA McGraw Hill, First reprint 2003.

REFERENCES:

1. David E.Simon, An Embedded Software Primer, Pearson Education Asia, First Indian Reprint 2000.

OUTCOMES:

On completion of the course:

• students get exposure with different families and architectures of Embedded System tools such as Microcontrollers, DSPs, FPGAs etc.

• students shall get the expertise required to design any embedded system (h/ w or s/w or both) based on any of the above tools

• students become highly proficient in Embedded Software particularly in real-time programming with Industry standard RTOS such as VxWorks and RTLinux

CACX14 ENTERPRISE RESOURCE PLANNING L T P C
3 0 0 3

OBJECTIVES:

The aims of the course are as follows

- Comprehend the role and function of human resource management in industry.
- Describe how to strategically plan for the human resources needed to meet the organizational needs.
- Gain insight of concepts of job analysis and compensation function and their legal provisions.

MODULE I INTRODUCTION 9

ERP: An Overview, Enterprise – An Overview, Benefits of ERP, ERP and Related Technologies, Business Process Reengineering (BPR), Data Warehousing, DataMining,OLAP,SCM

MODULE II ERP IMPLEMENTATION 9

ERP Implementation Lifecycle, Implementation Methodology, Hidden Costs, Organizing the Implementation, Vendors, Consultants and Users, Contracts with Vendors, Consultants and Employees, Project Management and Monitoring

MODULE III BUSINESS MODULES 9

Business modules in an ERP Package, Finance, Manufacturing, Human Resources, Plant Maintenance, Materials Management, Quality Management, Sales and Distribution

MODULE IV THE ERP MARKET 9

ERP Market Place, SAP AG, Peoplesoft, Baan, JD Edwards, Oracle, QAD, SSA

MODULE V ERP – PRESENT AND FUTURE 9

Turbo Charge the ERP System, EIA, ERP and e-Commerce, ERP and Internet, Future Directions

Total Hours –45

TEXT BOOKS:

1.Alexis Leon, Enterprise Resource Planning, second edition, Tata McGrawHill, 2008.

REFERENCES:

1. Joseph A Brady, Ellen F Monk, Bret Wagner, “Concepts in Enterprise

Resource Planning", Thompson Course Technology, USA, 2001.
2. Jagan Nathan Vaman, ERP in Practice, Tata McGraw-Hill, 2008

OUTCOMES:

At the completion of this course, the student will able to

- examine systematically the planning mechanisms in an enterprise, and identify all components in an ERP system and the relationships among the components.
- understand production planning in an ERP system, and systematically develop plans for an enterprise.
- understand the difficulties of a manufacturing execution system, select a suitable performance measure for different objectives, and apply priority rules to shop floor control..

CACX15 MOBILE COMMERCE L T P C

3 0 0 3

OBJECTIVES:

The objective of the course is as follows

- A broad knowledge of mobile commerce applications and technologies
- A high-level understanding of requirements of diverse m-commerce services
- A critical knowledge of wireless infrastructure for location-based services

MODULE I INTRODUCTION 9

Emerging applications, wireless service providers, middleware, wireless infrastructure, different players in m-commerce, and m-commerce life cycle-Requirements and multi-layer frameworks wireless and networking requirements, quality of service, location-management, security, dependability-Mobile financial services, mobile entertainment services, and proactive service management service details and usage scenarios

MODULE II LOCATION BASED M-COMMERCE SERVICES 9

Location, context and user-oriented services, location management in heterogeneous wireless and mobile networks. Location-based m-commerce services**:** push/pull services, role of middleware in location-based services, location-enabled devices

MODULE III GROUP ORIENTED MOBILE COMMERCE SERVICES 9

Mobile auctions, mobile entertainment services, multi-party games-Group-oriented mobile commerce services- wireless multicast and broadcast, multicast in wireless LANs, satellites, and cellular systems, multicast in wireless Internet

MODULE IV TRANSACTIONS IN MOBILE COMMERCE SERVICES 9

Group communications, membership management, transaction support, dis-connection and multi-stage transactions-Transactions in mobile commerce services-impact of failures on transactions, security and reliability of transactions.

MODULE V MANAGEMENT OF MOBILE COMMERCE SERVICES 9

Content development and distribution to hand-held devices, content caching, pricing of mobile commerce services.The emerging issues in mobile commerce - role of emerging wireless LANs and 3G/4G wireless networks, personalized content management, implementation challenges in m-commerce, futuristic m-commerce services

Total Hours –45

TEXT BOOKS:

1. Brian Mennecke and Troy J. Strader, Mobile Commerce: Technology, Theory and Applications Idea Group Publishing,2003.

REFERENCES:

1. Mobile Commerce and Applications, Upkar Varshney, A tutorial at IEEE International Conference on Wireless Communications (WCNC).
2. Mobile Commerce: Frameworks, Applications and Networking Support, ACM/Kluwer Journal on Mobile Networks and Applications (MONET), June 2002(Upkar Varshney and Ron Vetter).
3. Location-based Mobile Commerce Services, ACM Transactions on Internet Technology, August 2003, (Upkar Varshney).
4. Mobile Commerce: An Emerging Frontier, IEEE Computer, Oct 2000 (Varshney and others).
5. Group-oriented Mobile Services, ACM/Kluwer Journal on Mobile Networks and Applications (MONET), 2004 (Upkar Varshney).

OUTCOMES:

At the end of the course the students will be able to

- Identify the different types of service providers.
- Perform real time transactions.
- Identify the issues in Mobile Commerce

CACX16 MOBILE COMPUTING L T P C

3 0 0 3

OBJECTIVES:

- Introduction of an advanced element of learning in the field of wireless communication.
- The concepts of wireless devices and mobile computing.
- To introduce wireless communication and networking principles, that support connectivity to cellular networks, wireless internet and sensor devices.
- To appreciate the social and ethical issues of mobile computing, including privacy.

MODULE I INTRODUCTION

Introduction: Applications – A Simplified Reference Mode. Wireless Transmission: Cellular System. Medium Access Control : Motivation for a Specialized MAC : Hidden and exposed terminals – Near and far terminals – SDMA – FDMA – TDMA : Fixed TDM Classical Aloha – Slotted Aloha – Carrier Sense Multiple Access – Demand assigned Multiple Access – PRMA Packet Reservation Multiple Access – Reservation TDMA – Multiple Access With Collision Avoidance – Polling – Inhibit Sense Multiple Access. CDMA: Spread Aloha multiple access.

MODULE II TELECOMMUNICATIONS

Telecommunication Systems: GSM: Mobile Services – System Architecture – Radio Interface – Protocols - Localization And Calling – Handover – Security – New Data Services. DECT: System Architecture – Protocol Architecture - TETRA.

MODULE III SATELLITE AND BROADCAST SYSTEMS

UMTS and IMT 2000: UMTS Releases and Standardization – UMTS System Architecture - UMTS Radio Interface – UTRAN – Core Network – Handover. Satellite System: History – Applications – Basics: GEO – LEO – MEO . Routing – Localization – Handover. Broadcast Systems: Overview – Cyclical Repetition Of Data – Digital Audio Broadcasting – Digital Video Broadcasting – Convergence of Broadcasting and Mobile Communication.

MODULE IV WIRELESS NETWORKS

Wireless LAN: Infra Red Vs Radio Transmission – Infrastructure and Ad-Hoc Network IEEE 802.11: System Architecture – Protocol Architecture – Physical Layer – Medium Access Control Layer – MAC Management – HIPERLAN: HIPERLAN1 -WATM –

BRAN – HiperLAN2. Bluetooth: User scenarios – Architecture – Radio layer – Base band layer – Link manager protocol.

MODULE V MOBILE NETWORK LAYER

Mobile Network Layer: Mobile IP – Dynamic Host Configuration Protocol – Mobile AdHoc Networks. Mobile Transport Layer: Traditional TCP-Classical TCP Improvement-TCP Over 2.5/3G Wireless Networks – Performance Enhancing Proxies.

Total Hours –45

TEXT BOOKS:

1. Jochen Schiller , Mobile Communications,Pearson Education.,Second Edition,New Delhi,2008.

REFERENCES:

1. William C.Y.Lee, "Mobile Cellular Telecommunications-Analog and Digital Systems", Second Edition,Tata McGraw Hill Edition,2006.
2. C.K Toh,"Adhoc Mobile Wireless Networks", First Edition,Pearson Education,2002.

OUTCOMES:

Upon completion of the subject, students will be able to

- A working understanding of the characteristics and limitations of mobile hardware devices including their user-interface modalities
- The ability to develop applications that are mobile-device specific and demonstrate current practice in mobile computing contexts.
- A comprehension and appreciation of the design and development of context-aware solutions for mobile devices.
- An awareness of professional and ethical issues, in particular those relating to security and privacy of user data and user behavior.

CACX17 SOFTWARE PROJECT MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

The aims of the course are as follows

- Understand the fundamental principles of Software Project management
- Be familiar with the different methods and techniques used for project management.
- By the end of this course the student will have good knowledge of the issues and challenges faced while doing the Software project Management.
- Will be able to do the Project Scheduling, tracking, Risk analysis, Quality management and Project Cost estimation using different techniques

MODULE I INTRODUCTION TO SOFTWARE PROJECT MANAGEMENT **9**

Project Definition – Contract Management – Activities Covered By Software Project Management – Overview of Project Planning – Stepwise Project Planning.

MODULE II PROJECT EVALUATION **9**

Strategic Assessment – Technical Assessment – Cost Benefit Analysis –Cash Flow Forecasting – Cost Benefit Evaluation Techniques – Risk Evaluation – software effort estimation.

MODULE III ACTIVITY PLANNING **9**

Objectives – Project Schedule – Sequencing and Scheduling Activities – Network Planning Models – forward Pass – backward Pass – Activity Float – Shortening Project Duration – Activity on Arrow Networks – Risk Management – Nature of Risk – Types of Risk – Managing Risk – Hazard Identification – Hazard Analysis – Risk Planning and Control.

MODULE IV MONITORING AND CONTROL **9**

Resource allocation – identifying and scheduling resources – publishing resource and cost schedule – scheduling sequence – Creating Framework – Collecting the Data – Visualizing Progress – Cost Monitoring – Earned Value – Prioritizing Monitoring – Getting Project Back to Target – change control – Managing Contracts – Introduction – Types of Contract – Stages In Contract Placement – Typical Terms of a Contract – Contract Management – Acceptance

MODULE V MANAGING PEOPLE AND ORGANIZING TEAMS 9

Introduction – Understanding Behavior – Organizatinal Behaviour – Selecting the Right person. Instruction In The Best Methods – Motivation– The Oldman – Hackman Job Characteristics Model – Working In Groups – Becoming A Team – Decision Making – Leadership – Organizational Structures – Stress –Health And Safety – Case Studies.

Total Hours –45

TEXT BOOK:

1. Bob Hughes, “Mike Cotterell, Rajib Mall, Software Project Management”, 5th Edition, The McGraw-Hill Higher Education, ISBN :13:978-0-07-10724- 8 , 2011.

REFERENCE:

1. S. A. Kelkar, “Software Project Management: A Concise Study”, 3rd edition, PHI learning pvt Ltd ,ISBN: 9788120347021, 2013.
2. Robert K. Wysocki, “Effective Project Management – Traditional, Agile, Extreme”, 6th Edition, Wiley Publication, ISBN: 1118080653, 2011.

OUTCOMES:

At the completion of this course, the student will able to

- Understand and practice the process of project management and its application in delivering successful IT projects; •
- Evaluate a project to develop the scope of work, provide accurate cost estimates and to plan the various activities; •
- Understand and use risk management analysis techniques that identify the factors that put a project at risk and to quantify the likely effect of risk on project timescales;
- Identify the resources required for a project and to produce a work plan and resource schedule;
- Monitor the progress of a project and to assess the risk of slippage, revising targets or counteract drift;
- Distinguish between the different types of project and follow the stages needed to negotiate an appropriate contract

CACX18 WEB TECHNOLOGY L T P C

3 0 0 3

OBJECTIVES:

The aims of the course are as follows

- To learn about different kinds of Network protocols that are suited to different kinds of applications
- To understand the basics of HTML.
- To understand the basics of search engines.

MODULE I INTRODUCTION 9

Concept of the point to point and Broadcast Network , Bus, Ethernet LAN, FDDI LAN, Token Ring, Star, Hub, WAN, MAN, TCP/IP, Routers, Gateways, Bridge, Switches, Subnet, Internet & Intranet, Introduction to TCP/IP and Shell Account, Internet Addressing ,Difference between a Name and Address.

MODULE II NETWORK PROTOCOLS 9

Concept of ISP (Internet Service Provider), Internet Backbones, NAPs, Concept of URL Address, Domain Names, Hypertext Concepts and World Wide Web, FTP, NNTP. The Email Electronic Post Service, Type of Email, SMTP, Configuring a Computer for an email.

MODULE III WEB SECURITY

Web server and proxy server, Web caches, FAQS, Web browser ,Internet Viruses, Internet security issues, Embedded and S/W based firewall, Data encryption and Digital signatures and certificates

MODULE IV INTRODUCTION TO HTML

The art of creating the website and home page, The HTML programming basics, Syntax and rules, Tables, Frames, Forms, Example of HTML page, Choice of page color, banners, Linking with HTML page, Div, Span, metatags, span

MODULE V SEARCH ENGINES

The search and search engine for internet, Spidders, Robotes, Botes, Internet Agents, mobile agents, meta search sites, outlook express and front page.

Total Hours –45

TEXT BOOK:

1. Jeffrey C. Jackson Web Technology : A Computer Science Perspective -

Pearson Education 2012.

REFERENCE:

1. Raj Kamal , Internet and Web Technologies, TATA McGraw Hill 2012

OUTCOMES:

At the completion of this course, the student will able to

- Obtain knowledge on Internet technologies.
- Identify the strengths and weaknesses of different search engines
- choose the appropriate data encryption technique.

CACX19 BIG DATA ANALYTICS L T P C

3 0 0 3

OBJECTIVES:

The aim of the course is to

- Learn tips and tricks for Big Data use cases and solutions
- Learn to build and maintain reliable, scalable, distributed systems with Apache Hadoop.
- Apply Hadoop system components
- bring together several key technologies used in manipulating, storing, and analyzing big data.
- Make the student understand details of Hadoop

MODULE I INTRODUCTION TO BIG DATA 9

Introduction– Big Data and its importance, Big data applications. Four V's of Big Data – Drivers for Big Data – Introduction to Big Data Analytics –

MODULE II BIG DATA TECHNOLOGIES 9

Hadoop's Parallel World – Data discovery – Open source technology for Big Data Analytics – cloud and Big Data –Predictive Analytics – Mobile Business Intelligence and Big Data

MODULE III – INTRODUCTION TO HADOOP 9

Big Data – Apache Hadoop & Hadoop EcoSystem – Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce - Data Serialization.

MODULE IV HADOOP ARCHITECTURE 9

Hadoop Architecture, Hadoop Storage: HDFS, Common Hadoop Shell commands , Hadoop Configuration – HDFS Administering –Monitoring & Maintenance

MODULE V MAP REDUCE 9

Hadoop Distributed File Systems – Visualizations - Visual Data Analysis Techniques - Interaction Techniques; Systems and Applications

Total Hours –45

TEXT BOOKS:

1. Kevin Roebuck, "Storing and managing Big Data - NoSql, Hadoop and more: High-Impact Strategies - What You Need to Know", Tebbo Publishers, 2011.

REFERENCES:

1. Tom White, "Hadoop: The Definitive Guide", 3rd Edition, O'Reilly, 2012.
2. Michael Minelli, Michehe Chambers, Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business", 1st Edition, Wiley CIO Series, 2013.

OUTCOMES:

After completing this course students must be able to demonstrate the knowledge and ability to:

- Explain the human components functions regarding interaction with computer
- Explain Computer components functions regarding interaction with human
- Demonstrate Understanding of Interaction between the human and computer components.
- Implement Interaction design basics
- Use HCI in the software process
- Apply Design rules
- Use Evaluation techniques

CACX21 SOFTWARE QUALITY ASSURANCE L T P C
3 0 0 3

OBJECTIVES:

- To make the students understand the importance of quality in software development.

MODULE I FUNDAMENTALS OF SOFTWARE QUALITY ASSURANCE 9

The Role of SQA – SQA Plan – SQA considerations – SQA people – Quality Management – Software Configuration Management

MODULE II MANAGING SOFTWARE QUALITY 9

Managing Software Organizations – Managing Software Quality – Defect Prevention – Software Quality Assurance Management

MODULE III SOFTWARE QUALITY ASSURANCE METRICS 9

Software Quality – Total Quality Management (TQM) – Quality Metrics – Software Quality Metrics Analysis

MODULE IV SOFTWARE QUALITY PROGRAM 9

Software Quality Program Concepts – Establishment of a Software Quality Program – Software Quality Assurance Planning – An Overview – Purpose & Scope.

MODULE V SOFTWARE QUALITY ASSURANCE STANDARDIZATION 9

Software Standards–ISO 9000 Quality System Standards - Capability Maturity Model and the Role of SQA in Software Development Maturity – SEI CMM Level 5 – Comparison of ISO 9000 Model with SEI's

Total Hours –45

TEXT BOOKS:

1. Abu SayedMahfuz, "Software Quality Assurance: Integrating Testing, Security, and Audit", CRC Press, Taylor and Francis Group, Auerbach Publications, ISBN 978-1-498-73553-7, 2016.

REFERENCES:

1. Gordon G Schulmeyer, "Handbook of Software Quality Assurance", Third Edition,Artech House Publishers 2007

2. Nina S Godbole, “Software Quality Assurance: Principles and Practice”, Alpha Science International, Ltd, 2004

OUTCOMES:

On completion of the course, the students will be

- able to identify and determine the practices needed to manage a software system configuration.
- understands the mission of a quality system and knows the applicable standards and norms.
- understands the interrelation between product quality and process quality.
- knows and applies product and process quality control techniques.

CACX21	WEB SERVICES AND SERVICE ORIENTED ARCHITECTURE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To Understand Web Services and implementation model for SOA
- To Understand the SOA, its Principles and Benefits
- To Understand XML concepts
- To Understand paradigms needed for testing Web Services
- To explore different Test Strategies for SOA-based applications
- To implement functional testing, compliance testing and load testing of Web Services
- To Identify bug-finding ideas in testing Web Services

MODULE I **9**

Evolution and Emergence of Web Services – Evolution of distributed computing. Core distributed computing technologies – client/server, CORBA, JAVA RMI, Micro Soft DCOM, MOM, Challenges in Distributed Computing, role of J2EE and XML in distributed computing, emergence of Web Services and Service Oriented Architecture (SOA). Introduction to Web Services – The definition of web services, basic operational model of web services, tools and technologies enabling web services, benefits and challenges of using web services.

MODULE II **9**

Web Service Architecture – Web services Architecture and its characteristics, core building blocks of web services, standards and technologies available for implementing web services, web services communication, basic steps of implementing web services. Describing Web Services – WSDL introduction, non functional service description, WSDL1.1 Vs WSDL 2.0, WSDL document, WSDL elements, WSDL binding, WSDL tools, WSDL port type, limitations of WSDL.

MODULE III **9**

Brief Over View of XML – XML Document structure, XML namespaces, Defining structure in XML documents, Reuse of XML schemes, Document navigation and transformation. SOAP : Simple Object Access Protocol, Inter-application communication and wire protocols, SOAP as a messaging protocol, Structure of a SOAP message, SOAP envelope, Encoding, Service Oriented Architectures, SOA revisited, Service roles in a SOA, Reliable messaging, The enterprise Service Bus, SOA Development Lifecycle, SOAP HTTP binding, SOAP communication model,

Error handling in SOAP.

MODULE IV **9**

Registering and Discovering Services : The role of service registries, Service discovery, Universal Description, Discovery, and Integration, UDDI Architecture, UDDI Data Model, Interfaces, UDDI Implementation, UDDI with WSDL, UDDI specification, Service Addressing and Notification, Referencing and addressing Web Services, Web Services Notification.

MODULE V **9**

SOA and web services security considerations, Network-level security mechanisms, Application-level security topologies, XML security standards, Semantics and Web Services, The semantic interoperability problem, The role of metadata, Service metadata, Overview of .NET and J2EE, SOA and Web Service Management, Managing Distributed System, Enterprise management Framework, Standard distributed management frameworks, Web service management, Richer schema languages, WS-Metadata Exchange.

Total Hours –45

TEXT BOOK:

1. Thomas Erl, "SOA Principles of Service Design", Prentice Hall, 2008.

REFERENCES:

1. Eric Newcomer, Greg Lomow, "Understanding Soa with Web Services", 2nd Edition, Pearson Education, 2009.
2. Shankar Kambhampaty, "Service Oriented Architecture for Enterprise Applications", 1st Edition, Wiley India Private Limited, 2008.

OUTCOMES:

1.Demonstrate an understanding of software oriented architectures.

2. Demonstrate an understanding of the service composition..

3. Demonstrate an ability to manage a modern medium scale software development project using SOA principles.

4.Demonstrate and ability to implement a service oriented application.

B.S. Abdur Rahman Crescent Institute of Science & Technology

Deemed to be University u/s 3 of the UGC Act, 1956

REGULATIONS 2016

CURRICULUM AND SYLLABI

B.Com

GENERAL

VISION AND MISSION OF THE DEPARTMENT OF COMMERCE

VISION

To develop into a world class centre of excellence in the fields of Business and Economics through value based education, training & research.

MISSION

- To impart holistic education using state of the art technology and to give a global perspective through value based education for social transformation.
- Inspire and empower the students to become innovative leaders and involving people who contribute to the success of organizations and betterment of communities.
- To develop a team of competent and qualified entrepreneur.
- To explore training and development opportunities
- To involve in projects leading to high quality research.
- To continuously evaluate our performance against suitable benchmarks, develop new programmes, global tie-ups to meet stakeholder requirements
- To train them with good communication and soft skills for employment.
- To prepare students for higher education in Commerce and Business Studies.
- To provide contextually relevant commerce education.
- To inculcate the use of Information and Communication Technology for the development of society.

PROGRAMME EDUCATIONAL OBJECTIVES

- To provide a strong foundation in Accounting, Business Laws and Taxation to the students
- To prepare students to pursue professional courses like CA, CWA, CS etc
- To provide sufficient knowledge and skills to students to seek employment or for managing business organization effectively.
- To provide career oriented education to students so that they can either go for jobs or engage in self-employment.

PROGRAMME OUTCOMES

On successful completion of the programme, the graduates will

- Apply the knowledge of accounting, business laws and taxation to understand the business and commerce.
- Be able to pursue the professional courses like CA, CWA, CS etc.
- communicate effectively and perform efficiently in the organization, social and personal life.
- Be able to aptly use the obligatory knowledge and skill to furnish as an entrepreneur and social entrepreneur.
- Be able to lead and manage a team effectually in varied situations.

B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE & TECHNOLOGY

B.COM GENERAL

CURRICULUM & SYLLABI, REGULATIONS 2017

SEMESTER I

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1	AECC	ENC 1183	General English-I	3	1	0	3	
2	AECC	LNC1182/ LNC 1184	German - I Tamil - I	3	1	0	3	
3	PC	COC 1101	Financial accounting	4	2	0	5	
4	PC	COC 1102	Business management	4	1	0	5	
5	PA	COC 1103	Quantitative techniques & reasoning	4	1	0	5	
6	SS	COC 1104	Excel modeling	0	0	4	2	
7	AECC	COC 1105	Environmental studies	2	0	0	2	**25**

SEMESTER II

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1	AECC	ENC 1284	General English II	3	0	1	3	
2	AECC	LNC1283/ LNC 1284	German - II/ Tamil - II	3	1	0	3	
3	PC	COC 1201	Advanced Financial Accounting	4	2	0	5	
4	PC	COC 1202	Business Law	4	1	0	5	
5	PA	COC 1203	Business Economics	4	1	0	5	
6	SS	COC 1204	Database Management System	0	0	4	2	
7	AECC	COC 1205/ LNC 1285/ LNC 1286	Business Environment/ Basic Tamil I/ Advanced Tamil I	2	0	0	2	**25**

SEMESTER III

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1	PC	COC 2101	Corporate Accounting I	4	2	0	5	
2	PC	COC 2102	Company Law	4	1	0	5	
3	PC	COC 2103	Marketing Management	4	2	0	5	
4	PC	COC 2104	Entrepreneurship Development	4	0	1	5	
5	PA	COC 2105	Business Statistics I	4	2	0	5	
6	SS	COC 2106/ LNC 2185/ LNC 2186	Office Management/ Basic Tamil II/ Advance Tamil II	2	0	0	2	**27**

SEMESTER IV

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1	PC	COC 2201	Advanced Corporate Accounting	4	2	0	5	
2	PC	COC 2202	Financial Management	5	1	0	5	
3	PC	COC 2203	Banking Theory, Law& Practice	4	0	1	5	
4	PC	COC 2204	Financial Markets & Services	4	0	1	5	
5	PA	COC 2205	Business Statistics II	5	1	0	5	
6	SS	COC 2206	Communication Skills	2	0	0	2	**27**

SEMESTER V

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1	PC	COC 3101	Income Tax Law & Practice I	4	2	0	5
2	PC	COC 3102	Cost Accounting	4	2	0	5
3	PC	COC 3103	Human Resource Management	4	0	2	5
4	PE		Elective I	4	2	0	5

5	PE	COC 3104	Project Work/Elective II	4	2	0	5	
6	GE	COC 3105	Personality Development	2	0	0	2	**27**

SEMESTER VI

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1	PC	COC 3201	Income Tax Law & Practice II	4	2	0	5	
2	PC	COC 3202	Management Accounting	4	2	0	5	
3	PC	COC 3203	Auditing	4	0	2	5	
4	PE		Elective III	4	2	0	5	
5	PE		Elective IV	0	2	4	5	
6	GE	COC 3204	Value Education	2	0	0	2	**27**

Total Credits: 158 Credits

LIST OF PROGRAMME ELECTIVE

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1	PE	COCX01	Investment management	4	1	0	5
2	PE	COCX02	International finance	4	1	0	5
3	PE	COCX03	Business strategies	4	1	0	5
4	PE	COCX04	Insurance	4	1	0	5
5	PE	COCX05	Research methodology	3	2	0	5
6	PE	COCX06	E-commerce	4	1	0	5

SEMESTER I

ENC 1184	GENERAL ENGLISH II	L	T	P	C
		3	1	0	3

OBJECTIVES:

- To make students learn English literary texts.
- To train them in appreciating and critically analyzing literary texts.
- To train in using the four skills, Reading, Writing, Speaking and Writing skills
- To encourage them to use appropriate vocabulary and grammatical expressions.

MODULE I **8**

Prose Education
Poem William Shakespeare - "All the World's a Stage"
Letter Writing Formal and Informal
Short Story O Henry - "Robe of Peace" (Extensive Reading)
Essential English Grammar - 1-3 MODULES

MODULE II **8**

Prose Employment & Unemployment
Poem Ben Jonson - "On Shakespeare"
Short Story Rudyard Kipling – "The Miracle of PuranBhagat" (Extensive Reading)
Essential English Grammar – 4-7 MODULES

MODULE III **9**

Prose A Dead Planet
Poem Robert Herrick - "Gather Ye Rosebuds"
Note Making
Short Story H.G.Wells – "The Truth About Pyecraft" (Extensive Reading)
Essential English Grammar – 8-10 MODULES

MODULE IV **8**

Prose Riddles
Poem Oliver Goldsmith - "The Village Schoolmaster"
Essential English Grammar – 11-13 MODULES

MODULE V **6**

Prose KillersA Short Story

Poem William Blake - “From Auguries of Innocence”

Précis Writing

Short Story William Somerset Maugham - “Mabel” (Extensive Reading)

Essential English Grammar – 14-17 MODULEs

6

MODULE VI

Prose Galloping Growth

PoemRobert Browning- “The Last Ride Together”

Developing story from hints

Short Story John Galsworthy - “Quality” (Extensive Reading)

Essential English Grammar-- 18 &19 Modules

TOTAL HOURS – 45

REFERENCES:

1. Krishnaswamy. N, Sriraman T. **Current English for Colleges.** Hyderabad: Macmillan Indian Ltd, 2006.

2. Dahiya SPS. Ed. **Vision in Verse- An Anthology of Poems**. New Delhi: Oxford University Press, 2002.

3. Murphy, Raymond. **Essential English Grammar**. New Delhi: Cambridge University Press, 2009.

4. Seshadri, K G Ed. **Stories for Colleges.** Chennai: Macmillan India Ltd, 2003.

OUTCOMES:

After completing the course the students would be able to

- Respond to literary texts efficiently.
- Appreciate and critically analyse literary texts.
- Use the four skills of the language
- Use vocabulary and grammatical expressions effectively.

LNC 1182	GERMAN I	L	T	P	C
		3	1	0	3

OBJECTIVES:

- To improve the proficiency of students in German language.
- To create awareness of using vocabulary among students.
- To expose them to correct grammatical forms of the language.
- To empower them for successful communication in social and academic contexts .

MODULE I **8**

Introduction to German alphabets, phonetics and pronunciation- Introducing themselves and others using simple sentences and answer to some basic personal questions-: Introduction to different types of articles and verbs, Nouns

MODULE II **8**

Understanding and responding to everyday queries like instruction, questions, - number & gender, pronouns, present and past tense.

MODULE III **7**

Short telephone messages, requests etc., if spoken slowly and clearly-- Detailed overview of articles, adjectives with/without articles, Prepositions

MODULE IV **7**

Asking and giving directions using simple prepositions- Ability to fill basic information on forms while registering for courses / classes.

MODULE V **8**

Ability to extract and understand relevant information in a public announcement, broadcast, newspaper, radio etc-- dative & accusative

MODULE VI **7**

Ability to describe about people, work, immediate environment, education and other topics related to personal needs in a concise manner-- Understanding of matters which are familiar and are encountered regularly like instances at school, work, at public places, places of leisure etc.

TEXT BOOKS:

1. Course book : Tangram aktuell 1 – Lektion 1–4 (Kursbuch + Arbeitsbuch mit Audio-CD zum Arbeitsbuch), Rosa-Maria Dallapiazza, Eduard von Jan, Til Schönherr, Hueber Publisher, ISBN 978-3-19-001801-7
2. Practice book: Tangram aktuell 1 – Lektion 1–4 (Kursbuch + Arbeitsbuch mit Audio-CD zum Arbeitsbuch), Rosa-Maria Dallapiazza, Eduard von Jan, Til Schönherr, Hueber Publisher, ISBN 978-3-19-001801-7

REFERENCES:

1. NETZWERK A1 TEXTBOOK, Deutsch als Fremdsprache,Stefanie Dengler,Paul Rusch, Helen Schmitz, Tanja Sieber, Langenscheidt and Klett, ISBN : 9788183076968
2. STUDIO D A1 (SET OF 3 BOOKS + CD), Hermann Funk. Cornelsen, ISBN: 9788183073509
3. Willkommen! Beginner's course. Paul Coggle, Heiner Schenke. 2nd edition. (chapter 1 - 6) ISBN: 9781444165159
4. Willkommen! Beginner's course. Paul Coggle, Heiner Schenke. ISBN: 978-1-444-16518-0
5. An Introduction to the German Language and Culture for Communication, Updated Edition Lovik, Thomas A., J. Douglas Guy & Monika Chavez. Vorsprung -. New York, Houghton Mifflin Company, 1997/2002. ISBN 0-618-14249-5
6.

OUTCOMES:

On completion of the course, students will be able to

- Show their proficiency in German Language.
- Use appropriate vocabulary in real life contexts.
- Use appropriate grammatical forms while communicating with people.
- Effectively use the language in social and academic contexts.

LNC 1184 **TAMIL I** **L T P C**

3 1 0 3

OBJECTIVES:

- சமூகமாற்றச் சிந்தனைகளைஉள்ளடக்கியதற்கால இலக்கியங்களைஅறிமுகம் செய்தல்
- புதுக்கவிதை,சிறுகதை,உரைநடைஆகிய இலக்கியங்களின் நயம் பாராட்டுதல்
- சந்திப் பிழையின்றிஎழுதமாணவர்களைப் பயிற்றுவித்தல்.

அலகு I இருபதாம் நூற்றாண்டுமரபுக்கவிதைகள 8

மனோன்மணியம் சுந்தரனார் - தமிழ்த்தாய் வாழ்த்து,பாரதியார் - யோகசித்தி,பாரதிதாசன் - நீங்களேசொல்லுங்கள்,கண்ணதாசன் - காலக்கணிதம்

அலகு II புதுக்கவிதைகள 8

ஈரோடுதமிழன்பன் - கனாக்காணும் வினாக்கள்,மீரா - ஊிசகள்,வைரமுத்து - அந்தி,நா.காமராசன் - அலிகள்,தாமரை - ஒருகதவும் கொஞ்சம் கள்ளிப்பாலும்,மொழிபெயர்ப்புக் கவிதைகள் - கீதாஞ்சலி,மும்பைவாசிகள் (10 கவிதைகள் மட்டும்)

அலகு III சிறுகதைகள் 8

புதுமைப்பித்தன் - பால்வண்ணம் பிள்ளை,பி.எஸ்.ராமையா - பணம் பிழைத்தது, ஜெயகாந்தன் - விதியும் விபத்தும். கி.இராஜநாராயணன் - நாற்காலி,சு.சமுத்திரம் மொழிபெயர்ப்புச் சிறுகதைகள் - காகிதஉறவு,மாதவிக்குட்டி - நெய்ப்பாயாசம்,அந்தோன்செகாவ் - பச்சோந்தி

அலகு IV மொழிப்பயிற்சி 7

கலைச்சொல்லாக்கம்,பிழைதிருத்தம் (ஒருமை,பன்மை, ல-ள-ழகர, ர�றீறகர, ண-ந-னகரவேறுபாடுகள்),அயற்சொற்களைதல்

அலகு V இலக்கியவரலாறு 7

பாடந்தழுவியது (இருபதாம் நூற்றாண்டுமரபுக் கவிதைகள்,புதுக்கவிதையின் தோற்றமும் வளர்ச்சியும்,சிறுகதையின் தோற்றமும் வளர்ச்சியும்)

அலகு VI படைப்பிலக்கியம 7

கவிதைஎழுதுதல்,சிறுகதைவரைதல்

டு – 45 வு – 30 வுழுவுயுடு ர்ழுருசுளு – 75

REFERENCES:

1. பொதுத்தமிழ் - செய்யுள்திரட்டு - தமிழ்த்துறைவெளியீடு
2. தமிழ் இலக்கியவரலாறு - சோம. இளவரசு
3. சிறுகதைத் தொகுப்பு (கட்டுரைக்களஞ்சியம்)

OUTCOMES:

- மாணவர்கள் சமூகமாற்றச் சிந்தனைகளைஅறிந்துகொள்வர்
- சந்திப்பிழைகளைநீக்கிஎழுதும் திறன் பெறுவர்
- புத்திலக்கியங்களைப் படைக்கும் திறனையும் திறனாய்வுசெய்யும் திறனையும் பெறுவர்

COC 1101	FINANCIAL ACCOUNTING	L	T	P	C
		4	2	0	5

OBJECTIVES:

- To facilitate the understanding of Accounting in General
- To give a comprehensive understanding of the system of Financial Accounting
- To understand the intermediate concepts for assets, liabilities and stockholders' equity
- To develop skill, related to problem solving and critical thinking

MODULE I INTRODUCTION TO ACCOUNTING 12

Meaning and scope of Accounting, Basic Accounting Concepts and Conventions, Objectives of Accounting, Accounting Transactions, Double Entry Book Keeping - Journal, Ledger, Preparation of Trial Balance

MODULE II FINAL ACCOUNTS 15

Preparation of Final Accounts of a Sole Trading Concern, Closing Stock, Adjustments, Outstanding and Prepaid items, Depreciation, bad debts, Provision for Bad and Doubtful Debts, Provision for Discount on Debtors, Provision for Discount on creditors, Interest on Capital and Drawings, Abnormal Loss of stock.

MODULE III RECTIFICATION OF ERRORS 18

Classification of Errors, Rectification of Errors, Preparation of Suspense Account-Profit & loss adjustment Account.

MODULE IV BANK RECONCILIATION STATEMENT 18

Introduction, Procedure for reconciling the cash book balance with the pass book balance, Methods of Bank Reconciliation Statement.

MODULE V DEPRECIATION ACCOUNTING 15

Depreciation, Meaning, Causes, Methods, Straight Line Method, Written down Value Method, Change in method of depreciation (retrospective and prospective method) Insurance claims **-** Insurance claims, Average Clause (Loss of stock only)

L – 52; T – 26;TOTAL HOURS – 78

TEXT BOOK:

1. Financial Accounting - T.S.Reddy&A.Murthy, Margham Publications, Chennai.

REFERENCES:

1. Financial Accounting by Hanif and Mukherjee, MCGRAW hill education
2. Financial Accounting by P.C. Tulsian, Pearson
3. Jain &Narang (2015) Financial Accounting, Kalyani Publishers.
-

OUTCOMES:

On successful completion of this course students are able to

- Explain the fundamental concept of financial accounting system
- Recognize the transaction, understand the accounting cycle and various accounts books
- Recognize the error and it rectification
- Understand the depreciation and its different treatment in accounting
- Understand the financial statement of its importance and method of preparation for sole proprietorship
- Understand the importance of bank reconciliation system and method of preparation of reconciliation statement

COC 1102 BUSINESS MANAGEMENT

L	T	P	C
4	1	0	5

OBJECTIVES:

- To understand the fundamental concepts in management
- To trace the evolution and growth of management as a body of knowledge
- To have an in depth knowledge of various functions of management and their relevance to an organization

MODULE I MANAGEMENT 10

Meaning – Role of Management – Management Process – Importance – Management & Administration – Levels of Management – Taylor's Scientific Management – Fayol's Administrative Management Principles.

MODULE II PLANNING 20

Nature & Characteristics – Importance – Advantages & Limitations – Steps in Planning – Types of Plan – Standing Plan – Objectives – Policies – Procedures – Rules – Strategies – Single use Plans – Programmers and Budgets.

Management by Objectives: Concept, Process and Limitations. Decision Making: Process, Limitations and Techniques used in decision making.

MODULE III ORGANIZATION 15

Importance – Types – Line, Functional, Line and Staff – Committee Organization – Authority and Responsibility – Delegation of Authority – Principles, Types, advantages and Barriers to Delegation – Departmentalization – Formal and Informal Organization. Staffing: Nature & Importance – Functions of Staffing (In Brief)

MODULE IV DIRECTING 10

Nature & Importance – Elements of Directing Function – Supervision – Span of Supervision – Factors Determining span of supervision.

Motivation: Importance – Types of Motivators – Maslow's Theory – Hertzberg's Two factor theory – Douglas McGregor's Theory X & Theory Y.

MODULE V CONTROL 10

Need for Control – Controlling Process – Controlling Tools & Techniques. Coordination: Need & Importance – Principles & techniques of Coordination

Leadership: Importance – Formal & Informal Leaders – Leadership Styles – Traits

of a Good Leader.

L – 52; T – 13; TOTAL HOURS-65

TEXT BOOK

- Business Management – DinkarPagare
- Principles of Management – C.B.Guptha

REFERENCES:

- J. Jayasankar, 1st Edition. 2004, Reprint2008-Principles of Management (Business Management). Margham Publication. Chennai
- P.C.Tripathi& P.N Reddy, 1991, Principles of Management. Tata Mc.Graw, Hill. New Delhi.
- Weihnrich and Koontz, Management, 10th Edition, 1993, A Global Perspective.
- N. Premavathy, 2nd Edition, 2003, Principles of Management, Sri Vishnu Publication. Chennai.

OUTCOMES:

At the end of this course, the students will be able to:

- understand different types of functions plans and the managerial decisions
- understand the organizational chart and explain the staffing process
- understand the different control technique in the organizations
- understand the appropriate way to lead and motivate the team.

COC 1103 QUANTITATIVE TECHNIQUES & LOGICAL REASONING

L	T	P	C
4	1	0	5

OBJECTIVES

- To learn basics of mathematical equations.
- To have knowledge in various arithmetical calculations.
- To understand different mathematical operations for logical analysis

MODULE I QUANTITATIVE **15**

LCM & HCF – Average - Ratio and Proportion – Logarithm – Permutation and Combination – Probability (Excluding conditional probability and Bayes' Therom).

MODULE II SEQUENCES AND SERIES **15**

Arithmetic Progression, Sum up to n terms, Properties of Arithmetic Progression, Geometric Progression, Sum up to n terms Properties of GP

MODULE III INTEREST AND ROOTS **10**

Simple Interest and Compound Interest – Surds and Indices – Square root – Calendar and Clock.

MODULE IV MENSURATION **10**

Fractions and Percentage and Simplification – Simple Equation – Time and Work – Speed & Distance – Mensuration: Area (Circle, Square, Rectangle, Triangle) – Volume (Cube, Cuboid, Cone, Sphere).

MODULE V LOGICAL REASONING **15**

Coding and Decoding – Mathematical Operations – Series completion (alphabets and numbers) – Logical Venn Diagram.

L – 52; P – 13; TOTAL HOURS – 65

REFERENCES:

1. Quantitative Aptitude – R.S. Aggarwal – Sultan Chand Publication.
2. Logical Reasoning - R.S. Aggarwal – Sultan Chand Publication.

OUTCOMES:

On completion of the course, the students will be able to

- Calculate the various practical problem on Ratio, Proportion and Logarithm

- Students will be able to solve the problem related to Linear Equation, Inequalities and Interests.
- Students will be able to solve the problem of Permutation and Combination and Arithmetic and Geometric Series

COC 1104 EXCEL MODELING (PRACTICAL)

L	T	P	C
0	0	4	2

OBJECTIVES:

- Analyse business data for better decision making.
- Apply basic tools and functions of excel.
- Solve various mathematical and managerial problems.
-

MODULE I BASICS OF EXCEL 8

Entering Data, Selecting an area of worksheet, Saving closing and opening files, Copying Data, Inserting and deleting rows and columns, Wrap text, Merge and center, Understanding excel options, Setting advanced options-Data validation, Working with multiple sheets, Fixing of cells, Freezing of cells, Alignment, Protect sheet, Protect workbook, Page layout, Insert equation and symbol, Insert text box, Insert header and footer.

MODULE II BASIC MATHEMATICAL FUNCTIONS 12

Sum, Average, Product, SQRT, MOD, Aggregate, Power, SUM PRODUCT. **Financial arithmetic**: Compound interest, Continuous compounding, Simple interest, Fractional years.

MODULE III DATA HANDLING 10

Sorting data, Filtering data, Parsing data, Data validations, What-If-Analysis, Group, Ungroup, Creating subtotals, Understanding data consolidation, Consolidating data using the SUM function. **Descriptive statistics**: Mean, Median, Mode, Variance, Standard deviation, Weighted averages, Maximum and Minimum, Range.

MODULE IV CHARTS AND GRAPHS 10

XY Scatter plot, Column and Bar Chart, Pie Charts, Adding Legends and Titles.**Depreciation using Excel**: Calculating Fixed Line Depreciation using DB function, Calculating Straight Line Depreciation using SLN function.

MODULE V CONDITIONAL FORMATTING 12

Highlight cell rules, Top/Bottom rules, Data Bars,Color Scales and Icon Sets, New Rule, Clear Rules, Manage rules.**Data analysis in Excel**: Analysis by goal seek, Analysis by pivot table and charts, Solver to determine the optimal product mix.

TOTAL HOURS – 52

TEXT BOOK:

1. Microsoft excel 2013: data analysis and business modeling by waynewinston, prentice hall

REFERENCES:

1. Business data analysis using excel by davidwhigham, oxford university press
2. Excel Bible 2013

OUTCOMES:

At the end of the course students will be able to

- Anaylse data using descriptive statistics
- copy data and paste it in the desired location, give name to cells and use them, inserting and deleting rows and columns
- learn to use the advanced excel options
- learn to work with Protect sheet, Protect workbook, Page layout, Insert equation and symbol, Insert text box, Insert header and footer
- learn to work Page layout and data validation
- apply basic mathematical functions
- calculate Compound interest , Fractional year and continuous compounding in excel
- work with Filtering data, Parsing data
- calculate mode and average in excel
- Ablility to analyse data using charts and graphs

COC 1105 ENVIRONMENTAL STUDIES L T P C
2 0 0 2

OBJECTIVES:

- Developing an awareness and sensitivity to the total environment and its related problems
- Motivating people for active participation in environmental protection and improvement
- Developing skills for active identification and development of solutions to environmental problems
- Evaluation of environmental programes in terms of social, economic, ecological and aesthetic factors.

MODULE I MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES 6

Definition-scope and importance- need for public awareness.

Natural resources and associated problems

a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.

b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources

d) Food resources : World food problems, changes caused by agriculture and over-grazing, effects of modern agriculture, fertilizer-pesticide problems, water logging ,salinity

e) Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources.

f) Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources-Equitable use of resources for sustainable lifestyles.

MODULE II ECOSYSTEMS 7

Concept of an ecosystem.-Structure and function of an ecosystem.-Producers, consumers and decomposers.-Energy flow in the ecosystem.-Ecological succession-Food chains, food webs and ecological pyramids.-Introduction, types, characteristic features, structure and function of the following Ecosystems :-

a.Forest ecosystems.
b.Grassland ecosystem.
c.Desert ecosystem
d.Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

MODULE III BIODIVERSITY AND ITS CONSERVATION 5

Introduction – Definition : genetic, species and ecosystem diversity.- Bio geographical classification of India-Value of biodiversity:consumptive use, productive use, social, ethical, aesthetic adoption values-Biodiversity at global, National and local levels.-Hot-sports of biodiversity.-Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts.-Endangered and endemic species of India
Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity.

MODULE IV ENVIRONMENTAL POLLUTION 5

Definition-Cause, effects and control measures of :-Air pollution-Water pollution-Soil pollution-Marine pollution-Noise pollution-Thermal pollution- Nuclear hazards
Solid waste Management : Causes, effects and control measures of urban and industrial wastes.-Role of an individual in prevention of pollution.
Disaster management : floods, earthquake, cyclone and landslides.

TOTAL HOURS – 23

REFERENCES:

1. Environmental Science- Kaushik&Kaushik-New Age International Publications
2. Environmental Science & Engineering-Anandan&Kumaravelan-Scicech Publications

OUTCOMES:

At the end of the course students will be able to

- Understand the natural environment and its relationships with human activities.
- Characterize and analyze human impacts on the environment.
- Integrate facts, concepts, and methods from multiple disciplines and apply to environmental problems.
- Acquire practical skills for scientific problem-solving, including familiarity with laboratory and field instrumentation, computer applications, statistical and modeling techniques.

SEMESTER II

ENC 1284	GENERAL ENGLISH II	L	T	P	C
		3	1	0	3

OBJECTIVES:

- To make students learn English literary texts.
- To train them in appreciating and critically analyzing literary texts.
- To train in using the four skills, Reading, Writing, Speaking and Writing skills
- To encourage them to use appropriate vocabulary and grammatical expressions

MODULE 1 **9**

Prose Qahwah

Poem William Wordsworth – "Nutting"

Filling Money Order Challan and Bank Challan

Short Story G.K.Chesterton – The Hammer of God (Extensive Reading)

Essential English Grammar: - 31-33 Modules

MODULE 2 **8**

Prose Environment

Poetry John Keats – "La Belle Dame Sans Merci"

Short Story Katherine Mansfield—A Cup of Tea (Extensive Reading)

Dialogue Writing

Essential English Grammar: 34-37 Modules

MODULE 3 **8**

Prose A Dilemma

Poetry Robert Frost – "Design"

Short Story Thomas Wolfe—The Far and the Near (Extensive Reading)

Conversations

Essential English Grammar: 38-40 Modules

MODULE 4 **8**

Prose Computeracy

Poetry Sarojini Naidu –"The Gift of India"

Short Story R.K. Narayan – "Half a Rupee Worth" (Extensive Reading)

Essential English Grammar: 41-43 Modules

MODULE 5 **11**

Prose War Minus Shooting
Who's Who

Poetry Nissim Ezekiel – "The Night of The Scorpion"

Short Story Anita Desai – "A Devoted Son" (Extensive Reading)
Ruskin Bond – "The Boy Who Broke the Bank" (Extensive Reading)

Report Writing

Letter to the Editor

Essential English Grammar: 44-47 Modules

8

MODULE 6

Prose Usage and Abusage

Poetry Mathew Arnold –Dover Beach

Short Story ManoharMalgonkar – "Bacha Lieutenant"

Essential English Grammar: 48-50 Modules

TOTAL HOURS – 52

REFERENCES:

1. Krishnaswamy. N, Sriraman T. **Current English for Colleges.** Hyderabad: Macmillan Indian Ltd, 2006.
2. Dahiya SPS. Ed. **Vision in Verse- An Anthology of Poems**. New Delhi: Oxford University Press, 2002.
3. Murphy, Raymond. **Essential English Grammar**. New Delhi: Cambridge University Press, 2009.
4. Seshadri, K G Ed. **Stories for Colleges.** Chennai: Macmillan India Ltd, 2003.

OUTCOMES:

After completing the course the students would be able to

- Respond to literary texts efficiently.
- Appreciate and critically analyse literary texts.
- Use the four skills of the language
- Use vocabulary and grammatical expressions effectively.

LNC 1284 **TAMIL II** **L T P C**

3 1 0 3

OBJECTIVES:

- சமூகமாற்றச் சிந்தனைகளைஉள்ளடக்கியதற்கால இலக்கியங்களைஅறிமுகம் செய்தல்
- புதுக்கவிதை,சிறுகதை,உரைநடைஆகிய இலக்கியங்களின் நயம் பாராட்டுதல்
- சந்திப் பிழையின்றிஎழுதமாணவர்களைப் பயிற்றுவித்தல்

அலகு I **அற இலக்கியங்கள்** **8**

திருக்குறள் - சொல்வன்மை (65ஆம் அதிகாரம்),நாலடியார் - அவையறிதல் (5 பாடல்கள் -32ஆம் அதிகாரம்),பழமொழிநானூறு - இன்னாசெய்யாமை(5 பாடல்கள்), இனியவைநாற்பது - முதலைந்துபாடல்கள

அலகு II **பக்தி இலக்கியங்கள்** **8**

தேவாரம் - மூவர் தேவாரம் (15 பாடல்கள்) அப்பர் தேவாரம்,திருஞானசம்பந்தர் தேவாரம்,சுந்தரர் தேவாரம் (ஒவ்வொன்றிலிருந்தும் ஐந்துபாடல்கள்),காரைக்காலம்மையார் - மூன்றுபாடல்கள் (அற்புதத் திருவந்தாதி),மாணிக்கவாசகர் - திருவெம்பாவை (தேர்ந்தெடுக்கப்பெற்ற 5 பாடல்கள்),ஆண்டாள் - திருப்பாவை (தேர்ந்தெடுக்கப்பெற்ற 5 பாடல்கள்),குலசேகராழ்வார் - திருவேங்கடத்தில் பிறத்தலும் இருத்தலும் போதுமெனல் (11 பாசுரம்)

அலகு III **காப்பியங்கள்** **8**

மணிமேகலை - ஆதிரைபிச்சையிட்டகாதை (20 அடிகள் மட்டும்),கம்பராமாயணம் - பாலகாண்டம்,நாட்டுப்படலகம் (10 பாடல்கள் மட்டும்), இரட்சணியயாத்ரிகம் - சிலுவைப்பாடு (10 பாடல்கள்),சீறாபுராணம் - மானுக்குப் பிணைநின்றபடலம் (6 பாடல்கள்)

அலகு IV **கட்டுரைகள்** **7**

உ.வே.சாமிநாதையர்-தமிழ்நாட்டுவணிகர். வ.இராமசாமிஐயங்கார்-மூதறிஞர் இராஜகோபாலாச்சாரியார்,மா.இராசமாணிக்கனார்-சித்தன்னவாசல் ஓவியங்கள், பி.எல்.சாமி-சங்க இலக்கியத்தில் அறிவயல் கலை,க.கைலாசபதி - பாரதியும் மேனாட்டுக் கவிஞரும்,தொ. பரமசிவன் - சொல்லும் பொருளும்.

அலகு V **இலக்கியவரலாறு** **7**

அற இலக்கியங்களின் தோற்றமும் வளர்ச்சியும்,சைவவைணவ இலக்கியங்கள் தோற்றமும் வளர்ச்சியும்,காப்பியங்கள் தோற்றமும் வளர்ச்சியும்,உரைநடைதோற்றமும் வளர்ச்சியும்

அலகு VI **மொழிப்பயிற்சி** **7**

இலக்கணக் குறிப்புத் தருதல்,வல்லினம் மிகுமிடங்களும்,மிகாவிடங்களும்,மொழிபெயர்ப்பு (ஆங்கிலத்திலிருந்துதமிழில் பெயர்த்தல்),கடிதங்களும் வகைகளும்

L – 45; T – 15; TOTAL HOURS – 60

REFERENCES:

1. பொதுத்தமிழ் - செய்யுள்திரட்டு - தமிழ்த்துறைவெளியீடு
2. தமிழ் இலக்கியவரலாறு - சோம. இளவரசு
3. சிறுகதைத் தொகுப்பு (கட்டுரைக்களஞ்சியம்)

OUTCOMES:

- மாணவர்கள் சமூகமாற்றச் சிந்தனைகளைஅறிந்துகொள்வர்
- சந்திப்பிழைகளைநீக்கிஎழுதும் திறன் பெறுவர்
- புத்திலக்கியங்களைப் படைக்கும் திறனையும் திறனாய்வுசெய்யும் திறனையும் பெறுவர்

LNC1282	GERMAN II	L	T	P	C
		3	1	0	3

OBJECTIVES:

- To develop existing language skills further and to achieve a professional fluency.
- By the end of the course you will be able to understand general and detailed information and to communicate in standard speech on a range of everyday issues.

MODULE I **8**

Shopping for food and going to restaurants, Recent events, Personal experiences, Apologies and excuses

MODULE II **8**

Studying German Wishes and needs, Plans and projects, Certainty and probability, Physical condition, illness and remedies

MODULE III **7**

A birthday party, Food and drink, Presents and Congratulations

MODULE IV **7**

Travelling (I), Biographies, Important events in life, Social situations

MODULE V **8**

Telephone conversations, appointments and invitations, Travelling (II), City life: public places, transport and directions, Leisure activities

MODULE VI **7**

Objects, shapes and material, Speaking about historical events, Childhood and memories, Personality traits

L – 30; T – 15; TOTAL HOURS – 45

TEXT BOOKS:

Prescribed Text

1. Course book : Tangram aktuell 1 – Lektion 5–8 (Kursbuch + Arbeitsbuch mit Audio-CD zum Arbeitsbuch), Rosa-Maria Dallapiazza, Eduard von Jan, Til Schönherr, Hueber Publisher, 9788183070867
2. Practice book: Tangram aktuell 1 – Lektion 5–8 (Kursbuch +

Arbeitsbuch mit Audio-CD zum Arbeitsbuch), Rosa-Maria Dallapiazza, Eduard von Jan, Til Schönherr, Hueber Publisher, ISBN 9788183070867

REFERENCES:

1. NETZWERK A2 TEXTBOOK, Deutsch als Fremdsprache,Stefanie Dengler,Paul Rusch, Helen Schmitz, Tanja Sieber, Langenscheidt and Klett, ISBN : 9788183077231
2. STUDIO D A2 (SET OF 3 BOOKS + CD), Hermann Funk. Cornelsen, ISBN: 9788183073516

OUTCOMES:

On completion of the course, students will be able to

- Read printed and handwritten script on a limited number of everyday topics
- Write simple texts using descriptive language accurately.
- Developed intercultural competence.

COC 1201 ADVANCED FINANCIAL ACCOUNTING L T P C

4 2 0 5

OBJECTIVES:

- To facilitate the understanding of Accounting in specific areas
- To understand the practical applicability of Financial Accounting
- To develop skill, related to problem solving and critical thinking

MODULE I BRANCH AND DEPARTMENTAL ACCOUNTS 15

Dependent branches-Accounting Method

Departmental Accounts: Basis for allocation of expenses, Inter departmental transfer at cost or selling price, Treatment of expenses which cannot be allocated

MODULE II HIRE PURCHASE AND INSTALLMENT ACCOUNTING 12

Hire purchase and Installment-Default and repossession, Hire purchase trading account, Installment purchase system

MODULE III PARTNERSHIP 18

Admission of a Partner: Calculation of New Profit Sharing Ratio and Sacrificing Ratio – Treatment of Goodwill – Revaluation Account – Memorandum Revaluation Account – Adjustment of Capital – Preparation of Balance sheet of New Firm.

MODULE IV PARTNERSHIP 15

Retirement, Admission cum retirement of partners and Death of a partner: Calculation of New profit Sharing Ratio and Gaining Ratio – Treatment of Goodwill – Revaluation account – memorandum revaluation account – Adjustment of Capital – preparation of balance sheet of new firm.

MODULE V DISSOLUTION OF A PARTNERSHIP 12

Insolvency of a partner (Application of Indian Partnership Act 1932), Insolvency of all partners, Gradual Realization of Assets and Piecemeal Distribution.

L – 52; T – 26; TOTAL HOURS – 78

TEXT BOOKS:

1. Financial Accounting -T.S.Reddy&A.Murthy,Margham Publications, Ch-17

2. Jain &Narang (2015) Financial Accounting,Kalyani Publishers, New Delhi.

REFERENCES:

1. R.L.Gupta&V.K.Gupta. (2009) Advanced Accounting, Sultan Chand & Sons, New Delhi
2. Shukla&Grewal (2009) Advanced Accounting,S Chand & Co, New Delhi.
3. P.C.Tulsian (2009) - Financial Accounting , Tata McGraw-Hill
4. Financial Accounting-T.S.Reddy&A.Murthy,Margham Publications,Ch-17
5. Jain &Narang (2015) Financial Accounting,Kalyani Publishers, New Delhi.

OUTCOMES:

On successful completion of this course students are able to

- Record the transaction related to installment and hire purchase system
- Explain the accounting for branches and departments and transactions related to it.
- Record the transactions in partnership form of business

COC 1202 BUSINESS LAW L T P C
4 1 0 5

OBJECTIVES:

- To enable the students to learn the elements of general contract.
- To make the learners to understand and apply the various contracts in business or profession.

MODULE I NATURE OF CONTRACT 10

Object of Law of Contract-The Indian Contract Act 1872-Meaning and definition of contract -Essential elements of a valid contract- Classification of contracts.

MODULE II OFFER, ACCEPTANCE AND CONSIDERATION 15

Offer- Meaning-Definition-Rules relating to offer-tenders-Types of offer.
Acceptance-Meaning and definition. Legal rules as to acceptance. Revocation of offer and acceptance
Consideration-Meaning and definition- Legal rules relating to consideration-stranger to contract and consideration- Contracts without consideration.

MODULE III CAPACITY TO CONTRACT, FREE CONSENT AND LEGALITY OF OBJECT 10

Minors-Rules relating to agreements with minors-Persons disqualified by law to enter into valid contact- Persons of unsound mind.
Free consent- Meaning and definition of free consent. Coercion- fraud- Misrepresentation- Undue influence- Mistakes
Legality of object. Illegal agreements and agreements opposed to public policy.

MODULE IV QUASI AND CONTINGENT CONTRACTS 15

Quasi Contracts: Meaning and Definition, Types of Quasi Contracts.
Contingent Contracts: Meaning and Definition- Rules regarding Contingent Contracts.

MODULE V PERFORMANCE OF CONTRACTS 15

Meaning and definition-Performance of reciprocal promises-Time as the essence of contract-Appropriation of payments-Breach of contracts.-Remedies for breach of contract.

L – 52; T – 13;TOTAL HOURS-65

TEXT BOOK:

1. KAPOOR N.D, Business Law, Sultan Chand & Sons, New DeIhi-2015.

REFERENCES:

1. KUCHAL,*Mercantile Law*, Vikas Publishing House, New Delhi, 2015.
2. R.S.N.PILLAI & BAGAVATHI, *Mercantile Law*, Sultan Chand &Sons- New Delhi-2015
3. BALACHANDRAN V, & THOTHARDI, *Business Law*, Tata McGraw Hill Publishing Company Ltd.-2015.

OUTCOMES:

Through this course students should be able to

- appreciate the legal provisions related to Contract act and special contracts
- acquaint with the legal provisions related to various essential elements of a valid contract.
- Understand various provisions of contract related to business.

COC 1203 BUSINESS ECONOMICS L T P C
4 1 0 5

OBJECTIVES:

- To introduce students to the fundamentals of economics relevant from business aspects
- To familiarize students with the importance of economic approaches in business decision making
- To study about the application of economic theory into practical business
- To study about the economic tools and analysis that help make better business decisions

MODULE I INTRODUCTION TO ECONOMICS 15

Positive and Normative economics definition, Scope and Importance of business economics concepts, Uses and Limitations of Microeconomic Theories

MODULE II DEMAND AND SUPPLY 10

Demand and Supply Analysis: Introduction to demand, Law of demand, Shift and movement in the demand curve, Price, income and cross elasticity, Market Equilibrium, Elasticity of demand, Exceptions of the law of demand, Law of supply: shift and movements, Determinant of supply and supply function

MODULE III PRODUCTION THEORY 10

Production Function with one variable and more than one variable, Return to factor and Return to scale, Types of inputs, Total, Marginal and Average Product, Introduction to production function.

MODULE IV ECONOMIC CONCEPT OF COST AND REVENUE 15

Average and Marginal concepts in Cost in long and short run, Relationship between average cost curves- Long Run and Short Run, Kinds of costs, Economies and diseconomies of Scale

Revenue Analysis: Average and Marginal Revenue Curves, Relationship between Revenue curves

MODULE V MARKET STRUCTURE 15

Perfect Competition: Introduction and features of Perfect Competition, Short Run and long run equilibrium

Monopoly: Introduction and features, Price discrimination, Price and output decisions of discriminating monopolist., Types of monopoly, Price and output determination in

short run and long run

Monopolistic Competition: Introduction to monopoly and its features, Price and output determination in short and long run, Role of advertising in monopolistic competition.

L – 52; T – 13; TOTAL HOURS – 65

TEXT BOOK:

1. Business Economics-S Sankaran, Margam Publication
2. Business Economics-Lekhi- Kalyani publications

REFERENCES:

1. Managerial economics: an integrative approach by hirshey, mark, cengage learning
2. Micro economics by Salvatore dominick, oxford university press
3. Advanced economic theory. micro economic analysis by aujah.l, s. chand& company

OUTCOMES:

Through this course students should be able to

- understand basic concepts of economic applied in managerial decision making
- analyse the demand and supply conditions and assess the position of a comapny
- understand the determinants of consumer choices, including inter-temporal choices and those involving risk.
- describe how firm's behavior differs in different market structures and may help to determine those structures.
- Integrate the knowledge of the economic theory with decision-making techniques

COC 1204	DATABASE MANAGEMENT SYSTEM	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To analyze the large amount of data in meaningful way and quickly.
- To be able to demonstrate the proficiency in Access, executing powerful analysis on large database.
-

MODULE I **13**

Basics of Data, Information, Introduction of Data, Database, & Database Management System, Advantages of Computerized Data Base, Various View of Data, Data Independence, Database Schema and Subschema, Data Models, Introduction to Various Models, Database Languages, DDL, DML, DCL, Database Administrator, Functions of DBA, Role of DBA, Data Base User, Various Types of Database User, E-R Model, E-R Diagram, Keys: Primary, Candidate Key, Super Key, Key Candidate, Foreign Key

MODULE II **15**

Access Concepts and Terms, Starting and Quiting Access, Database Tables, Relational Database Management System, Relational Database and its Advantages, Relational Database and its Advantages, Parts of Access Window

Database Tables, Relational Database, Records and Fields, Tables, Creating Database, Fields Controls and Objects, Queries, Creating and run Queries, Introduction of Dynasets, Forms, Reports, Properties, Wizard, Macro, Advantages of Macros, Hardware & Software Requirements for MS Access

MODULE III **14**

Creating Database, Creating Database With Wizard, Creating Database Without Wizard, Field Name and Field Properties, Various Data Types and Use, Properties of Various Data Types, Adding Fields in to Existing Tables, Removing Fields From Existing Tables, Renaming Fields, Renaming Field's Caption, Resizing Fields, Freezing Columns, Primary Key Field, Indexing Fields

MODULE IV **8**

Forms, Use, Form Creation, Creating, Saving, and Modifying Forms, Entering and Editing Data Via Forms, Finding Data,Sorting Data, Displaying Data,Dynaset

Queries, Creating and run Queries, Creating Select Query,Using Select Query, Using Wild Cards in Select Query

10

MODULE V

Reports: Creating Reports, Previewing and Printing Reports, Modifying and Saving Reports, Relational Database: Definition & Purpose, Creating Relational Database, Viewing and Deleting Expressions, Data Models, Creating Database
Keys, Queries

TOTAL HOURS – 60

TEXT BOOK:

1. Michael Alexander, Microsoft Access 2007 Data Analysis, Wiley Publishing, Inc.

REFERENCES:

1. Michael Alexander and Dick Kusleika, Access® 2013 Bible, John Wiley & Sons, Inc
2. Michael Alexander, Microsoft Access 2007 Data Analysis, Wiley Publishing, Inc

OUTCOMES:

After studying this course students will able to

- Manage large data of business effectively
- Generate different type of reports from the large data effectively

COC 1205	BUSINESS ENVIRONMENT	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To enable the students to have an overview of Business Environment – Political, social and Global.
- To enable the students to appreciate the importance of environment and its impact on business and society

MODULE I INTRODUCTION 6

Definition and meaning of business – Scope of Business – Characteristics of Business – Business goals – Business during the 21st century - Knowing the environment – Factors influencing the Indian Business Environment – Environmental Analysis.

MODULE II ECONOMIC ENVIRONMENT 5

Economic Environment – Nature of the Economy – Structure of the Economy – Economic policies & planning the economic conditions.

MODULE III POLITICAL ENVIRONMENT 5

Political & Government Environment – Functions of the state – Economic Roles of the government – Government and Legal Environment – The constitutional Environment.

MODULE IV SOCIAL ENVIRONMENT 5

Social Environment – Business and Society Ecology and Consumerism), Consumer rights – Business Ethics – Social Responsibility of Business towards stakeholders – Natural Environment and Ecology.

MODULE V GLOBAL ENVIRONMENT 5

Global Environment – globalisation – Meaning and Rationale for globalisation – the role of WTO – GATT – trading blocks in globalisation – Impact of globalisation on India

TOTAL HOURS –26

TEXT BOOK:

1. S.Sankaran, Business Environment, Margham Publications, Chennai, 2002

REFERENCES:

1. K.Aswathappa, Essentials of Business Environment, Himalaya Publishing House,New Delhi, 2001.
2. Raj Agarwal, Business Environment, Excel Books,New Delhi, 2000
3. Dr. Francis Cherunilam, Business Environment, Himalaya Publishing House, New Delhi, 2003.

OUTCOMES:

After studying this course students will able to

- Analyze the various factors affecting the business environment
- Understand the social responsibility of business towards different interest groups
- describe the recent developments in Indian Economy that have greatly influenced the working of business units in India
- Understand the Global business Scenario and the impact of Globalisation in India

LNC 1285	அடிப்படைத் தமிழ் I / BASIC TAMIL I	L	T	P	C
		2	0	0	2

பன்னிரண்டாம் வகுப்புவரை தமிழ் பயிலாத மற்றும் கல்லூரியில் பகுதி-1ல் தமிழ் பயிலாத அனைத்து இளநிலை பயில் மாணவருக்கும் உரியது.

Basic Tamil is offered to all UG students those who have not studied Tamil Up to XII standard and have taken a non-Tamil Language under Part I

நோக்கங்கள்

- தமிழ்மொழியை அடிப்படைநிலையில் பேசவும் படிக்கவும் எழுதவும் மாணவர்களை ஆயத்தப்படுத்துதல்.
- தமிழ்மொழி மற்றும் தமிழ் பண்பாட்டை விளங்க வைத்தல்
- நடைமுறை வாழ்வியலுக்கான தமிழ்ச்சொற்களை அறிய வைத்தல்
- ❖ To equip the students to speak, read and write Tamil at the basic level
- ❖ To make them understand the features of Tamil Language and Tamil culture.
- ❖ To familiarize every day usage words in Tamil

அலகு I **6**

உயிரெழுத்துக்கள் (Vowels) - மெய்யெழுத்துக்கள் (Consonants) - உயிர் மெய்யெழுத்துக்கள் (Vowel consonants) - கிரந்த எழுத்துக்கள் (Grantha Letters)

அலகு II **6**

பெயர்ச்சொல் (Noun) - வினைச்சொல் (Verb) - பிரதிபெயர் (Pronoun) - பெயரடை (Adjective) - வினையடை (Adverb)

அலகு III **6**

திணை (Human / Non Human) - பால் (Gender) - எண் (Singular / Plural) - இடம் (First / Second / Third Person) - காலம் (Tense)

அலகு IV **6**

எண்கள் (Numbers) - உறவுப்பெயர்கள் (Kinship Terms) - வாரத்தின் நாட்கள் (week days) - இயற்கை (Nature) - உடல் உறுப்புகள் (Parts of the body) - பயன்பாட்டுப் பொருட்களின் பெயர்கள் (Everyday usage words)

அலகு V **2**

பிழைநீக்கி எழுதுதல் (Spot the error) - அகர வரிசைப்படுத்துதல் (Arrange in Alphabetical order) - எதிர்ச்சொல் அறிதல் (Antonyms)

L – 26 ; TOTAL HOURS – 26

குறிப்புகள்

1. தமிழ்மொழி அறிமுகம் - முனைவர் ப. டேவிட்பிரபாகர், விவி வெளியிடு, பதிப்பு-2004.
2. தமிழில் நீங்களும் பிழையில்லாமல் எழுதலாம் - முனைவர் பொற்கோ, புதுவாழ்வு பதிப்பகம், பதிப்பு – 1992.
3. பிழையின்றி நல்லதமிழ் எழுதுவது எப்படி? ஸ்ரீ சந்திரன், தமிழ்நிலையம், பதிப்பு – 2007.
4. Hand Book Tamil – Dr. S. Jean Lawrence, Dr. D. Ranganathan, International Institute of Tamil Studies – 1988.
5. www.Tamilvu.org

வெளிப்பாடு

- தமிழ்மொழி மற்றும் தமிழ் பண்பாட்டை விளங்க வைத்தல்
- நடைமுறை வாழ்வியலுக்கான தமிழ்ச்சொற்களை அறிய வைத்தல்

LNC 1286	சிறப்புத் தமிழ் I / ADVANCED TAMIL I	L T P C 2 0 0 2

பத்தாம் வகுப்பு மற்றும் பன்னிரண்டாம் வகுப்புவரை தமிழ் பயின்று கல்லூரியில் பகுதி-1ல் தமிழ் பயிலாத மாணவர்களுக்கு உரியது.

நோக்கங்கள்

- தமிழ்மொழி மற்றும் தமிழ் பண்பாட்டை விளங்க வைத்தல்
- நடைமுறை வாழ்வியலுக்கான தமிழ்ச்சொற்களை அறிய வைத்தல்

அலகு I **செய்யுள்** **8**

யோகசித்தி – பாரதியார் - நீங்களே சொல்லுங்கள் - பாரதிதாசன் - போராட்டம் - முதுமை – அப்துல் ரகுமான் - தேசபிதாவுக்கு ஒரு பாடகன் அஞ்சலி – மேத்தா - தொலைந்து போனது - ஆண்டாள் பிரிதர்ஷினி - அலிகள் - ந. காமராசர்

அலகு II **சிறுகதை** **3**

ஜெயகாந்தன் - பால்வடியும் முகம் - பி.எஸ்.ராமையா – பணம் பிழைத்தது

அலகு III **இலக்கிய வரலாறு** **5**

கவிதை, சிறுகதை, நாவல்

அலகு IV **மொழித்திறன்** **5**

பிறமொழிச் சொற்களுக்கு இணையான தமிழ்ச்சொற்கள் - கலைச் சொல்லாக்கம் - பழைதிருத்தம்

அலகு V **படைப்பிலக்கியம்** **5**

கவிதை எழுதுதல், சிறுகதை வரைதல்

L – 26 ; TOTAL HOURS – 26

குறிப்புகள்

1. செய்யுள், உரைநடை
2. தமிழ் இலக்கிய வரலாறு - சோம. இளவரசு
3. சிறுகதைத் தொகுப்பு (கட்டுரைக்களஞ்சியம்)

வெளிப்பாடு

- மாணவர்கள் சமூக மாற்றச் சிந்தனைகளை அறிந்துகொள்வர்
- சந்திப்பிழைகளை நீக்கி எழுதும் திறன் பெறுவர்
- புத்திலக்கியங்களைப் படைக்கும் திறனையும் திறனாய்வு செய்யும் திறனையும் பெறுவர்

SEMESTER III

COC2101	CORPORATE ACCOUNTING - I	L	T	P	C
		4	2	0	5

OBJECTIVES:

- To facilitate the understanding of Corporate Accounting in General
- To give a comprehensive understanding of the system of Corporate Accounting
- To develop skill, related to critical thinking and problem solving
- To facilitate the understanding of the format of P&L account and B/S of the companies as per new schedule with reference to all chapters

MODULE I ISSUE OF SHARES AND DEBENTURES 15

Issue of shares and debentures – various kinds of issues – forfeiture – re-issue – underwriting of shares and debentures.

MODULE II REDEMPTION OF PREFERENCE SHARES AND DEBENTURES 15

Redemption of preference shares and debentures – purchase of business – profits prior to incorporation – Treatment of profit or loss prior to incorporation.

MODULE III COMPANY FINAL ACCOUNTS 15

Preparation of company final accounts – company balance sheet preparation – computation of managerial remuneration.

MODULE IV VALUATION OF GOODWILL AND SHARES 15

Valuation of good will and shares – Factors affecting value of goodwill – Methods of valuation of shares – Computation of valuation of goodwill and shares.

MODULE V INTERNAL RECONSTRUCTION 18

Alteration of share capital – internal reconstruction and reduction of capital – different kinds of alteration of share capital – Procedure for alteration reducing share capital – Accounting entries for alteration and reduction of share capital.

L – 52; T – 26; Total Hours –78

TEXT BOOKS:

1. T.S. Reddy & Murthy, “Corporate Finance”, Margham Publications, Reprint, 2013.

REFERENCES:

1. Dr. S. Kr.Paul&Chandri Paul, “Corporate Finance”, New Central Book Agency (p) Ltd, 2009.
2. K. K. Varma, “Corporate Accounting”, Published by Anurag Jain for Excel Books, First Edition, 2008.
3. Dr. Naseem Ahmed, “Corporate Accounting”, Atlantic Publication, First Edition, 2007

OUTCOMES:

After completing the course the students would be able to

- Understand the features of Shares and Debentures
- Develop an understanding about redemption of Shares and Debenture and its types
- Gets an exposure to the company final accounts and Goodwill
- Effectively use an idea about internal reconstruction

COC2102	COMPANY LAW	L	T	P	C
		4	1	0	5

OBJECTIVES:

- To make students aware of the provisions of the companies Act, 1956 this would help item to float a company and to manage the affairs of the company effectively.

MODULE I INTRODUCTION TO COMPANY ACT 2013 13

Introduction-Company definition-Characteristics-Types of companies-Features of public company and private company- Conversion of public company into private company-Companies registration -Lifting up of corporate veil.

MODULE II MEMORANDUM & ARTICLES 12

Memorandum of association-Contents-Alteration of memorandum- Articles of association –contents –Alteration of Articles –Doctrine of Constructive notice – Doctrine of Indoor Management - Prospectus.

MODULE III MEETINGS 12

Introduction-Definition-General meeting of shares holders-Statutory meeting-Annual general meeting-Extraordinary general meeting Class meeting-Quorum for meeting-Proxy-Resolution-Minutes.

MODULE IV DIRECTORS 13

Board of directors-Appointment of directors-Appointment of directors by small shareholders -Appointment of additional director, alternate directors, nominee directors Women Directors - Powers & Duties of directors-Vacation of office of directors-Register of director-Removal of directors.

MODULE V WINDING UP 10

Dissolution of company-Winding up by court-Voluntary Winding up-.General provisions on Winding up

L – 52; T – 13; Total Hours –65

TEXT BOOKS:

1. N.D.Kapoor – Company Law

REFERENCES:

1. P.P.S.Gogna – A Text Book of Company Law

2. A.K. Majumdar and G.K. Kapoor Company Law & Practice, Taxman Publications
3. P.K.Ghosh & Dr.V.Balachandran – Outline of Company Secretary Practice

OUTCOMES:

On completion of the course, students will be able to

- Acquainted with the company act 2013 and their practical application in managing the company.
- Familiar in the provision of Memorandum & Articles of the Company.
- Acquire knowledge of various procedures of Meetings of the Company
- Get a deep insight in appointment of Directors of the company and Winding up of the Company

COC2103	MARKETING MANAGEMENT	L	T	P	C
		4	2	0	5

OBJECTIVES:

- To acquaint the students with the basics of marketing to make them understand the consumer behaviour and buying motives.
- To equip students with Product and Pricing Knowledge
- To impart knowledge on Sales Forecasting.

MODULE I INTRODUCTION 15

Nature Scope and importance of marketing – marketing approaches – Role of marketing – Various environmental factors affecting marketing functions – concept of marketing mix – Market – meaning types of market.

MODULE II CONSUMER BEHAVIOUR 15

Consumer Behavior – Meaning and its importance – factors influencing Buying Behavior Buying motives.

MODULE III PRODUCT 18

Products –Classifications of products – Product characteristics – new product development process – product life cycle – product positioning, Targeting, Branding and Packaging – Market segmentation – needs and basis of segmentation.

MODULE IV PRICING 15

Pricing – Objection of pricing, pricing policies and procedures, Factors influencing pricing decision – importance of distribution, Various kinds of marketing channels.

MODULE V SALES FORECASTING 15

Sales forecasting – Various methods of sales forecasting sales management – Motivation and Compensation of salesman – Personal selling – Direct selling – Sales promotion – An overview of Advertising, Publicity and public Relations.

L – 52; T – 26; Total Hours –78

TEXT BOOKS:

1. Philp Kotler, “Marketing Management”, Pearson Education, 06-Jan-2015.
2. Slanton , W.J. “Fundamentals of Marketing”, McGraw-Hill, 01-Jan-1994.

REFERENCES:

1. Rajan Nair, “Marketing Management”, Sultan Chand & Sons, 01-Jan-1995

2. Ramaswany Namakumari, “Marketing Management”, Macmillan India Limited, 2002.

OUTCOMES:

After completing the course the students would be able to

- Develop an idea about marketing and its functions
- Enhance the students on consumer behaviour
- Familiarize students about product and its classifications
- Make them understand pricing policies
- Get an exposure on the concept of sales forecast

COC2104	ENTERPRENEURSHIP DEVELOPMENT	L	T	P	C
		4	1	0	5

OBJECTIVES:

- To enrich the students towards the knowledge of entrepreneurial skills
- To make the students understand the approaches to attain the goals of the business.

MODULE I INTRODUCTION 13

Entrepreneurship – Meaning – Definition – Types – Entrepreneur – Definition – Entrepreneur and Entrepreneurship – Characteristics - Types – Functions – Factors Influencing Entrepreneurship – Role of Entrepreneur in Economic Development – Factor Affecting Entrepreneurial Growth – Development of Women Entrepreneur and Rural Entrepreneurs.

MODULE II ENTREPRENEURIAL DEVELOPMENT PROGRAMME 12

Entrepreneurial Development Programmes (EDP's) – their Relevance and Achievement – Phases Of EDP – Course Content EDP – Role Of Government in Organizing EDP's – Critical Evaluation.

MODULE III PROJECT FORMULATION 12

Project Formulation – Importance of Project formulation - Project Identification – Process of Project identification - Evaluation – Feasibility Analysis – Project Report.

MODULE IV EDP SCHEMES 13

Entrepreneurial Development Agencies – Commercial Banks – District Industries Centers (DIC's) – National Small Industries Corporation (NSIC) – Small Industries Development Organization (SIDO) – Small Industries Service Institute (SISI) – All India Financial Institution – IDBI, IFCI, ICICI, IRDBI.

MODULE V ENTERPRENEURIAL GROWTH 10

Economic Development and Entrepreneurial Growth – MSME – Definition – Importance – Role in Economic Growth – Incentives and Subsides of Government to MSME – Networking - Niche Play – Geographic Concentration – Franchising and Dealership.

L – 52; T – 13; Total Hours –65

TEXT BOOKS:

1. C.S.V. Murthy, " Entrepreneurial Development", Himalaya publishing house, 2015.

REFERENCES:

1. Dr.S.S. Khanka, "Entrepreneurial Development", S. Chand & Company (pvt).Ltd, 2014.
2. Sami Uddin, "Entrepreneurial development in India", Mittal Publications, First Edition, 1989.

OUTCOMES:

After completing the course the students would be able to

- Develop students about Entrepreneurship development
- Create awareness on various Entrepreneurship Development Programme III. To enable them to understand project formulation
- Familiarize the students with EDP schemes
- Give an introduction about MSME, EDI and other training institutes in Entrepreneurship

COC2105 BUSINESS STATISTICS - I

L	T	P	C
5	1	0	5

OBJECTIVES:

- To develop skills in analysis & interpretation of data
- Handle challenging problems using appropriate analysis tools

MODULE I INTERPRETATION OF STATISTICAL DATA 15

Introduction – Classification and tabulation of statistical data - Diagrammatic and graphical representation of data

MODULE II INTERPRETATION OF STATISTICAL DATA 15

Measures of Central tendency –Mean, median and mode – Dispersion , Range, Quartile Deviation, Mean Deviation , Standard Deviation – Measures of Skewness.

MODULE III CORRELATION AND REGRESSION 15

Karl Pearson's Coefficient of Correlation – Spearman's Rank Correlation – Regression Lines and Coefficients

MODULE IV TIME SERIES 15

Time Series Analysis – Trend – Seasonal Variation.

MODULE V PROBABILITY 18

Probability – Addition and Multiplication Theorem – Conditional probability – Bayer's Theorem (without proof) – Simple problems.

L – 52; T – 26; Total Hours –78

TEXT BOOKS:

1. Statistical Methods – S.P. Gupta, Sultan Chand & Sons

REFERENCES:

1. Introduction to Operations Research – Dr. P.R. Vittal, Margham Publications
2. Fundamentals of Statistics -Elhance D.N. KitabMahal
3. Operations Research – Hira and Gupta, S. Chand & Co.
4. Operations Research – Handy and H.A. Taha, Macmillan Publishers.

OUTCOMES:

On the successful completion of the course the students should have:

- Tabulate and classify various statistical data
- To analyse data using various statistical tools
- To have knowledge on correlation and Regression.

COC 2106 OFFICE MANAGEMENT L T P C

2 0 0 2

OBJECTIVES:

- To provide students with the knowledge, understanding and application of the concepts, competence and responsibilities associated with office organization, system, procedures and administration.
- To provide students with good business awareness, decision-making and time management skills so as to enable them to hold responsible office administrative positions.
- To help students develop accuracy, flexibility, commitment and initiative.

MODULE I INTRODUCTION 5

Office management – Meaning – Elements of office management – Functions of office management.

MODULE II OFFICE ORGANIZATION 6

Office organization – Definition, Characteristics and Steps – Types of Organization – Functions of an Office administrator

MODULE III RECORD MANAGEMENT 5

Office record management – Importance – Filing essentials –Classification and arrangement of files-Modern methods of filing-Modern filing devices

MODULE IV OFFICE COMMUNICATION 5

Office Communication – Correspondence–Meaning of office communication & mailing

MODULE V FORM LETTERS & REPORT WRITING 5

Form letters –Meaning, Principles, and Factors to be considered in designing office forms – Report writing -Types of report writing

TOTAL HOURS-26

TEXT BOOK:

1. Office Management by S.P.Arora, Vikas Publications.

REFERENCES:

1. Fundamentals of office management – by J.P.Mahajan
2. Office Management – R.S.N.Pillai & Bagavathi- S.Chand.

3. Office Management – R K Chopra , Himalaya Publication

OUTCOMES:

Through this course students should be able to

- Identity the various elements of Office Management
- Analyze the various functions of an Office Administrator
- Understand the various office communication techniques
- Identify the various Office Communication in the environment

LNC 1285	அடிப்படைத் தமிழ் II / BASIC TAMIL II	L	T	P	C
		2	0	0	2

பன்னிரண்டாம் வகுப்புவரை தமிழ் பயிலாத மற்றும் கல்லூரியில் பகுதி-1ல் தமிழ் பயிலாத அனைத்து இளநிலை பயில் மாணவருக்கும் உரியது.

Basic Tamil is offered to all UG students those who have not studied Tamil Up to XII standard and have taken a non-Tamil Language under Part I

நோக்கங்கள்

- தமிழ்மொழியை அடிப்படைநிலையில் பேசவும் படிக்கவும் எழுதவும் மாணவர்களை ஆயத்தப்படுத்துதல்.
- தமிழ்மொழி மற்றும் தமிழ் பண்பாட்டை விளங்க வைத்தல்
- நடைமுறை வாழ்வியலுக்கான தமிழ்ச்சொற்களை அறிய வைத்தல்
- ❖ To equip the students to speak, read and write Tamil at the basic level
- ❖ To make them understand the features of Tamil Language and Tamil culture.
- ❖ To familiarize every day usage words in Tamil

அலகு I **6**

எழுவாய் (Subject) - பயனிலை (Verb) - செயப்படுபொருள் (Object) - உடன்பாட்டு வாக்கியம் (Affirmative sentence) - எதிர்மறை வாக்கியம் (Negative Sentence) - வினா வாக்கியம் (Interrogative Sentence)

அலகு II **6**

தமிழ் இலக்கியங்கள் மற்றும் புலவர்கள் அறிமுகம் - (Introduction to Tamil Literature and Poets) - தமிழ்மொழியின் செம்மொழித்தகுதி (Tamil Language as Classical Language) - தமிழகச் சுற்றுலாத்தலங்கள் (Tourist places in Tamil Nadu)

அலகு III **6**

திணை (Human / Non Human) - பால் (Gender) - எண் (Singular / Plural) - இடம் (First / Second / Third Person) - காலம் (Tense)

அலகு IV **6**

தமிழர் உணவு (Tamil Food) - தமிழர் விழாக்கள் (Tamil Festival) - தமிழர் நடனம் (Tamil Dance)

அலகு V **2**

உரையாடல் எழுதுதல் (Dialogue Writing) - மொழிபெயர்ப்பு செய்தல் (Translation)- நாளிதழ் படிக்க பயிற்சி தருதல் (Practice on reading Newspaper)

L – 26 ; TOTAL HOURS – 26

குறிப்புகள்

1. தமிழ்மொழி அறிமுகம் - முனைவர் ப. டேவிட்பிரபாகர், விவி வெளியிடு, பதிப்பு-2004.
2. தமிழில் நீங்களும் பிழையில்லாமல் எழுதலாம் - முனைவர் பொற்கோ, புதுவாழ்வு பதிப்பகம், பதிப்பு – 1992.
3. பிழையின்றி நல்லதமிழ் எழுதுவது எப்படி? ஸ்ரீ சந்திரன், தமிழ்நிலையம், பதிப்பு – 2007.
4. Hand Book Tamil – Dr. S. Jean Lawrence, Dr. D. Ranganathan, International Institute of Tamil Studies – 1988.
5. www.Tamilvu.org

வெளிப்பாடு

- தமிழ்மொழி மற்றும் தமிழ் பண்பாட்டை விளங்க வைத்தல்
- நடைமுறை வாழ்வியலுக்கான தமிழ்ச்சொற்களை அறிய வைத்தல்

LNC 1286	சிறப்புத் தமிழ் II / ADVANCED TAMIL II	L	T	P	C
		2	0	0	2

பத்தாம் வகுப்பு மற்றும் பன்னிரண்டாம் வகுப்புவரை தமிழ் பயின்று கல்லூரியில் பகுதி-1ல் தமிழ் பயிலாத மாணவர்களுக்கு உரியது.

நோக்கங்கள்

- தமிழ்மொழி மற்றும் தமிழ் பண்பாட்டை விளங்க வைத்தல்
- நடைமுறை வாழ்வியலுக்கான தமிழ்ச்சொற்களை அறிய வைத்தல்

அலகு I **செய்யுள்** **8**

சங்க இலக்கியம் - புறம் 2 அகம் 2 - சிலப்பதிகாரம் - அடைக்கலக்காதை (தெரிவு செய்யப்பட்டவை) - திருக்குறள் - 1 - திருமந்திரம் - 3 பாடல்கள் - இயேசு காவியம் - கசப்புறு பாத்திரம் (தெரிவு செய்யப்பட்டவை) - சீறாபுராணம் - மானுக்குப் பிணை நின்ற படலம் (தெரிவு செய்யப்பட்டவை) - குற்றாலக்குறவஞ்சி – சிங்கன் சிங்கி உரையாடல்

அலகு II **உரைநடை** **3**

எது வாழ்க்கை, அறிவியலும் இலக்கியம்

அலகு III **இலக்கிய வரலாறு** **5**

எட்டுத்தொகை, பத்துப்பாட்டு

அலகு IV **பயன்பாட்டுத்தமிழ்** **5**

கடிதம் எழுதுதல் - கட்டுரை எழுதுதல் - தமிழ் இணையதளங்கள் அறிதல்

அலகு V **மொழிப்பயிற்சி** **5**

வல்லினம் மிகுமிடங்கள் - மிகாவிடங்கள் - மொழிபெயர்ப்பு

L – 26 ; TOTAL HOURS – 26

குறிப்புகள்

1. செய்யுள், உரைநடை
2. தமிழ் இலக்கிய வரலாறு - சோம. இளவரசு
3. சிறுகதைத் தொகுப்பு (கட்டுரைக்களஞ்சியம்)

வெளிப்பாடு

- மாணவர்கள் சமூக மாற்றச் சிந்தனைகளை அறிந்துகொள்வர்
- சந்திப்பிழைகளை நீக்கி எழுதும் திறன் பெறுவர்
- புத்திலக்கியங்களைப் படைக்கும் திறனையும் திறனாய்வு செய்யும் திறனையும் பெறுவர்

SEMESTER IV

		L	T	P	C
COC2201	**ADVANCED CORPORATING ACCOUNTING**	**4**	**2**	**0**	**5**

OBJECTIVES:

To introduce students to the changes in the preparation of Banking and Insurance Company Accounts and the relevance of Accounting Standards in Company Accounts.

MODULE I ACCOUNTS RELATING TO AMALGAMATION, ABSORPTION AND EXTERNAL RECONSTRUCTION OF COMPANIES **15**

Amalgamation – Absorption and External Reconstruction of a Company – Purchase Consideration – Methods of Accounting – Accounts for closing the books of the Vendor Company – journal entries in the books of the purchasing company.

MODULE II ACCOUNTS OF BANKING COMPANIES **15**

Final Accounts of Banking Company – Preparation of Profit and Loss Account – Balance Sheet – Preparation of Schedules.

MODULE III ACCOUNTS OF INSURANCE COMPANIES **15**

Final Accounts of Insurance Company – Preparation of Final Accounts of Life Insurance and General Insurance – Revenue Account – Profit and Loss Account and Balance sheet.

MODULE IV LIQUIDATION OF COMPANIES **15**

Liquidation – Meaning and Definition – Modes of Winging Up – Statement of Affairs and Deficiency Account – Liquidator's Final Statement of Accounts.

MODULE V HOLDING COMPANY ACCOUNTS **18**

Holding Company- Subsidiary Company – capital Profit – Revenue Profits –Minority Interest – Cost of Control – Mutual Owings – Preparation of Balance sheet - Consolidated.

L – 52; T – 26; Total Hours –78

TEXT BOOKS:

1. T.S. Reddy & Murthy, "Corporate Finance", Margham Publications, Reprint, 2013.

REFERENCES:

1. Dr. S. Kr.Paul&Chandri Paul, “Corporate Finance”, New Central Book Agency (p) Ltd, 2009.
2. K. K. Varma, “Corporate Accounting”, Published by Anurag Jain for Excel Books, First Edition, 2008.
3. Dr. Naseem Ahmed, “Corporate Accounting”, Atlantic Publication, First Edition, 2007

OUTCOMES:

After completing the course the students would be able to

- Get knowledge about Amalgamation, Absorption and External reconstruction of Companies.
- Prepare banking companies accounts.
- gain knowledge about insurance company accounts
- Understand the role of liquidation of company.
- Know about holding company and subsidiary company.

COC2202 **FINANCIAL MANAGEMENT**

L	T	P	C
5	1	0	5

OBJECTIVES:

To introduce the students to the activity – gritty of financial management to understand the role of financial manager to give them an input into various concepts like capital structure planning cost of capital, dividend policies and working capital which will be foundation if they go for management studies.

MODULE I FINANCE FUNCTIONS 15

Finance function and its importance in business – Role of the finance Manager – Goals of Financial Management – Time Value of Money.

MODULE II WORKING CAPITAL 15

Working capital management – Working capital policy – cash management – Credit management – inventory management.

MODULE III CAPITAL BUDGETING AND COST OF CAPITAL 15

Capital Budgeting – Basics of Capital Budgeting – Cost of Capital: Cost of equity- Cost of debentures – Cost of preference shares – Cost of other sources of capital.

MODULE IV DIVIDEND POLICIES 15

Dividend policies – Factors affecting dividend payment – Company law provisions on dividend payment – Various Dividend models (Walter's Gordon's – M.M. Hypothesis)

.

MODULE V CAPITAL STRUCTURE 18

Capital structure decision – EBIT – EBT analysis – Factors affecting Capital Structure Determining Debt and equity proportion – Theories of capital structures – Leverage – Operational – Financial – Composite leverage

L – 65; T – 13; Total Hours –78

TEXT BOOKS:

1. Prasanna Chandra – Fundamentals of Financial Management, TMH

REFERENCES:

1. I.M. Pandey , "Financial Management", Vikas Publishing House Pvt Ltd, 01-Nov-2009
2. P.c. Kulkarni, "Financial Management", B.G. Sathyaprasad, Himalaya

Publications, 2004.
3. Dr..V.R.Palanivelu, “Financial Management”, S.Chand Publication,2010

OUTCOMES:

After completing the course the students would be able to

- Learn important and functions of finance.
- Gain information about capital structure.
- Know about cost of capital and WACC.
- Learn dividend policy.
- Know about working capital management.

COC2203 BANKING THEORY, LAW & PRACTICE

L	T	P	C
4	0	1	5

OBJECTIVES:

- To familiarize students in Banking Regulation Act 1949 and banking activities.
- To equip students with the Relationship with bankers and customers
- To create awareness on E- Banking and services
- To give information on how funds are transferred.

MODULE I INTRODUCTION **12**

Origin and development of banks- Banking Regulations Act 1949- Definition of Banking, Licensing – opening of branches- importance and functions of banks – inspection. Commercial banks- Universal banking.

MODULE II DEPOSITS AND ADVANCES **13**

Central bank – Reserve bank of India – Objectives – organization – functions – monetary policy – credit control measures and their effectiveness. Management of Deposits and advances- classification and nature of deposit accounts and advances, - principles of sound bank lending.

MODULE III NEGOTIABLE INSTRUMENTS **13**

Relationship between banker and customer- special types of bank customers - Negotiable instruments – definition – features – promissory note, bill of exchange and cheque- holder and holder in due course- crossing of cheque –Types of crossing – Endorsement –Negotiation & Dishonour and discharge of Negotiable instrument – protection of collection banker and paying banker.

MODULE IV E-BANKING **12**

Meaning - Benefits – Internet Banking Services – Drawbacks – Mobile Banking – Features – Drawbacks – ATM –Features – Benefits – Challenges – Credit Cards – Benefits – Constraints – cash deposit machine CDM, coin vending machine, MICR Cheques – Benefits.

MODULE V ELECTRONIC FUND TRANSFER (EFT) **10**

Electronic Fund Transfer (EFT) - RBI Guidelines – Benefits of Electronic Clearing Systems – E-Cheques – E-Money – Real Time Gross Settlement (RTGS) – Benefits to Banker and Customer – Cheque Transaction – Core Banking Solutions (CBS) –

Benefits – Single Window Concepts – Features. Demate account –ASBA

L – 52; T – 13; Total Hours –65

TEXT BOOKS:

1. KPM Sundharam & PN Varhney (2010) Banking theory law and practice, Sultan Chand & Sons, Publication, New Delhi.

REFERENCES:

1. Banking and Financial Systems – B. Santhanam (Margham Publishers)
2. Banking Law Theory and Practice – S.N. Maheswari – Kalyani Publications
3. Indian Banking – Parameswaran – S. Chand and Co.
4. Banking Law Theory and Practice – Tanon
5. Banking Law Theory and Practice – Sherlaker & Sherlaker

OUTCOMES:

After completing the course the students would be able to

- Get familiarized on banking system
- Acquires knowledge on banker and customer relationship
- Get awareness on E-Banking Services
- Can gain of information on fund transferring

COC2204	FINANCIAL MARKETS & SERVICES	L	T	P	C
		4	0	1	5

OBJECTIVES:

- To know about the various financial services and market.
- To get awareness of the credit rating and its operations.
- To learn about the mutual fund services to the people.
- To get insight knowledge in Leasing and Hire purchase functions to the society.
- To know about the concept of Dematerialization.
- To gain knowledge of the Factoring and forfaiting services.

MODULE I INTRODUCTION TO FINANCIAL SERVICES 10

An overview of financial system in Markets – Objectives of financial system – Types of financial services – Regulation of Financial services – Problems and Prospects of Financial service sector.

MODULE II INTRODUCTION TO FINANCIAL MARKET 10

Management of NIM – Secondary market Vs NIM - Functions of Stock exchanges –– National Stock Exchanges – OTCEI- Non Banking Financial Institutions - SEBI Functions and Workings - Listing of securities.

MODULE III CREDIT RATING, FACTORING & FORFAITING 15

Credit Rating:

Definition- Features – Advantages – Credit rating system (Growth Factors) – Global Credit Rating agencies – Rating agencies in India (CRISIL, IICRA, CAREDCR) - Credit rating symbols – Credit rating process and its limitations, - SEBI Guidelines – Future credit rating in India.

Factoring & Forfaiting:

The concept – significance – types – factoring mechanism – factoring in India. Forfaiting - Definition – Factoring Vs Forfaiting – Problems and prospects of forfaiting.

MODULE IV LEASING AND HIRE PURCHASE 15

Leasing: The concept –Types of lease – Structure of leasing industry – Legal aspects – Problems and prospects.

Hire purchase: Meaning – Hire purchase –Leasing VS Hire purchase – Problems and prospects of hire purchase in India.

MODULE V **MUTUAL FUNDS, DEMATERIALISATION & REMATERIALISATION:** **15**

Mutual Funds: Meaning – Classification – Functions – Importance – Risk involved in M.F) – Commercial banks and Mutual Funds (includes UTI, LIC) -. General guidelines of M.F. – Future of mutual fund industry.

Dematerialisation & Rematerialisation:

Meaning – objective – Functions – Merits and Demerits – Progress of demat in India – NSDL & CDSL (Growth & Functioning)

L – 52; T – 13; Total Hours –65

TEXT BOOKS:

1. Gordon Natarajan - Financial Markets and Services – Himalaya publishing House

REFERENCES:

1. Banking & Financial System - B.Santhanam - Margham Publishers
2. Indian Financial Systems – Dr.S.Guruswamy
3. Vasant Desai, Indian Financial Systems, Himalaya Publishers

OUTCOMES:

After completing the course the students would be able to

- Learns about the various financial services and market
- Gets knowledge and ides on credit and mutual funds.
- Acquire knowledge on Leasing and Hire- purchasing
- Gets an insight on Dematerialization and factoring.

COC2205 BUSINESS STATISTICS - II

L	T	P	C
5	1	0	5

OBJECTIVES:

- To develop skills in analysis & interpretation of data
- Handle challenging problems using appropriate analysis tools

MODULE I INTRODUCTION TO OPERATION RESEARCH 15

Introduction to OR –Meaning & Scope –Characteristics-models in OR. LPP-formulation graphical method-simplex method (Simple Problems) - Big M method application in business- merits & demerits.

MODULE II ASSIGNMENT& TRANSPORTATION 15

Transportation model- basic feasible solution- formulation, solving a TP. Assignment models – Formulation – solution

MODULE III NETWORK ANALYSIS 15

Network analysis - work break down analysis – Construction - numbering of event. Time calculation - critical path, slack, float - application.

MODULE IV DISTRIBUTIONS 15

Discrete probability distributions- Binomial – Geometric- Poisson.
Continuous probability distributions - Uniform- Normal

MODULE V TESTING HYPOTHESIS 18

Testing hypothesis- testing of means and proportions-large and small samples- Z test and t test. Chi square distribution- Characteristics and application- test of goodness of fit and test of independence- Test of Homogeneity, F distribution- testing equality of population variances- Analysis of variance-one way and two way classification.

L – 52; T – 26; Total Hours –78

TEXT BOOKS:

1. Statistical Methods – S.P. Gupta, Sultan Chand & Sons

REFERENCES:

1. Introduction to Operations Research – Dr. P.R. Vittal, Margham Publications

2. Fundamentals of Statistics -Elhance D.N. KitabMahal
3. Operations Research – Hira and Gupta, S. Chand & Co.
4. Operations Research – Handy and H.A. Taha, Macmillan Publishers.

OUTCOMES:

On the successful completion of the course the students should have:

- Tabulate and classify various statistical data
- To analyse data using various statistical tools
- To have knowledge on correlation and Regression.

COC2206 COMMUNICATION SKILLS L T P C
2 0 0 2

OBJECTIVES:

- To equip students with networking system
- To make awareness among students on how to maintain public relation
- To familiarize with grievance handling procedure.
- To gain/ acquires skill on business correspondence

MODULE I PRESENTATION SKILLS 5

Presentations: (to be tested in tutorials only) 4 Principles of Effective Presentation Effective use of OHP Effective use of Transparencies How to make a Power-Point Presentation

MODULE II GROUP COMMUNICATION - I 5

Interviews : Group Discussion Preparing for an Interview, Types of Interviews – Selection, Appraisal, Grievance, Exit Meetings: Need and Importance of Meetings, Conduct of Meeting and Group Dynamics Role of the Chairperson, Role of the Participants, Drafting of Notice, Agenda and Resolutions

MODULE III GROUP COMMUNICATION - II 5

Conference: Meaning and Importance of Conference Organizing a Conference
Modern Methods: Video and Tele – Conferencing
Public Relations: Meaning, Functions of PR Department, External and Internal Measures of PR.

MODULE IV BUSINESS CORRESPONDENCE TRADE LETTERS 6

Order, Credit and Status Enquiry, Collection (just a brief introduction to be given) Only following to be taught in detail:- Letters of Inquiry, Letters of Complaints, Claims, Adjustments Sales Letters, promotional leaflets and fliers Consumer Grievance Letters, Letters under Right to Information (RTI) Act
[Teachers must provide the students with theoretical constructs wherever necessary in order to create awareness. However students should not be tested on the theory.]

MODULE V LANGUAGE AND WRITING SKILLS 5

Reports: Parts, Types, Feasibility Reports, Investigative Reports. Summarization: Identification of main and supporting/sub points presenting these in a cohesive manner

L – 26; T – 0; Total Hours –26

REFERENCES:

1. Alien, R.K.(1970) Organisational Management through Communication.
2. Balan,K.R. and Rayudu C.S. (1996) Effective Communication, Beacon New Delhi.
3. BoveeCourtland,L and Thrill, John V(1989) Business Communication, Today McGraw Hill, New York, Taxman Publication

OUTCOMES:

After completing the course the students would be able to

- Become familiar in office correspondence
- Learn and know as to how to maintain good Public Relationship
- Get awareness on how to face problems
- Familiarize to latest networking system.

SEMESTER V

		L	T	P	C
COC3101	**INCOME TAX LAW AND PRACTICE – I**	**4**	**2**	**0**	**5**

OBJECTIVES:

To introduce students to the basic concepts in Income-Tax. To help them to apply the provisions and complete incomes under various heads.

MODULE I INTRODUCTION TO INCOME TAX 15

Meaning of Income – Canons of Taxation and Income Tax values Act – Important definition Under Income Tax. Act – Residential status – Incidence of Tax of an Individual – Income exempted from tax.

MODULE II HEADS OF INCOME – INCOME FROM SALARY 15

Income From Salary – Allowance perquisites And Their Valuations – Profit in Lien of Salary – Deductions of Salary – Other Related Provisions – Gratuity – Pension – Communication of Pension – Provident Fund and Rebate.

MODULE III INCOME FROM HOUSE PROPERTY 15

Income from House Property – Annual Income – Reduction From Annual Income – Computation of Income From House Property Under Different Circumstances.

MODULE IV INCOME FROM BUSINESS OR PROFESSION 15

Income from Business or Profession – Allowable and Not Allowable Expenses – General Deductions – Computation of Taxable Income from Business or Profession.

MODULE V PROVISIONS RELATING TO DEPRECIATION 18

Depreciation – Meaning – Bases – Rates – Block of Assets – Unabsorbed – Depreciation – Provisions Relating to Depreciation.

L – 52; T – 26; Total Hours –78

TEXT BOOKS:

1. Dr Vinod K. Singhania, “Income Tax Law and Practice”, Taxmann Publications Pvt. Limited, 2005.

REFERENCES:

1. V.B. Gaur & Narang , “Income Tax Law And Practice”, Kalayani Publishers,2001.
2. T.S. Reddy & Y. Hari Prasad Reddy, “Income Tax Law and Practice” Margham Publications, 2008

OUTCOMES:

After completing the course the students would be able to

- Know about the provisions of the Income Tax Act of 1961.
- Get knowledge about heads of income very particular about salary income.
- Learn about capital gain.
- Learn about house property income.
- Get provisions of Income Tax Act for depreciation.

COC3102	COST ACCOUNTING	L	T	P	C
		4	2	0	5

OBJECTIVES:

To familiarize students with the basic concepts of cost and various methods and techniques of costing.

MODULE I INTRODUCTION 15

Cost accounting – Definition – Scope and Objectives of Cost Accounting – Cost Accounting Vs Financial Accounting – Advantages and Limitations of Cost Accounting – Installation of Cost Accounting System – Classification of Cost – Cost Centers and Profit Centers – Methods of Costing – Techniques of Types of Costing.

MODULE II PREPARATION OF COST SHEET 15

Cost Sheet – Tenders and Quotation – Reconciliation of Cost and Financial Accounts

MODULE III MATERIAL CONTROL AND PRICING METHODS 15

Material control – Meaning – Objectives – Essential – Advantages – Purchase control – Centralized Vs Decentralized purchasing – Advantages and Dis-advantages – Purchase procedure – Store Keeping and Stock control and inventory control – Meaning and importance – Duties And Responsibilities of Store Keeper – Centralized and Decentralized stores - Classification and codification of Materials – Stores Records – VED analysis – pricing of material issues FIFO, LIFO, HIFO, Market price, Base stock and Standard price Method.

MODULE IV REMUNERATION AND INCENTIVES 15

Labour Cost – Computation and Control – Labour Turnover – Time Keeping – Remuneration and Incentives – Time Rates System – Price Rate System – Premium and Bonus Plans – Treatment of Ideal Times an Overtime.

MODULE V OVERHEAD COST 18

Over Head Cost – Meaning And Definition - Importance of Over Head Cost – Classification of Over Head Cost – Allocation, Apportionment and Absorption and of Over Head Cost – Primary And Secondary Distribution – Classification Machine Hour Rate.

L – 52; T – 26; Total Hours –78

TEXT BOOKS:

1. T.S. Reddy & Y. Hari Prasad Reddy, " Cost Accounting", Margham Publications, 2014.

REFERENCES:

1. Manash Dutta, "Cost Accounting", Pearson Education (Singapore) Pvt. Ltd, Second Edition Print, 2005.
2. M.C. Shukla, T.S. Grewal, Dr.M.P.Gupta, "Cost Accounting", S.Chand & Company Ltd, 2010.
3. Manosh Dutta, "Cost Accounting', Dorling Kindersley (India) Pvt. Ltd, 2010

OUTCOMES:

After completing the course the students would be able to

- Get knowledge about various concepts of cost, costing, cost accounting.
- Familiarize in cost sheet and causes of disagreement of profit between cost and financial accounting.
- Study the material control.
- Control the labor and their motivation.

COC3103 HUMAN RESORURCE MANAGEMENT L T P C
4 0 2 5

OBJECTIVES:

To familiarize students with the Human Resources management involving planning, placement and training, significance of performance appraisal and methods of compensation.

MODULE I MANAGEMENT OF HUMAN RESOURCES 15

Human Resources Management – Meaning – Definition – Nature – Objectives And Importance – Functions And Scope – Environment Of HRM – Strategic HRM.

MODULE II HUMAN RESOURCES PLANNING 15

Human Resources Planning – Concept – Objectives – Need And Importance – Process And Levels Of Resource Planning – Requirement And Levels Of Resource Planning – Requirement And Selection – meaning – process of requirement – sources and techniques of Requirement – Meaning and Process of Selection – Selection Tests And Interviews.

MODULE III PLACEMENT AND TRAINING 15

Placement and Induction – Concept and Objectives – How to Make induction Effective – Advantages of Formal induction – Training – Concept And Need – Importance and Objectives – Identifying Training Needs – Designing A Training Program - Methods of Training – Evaluating Training Effectiveness.

MODULE IV PERFORMANCE AND APPRAISAL 15

Performance And Appraisal – Concept And Objectives – Users and Process of Performance Appraisal – Problems in Performance Appraisal – Essentials of Effective Appraisal System – Methods and Techniques of Appraisal – Job Evaluation – Concepts, Process and Objectives – Advantages and Limitations – Methods.

MODULE V COMPENSATION 18

Compensation – Wage and salary Administration – Objectives and Principles - Essentials of A Sound Wage Structure – Factors Affecting Wages – Methods If Wage Payment – Incentive Plans And Profit Sharing – Meaning Of Wage Incentives – Advantages And Limitations Of Intensives Plans – Essentials Of Sound Intensive – Types Of Intensive Plans – concepts Of Profit Sharing – Advantages And Limitations.

L – 52; T – 26; Total Hours –78

TEXT BOOKS:

- V.S.P. Rao, “Human Resource Management”, Excel Books, New delhi, 2000

REFERENCES:

- Ashwathappa, “Human Resource Management”, Tata Mc Graw Hill, New Delhi, 1999
- Gary Dessler, “Human Resource Mangement”, Dorling Kindessly Pvt Ltd., Twelfth Edition, 2011.

OUTCOMES:

After completing the course the students would be able to

- Explain the fundamental concept in Human Resources Management
- To introduce the students about placement and training
- Show their proficiency in performance appraisal and its methods
- To provide an idea about different compensation policies

COC3105 PERSONALITY DEVELOPMENT L T P C
2 0 0 2

OBJECTIVES:

To Make Aware About The Importance Of Personality And Development In The Business World. To Make The Students Follow The Good Personality And Create A Good Relationship With Others.

MODULE I PERSONALITY DEVELOPMENT-INTRODUCTION 5

The Concept Personality - Dimensions of Personality - Term Personality Development - Significance. The Concept of Success And Failure What Is Success? - Hurdles In Achieving Success - Overcoming Hurdles - Factors Responsible For Success – What Is Failure - Causes of Failure - Do's And Don'ts Regarding Success And Failure.

MODULE II ATTITUDES AND VALUES 5

Attitude - Concept - Significance - Factors Affecting Attitudes - Positive Attitude - Advantages -Negative Attitude - Disadvantages - Ways To Develop Positive Attitude – Difference between Personalities Having Positive And Negative Attitude.

MODULE III MOTIVATION 5

Concept Of Motivation - Significance - Internal And External Motives - Importance Of Self-Motivation- Factors Leading To De-motivation -Theories To Motivation.

MODULE IV SELF ESTEEM AND SMART 6

Term Self-Esteem - Symptoms - Advantages - Do's And Don'ts To Develop Positive Self-Esteem – Low Self-Esteem - Symptoms - Personality Having Low Self Esteem - Positive And Negative Self-Esteem. Interpersonal Relationships - Teaming - Developing Positive Personality - Analysis of Strengths and Weaknesses. Concept Of Goal-Setting - Importance Of Goals - Dream Vs Goal - Why Goal-Setting Fails? – Smart (Specific, Measurable, Achievable, Realistic, Time-Bound) Goals - Art Of Prioritization - Do's And Don'ts About Goals.

MODULE V BODY LANGUAGE, STRESS MANAGEMENT & TIME MANAGEMENT 5

Body Language - Assertiveness - Problem-Solving - Conflict And Stress Management - Decision-Making Skills - Positive And Creative Thinking - Leadership And Qualities Of A Successful Leader - Character-Building - Team-Work - Lateral Thinking - Time

Management - Work Ethics – Management Of Change - Good Manners And Etiquettes (Concept, Significance And Skills To Achieve Should Be Studied.)

L – 26; T – 0; Total Hours –26

TEXT BOOKS:

1. Richard Denny, “Communicate To Win”, Kogan Page India Private Limited, New Delhi-2009.

REFERENCES:

1. S. P. Robbins, “OrganisationalBehaviour”,Prentice-Hall Of India Pvt. Ltd., New Delhi-15th edition, 2013
2. Rajendra Pal And J. S. Korlhalli ,“Essentials Of Business Communication”, Sultan Chand & Sons, New Delhi,1st edition,2012.

OUTCOMES:

After completing the course the students would be able to

- Provide orientation about personality development
- Understand the importance of Values and Attitudes for their self-development.
- give them Motivation and to create knowledge about motivation theories
- Enable them to become SMART and Self esteemed
- Create awareness about body language and stress management

SEMESTER VI

COC 3201 INCOME TAX LAW AND PRACTICE - II

L	T	P	C
4	2	0	5

OBJECTIVES:

To make the students competent to compute the total income and tax liability of individual assesses and firms. To give them the necessary expertise to file return of income tax and to take up job in filing of tax.

MODULE I INCOME FROM CAPITAL GAINS 15

Capital assets meaning, types cost inflation index, transfer types, transfer not regarded as transfer, Cost of acquisition of various assets, deductions from capital gains.

Exemptions u /s 54. Computation of taxable capital gains (including problems)

MODULE II INCOME FROM OTHER SOURCES 15

Interest on securities, Bond washing transactions, Dividends on shares, casual income, family person, Gifts received and other general incomes including deductions, Deemed income.

MODULE III SET-OFF AND CARRY FORWARD OF LOSSES 15

Deductions from gross total income and rebates, clubbing and aggregation of incomes, Set off and carry forward of tosses.

MODULE IV ASSESSMENT OF INDIVIDUAL ASSESSES 15

Computation of total income and tax liability of individual assesses, (including problems). Assessments procedure, Filling of returns, Self – assessment, Regular assessment, Best judgment assessment, Income tax authorities.

MODULE V ASSESSMENT OF FIRMS 18

Assessment of firms – Introduction – Assessed for the firm – Book proof – Remunerations rules to partner – Deduction u/s 80 – calculation of income of the film.

L – 52; T – 26; Total Hours –78

TEXT BOOKS:

1. Dr Vinod K. Singhania, “Income Tax Law and Practice”, Taxmann Publications Pvt. Limited, 2005.

REFERENCES:

1. V.B. Gaur & Narang , “Income Tax Law And Practice”, Kalayani Publishers,2001.
2. T.S. Reddy & Y. Hari Prasad Reddy, “Income Tax Law and Practice” Margham Publications, 2008

OUTCOMES:

After completing the course the students would be able to

- Learn income from capital gain.
- Capture income from other sources.
- Knowledge about set of carry forward losses.
- Assess the individual assets.
- Can study the assessment of firms

COC3202 MANAGEMENT ACCOUNTING

L	T	P	C
4	2	0	5

OBJECTIVES:

- To introduce students to the various tools and techniques of management Accounting.
- To enlighten students on Financial Statement Analysis with the emphasis on the preparation of fund flow and cash flow statement.

MODULE I INTRODUCTION TO MANAGEMENT ACCOUNTING

Management Accounting – Meaning – Scope – Objectives – Importance – Limitations– Function – Management Accounting Vs Financial Accounting – Management Accounting Vs Cost Accounting.

MODULE II FINANCIAL STATEMENT ANALYSIS – RATIOS

Financial statement Analysis – Meaning-process of Financial Statement Analysis And Interpretation – Types Of Analysis – techniques Of tools of financial statement analysis – Ratio analysis – Meaning of Ratio – Advantage-classification of Ratios – Profitability Ratios - Turnover or Activity Ratio – Solvency or Financial Ratios – Computation Of Ratio.

MODULE III FUND FLOW & CASH FLOW STATEMENT

Funds flow statement – Concepts of Funds – Importance or used of Funds Flow Statement – Working capital Statement or schedule Of Changes In Working Capital – Preparation of Funds Flow Statement – Cash Flow Statement – Advantages And Limitations – Preparation of Cash Flow Statement.

MODULE IV BUDGETING AND BUDGETARY CONTROL

Budgeting and Budgetary Control – Meaning And Definition – Objectives of Budgetary Control – Advantages and Limitations – Essential Of Successful Budgetary Control – Preparation of Budgets – Sales Budget – Production Budget – Materials Budget – Cash Budget – Flexible Budget.

MODULE V MARGINAL COSTING

Marginal Costing definition of marginal cost and marginal costing – Salient Features of Marginal Costing – Advantages and Limitations of Marginal Costing – Managerial Costing and Absorption Costing and Absorption Costing – Cost volume profit analysis – Contribution - Break Even Analysis Significance Of Margin Of Safety – Application

of Managerial Costing (Simple Problems only).

L – 52; T – 26; Total Hours –65

TEXT BOOKS:

1. M Y Khan, PK Jain, “Management Accounting”, Tata Mc Graw hill, Fourth Edition, 2003.
2. I.M. Pandey, “Management Accounting”, Vikas Publishing, third Edition, 2006.

REFERENCES:

1. A.R. Ramanathan, N.L. Hingorani, T.S. Grewal, “ Management Accounting”, Sultan Chand & sons, 5th Edition. 2003.
2. T.S.reddy & Dr. Y. Hariprasad reddy, “Management Accounting”, Margham Publications, Fifth revised Edtion, 2014.

OUTCOMES:

After completing the course the students would be able to

- Know about the provisions of the Income Tax Act of 1961.
- Get knowledge about heads of income very particular about salary income.
- Learn about capital gain. Students can learn about house property income.
- Get provisions of Income Tax Act for depreciation.

COC3203 **AUDITING** **L T P C**

4 2 0 5

OBJECTIVES:

- To equip students with audit system
- To create awareness on vouching
- To impart knowledge on EDP base audit
- To educate on auditors appointment procedures

MODULE I INTRODUCTION **15**

Definition – Objective of an Audit – Role of auditors in detecting errors and frauds – basic principles governing an audit – scope and procedures – advantages and limitations – classification of audit.

MODULE II INTERNAL CHECK **15**

Internal check – Internal control and Internal Audit – Introduction of vouching – Objectives – importance of vouching – verification of assets and liabilities.

MODULE III EDP **15**

General approach to EDP based audit – Approaches to EDP audit – Special techniques for auditing in an EDP environment.

Investigation : Objectives-difference between investigation and auditing

MODULE IV APPOINTMENT OF AUDITOR **15**

Appointment – Qualification. Rights and liabilities of company auditor – Types of audit reports – Audit certificate.

MODULE V AUDITING OF COMPANIES **18**

Auditing of Banking companies, Insurance companies, Educational institutions and Hospitals

L – 52; T – 26; Total Hours –78

TEXT BOOKS:

1. B.N.Tandon - Auditing . S.Chand

REFERENCES:

1. Auditing concepts and techniques, Pearson Ed

OUTCOMES:

After completing the course the students would be able to

- Gain knowledge on audit system
- Learn about vouching of transactions
- Get an exposure on EDP based audit
- Familiarize with auditors appointment procedures

PROGRAMME ELECTIVE

COCX01	**INVESTMENT MANAGEMENT**	**L**	**T**	**P**	**C**
		4	**1**	**0**	**5**

OBJECTIVES:

- To provide knowledge on the various investment avenues that benefit the individuals and nation.
- To introduce the students to the application of various tools and techniques of investments and risks management.

MODULE I INVESTMENT 13

Investment - Investment process - Speculation - Security Analysis - Construction of portfolio - Negotiable and non-negotiable securities – Concepts of Risk and Return

MODULE II PRIMARY AND SECONDARY MARKET 12

New issue market - Methods of issues -Placement of the issues - Pricing of new issues - Investors protection - The secondary market - History of stock exchange - Its function - Types of orders - Share groups - Online trading.

MODULE III FUNDAMENTAL ANALYSIS 12

Fundamental Analysis - Economic Analysis - Industry Analysis - Company Analysis - Quantitative Analysis.

MODULE IV TECHNICAL ANALYSIS AND EMH 13

Technical Analysis - Assumptions - History of technical analysis -Technical tools - Dow Theory - Primary trend - Secondary trend - Mirror trends. Technical Analysis - Assumptions - History of technical analysis -Technical tools - Dow Theory - Primary trend - Secondary trend - Mirror trends.

MODULE V DERIVATIVES 10

Futures and Options - Meaning - Types - Factors affecting the value of option - Futures - Types.

L – 52; T – 13; Total Hours –65

TEXT BOOKS:

1. Punithavathi Pandian, (2013), Security Analysis and Portfolio Management, Vikas Publishing House Pvt ltd, New Delhi.

REFERENCES:

1. Natarajan L, (2013), Investment Management, Security Analysis and Portfolio

management, Margham Publications, Chennai.
2. Avadhani VA, (2008), Investment and Securities Market in India, Himalaya Publishing House, Mumbai.
3. Bhalla VK, (2009), Investment Management, Security Analysis and Portfolio Management, S.Chand and Company Ltd, New Delhi.
4. Prasanna Chandra, (2009), Investment Analysis and Portfolio Management, Tata McGraw-Hill Publishing Company Limited, New Delhi.

OUTCOMES:

After completing the course the students would be able to

- Obtains in-depth knowledge on stock market operations(Equity Market)
- Get acquainted with analysis on fundamental and technical analysis
- Get an insight in the derivatives market

Theory - 60% Problems - 40%

COCX02 INTERNATIONAL FINANCE L T P C

4 1 0 5

OBJECTIVES:

- To have exposure on international monetary system
- To understand about balance of payments
- To familiarize the international financial markets and instrument

MODULE I INTRODUCTION 13

International Finance- scope- International Monetary System- Bimetallism- Gold standard- Bretton Wood System- Floating Exchange Rate regime- European Monetary System- IMF- WTO-GATT

MODULE II BALANCE OF PAYMENT 12

Balance of Payments – The Current Account – The Capital Account – Significance – Balance of Payments in the World – Balance of Payments Account of India

MODULE III INTERNATIONAL FINANCIAL MARKETS 12

International Financial Markets – Sources of International Funds – Multilateral Development Banks – International Banks – International Equities – GDRs – ADRs – Euro Bonds – Repos – Euro Deposits – Euro Issues in India.

MODULE IV CURRENCY RISK AND EXPOSURE 13

Currency Risk and Exposure – Types of Currency Risk – Management of Currency Risk – Concept and Measurement of Transaction Exposure – Translation Exposure methods – Exchange risk – Operating Exposure.

MODULE V FOREIGN DIRECT INVESTMENT (FDI 10

Foreign Direct Investment (FDI) – Forms of FDIs – Purpose of overseas investment - Benefits to the Host Countries – Effect of FDI – FDI in India – Current trends in FDI in India.

L – 52; T – 13; Total Hours –65

TEXT BOOKS:

- Dr. V.A. Avadhani, International Finance, JBA, New Delhi, 2011
- Kevin. S Fundamentals of International Financial Management, PHI, Delhi, 2009.

REFERENCES:

- H. Kent Baker, Leigh A. Riddick, International Finance, Oxford University Press, 2013
- Joseph Anbarasu, Global Financial Management, Ane, New Delhi, 2010
- G. Shailaja, International Finance, JBA, New Delhi, 2011.

OUTCOMES:

After completing the course the students would be able to

- Get an exposure on monetary system
- Familiarized with the financial markets and instruments
- Gain knowledge on balance of payment

COCX03 BUSINESS STRATEGIES

L	T	P	C
4	1	0	5

OBJECTIVES:

- To create awareness on business strategy and business policy
- To familiarize with the concept of strategic management
- To provide information on strategic analysis
- To impart on strategy planning , formation and implementation

MODULE I INTRODUCTION TO BUSINESS STRATEGY 13

Introduction, Concept of Business Strategy, Need for Business Strategy, Essentials of Effective Strategy, Effects of Inadequate Strategies, Functions of Business Strategies Business Policy: Introduction, Definition of Business Policy, Factors influencing Business Policy, Business Policy vs. Strategy, Policy decisions and their impact on Business Strategies.

MODULE II STRATEGIC MANAGEMENT 12

Introduction, Strategic Management – Definition, Meaning and Role, Objectives of Strategic Management, Benefits of Strategic Management, Importance of Strategic Management, Causes for failure of Strategic Management

MODULE III STRATEGIC MANAGEMENT PROCESS AND ANALYSIS 13

Strategic Management Process : Introduction, Strategic Management Process, Strategic Vision and the role of a Strategist, Criteria for Effective strategy, Role of Strategic Management in Policy Making.

Strategic Analysis: Introduction, Strategic Analysis – definition, Need for Strategic Analysis & Environmental Scanning, Understanding environment of business for strategic analysis, Strategic thinkers & their contributions, Role of Strategic Analysis in Policy making

MODULE IV STRATEGY FORMULATION AND PLANNING & IMPLEMENTATION 12

Strategy Formulation : Introduction, Types of Strategies, Steps in Strategy Formulation, Core Competencies and their Importance in Strategy Formulation, Strategic Planning and Implementation: Introduction, Strategic Planning Process, Types of Strategies, Stability, Expansion or Growth, Mergers and Acquisitions, Activating Strategy, Issues in Strategy Implementation, Integrating the Functional Plan and Policies,

MODULE V STRATEGIC LEADERSHIP 10

. Introduction, Leadership Functions, Leadership Traits, Leadership Styles, Strategic Leadership and Competitive Advantage

L – 52; T – 13; Total Hours –65

TEXT BOOKS:

1. Mamoria and Mamoria – Business planning and Policy, Himalaya Publishing house – 1998.
2. Budhiraja SB and Athreya MB, Cases in Strategic Management, Tata McGraw Hill 1996.
3. R. Srinivasan, Strategic Management the Indian context, Prentice Hall of India, 2002

REFERENCES:

1. Lawrance, Jauch and William Blucck Business Policy and Strategic Mgt., - McGraw Hill Intl 1998.
2. Christensen CR, Business Policy: Text and cases, Illinois, Richdar Irwin 1987.
3. Hitt, Strategic Management, competitiveness and Globalization, Thomson, 2001
4. David Fred, Strategic Management, Prentice Hall of India, 1997.

OUTCOMES:

After completing the course the students would be able to

- Getting awareness on business policy strategy
- Familiarize with the concept of strategies management
- Gaining information on strategic analysis
- Gaining knowledge on strategy planning formulation and implementation

COC X04 **INSURANCE** **L T P C**

4 1 0 5

OBJECTIVES:

- To understand the nature of insurance and the principles that governs general insurance.
- To gain an insight on the nature of life insurance, fire insurance and marine insurance and to know the procedures for making claims against different kinds of insurance policies
- To understand the importance of burglary insurance and personal accident insurance.

MODULE I INSURANCE 13

Meaning, functions, nature and principles of insurance, importance of insurance to individuals and business

MODULE II LIFE INSURANCE 12

Life Insurance – features of a life insurance contract – classification of policies – investment of funds – surrender value – bonus option – policy condition – annuity contracts.

MODULE III MARINE INSURANCE 12

Contract of marine insurance – elements of marine insurance – classes of policies – policy conditions – clause in a marine insurance policy – marine losses.

MODULE IV FIRE INSURANCE 13

Fire Insurance – features of a fire insurance – kinds of policies – policy conditions – payment of claims – reinsurance.

MODULE V MISCELLANEOUS INSURANCE 10

Miscellaneous Insurance – motor insurance – burglary – personal accident insurance.

L – 52; T – 13; Total Hours –65

TEXT BOOKS:

1. M. N. Mishra, Insurance Principles And Practice,S. Chand & Co, New Delhi,2000

REFERENCES:

1. M.N.Mishra, Modern concepts of Insurance, S.Chand&Co., 2000
2. P.S . Palandi, Insurance in India, Response Books – Sagar Publications, 2000

OUTCOMES

After completing the course the students would be able to

- Gains wide information on nature and principles of insurance
- Acquires knowledge of various types of insurances (life , Marine, Fire)
- Gets an insight into the importance of burglary

COCX05	RESEARCH METHODOLOGY	L	T	P	C
		3	2	0	5

OBJECTIVES:

- To enable to student to understand and work methods and concepts related research.
- To enable the student to develop research project and work with research problem.

MODULE I INTRODUCTION 13

Meaning and Definition of Research - Characteristics of Research – Objectives of Research – Types of Research – Process and steps of Research.

MODULE II PROCESS OF SELECTION AND FORMULATION OF RESEARCH PROBLEM 12

Problem Selection / Identification of the problem – Sources of research problems – Criteria of a good research problem – Principles of research problem – Hypothesis – Meaning – Sources of Hypothesis – Characteristics of good Hypothesis.

MODULE III RESEARCH DESIGN 12

Meaning of R/D – Types of R/D – Essential steps in preparation of R/D – Evaluation of the R/D – A Model Design.

MODULE IV DATA COLLECTION AND ANALYSIS AND INTERPRETATION OF DATA. 13

Main forms of Data Collection responses – Methods of data Collection – Analysis of data – Types of analysis – Statistical tools and analysis – Interpretation of data – Need and Importance – Technique of interpretation

MODULE V . RESEARCH REPORT 10

Meaning of R / R – Steps in Organization of R / R – Types of Report – Significance of Report Writing – Drafting of reports – Contents of a report.

L – 39; T – 26; Total Hours –65

TEXT BOOKS:

1. Dr. P. Ravilochanan, Research Methodlogy , Margham Publications, Chennai

REFERENCES:

1. C. R. Kothari - Research Methodology: Methods and Techniques- New Age

International Publisher.
2. Patten chetty - Research Methodology - Rainbow Publications.
3. P.Saravanavel - Research Methodology - Kidap Publications

OUTCOMES:

After completing the course the students would be able to

- Get good understanding on research concept and its methods
- Gets awareness on choosing research topics
- Acquire knowledge on how to define a problem
- Gets an idea on how to prepare project proposal

COCX06	E- COMMERCE	L	T	P	C
		4	1	0	5

OBJECTIVES:

- To analyze the business model of firm, and determine the role that the internet (and related technologies) can play to support or even enable this model
- To understand the key issues involved in managing electronic commerce initiatives
- To utilize the internet to collect information to conduct research.

MODULE I TELECOMMUNICATION NETWORKS 13

Introduction- LAN-WAN- internet- what is electronic commerce- brief history of electronic commerce- advantages and limitations of electronic commerce- types of electronic commerce- integrating electronic commerce key questions for management.

MODULE II THE INTERNET AND THE WORLD WIDE WEB 12

The internet today- history of the web- unique benefits of the internet- internet architecture – world wide web concepts and technology- creating web pages- launching a business on the internet.

MODULE III ELECTRONIC PAYMENT SYSTEMS 12

Overview of the electronic payment technology- requirements for internet based payments – electronic payment media - electronic commerce and banking.

MODULE IV E-SECURITY 13

Security in the cyberspace- designing for security- virus- security protection and recovery encryption- the basin algorithm system- authentication and trust- key management internet security protocols and standard- other encryption issues.

MODULE V WEB BASED BUSINESS 10

Business-to-business electronic commerce- intranets and extranets- intranets and supply chain management- legal and ethical issues- case studies.

L – 52; T – 13; Total Hours –65

TEXT BOOKS:

1. Elias.m. Awad,”Electronic Commerce” prentice- hall of India Pvt Ltd, 2002

REFERENCES:

1. Ravi kalakota, Andrew B. Whinston, “Electronic Commerce – a manager's

guide", Addison- Wesley, 2000.
2. Zheng Qin, "Introduction to E-Commerce", T Singha University Press, Beijing, 2009.

OUTCOMES:

On the successful completion of the course the students should have:

- Understand the concept of E-Commerce and Describe the opportunities and challenges offered by E-Commerce
- Able to handle electronic payment technology and requirements for internet based payments
- Understand the categories of E-Commerce and understand the different applications of E-Commerce
- understand and identify security issues of E-Commerce
- Understand the concept of WEB Based Business Understand the M-Commerce applications

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REGULATIONS 2016

CURRICULUM AND SYLLABI

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ACCOUNTS AND FINANCE

VISION AND MISSION OF THE DEPARTMENT OF COMMERCE

VISION

To develop into a world class centre of excellence in the fields of Business and Economics through value based education, training & research.

MISSION

- To impart holistic education using state of the art technology and to give a global perspective through value based education for social transformation.
- Inspire and empower the students to become innovative leaders and involving people who contribute to the success of organisations and betterment of communities.
- To develop a team of competent and qualified entrepreneur.
- To explore training and development opportunities
- To involve in projects leading to high quality research.
- To continuously evaluate our performance against suitable benchmarks, develop new programmes, global tie-ups to meet stakeholder requirements
- To train them with good communication and soft skills for employment.
- To prepare students for higher education in Commerce and Business Studies.
- To provide contextually relevant commerce education.
- To inculcate the use of Information and Communication Technology for the development of society.

PROGRAMME EDUCATIONAL OBJECTIVES

- To make students well versed with the various Accounting, Finance, Business Law and Taxation policies in India.
- To facilitate taking up of various professional courses (CA, ICWA, CMA, CS etc.) by providing the necessary inputs.
- To provide an in-depth understanding of various accounting and taxation rules to the students.
- To provide sufficient knowledge and skills to students to seek employment or for managing business organization effectively.
- To provide career oriented education to students so that they can either go for jobs or engage in self-employment.

PROGRAMME OUTCOMES

On successful completion of the programme, the graduates will

- Be able to apply the knowledge of accounting, business laws and taxation in business and commerce.
- Be able to pursue the professional courses like CA, CWA, CS etc.
- Communicate effectively and perform efficiently in the organization, social and personal life.
- Be able to aptly use the obligatory knowledge and skill to furnish as an entrepreneur and social entrepreneur.
- Be able to lead and manage a team effectually in varied situations.
- Have sufficient skill to handle the financial matter of organizations.

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CURRICULUM & SYLLABI, REGULATIONS 2017

SEMESTER I

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1	AECC	ENC 1183	General English-I	3	1	0	3	
2	AECC	LNC1182/ LNC 1184	German - I Tamil - I	3	1	0	3	
3	PC	COC 1101	Financial Accounting	4	2	0	5	
4	PC	COC 1102	Business Management	4	1	0	5	
5	PA	COC 1103	Quantitative Techniques & Reasoning	4	1	0	5	
6	SS	COC 1104	Excel Modeling	0	0	4	2	
7	AECC	COC 1105	Environmental Studies	2	0	0	2	**25**

SEMESTER II

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1	AECC	ENC 1284	General English II	3	1	0	3	
2	AECC	LNC1282/ LNC 1284	German - II/ Tamil - II	3	1	0	3	
3	PC	COC 1201	Advanced Financial Accounting	4	2	0	5	
4	PC	COC 1211	Banking & Financial System	4	1	0	5	
5	PA	COC 1212	Business Statistics & Operations Research	4	1	0	5	
6	SS	COC 1204	Database Management System	0	0	4	2	
7	AECC	COC 1205/ LNC 1285/ LNC 1286	Business Environment/ Basic Tamil I/ Advanced Tamil I	2	0	0	2	**25**

SEMESTER III

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1	PC	COC 2101	Corporate Accounting I	4	2	0	5	
2	PC	COC 2111	Management Accounting	4	1	0	5	
3	PC	COC 2112	Foreign Exchange	4	2	0	5	
4	PC	COC 2113	Practical Auditing	4	0	1	5	
5	PA	COC 2114	Business Economics	4	2	0	5	
6	SS	COC 2106/ LNC 2185/ LNC 2186	Office Management/ Basic Tamil II/ Advance Tamil II	2	0	0	2	**27**

SEMESTER IV

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1	PC	COC 2201	Advanced Corporate Accounting	4	2	0	5	
2	PC	COC 2211	Principles of Financial Management	5	1	0	5	
3	PC	COC 2212	Business & Corporate Laws	4	0	1	5	
4	PC	COC 2213	Goods & Service Tax(gst)	4	0	1	5	
5	PA	COC 2214	Fiscal Economics	5	1	0	5	
6	SS	COC 2206	Communication Skills	2	0	0	2	**27**

SEMESTER V

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1	PC	COC 3111	Principles of Cost Accounting	4	2	0	5
2	PC	COC 3112	Advanced Financial Management	4	2	0	5
3	PC	COC 3113	Taxation I	4	0	2	5
4	PE		Elective I	4	2	0	5

5	PE	COC 3104	Project work/Elective II	4	2	0	5	
6	GE	COC 3105	Personality Development	2	0	0	2	**27**

SEMESTER VI

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1	PC	COC 3211	Advanced Cost Accounting	4	2	0	5	
2	PC	COC 3212	Computerized Accounting	4	2	0	5	
3	PC	COC 3213	Taxation II	4	0	2	5	
4	PE		Elective III	4	2	0	5	
5	PE		Elective IV	0	2	4	5	
6	GE	COC 3204	Value Education	2	0	0	2	**27**

Total Credits: 158 Credits

LIST OF PROGRAMME ELECTIVE

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1	PE	COCX01	Investment management	4	1	0	5
2	PE	COCX02	International finance	4	1	0	5
3	PE	COCX04	Insurance	4	1	0	5
4	PE	COCX05	Research methodology	3	2	0	5
5	PE	COCX21	Accounting Standards	4	1	0	5
6	PE	COCX22	Financial Markets and Services	4	1	0	5

SEMESTER I

ENC1183	GENERAL ENGLISH I	L	T	P	C
		3	1	0	3

OBJECTIVES:

- To make students learn English literary texts.
- To train them in appreciating and critically analyzing literary texts.
- To train in using the four skills, Reading, Writing, Speaking and Writing skills
- To encourage them to use appropriate vocabulary and grammatical expressions.

MODULE I **8**

Prose Education
Poem William Shakespeare - “All the World’s a Stage”
Letter Writing Formal and Informal
Short Story O Henry - “Robe of Peace” (Extensive Reading)
Essential English Grammar - 1-3 MODULES

MODULE II **8**

Prose Employment & Unemployment
Poem Ben Jonson - “On Shakespeare”
Short Story Rudyard Kipling – “The Miracle of Puran Bhagat” (Extensive Reading)
Essential English Grammar – 4-7 MODULES

MODULE III **9**

Prose A Dead Planet
Poem Robert Herrick - “Gather Ye Rosebuds”
Note Making
Short Story H.G.Wells – “The Truth About Pyecraft” (Extensive Reading)
Essential English Grammar – 8-10 MODULES

MODULE IV **8**

Prose Riddles
Poem Oliver Goldsmith - “The Village Schoolmaster”
Essential English Grammar – 11-13 MODULES

MODULE V **6**

Prose Killers

A Short Story

Poem William Blake - “From Auguries of Innocence”

Précis Writing

Short Story William Somerset Maugham - “Mabel” (Extensive Reading)

Essential English Grammar – 14-17 MODULES

MODULE VI **6**

Prose Galloping Growth

Poem Robert Browning- “The Last Ride Together”

Developing story from hints

Short Story John Galsworthy - “Quality” (Extensive Reading)

Essential English Grammar-- 18 &19 Modules

TOTAL HOURS – 45

REFERENCES:

1. Krishnaswamy. N, Sriraman T. **Current English for Colleges.** Hyderabad: Macmillan Indian Ltd, 2006.

2. Dahiya SPS. Ed. **Vision in Verse- An Anthology of Poems**. New Delhi: Oxford University Press, 2002.

3. Murphy, Raymond. **Essential English Grammar**. New Delhi: Cambridge University Press, 2009.

4. Seshadri, K G Ed. **Stories for Colleges.** Chennai: Macmillan India Ltd, 2003.

OUTCOMES:

After completing the course the students would be able to

- Respond to literary texts efficiently.
- Appreciate and critically analyse literary texts.
- Use the four skills of the language
- Use vocabulary and grammatical expressions effectively.

LNC 1182	GERMAN	L	T	P	C
		3	1	0	3

OBJECTIVES:

- To improve the proficiency of students in German language.
- To create awareness of using vocabulary among students.
- To expose them to correct grammatical forms of the language.
- To empower them for successful communication in social and academic contexts.

MODULE I **8**

Introduction to German alphabets, phonetics and pronunciation- Introducing themselves and others using simple sentences and answer to some basic personal questions-: Introduction to different types of articles and verbs, Nouns

MODULE II **8**

Understanding and responding to everyday queries like instruction, questions, - number & gender, pronouns, present and past tense.

MODULE III **7**

Short telephone messages, requests etc., if spoken slowly and clearly-- Detailed overview of articles, adjectives with/without articles, Prepositions

MODULE IV **7**

Asking and giving directions using simple prepositions- Ability to fill basic information on forms while registering for courses / classes.

MODULE V **8**

Ability to extract and understand relevant information in a public announcement, broadcast, newspaper, radio etc-- dative & accusative

MODULE VI **7**

Ability to describe about people, work, immediate environment, education and other topics related to personal needs in a concise manner-- Understanding of matters

which are familiar and are encountered regularly like instances at school, work, at public places, places of leisure etc.

L – 30; T – 15; TOTAL HOURS – 45

TEXT BOOKS:

1. Course book : Tangram aktuell 1 – Lektion 1–4 (Kursbuch + Arbeitsbuch mit Audio-CD zum Arbeitsbuch), Rosa-Maria Dallapiazza, Eduard von Jan, Til Schönherr, Hueber Publisher, ISBN 978-3-19-001801-7
2. Practice book: Tangram aktuell 1 – Lektion 1–4 (Kursbuch + Arbeitsbuch mit Audio-CD zum Arbeitsbuch), Rosa-Maria Dallapiazza, Eduard von Jan, Til Schönherr, Hueber Publisher, ISBN 978-3-19-001801-7.

REFERENCES:

1. NETZWERK A1 TEXTBOOK, Deutsch als Fremdsprache,Stefanie Dengler,Paul Rusch, Helen Schmitz, Tanja Sieber, Langenscheidt and Klett, ISBN : 9788183076968
2. STUDIO D A1 (SET OF 3 BOOKS + CD), Hermann Funk. Cornelsen, ISBN: 9788183073509
3. Willkommen! Beginner’s course. Paul Coggle, Heiner Schenke. 2nd edition. (chapter 1 - 6) ISBN: 9781444165159
4. Willkommen! Beginner’s course. Paul Coggle, Heiner Schenke. ISBN: 978-1-444-16518-0
5. An Introduction to the German Language and Culture for Communication, Updated Edition Lovik, Thomas A., J. Douglas Guy & Monika Chavez. Vorsprung -. New York, Houghton Mifflin Company, 1997/2002. ISBN 0-618-14249-5

OUTCOMES:

On completion of the course, students will be able to

- Show their proficiency in German Language.
- Use appropriate vocabulary in real life contexts.
- Use appropriate grammatical forms while communicating with people.
- Effectively use the language in social and academic contexts.

LNC 1184	TAMIL I	L	T	P	C
		3	1	0	3

நோக்கங்கள்

- சமூக மாற்றச் சிந்தனைகளை உள்ளடக்கிய தற்கால இலக்கியங்களை அறிமுகம் செய்தல்
- புதுக்கவிதை, சிறுகதை, உரைநடை ஆகிய இலக்கியங்களின் நயம் பாராட்டுதல்
- சந்திப் பிழையின்றி எழுத மாணவர்களைப் பயிற்றுவித்தல்

அலகு I **இருபதாம் நூற்றாண்டு மரபுக்கவிதைகள** 8

மனோன்மணியம் சுந்தரனார் - தமிழ்த்தாய் வாழ்த்து, பாரதியார் - யோக சித்தி, பாரதிதாசன் - நீங்களே சொல்லுங்கள், கண்ணதாசன் - காலக்கணிதம்

அலகு II **புதுக்கவிதைகள** 8

ஈரோடு தமிழன்பன் - கனாக்காணும் வினாக்கள், மீரா - ஊிசகள், வைரமுத்து - அந்தி, நா.காமராசன் - அலிகள், தாமரை - ஒரு கதவும் கொஞ்சம் கள்ளிப்பாலும், மொழிபெயர்ப்புக் கவிதைகள் - கீதாஞ்சலி, மும்பைவாசிகள் (10 கவிதைகள் மட்டும்)

அலகு III **சிறுகதைகள்** 8

புதுமைப்பித்தன் - பால்வண்ணம் பிள்ளை, பி.எஸ்.ராமையா - பணம் பிழைத்தது, ஜெயகாந்தன் - விதியும் விபத்தும். கி.இராஜநாராயணன் - நாற்காலி, சு.சமுத்திரம் மொழிபெயர்ப்புச் சிறுகதைகள் - காகித உறவு, மாதவிக்குட்டி - நெய்ப்பாயாசம், அந்தோன்செகாவ் - பச்சோந்தி

அலகு IV **மொழிப்பயிற்சி** 7

கலைச்சொல்லாக்கம், பிழை திருத்தம் (ஒருமை, பன்மை, ல-ள-ழகர, ர�றீறகர, ண-ந-னகர வேறுபாடுகள்), அயற்சொற்களைதல்

அலகு V **இலக்கிய வரலாறு** 7

பாடந்தழுவியது (இருபதாம் நூற்றாண்டு மரபுக் கவிதைகள், புதுக்கவிதையின் தோற்றமும் வளர்ச்சியும், சிறுகதையின் தோற்றமும் வளர்ச்சியும்)

அலகு VI **படைப்பிலக்கியம** 7

கவிதை எழுதுதல், சிறுகதை வரைதல்

L – 45; T – 30; TOTAL HOURS – 75

குறிப்புகள்:

1. பொதுத்தமிழ் - செய்யுள்திரட்டு - தமிழ்த்துறை வெளியீடு
2. தமிழ் இலக்கிய வரலாறு - சோம. இளவரசு
3. சிறுகதைத் தொகுப்பு (கட்டுரைக்களஞ்சியம்)

வெளிப்பாடு:

1. மாணவர்கள் சமூக மாற்றச் சிந்தனைகளை அறிந்துகொள்வர்
2. சந்திப்பிழைகளை நீக்கி எழுதும் திறன் பெறுவர்
3. புத்திலக்கியங்களைப் படைக்கும் திறனையும் திறனாய்வு செய்யும் திறனையும் பெறுவர்

COC 1101 FINANCIAL ACCOUNTING L T P C

4 2 0 5

OBJECTIVES:

- To facilitate the understanding of Accounting in General
- To give a comprehensive understanding of the system of Financial Accounting
- To understand the intermediate concepts for assets, liabilities and stockholders' equity
- To develop skill, related to problem solving and critical thinking

MODULE I INTRODUCTION TO ACCOUNTING 12

Meaning and scope of Accounting, Basic Accounting Concepts and Conventions, Objectives of Accounting, Accounting Transactions, Double Entry Book Keeping - Journal, Ledger, Preparation of Trial Balance

MODULE II FINAL ACCOUNTS 15

Preparation of Final Accounts of a Sole Trading Concern, Closing Stock, Adjustments, Outstanding and Prepaid items, Depreciation, bad debts, Provision for Bad and Doubtful Debts, Provision for Discount on Debtors, Provision for Discount on creditors, Interest on Capital and Drawings, Abnormal Loss of stock.

MODULE III RECTIFICATION OF ERRORS 18

Classification of Errors, Rectification of Errors, Preparation of Suspense Account-Profit & loss adjustment Account.

MODULE IV BANK RECONCILIATION STATEMENT 18

Introduction, Procedure for reconciling the cash book balance with the pass book balance, Methods of Bank Reconciliation Statement.

MODULE V DEPRECIATION ACCOUNTING 15

Depreciation, Meaning, Causes, Methods, Straight Line Method, Written down Value Method, Change in method of depreciation (retrospective and prospective method)
Insurance claims **-** Insurance claims, Average Clause (Loss of stock only)

L – 52:T – 26; TOTAL HOURS – 78

TEXT BOOK:

1. Financial Accounting-T.S.Reddy & A.Murthy, Margham Publications, Ch.

REFERENCES:

1. Financial Accounting by Hanif and Mukherjee, MCGRAW hill education
2. Financial Accounting by P.C. Tulsian, Pearson
3. Jain &Narang (2015) Financial Accounting, Kalyani Publishers.

OUTCOMES:

On successful completion of this course students are able to

- Explain the fundamental concept of financial accounting system
- Recognize the transaction, understand the accounting cycle and various accounts books
- Recognize the error and it rectification
- Understand the depreciation and its different treatment in accounting
- Understand the financial statement of its importance and method of preparation for sole proprietorship
- Understand the importance of bank reconciliation system and method of preparation of reconciliation statement

COC 1102 BUSINESS MANAGEMENT L T P C

4 1 0 5

OBJECTIVES:

- Understand the fundamental concepts in management
- Trace the evolution and growth of management as a body of knowledge
- Have an in depth knowledge of various functions of management and their relevance to an organization

MODULE I MANAGEMENT 10

Meaning – Role of Management – Management Process – Importance – Management & Administration – Levels of Management – Taylor's Scientific Management – Fayol's Administrative Management Principles.

MODULE II PLANNING 20

Nature & Characteristics – Importance – Advantages & Limitations – Steps in Planning – Types of Plan – Standing Plan – Objectives – Policies – Procedures – Rules – Strategies – Single use Plans – Programmers and Budgets.

Management by Objectives: Concept, Process and Limitations. Decision Making: Process, Limitations and Techniques used in decision making.

MODULE III ORGANIZATION 15

Importance – Types – Line, Functional, Line and Staff – Committee Organization – Authority and Responsibility–Delegation of Authority–Principles,Types, advantages and Barriers to Delegation – Departmentalization – Formal and Informal Organization. Staffing: Nature & Importance – Functions of Staffing (In Brief)

MODULE IV DIRECTING 10

Nature & Importance – Elements of Directing Function – Supervision – Span of Supervision – Factors Determining span of supervision.

Motivation: Importance – Types of Motivators – Maslow's Theory – Hertzberg's Two factor theory – Douglas McGregor's Theory X & Theory Y.

MODULE V CONTROL 10

Need for Control – Controlling Process – Controlling Tools & Techniques.

Coordination: Need & Importance – Principles & techniques of Coordination
Leadership: Importance – Formal & Informal Leaders – Leadership Styles – Traits of a Good Leader.

L – 52; T – 13; TOTAL HOURS – 65

TEXT BOOKS:

1. Business Management – Dinkar Pagare
2. Principles of Management – C.B.Guptha

REFERENCES:

1. J. Jayasankar, 1st Edition. 2004, Reprint2008-Principles of Management (Business Management). Margham Publication. Chennai
2. P.C.Tripathi& P.N Reddy, 1991, Principles of Management. Tata Mc.Graw, Hill. New Delhi.
3. Weihnrich and Koontz, Management, 10th Edition, 1993, A Global Perspective.
4. N. Premavathy, 2nd Edition, 2003, Principles of Management, Sri Vishnu Publication. Chennai.

OUTCOMES:

At the end of this course, the students will be able to:

- understand different types of functions plans and the managerial decisions
- understand the organizational chart and explain the staffing process
- understand the different control technique in the organizations
- understand the appropriate way to lead and motivate the team.

COC 1103	QUANTITATIVE APTITUDE REASONING	L	T	P	C
		4	1	0	5

OBJECTIVES:

- To learn basics of mathematical equations.
- To have knowledge in various arithmetical calculations.
- To understand different mathematical operations for logical analysis

MODULE I QUANTITATIVE 15

LCM & HCF – Average - Ratio and Proportion – Logarithm – Permutation and Combination – Probability (Excluding conditional probability and Bayes' Therom).

MODULE II SEQUENCES AND SERIES 15

Arithmetic Progression, Sum up to n terms, Properties of Arithmetic Progression, Geometric Progression, Sum up to n terms Properties of GP

MODULE III INTEREST AND ROOTS 10

Simple Interest and Compound Interest – Surds and Indices – Square root – Calendar and Clock.

MODULE IV MENSURATION 10

Fractions and Percentage and Simplification – Simple Equation – Time and Work – Speed & Distance – Mensuration: Area (Circle, Square, Rectangle, Triangle) – Volume (Cube, Cuboid, Cone, Sphere).

MODULE V LOGICAL REASONING 15

Coding and Decoding – Mathematical Operations – Series completion (alphabets and numbers) – Logical Venn Diagram.

L – 52; T – 13; TOTAL HOURS – 65

REFERENCES:

1. Quantitative Aptitude – R.S. Aggarwal – Sultan Chand Publication.
2. Logical Reasoning - R.S. Aggarwal – Sultan Chand Publication.

OUTCOMES:

On completion of the course, the students will be able to

- Calculate the various practical problem on Ratio, Proportion and Logarithm
- Students will be able to solve the problem related to Linear Equation, Inequalities and Interests.
- Students will be able to solve the problem of Permutation and Combination and Arithmetic and Geometric Series

COC 1104 EXCEL MODELLING (PRACTICAL)

L	T	P	C
0	0	4	2

OBJECTIVES:

- Analyse business data for better decision making.
- Apply basic tools and functions of excel.
- Solve various mathematical and managerial problems.

MODULE I BASICS OF EXCEL **8**

Entering Data, Selecting an area of worksheet, Saving closing and opening files, Copying Data, Inserting and deleting rows and columns, Wrap text, Merge and center, Understanding excel options, Setting advanced options-Data validation, Working with multiple sheets, Fixing of cells, Freezing of cells, Alignment, Protect sheet, Protect workbook, Page layout, Insert equation and symbol, Insert text box, Insert header and footer.

MODULE II BASIC MATHEMATICAL FUNCTIONS **12**

Sum, Average, Product, SQRT, MOD, Aggregate, Power, SUM PRODUCT. **Financial arithmetic**: Compound interest, Continuous compounding, Simple interest, Fractional years.

MODULE III DATA HANDLING **10**

Sorting data, Filtering data, Parsing data, Data validations, What-If-Analysis, Group, Ungroup, Creating subtotals, Understanding data consolidation, Consolidating data using the SUM function. **Descriptive statistics**: Mean, Median, Mode, Variance, Standard deviation, Weighted averages, Maximum and Minimum, Range.

MODULE IV CHARTS AND GRAPHS **10**

XY Scatter plot, Column and Bar Chart, Pie Charts, Adding Legends and Titles.**Depreciation using Excel**: Calculating Fixed Line Depreciation using DB function, Calculating Straight Line Depreciation using SLN function.

MODULE V CONDITIONAL FORMATTING **12**

Highlight cell rules, Top/Bottom rules, Data Bars, Color Scales and Icon Sets, New Rule, Clear Rules, Manage rules. **Data analysis in Excel**: Analysis by goal seek,

Analysis by pivot table and charts, Solver to determine the optimal product mix.

TOTAL HOURS – 52

TEXT BOOK:

1. Microsoft excel 2013: data analysis and business modeling by waynewinston, prentice hall

REFERENCES:

1. Business data analysis using excel by david whigham, oxford university press
2. Excel Bible 2013

OUTCOMES:

At the end of the course students will be able to

- Anaylse data using descriptive statistics
- copy data and paste it in the desired location, give name to cells and use them, inserting and deleting rows and columns
- learn to use the advanced excel options
- learn to work with Protect sheet, Protect workbook, Page layout, Insert equation and symbol, Insert text box, Insert header and footer
- learn to work Page layout and data validation
- apply basic mathematical functions
- calculate Compound interest , Fractional year and continuous compounding in excel
- work with Filtering data, Parsing data
- calculate mode and average in excel
- Ablility to analyse data using charts and graphs

COC 1105	ENVIRONMENTAL STUDIES	L	T	P	C
		2	0	0	2

OBJECTIVES:

- Developing an awareness and sensitivity to the total environment and its related problems
- Motivating people for active participation in environmental protection and improvement
- Developing skills for active identification and development of solutions to environmental problems
- Evaluation of environmental programes in terms of social, economic, ecological and aesthetic factors.

MODULE I MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES **6**

Definition-scope and importance- need for public awareness.

Natural resources and associated problems

a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.

b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources

d) Food resources : World food problems, changes caused by agriculture and over-grazing, effects of modern agriculture, fertilizer-pesticide problems, water logging ,salinity

e) Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources.

f) Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources-Equitable use of resources for sustainable lifestyles.

MODULE II ECOSYSTEMS **7**

Concept of an ecosystem.-Structure and function of an ecosystem.-Producers, consumers and decomposers.-Energy flow in the ecosystem.-Ecological succession-Food chains, food webs and ecological pyramids.-Introduction, types, characteristic

features, structure and function of the following Ecosystems :-

a.Forest ecosystems.

b.Grassland ecosystem.

c.Desert ecosystem

d.Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

MODULE III BIODIVERSITY AND ITS CONSERVATION 5

Introduction – Definition : genetic, species and ecosystem diversity.- Bio geographical classification of India-Value of biodiversity:consumptive use, productive use, social, ethical, aesthetic adoption values-Biodiversity at global, National and local levels.-Hot-sports of biodiversity.-Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts.-Endangered and endemic species of India

Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity.

MODULE IV ENVIRONMENTAL POLLUTION 5

Definition-Cause, effects and control measures of :-Air pollution-Water pollution-Soil pollution-Marine pollution-Noise pollution-Thermal pollution- Nuclear hazards

Solid waste Management : Causes, effects and control measures of urban and industrial wastes.-Role of an individual in prevention of pollution.

Diaster management : floods, earthquake, cyclone and landslides.

TOTAL HOURS – 23

REFERENCE BOOKS:

- Environmental Science- Kaushik & Kaushik-New Age International Publications
- Environmental Science & Engineering-Anandan & Kumaravelan-Scicech Publications

OUTCOMES:

At the end of the course students will be able to

- Understand the natural environment and its relationships with human activities.
- Characterize and analyze human impacts on the environment.
- Integrate facts, concepts, and methods from multiple disciplines and apply to environmental problems.
- Acquire practical skills for scientific problem-solving, including familiarity with laboratory and field instrumentation, computer applications, statistical and modeling techniques.

SEMESTER II

		L	T	P	C
ENC1284	**GENERAL ENGLISH II**	**3**	**1**	**0**	**3**

OBJECTIVES:

- To make students learn English literary texts.
- To train them in appreciating and critically analyzing literary texts.
- To train in using the four skills, Reading, Writing, Speaking and Writing skills
- To encourage them to use appropriate vocabulary and grammatical expressions

MODULE 1 **9**

Prose Qahwah

Poem William Wordsworth – "Nutting"

Filling Money Order Challan and Bank Challan

Short Story G.K.Chesterton – The Hammer of God (Extensive Reading)

Essential English Grammar: - 31-33 Modules

MODULE 2 **8**

Prose Environment

Poetry John Keats – "La Belle Dame Sans Merci"

Short Story Katherine Mansfield—A Cup of Tea (Extensive Reading)

Dialogue Writing

Essential English Grammar: 34-37 Modules

MODULE 3 **8**

Prose A Dilemma

Poetry Robert Frost – "Design"

Short Story Thomas Wolfe—The Far and the Near (Extensive Reading)

Conversations

Essential English Grammar: 38-40 Modules

MODULE 4 **8**

Prose Computeracy

Poetry Sarojini Naidu –"The Gift of India"

Short Story R.K. Narayan – "Half a Rupee Worth" (Extensive Reading)

Essential English Grammar: 41-43 Modules

MODULE 5 **11**

Prose War Minus Shooting
Who's Who

Poetry Nissim Ezekiel – "The Night of The Scorpion"

Short Story Anita Desai – "A Devoted Son" (Extensive Reading)
Ruskin Bond – "The Boy Who Broke the Bank" (Extensive Reading)

Report Writing

Letter to the Editor

Essential English Grammar: 44-47 Modules

MODULE 6 **8**

Prose Usage and Abusage

Poetry Mathew Arnold –Dover Beach

Short Story Manohar Malgonkar – "Bacha Lieutenant"

Essential English Grammar: 48-50 Modules

TOTAL HOURS – 52

REFERENCES:

1. Krishnaswamy. N, Sriraman T. **Current English for Colleges.** Hyderabad: Macmillan Indian Ltd, 2006.
2. Dahiya SPS. Ed. **Vision in Verse- An Anthology of Poems**. New Delhi: Oxford University Press, 2002.
3. Murphy, Raymond. **Essential English Grammar**. New Delhi: Cambridge University Press, 2009.
4. Seshadri, K G Ed. **Stories for Colleges.** Chennai: Macmillan India Ltd, 2003.

OUTCOMES:

After completing the course the students would be able to

- Respond to literary texts efficiently.
- Appreciate and critically analyse literary texts.
- Use the four skills of the language
- Use vocabulary and grammatical expressions effectively.

LNC1282	GERMAN II	L	T	P	C
		3	1	0	3

OBJECTIVES:

- To develop existing language skills further and to achieve a professional fluency.
- By the end of the course you will be able to understand general and detailed information and to communicate in standard speech on a range of everyday issues.

MODULE I **12**

Shopping for food and going to restaurants, Recent events, Personal experiences, Apologies and excuses

MODULE II **15**

Studying German Wishes and needs, Plans and projects, Certainty and probability, Physical condition, illness and remedies

MODULE III **18**

A birthday party, Food and drink, Presents and Congratulations

MODULE IV **18**

Travelling (I), Biographies, Important events in life, Social situations.

MODULE V **15**

Telephone conversations, appointments and invitations, Travelling (II), City life: public places, transport and directions, Leisure activities

TOTAL HOURS – 78

TEXT BOOK:

1. Course book :Tangram aktuell 1 – Lektion 5–8 (Kursbuch + Arbeitsbuch mit Audio-CD zum Arbeitsbuch), Rosa-Maria Dallapiazza, Eduard von Jan, Til Schönherr, Hueber Publisher, 9788183070867
2. Practice book:Tangram aktuell 1 – Lektion 5–8 (Kursbuch + Arbeitsbuch mit Audio-CD zum Arbeitsbuch), Rosa-Maria Dallapiazza, Eduard von Jan, Til

Schönherr, Hueber Publisher, ISBN 9788183070867

TEXT BOOK:

1. Course book :Tangram aktuell 1 – Lektion 5–8 (Kursbuch + Arbeitsbuch mit Audio-CD zum Arbeitsbuch), Rosa-Maria Dallapiazza, Eduard von Jan, Til Schönherr, Hueber Publisher, 9788183070867
2. Practice book:Tangram aktuell 1 – Lektion 5–8 (Kursbuch + Arbeitsbuch mit Audio-CD zum Arbeitsbuch), Rosa-Maria Dallapiazza, Eduard von Jan, Til Schönherr, Hueber Publisher, ISBN 9788183070867

REFERENCES:

- NETZWERK A2 TEXTBOOK, Deutsch als Fremdsprache,Stefanie Dengler,Paul Rusch, Helen Schmitz, Tanja Sieber, Langenscheidt and Klett, ISBN : 9788183077231
- STUDIO D A2 (SET OF 3 BOOKS + CD), Hermann Funk. Cornelsen, ISBN: 9788183073516

OUTCOMES:

On completion of the course, students will be able to

- Read printed and handwritten script on a limited number of everyday topics
- Write simple texts using descriptive language accurately.
- Developed intercultural competence.

LNC1284 **TAMIL II** **L T P C**

3 1 0 3

OBJECTIVES:

- சமூகமாற்றச் சிந்தனைகளைஉள்ளடக்கியதற்கால இலக்கியங்களைஅறிமுகம் செய்தல்
- புதுக்கவிதை,சிறுகதை,உரைநடைஆகிய இலக்கியங்களின் நயம் பாராட்டுதல்
- சந்திப் பிழையின்றிஎழுதமாணவர்களைப் பயிற்றுவித்தல்

அலகு I அற இலக்கியங்கள் 8

திருக்குறள் - சொல்வன்மை (65ஆம் அதிகாரம்),நாலடியார் - அவையறிதல் (5 பாடல்கள் - 32ஆம் அதிகாரம்),பழமொழிநானூறு - இன்னாசெய்யாமை(5 பாடல்கள்), இனியவைநாற்பது - முதலைந்துபாடல்கள்

அலகு II பக்தி இலக்கியங்கள் 8

தேவாரம் - மூவர் தேவாரம் (15 பாடல்கள்) அப்பர் தேவாரம்,திருஞானசம்பந்தர் தேவாரம்,சுந்தரர் தேவாரம் (ஒவ்வொன்றிலிருந்தும் ஐந்துபாடல்கள்),காரைக்காலம்மையார் - மூன்றுபாடல்கள் (அற்புதத் திருவந்தாதி),மாணிக்கவாசகர் - திருவெம்பாவை (தேர்ந்தெடுக்கப்பெற்ற 5 பாடல்கள்),ஆண்டாள் - திருப்பாவை (தேர்ந்தெடுக்கப்பெற்ற 5 பாடல்கள்),குலசேகராழ்வார் - திருவேங்கடத்தில் பிறத்தலும் இருத்தலும் போதுமெனல் (11 பாசுரம்)

அலகு III காப்பியங்கள் 8

மணிமேகலை - ஆதிரைபிச்சையிட்டகாதை (20 அடிகள் மட்டும்),கம்பராமாயணம் - பாலகாண்டம்,நாட்டுப்படலகம் (10 பாடல்கள் மட்டும்), இரட்சணியயாத்ரிகம் - சிலுவைப்பாடு (10 பாடல்கள்),சீறாபுராணம் - மானுக்குப் பிணைநின்றபடலம் (6 பாடல்கள்)

அலகு IV கட்டுரைகள் 7

உ.வே.சாமிநாதையர்-தமிழ்நாட்டுவணிகர். வ.இராமசாமிஐயங்கார்-மூதறிஞர் இராஜகோபாலாச்சாரியார்,மா.இராசமாணிக்கனார்-சித்தன்னவாசல் ஓவியங்கள், பி.எல்.சாமி-சங்க இலக்கியத்தில் அறிவயல் கலை,க.கைலாசபதி - பாரதியும் மேனாட்டுக் கவிஞரும்,தொ. பரமசிவன் - சொல்லும் பொருளும்.

அலகு V இலக்கியவரலாறு 7

அற இலக்கியங்களின் தோற்றமும் வளர்ச்சியும்,சைவவைணவ இலக்கியங்கள் தோற்றமும் வளர்ச்சியும்,காப்பியங்கள் தோற்றமும் வளர்ச்சியும்,உரைநடைதோற்றமும் வளர்ச்சியும்

அலகு VI மொழிப்பயிற்சி 7

இலக்கணக் குறிப்புத் தருதல்,வல்லினம் மிகுமிடங்களும்,மிகாவிடங்களும்,மொழிபெயர்ப்பு (ஆங்கிலத்திலிருந்துதமிழில் பெயர்த்தல்),கடிதங்களும் வகைகளும்

L – 30; P – 15; TOTAL HOURS – 45

REFERENCES:

1. பொதுத்தமிழ் - செய்யுள்திரட்டு - தமிழ்த்துறைவெளியீடு
2. தமிழ் இலக்கியவரலாறு - சோம. இளவரசு
3. சிறுகதைத் தொகுப்பு (கட்டுரைக்களஞ்சியம்)

OUTCOMES:

- மாணவர்கள் சமூகமாற்றச் சிந்தனைகளைஅறிந்துகொள்வர்
- சந்திப்பிழைகளைநீக்கிஎழுதும் திறன் பெறுவர்
- புத்திலக்கியங்களைப் படைக்கும் திறனையும் திறனாய்வுசெய்யும் திறனையும் பெறுவர்

COC 1201 ADVANCED FINANCIAL ACCOUNTING

L	T	P	C
4	2	0	5

OBJECTIVES:

- To facilitate the understanding of Accounting in specific areas
- To understand the practical applicability of Financial Accounting
- To develop skill, related to problem solving and critical thinking

MODULE I BRANCH AND DEPARTMENTAL ACCOUNTS 15

Dependent branches-Accounting Method

Departmental Accounts: Basis for allocation of expenses, Inter departmental transfer at cost or selling price, Treatment of expenses which cannot be allocated

MODULE II HIRE PURCHASE AND INSTALLMENT ACCOUNTING 12

Hire purchase and Installment-Default and repossession, Hire purchase trading account, Installment purchase system

MODULE III PARTNERSHIP 18

Admission of a Partner: Calculation of New Profit Sharing Ratio and Sacrificing Ratio – Treatment of Goodwill – Revaluation Account – Memorandum Revaluation Account – Adjustment of Capital – Preparation of Balance sheet of New Firm.

MODULE IV PARTNERSHIP 15

Retirement, Admission cum retirement of partners and Death of a partner: Calculation of New profit Sharing Ratio and Gaining Ratio – Treatment of Goodwill – Revaluation account – memorandum revaluation account – Adjustment of Capital – preparation of balance sheet of new firm.

MODULE V DISSOLUTION OF A PARTNERSHIP 12

Insolvency of a partner (Application of Indian Partnership Act 1932), Insolvency of all partners, Gradual Realization of Assets and Piecemeal Distribution.

L – 52; P – 26; TOTAL HOURS – 78

TEXT BOOKS:

1. Financial Accounting -T.S.Reddy & A.Murthy,Margham Publications,Ch-17

2. Jain &Narang (2015) Financial Accounting,Kalyani Publishers, New Delhi.

REFERENCES:

1. R.L.Gupta & V.K.Gupta. (2009) Advanced Accounting, Sultan Chand & Sons, New Delhi
2. Shukla & Grewal (2009) Advanced Accounting, S Chand & Co, New Delhi.
3. P.C.Tulsian (2009) - Financial Accounting , Tata McGraw-Hill
4. Financial Accounting-T.S.Reddy & A.Murthy,Margham Publications,Ch-17
5. Jain &Narang (2015) Financial Accounting,Kalyani Publishers, New Delhi.

OUTCOMES:

On successful completion of this course students are able to

- Record the transaction related to installment and hire purchase system
- Explain the accounting for branches and departments and transactions related to it.
- Record the transactions in partnership form of business

COC 1211 BANKING & FINANCIAL SYSTEM L T P C
4 1 0 5

OBJECTIVES:

- Understand the specific function of various banks and importance of different development banks
- Various aspects of capital market and money market

MODULE I FINANCIAL SYSTEM 10

Nature – Financial System and Economic Development- Composition of Indian Financial System.

Legal Regulatory Framework governing Financial Services. Merchant Banking: Meaning- Role of Merchant Banker in managing public Issues -Drawbacks.

MODULE II BANKING 15

Commercial Banking – Functions - Banking Services (Agency and General Utility services). Central Banking: Functions- Central Banking Vs Commercial Banking – Tools of Credit Control (Quantitative & Qualitative Methods).

Modern Banking Functions - E-Banking –RTGS- NEFT– Credit Cards - Debit Card – Benefits & Disadvantages

MODULE III NEGOTIABLE INSTRUMENTS ACT 10

Bills of Exchange – Promissory Note - Cheque - Holder & Holder in Due Course - Crossing of Cheques – Meaning & Types of Endorsement.

MODULE IV CAPITAL MARKETS 15

Importance – Primary Vs. Secondary Markets- Initial Public Offering – Functions of Stock Exchanges in India - Listing of Securities(Requirements, benefits and limitations) - Role of SEBI in Capital Market.

Money Market: Characteristics - Constituents – Importance – Instruments - Money Market Vs Capital Market - Features of Money Market in India.

MODULE V VENTURE CAPITAL 15

Features - Stages involved in Venture Capital financing - Importance of VCF - Venture Investment Process.

Credit Rating: Need - Rating Process - Rating Factors - Credit Rating agencies in India with their rating symbols - Defects of Credit Rating in India.

L – 52; T – 13; TOTAL HOURS-65

TEXT BOOK:

1. Banking & Financial System - B.Santhanam - Margham Publishers

REFERENCES:

1. Indian Financial Systems – Dr.S.Guruswamy
2. Banking & Financial System - B.Santhanam - Margham Publishers

OUTCOMES:

After completion of this course students will be able to

- Differentiate between banking and other type of business and types of bank customer relationship and various deposit services available to customer
- Understand the difference between banks and NBFCs
- Various funding agencies to a business

COC 1212	BUSINESS STATISTICS & OPERATIONS RESEARCH	L	T	P	C
		4	1	0	5

OBJECTIVES:

- To develop skills in analysis & interpretation of data
- Handle challenging problems using appropriate analysis tools

MODULE I INTERPRETATION OF STATISTICAL DATA 5

Introduction – Classification and tabulation of statistical data - Diagrammatic and graphical representation of data

MODULE II MEASURES OF CENTRAL TENDENCY AND DISPERSION 15

Measures of Central tendency –Mean, median and mode – Dispersion , Range, Quartile Deviation, Mean Deviation , Standard Deviation – Measures of Skewness.

MODULE III CORRELATION AND REGRESSION 10

Karl Pearson's Coefficient of Correlation – Spearman's Rank Correlation – Regression Lines and Coefficients

MODULE IV TIME SERIES AND PROBABILITY 15

Time Series Analysis – Trend – Seasonal Variation.

Probability – Addition and Multiplication Theorem – Conditional probability

MODULE V OPERATIONS RESEARCH 20

Introduction to OR – Linear Programming – Graphical -Network Analysis -PERT and CPM (no crashing)-Assignment and Transportation Problems (IBFS only)

L – 52; T – 13; TOTAL HOURS – 65

TEXT BOOK:

1. Statistical Methods – S.P. Gupta, Sultan Chand & Sons .

REFERENCES:

1. Introduction to Operations Research – Dr. P.R. Vittal, Margham Publications
2. Fundamentals of Statistics -Elhance D.N. KitabMahal
3. Operations Research – Hira and Gupta, S. Chand & Co.
4. Operations Research – Handy and H.A. Taha, Macmillan Publishers.

OUTCOMES:

After studying this course students will able to

- Tabulate and classify various statistical data
- To analyse data using various statistical tools
- To have knowledge on operations research analysis

COC 1204 DATABASE MANAGEMENT SYSTEM L T P C
0 0 4 2

OBJECTIVES:

- To analyze the large amount of data in meaningful way and quickly.
- To be able to demonstrate the proficiency in Access, executing powerful analysis on large database.

MODULE I **13**

Basics of Data, Information, Introduction of Data, Database, & Database Management System, Advantages of Computerized Data Base, Various View of Data, Data Independence, Database Schema and Subschema, Data Models, Introduction to Various Models, Database Languages, DDL, DML, DCL, Database Administrator, Functions of DBA, Role of DBA, Data Base User, Various Types of Database User, E-R Model, E-R Diagram, Keys: Primary, Candidate Key, Super Key, Key Candidate, Foreign Key

MODULE II **15**

Access Concepts and Terms, Starting and Quiting Access, Database Tables, Relational Database Management System, Relational Database and its Advantages, Relational Database and its Advantages, Parts of Access Window
Database Tables, Relational Database, Records and Fields, Tables, Creating Database, Fields Controls and Objects, Queries, Creating and run Queries, Introduction of Dynasets, Forms, Reports, Properties, Wizard, Macro, Advantages of Macros, Hardware & Software Requirements for MS Access

MODULE III **14**

Creating Database, Creating Database With Wizard, Creating Database Without Wizard, Field Name and Field Properties, Various Data Types and Use, Properties of Various Data Types, Adding Fields in to Existing Tables, Removing Fields From Existing Tables, Renaming Fields, Renaming Field's Caption, Resizing Fields, Freezing Columns, Primary Key Field, Indexing Fields

MODULE IV **8**

Forms, Use, Form Creation, Creating, Saving, and Modifying Forms, Entering and Editing Data Via Forms, Finding Data,Sorting Data, Displaying Data,Dynaset
Queries, Creating and run Queries, Creating Select Query,Using Select Query, Using Wild Cards in Select Query

MODULE V **10**

Reports: Creating Reports, Previewing and Printing Reports, Modifying and Saving Reports, Relational Database: Definition & Purpose, Creating Relational Database, Viewing and Deleting Expressions, Data Models, Creating Database Keys, Queries

TOTAL HOURS – 60

TEXT BOOK:

1. Michael Alexander, Microsoft Access 2007 Data Analysis, Wiley Publishing, Inc.

REFERENCES:

1. Michael Alexander and Dick Kusleika, Access® 2013 Bible, John Wiley & Sons, Inc
2. Michael Alexander, Microsoft Access 2007 Data Analysis, Wiley Publishing, Inc

OUTCOMES:

After studying this course students will able to

- Manage large data of business effectively
- Generate different type of reports from the large data effectively

COC 1205 BUSINESS ENVIRONMENT

L	T	P	C
2	0	0	2

OBJECTIVES:

- To enable the students to have an overview of Business Environment – Political, social and Global.
- To enable the students to appreciate the importance of environment and its impact on business and society

MODULE I Introduction 6

Definition and meaning of business – Scope of Business – Characteristics of Business – Business goals – Business during the 21st century - Knowing the environment – Factors influencing the Indian Business Environment – Environmental Analysis.

MODULE II Economic Environment 5

Economic Environment – Nature of the Economy – Structure of the Economy – Economic policies & planning the economic conditions.

MODULE III Political Environment 5

Political & Government Environment – Functions of the state – Economic Roles of the government – Government and Legal Environment – The constitutional Environment

MODULE IV Social Environment 5

Social Environment – Business and Society Ecology and Consumerism), Consumer rights – Business Ethics – Social Responsibility of Business towards stakeholders – Natural Environment and Ecology

MODULE V Global Environment 5

Global Environment – globalisation – Meaning and Rationale for globalisation – the role of WTO – GATT – trading blocks in globalisation – Impact of globalisation on India

TOTAL HOURS – 26

TEXT BOOK:

- S.Sankaran, Business Environment, Margham Publications, Chennai, 2002

REFERENCES:

- K.Aswathappa, Essentials of Business Environment, Himalaya Publishing House, New Delhi, 2001.
- Raj Agarwal, Business Environment, Excel Books,New Delhi, 2000
- Dr. Francis Cherunilam, Business Environment, Himalaya Publishing House, New Delhi, 2003.

OUTCOMES:

After studying this course students will able to

- Analyze the various factors affecting the business environment
- Understand the social responsibility of business towards different interest groups
- describe the recent developments in Indian Economy that have greatly influenced the working of business units in India
- Understand the Global business Scenario and the impact of Globalisation in India

LNC 1285	அடிப்படைத் தமிழ் I / BASIC TAMIL I	L	T	P	C
		2	0	0	2

பன்னிரண்டாம் வகுப்புவரை தமிழ் பயிலாத மற்றும் கல்லூரியில் பகுதி-1ல் தமிழ் பயிலாத அனைத்து இளநிலை பயில் மாணவருக்கும் உரியது.

Basic Tamil is offered to all UG students those who have not studied Tamil Up to XII standard and have taken a non-Tamil Language under Part I

நோக்கங்கள்

- தமிழ்மொழியை அடிப்படைநிலையில் பேசவும் படிக்கவும் எழுதவும் மாணவர்களை ஆயத்தப்படுத்துதல்.
- தமிழ்மொழி மற்றும் தமிழ் பண்பாட்டை விளங்க வைத்தல்
- நடைமுறை வாழ்வியலுக்கான தமிழ்ச்சொற்களை அறிய வைத்தல்
- To equip the students to speak, read and write Tamil at the basic level
- To make them understand the features of Tamil Language and Tamil culture.
- To familiarize every day usage words in Tamil

அலகு I **6**

உயிரெழுத்துக்கள் (Vowels) - மெய்யெழுத்துக்கள் (Consonants) - உயிர் மெய்யெழுத்துக்கள் (Vowel consonants) - கிரந்த எழுத்துக்கள் (Grantha Letters)

அலகு II **6**

பெயர்ச்சொல் (Noun) - வினைச்சொல் (Verb) - பிரதிபெயர் (Pronoun) - பெயரடை (Adjective) - வினையடை (Adverb)

அலகு III **6**

திணை (Human / Non Human) - பால் (Gender) - எண் (Singular / Plural) - இடம் (First / Second / Third Person) - காலம் (Tense)

அலகு IV **6**

எண்கள் (Numbers) - உறவுப்பெயர்கள் (Kinship Terms) - வாரத்தின் நாட்கள் (week days) - இயற்கை (Nature) - உடல் உறுப்புகள் (Parts of the body) - பயன்பாட்டுப் பொருட்களின் பெயர்கள் (Everyday usage words)

அலகு V **2**

பிழைநீக்கி எழுதுதல் (Spot the error) - அகர வரிசைப்படுத்துதல் (Arrange in Alphabetical order) - எதிர்ச்சொல் அறிதல் (Antonyms)

L – 26 ; TOTAL HOURS – 26

குறிப்புகள்

1. தமிழ்மொழி அறிமுகம் - முனைவர் ப. டேவிட்பிரபாகர், விவி வெளியிடு, பதிப்பு-2004.
2. தமிழில் நீங்களும் பிழையில்லாமல் எழுதலாம் - முனைவர் பொற்கோ, புதுவாழ்வு பதிப்பகம், பதிப்பு – 1992.
3. பிழையின்றி நல்லதமிழ் எழுதுவது எப்படி? ஸ்ரீ சந்திரன், தமிழ்நிலையம், பதிப்பு – 2007.
4. Hand Book Tamil – Dr. S. Jean Lawrence, Dr. D. Ranganathan, International Institute of Tamil Studies – 1988.
5. www.Tamilvu.org

வெளிப்பாடு

- தமிழ்மொழி மற்றும் தமிழ் பண்பாட்டை விளங்க வைத்தல்
- நடைமுறை வாழ்வியலுக்கான தமிழ்ச்சொற்களை அறிய வைத்தல்

LNC 1286	சிறப்புத் தமிழ் I / ADVANCED TAMIL I	L	T	P	C
		2	0	0	2

பத்தாம் வகுப்பு மற்றும் பன்னிரண்டாம் வகுப்புவரை தமிழ் பயின்று கல்லூரியில் பகுதி-1ல் தமிழ் பயிலாத மாணவர்களுக்கு உரியது.

நோக்கங்கள்

- தமிழ்மொழி மற்றும் தமிழ் பண்பாட்டை விளங்க வைத்தல்
- நடைமுறை வாழ்வியலுக்கான தமிழ்ச்சொற்களை அறிய வைத்தல்
-

அலகு I **செய்யுள்** **8**

யோகசித்தி – பாரதியார் - நீங்களே சொல்லுங்கள் - பாரதிதாசன் - போராட்டம் - முதுமை – அப்துல் ரகுமான் - தேசபிதாவுக்கு ஒரு பாடகன் அஞ்சலி – மேத்தா - தொலைந்து போனது - ஆண்டாள் பிரிதர்ஷினி - அலிகள் - ந. காமராசர்

அலகு II **சிறுகதை** **3**

ஜெயகாந்தன் - பால்வடியும் முகம் - பி.எஸ்.ராமையா – பணம் பிழைத்தது

அலகு III **இலக்கிய வரலாறு** **5**

கவிதை, சிறுகதை, நாவல்

அலகு IV **மொழித்திறன்** **5**

பிறமொழிச் சொற்களுக்கு இணையான தமிழ்ச்சொற்கள் - கலைச் சொல்லாக்கம் - பழைதிருத்தம்

அலகு V **படைப்பிலக்கியம்** **5**

கவிதை எழுதுதல், சிறுகதை வரைதல்

L – 26 ; TOTAL HOURS – 26

குறிப்புகள்

1. செய்யுள், உரைநடை
2. தமிழ் இலக்கிய வரலாறு - சோம. இளவரசு
3. சிறுகதைத் தொகுப்பு (கட்டுரைக்களஞ்சியம்)

வெளிப்பாடு

- மாணவர்கள் சமூக மாற்றச் சிந்தனைகளை அறிந்துகொள்வர்
- சந்திப்பிழைகளை நீக்கி எழுதும் திறன் பெறுவர்
- புத்திலக்கியங்களைப் படைக்கும் திறனையும் திறனாய்வு செய்யும் திறனையும் பெறுவர்

SEMESTER III

		L	T	P	C
COC2101	**CORPORATE ACCOUNTING - I**	**4**	**2**	**0**	**5**

OBJECTIVES:

- To facilitate the understanding of Corporate Accounting in General
- To give a comprehensive understanding of the system of Corporate Accounting
- To develop skill, related to critical thinking and problem solving
- To facilitate the understanding of the format of P&L account and B/S of the companies as per new schedule with reference to all chapters

MODULE I ISSUE OF SHARES AND DEBENTURES 15

Issue of shares and debentures – various kinds of issues – forfeiture – re-issue – underwriting of shares and debentures.

MODULE II REDEMPTION OF PREFERENCE SHARES AND DEBENTURES 15

Redemption of preference shares and debentures – purchase of business – profits prior to incorporation – Treatment of profit or loss prior to incorporation.

MODULE III COMPANY FINAL ACCOUNTS 15

Preparation of company final accounts – company balance sheet preparation – computation of managerial remuneration.

MODULE IV VALUATION OF GOODWILL AND SHARES 15

Valuation of good will and shares – Factors affecting value of goodwill – Methods of valuation of shares – Computation of valuation of goodwill and shares.

MODULE V INTERNAL RECONSTRUCTION 18

Alteration of share capital – internal reconstruction and reduction of capital – different kinds of alteration of share capital – Procedure for alteration reducing share capital – Accounting entries for alteration and reduction of share capital.

L – 52; T – 26; Total Hours –78

TEXT BOOKS:

1. T.S. Reddy & Murthy, “Corporate Finance”, Margham Publications, Reprint, 2013.

REFERENCES:

1. Dr. S. Kr.Paul&Chandri Paul, “Corporate Finance”, New Central Book Agency (p) Ltd, 2009.
2. K. K. Varma, “Corporate Accounting”, Published by Anurag Jain for Excel Books, First Edition, 2008.
3. Dr. Naseem Ahmed, “Corporate Accounting”, Atlantic Publication, First Edition, 2007

OUTCOMES:

After completing the course the students would be able to

- Understand the features of Shares and Debentures
- Develop an understanding about redemption of Shares and Debenture and its types
- Gets an exposure to the company final accounts and Goodwill
- Effectively use an idea about internal reconstruction

COC2111 MANAGEMENT ACCOUNTING

L	T	P	C
4	1	0	5

OBJECTIVES:

- To introduce students to the various tools and techniques of ManagementAccounting.
- To enlighten students on Financial Statement Analysis with the emphasis on the preparation of fund flow and cash flow statement.

MODULE I INTRODUCTION TO MANAGEMENT ACCOUNTING 12

Management Accounting – Meaning – Scope – Objectives – Importance – Limitations– Function – Management Accounting Vs Financial Accounting – Management Accounting Vs Cost Accounting.

MODULE II FINANCIAL STATEMENT ANALYSIS – RATIOS 15

Financial statement Analysis – Meaning-process of Financial Statement Analysis And Interpretation – Types Of Analysis – techniques Of tools of financial statement analysis – Ratio analysis – Meaning of Ratio – Advantage-classification of Ratios – Profitability Ratios - Turnover or Activity Ratio – Solvency or Financial Ratios – Computation Of Ratio.

MODULE III FUND FLOW & CASH FLOW STATEMENT 13

Funds flow statement – Concepts of Funds – Importance or used of Funds Flow Statement – Working capital Statement or schedule Of Changes In Working Capital – Preparation of Funds Flow Statement – Cash Flow Statement – Advantages And Limitations – Preparation of Cash Flow Statement.

MODULE IV BUDGETING AND BUDGETARY CONTROL 12

Budgeting and Budgetary Control – Meaning And Definition – Objectives of Budgetary Control – Advantages and Limitations – Essential Of Successful Budgetary Control – Preparation of Budgets – Sales Budget – Production Budget – Materials Budget – Cash Budget – Flexible Budget.

MODULE V MARGINAL COSTING 13

Marginal Costing definition of marginal cost and marginal costing – Salient Features of Marginal Costing – Advantages and Limitations of Marginal Costing – Managerial Costing and Absorption Costing and Absorption Costing – Cost volume profit analysis – Contribution - Break Even Analysis Significance Of Margin Of Safety – Application

of Managerial Costing (Simple Problems only).

L – 52; T – 13; Total Hours –65

TEXT BOOKS:

1. M Y Khan, PK Jain, “Management Accounting”, Tata McGraw hill, Fourth Edition, 2003.
2. I.M. Pandey, “Management Accounting”, Vikas Publishing, third Edition, 2006.

REFERENCES:

1. A.R. Ramanathan, N.L. Hingorani, T.S. Grewal, “ Management Accounting”, Sultan Chand & sons, 5th Edition. 2003.
2. T.S.reddy& Dr. Y. Hariprasadreddy, “Management Accounting”, Margham Publications, Fifth revised Edtion, 2014.

OUTCOMES:

- Students will be able to analyse the financial statements using various Management accounting techniques
- To understand various Budgeting techniques and steps to implement them in business
- To be able to understand the differences between cash and fund flows in a business
- To identify the various concepts of Marginal Costing and its impact in business entity

COC2112 FOREIGN EXCHANGE L T P C

4 2 0 5

OBJECTIVES:

- To acquaint the student with the various concepts of foreign exchange rate determination, exchange rate markets, trading, control, etc.
- To make students understand the various Foreign exchange acts in India
- To analyse the various factors determining exchange rates.
- To know the various concepts of FOREX tradeing

MODULE I INTRODUCTION 15

Elements for Foreign Exchange : Meaning - Importance, evolution of exchange rates system - International monetary systems - Gold standard - Fixed exchange rates - Flexible exchange rates - Managed float system -Fluctuations in foreign exchange rate - its causes and effects - Need for stability in foreign exchange rate.

MODULE II FOREIGN EXCHANGE MARKET 15

Foreign Exchange Market : Cash and spot exchange markets Eurocurrency Markets, The Role of Commercial Banks, Mechanics of Making foreign payment,.SWIFT, Costs Associated with International payments.

MODULE III EXCHANGE RATES 15

Determination of Exchange Rates : Factors affecting exchange rates - International trade -Theories of determination of foreign exchange rates - The law of one price, purchasing power parity, Interest parity. Balance of payment theory - Forecasting Forex rates, the forward rate as a short - term forecast, technical forecasts, economic models, forecasting of fixed exchange rates from convertible currencies.

MODULE IV FOREX TRADING 15

Forex Trading: Fore trading infrastructure and networks, control's on order placing, direct and indirect quotas, cross rates, speculation, exchange arithmetics psychology of the forex trader, computerized trading programme, information analysis of trading.

MODULE V INDIAN FOREX MARKET 18

Indian ForexMarket : Foreign exchange administration in India Setting up and operating a forex dealership -Convertibility of Rupees on current account. Convertibility of rupee on capital account, Pros and Cons, Foreign Exchange control objectives. Methods - Exchange control in India - Role of FEDAI - FERA 1973 to

FEMA 1997 Bill - The Hawala market - Foreign exchange problems in India - Steps for settlement role of reserve Bank of India.

L – 52; T – 26; Total Hours –78

TEXT BOOKS:

1. C. Jeevanandam Foreign exchange

REFERENCES:

1. A.V. Rajawade : Foreign exchange, International.
2. A.K. Chatterjee : Principles of foreign exchange,
3. C. Jeevanadam : Foreign exchange arithmetics.

OUTCOMES:

Students will be able to calculate FOREX rates

- Will help student to identify the various steps in Foreign Exchange trading
- Students will understand the various regulation of Foreign Exchange

COC2113 PRACTICAL AUDITING

L	T	P	C
4	0	1	5

OBJECTIVES:

- To understand the meaning, nature and scope of auditing and auditor
- To analyse the various audit programs
- To know how vouching is done by auditors
- To identify the various steps in valuation of assets and liabilities by an auditor
-

MODULE I INTRODUCTION 12

Meaning and Definition of Auditing – Nature and Scope of Auditing – Accountancy and Auditing, Auditing and Investigation – Objectives of Auditing – Limitations of Audit – Advantages of Audit – Classification of Audit

MODULE II AUDIT PROGRAMME 13

Meaning and Definition of Audit Programme – Advantages and Disadvantages – Audit File, Audit Note Book, Audit Working Papers – Purposes and Importance of Working Papers – Internal Check – Meaning, Object of Internal Check – Features of Good Internal Check System – Auditors duty with regards to Internal Check System – Internal Check and Internal Audit.

MODULE III VOUCHING 15

Vouching – Meaning – Objects – Importance of Vouching – Meaning of Voucher – Vouching of Cash Receipts and Vouching of Cash Payments – Vouching of Trading Transactions.

MODULE IV VERIFICATION AND VALUATION OF ASSETS AND LIABILITIES 13

Verification and Valuation of assets and liabilities – Meaning and objects of verification – Vouching and verification – Verification and Valuation of different kinds of Assets and Liabilities.

MODULE V THE AUDIT OF LIMITED COMPANIES 12

The Audit of Limited Companies – Necessity of Company Audit – Qualification and Disqualification of Auditors – Appointment – Removal – Remuneration – Status of Auditors – Rights – Powers – Duties and Liability of Auditors – Auditor's Report – Importance and Contents.

L – 52; P – 13; Total Hours –65

TEXT BOOKS:

1. B.N. Tandon, Sultan Chand – A handbook of practical auditing
2. DinkarPagare-Principles and Practices of Auditing

REFERENCES:

1. B.N. Tandon, Sultan Chand – A handbook of practical auditing
2. B.N. Tandon, Sudharsanam, Sundharabahu – S Chand – Practical auditing
3. Sharma, SahityaBhavan, Agra – Auditing
4. Dr.N.Premavathy, Practical Auditing, Sri Vishnu Publications, Chennai.

OUTCOMES:

- Student will be in a position to identify the various duties and responsibilities of an auditor
- Will be able to understand how vouching is done for cash receipts and cash payments
- Student will understand the various roles of an Internal Auditor
- Will bring knowledge to students about how an auditor prepares his audit report

COC 2114 BUSINESS ECONOMICS L T P C
4 1 0 5

OBJECTIVES:

- To introduce students to the fundamentals of economics relevant from business aspects
- To familiarize students with the importance of economic approaches in business decision making
- To study about the application of economic theory into practical business
- To study about the economic tools and analysis that help make better business decisions

MODULE I INTRODUCTION TO ECONOMICS 15

Positive and Normative economics definition, Scope and Importance of business economics concepts, Uses and Limitations of Microeconomic Theories

MODULE II DEMAND AND SUPPLY 10

Demand and Supply Analysis: Introduction to demand, Law of demand, Shift and movement in the demand curve, Price, income and cross elasticity, Market Equilibrium, Elasticity of demand, Exceptions of the law of demand, Law of supply: shift and movements, Determinant of supply and supply function

MODULE III PRODUCTION THEORY 10

Production Function with one variable and more than one variable, Return to factor and Return to scale, Types of inputs, Total, Marginal and Average Product, Introduction to production function.

MODULE IV ECONOMIC CONCEPT OF COST AND REVENUE 15

Average and Marginal concepts in Cost in long and short run, Relationship between average cost curves- Long Run and Short Run, Kinds of costs, Economies and diseconomies of Scale

Revenue Analysis: Average and Marginal Revenue Curves, Relationship between Revenue curves

MODULE V MARKET STRUCTURE 15

Perfect Competition: Introduction and features of Perfect Competition, Short Run and long run equilibrium

Monopoly: Introduction and features, Price discrimination, Price and output decisions

of discriminating monopolist., Types of monopoly, Price and output determination in short run and long run

Monopolistic Competition: Introduction to monopoly and its features, Price and output determination in short and long run, Role of advertising in monopolistic competition.

L – 52; T – 13; TOTAL HOURS – 65

TEXT BOOK:

1. Business Economics-S Sankaran, Margam Publication
2. Business Economics-Lekhi- Kalyani publications

REFERENCES:

1. Managerial economics: an integrative approach by hirshey, mark, cengage learning
2. Micro economics by Salvatore dominick, oxford university press
3. Advanced economic theory. micro economic analysis by aujah.l, s. chand& company

OUTCOMES:

Through this course students should be able to

- understand basic concepts of economic applied in managerial decision making
- analyse the demand and supply conditions and assess the position of a comapny
- understand the determinants of consumer choices, including inter-temporal choices and those involving risk.
- describe how firm's behavior differs in different market structures and may help to determine those structures.
- Integrate the knowledge of the economic theory with decision-making techniques

COC 2106 OFFICE MANAGEMENT L T P C
2 0 0 2

OBJECTIVES:

- To provide students with the knowledge, understanding and application of the concepts, competence and responsibilities associated with office organization, system, procedures and administration.
- To provide students with good business awareness, decision-making and time management skills so as to enable them to hold responsible office administrative positions.
- To help students develop accuracy, flexibility, commitment and initiative.

MODULE I INTRODUCTION 5

Office management – Meaning – Elements of office management – Functions of office management.

MODULE II OFFICE ORGANIZATION 6

Office organization – Definition, Characteristics and Steps – Types of Organization – Functions of an Office administrator

MODULE III RECORD MANAGEMENT 5

Office record management – Importance – Filing essentials –Classification and arrangement of files-Modern methods of filing-Modern filing devices

MODULE IV OFFICE COMMUNICATION 5

Office Communication – Correspondence–Meaning of office communication & mailing

MODULE V FORM LETTERS & REPORT WRITING 5

Form letters –Meaning, Principles, and Factors to be considered in designing office forms –Report writing -Types of report writing

TOTAL HOURS-26

TEXT BOOK:

1. Office Management by S.P.Arora, Vikas Publications.

REFERENCES:

1. Fundamentals of office management – by J.P.Mahajan
2. Office Management – R.S.N.Pillai&Bagavathi- S.Chand.

3. Office Management – R K Chopra , Himalaya Publication

OUTCOMES:

Through this course students should be able to

- Identity the various elements of Office Management
- Analyze the various functions of an Office Administrator
- Understand the various office communication techniques
- Identify the various Office Communication in the environment

LNC 1285	அடிப்படைத் தமிழ் II / BASIC TAMIL II	L	T	P	C
		2	0	0	2

பன்னிரண்டாம் வகுப்புவரை தமிழ் பயிலாத மற்றும் கல்லூரியில் பகுதி-1ல் தமிழ் பயிலாத அனைத்து இளநிலை பயில் மாணவருக்கும் உரியது.

Basic Tamil is offered to all UG students those who have not studied Tamil Up to XII standard and have taken a non-Tamil Language under Part I

நோக்கங்கள்

- தமிழ்மொழியை அடிப்படைநிலையில் பேசவும் படிக்கவும் எழுதவும் மாணவர்களை ஆயத்தப்படுத்துதல்.
- தமிழ்மொழி மற்றும் தமிழ் பண்பாட்டை விளங்க வைத்தல்
- நடைமுறை வாழ்வியலுக்கான தமிழ்ச்சொற்களை அறிய வைத்தல்
- ❖ To equip the students to speak, read and write Tamil at the basic level
- ❖ To make them understand the features of Tamil Language and Tamil culture.
- ❖ To familiarize every day usage words in Tamil

அலகு I **6**

எழுவாய் (Subject) - பயனிலை (Verb) - செயப்படுபொருள் (Object) - உடன்பாட்டு வாக்கியம் (Affirmative sentence) - எதிர்மறை வாக்கியம் (Negative Sentence) - வினா வாக்கியம் (Interrogative Sentence)

அலகு II **6**

தமிழ் இலக்கியங்கள் மற்றும் புலவர்கள் அறிமுகம் - (Introduction to Tamil Literature and Poets) - தமிழ்மொழியின் செம்மொழித்தகுதி (Tamil Language as Classical Language) - தமிழகச் சுற்றுலாத்தலங்கள் (Tourist places in Tamil Nadu)

அலகு III **6**

திணை (Human / Non Human) - பால் (Gender) - எண் (Singular / Plural) - இடம் (First / Second / Third Person) - காலம் (Tense)

அலகு IV **6**

தமிழர் உணவு (Tamil Food) - தமிழர் விழாக்கள் (Tamil Festival) - தமிழர் நடனம் (Tamil Dance)

அலகு V **2**

உரையாடல் எழுதுதல் (Dialogue Writing) - மொழிபெயர்ப்பு செய்தல் (Translation)-

நாளிதழ் படிக்க பயிற்சி தருதல் (Practice on reading Newspaper)

L – 26 ; TOTAL HOURS – 26

குறிப்புகள்

1. தமிழ்மொழி அறிமுகம் - முனைவர் ப. டேவிட்பிரபாகர், விவி வெளியிடு, பதிப்பு-2004.
2. தமிழில் நீங்களும் பிழையில்லாமல் எழுதலாம் - முனைவர் பொற்கோ, புதுவாழ்வு பதிப்பகம், பதிப்பு – 1992.
3. பிழையின்றி நல்லதமிழ் எழுதுவது எப்படி? ஸ்ரீ சந்திரன், தமிழ்நிலையம், பதிப்பு – 2007.
4. Hand Book Tamil – Dr. S. Jean Lawrence, Dr. D. Ranganathan, International Institute of Tamil Studies – 1988.
5. www.Tamilvu.org

வெளிப்பாடு

- தமிழ்மொழி மற்றும் தமிழ் பண்பாட்டை விளங்க வைத்தல்
- நடைமுறை வாழ்வியலுக்கான தமிழ்ச்சொற்களை அறிய வைத்தல்

LNC 1286	சிறப்புத் தமிழ் II / ADVANCED TAMIL II	L	T	P	C
		2	0	0	2

பத்தாம் வகுப்பு மற்றும் பன்னிரண்டாம் வகுப்புவரை தமிழ் பயின்று கல்லூரியில் பகுதி-1ல் தமிழ் பயிலாத மாணவர்களுக்கு உரியது.

நோக்கங்கள்

- தமிழ்மொழி மற்றும் தமிழ் பண்பாட்டை விளங்க வைத்தல்
- நடைமுறை வாழ்வியலுக்கான தமிழ்ச்சொற்களை அறிய வைத்தல்

அலகு I **செய்யுள்** **8**

சங்க இலக்கியம் - புறம் 2 அகம் 2 - சிலப்பதிகாரம் - அடைக்கலக்காதை (தெரிவு செய்யப்பட்டவை) - திருக்குறள் - 1 - திருமந்திரம் - 3 பாடல்கள் - இயேசு காவியம் - கசப்புறு பாத்திரம் (தெரிவு செய்யப்பட்டவை) - சீறாபுராணம் - மானுக்குப் பிணை நின்ற படலம் (தெரிவு செய்யப்பட்டவை) - குற்றாலக்குறவஞ்சி – சிங்கன் சிங்கி உரையாடல்

அலகு II **உரைநடை** **3**

எது வாழ்க்கை, அறிவியலும் இலக்கியம்

அலகு III **இலக்கிய வரலாறு** **5**

எட்டுத்தொகை, பத்துப்பாட்டு

அலகு IV **பயன்பாட்டுத்தமிழ்** **5**

கடிதம் எழுதுதல் - கட்டுரை எழுதுதல் - தமிழ் இணையதளங்கள் அறிதல்

அலகு V **மொழிப்பயிற்சி** **5**

வல்லினம் மிகுமிடங்கள் - மிகாவிடங்கள் - மொழிபெயர்ப்பு

L – 26 ; TOTAL HOURS – 26

குறிப்புகள்

1. செய்யுள், உரைநடை
2. தமிழ் இலக்கிய வரலாறு - சோம. இளவரசு
3. சிறுகதைத் தொகுப்பு (கட்டுரைக்களஞ்சியம்)

வெளிப்பாடு

- மாணவர்கள் சமூக மாற்றச் சிந்தனைகளை அறிந்துகொள்வர்
- சந்திப்பிழைகளை நீக்கி எழுதும் திறன் பெறுவர்
- புத்திலக்கியங்களைப் படைக்கும் திறனையும் திறனாய்வு செய்யும் திறனையும் பெறுவர்

SEMESTER IV

		L	T	P	C
COC2201	**ADVANCED CORPORATING ACCOUNTING**	**4**	**2**	**0**	**5**

OBJECTIVES:

- To introduce students to the changes in the preparation of Banking and Insurance Company Accounts and the relevance of Accounting Standards in Company Accounts.
- To impart knowledge on Accounting for Liquidating companies
- To introduce the concepts of accounting among Holding & Subsidiary Books

MODULE I **ACCOUNTS RELATING TO AMALGAMATION, ABSORPTION AND EXTERNAL RECONSTRUCTION OF COMPANIES** **15**

Amalgamation – Absorption and External Reconstruction of a Company – Purchase Consideration – Methods of Accounting – Accounts for closing the books of the Vendor Company – journal entries in the books of the purchasing company.

MODULE II **ACCOUNTS OF BANKING COMPANIES** **15**

Final Accounts of Banking Company – Preparation of Profit and Loss Account – Balance Sheet – Preparation of Schedules.

MODULE III **ACCOUNTS OF INSURANCE COMPANIES** **15**

Final Accounts of Insurance Company – Preparation of Final Accounts of Life Insurance and General Insurance – Revenue Account – Profit and Loss Account and Balance sheet.

MODULE IV **LIQUIDATION OF COMPANIES** **15**

Liquidation – Meaning and Definition – Modes of Winging Up – Statement of Affairs and Deficiency Account – Liquidator's Final Statement of Accounts.

[[

MODULE V **HOLDING COMPANY ACCOUNTS** **18**

Holding Company- Subsidiary Company – capital Profit – Revenue Profits –Minority Interest – Cost of Control – Mutual Owings – Preparation of Balance sheet - Consolidated.

L – 52; T – 26; Total Hours –78

TEXT BOOKS:

1. T.S. Reddy & Murthy, “Corporate Finance”, Margham Publications, Reprint, 2013.

REFERENCES:

1. Dr. S. Kr.Paul&Chandri Paul, “Corporate Finance”, New Central Book Agency (p) Ltd, 2009.
2. K. K. Varma, “Corporate Accounting”, Published by Anurag Jain for Excel Books, First Edition, 2008.
3. Dr. Naseem Ahmed, “Corporate Accounting”, Atlantic Publication, First Edition, 2007

OUTCOMES:

After completing the course the students would be able to

- Get knowledge about Amalgamation, Absorption and External reconstruction of Companies.
- Prepare banking companies accounts.
- gain knowledge about insurance company accounts
- Understand the role of liquidation of company.
- Know about holding company and subsidiary company.

COC2211 PRINCIPLES OF FINANCIAL MANAGEMENT L T P C
5 1 0 5

OBJECTIVES:

- To enhance student's knowledge on various aspects related to Financial Management
- To understand different types of risks that are present in the current market conditions
- To impart knowledge on various types of Leverages and Capital Structure decisions
- To have an overview of Cash Management and Receivables Management

MODULE I RISK AND RETURN 12

Risk and Return Introduction Meaning of Return Types of Return- Holding Period Return, Annualized Return, Expected Return Meaning of Risk Types of Risk- Business Risk, Financial Risk, Interest Rate risk, Market Risk and Liquidity Risk (Including Practical Problem

MODULE II LEVERAGE 13

Introduction EBIT & EPS Analysis Types of Leverages: Operating Leverage, Financial Leverage & Composite Leverage Relationship between Operating Leverage and Financial Leverage (Including Practical Problems)

MODULE III CAPITAL STRUCTURE DECISIONS 15

Capital Structure Decisions Meaning Choice of Capital Structure. Importance Optimal capital Structure EBIT-EPS Analysis Cost of Capital, Capital structure and Market Price of Share Capital Structure Theories Dividend Policy - Payout Ratio

MODULE IV CASH MANAGEMENT 12

Introduction Motives for holding cash Aspects of cash management Long terms cash forecasting Reason for cash surplus Cash management: Basic strategies, Cash Management Techniques/Processes, Marketable Securities (Including Practical Problems)

MODULE V RECEIVABLE MANAGEMENT 13

Introduction Aspects of Receivable Management Credit Policy, Credit Evaluation, Credit Granting decision, Control on Accounts Receivable (Including Practical Problems)

L – 52; P – 13; Total Hours –65

TEXT BOOKS:

1. Prasanna Chandra – Fundamentals of Financial Management, TMH

REFERENCES:

1. I.M. Pandey , “Financial Management”, Vikas Publishing House Pvt Ltd, 01-Nov-2009
2. P.c. Kulkarni, “Financial Management”, B.G. Sathyaprasad, Himalaya Publications, 2004.
3. Dr..V.R.Palanivelu, “Financial Management”, S.Chand Publication,2010

OUTCOMES:

- Students will be equipped with the knowledge of various Financial Management techniques
- Students will be able to understand various concepts of Leverages
- Students will analyze various Cash Management and Receivables Management concepts in Financial Statements

COC2212 BUSINESS AND CORPORATE LAWS

L	T	P	C
4	0	1	5

OBJECTIVES:

- To help the students to understand the basic laws related with business and corporate.
- To orient students, about the legal aspects of business and corporate
- To familiarize the students with case law studies related to Business and Corporate Law

MODULE I INTRODUCTION 12

Law of contract-Nature of contract-classification-offer and acceptance-capacity of parties to contract-free consent-consideration-legality of object-Agreement declared void

MODULE II CONTRACT ACT 13

Performance of contract-discharge of contract-Remedies of breach of contract-Quasi contract(general contract-section 1 to 75) Contract of indemnity-Guarantee-Bailment &pledge-contract of agency.

MODULE III SALE OF GOODS ACT 15

Sale of goods act-Definition-sale-Agreement to sell-distinction between sale and agreement to sell-condition and warranties-distinction between condition and warranties-Right and duties of an unpaid seller.

MODULE IV COMPANIES ACT 13

Company-types of companies-memorandum of association-Articles of association-prospectus-shares and debentures-company meetings.

MODULE V FOREIGN EXCHANGE 12

Foreign exchange management act 1999(FEMA)-Information technology act-Intellectual property rights(IPRA).

L – 52; T – 13; Total Hours –65

TEXT BOOKS:

1. Business laws-N.D.Kapoor, sultan chand& sons

REFERENCES:

1. P.Saravanavel,S.Sumathi**,** Legal System in Business,
2. Kapoor publication pvt., ltd – Student guide to Student guide to mercantile law
3. Balachandran, by Company law - Vijai Nicole publication.

OUTCOMES:

- Make the students understand about business and corporate law
- Develop knowledge on contract and various types of contracts
- To help the students to understand the concept of sale of goods
- Make the students understand about companies and its types
- To equip the students with proper knowledge about Foreign exchange

COC2213 GOODS & SERVICE TAX (GST)

L	T	P	C
4	0	1	5

OBJECTIVES:

- To provide students with a working knowledge of principles and provisions of GST
- To make students understand the various impacts of GST in current scenario
- To impart knowledge to students about the procedures involved in calculation in GST

MODULE I INTRODUCTION **13**

Constitutional framework of Indirect Taxes before GST (Taxation Powers of Union & State Government); Concept of VAT: Meaning, Variants and Methods; Major Defects in the structure of Indirect Taxes prior to GST; Rationale for GST; Structure of GST (SGST, CGST, UTGST &IGST); GST Council, GST Network, State Compensation Mechanism, Registration.

MODULE II LEVY AND COLLECTION OF GST **15**

Taxable event- “Supply” of Goods and Services; Place of Supply: Within state, Interstate, Import and Export; Time of supply; Valuation for GST- Valuation rules, taxability of reimbursement of expenses; Exemption from GST: Small supplies and Composition Scheme; Classification of Goods and Services: Composite and Mixed Supplies.

MODULE III INPUT TAX CREDIT **12**

Eligible and Ineligible Input Tax Credit; Apportionments of Credit and Blocked Credits; Tax Credit in respect of Capital Goods; Recovery of Excess Tax Credit; Availability of Tax Credit in special circumstances; Transfer of Input Credit (Input Service Distribution); Payment of Taxes; Refund; Doctrine of unjust enrichment; TDS, TCS. Reverse Charge Mechanism, Job work

MODULE IV PROCEDURES **12**

Tax Invoice, Credit and Debit Notes, Returns, Audit in GST, Assessment: Self-Assessment, Summary and Scrutiny.

MODULE V SPECIAL PROVISIONS **13**

Taxability of E-Commerce, Anti-Profiteering, Avoidance of dual control, E-way bills, zero-ratedsupply, Offences and Penalties, Appeals

L – 52; P – 13; Total Hours –65

REFERENCES:

1. The Central Goods and Services Tax, 2017
2. The Integrated Goods and Services Tax, 2017
3. The Union Territory Goods and Services Tax, 2017
4. The Goods and Services Tax (Compensation to States), 2017
5. The Constitution (One hundred and First Amendment) Act, 2016
6. Gupta, S.S. , GST- How to meet your obligations (April 2017), Taxmann Publications
7. Halakandhi, S., G.S.T (Vastu and Sevakar) (Hindi) Vol-1, 2017
8. Gupta, S.S., Vastu and Sevakar, Taxmann Publications, 2017
9. Vastu and SevakarVidhan by Government of India Note: More Readings for this paper will be notified in due course of time.

OUTCOMES:

- Students will be able to identify the various aspects of GST
- They will be able to calculate the value of GST on different products
- Students will have knowledge on Input Tax Credit methods
- Students will be equipped with the knowledge of how GST is levied and collected

COC2214 FISCAL ECONOMICS L T P C

5 1 0 5

OBJECTIVES:

- To impart knowledge on Public Finance to students
- To make students understand the concepts like Public Expenditure and Revenue
- To brief about the term Direct & Indirect Taxes
- To make students understand the Financial policy in India

MODULE I INTRODUCTION 15

Public Finance – Its meaning and Scope – Uses and Role of Public Finance in the Economy – Public Finance and private Finance – The principles of maximum social advantage

MODULE II PUBLIC EXPENDITURE & PUBLIC REVENUE 15

Sources of revenue of the center and states – Recent trends – Tax Revenues – Non-tax Revenues – Recent trends – Role of Direct taxes – Income Tax – Corporate Tax – Excise duty and customs duty – Wealth Tax – Capital gains Tax – Death duty, gift Tax – Public Expenditure – general growth of public expenditure – causes, effects and control of expenditure.

MODULE III TAXATION – PRINCIPLES AND KINDS 15

Principles of taxation – The cost of Service – The benefit – The ability to pay – The progressive and proportional Taxation – Direct and Indirect Taxes – Merits and demerits – VAT – shifting of tax burden – effects of Taxation.

MODULE IV PUBLIC DEBT 15

Need for Public debt – Public debt and private debt – causes and effects of public – debt – public department redemption – Public department– recent trends – Public debt of the State Government.

MODULE V FEDERAL FINANCE 18

Evolution – Central – State Financial Relationship – Finance Commissions – The Recent Finance Commission and its report – Local Finance – Its trend in India – Fiscal policy – Objectives, uses, limitations – Fiscal policy in India – functional finance of A.P.Lerner.

L – 52; T – 26; Total Hours –78

TEXT BOOKS:

1. Sundaram. KPM. Fiscal Economics, Sultan Chand Educational Publishers – New Delhi – 2.
2. Sankaran. S - Fiscal Economics- MarghamPublication,Chennai.

REFERENCES:

1. Ganguli – NN., (1998) Public Finance, Sultan Chand Publication, New Delhi – 2.
2. Loganathan. P., (2000), Public Finance, Emerald publishers. 135.Annasalai – Madras – 2.
3. Sankaran K. (2002), Kamala Publication, Madras – 2.

OUTCOMES:

On the successful completion of the course the students should have:

- The student will understand about the various Financial aspects of the country
- Knowledge about Public Debt & Finance
- The roles of various Direct and Indirect Taxes

COC2206	COMMUNICATION SKILLS	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To equip students with networking system
- To make awareness among students on how to maintain public relation
- To familiarize with grievance handling procedure.
- To gain/ acquires skill on business correspondence

MODULE I PRESENTATION SKILLS 5

Presentations: (to be tested in tutorials only) 4 Principles of Effective Presentation Effective use of OHP Effective use of Transparencies How to make a Power-Point Presentation

MODULE II GROUP COMMUNICATION - I 5

Interviews:Group Discussion Preparing for an Interview, Types of Interviews – Selection, Appraisal, Grievance, Exit Meetings:Need and Importance of Meetings, Conduct of Meeting and Group Dynamics Role of the Chairperson, Role of the Participants, Drafting of Notice, Agenda and Resolutions

MODULE III GROUP COMMUNICATION - II 5

Conference: Meaning and Importance of Conference Organizing a Conference
Modern Methods: Video and Tele – Conferencing
Public Relations: Meaning, Functions of PR Department, External and Internal Measures of PR.

MODULE IV BUSINESS CORRESPONDENCE TRADE LETTERS 6

Order, Credit and Status Enquiry, Collection (just a brief introduction to be given) Only following to be taught in detail:- Letters of Inquiry, Letters of Complaints, Claims, Adjustments Sales Letters, promotional leaflets and fliers Consumer Grievance Letters, Letters under Right to Information (RTI) Act

[Teachers must provide the students with theoretical constructs wherever necessary in order to create awareness. However students should not be tested on the theory.]

MODULE V LANGUAGE AND WRITING SKILLS 5

Reports: Parts, Types, Feasibility Reports, Investigative Reports. Summarization: Identification of main and supporting/sub points presenting these in a cohesive

manner

L – 26; T – 0; Total Hours –26

REFERENCES:

1. Alien, R.K.(1970) Organisational Management through Communication.
2. Balan,K.R. and Rayudu C.S. (1996) Effective Communication, Beacon New Delhi.
3. BoveeCourtland,L and Thrill, John V(1989) Business Communication, Today McGraw Hill, New York, Taxman Publication

OUTCOMES:

After completing the course the students would be able to

- Become familiar in office correspondence
- Learn and know as to how to maintain good Public Relationship
- Get awareness on how to face problems
- Familiarize to latest networking system.

SEMESTER V

COC3111	**PRINCIPLES OF COST ACCOUNTING**	**L**	**T**	**P**	**C**
		4	**2**	**0**	**5**

OBJECTIVES:

- To enlighten the students on the importance of cost ascertainment reduction and control.
- To teach the students to calculate the element-wise and the total cost of product and services
- To understand the methods of costing adopted by different types of industries.

MODULE I INTRODUCTION TO COSTING 15

Nature and Scope – Objectives, Advantages and Limitations – Financial Vs. Cost Accounting - Costing System - Types of Costing and Cost Classification – Cost Sheet and Tenders – Cost Unit – Cost Centre and Profit Centre.

MODULE II MATERIAL PURCHASE AND CONTROL 15

Purchase Department and its Objectives – Purchase Procedure – Classification and Codification of Materials, Material Control: Levels of Stock and EOQ – Perpetual Inventory System, ABC and VED Analysis – Accounting of Material Losses.

MODULE III PRICING OF MATERIALS 15

Cost Price Methods: FIFO, LIFO, Average Price Methods: Simple and Weighted Average Price Methods, Notional Price Methods: Standards Price, and Market Price Methods

MODULE IV LABOUR COSTING 15

Labour Turnover: Causes, Methods of Measurement and Reduction of Labour Turnover –

Idle and Over Time – Remuneration and Inventive: Time and Piece Rate – Taylor's, Merricks and Gantt's Task – Premium Bonus System – Halsey, Rowan and Emerson's

Plans – Calculation of Earnings of Workers

MODULE V OVERHEADS 18

Classification of Overhead Costs – Departmentalization of Overheads – Allocation Absorption and Appointment of Overhead Costs – Primary and Secondary Distribution of Overheads – Computation of Machine Hour Rate and Labour Hour Rate.

L – 52; T – 26; Total Hours –78

TEXT BOOKS:

1. T.S. Reddy &Hari Prasad Reddy – Cost Accounting – Margham Publications, Chennai

REFERENCES:

1. S.P.Jain and Narang – Cost Accounting – Kalyani Publishers, New Delhi
2. S.N.Maheswari – Principles of Cost Accounting – Sultan Chand & sons, New Delhi
3. S.P.Iyangar – Cost Accounting – Sultan Chand & Sons, New Delhi
4. A.Murthy and S. Gurusamy, Cost Accounting, Tata McGraw-Hill Publishing Company Ltd. New Delhi.
5. Tulsian P.C. – Cost Accounting – Tata McGraw Hills

OUTCOMES:

- Students will be able to analyse the term cost in every aspect
- They will have knowledge about the various Elements of Cost
- Students will ne able to prepare a Cost Sheet for an Organisation
- Students will have an understanding on various components of cost and steps to control it

COC3112 ADVANCED FINANCIAL MANAGEMENT L T P C
4 2 0 5

OBJECTIVES:

- To create awareness on Financial Planning
- To equip with application on Dividend, Equity and its yield
- To make them learn on the approaches to theory on Dividend
- To make them familiar on Portfolio Management and Mutual Fund

MODULE I FINANCIAL POLICY AND CORPORATE STRATEGY 15

Meaning of strategic financial management Strategic financial decision making framework Functions of Strategic Financial Management Financial Planning

MODULE II SECURITY ANALYSIS 15

Fundamental analysis - Meaning, Dividend growth model and PE multiple Industry analysis - Factors affecting industry analysis, Techniques used industry analysis, Company analysis Technical analysis - Meaning ,General principles and methods, The Dow theory, Market indicators Bond valuation - Introduction , Bond valuation model ,Bond value theorems ,Yield to maturity Bond values with semi-annual interest

MODULE III DIVIDEND DECISIONS 15

Introduction of dividend policy Practical considerations in dividend policy Theories on dividend policy, Traditional position, Walter approach, Gorden Growth approach Modigilani and Miller hypothesis

MODULE IV MUTUAL FUNDS 15

Introduction Classification of MFs Evaluating performance MFs, NAV, Costs incurred by MFs, Holding Period Return Criteria for evaluating the performance, Sharpe ratio, Treynor ratio, Jensen’s ratio

MODULE V PORTFOLIO THEORY 18

Activities in portfolio management Objectives of portfolio management Theories, Traditional approach, Modern approach Portfolio analysis

L – 52; T – 26; Total Hours –78

TEXT BOOKS:

1. Prasanna Chandra – Fundamentals of Financial Management, TMH

REFERENCES:

- I.M. Pandey , “Financial Management”, Vikas Publishing House Pvt Ltd, 01-Nov-2009
- P.c. Kulkarni, “Financial Management”, B.G. Sathyaprasad, Himalaya Publications, 2004.
- Dr..V.R.Palanivelu, “Financial Management”, S.Chand Publication,2010

OUTCOMES:

On the successful completion of the course the students should have:

- Equip them with gaining knowledge on Financial Planning
- Familiarize with dividend theories and its approaches
- Get good knowledge on Mutual Knowledge and Portfolio Management

COC3113 TAXATION I

L	T	P	C
4	0	2	5

OBJECTIVES:

- To enable the students in familiarizing the income tax provisionsand to compute tax liability.
- To impart Knowledge of various heads of Income under Income Tax act
- To enlighten students on various concepts relating to Taxation in day today transactions

MODULE I INTRODUCTION 15

Basic concepts: Income, agricultural income, casual income, assessment year, previous year, Gross total income, person: Tax evasion, Avoidances and tax planning. - Bases of Charge: Scope of total income residential status and tax liability, income which does not form part of total income

MODULE II INCOME FROM SALARIES 15

Income from Salaries – Definition- features – composition of salary income – treatment of P.F – Allowances – perquisites – rent free accommodation – treatment of other items in salary – deductions – tax rebate

MODULE III INCOME FROM HOUSE PROPERTY 15

Income from house Property – computation of annual value – deductions from house property – comprehensive problems ; self-occupied houses –house deemed to be let out – house let out and self-occupied – let-out house property.

MODULE IV INCOME FROM BUSINESS OR PROFESSION 15

Income from Business or Profession – Allowable and Not Allowable Expenses – General Deductions – Computation of Taxable Income from Business or Profession.

MODULE V CAPITAL GAINS 18

Capital gains – computation of all kinds of capital gains – exemption of tax on capital gains - Income chargeable under the head Income from other Sources

L – 52; T – 26; Total Hours –78

TEXT BOOKS:

1. Singhanai V.K., Students‟ Guide to Income Tax”Taxmann, Delhi.*

REFERENCES:

1. Prasad, Bhagwathi., Income Tax Law & Practice; Wiley Publication New Delhi.
2. Mehrotra H.C., Income Tax Law & Accounts, SahityaBhawan, Agra.
3. DinkerPagare., Income Tax Law and Practice; Sultan Chand & Sons, New Delhi.
4. GirishAhuja and Ravi Gupta., Systematic approach to income Tax; SahityaBhawanPublications, New Delhi.
5. Chandra Mahesh and Shukla D.C., Income Tax Law and practice; PragatiPublications, New Delhi.

OUTCOMES:

- To know about the provisions of the Income Tax Act of 1961.
- Students can get knowledge about heads of income very particular about salary income.
- To learn about capital gain. Students can learn about house property income.
- Students will get provisions of Income Tax Act for depreciation.

COC3105 PERSONALITY DEVELOPMENT L T P C
2 0 0 2

OBJECTIVES:

- To Make Aware About The Importance Of Personality And Development InThe Business World.
- To Make The Students Follow The Good Personality And Create A Good Relationship With Others.

MODULE I PERSONALITY DEVELOPMENT-INTRODUCTION 5

The Concept Personality - Dimensions of Personality - Term Personality Development - Significance. The Concept of Success And Failure What Is Success? - Hurdles In Achieving Success - Overcoming Hurdles - Factors Responsible For Success – What Is Failure - Causes of Failure-Do's And Don'ts Regarding Success And Failure.

MODULE II ATTITUDES AND VALUES 5

Attitude - Concept - Significance - Factors Affecting Attitudes - Positive Attitude - Advantages -Negative Attitude - Disadvantages - Ways To Develop Positive Attitude – Difference between Personalities Having Positive And Negative Attitude.

MODULE III MOTIVATION 5

Concept Of Motivation - Significance - Internal And External Motives - Importance Of Self-Motivation- Factors Leading To De-motivation -Theories To Motivation.

MODULE IV SELF ESTEEM AND SMART 6

Term Self-Esteem - Symptoms - Advantages - Do's And Don'ts To Develop Positive Self-Esteem – Low Self-Esteem - Symptoms - Personality Having Low Self Esteem - Positive And Negative Self-Esteem. Interpersonal Relationships - Teaming - Developing Positive Personality - Analysis of Strengths and Weaknesses. Concept Of Goal-Setting - Importance Of Goals - Dream Vs Goal - Why Goal-Setting Fails? – Smart (Specific, Measurable, Achievable, Realistic, Time-Bound) Goals - Art Of Prioritization - Do's And Don'ts About Goals.

MODULE V BODY LANGUAGE, STRESS MANAGEMENT & TIME MANAGEMENT 5

Body Language - Assertiveness - Problem-Solving - Conflict And Stress Management - Decision-Making Skills - Positive And Creative Thinking - Leadership

And Qualities Of A Successful Leader - Character-Building - Team-Work - Lateral Thinking - Time Management - Work Ethics – Management Of Change - Good Manners And Etiquettes (Concept, Significance And Skills To Achieve Should Be Studied.)

L – 26; T – 0; Total Hours –26

TEXT BOOKS:

1. Richard Denny, “Communicate To Win”, Kogan Page India Private Limited, New Delhi-2009.

REFERENCES:

1. S. P. Robbins, “OrganisationalBehaviour”,Prentice-Hall Of India Pvt. Ltd., New Delhi-15th edition, 2013
2. Rajendra Pal And J. S. Korlhalli ,“Essentials Of Business Communication”, Sultan Chand & Sons, New Delhi,1st edition,2012.

OUTCOMES:

After completing the course the students would be able to

- Provide orientation about personality development
- Understand the importance of Values and Attitudes for their self-development.
- give them Motivation and to create knowledge about motivation theories
- Enable them to become SMART and Self esteemed
- Create awareness about body language and stress management

SEMESTER VI

COC3211	**ADVANCED COST ACCOUNTING**	**L**	**T**	**P**	**C**
		4	**2**	**0**	**5**

OBJECTIVES:

- To enlighten the students on the importance of cost ascertainment reduction and control.
- To teach the students to calculate the element-wise and the total cost of product and services
- To understand the methods of costing adopted by different types of industries.

MODULE I JOB, BATCH, CONTRACT COSTING 15

Job, Batch, Contract Costing: Job Costing – definition – Features – Procedure – WIP – Cost Accumulation, Batch Costing – EBQ, Contract Costing – Definition, Features, Work Certified and Uncertified – Incomplete Contact – Escalation Clause – Cost Plus Contract – Contract Account

MODULE II MATERIAL PURCHASE AND CONTROL 15

Process Costing : Definition – Features – Job Vs Process Costing – Process Account – Losses – By Products and Joint Products – WIP – Equivalent Units and its Calculation - Closing WIP with or without Process Loss.

MODULE III OPERATING COSTING 15

Operating Costing (Transport Costing): Cost Unit – Cost Classification – Operating Cost sheet.

MODULE IV MARGINAL COSTING 15

Marginal Costing: Definition – Advantages and Limitation – Break Even Point – Margin of Safety – P/V Ratio – Key factor – Make or Buy Decision – Selection of Product Mix – Changes in Selling Price – Foreign Market Offer – Desired Level of Profit.

MODULE V RECONCILIATION 18

Reconciliation of Cost and Financial Accounts.

L – 52; T – 26; Total Hours –78

TEXT BOOKS:

1. T.S. Reddy &Hari Prasad Reddy – Cost Accounting – Margham Publications,

Chennai

REFERENCES:

1. S.P.Jain and Narang – Cost Accounting – Kalyani Publishers, New Delhi
2. S.N.Maheswari – Principles of Cost Accounting – Sultan Chand & sons, New Delhi
3. S.P.Iyangar – Cost Accounting – Sultan Chand & Sons, New Delhi
4. A.Murthy and S. Gurusamy, Cost Accounting, Tata McGraw-Hill Publishing Company Ltd. New Delhi.
5. Tulsian P.C. – Cost Accounting – Tata McGraw Hills

OUTCOMES:

After completing the course the students would be able to

- Calculate the various elements of cost of a product
- Analyse the various Marginal Costing Techniques
- Identify the various Job and Process Costing methods

COC3212 COMPUTERIZED ACCOUNTING L T P C
4 0 2 5

OBJECTIVES:

- To create an awareness on operation and maintenance of computerized accounting.
- To educate students on latest version of tally accounting software.

MODULE I FUNDAMENTALS OF COMPUTERIZED ACCOUNTING 15

Fundamentals of Computerized accounting – Computer accounting Vs Manual accounting. Architecture and customization of Tally – Features of Tally – Configuration of Tally – Tally screen and menu.

MODULE II CREATION OF COMPANY 15

Creation of company – Group – Editing and deleting ledgers. Creation of ledgers – Editing and deleting ledgers. Introduction to voucher entries – Payment voucher – Contra voucher – Journal voucher – Editing and deleting vouchers.

MODULE III INTRODUCTION TO INVENTORIES 15

Introduction to inventories – Creation – Configuration and features of stock item – Editing and deleting – Usage of stock in voucher entry – Purchase orders – Stock vouchers.

MODULE IV INTRODUCTION TO COST 15

Introduction to cost – Creation of cost categories – Creation of cost centers – Editing and deleting – Usage of cost category and cost centers in voucher entry.

MODULE V VALUE ADDED TAX. 18

Generating and printing reports in detailed and condensed format – Day book – Balance sheet – Trial Balance – Profit and Loss account – Ratio analysis – Cash flow statement – Fund flow statement – Cost centers report – Inventory report – Bank reconciliation statement. - VAT.

L – 52; T – 26; Total Hours –78

TEXT BOOKS:

1. K.K.Nandhani - Implementing tally 9.0 - BPB Publishers
2. Tally Note Book - Work book and study material - Teaching Staff from the department

REFERENCES:

1. Narmata Agarwal – Tally – Dreamtech press

OUTCOMES:

After completing the course the students would be able to

- At the end of the course, students shall be able to initiate, operate and maintain computerized accounts of business concern using Tally accounting software as per the version in the use.

COC3213	TAXATION – II	L	T	P	C
		4	0	2	5

OBJECTIVES:

- To impart knowledge on Computation on Tax Liability
- Get awareness on powers and functions of Income Tax Officers
- Students will get knowledge and information on appealing procedure

MODULE I COMPUTATION OF TAX LIABILITY 15

Computation of total income and tax liability of an individual, H.U.F and firm.

MODULE II AGGREGATIONS AND DEDUCTIONS 15

Aggregation of income; Set-off and carry forward of losses; Deduction from Gross total income

MODULE III TAX MANAGEMNET 15

Tax Management: Tax deduction at source; Advance payment of tax; Assessment Procedure; Tax planning for individuals.

MODULE IV INCOME TAX AUTHORITIES 15

Income Tax Authorities: Powers and Functions of Income Tax Officer, Central Board of Direct Taxes, Commissioner of Income Tax – Types of Assessments and Rectification of Mistakes – Recovery of Tax and Refunds.

MODULE V APPEALS AND REVISION 18

Appeals and revision – procedure in appeal – powers of commissioner (Appeal) – appeal to Appellate Tribunal – reference to high court- appeal to supreme court – revision of best judgement assessment – revision by commissioner – penalties and prosecution – procedure and time limit for imposing penalty – offences and prosecution

L – 52; T – 26; Total Hours –78

TEXT BOOKS:

1. Singhanai V.K., Students" Guide to Income Tax; Taxmann, Delhi.*

REFERENCES:

1. Prasad, Bhagwathi., Income Tax Law & Practice; Wiley Publication New Delhi.
2. Mehrotra H.C., Income Tax Law & Accounts, SahityaBhawan, Agra.

3. DinkerPagare., Income Tax Law and Practice; Sultan Chand & Sons, New Delhi.
4. GirishAhuja and Ravi Gupta., Systematic approach to income Tax; SahityaBhawanPublications, New Delhi.
5. Chandra Mahesh and Shukla D.C., Income Tax Law and practice; PragatiPublications, New Delhi.

OUTCOMES:

After completing the course the students would be able to

- Calculate the tax liability of an Individual
- Identify the various Deductions available in computation of Tax Liability
- Understand the various roles and responsibilities of Income Tax Officers

COC 3204 VALUE EDUCATION L T P C
2 0 0 2

OBJECTIVES:

- To help individuals think about and reflect on different values.
- To deepen understanding, motivation and responsibility with regard to making personal and social choices and the practical implications of expressing them in relation to themselves, others, the community and the world at large.
- To inspire individuals to choose their own personal, social, moral and spiritual values and be aware of practical methods for developing and deepening.

MODULE I VALUE SYSTEM 4

Value Education- Introduction – Definition of values–Need for Inculcation of values – Object of Value- Education-Sources of Value – Types

MODULE II PERSONAL VALUES 6

definition of person - Self confidence – Self discipline – Self Assessment – Self restraint – Self motivation – Determination – Ambition – Contentment – Humility and Simplicity – Sympathy and Compassion –Gratitude – Forgiveness – Honesty – Courtesy.

MODULE III SOCIAL VALUES 5

Definition of Society – Units of Society – Individual, family, different groups – Community – Social consciousness – Equality and Brotherhood – Dialogue – Tolerance – Responsibility – Co-operation Freedom –Repentance and Magnanimity.

MODULE IV PROFESSIONAL VALUES 4

Definition – Competence – Confidence – Devotion to duty – Efficiency – Accountability –Respect for learning / learned – Willingness to learn-Open and balanced mind – Team spirit – Professional Ethic –Willingness for Discussion – Aims – Effort – Avoidance of Procrastination and slothfulness – Alertness.

MODULE V BEHAVIORAL VALUES

Individual values and group values – Good manners at home and outside – Equality – purity of thought, speech and action – Understanding the role of religion – Faith – Understanding the commonness of religions –respect for other faiths – unity diversity – Living together – Tolerance – Non-violence – Truthfulness – Common aim –Unified efforts towards peace – Patriotism.

TOTAL HOURS – 26

OUTCOMES:

Through this course students should be able to

- to be respectful of others
- To provide guiding principles and tools for the development of the whole person recognizing that the individual is comprised of Physical, Intellectual, Emotional and Spiritual dimensions.
- Students will understand the importance of acting responsibly and respectfully when using forums, social media, or mobile
- Be good citizens and learn to avoid the misuse of information or to acknowledge and respect others' right to peace and privacy.
- Showing tolerance and understanding to those less fortunate.

PROGRAMME ELECTIVE

COCX01	**INVESTMENT MANAGEMENT**	**L**	**T**	**P**	**C**
		4	**1**	**0**	**5**

OBJECTIVES:

- To provide knowledge on the various investment avenues that benefit the individuals and nation.
- To introduce the students to the application of various tools and techniques of investments and risks management.

MODULE I INVESTMENT 13

Investment - Investment process - Speculation - Security Analysis - Construction of portfolio - Negotiable and non-negotiable securities – Concepts of Risk and Return

MODULE II PRIMARY AND SECONDARY MARKET 12

New issue market - Methods of issues -Placement of the issues - Pricing of new issues - Investors protection - The secondary market - History of stock exchange - Its function - Types of orders - Share groups - Online trading.

MODULE III FUNDAMENTAL ANALYSIS 12

Fundamental Analysis - Economic Analysis - Industry Analysis - Company Analysis - Quantitative Analysis.

MODULE IV TECHNICAL ANALYSIS AND EMH 13

Technical Analysis - Assumptions - History of technical analysis -Technical tools - Dow Theory - Primary trend - Secondary trend - Mirror trends. Technical Analysis - Assumptions - History of technical analysis -Technical tools - Dow Theory - Primary trend - Secondary trend - Mirror trends.

MODULE V DERIVATIVES 10

Futures and Options - Meaning - Types - Factors affecting the value of option - Futures - Types.

L – 52; T – 13; Total Hours –65

TEXT BOOKS:

1. PunithavathiPandian, (2013), Security Analysis and Portfolio Management, Vikas Publishing House Pvt ltd, New Delhi.

REFERENCES:

1. Natarajan L, (2013), Investment Management, Security Analysis and Portfolio management, Margham Publications, Chennai.
2. Avadhani VA, (2008), Investment and Securities Market in India, Himalaya Publishing House, Mumbai.
3. Bhalla VK, (2009), Investment Management, Security Analysis and Portfolio Management, S.Chand and Company Ltd, New Delhi.
4. Prasanna Chandra, (2009), Investment Analysis and Portfolio Management, Tata McGraw-Hill Publishing Company Limited, New Delhi.

OUTCOMES:

After completing the course the students would be able to

- Obtains in-depth knowledge on stock market operations(Equity Market)
- Get acquainted with analysis on fundamental and technical analysis
- Get an insight in the derivatives market

COCX02 INTERNATIONAL FINANCE

L	T	P	C
4	1	0	5

OBJECTIVES:

- To have exposure on international monetary system
- To understand about balance of payments
- To familiarize the international financial markets and instrument

MODULE I INTRODUCTION 13

International Finance- scope- International Monetary System- Bimetallism- Gold standard- Bretton Wood System- Floating Exchange Rate regime- European Monetary System- IMF- WTO-GATT

MODULE II BALANCE OF PAYMENT 12

Balance of Payments – The Current Account – The Capital Account – Significance – Balance of Payments in the World – Balance of Payments Account of India

MODULE III INTERNATIONAL FINANCIAL MARKETS 12

International Financial Markets – Sources of International Funds – Multilateral Development Banks – International Banks – International Equities – GDRs – ADRs – Euro Bonds – Repos – Euro Deposits – Euro Issues in India.

MODULE IV CURRENCY RISK AND EXPOSURE 13

Currency Risk and Exposure – Types of Currency Risk – Management of Currency Risk – Concept and Measurement of Transaction Exposure – Translation Exposure methods – Exchange risk – Operating Exposure.

MODULE V FOREIGN DIRECT INVESTMENT (FDI 10

Foreign Direct Investment (FDI) – Forms of FDIs – Purpose of overseas investment - Benefits to the Host Countries – Effect of FDI – FDI in India – Current trends in FDI in India.

L – 52; T – 13; Total Hours –65

TEXT BOOKS:

1. Dr. V.A. Avadhani, International Finance, JBA, New Delhi, 2011
2. Kevin. S Fundamentals of International Financial Management, PHI, Delhi, 2009.

REFERENCES:

1. H. Kent Baker, Leigh A. Riddick, International Finance, Oxford University Press, 2013
2. Joseph Anbarasu, Global Financial Management, Ane, New Delhi, 2010
3. G. Shailaja, International Finance, JBA, New Delhi, 2011.

OUTCOMES:

After completing the course the students would be able to

- Get an exposure on monetary system
- Familiarized with the financial markets and instruments
- Gain knowledge on balance of payment

COCX04	INSURANCE	L	T	P	C
		4	1	0	5

OBJECTIVES:

- To understand the nature of insurance and the principles that governs general insurance.
- To gain an insight on the nature of life insurance, fire insurance and marine insurance and to know the procedures for making claims against different kinds of insurance policies
- To understand the importance of burglary insurance and personal accident insurance.

MODULE I INSURANCE **13**

Meaning, functions, nature and principles of insurance, importance of insurance to individuals and business

MODULE II LIFE INSURANCE **12**

Life Insurance – features of a life insurance contract – classification of policies – investment of funds – surrender value – bonus option – policy condition – annuity contracts.

MODULE III MARINE INSURANCE **12**

Contract of marine insurance – elements of marine insurance – classes of policies – policy conditions – clause in a marine insurance policy – marine losses.

MODULE IV FIRE INSURANCE **13**

Fire Insurance – features of a fire insurance – kinds of policies – policy conditions – payment of claims – reinsurance.

MODULE V MISCELLANEOUS INSURANCE **10**

Miscellaneous Insurance – motor insurance – burglary – personal accident insurance.

L – 52; T – 13; Total Hours –65

TEXT BOOKS:

1. M. N. Mishra, Insurance Principles And Practice,S. Chand & Co, New Delhi,2000

REFERENCES:

1. M.N.Mishra, Modern concepts of Insurance, S.Chand&Co., 2000
2. P.S .Palandi, Insurance in India, Response Books – Sagar Publications, 2000

OUTCOMES:

After completing the course the students would be able to

- Gains wide information on nature and principles of insurance
- Acquires knowledge of various types of insurances (life , Marine, Fire)
- Gets an insight into the importance of burglary

COCX05 RESEARCH METHODOLOGY L T P C
3 2 0 5

OBJECTIVES:

- To enable to student to understand and work methods and concepts related research.
- To enable the student to develop research project and work with research problem.

MODULE I INTRODUCTION 13

Meaning and Definition of Research - Characteristics of Research – Objectives of Research – Types of Research – Process and steps of Research.

MODULE II PROCESS OF SELECTION AND FORMULATION OF RESEARCH PROBLEM 12

Problem Selection / Identification of the problem – Sources of research problems – Criteria of a good research problem – Principles of research problem – Hypothesis – Meaning – Sources of Hypothesis – Characteristics of good Hypothesis.

MODULE III RESEARCH DESIGN 12

Meaning of R/D – Types of R/D – Essential steps in preparation of R/D – Evaluation of the R/D – A Model Design.

MODULE IV DATA COLLECTION AND ANALYSIS AND INTERPRETATION OF DATA. 13

Main forms of Data Collection responses – Methods of data Collection – Analysis of data – Types of analysis – Statistical tools and analysis – Interpretation of data – Need and Importance – Technique of interpretation

MODULE V . RESEARCH REPORT 10

Meaning of R / R – Steps in Organization of R / R – Types of Report – Significance of Report Writing – Drafting of reports – Contents of a report.

L – 39; T – 26; Total Hours –65

TEXT BOOKS:

1. Dr. P. Ravilochanan, Research Methodlogy, Margham Publications, Chennai

REFERENCES:

1. C. R. Kothari - Research Methodology: Methods and Techniques- New Age

International Publisher.
2. Patten chetty - Research Methodology - Rainbow Publications.
3. P.Saravanavel- Research Methodology - Kidap Publications

OUTCOMES:

After completing the course the students would be able to

- Get good understanding on research concept and its methods
- Gets awareness on choosing research topics
- Acquire knowledge on how to define a problem
- Gets an idea on how to prepare project proposal

COCX21	ACCOUNTING STANDARD	L	T	P	C
		5	1	0	5

OBJECTIVES:

- To lay a theoretical foundation for the preparation and presentation of financial statements;
- To gain working knowledge of the professional standards, principles and procedures of accounting and their application to different practical situations;
- To gain the ability to solve simple problems and cases relating to sole proprietorship, partnership and companies; and
- To familiarize students with the fundamentals of computerized system of accounting.

MODULE I INTRODUCTION 15

A General Knowledge of the framing of the accounting standards, national and international accounting authorities, adoption of international financial reporting standards

MODULE II Accounting Standards - I 15

AS 1:Disclosure of Accounting Policies

AS 2:Valuation of Inventories

MODULE III Accounting Standards - II 15

AS 3: Cash Flow Statements

AS 6: Depreciation Accounting

MODULE IV Accounting Standards - III 15

AS 7: Construction Contracts (Revised 2002)

AS 9: Revenue Recognition

MODULE V Accounting Standards - IV 18

AS 10: Accounting for Fixed Assets

AS 13: Accounting for Investments

L – 52; T – 26; Total Hours –78

REFERENCES:

1. IPCC/IPCE study material

OUTCOMES:

On the successful completion of the course the students should have:

- Knowledge about various accounting standards and its impacts
- They will be able to have an indepth knowledge about various Accounting standards that are commonly used in Financial aspects
- They will be able to understand the concepts of Financial reporting and its impact

COCX22	FINANCIAL MARKETS & SERVICES	L	T	P	C
		4	0	1	5

OBJECTIVES:

- To know about the various financial services and market.
- To get awareness of the credit rating and its operations.
- To learn about the mutual fund services to the people.
- To get insight knowledge in Leasing and Hire purchase functions to the society.
- To know about the concept of Dematerialization.
- To gain knowledge of the Factoring and forfaiting services.

MODULE I INTRODUCTION TO FINANCIAL SERVICES 10

An overview of financial system in Markets – Objectives of financial system – Types of financial services – Regulation of Financial services – Problems and Prospects of Financial service sector.

MODULE II INTRODUCTION TO FINANCIAL MARKET 10

Management of NIM – Secondary market Vs NIM - Functions of Stock exchanges –– National Stock Exchanges – OTCEI- Non Banking Financial Institutions - SEBI Functions and Workings - Listing of securities.

MODULE III CREDIT RATING, FACTORING & FORFAITING 15

Credit Rating:

Definition- Features – Advantages – Credit rating system (Growth Factors) – Global Credit Rating agencies – Rating agencies in India (CRISIL, IICRA, CAREDCR) - Credit rating symbols – Credit rating process and its limitations, - SEBI Guidelines – Future credit rating in India.

Factoring & Forfaiting:

The concept – significance – types – factoring mechanism – factoring in India.

Forfaiting - Definition – Factoring Vs Forfaiting – Problems and prospects of forfaiting.

MODULE IV LEASING AND HIRE PURCHASE 15

Leasing: The concept –Types of lease – Structure of leasing industry – Legal aspects – Problems and prospects.

Hire purchase: Meaning – Hire purchase –Leasing VS Hire purchase – Problems and prospects of hire purchase in India.

MODULE V **MUTUAL FUNDS, DEMATERIALISATION & REMATERIALISATION** **15**

Mutual Funds: Meaning – Classification – Functions – Importance – Risk involved in M.F) – Commercial banks and Mutual Funds (includes UTI, LIC) -. General guidelines of M.F. – Future of mutual fund industry.

Dematerialisation&Rematerialisation:

Meaning – objective – Functions – Merits and Demerits – Progress of demat in India – NSDL & CDSL (Growth & Functioning)

L – 52; T – 13; Total Hours –65

TEXT BOOKS:

1. Gordon Natarajan - Financial Markets and Services – Himalaya publishing House

REFERENCES:

1. Banking & Financial System - B.Santhanam - Margham Publishers
2. Indian Financial Systems – Dr.S.Guruswamy
3. Vasant Desai, Indian Financial Systems, Himalaya Publishers

OUTCOMES:

After completing the course the students would be able to

- Learns about the various financial services and market
- Gets knowledge and ides on credit and mutual funds.
- Acquire knowledge on Leasing and Hire- purchasing
- Gets an insight on Dematerialization and factoring.

B.S. Abdur Rahman Crescent Institute of Science & Technology

Deemed to be University u/s 3 of the UGC Act, 1956

REGULATIONS 2017

CURRICULUM AND SYLLABI (I & II Semester)

B.DES
(INTERIOR ARCHITECTURE)

VISION AND MISSION

CRESCENT SCHOOL OF ARCHITECTURE

VISION

To be a leading school for Education, Training and Research in Architecture & Design for a better future and over-all Socio-Economic progress of the Country in a sustainable manner.

MISSION

- To nurture Architects & Designers into ethically strong and responsible leaders to address Global challenges through Quality Education, Application oriented research, innovation, inspiration, motivation and sustainable growth.
- To enrich and enhance knowledge for the best practices in various disciplines of Architecture & Design through Collaborations with Global Institutions of Excellence, Industries and Research Organizations.

PROGRAMME EDUCATIONAL OBJECTIVES

Bachelor of Design (Interior Architecture) curriculum is designed to prepare the graduates having aptitude and knowledge

- To enable a successful professional and technical career.
- To enable a strong foundation in Theory, Theory cum studio & Interior Design Studio.
- To impart knowledge of the theories and practices in the field of Interior Architecture.
- Engage in life-long learning to keep themselves abreast of new developments.
- To put into practice and inspire high ethical values and technical standards.

PROGRAMME OUTCOMES

The graduates will be have the

- Ability to gain knowledge of Theory, Theory cum studio & Interior Design studio.
- Ability to understand elements of Interior Architecture and apply basic principles in Design projects.
- Ability to identify social, economic and cultural issues in Interior Architectural Design.
- Ability to analyze and apply theoretical knowledge to achieve Interior Architectural Design solutions.
- Ability to understand ethical and professional responsibilities.
- Ability to review, comprehend and report technological developments.
- Ability to understand real life situation of Interior Architectural Practice.
- Ability to communicate effectively and work in interdisciplinary groups.

B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE & TECHNOLOGY

B.DES. INTERIOR ARCHITECTURE

CURRICULUM & SYLLABUS, REGULATIONS 2017

SEMESTER I

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	**Studio**	IA C 1101	Basic Studio- I	0	0	11	**6**	
2.	**Theory cum studio**	IA C 1102	Allied Design Studio- I	2	0	4	**4**	
3.	**Theory cum studio**	IA C 1103	Workshop- I	1	0	4	**3**	
4.	**Theory cum studio**	IA C 1104	Integrated Design Studio- I	1	0	4	**3**	
5.	**Theory**	IA C 1105	Skill Development-I	2	0	0	**2**	
6.	**Theory**	IA C 1106	Theory of Design	3	0	0	**3**	**21**

SEMESTER II

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	**Studio**	IA C 1201	Interior Design Studio- I	0	-	11	**6**	
2.	**Theory cum studio**	IA C 1202	Allied Design Studio- II	2	0	3	**4**	
3.	**Theory cum studio**	IA C 1203	Workshop- II	1	0	3	**3**	
4.	**Theory cum studio**	IA C 1204	Integrated Design Studio- II	1	0	4	**3**	
5.	**Theory**	IA C 1205	History of Interior Design- I	3	0	0	**3**	
6.	**Theory**		Theory- Open Elective I	3	0	0	**3**	**22**

SEMESTER III

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	**Studio**	IA C 2301	Interior Design Studio- II	0	0	11	**6**

2.	**Theory cum studio**	IA C 2302	Allied Design Studio- II	2	0	3	**4**	
3.	**Theory cum studio**	IA C 2303	Workshop- III	1	0	3	**3**	
4.	**Theory cum studio**	IA C 2304	Integrated Design Studio- II	1	0	4	**3**	
5.	**Theory**	IA C 2305	Estimation & Costing	3	0	0	**3**	
6.	**Theory**		Theory- Open Elective II	3	0	0	**3**	**22**

SEMESTER IV

Sl. No.	**Course Group**	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	
1.	**Studio**	IA C2401	Interior Design Studio- III	0	0	12	**6**	
2.	**Theory cum studio**	IA C2402	Allied Design Studio- IV	2	0	3	**4**	
3.	**Theory cum studio**	IA C 2403	Workshop- IV	1	0	3	**3**	
4.	**Theory cum studio**	IA B2404	Integrated Design Studio- III	1	0	3	**3**	
5.	**Theory**	IA C 2405	History of Interior Architecture-II	3	0	0	**3**	
6.	**Theory**		Theory- Open Elective III	3	0	0	**3**	**22**

SEMESTER V

Sl. No.	**Course Group**	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	
1.	**Studio**	IA C 3501	Interior Design Studio- IV	0	0	17	**8**	
2.	**Theory cum studio**	IA C 3502	Allied Design Studio- V	2	0	4	**4**	
3.	**Theory cum studio**	IA C 3504	Integrated Design Studio- IV	1	0	4	**3**	
4.	**Theory**	IA C 3505	Furniture Design	3	0	0	**3**	
5.	**Theory**		Theory- Open Elective IV	3	0	0	**3**	**21**

SEMESTER VI

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	**Studio**	IA C 3601	Interior Design Studio- VI	0	0	22	**9**	
2.	**Theory cum studio**	IA C 3602	Allied Design Studio- V	2	0	6	**5**	
3.	**Theory**	IA C3603	Professional Practice : Contracts, Tenders, Competitions Arbitrations	3	0	0	**3**	
4.	**Theory**		Theory- Open Elective V	3	0	0	**3**	**20**

SEMESTER VII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.		IA C4701	Practical Training	0	0	0	**10**	**10**

SEMESTER VIII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.		IA C4801	Interior Architectural Thesis	0	0	0	**20**	**20**

Total credits – 158

LIST OF PROFESSIONAL ELECTIVES

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	IA C X01	Vernacular Architecture	3	0	0	**3**
2.	PE	IA C X02	Energy efficient design	3	0	0	**3**
3.	PE	IA C X03	Strategies for Innovation in Design	3	0	0	**3**
4.	PE	IA C X04	Landscape Design	3	0	0	**3**
5.	PE	IA C X05	Digital Technology	3	0	0	**3**
6.	PE	IA C X06	Advanced Building Energy Efficiency	3	0	0	**3**
7.	PE	IA C X07	Advanced Product design	3	0	0	**3**
8.	PE	IA C X08	Advanced Lighting design	3	0	0	**3**
9.	PE	IA C X09	Interior Architecture Photography	3	0	0	**3**
10.	PE	IA C X10	Advanced Furniture design	3	0	0	**3**

SEMESTER I

IA C 1101	BASIC DESIGN – I	L	T	P	C
		0	0	11	6

OBJECTIVES:

Basic Design studio aims at

- Allowing the students to develop the observational, analytical, inference & visualization skills by involving in design problems.
- Offers the transition phase for the students in which they can explore the potential creativity through design exercises.
- The next phase of the students is the phase of realization of the practical design exercise, by which they explore creating appealing harmonious interior Environment.

PHASE I: 60

- Elements and Principles –Exercises related to the same.
- Exploring color schemes and their application in a visual composition and in Architectural forms and spaces.
- Study of texture and schemes of texture both applied and stimulated and their application
- Study of linear and planar forms using simple material like Mount Board, metal foil, box boards, wire string, thermocol etc.
- Study of Solids and voids to evolve sculptural forms and spaces and explore the play of light and shade and application of color.
- Analytical appraisal of building form in terms of visual character, play of light and shade, solids and voids etc.

PHASE II 65

- Application of Basic design through design of simple architectural elements like
- Introduction to Design principles & ordering systems through exercises in Product Designs. Eg: Pen Holder, Book Shelves, etc.,
- Focus on understanding physical dimensions through exercises in ergonomics and anthropometric. Eg: Small scale furniture design.
- Exercises to explore the translation of verbal (adjective & verbs) to visual through compositions both in two and three dimensions.

PHASE III **55**

- Materials, Built forms and expressions.
- Understanding of built Environments and its determinants. Eg:. Single space Design exercises- Typology of single room/User/Utility area Eg: Bedroom, Toilet, Living area, Kiosk Design, etc.,
- Man and his basic living activity- Body, Activity & Enclosure.

TOTAL HOURS – 180

TEXT BOOKS:

1. Paul Zelanski & Mary Pat Fisher, "Design principles & Problems" , 2nd Ed, Thomson & Wadsworth,USA,1996
2. Owen Cappleman & Michael Jack Kordan, "Foundations in Architecture: An Annotated Anthology of beginning design projects", Van Nostrand Reinhold, New York.
3. Paul Laseau, "Graphic Thinking For Architects and Designers", John Wiley & Sons, New York, 2001.
4. Francis D.K.Ching, "Architecture - Form Space and Order", Van Nostrand Reinhold Co., (Canada), 1979.

REFERENCES:

1. John W.Mills, “The Technique of Sculpture", B.T.Batsford Limited, New York - Reinhold Publishing Corporation, London,1966.
2. C.Lawrence Bunchy, "Acrylic for Sculpture and Design", 450,West 33rd Street,New York,N.Y.10001,1972.
3. Charles Wallschlaeger & Synthia Busic Snyder, "Basic Visual Concepts & Principles for artists, architects & designers", McGraw hill, USA, 1992.
4. Exner V., Pressel D., “Basics Spatial Design”, Birkhanser, 2009.

OUTCOMES:

- To understand various design elements and principles - applying them in two-dimensional and three-dimensional compositions.
- To understand the creative process, develop techniques and methods of creative problem solving.
- To equip the students to understand about the various anthropometric aspects, human factors & other design criteria involved in the design

through small scale furniture.

- To produce the best possible solution within given limits of time.
- To acquire the knowledge of colors schemes and textures
- To acquire a basic knowledge of art terminology to express their ideas verbally.
- To familiarize the students with design principles and ordering system through 3D modeling and the product designs.
- To develop understanding of the scale, function and options existing when designing small-scale spaces in residences such as toilets, kitchens, living, bedrooms etc
- Increase awareness of the creative process

IA C 1102	ALLIED DESIGN STUDIO- I	L	T	P	C
		2	0	4	4

OBJECTIVES:

Allied Design Studio aims to provide the students with the knowledge of the basic understanding of materials in Interior Design. This studio also focuses on two dimensional and three dimensional geometry and its representations through drawing.

PHASE I CONSTRUCTION TECHNIQUES & REPRESENTATIONS 50

1. Exercises involve the understanding and representation of principles of geometry, orthographic projections of points, lines, and planes and solids sections of simple and complex solids and the development of the surfaces of solids.
2. Exercises that helps the students to familiarize with drawing materials and equipments. Significance of precision and accuracy in technical drawings is taught to the students.
3. Understanding of use of Bricks in Buildings and interiors.

PHASE II BRICKS IN BUILDING CONSTRUCTION 25

4. Understanding of components of buildings throughsection through walls
5. Brick bonding - English and Flemish: L- junction, T- junction, intersections. Stretcher and header bond. Rat-trap bond, Creative bonding. Piers and foundations.

TOTAL HOURS – 75

TEXT BOOKS:

1. P.C. Varghese, "Building Materials", Prentice Hall of India put Ltd New Delhi 110001, 2005.
2. B.C. Punmia, "Building Construction", 2005.

REFERENCES:

1. I.H. Morris, Geometrical Drawing for Art Students, Orient Longman Chennai.
2. Ralph W. Liebing "Architectural Working Drawing", John Wiley & Sons. Inc - 2000.
3. Morgan, "Elements of structure".

OUTCOMES:

- To equip the students with various tools of drafting.
- To acquire the knowledge of basic and complex projections.

- To familiarize the students in two dimensional and three dimensional geometry and its representations through drawing.
- To develop understanding of the scale and proportion.
- To attain the knowledge of components of building through section.
- To gain the technical knowledge of bricks and its bonding in Buildings and interiors.

IA C 1103 **WORKSHOP- I**

L	T	P	C
1	0	4	3

OBJECTIVES:

- Workshop aims at the development of model making skills of the students to communicate and develop ideas through model making techniques.
- Not restricted to any specific medium, the course offers the platform for the students to explore their mode of model making techniques.

COURSE CONTENTS:

PHASE I **30**

- Understand material and tools by making objects which allow students to explore forms, surfaces, textures, and patterns i.e. elements and principles of design.
- Model making- Tools, materials, Techniques of Model- making. Scaled models are still the most effective and instant way of completely communicating a concept in spite of advances in computerization.

PHASE II **30**

- This subject teaches the students to properly comprehend the three dimensional in its aesthetic and functional totality.
- Connecting with the Basic Design Studio –I exercises. The models for the end products of Design can be made through the techniques learned in this workshop.

TOTAL HOURS –60

TEXT BOOKS:

1. Paul Zelanski & Mary Pat Fisher, "Design principles & Problems" , 2nd Ed, Thomson & Wadsworth,USA,1996
2. Owen Cappleman & Michael Jack Kordan, "Foundations in Architecture: An Annotated Anthology of beginning design projects", Van Nostrand Reinhold, New York.

REFERENCES:

1. Charles Wallschlaeger & Synthia Busic Snyder, "Basic Visual Concepts & Principles for artists, architects & designers", McGraw hill, USA, 1992.

2. John W.Mills, " The Technique of Sculpture", B.T.Batsford Limited, New York - Reinhold Publishing Corporation, London,1966.

OUTCOMES:

- The students will be made to understand the materials and tools by making objects which allow them to explore forms, surfaces, textures, and patterns i.e. elements and principles of design.
- The students will be made familiar with Model making- Tools, materials and techniques of Model- making.
- Scaled models are still the most effective and instant way of completely communicating a concept in spite of advances in computerization.
- This subject teaches the students to properly comprehend the three dimensional in its aesthetic and functional totality.
- Connecting with the Basic Design Studio –I exercises. The models for the end products of Design can be made through the techniques learned in this workshop.
- products of Design can be made through the techniques learned in this workshop.

IA C 1104	INTEGRATED DESIGN STUDIO01	L	T	P	C
		1	0	4	3

OBJECTIVES:

The phase I of the course explores the use of free hand sketching and drawing as tools of visual representation.It uses geometrical analysis of objects as a means to understand shapes and proportions, as well as aspects like opacity, transparency, shades and shadows, and light and depth. Students develop skills in observation andrecording through drawing with different media like pencil, pen, dry pastels and water colors.

The phase II of the course explores the use of digital media as a tool for both designing & Creation. The course aims to make the students proficient in digital skills by constant practice in the various updated software. It introduces the students to the basics of software, and techniques of two dimensional drawings and representation.

COURSE CONTENTS:

PHASE I **30**

- Exercises to understand Color wheels & color theory.
- Free hand Sketching
- Understanding & Representing the quality of various materials- opacity, transparency, shades and shadows, and light and depth
- Exercises to explore various medium of presentations- pencil, pen, crayons and water colors, etc.,
- Exercise to improve the skills of observation through the recording of different types of spaces with respect to their scale, volume, form, materials and finishes.

PHASE II **30**

- Understanding the use of drawing tools, object editing, drawing objects, filing and setting drawing units, scales, limits that size and dimensioning, lettering. Setting up of drawing of various simple objects with complete text and dimensioning.
- Transparent overlays, hatching utilities, assigned color and line type, use of multi-line, style, block, symbol library, manipulation for accurate drawings, incorporating the above mentioned utilities.
- Introduction to tools of productivity – Blocks. Understanding concepts of View

port, concept of object linking and editing session.

- Introduction to basic presentation tools- PowerPoint techniques, Communication tools.

TOTAL HOURS –60

TEXT BOOKS:

1. Jim Legitt, "Drawing Shortcuts", John Wiley & sons Inc, 2010.
2. Webb, Frank, “The Artist guide to Composition”, David & Charles, U.K., 1994.
3. Ching Francis, “Drawing a Creative Process”, Van Nostrand Reinhold, New York, 1990.
4. Alan Swann, “Graphic Design School”, Harper Collins, 1991.

REFERENCES:

1. Moivahuntly, "The artist drawing book", David & Charles, U.K., 1994.
2. Drawing a Creative Process", Ching Francis, Van Nostrand Reinhold, New York, 1990.
3. Arundell (Jan) Exploring sculpture, Mills and Boon, London/Charles, T. Brand Ford Company, U.S.A.
4. The art of drawing trees, heads, colours, mixing, drawing, landscape and painting, water colour, oil colour, etc. – The Grumbacher Library Books, New York, 1996.
5. Caldwell peter, “Pen and Ink Sketching”, B.T. Bats ford Ltd., London, 1995.

OUTCOMES:

- The students are expected to have the knowledge of free hand sketching and Understand visual perception, principles and systems of order that inform two- and three-dimensional design, architectural composition.
- To familiarize the students with the concepts of 3D modeling.
- To enable them to experiment with forms, mapping, rendering and presentation techniques.
- To equip the students with various tools of sketching and rendering like pencils, pens, different medium of colors, etc.
- To practice and extend the ability to think visually and to communicate concepts, design solutions and arguments clearly and concisely through visual, verbal and written means.
- To attain the knowledge of quality of various materials- opacity, transparency, shades and shadows, and light and depth

IA C 1105	SKILL DEVELOPMENT	L	T	P	C
		2	0	0	2

OBJECTIVES:

The primary objective of this course is to improve communication skill development and technical writing.

The course is aimed at providing the students with language skills which is an inescapable tool for the young technocrats to break geographical boundaries and step into global world.

COURSE CONTENT

PHASE I **15**

- Seminars, Guest Lectures, putting up Exhibitions, Workshops, participating in Architectural Competitions or conducting Site Visits or Study Tours.
- INTRODUCTION: Skimming, scanning, inferring, predicting and responding to content - Guessing the meaning of words from contexts - Note making and vocabulary extension.
- VOCABULARY DEVELOPMENT: Listening and understanding recorded, structured talks and classroom lectures - Comprehending the matter - understanding the links between different parts of speech - practice in note taking.

PHASE II **15**

- COMMUNICATION: Features of an effective speech-Practice in speaking fluently - Dialogue practice- simple social exchanges - short extempore talks.
- COMPREHENSION: Effective sentences-cohesive paragraphs - clear and concise writing - Introduction to technical writing - Definition, Description, Instruction - Summary Writing practice.
- RESOURCE UTILIZATION: Use of library - Role of Bibliography, Table of contents, Index etc. - use of Dictionary.

TOTAL HOURS –30

OUTCOMES:

- Seminars, Guest Lectures, putting up Exhibitions, Workshops, participating in Architectural Competitions or conducting Site Visits or Study Tours.
- INTRODUCTION: Skimming, scanning, inferring, predicting and responding to content - Guessing the meaning of words from contexts - Note making and vocabulary extension.
- VOCABULARY DEVELOPMENT: Listening and understanding recorded,

structured talks and classroom lectures - Comprehending the matter - understanding the links between different parts of speech - practice in note taking.

- COMMUNICATION: Features of an effective speech-Practice in speaking fluently - Dialogue practice- simple social exchanges - short extempore talks.
- COMPREHENSION: Effective sentences-cohesive paragraphs - clear and concise writing - Introduction to technical writing - Definition, Description, Instruction - Summary Writing practice.
- RESOURCE UTILIZATION: Use of library - Role of Bibliography, Table of contents, Index etc. - use of Dictionary.

IA C 1106	THEORY OF DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- The course aims to provide the basic theories and principles needed for the students while handling the design exercises.
- They are equipped with the knowledge of theories applied in the conception and development of design.
- The theoretical approach is to be interwoven with the design processes.

COURSE CONTENT:

PHASE I **15**

- Space – definition; Interior space – spatial qualities: form, scale, outlook; structuring space with interior design elements; spatial form; spatial dimension; height of space; spatial transitions – openings within wall planes, doorways, windows, stairways.
- Point, line, volume, shape, texture, color & Form – in relation to light, pattern etc. and application of the same in designing interiors.

PHASE II **15**

- Ratio; proportions – golden section; relationships; scale; Balance, symmetry, harmony; unity; variety; rhythm; emphasis.
- Definition, theory of standard dimension based on human figures for activities, functions, circulation, furniture design, spatial requirements etc. Study of Ergonomics Design of Furniture for Living, Dining, Kitchen, Office etc.

PHASE III **15**

- Design process – Analysis, synthesis, design evaluation;
- Design criteria – function and purpose, utility and economy, form and style;
- Human factors - human dimensions, distance zones, activity relationships;
- Fitting the space – plan arrangements, function, aesthetics.

TOTAL HOURS – 45

TEXT BOOKS:

1. Ching, Frank (Francis D.K.), "Architecture: Form, Space & Order", Van Nostrand Reinhold, New York. Hoboken 2007; ISBN 0471752169
2. Ching, Frank (Francis D.K.), "Drawing: A Creative Process", Van Nostrand Reinhold, New York 1990.

3. Simon Unwin, "Analysing Architecture", Rouledge, London, 2003.
4. V.S.Pramar, "Design Fundamentals in Architecture", Somaiya Publications Private Ltd.,

REFERENCES:

1. Yatin Pandya,"Elements of Space making", Mapin 2007.
2. Leland M.Roth, "Understanding Architecture: Its Experience History and Meaning", Craftsman house, 1994.
3. Peter von Meiss, "Elements of architecture – from form to place", Spon Press 1977.
4. Rudolf Arnheim, "The dynamics of architectural form", University of California Press, 1977.
5. Neils Prak, "The language of Architecture", Mounton & Co., 1968.
6. . Paul Alan Johnson, "The Theory of Architecture – Concepts and themes", Van Nostrand Reinhold Co., New York, 1994.

OUTCOMES:

- The students will be taught about Space – definition; Interior space – spatial qualities: form, scale, outlook; structuring space with interior design elements; spatial form; spatial dimension; height of space; spatial transitions – openings within wall planes, doorways, windows, stairways.
- Application of the design principles like Point, line, volume, shape, texture, color & Form – in relation to light, pattern etc. in designing interiors.
- The will be encouraged to use Ratio; proportions – golden section; relationships; scale; Balance, symmetry, harmony; unity; variety; rhythm; emphasis in basic design and workshop exercises.
- Definition and theory of standard dimension based on human figures for activities, functions, circulation, furniture design, spatial requirements etc. Study of Ergonomics Design of Furniture for Living, Dining, Kitchen, Office etc. will be brought in use through the workshop's model making exercises.

SEMESTER II

		L	T	P	C
IA C 1201	**INTERIOR DESIGN STUDIO - I**	**0**	**0**	**11**	**6**

OBJECTIVES:

- Interior Design studio- II facilitate the students to design spatial interventions in response to physical and visual attributes of a given site context.
- To understand the basic structural systems.
- To comprehend the services pertaining the design projects.
- As continued from the Basic Design - Phase II, the students explore creating appealing harmonious Environment.

COURSE CONTENTS

PHASE I **70**

- Multi space design Exercises- Eg: Types of Residence.
- Exercise to involve the development of services along with the design problem.

PHASE II **50**

- Site Planning and analysis
- Contextual Exploration of materials and usage.

PHASE III **60**

- Working of the Basic structural systems.
- Working drawings with respect to the Plumbing, Electrical details.

TOTAL HOURS – 180

TEXT BOOKS:

1. Joseph De Chiara, Michael J Crosbie, Time Saver Standards for Building Types, McGraw Hill Professional 2001.
2. Julius Panero, Martin Zelnik, Human Dimension and Interior Space, Whitney Library of Design, 1975
3. Joseph De Chiara, Julius Panero, Martin Zelnik, Time Saver Standards for Interior Design and Space Planning, McGraw Hill 2001.
4. Ernst Neuferts Architects Data, Blackwell 2002

REFERENCES:

1. Hideaki Hareguchi, A Comparative analysis of 20thcentury houses, Academy Editions, 1988
2. Robert Powell, Tropical Asian House, Select Books, 1996

3. Terence Conran, The Essential House Book, Conran Octopus, 1994
4. Sam F. Miller, Design Process: A Primer for Architectural and Interior Design, Van Nostrand Reinhold, 1995.

OUTCOMES:

- The students will be able to comprehend to physical and visual attributes of a given site context.
- The students will be able to familiarize themselves with the structural systems of the projects.
- The students will be able to comprehend the services pertaining the design projects.

IA C 1202	ALLIED DESIGN STUDIO- II	L	T	P	C
		2	0	3	4

OBJECTIVES:

- Allied Design Studio aims to provide the students with the knowledge of the basic understanding of materials in Interior Design.
- This studio focuses on Doors, windows, Ventilators- materials, types, construction details.
- To study about the various recent developments regarding the opening in spaces.

COURSE CONTENT

PHASE I **25**

- Introduction to the openings in spaces.
- Doors- types of doors- Fully paneled single and double shutter doors of various types and sizes.Drawings of timber joinery for Doors. With respect to material: Details of Aluminum doors - Openable, Sliding, Pivoted, Glass Entrance doors, UPVC doors.

PHASE II **25**

- Windows- fully glazed window, fixed glass and timber louvered windows. Drawings of timber joinery for Windows. With respect to material: Details of Aluminum windows - Openable, Sliding, Fixed, Pivoted.

PHASE III **25**

- Ventilators- Drawings of timber joinery for Ventilators, Aluminum ventilators - Top hung, Bottom hung, Pivoted, Louvered.
- Study of various other recent developments in Industry regarding openings in spaces.

TOTAL HOURS –75

TEXT BOOKS:

1. W.B. Mickay, “Building construction Vol 1,2 and 3”, Longmans, UK 2005.
2. R.Chudley, ”Building Construction Handbook”, Elsevier/Butterworth-Heinemann2006.
3. S.C.Rangwala, “Engineering materials”, Charotar Publishing, 2011.
4. S.P.Arora & S.P.Bindra, “Text book of Building Construction”, Ganpat Rai Publications (P) Ltd, New Delhi, 2013
5. B.C. Punmia, “Building Construction”, 2005
6. P.C. Varghese, “Building Materials”, Prentice Hall of India put Ltd New Delhi 110001, 2005

REFERENCES:

1. Don A.Watson, “Construction Materials and Processes”, McGraw Hill Co.,1992.
2. Alanwerth, “Materials”, The Mitchell Pub.Co.Ltd., London,1986

OUTCOMES:

- The students will be equipped with the knowledge of the basic understanding of materials in Interior Design.
- The students can comprehend the details and techniques of Doors, windows, Ventilators- materials, types, and construction details.
- To familiarize with various recent developments regarding the opening in spaces.

IA C 1203	WORKSHOP- II	L	T	P	C
		1	0	3	3

OBJECTIVES:

- Workshop II aim at the development of model making skills of the students to communicate and develop ideas through model making techniques. Not restricted to any specific medium, the course offers the platform for the students to explore their mode of model making techniques.

COURSE CONTENT:

PHASE I **25**

- Exercises related to Model making
- Understand material and tools by making objects which allow students to explore forms, surfaces, textures, and patterns i.e. elements and principles of design.
- Exploration of the model making techniques in the recent development of the Industry.

PHASE I **35**

- Textile Printing- Basic Knowledge of the fabric as interior element.
- Woodwork & Carpentry.
- Glass painting.

TOTAL HOURS – 60

TEXT BOOKS:

1. Owen Cappleman & Michael Jack Kordan, "Foundations in Architecture: An Annotated Anthology of beginning design projects", Van Nostrand Reinhold, New York.
2. John W.Mills, " The Technique of Sculpture", B.T.Batsford Limited, New York - Reinhold Publishing Corporation, London,1966.
3. C.Lawrence Bunchy, "Acrylic for Sculpture and Design", 450,West 33rd Street,New York,N.Y.10001,1972.

REFERENCES:

1. Charles Wallschlaeger & Synthia Busic Snyder, "Basic Visual Concepts & Principles for artists, architects & designers", McGraw hill, USA, 1992.
2. John W.Mills, " The Technique of Sculpture", B.T.Batsford Limited, New York - Reinhold Publishing Corporation, London,1966.

OUTCOMES:

- The students will be able to communicate and develop ideas through model

making techniques.

- The students will be equipped with the various recent model making techniques in the industry.

IA C 1204 INTEGRATED DESIGN STUDIO L T P C
1 0 4 3

OBJECTIVES:

- The course explores the use of digital media as a tool for both designing & Creation. The course aims to make the students proficient in digital skills by constant practice in the various updated software.
- It introduces the students to the basics of three dimensional form explorations.

COURSE CONTENT

PHASE I 30

- Introduction to 3 D software- tools of productivity, rendering techniques.
- Understanding the use of drawing tools, object editing, drawing objects, filing and setting drawing units, scales, limits that size and dimensioning, lettering.
- Setting up of drawing of various simple objects with complete text and dimensioning.
- Layout - way to use the fundamental drawing, editing and navigation tools to put together quick presentations.
- Leverage Templates, including custom Title blocks, Document Settings.

PHASE II 30

- Ways to light your model and add realistic reflections and finishes in Shade light
- Advance command programming – Transparent overlays, hatching utilities, assigned color and line type, use of multi-line, style, block, symbol library, manipulation for accurate drawings, incorporating the above mentioned utilities.
- Introduction to tools of productivity – Blocks. Understanding concepts of View port, concept of object linking and editing session.

TOTAL HOURS – 60

TEXT BOOKS:

1. Watt, “Fundamentals of Three-Dimensional Computer Graphics”, Addison Wesley, Massachusetts, 1989.
2. Aouad, “Computer Aided Design guide for Architecture, Engineering and construction”, Spon process, 2012.

REFERENCES:

1. Ralph Grabowski, “The Illustrated AutoCAD 2002 Quick Reference”, 1 st edition, Cengage Learing, 2001
2. Sham tikoo, “Autocad 2000: A Problem-Solving Approach”,.Delmar Cengage Learning, 1999.
3. Fiorello. J. A., “CAD for Interiors beyond the basics”, Wiley publications, 2011.

OUTCOMES:

- The students becomes equipped with the exploration of digital media as a tool for both designing & Creation.
- The students become proficient in digital skills by constant practice in the various updated software.
- The students are introduced with the basics of three dimensional form explorations.

IA C 1205 HISTORY OF INTERIOR ARCHITECTURE

L	T	P	C
3	0	0	3

OBJECTIVES:

- The course aim to provide a brief overview of the development of Interior Architecture through various historical phases that is explained through various examples.

COURSE CONTENT:

- EARLY CLASSICAL PERIOD: Prehistoric Cave paintings – Primitive Designs- Interiors during Egyptian, Greek, Roman, Gothic, Early Christian & Renaissance Periods.
- MIDDLE AGES: Interiors in Romanesque, Gothic, and renaissance periods
- COLONIALPeriod: Colonial, Victorian designs, Arts & Crafts movement, Art Nouveau.
- PROJECTS: Projects based on Historical Styles in Interiors & Assignments.

PHASE I **25**

- EARLY CLASSICAL PERIOD: Prehistoric Cave paintings – Primitive Designs- Interiors during Egyptian, Greek, Roman, Gothic, Early Christian & Renaissance Periods.
- MIDDLE AGES: Interiors in Romanesque, Gothic, and renaissance periods.

PHASE II **20**

- COLONIAL Period: Colonial, Victorian designs, Arts & Crafts movement, Art Nouveau.
- PROJECTS: Projects based on Historical Styles in Interiors & Assignments.

TOTAL HOURS – 45

TEXT BOOKS:

1. Sir Banister Fletcher, A History of Architecture, University of London, The Antholone Press, 1996.
2. Spiro Kostof - A History of Architecture - Setting and Rituals, Oxford University Press, London, 1985.
3. Henri Stelerlin - The Pharaohs - Plerre Terrail - 2001.
4. G.K.Hiraskar, Great Ages of World Architecture, Dhanpat Rai & Sons, Delhi

REFERENCES:

1. Marco Bussagli - Rome Art and Architecture - Konemann - 2004.
2. S.Lloyd and H.W.Muller, History of World Architecture - Series, Faber and Faber Ltd., London, 1986
3. Gosta, E. Samdstrp, Man the Builder, Mc.Graw Hill Book Company, New York, 1970

OUTCOMES:

- The students become aware of the development of Interior Architecture through various historical phases that is explained through various examples.
- The students are exposed to various inspirations/ Techniques/ Design details of the historical Examples.

IA CX01	VERNACULAR DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- The course aims to the students understand traditional architecture built in various cultural and geographical regions of India with an emphasis on spatial types, use, materials, construction and building process.
- It also aims to explore the various approaches, definition, concepts and typologies of the vernacular designs of a region for better understanding, comprehension and interpretation.
- It also explores the role of indigenous materials and climate in the elements, ornamentation, layout and character of residential and public buildings.

COURSE CONTENT

PHASE I **20**

- Definition of Vernacular designs: Importance and factors determining the character of vernacular designs. Approaches and concepts used - Aesthetic, Anthropology, Architectural, Geographical, spatial, Ecological, Behavioral and Developmental.

PHASE II **25**

- Cultural aspects, symbolism, color, art, materials of construction and construction techniques of Northern India, Gujarat, Kerala & Tamilnadu. Examples related to the same.
- Contemporary projects by various nationally & internationally acclaimed Designers using vernacular elements & characters.

TOTAL HOURS – 45

TEXT BOOKS:

1. Minakshi, J., & Khulbushan, J. (1992.). Mud Architecture of the Indian Desert. Ahmedabad: Aadi Centre.
2. Randhawa, T. S. (1999). The Indian courtyard house. Prakash Books.

REFERENCES:

1. G.H.R.Tillotsum. (1989). The tradition of Indian Architecture Continuity, Controversy Change since 1850. New Delhi: Oxford University Press.
2. Meenakshi, M., Muthiah, S., Visalakshi, R., & Muthuraman, V. (2006). The

Chettiar Heritage. Chennai: Chettiar Heritage.
3. Oliver, P. (1998). Encyclopedia of Vernacular Architecture of the World. Cambridge: Cambridge University Press.
4. V.S.Pramar. (1989). Haveli - Wooden Houses & Mansions of Gujarat. Ahmedabad: Mapin Publishing Pvt. Ltd.

OUTCOMES:

- The students understand traditional architecture built in various cultural and geographical regions of India with an emphasis on spatial types, use, materials, construction and building process.
- The students explore the various approaches, definition, concepts and typologies of the vernacular designs of a region for better understanding, comprehension and interpretation.
- The students also explores the role of indigenous materials and climate in the elements, ornamentation, layout and character of residential and public buildings

IA CX02	ENERGY EFFICIENT DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- A growing worldwide concern for the conservation of energy & environment has led to energy efficient designs; renewable nature sources of energy (solar energy etc.) and utilizing materials that least pollute the environment.
- This course attempts to make the students understand about built environments responses to natural heating and cooling and thereby understanding principles to be implemented when designing spaces.

COURSE CONTENT:

PHASE I **10**

- Introduction to energy efficient designs and need for the day.
- Solar geometry and shading - Thermal comfort - Heat Transfer - Heating and cooling loads - Energy estimates - Conservation - Day lighting - Water Heating and Photo voltaic system.

PHASE II **15**

- Passive Solar heating: General principles - Direct Gain - Thermal storage wall - Sunspace - Convective air loop - related examples.
- Passive Cooling Techniques: General principles - Ventilation - Radiation - Evaporation and Dehumidification, - Mass effect - related examples.

PHASE III **20**

- Site Planning & Developments: Land form - vegetation type and pattern - water bodies - open spaces and built spaces - urbanscape - design strategies.
- Contemporary projects by various nationally & internationally acclaimed Designers using energy efficient concepts and techniques.

TOTAL HOURS – 45

TEXT BOOKS:

1. Fuller Moore, Environmental Control Systems, McGraw Hill Inc., New Delhi, 1997.
2. Climatically Responsive Energy Efficient Architecture, PLEA/SPA, New Delhi - 1998.

REFERENCES:

1. A.Konya, Design Primer for Hot Climates, Architectual Press, London, 1988.

2. Ms.Sudha, N.K.Bansal and M.A.S.Malik - Solar Passive Building - Pergamon.
4. V.Gupta - Energy and Habitat - Wiley Eastern Limited, New Delhi.

OUTCOMES:

- The students are exposed to the growing worldwide concern for the conservation of energy & environment has led to energy efficient designs; renewable nature sources of energy (solar energy etc.) and utilizing materials that least pollute the environment.
- The students understand about built environments responses to natural heating and cooling and thereby understanding principles to be implemented when designing spaces.

B.S. Abdur Rahman Crescent Institute of Science & Technology

Deemed to be University u/s 3 of the UGC Act, 1956

REGULATIONS 2017

LAW DEGREE PROGRAMMES

(Recognized by Bar Council of India)

CURRICULUM AND SYLLABI

BBA.LL.B (Hons)

CRESCENT SCHOOL OF LAW

VISION

The Vision of Crescent School of Law is to produce promising and credible Law Graduates with potential knowledge and skills to meet the requirements of contemporary times. The present world that is global, competitive and complex and the 'issues' that are the confronting was also on the same span. Hence, the Crescent School of Law contemplates to train young minds with strong fundamentals, sound legal knowledge and skill-set to deal, answer and fight for just and legal causes.

The vision of Crescent School of Law is to produce competent law graduates who can be instrumental in delivering goods as Advocates, Judicial Officers, Legal Advisors and Law Officers/Executives not only in legal arena but in Corporate and Business world as well.

Crescent School of Law espouses the cause of translating the Constitutional values into a reality. It cherishes a just and equitable society where every individual has a place to survive and flourish. Hence, for Crescent, Law is more of social engineering.

MISSI0N

- To train the students a competent legal/corporate professionals with all necessary in-puts with a holistic approach.
- To provide excellent academic ambience where the students can learn and excel.
- To equip the students to meet the challenges of profession by exposing them to contemporary issues through discussions, debates and by organizing work-shops, seminars and moot-courts etc.
- To encourage a spirit of enquiry, research inquisitiveness with interdisciplinary approach to find solutions to the legal/social issues.

PROGRAMME EDUCATIONAL OBJECTIVES

- To provide a strong foundations of social sciences to ensure comprehensive understanding of 'Law' as a unique discipline.
- To equip the students with required knowledge and skills to meet the demands of the Legal, Corporate and Business world.
- To infuse confidence and competencies among the students to analyze various legal and social issues and offer legal solutions.
- To train the student as an active responsible citizen to uphold the values of democracy.
- To make sure the students perform cross functional management tasks efficiently.
- To infuse ethical and legal in management practices among the students.

PROGRAMME OUTCOMES

On successful completion of the programme, the graduates will be able to

- Establish as legal professionals to take up responsibilities in legal/corporate arena.
- Demonstrate a clear understanding of law and its underlining principles with conceptual clarity.
- Apply the knowledge and principles into real-life/ practical situations and to find solutions that are legal and valid.
- Defend and uphold democratic spirit and constitutional values and fight for them within and outside the Court.
- Apply the knowledge of Management science to solve of complex business problems specifically with respect of financial services sector.
- Formulate innovative approach to business problems resolution and identifying & tapping new opportunities in the market place.

B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE & TECHNOLOGY

B.B.A LL.B (Hons.)

CURRICULUM & SYLLABUS, REGULATIONS 2017

SEMESTER I

Sl. No.	Course Code	Course Title	L	T	P	C	
1.	SSC1184	Principles of Economics	4	1	0	5	
2.	BLC1101	Principles of Management and Human Resources Management	4	1	0	5	
3.	BLC1102	Introduction to Law	4	1	0	5	
4.	BLC1103	General Principles of Contract	4	1	0	5	
5.	BLC1104	Law and Language	4	1	0	5	**25**

SEMESTER II

Sl. No.	Course Code	Course Title	L	T	P	C	
1.	ENC1286	Business English	4	1	0	5	
2.	SSC1281	Introduction to Sociology	4	1	0	5	
3.	BLC1201	Law of Torts & Accident Claims under The Motor Vehicles Act	4	1	0	5	
4.	BLC1202	Special Contracts	4	1	0	5	
5.	BLC1211	Organizational Behaviour	4	1	0	5	
6.	GEC1212	Environmental Studies	2	0	0	2	27

SEMESTER III

Sl. No.	Course Code	Course Title	L	T	P	C
1.	BLC2101	Law of Crimes-I(IPC)	4	1	0	5
2.	BLC2102	Family Law-I	4	1	0	5
3.	BLC2103	Constitutional Law-I	4	1	0	5

4.	SSC2181	Introduction to Political Science	4	1	0	5	
5.	BLC2111	Financial and Management Accounting	4	1	0	5	**25**

SEMESTER IV

Sl. No.	Course Code	Course Title	L	T	P	C	
1.	BLC2201	Managerial Economics	4	1	0	5	
2.	BLC2202	Jurisprudence	4	1	0	5	
3.	BLC2203	Family Law-II	4	1	0	5	
4.	BLC2204	Constitutional Law-II	4	1	0	5	
5.	BLC2211	Computer for Management and Management Information System(MIS)	4	1	0	5	
6.	BLC2205	Internship – I	0	0	2	2	**27**

SEMESTER V

Sl. No.	Course Code	Course Title	L	T	P	C	
1.	BLC3101	Public International Law	4	1	0	5	
2.	BLC3102	Company Law	4	1	0	5	
3.	BLC3103	Human Rights	4	1	0	5	
4.	BLC3111	Strategic Management	4	1	0	5	
5.	BLC3112	Fundamentals of Marketing Management	4	1	0	5	**25**

SEMESTER VI

Sl. No.	Course Code	Course Title	L	T	P	C	
1.	BLC3201	Law of Evidence	4	1	0	5	
2.	BLC3202	Labour Law – I	4	1	0	5	
3.	BLC3203	Administrative Law	4	1	0	5	
4.	BLC3204	Professional Ethics, Bar Bench	2	0	3	5	

		Relations and Accountancy for Lawyers (Practical Training Paper)					
5.	BLC3211	Public Finance	4	1	0	5	
6.	BLC3205	Internship – II	0	0	2	2	**27**

SEMESTER VII

Sl. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	
1.	BLC4101	Transfer of Property Law	4	1	0	5	
2.	BLC4102	Intellectual Property Law	4	1	0	5	
3.	BLC4103	Labour Law – II	4	1	0	5	
4.	BLC4104	Law of Banking	4	1	0	5	
5.	BLC4105	Alternative Dispute Resolution Mechanism (Practical Training Paper)	2	0	3	5	**25**

SEMESTER VIII

Sl. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	
1.	BLC4201	Competition law	4	1	0	5	
2.	BLC4202	Environmental law	4	1	0	5	
3.	BLC4203	Maritime Law	4	1	0	5	
4.	BLC4204	International Trade Law	4	1	0	5	
5.	BLC4205	Cyber Law and Forensic	4	1	0	5	
6.	BLC4206	Internship – III	0	0	2	2	**27**

SEMESTER IX

Sl. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1.	BLC5101	Law of Insurance	4	1	0	5
2.	BLC5102	Law of Crimes-II(Cr.P.C.)	4	1	0	5
3.	BLC5103	Civil Procedure Code & Limitation Act	4	1	0	5
4.	BLC5104	Land Laws	4	1	0	5

5.	BLC5105	Moot Court (Practical Training Paper)	0	0	5	5	**25**

SEMESTER X

Sl. No.	Course Code	Course Title	L	T	P	C	
1.	BLC5201	Interpretation of Statutes	4	1	0	5	
2.	BLC5202	Right to Information Act	4	1	0	5	
3.	BLC5203	Law of Taxation	4	1	0	5	
4.	BLC5204	Criminology and Penology	4	1	0	5	
5.	BLC5205	Drafting Pleading and Conveyancing. (Practical Training Paper)	2	0	3	5	
6.	BLC5206	Internship – IV	0	0	2	2	**27**

TOTAL CREDITS : 260

SEMESTER I

SSC1184	PRINCIPLES OF ECONOMICS	L	T	P	C
		4	1	0	5

OBJECTIVES:

- To introduce the basic concepts of economics and economic systems.
- To provide an idea about demand, supply and market equilibrium.
- To familiarize the concept of consumer behavior, cardinal, ordinal and revealed preference analysis.
- To give an overview about the production, distribution, pricing and different forms of markets.
- To provide basic understanding about the Indian economy.

MODULE I NATURE AND SCOPE OF ECONOMICS 10

Definitions: Wealth, Welfare, Scarcity and Growth – Micro Economics and Macro Economics - Normative and Positive Economics Basic economic problems - production possibilities- Basic features of prevalent economic systems- capitalism, socialism, mixed economy – Gandhian economic principles.

MODULE II PRICES AND MARKETS 10

. Demand – Individual demand and market demand - Demand curve-Law of demand – Exceptions to the Law of Demand – Law of Supply –Individual supply and market supply – Market equilibrium - shift in demand, supply and price – Elasticity of demand – meaning, degrees and measurement

MODULE III CONSUMER BEHAVIOR 10

Consumption - meaning - Utility – Cardinal and Ordinal – Law of Diminishing Marginal Utility. Law of Equi-marginal Utility –Indifference Curve Analysis-consumers surplus.

MODULE IV PRODUCTION, PRODUCT PRICING, DISTRIBUTION AND MARKETS 10

Production – basic concepts of costs – opportunity cost – Production function – Short run and Long run – Returns to a factor-Law of variable proportions -Laws

of returns to scale - economies and diseconomies of scale - internal and external economies of scale-Main market forms - Perfect Competition, Monopoly, Monopolistic Competition, Oligopoly and Duopoly.

MODULE V INDIAN ECONOMY 10

Indian Economy-Problems-Features– Population-Causes-Trends-Consequences-Population Policy-2000, Poverty Alleviation Programmes - Concepts-Causes-Measurement-Trends - unemployment- causes-types-trends programmes - HDI.

TOTAL HOURS : 50

REFERENCES:

1. Samuelson. P.A. Nordhaus (2009), Economics, Tata McGraw Hill
2. Mankiw, Gregory (recent edition), Principles of Economics, Cengage Learning, Delhi
3. Case & Fair (2007), Principles of Economics, Pearson Education, Delhi
4. Koutsoyiannis (1979), Modern Microeconomics ,Macmillan Press Ltd .London
5. Indian Economy- Ruddar Dutt and KPM Sundaram

OUTCOMES:

- Students will gain about the basic concepts of economics and economic system
- Students will have an exposure about the market forces and market equilibrium.
- They will learn about the consumer behavior and utility analysis.
- Students will understood about the production, pricing, distribution and different forms markets.
- Students will gain an overview about Indian economy and its relevant policies.

BLC1101	PRINCIPLES OF MANAGEMENT AND HUMAN RESOURCE MANAGEMENT	L	T	P	C
		4	1	0	5

OBJECTIVES:

This course is an introduction to the management function. It will focus on the theory and functional concepts of management including planning, organizing, leadership and control. This course will also review the human resource management. It deals with human capital and its constitution, organization and productive usage as part of management function. Basic knowledge on functional management is the essence of this course.

MODULE I **10**

Definition of Management- Nature and Scope – Science or Art-Development of Management Thought-Contributions of Fayol and Taylor- Functions of Management- Types of Business Organisation-Planning-Objectives-Process of Management by objectives- strategies, Policies and Planning Premises Forecasting-Decision Making- Management by Exception, Managerial Levels and Managerial Skill

MODULE II **10**

Nature and Purpose – Formal and Informal Organisation- Organisation Chart-Structures and Process- Departmentalisation by different strategy-Decentralisation and Centralisation- Delegation of Authority-Staffing-Selection-Process and Techniques-Co-ordination-Need Types and Techniques for Excellent Co-ordination-Controlling-Meaning and Importance-Control Process- Span of Control, Control Techniques

MODULE III **10**

Nature and Scope of HRM-Difference between Personnel Management and HRM-Human Resource Selection- HRM & HRD, Concept of Human resource planning , sources and Techniques of recruitment-Interview Techniques-Placement-Induction-Training. Methods-Techniques-Identification of the Training needs- Training and Development- Performance Appraisal-Career Development.

MODULE IV **10**

Remuneration- Components of Remuneration-Incentives-Benefit-Motivation-Welfare and Social Security Measures-Human Factors-Creativity-Intellectual skills-

Innovation Information Communication and Technology (ICT)- Job Evaluation, ESOPS

MODULE V **10**

Functions of Trade Unions – Forms of Collective Bargaining-Workers Participation in Management- Types and Effectiveness-Industrial Disputes and Settlements –HR Audit-Nature-Benefit-Approaches- Code of Discipline

TOTAL HOURS : 60

TEXT BOOKS:

1. C.B.Gupta –Management Theory and Practice
2. L.M.Prasad- Principls and Practice of Management
3. P.C. Tripathi and P.N. Pandy – Principles of Management

REFERENCES:

1. P.C.Tripathi- Human Resource Development
2. T.V.Rao- Human Resource Development
3. Dr N.Premavathy- Human Resource Management

OUTCOMES:

- Student will get an idea about ‘Management’ as a function and its challenging tasks.
- Student can understand and observe the current trends in Management with historical background.
- Student acquaints with management principles and methods and techniques.
- Student will familiarize with management functions such as planning, organizing, leading and controlling.

BLC1102 INTRODUCTION TO LAW

L	T	P	C
4	1	0	5

OBJECTIVES:

This papers aims at introducing fundamental concepts of Law. Law-its definition-scope-nature-purpose-functions-sources-classification - Legal system - law making process. The beginners in Law will be exposed to tools of understanding the Statues and Judgments. The focus is on providing insights in to the basics as such.

MODULE I INTRODUCTION TO LAW 12

Concept of Law - its definition; Law its Scope; Law its nature; Law and its purpose; Law and its relationship with Political Science, Economics, Sociology, History and other social sciences. Law and Custom; Law and Morality; Law and Justice' Law its Sources

MODULE I CLASSIFICATION OF LAW 12

Basic Law-Ordinary Law; Substantive Law and Procedural Law; Domestic (Municipal) Law and International Law, Civil Law and Criminal Law, Public Law and Private Law, Public International Law and Private International Law; What is Common Law; World legal order - Major legal systems in the World.

MODULE III CONCEPT OF STATE AND ITS POWER 12

State and its characteristics; Constitution and the Constitutional Law; Separation of Powers, Custom as a source of Law, Legislation as a source of Law. Legislative process - Law making bodies, / Rule Making power of the Executive nd the Law declared by the Court. Definition of Law, Definition of State (Article 12), What is an Ordinance. Striking features of Indian Constitution – Article 32 as a Fundamental Right.

MODULE IV HIERARCHY OF COURTS - CONCEPT OF RIGHT 12

Higher Judiciary-Subordinate Judiciary – Supreme Court and its power - Law Declared by the Supreme Court - Stare Decisis – Precedent – High Court – Powers – Tribunals – Quasi – Judicial Authorities – Commissions – ADR Mechanisms – Lok – Adalat, Ombudsman.

Rights-Divine Rights, Natural Rights, Human Rights, Fundamental Rights, Constitutional Rights, Legal Rights, Rights arise out of Procedure etc. Rights and Duties

MODULE V INTERPRETATION OF STATUTES 12

How to interpret/ understand an Act/Law. Parts of the Statute and their relevance in interpretation. General rules of Interpretation. Classification of statutes – Welfare, Penal and Tax Laws.

TOTAL HOURS : 60

TEXT BOOKS:

1. Madabhushi Sridhar: Legal Language and Legal Writing- Asia Law House
2. "Kush-kaira' "Law for Common Man:
3. 'Law for Layman" by Kush Kaira and Ayushi Gaur.
4. Prof. N.V.Pranjape "Jurisprudence"
5. V.D.Mahajan " Jurisprudence"
6. Adam Podgorcki – "Law and Society.

OUTCOMES:

- Student will get initiated into the subject of Law as a unique discipline.
- Familiarizes Law with different aspects, areas and their scope.
- Acquaintance and development of legal inquisitive interest in various facets of Law
- Can able to track and follow legislative & judicial trends and appreciate.

BLC1103 GENERAL PRINIPLES OF CONTRACTS L T P C

4 1 0 5

OBJECTIVES:

Law of Contracts stands as a basis on which whole spectrum of law in general and business, trade, commerce and corporate law in particular. As the whole web of contractual relations are governed by the Law of Contracts, it is essential for law students to have conceptual clarity on concepts and general principles that govern contracts. Legal dimension of – how a contract will be formed – how it will be performed – how it can be discharged – and what are redressal mechanisms available to the aggrieved parties.

MODULE I ESSENTIALS OF A CONTRACT 12

Basic Nature of Contract – Formation of Contract – Offer, Acceptance, Revocation, Lapse of offer and Acceptance – Intention to create Legal Relationship – Terms of Contracts & Standard form Contracts.

MODULE II CONSIDERATION AND LEGALITY 12

Consideration – past, present, future consideration – Privity as to consideration - Value & Adequacy of consideration, Rule in Pinnel's case – Exceptions to consideration – Capacity to contract – Free consent – Factors which vitiate free consent – Objects of a Contract – Unlawful & illegal objects or considerations – Valid, Voidable, Void Agreements.

MODULE III PERFORMANCE & ENFORCEMENT 12

Performance of Contract – Privity of Contract – Tender of performance - Time as essence to performance – Law relating to time, place & order of performance – Performance of reciprocal promises, contingent contracts, joint promises – appropriation of payments.

MODULE IV TERMINATION OF CONTRACT 12

Discharge of contracts – by – Impossibility of performance – Discharge by Agreement - Novation, Recission, Alteration – Discharge by Breach - Waiver – Accord & Satisfaction – Material Alteration – Damages – Types and Measure.

MODULE V LEGAL -REDRESSAL 12

Quasi contracts – Quantum Meruit – Specific Relief Act, 1963 - recovery of possession - specific performance of contracts-rectification, Cancellation of

Instruments - Rescission-Declaratory Decrees - Injunctions.

TOTAL HOURS : 60

TEXT BOOKS:

1. Dr. Avatar Singh – Law of Contract & Specific Relief.
2. Anson's Law of Contract.
3. Venkatesh Iyer – Indian Contract Law
4. M. Krishnan Nair – Indian Contract Law.

Bare Acts:

1. Indian Contract Act, 1872
2. Specific Relief Act, 1963

REFERENCES:

1. Cheshire & Fifoot – Law of Contracts.
2. Mulla – Indian Contract Act.
3. Sarkar – Specific Relief Act..
4. Basu – Specific Relief Act.
5. Smith & Thomas – A Casebook on Contract.

OUTCOMES:

The student will

- have conceptual clarity on matters relating to legally enforceable contracts. (Formation-Performance-Discharge of a contract)
- be familiarized with the redressal mechanisms available to the aggrieved parties in case of breach of contract.

BLC 1104	LAW AND LANGUAGE	L	T	P	C
		4	1	0	5

OBJECTIVES:

- To train students to use appropriate vocabulary in academic and technical/legal contexts.
- To facilitate students to speak effectively while exchanging ideas and making presentations.
- To develop students' listening skill for comprehending and analyzing information.
- To develop their reading skill through sub skills like skimming, scanning and critical reading of a text.
- To sharpen their academic writing skills.
- To expose them to the correct usage of language and help them to apply that knowledge appropriately.

MODULE I **7**

L: Listening for general information

S : Self Introduction, Introducing one another.

R: Predicting the content

W: Paragraph Writing

Language Focus: Affixes, Simple Present tense , Connective & Prepositions.

Language-significance-English as a legal language-distinctive features of English as a legal language - Basics of Law

MODULE II **7**

L: Listening for specific information (from dialogues)

S: Exchanging opinion.

R: Skimming technical Passages

W: Argumentative Writing (using the concept of Flipped Learning), Letter to the Editor.

Language Focus: Idioms, use of Modals, Simple Past tense & use of "Wh" and question tags.

Indian Languages as Legal Language - Legal Terms

MODULE III **8**

L: Learning the ways of describing images and presenting specific information (focusing on note making)

S: Making Presentations using visuals.

R : Scanning short texts for gist of information

W: Letter of Invitation, Expository Writing

Language Focus: Homophones, Homographs, Simple Future & Collocations.

Latin Expressions - Doctrines and Legal Maxims

MODULE IV **8**

L: Understanding prepared presentation techniques through videos

S: Short Presentations.

R: Reading for coherence and cohesion

W: Letter seeking permission for Industrial Visit

Language Focus: S-V agreement, Euphemism

Confused wordings, Phrases, Idioms, Synonyms, Legal Jargon - Terminology - Vocabulary in Law of Torts

MODULE V **8**

L : Understanding Non- Verbal Communications while listening to narration of incidents.

S: Narrating an experience

R: Inferential Reading

W: Process Description – Transcoding a Flow chart.

Language Focus: Interchange of Active & passive voice, Impersonal Passive voice.

Legal jargon in Family Law - Business Law

MODULE VI **7**

L: Learning Story telling techniques (stories & visuals) through audio files

S: Discussion in groups

R: Reading for critical appreciation

W: Developing an idea, Slogan writing, Interpreting a Bar Chart.

Language Focus: If clause and phrasal verbs.

Legal jargon in Cyber Law - International Law - Procedural Laws

TOTAL HOURS : 45

REFERENCES:

1. Carol Rosenblun Perry (2011). The Fine Art of Technical Writing. Create Space Independent Publishing Platform, New Delhi.
2. Dutt, P.K. Rajeevan. G and Prakash , C.L.N. (2007) A course in Communication Skills. Cambridge Univesity Press, India.
3. Sen, Leena. (2004) Communication Skills. Prentice Hall, New Delhi.
4. Matt Firth, Chris Sowton et.al. (2012). Academic English: An Integrated Skills Course for EAP. Cambridge University Press, Cambridge.
5. Legal Language- Dr Madabhushi Sridhar-Asia Law House, Hyderabad
6. Legal Language and Legal Writing Dr S.R.Myneni- Asia Law House, Hyderabad.
7. Avatar Sing-College Law Dictionary
8. Ramanatha Aiyer P - The Law Lexicon
9. Dr Rega Surya Rao: Lecturers on Legal Language and Legal Writing, Asia Law House, Hyderabad
10. Glanville Williams: Learning the Law
11. Dr. Anirud Prasad: Outlines of Legal Language in India

OUTCOMES:

After completion of the course, students will have the ability to

- Demonstrate their range of vocabulary in academic and Technical/legal contexts
- Exchange ideas and make presentations
- Comprehend and respond appropriately to listening tasks.
- Read a text efficiently and process information.
- Create and draft different kinds of academic documents
- Communicate effectively using grammatically correct expressions.

SEMESTER II

		L	T	P	C
ENC1286	**BUSINESS ENGLISH**	**4**	**1**	**0**	**5**

OBJECTIVES:

The objectives of teaching a business English language are reflected, first, in developing oral and written language skills in the business context: of reading, listening, speaking, writing and, second, in raising a consciousness of cultural differences in the language in various business/corporate cultures. The objective of teaching business English language is to strengthen the oral and written linguistic skills in a business environment.

MODULE I COMMUNICATION 8

Definition – Methods – Types – Principles of effective communication – Barriers of communications – Relevance and importance of Business communication - Four skills of language Acquisition – understanding spoken language –oral and written. Business Vocabulary.

MODULE II TYPES OF COMMUNICATION 8

Communication in a Globalised world after LPG (Liberalization, Privatization and Globalization) –Modern forms of Communication – Different types of Presentations: eg. Talking about a product, transaction with a client, Arguing a case – Types of writing: Fax - Email – Video Conferencing – Internet – Websites and their use in Business.

MODULE III BUSINESS LETTERS 8

Kinds of Business Letters - Layout – Interview – Appointment – Acknowledgement – Promotion – Enquiries – Replies – Orders – Sales – Circular – Complaints.

MODULE IV CORRESPONDENCE 8

Bank Correspondence – Insurance Correspondence – Agency Correspondence -Correspondence with Shareholders – correspondence with Directors.

MODULE V REPORTING WRITING 8

Reports Writing – Agenda, Minutes of Meeting – Memorandum – Office Order –Circular – Notes-

MODULE VI

Case law- Identification of case Law from different resources to get case law- Law Websites-Different Law Journals- and their names-Abbreviations...Law **10** Digests-Encyclopedias-How to Use Law Library

TOTAL HOURS : 50

TEXT BOOKS:

1. Rajendra Pal & J. S. Korlahalli, Essentials of Business Communication, Sultan Chand & Sons, New Delhi.
2. Shirley Taylor, Communication for Business, Pearson Publications, New Delhi
3. Bovee, Thill, Schatzman, Business Communication Today, Pearson Education Private Ltd.,
4. Penrose, Rasbery, Myers, Advanced Business Communication,
5. Simon Collin, Doing Business on the Internet, Kogan Page Limited, London
6. Mary Ellen Guffey, Business Communication – Process and Product, International Thomson Publishing, Ohio.
7. David Annousamy, The Language Ridddle.

OUTCOMES:

The students are given an understanding of various types of correspondence writing reports, tabling minutes, officer orders etc.. the modern forms of communication and the ways of communication through it for business purpose are also covered. Students will be familiar with the principles of effective communication and can overcome barriers.

SC1281	INTRODUCTION TO SOCIOLOGY	L	T	P	C
		4	1	0	5

OBJECTIVES:

- To acquaint the students with concepts and perspectives of Sociology
- To explain the reflection of society in Individuals and vice versa
- To present a portrayal of the Social Inequality and Stratification
- To explicate the dimensions, forms and Social Control and Deviance.
- To examine the causality and magnitude of social problems facing the contemporary India.

MODULE I INTRODUCTION 10

Sociology-Definition, scope and importance; Elements of social formation-Society, Community, Groups and Association; Associative Social Process- Co-operation, Accommodation and Assimilation; Dissociative Social Process- Competition and Conflict.

Culture-definition, characteristics, functions, types, cultural lag and civilization;

MODULE II SOCIAL INSTITUTION AND SOCIALIZATION 10

. Family- definition, types, characteristics, functions of family; Joint Family- definition features, utility, changes; Marriage- definition, characteristics, marriage as sacrament or contract; Socialization – definition, process, stages, agencies and anticipatory socialization; Social Control- definition, characteristics, importance, types & agencies.

MODULE III SOCIAL INEQUALITY AND STRATIFICATION 10

Concepts- inequality, hierarchy, differentiation, Social Exclusion, and Social Stratification. Forms of Social Stratification- Caste, Class and Estate. Gender and Social Stratification- sex and gender, patriarchy, factors perpetuating gender stratification; Globalization and gender inequality.

MODULE IV SOCIAL CONTROL AND SOCIAL DEVIANCE 10

Social Control: Definition - nature of social control – types of social control – agencies of social control. Social Deviance: Definition and types of deviance – factors facilitating deviance – social significance of deviant behaviour – contemporary development in deviance – mass media and social deviance

MODULE V SOCIAL PROBLEMS IN INDIA 10

Social Problem-Definition, nature, social disorganization; Population explosion-causes, effects, relationship with development; Child Labour- causes, magnitude and consequences; Unemployment-nature , types, causes and effects; Gender issues- social status of women, violence against women and women in work place; Contemporary issues- communalism, terrorism and corruption.

TOTAL HOURS :50

TEXT BOOKS:

1. Giddens A. 1989. “Sociology” Cambridge: Polity Press.
2. Heald Haralambos, R.M(2014) . ‘‘Sociology Themes and Perspectives”, Oxford, New Delhi-92
3. Bhushan Vidya and D.R. Sachdeva (2012). ‘‘Fundamental of Sociology”, Pearson, Delhi.
4. Ahuja Ram. 1999. *Social problems in India*, Rawat Publication: New Delhi.
5. Ahuja Ram. 2014. *Society in India,*, Rawat Publication: New Delhi.

REFERENCES:

1. Das Gupta, Samir and Paulomi Saha (2012), ‘‘An Introduction to Sociology”, Pearson, Delhi
2. Bottomore, T.B. 1972. *Sociology- A Guide to Literature and Problems*, New Delhi,
3. Atal, yogesh (2006), “Changing Indian Society” Rawat Publications, Jaipur

OUTCOMES:

On successful completion of this course,

- Students will have exposure to the fundamentals tenets of Sociology.
- Students will be trained to understand social reality with sociological perspective.
- Students will gain knowledge about Social Inequality and Stratification
- Students will be exposed to the social problems encountered in contemporary India
- Students will gain exposure to the dynamics of Social control and Social Deviance

BLC1201	LAW OF TORTS & ACCIDENT CLAIMS UNDER THE MOTOR VEHICLES ACT.	L	T	P	C
		4	1	0	5

OBJECTIVES:

The law is nothing but balancing interests. In civil litigation claims under Law of Contracts and Law of Torts are numerous. Tort law is an un-codified law and conceptual in content. Tort law attempts to adjust for legal injury done, by awarding damages to a successful plaintiff who demonstrates that the defendant was the cause of plaintiff's losses. Concepts of Negligence, Nuisance and Liability were among other things in this subject of study. Accident claims under Motor Vehicles Act will also be studied.

MODULE I **GENERAL PRINCIPLES** **12**

Nature & Scope, Definition, Distinction between Tort & Crime – Tort & Contract, foundation of Tortuous Liability – Elements of Torts – General defenses.

MODULE II **LIABILITY FOR THE BY OTHER WRONG COMMITTED PERSON** **12**

. Vicarious liability - Joint tort feasors- Capacity to sue and be sued - Remedies.

MODULE III **SPECIFIC TORTS** **12**

Negligence, Contributory Negligence, Nuisance, Remoteness of damage. Nervous-shock.

MODULE IV **TORTS AGAINST HUMAN BEING(S) & PROPERTY** **12**

Assault, Battery, Distress, Malicious - Prosecution, Conspiracy, False Imprisonment- Defamation - Trespass: To land, to goods, passing off-No fault liability- Strict liability, Absolute liability - Recent Trends – Law relating to Motor Vehicles - Accident Claims

MODULE V **MOTOR VEHICLE ACT, 1988** **12**

Insurance of motor vehicle against third party risk –claim-Tribunals- Offences-penalties and procedure.

TOTAL HOURS : 60

TEXT BOOKS:

1. B. M. Gandhi : Law of Torts
2. P. S. A. Pillai : The Law of Torts
3. Ratanlal and Dhiraj Lal : The Law of Torts
4. R. K. Bangia : Law of Torts including Motor Vehicles Act
5. Motor Vehicle Act, 1988

REFERENCES:

1. Ramaswamy Iyer : Law of Tort
2. Winfield : Law of Tort
3. Salmond : Law of Tort

OUTCOMES:

Student will have conceptual clarity and its application, will study the general defenses' available in tort claims. students will be able to understand the litigations for the civil wrong.

BLC1211 ORGANISATIONAL BEHAVIOUR L T P C

4 1 0 5

OBJECTIVES:

To familiarize the students with the basic concepts of the Organizational Behavior and to enhance their understanding of the interaction between the individuals and the Organizations.

MODULE ORGANIZATIONAL BEHAVIOR 10

Concepts, meaning, nature, scope features of OB.OB and other disciplines.

MODULE II INDIVIDUAL BEHAVIOR 10

Basic psychological process—personality, Determinants of Personality—personality traits—perception, factors affecting perception—learning, theories of Learning—social learning. Motivation—theories of motivation (Maslow's, Hertzberg, Mc Greger, X and Y theory) financial and non financial motivation-Attitudes & Values, personality theories

MODULE III GROUP 10

Concept of group dynamics—features of group—types of group behavior—formal and informal group behavior—stages of group development— group moral—group Norms—group cohesiveness..

MODULE IV LEADERSHIP 10

Types—theories of leadership (Trait theory, Michigan studies and Fideler's contingency model) modern approach to leadership theories—leadership styles.

MODULE V STRESS MANAGEMENT 10

Meaning, types of stress—consequences of work stress—causesof stress—Conflict, types of conflicts, conflict resolution— Organizational development—Meaning, need, benefits and limitations of OD—steps in OD. Organizational changes.

TOTAL HOURS : 50

REFERENCES:

1. Fred Luthans : Organisational behavior

2. Danial C. Fieldman and Hugh Arnold : Managing individual and group Behavior in organization

3. Henry Mintzberg : The structure of organization

4. Edwin Gerlof : Organization theory and design5 Robin. S. P : Organizational behavior

OUTCOME:

- Student will form an idea how an Individual will discharge his role in an Organization individually and collectively.
- Students will be able to discuss the development in the field of Organizational Behavior and explain the micro and macro approaches to analyze and will be able to compare different models.
- .The study helps to identify the processes used in developing communication and resolving conflicts in an Organization.
- The course helps to explain group dynamics and demonstrates skills required for working in groups therefore enables team building.

GEC 1212	ENVIRONMENTAL STUDIES	L	T	P	C
		2	0	0	2

OBJECTIVES:

The student will be conversant with the

- various natural resources, availability, utilization and its current scenario
- different ecosystems, energy transfer, values, threats and conservation of biodiversity
- levels of different pollutants and its impact and the causes and effects of natural disasters
- impacts of human population, impact assessment, human rights and environmental acts and sustainable development

MODULE I NATURAL RESOURCES 8

Land resources: land degradation, soil erosion and desertification - Forest resources: use and over-exploitation, deforestation - Water resources: use and over-utilisation of surface and ground water, conflicts over water (inter-state and international), dams (benefits and problems), water conservation (rainwater harvesting and watershed management) - Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources, mining - Food resources: world food problems, changes in land use by agriculture and overgrazing, modern agriculture and its effects, fertilizer and pesticide problems, water logging and salinity - Energy resources: increasing energy needs, renewable and non-renewable, use of alternate energy sources.

MODULE II ECOSYSTEM AND BIODIVERSITY 8

Ecosystem- energy flow in the ecosystem - food chains, food webs and ecological pyramids - characteristics, structure and function of (a) Terrestrial ecosystems (forest, grassland, desert) and (b) Aquatic fresh water ecosystems (pond, lake, river) (c) Aquatic salt water ecosystems (ocean, estuary) - ecological succession.

Biodiversity - genetic, species and ecosystem diversity – hot-spots of biodiversity –biogeographic classification of India - endangered, endemic, extinct and invasive species of India - red data book - values of biodiversity: consumptive, productive, social, ethical, aesthetic and option values - threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts - conservation of biodiversity: in-situ and ex-situ conservation of biodiversity

MODULE III ENVIRONMENTAL POLLUTION AND NATURAL DISASTER 8

Definition, cause, effects and control measures of (a) air pollution (b) water pollution (c) soil pollution (d) marine pollution (e) noise pollution (f) thermal pollution (g) nuclear hazards - ill-effects of fireworks and upkeep of clean environment - solid waste management: types (urban, industrial, biomedical and electronic wastes), collection, processing and disposal (incineration, composting and land-fill) - natural disaster and management: flood, cyclone, drought, landslide, avalanche, volcanic eruptions, earthquake and tsunami.

MODULE IV HUMAN POPULATION, HEALTH AND SOCIAL ISSUES 6

Population and population growth, population variation among nations, population explosion, family welfare programme.

Human health: air-borne, water borne diseases, infectious diseases, risks due to chemicals in food and environment.

Sustainable development - environmental legislation and laws: water act, air act, wildlife protection act, forest conservation act, environment protection act - environmental impact assessment, steps in EIA - human rights - women and child welfare.

TOTAL HOURS : 30

TEXT BOOKS:

1. Erach Bharucha, Textbook for Environmental Studies For Undergraduate Courses of all Branches of Higher Education for University Grants Commission, Orient Blackswan Pvt Ltd, Hyderabad, India, 2013.
2. Benny Joseph, Environmental Studies, Tata McGraw-Hill Education, India, 2009.
3. Ravikrishnan A, Environmental Science and Engineering, Sri Krishna Publications, Tamil Nadu, India, 2015.
4. Raman Sivakumar, Introduction to Environmental Science and Engineering, McGraw Hill Education, India, 2009.
5. Venugopala Rao P, Principles of Environmental Science and Engineering, Prentice Hall India Learning Private Limited; India, 2006.
6. Anubha Kaushik and Kaushik C.P., Environmental Science and

Engineering, New Age International Pvt Ltd., New Delhi, India, 2009.

REFERENCES:

1. Masters G.M., Introduction to Environmental Engineering and Science, Prentice Hall, New Delhi, 1997.
2. Henry J.G. and Heike G.W., Environmental Science and Engineering, Prentice Hall International Inc., New Jersy, 1996.
3. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co. Boston, USA, 2016.

OUTCOMES:

The student will be able to

- Predict the scenario of various natural resources and suggest remedies to curb the exploitation of these resources.
- Identify food chain and web and its role in various ecosystems, assess the impacts on biodiversity and provide solutions to conserve it.
- analyse the impacts of pollutants in the environment and propose suitable method to alleviate the pollutants and the natural disasters.
- assess on the impact of human population and the health related issues and the ethics to be followed for sustainable life.

SEMESTER III

BLC 2101	LAW OF CRIMES-I (IPC)	L	T	P	C
		4	1	0	5

OBJECTIVES:

Crime and Law are so closely connected with each other that it is very difficult to understand one without knowing the other. Student should have clarity on concepts relating to crime, criminal and punishment.

MODULE I INTRODUCTION- GENERAL DEFENCES 10

Nature and Scope of Criminal Law: Definition-Essential Elements- Strict Responsibility-MensRea-Intention and Negligence-Recklessness and Knowledge-Offences without Conduct- Punishment Objectives- Basis and Types-Theories of Punishment- Justification of Punishment- General Defences- Justifiable defenses-Private defence- Joint and Constructive Liability- Abetment-Conspiracy-Attempt-corporate Liability- Jurisdiction-Territorial-Extra Territorial Personal and Admiralty.

MODULE II OFFENCES AGAINST HUMAN BODY: **10**

Culpable Homicide and Murder- Suicide-Causing Miscarriage-Hurt-Wrongful Restraint and Wrongful Confinement- Assault- Kidnapping-Abduction and Rape

MODULE III GENERAL OFFENCES 10

Offences against State- Offences against Public Peace- Unlawful Assembly- Riot-Affray- Offences against election- Bribery- inpersonation- Offences relating to Religion- Offences against Public Justice- Administration of Justice-Giving and Fabricating the false Evidence- disappearance of Evidence.

MODULE IV OFFENCES AGAINST PROPERTY 10

.Offences against Property: Theft-Extortion-Robbery and Dacoity-Criminal Misappropriation of Property and Trust-Cheating Mischief-offences relating to Documents.

MODULE V OFFENCES RELATING TO MARRIAGE AND REPUTATION: 10

Mock or Deceitful Marriage-Bigamy-Adultery-Cruelty by Husband or Relatives-Defamation- Intimidation - Attempt to Commit Offences- Thug.

TOTAL HOURS : 50

REFERENCES:

ACTS:

- Indian Penal Code
- Kenny- Outlines of Criminal Law
- Ratan Lal : Indian Penal Code
- M.K.D. Gour - Criminal Law
- Atchuthan Pillai - Criminal Law
- B.M.Gandhi- Indian Penal Code
- Glanville William - Criminal Law
- Russel - Criminal Law
- Ejaz's Law of Crimes
- Nigam- Law of Crimes (Volume I)
- Dr. H.S. Gour- Penal Law of India
- Raghavan V.V. - Law of Crimes

OUTCOMES:

Student can understand the basis on which the criminal law is based. Various offences and the punishment thereof.

BLC2102 **FAMILY LAW - I** **L T P C**
3 1 0 4

OBJECTIVES:

To understand the Family as an Institution and various personal laws that govern issues relating to marriage, divorce, adoption and maintenance, minority and guardianship are the subject matter of this course. Student will go through Acts that govern and the decision of higher judiciary on various matter

MODULE I **8**

Application of various personal laws- Traditional and modern sources of Hindu Law and Muslim Law – The Classical Schools of Hindu Law and Muslim Law – Origin of the Schools – Main Schools and sub-Schools – Effect of Migration

MODULE II **LAW ON MARRIAGE**

Nature of Marriage – Various forms of marriage and requirements for a valid marriage on a comparative analysis – Void, voidable and valid marriage in different religious texts and statutes – Laws and Issues on marriage under the Special Marriage Act – Unisex marriage and question on living together – The demand of dowry and the concept of dower under the relevant personal laws – ceremonies of marriage under various religious systems.

MODULE III **LAW ON DIVORCE & MAINTENANCE**

Restitution of Conjugal Rights, Judicial Separation, Nullity of Marriage and

Divorce – Various grounds and procedure on a comparative analysis – Court's jurisdiction and procedure for the issues raised on marriage and divorce – In Camera proceedings – Decree on proceedings – Maintenance under Hindu, Muslim and Christian Laws – Permanent alimony – Maintenance during pendency of the suit - Maintenance under the Special Marriage Act, the Hindu Adoptions and Maintenance Act and the Code of Criminal Procedure. Structure, procedure and jurisdiction of Family Courts – The Family Courts Act

MODULE IV **LAW ON LEGITIMACY OF CHILDREN AND ADOPTION** **12**

Legitimacy of children born of void and voidable marriages – Their rights and legal issues – Adoption in different religious groups – Requisites, conditions, procedure of

adoption – Effect of adoption – Inter-Country adoption

MODULE V **LAW ON MINORITY AND GUARDIANSHIP** **12**

Guardian under the Hindu Minority and Guardianship Act, 1956 – Definition- types of guardians – Guardianship under Muslim Law – Procedure for appointment and their powers – Guardian under the Guardian and Wards Act 1890

Total Hours –60

TEXT BOOKS:

Books

Mulla - Hindu Law

N.R. Raghavachari - Hindu Law

Dr. Paras Diwan - Family Law

Mulla - Principles of Mahomedan Law

Fyzee - Outlines of Mahomedan Law

Kusum - Family Law Lectures – Family Law I

Mayne - Hindu Law & Usage

Mitra - Hindu Law

REFERENCES:

References:

Acts:

The Hindu Marriage Act, 1955

The Hindu Adoptions and Maintenance Act, 1956

The Hindu Minority and Guardianship Act, 1956

The Special Marriage Act, 1954

The Guardian and Wards Act, 1890

The Dissolution of Muslim Marriage Act, 1939

The Christian Marriage Act 1872

Indian Divorce Act, 1869

Indian Majority Act, 1875

The Muslim Women (Protection Of Rights On Divorce) Act, 1986

The Family Courts Act, 1984

The Dowry Prohibition Act, 1961

The Hindu Widows' Remarriage Act 1856

Prohibition of Child Marriage Act, 2006

OUTCOMES:

Student will get clarity on family as an institution and legal issues arise out of family relations. He can understand changing facets of family as a social unit and legal issues that surface.

BLC 2103 CONSTITUTIONAL LAW- I

L	T	P	C
4	1	0	5

OBJECTIVES:

This course enables the student to understand and appreciate the importance of Constitutional Law as a Fundamental Law of the Land. It gives emphasis on fundamental rights which are non-negotiable and Directive Principles of State Policy that promotes good governance. It ignites the minds of student on issues that are detrimental to make democracy vibrant.

MODULE I CLASSIFICATION OF CONSTITUTION AND GOVERNMENTS 12

Classification of Constitution and Governments. Definition and meaning of Constitution - Kinds of Constitution - Meaning of Constitutionalism- Features of Indian Constitution. Constitution and the Constitutional Law. Preamble-meaning-scope-importance-objectives and values, Union and its Territories (Art 1 to 4)- Citizenship (Article 5 to 11) Definition and meaning of State (Article 12) Definition and meaning of Law (Article 13)

MODULE II PREAMBLE, BASIC STRUCTURE-JUDICIAL REVIEW 12

Doctrine of Basic Structure, Development of Basic Structure theory- Doctrine of Eclipse-Severability and Ultravires- Judicial Review-

MODULE III FUNDAMENTAL RIGHTS - I 12

Fundamental Rights - Article 14- Right to Equality-General Equality Clasuse under Article 14- Reasonable Classification- Protective Discrimination-Reservation and Social Justice under Article 15 and 16. Untouchability under Article 17. Right to Freedom: Freedom of Speech and Expression Article 19-Scope and Ambit- Reasonable restrictions- Right to strike-Bundh-Hartal- Right to Information. Rights of the Accused: Article 20 Ex-post Facto- Double jeopardy-Self incrimination.

MODULE IV FUNDAMENTAL RIGHTS - II 12

Right to Life under Article 21- Life and Liberty-Meaning and Scope- Procedure established by Law- Judicial Interpretation- Maneka Gandhi's Case and its consequences on Constitutional Law. Article 21 A: Right to Education. Land

mark cases in which Right to Life has given a wider scope. Preventive Detention Laws- Exceptions- Safeguards.

Freedom of Religion Article 25 to 28. Secularism-Judicial Interpretation- Cultural and Educational Rights of the Minorities- Recent trends on Minority Educational Institutions. Right to Constitutional remedies Article 32 and Article 226.

MODULE V **12**

. Director Principles of State Policy and Fundamental Duties Relationship between Part III and Part IV. Relevance of Fundamental Duties.

TOTAL HOURS : 60

References:

- M.P. Jain Indian Constitutional Law
- Dr. V.N. Shukla- Constitution of India
- J.N. Pande - Indian Constitutional Law
- DD Basu- Shorter Constitution of India
- Granville Austin- working of Democratic Constitution - A History of Indian Experience
- Constituent Assembly Debates Vol. 1 to 12
- H.M. Seervai - Constitution of India
- G. Austin- Indian Constitution: Cornerstone of a Nation.
- Report of the National Commission to Review the Working of the Constitution. (NCRWC-2002)
- D.J. De- The Constitutional Law of India Vol I and Vol II.

OUTCOMES:

The student will get an understanding the importance of Fundamental Rights the essence of democratic spirit and Directive Principles of State Policy the core of good governance.

SSC 2181 INTRODUCTION TO POLITICAL SCIENCE L T P C
4 1 0 5

OBJECTIVES:

Political Science has close link with Legal Studies. The Course intends to make the student to understand the basic concepts connected with Political Science such as, state and its functions, origin of state, various theories of its origin different forms of governments. Concepts like Sovereignty, Liberty, Equality, Citizenship, Rights and Duties. It also focuses on International facets of political science such as Realism, Political Power, National Power, Balance of Power, Diplomacy, Cold War and Alliance and the Structure and Functions of International and Regional Institutions.

MODULE I INTRODUCTION- NATURE, SCOPE, SIGNIFICANCE STATE AND ITS ELEMENTS-FUNCTIONS 10

Meaning, Nature, Scope and Significance of Political Science- Political Science and other Social Sciences, Theories of the origin of State- Divine Origin Theory- Force Theory- Patriarchal and Matriarchal theories- Social Contract Theories of Hobbes, Locke and Rousseau- Evolutionary Theory. Approaches to study of Political Science- Traditional Approach- Modern Approach- Marxist Approach. Elements of State, State and Society- State and Nation- State and Functions.

MODULE II EQUALITY-JUSTICE-RIGHTS AND DUTIES- LIBERTY 10

Equality- Extent of Equality in Modern Times. Rights and Duties-Rights recognized by the State- Human Rights recognized by International bodies Basic Political Concepts: Sovereignty- Characteristics and types of Sovereignty- Justice- Meaning and Kinds of Justice- Liberty- Meaning- Kinds of Liberty- Civil Liberty- Political Liberty-Safeguards of Liberty.

MODULE III VARIOUS FORMS OF GOVERNMENTS 10

Classification of Government. Merits and demerits of Democracy- Merits and demerits of Monarchy, Merits and demerits of Dictatorship- Role of Law in Governance. Laissez Faire theory- Welfare governments-Parliamentary form of government- Presidential form of government- Unitary and Federal systems. Unicameral and Bicameral legislatures- Role of political parties- public opinion

MODULE IV INTERNATIONAL FACETS 10

Introduction to International Relations- Relationship between International Relations and International Law. Theories of International Relations- Moralistic Theory Merits

and Demerits- Realistic' Theory- Concept of Political Power of the State- Concept of National Power, Elements of National Power- Limitations of National Power- role of Political Power in International Relations- Two World-Wars and their Impact.

MODULE V GLOBAL SCENARIO 10

Bi-Polar World- Cold War- end of the Cold War- Unipolar world and Multi-polar World- Balance of Power- Non-Aligned movement - UNO and its structure and its role in International Peace and Security- Non State Actors- Terrorism- Human Rights and Environmental issues.

OUTCOMES: TOTAL HOURS : 50

* Student can understand and appreciate the relationship between political science and law.
* Student can understand political science basic in Global context.
* Student can understand the issues that the world is facing.

REFERENCES:

1. Amal ray and Mohit Battacharya - Political Theory: Ideals and Institutions.
2. Norman, D. Palmer and Howard, C. Perkins- International Relations: - The World Community in Transition.
3. A.C.Kapoor - Principles of Political Science
4. Hans J. Margenthan - Politics among Nations
5. Baylis - Introduction to International Relations

BLC 2105	FINANCIAL AND MANAGEMENT ACCOUNTING	L	T	P	C
		4	1	0	5

OBJECTIVES:

Knowledge about financial services, markets and their concepts and functions, are essential to the students. This course is designed to understand the information and ideas about financial market and marketing management practices in prevailing situation.

MODULE I INTRODUCTION TO FINANCIAL SERVICES 10

Financial Service- Meaning - Importance- types- financial Service and Economic Development - Financial Instruments- financial Services Sector- Problems- Challenges- Reforms- Financial Markets and Capital Markets in India.

MODULE II MERCHANT BANKING AND VENTURE CAPITAL FINANCE 10

Merchant Banking- concept-Origin and Growth- Scope of Merchant Banking and Services-Issues-Issues Management- Underwriting- Importance - Methods - Venture Capital Finance - Concept and Growth of Venture Capital Finance in India - Leasing- type and Methods - Leasing and Borrowing -Credit Rating - Importance - factoring- Arrangements - Purpose and Procedures of Credit Rating - Short Term and Long Term Instruments - role of CRISIL- ICRA- and other Credit Rating Agencies.

MODULE III MUTUAL FUNDS AND FOREIGN EXCHANGE MARKET 10

Mutual Funds- Concept - Objectives - Importance - Mutual Fund Schemes - Mutual Funds and Money Markets-Portfolios - Concepts - Importance- Classification - Portfolio Management- Debt Securitization - SEBI- Introduction Functions Role of SEBI- NSDL-CSDL- foreign Exchange Market - Importance - Currency Swap-forward Contract and Future Contract- Money Laundering- Importance.

MODULE IV INTRODUCTION TO MARKETING MANAGEMENT 10

Marketing Management- Meaning- Importance- fundamentals- Approaches- Factors Affecting Marketing Functions- Market Mix-Buyers Behavior and Motives- consumer goods and Industrial Goods- Market Segmentation-

Targeting- Positioning.

MODULE V THE PRODUCT AND MARKETING CHANNELS 10

The Product-Meaning-Characteristics and Classifications- New Product Process - Product Life Cycle- Branding- Packaging- Physical Distribution - Importance and Kinds- Marketing Channels- Promotion- Advertisement - Publicity- Direct Selling and Sales Promotion.

TOTAL HOURS : 50

REFERENCE:

1. Dr. S. Premavathi, " Financial Management" Jeyanth Publications
2. E.F. Brisham, " Fundamentals of Management. CBS International Editor-New Delhi, India
3. I.M. Pandey - " Financial Management" Vikas Publishing Private Limited, New Delh

OUTCOMES:

The student will know about financial markets and marketing operations through this course. He will knowledge about securities, mutual funds, portfolio management etc. He will know about the role of SEBI as a regulatory authority.

SEMESTER - IV

		L	T	P	C
BLC 2201	**MANAGERIAL ECONOMICS**	**4**	**1**	**0**	**5**

OBJECTIVES:

The aim is to strengthen the analytical skills of the students by integrating the theoretical knowledge with decision making.

MODULE I NATURE AND SCOPE OF MANAGERIAL ECONOMICS 15

Meaning, Nature and Scope - Scarcity- Choice and Allocation - Decision Making Techniques - Marginalism- Equi-Marginalism and Opportunity Cost- Risk and Uncertainties

MODULE II DEMAND ANALYSIS AND FORECASTING 10

Demand Theory- Types of Demand- Demand Elasticity - Elasticity of Demand and Marginal Revenue - Users of Elasticity - Decision Making - Estimation of Demand and Function - Demand Forecasting - Quantitative and Qualitative Techniques.

MODULE III PRODUCTION ANALYSIS 10

Production Function - returns of Factors - Production Decision - Isoquant-Isocost - Production Possibility - Expansion Path - Optimum Product Mix of Multy-Product Firm - C.S. Function.

MODULE IV COST, REVENUE AND PROFIT ANALYSIS 05

Cost Theories - Applications and Types of Costs - Derivation of Cost Functions - Revenue - Concepts- Functions - Break Even Analysis - Economics Scale vs. Economics of Scope. Profit Maximization- Vs Sales Maximization- Accounting Profit Vs. Economic Profit - theories of Firm.

MODULE V MARKET STRUCTURE AND PRODUCT PRICING xx

Features - Output - Princing Decisions in Different Markets- Equilibrium of Firm and Industry - Monopoly Power- Welfare Triangle - Pricing and Output Decisions- Differentiate Pricing - Mark up Pricing - government Ingtervention and Pricing.

TOTAL HOURS : 40

REFERENCES:

- Rangarajan - Principles of Macro Economics
- P.L. Mehta - Managerial Economics
- Joel Dean - Managerial Economics
- Stephen Robbins and Timothy Judge- Organisational Behaviour
- Fired Luthana - Organisational Behaviour

OUTCOMES:

The student will have a grasp over functional economics in any business establishments with the above in-puts.

BLC 2202	JURISPRUDENCE	L	T	P	C
		4	1	0	5

OBJECTIVES:

Jurisprudence is the study of Law of the Law. Its philosophy and science. It clarifies legal concepts and concerns. Different Schools of Law and their relevance in the contemporary legal world.

MODULE I NATURE, DEFINITION AND SCHOOLS OF JURISPRUDENCE **12**

Nature and definition of jurisprudence – Analytical positivism, Natural law school, Historical school, Sociological school – Economic interpretation of law, Indian jurisprudence – Concept of dharma, PIL, social justice and compensatory jurisprudence.

MODULE I NATURE AND PURPOSE OF LAW **12**

Nature and definition of law, constitutional law and international law and their nature. Justice, critical studies, feminist jurisprudence and Art 142 of Constitution – The administration of justice.

MODULE III SOURCES OF LAW **12**

Legislation – Nature of legislation – Supreme and subordinate legislation – Relation of legislation to other sources, codification and the interpretation of enacted law. Precedent – The authority of precedents – Circumstances destroying or weakening the binding force of precedent, the hierarchy of authority – Ratio decidendi and judicial reasoning. Custom: Kinds of custom, conventional custom, local custom, custom and prescription – The general custom

MODULE IV LEGAL CONCEPTS I **12**

Legal Rights and Duties – Right – Duty correlation – Persons – Nature of personality – Status of unborn, Minor, Llunatic, Drunken and Dead persons – Corporate Personality Possession and Ownership

MODULE V LEGAL CONCEPTS II **12**

Title, Property, Liability, Obligation and the Procedure Law.

TOTAL HOURS : 60

TEXT BOOKS:

. 1. Salmond - Jurisprudence
2. Paton - Jurisprudence
3. H.L.A. Hart - Concept of law
4. Dias - Jurisprudence
5. Bodenheimer - Jurisprudence
6. V.D.Mahajan - Jurisprudence
7. Tripathi - Jurisprudence

OUTCOMES:

Student will get clarity on the concepts and concerns of Law and its philosophy. It demystifies certain notions and inculcates scientific legal attitude.

BLC 2203 FAMILY LAW – II L T P C
4 1 0 5

OBJECTIVES:

The main objective of this course is to make the students to indentify and understand the scheme of succession under the Hindu, Muslim and Christian Laws. Further, with reference to un- codified Hindu Law, the matters relating to Joint Family System, Coparcenaries,, Karta and his powers, partition and the Hindu Religions Endowments are given in the syllabus for understanding the changes effected after the passing of the Hindu Succession Act, 1956 and other related laws. Under Muslim Law the matters relating to wakfs, wills, Gifts and pre-Emption are given in separate chapters in addition to the Sunni and Shia Law of Inheritance. With reference to Christian Law, a Part of the Indian succession Act, 1925 relating to Law of Wills and the Christian Law of Inheritance are given in separate chapters.

MODULE I JOINT HINDU FAMILY 12

Institution of joint family – Coparcenary system – Classification of properties – Karta – Status, powers and duties – Principle of survivorship and succession – Partition.

MODULE I INTESTATE SUCCESSION 12

General principles of succession under Hindu Law, Muslim Law and Christian Law – Statutory conditions of disinheritance and disentitlement – Comparative analysis of right to property of women under different Religious and Statutory law. Dwelling house and Right of Pre-emption.

MODULE III TESTAMENTARY SUCCESSION 12

Testamentary succession under Hindu, Muslim and Christian Law – Limitation to testamentation under various religious and statutory law – Will and administration of will – Codicil – Lapse,
– Probate, letters of administration and succession certificate.

MODULE IV GIFT UNDER ISLAMIC LAW 12

Hiba – Nature and characteristics of Hiba – Subject matter of Hiba – Hiba-biliwaz, Hiba-ba-shart-ul-iwaz – Revocation of gift.

MODULE V RELIGIOUS ENDOWMENTS AND WAKF 12

Hindu religious endowments – Wakf – Meaning – Formalities of creation –

Types and administration of wakf – Mutawalli and his powers – Muslim religious institutions and offices.

TOTAL HOURS : 60

REFERENCES:

Acts:

1. The Hindu Succession Act, 1956 with recent amendments
2. Indian Succession Act, 1925
3. The Hindu Women's Right to Property Act, 1937
    a. The Wakf Acts.

Books:

1. Mulla - Principels Hindu Law
2. N.R. Raghavachari - Hindu Law
3. D.H. Chaudhari - The Hindu Succession Act, 1956
4. Fyzee - Outlines of Mahomedan Law
5. Dr. Paras Diwan - Family Law
6. Prof. G.C.V. Subba Rao - Family Law in India
7. Paruck - Indian succession Act
8. R. Swaroop - Hindu Law of Succession
9. Poonam Pradhan Saxera - Family Law Lectures Family Law II

OUTCOMES:

The student will have idea on issues relating to succession among Hindus, Muslims and Christians etc. He knows the Law that governs religious endowments and Wakfs.

BLC 2204 CONSTITUTIONAL LAW II

L	T	P	C
4	1	0	5

OBJECTIVES:

The very objective of this course is to introduce, explain and enlighten the student on the matters relating to Constitutional governance in India. Union government, State governments and their relations, Powers and Functions of Constitutional Bodies will be discussed.

MODULE I OFFICE OF THE PRESIDENT AND OFFICE OF THE GOVERNOR 10

The Union Executive - The President – Election, Term of Office, Powers and functions, Impeachment – Immunities – Pardoning power - Ordinance making power - President and Union Council of Ministers-The State Executive - Governor – Appointment, Powers and functions - Immunities – Pardoning power – Removal of Governor, Doctrine of Pleasure - State Council of Ministers

MODULE II PARLIAMENT AND STATE LEGISLATURES 10

Composition of Parliament and State legislatures – Office of the Speaker – Qualification/Disqualification of Members - Legislative Procedures, Legislative Privileges – Judicial interpretations – Anti Defection law, X Schedule Union Judiciary-Supreme Court of India (Articles 124-147) – Composition, Appointment and Removal of Judges of Supreme Court - Writ Jurisdiction of Supreme Court under Art 32 - Appellate Jurisdiction of Supreme Court – Civil, Criminal and in other Matters - Statutory Appeals and Enlargement of Jurisdiction - Special Leave to Appeal (Art. 136) - Power of Review (Art. 137) - Advisory Jurisdiction (Art. 143) - Public Interest Litigation – Compensatory Jurisprudence - Independence of Judiciary - Tribunals
State Judiciary -High Courts in the States - Composition, Appointment and Removal of Judges - Writ Jurisdiction of High Courts under Art. 226.

MODULE III DIVISION OF POWERS 10

Distribution of Legislative Powers - Doctrine of Territorial Nexus - Subject matter of laws made by Parliament and Legislatures of States - Doctrine of Harmonious Construction - Doctrine of Pith and Substance – Doctrine of Occupied Field- Colourable Legislation - Parliament's Power to Legislate in State List – Implied and Residuary Power - Doctrine of Repugnancy.

Administrative relations – Full faith and credit clause – Centre and inter-state conflict management Fiscal Relations – Sharing of tax – Grants-in-Aid – Restriction on the power of state legislatures – Doctrine of immunity of Instrumentality – Borrowing powers – Constitutional Limitations Freedom of Trade, Commerce and Intercourse (Art. 301-307) - Meaning of Freedom of trade, commerce and intercourse - Power of Parliament – Restrictions.

MODULE IV EMERGENCY 10

Emergency Provisions- National Emergency - Duty of the Union to protect the States against external aggression and internal disturbance - Power of Union Executive to issue directions and the effect of non- compliance.

State Emergency - Imposition of President's Rule in States – Grounds, Limitations, Parliamentary Control, Judicial Review (Articles 356-357) –

Financial Emergency (Article 360)

Emergency and suspension of fundamental rights

MODULE V CONSTITUTIONAL BODIES 10

Organisation, powers and function of Election Commission of India, Union Public Service Commission, State Public Commission, Comptroller and Auditor General, Attorney General & Advocate General– Constitutional safeguards for Civil Servants Art 311 - Protection against arbitrary dismissal, removal, or reduction in rank – Exceptions to Art 311 – Role of Finance Commission – Planning Commission- Niti Ayog – Inter- state Council – National Development Council – Local Self Government (Panchayat Raj)

TOTAL HOURS : 40

REFERENCES:

1. M. P. Jain- Indian Constitutional Law – Relevant Volumes
2. D.D.Basu, Shorter Constitution of India,
3. Virendra Grover, Centre – State Relations.
4. M.P.Singh(ed.), V.N.Shukla, Constitutional Law of India
5. Granville Austin, Working a Democratic Constitution - A History of the Indian Experience (1999)
6. Constitutent Assembly Debates Vol. 1 to 12 (1989)
7. M.V.V. Ramana, Inter-State River Water Disputes in India
8. Anirudh Prasad, Centre-State Relations in India

9. Reports of the Sarkaria, M.M.Punchi, Santhanam Commisssion on Centre-State Relations
10. H.M.Seervai, Constitution of India, Vol.1-3(1992), Tripathi, Bombay
11. Palanithurai , G. Dynamics of New Panchayati Raj Systems In India Vol. I & II
12. D. N. Banerjee, Some Aspects of the Indian Constitution
13. G. Austin, Indian Constitution: Cornerstone of a Nation (1972).
14. S.C.Kashyap, Parliamentary Procedure Law Privilege Practice & Precedents
15. Dr. V. N. Shukla – Constitution of India
16. N.A.Subramaniam – Case law on the Indian Constitution
17. T. K. Tope – Constitutional Law
18. D.J. De – The Constitution of India Vol. I and II
19. Administrative Reforms Committee Vol I and II
20. Report of the National Commission to Review the Working of the Constitution (NCRWC) (2002)

OUTCOMES:

Student will learn the scheme of Constitutional Frame-work- in respect of President, PM- Governors-State Governments- Emergency Provisions- Center - State Relations- Powers and Functions of Constitutional Bodies.

BLC 2211	COMPUTER FOR MANAGEMENT AND MANAGEMENT INFORMATION SYSTEMS (MIS)	L	T	P	C
		4	1	0	5

OBJECTIVES:

This subject is designed to provide such a knowledge-base, business application of word processing, database management system, electronic data interchange, internet and its basic concepts and Management information system as a major functional area of business. It helps the student in many ways.

MODULE I WORD PROCESSION 10

Introduction-Creating, Editing, Formatting and Printing Documents- Using Tools such as Spell Check, Thesaurus- etc. In Work Proceessors (MS Word), Electronic Spreadsheet, structure of Spread Sheet and its applications to Accounting, Finance and Marketing functions of business- Creating a Dynamic/Sensitive worksheet; concept of Absolute and relative cell- reference using Built in Functions; Goal Seeking and Using graphics and sharing data with other Desktop Applications, Strategies of Creating Error-free Worksheet. (MS Excel)

MODULE II DATA BASE MANAGEMENT SYSTEM 10

Data Base Management System: Basic concept of DBMS; Sorting, Indexing and Searching Data Records- Designing Queries, and Reports- Linking of Data Files- Developing Menu Driven Applications in query Language (MS Access) - Electronic Data Interchange (EDI) Introduction of EDI - EDI Standards- Financial EDI (FEDI) FEDI for International Trade Transaction-Applications of EDI, Advantages of EDI- Future of EDI.

MODULE III THE INTERNET AND ITS BASIC CONCEPTS 10

The Internet and its Basic Concepts; Development in India; Distributed Computing; Client-Server Computing; Internet Protocol Suits, IP Addresses, Internet Protocol, Domain Name System (DNS); Allocation of Second Level Domains; Application of Internet in Business, Education, Governance, etc. Allocation of Second Level Domains; Basic Idea of Information Audit; Difference with the Traditional concepts of Audit; Conduct and Applications of IS Audit in Internet Environment.

MODULE IV MANAGEMENT INFORMATION SYSTEM 10

Management Information System: Basic Concepts, MIS Support for Planning, Organizing and Controlling-Structure of MIS - Decision Making System concepts, Characteristics and Classification of Computers Input/output devices- storage devices- Batch and online Procession- Hardware and Software.

MODULE V SYSTEM ANALYSIS AND DESIGN: 10

SDLC -Role of System Analyst-Functional Information System- Personnel, Production, Material, Marketing. Decision Support System - Group Decision Support Systems- Business Process Outsourcing Functions.

TOTAL HOURS : 50

BOOKS:

1. Agarwala Kamlesh N and Agarwala Deeksha- 'Business on the Net - Introduction to E-Commerce'.
2. Dr. S.P. Rajagopalan " Management Information Systems and EDP.

REFERENCES:

1. Minoli Daniel, Minoli Emma - E. Commerce Technology Handbook
2. Kanter- Managing with Information System
3. Goyal - Management Information System
4. Mudrick and Ross- Management Information System

OUTCOMES:

This course will make the student computer literate in a scientific way. In this digital era, this course will enrich and empower him with necessary inputs on E-Related issues including E-Commerce and MIS Systems.

SEMESTER V

BLC 3101 PUBLIC INTERNATINAL LAW L T P C
4 1 0 5

OBJECTIVES:

International Law regulates the relations between and among States. The object is this course is that the student should understand the nature and scope of IL and its ever increasing significance. Student will learn about UNO - International treaties- Law of the Sea-Space-Refugee Law. It also looks into State as a subject and Individual as a subject of IL.

MODULE I NATURE AND SCOPE 10

International Law – Definition, Basis and Nature – Codification – International Law Commission – Sources of International Law – Relationship between International Law & Municipal Law – Theories and State Practice.

MODULE II STATE AND INDIVIDUAL AS A SUBJECT OF IL 10

State and Individual as a subject – Rights and Duties / Responsibilities – State Recognition – Theories – Kinds and legal effects – Nationality – Acquisition and loss related issues – Extradition Asylum - Territorial Sovereignty – Modes of acquisition and loss of territory – State Jurisdiction – State Succession and liability.

MODULE III LAW OF THE SEA- AIR AND SPACE 10

Law of the Sea - Air & Space Law; Diplomatic Law – Agents Consulars, Immunities and Privileges – Refugee Law.

MODULE IV FORMATION OF TREATIES AND OBSERVANCE 10

Concept - Definition of International Treaties – Formation of Treaties and its stages – Reservation, observance of Treaties, Interpretation of Treaties – Suspension and Termination of Treaties.

MODULE V UNITED NATIONS ORGZANISATION ITS FRAMEWORK. 10

Origin, Nature & Scope of International Organizations – League of Nations, United Nations and its organs – International Tribunals.

TOTAL HOURS : 40

REFERENCES:

1. Starke – International Law
2. S.K. Kapoor – International Law
3. K.K. Bhattachary – International Law
4. Agarwal – International Law
5. Oppenheim – International Law
6. Brierly - International Law
7. Schewrenberger - International Law
8. Salient Documents in International Law – R.P. Anand
9. Antonio Cassese – International Law
10. Ian Brownlie - International Law
11. R.P. Anand – New States in International Law
12. D.J. Haris – Cases Materials in International Law
13. Commentary on the Statute of ICJ – Andreas Zimmermann
14. Malcom N. Shah – An introduction to International Law.

OUTCOMES:

The student will learn about different facets of International Law and its frame-work in this course. He will also understand the UN Mechanism and how it works.

BLC 3102 **COMPANY LAW** **L T P C**
4 1 0 5

OBJECTIVES:

Corporate Governance plays an significant role in Commerce, Business and Management Studies. The object of this course is to help the students to understand the structure of a Corporate Organisation. To comprehend the legal aspects pertaining to forming, administrating and winding of a company.

MODULE I **INTRODUCTION, DEFINITION &TYPES OF COMPANIES** **10**

Corporate personality, the Companies Act 1956 as repealed by Companies Act 2013, Definition of Company, Types of Association, Illegal association, Classes of company, One Person Company.

MODULE II **FORMATION OF A COMPANY** **10**

Formation of a company – Promoters, Registration, Incorporation, Memorandum of Association Articles of association, Prospectus &Deposits, Application and Allotment of shares.

MODULE III **SHARES AND DIVIDENDS** **10**

Shares – Application and allotment of shares- members and shareholders ,shares and share capital- debentures, charges and debenture holder, dividends, borrowings, lending, investments, contracts.

MODULE IV **DIRECTORS AND BOARD** **10**

Directors- Independent Directors, Women directors and Managerial Personnel, Meetings, Accounts and Audit- Internal Auditing, National financial Reporting Authority, E- Filing and Information Technology Act 2000, Corporate Social Responsibility, Majority shareholders powers and minority share holders rights, Prevention of Oppression and Mismanagement, Investigation, Powers of Inspectors, Powers of NCLT, Insider
trading.

MODULE V **WINDING UP OF A COMPANY -** **10**

Compromises, arrangements and amalgamations – mergers and acquisitions, Winding up and kinds of winding up- Administration of NCLT and CLAT and special courts - powers of liquidators removal of names of companies from register of

companies, Defunct companies and restoration, revival and rehabilitation of sick companies.

TOTAL HOURS : 40

REFERENCES:

1. Gower :Company Law
2. Mayson,French&Ryamn :Company Law
3. Palmer : Company Law
4. Avatar Singh : Company Law

OUTCOMES:

Students will learn about the formation, administration and winding up of a Company as a legal person thereby he will have a basic idea on corporate governance.

BLC 3103	HUMAN RIGHTS	L	T	P	C
		4	1	0	5

OBJECTIVES:

The objective of the course is to introduce the Human Rights Law and facilitate to understand the working of both national and international Human Rights Law. The student will be introduced a theories of Human Rights and its practice.

MODULE I EVOLUTION OF HUMAN RIGHTS 10

General – Origin and development –– The MagnaCarta – Bill of Right – Petition of Right – American Revolution – The French Revolution – Opposition to the concept of natural rights –

United Nations Charter based institutions – Centre for Human Rights – United Nations Universal Declaration of Human Rights - specialized agencies – Origin and preparation of international bill of human rights – Adoption of the International Covenants on Human Rights and Protocols thereto – Universal Declaration of human rights – International covenant on economic, social and cultural rights –

International covenant on civil and political rights – Instrumentality of enforcement of the covenants.

MODULE II HUMAN RIGHTS- FUNDAMENTAL RIGHTS 15

A. The right to life, liberty and security of person – Provision of the United Nations Instruments – Right to life does not include right to die –Meaning and content of personal liberty in Article 21 – Second option protocol to the International Covenant on Civil and Political Rights –Problems of extra – legal execution –

   Abolition of slavery and slavery-like practice – Abolition of certain types forced or compulsory – Provisions of the United Nations instruments – ILO Forced Labour Convention 1930 and 1957 – Exploitation of Children: Article 24 of the Constitution.

B. Protection against torture and other forms of cruelty Inhuman or degrading treatment or punishment – Constitution of the committee against torture – Protection of prisoners in India.

C. Protection against arbitrary arrest and detention – provisions of international human rights instruments – Indian Constitution – Right to be produced before

a Magistrate within 24 hours of his arrest – Right not to be detained beyond twenty four hours without the authority of Magistrate Preventive detention – Communication of the grounds of detention – Detenu's right of representation – Subjective satisfaction of the detaining authority.

D. Freedom of thought, Conscience and Religion or Belief-Provisions of the United Nations instruments – Conscientious objection to military service Conscientious objection to military of police service which were used to enforce apartheid – Elimination of intolerance and discrimination based on religion or belief – Freedom to manage religious affairs.

E. Freedom of association including trade union rights – The International Covenant on Civil and Political Rights –CRC Provisions of ILO instruments – Scope of right to form association – Freedom to form association vis-a-vis armed forces and police-reasonable restrictions.

F. Human rights in the administration of justice – United Nations standards and norms-Strategies for effective implementations – Guidelines on the role of prosecutions – Declaration of basis principles of justice for victims of crime and abuse of power – Equality before the law and equal protection of laws – Prohibition of discrimination on certain grounds – Equal pay for equal work – Enabling provisions for weaker section of the society

Special provisions, for women and children – Special provisions for advancement of socially and educationally backward classes and Scheduled Caste and Scheduled Tribes.

MODULE III **INTERNATIONAL LABOUR ORGANISATION (ILO)** **10**

A. Right to work – Provisions on ILO instruments – International covenants The declaration of elimination of discrimination against women.

B. Right to education – UNESCO – Conventions – Educational rights of women and children.

C. Right to culture – Declaration of the principles of cultural co-operation – UNESCO recommendations.

MODULE IV **WOMEN, MINORITIES, DISABLED PERSONS** **15**

A. Rights of women – Objective equality – UN development fund of women

– World conferences on women – Nairobi strategy.

B. Rights of the Child – 1959 declaration – UN Children's Fund – UNICEF Convention of right of the child – Right against exploitation – 1990 declaration.

C. Rights of the disabled persons – Mentally retarded persons – Aged persons etc.

D. Rights of minorities – National, ethnic, religious, linguistic etc.,

E. Human rights Act, 1993 – National Human Rights Commission – India – Powers and functions

MODULE V HUMANITARIAN LAW 15

Origin and development of International Humanitarian Law – Geneva Conventions – Defenseless person, wounded, sick, medical personnel etc., - Repatriation – Prisoners of war – International armed conflicts – obstacles. Origin and development – Rights, Responsibilities of Refugees – Juridical status – UNRWA and UNHCR – Legal status of refugees in India

TOTAL HOURS : 60

REFERENCES:

1. Cransten – Human Rights toda
2. Galius Esejoifer – Protection of human rights under the law
3. John Locke – Civil Government
4. Richte – Natural rights
5. Raphael D.D., Macmillan – Human Rights Old and New
6. R. Dworkin – Taking rights seriously
7. Dr. U. Chandra – Human Rights, Allahabad Law Agency
8. Paras Diwan – Human Rights and Law

OUTCOMES:

The student will learn about the evaluation, frame work of Human Rights Law at Global level in general and in Indian context in particular both in theory and practice.

BLC 3111 STRATEGIC MANAGEMENT L T P C
4 1 0 5

OBJECTIVES:

Strategic Management is more than traditional management activities. It integrates core management functions to broader context keeping in view of external environment, internal capabilities, organization's purpose, direction and objectives. Quest for quality and continuous improvement is the essence of this course. Total quality management philosophy need to adopted in the challenging atmosphere in the market place. Each organization's experience with strategic management will be unique, reflecting the organization's distinct culture, environment, resources, structure, management style, and organizational features.

MODULE I INTRODUCTION 10

Strategy - strategic Management Process - Develping a Strategic Vision - Setting Objectives - Crafting Strategy - Strategies and tactics - Importance of Corporate Strategy - The 7-S Framework - Board of Directors : role and Functions- Board Functioning - Top Management: Role and Skills

MODULE II SOCIETY AND BUSINESS 10

Social responsibility of Business - Corporate Governance and Ethical Responsibility - Corporate Policy - Importance - Characteristics - Objectives - Policy Formulation and Development - Types of Business Policies - Implementation of Policies.

MODULE III ENVIRONMENTAL ANALYSIS 10

Environmental Scanning - Industry Analysis - The Synthesis of External Factors - Internal Scanning - Value Chain Analysis- SWOT Audit - Stakeholders Expectations- Scenario Planning.

MODULE IV STRATEGY FORMULATION AND ANALYSIS 10

Strategy Formulation- Strategic Factors Analysis Summary Matrix - Business Strategy - Corporate strategy - Functional Strategy - Strategic Choices - Generic, Competitive Strategies.

MODULE V STRATEGY IMPLEMENTATION 10

Strategy Implementation - Corporate Culture- M atching Organization Structure to

Strategy - Strategic Leadership - Strategic Control; Strategic Control Process- Du Pont's Control Model - Balanced Score Card - Michael Porter's Framework for Strategic Management - Future of Strategic Management- strategic Information System.

: TOTAL HOURS : 50

REFERENCES:

1. David, F.R. - Strategic Management concepts and Cases
2. Dess, G. Lumpkin, G.T> and Eisner - A. Strategic Management
3. Hill, C.W.L. and Jones, G.R. strategic Management
4. Kazmi, A. - Strategic Management and Business Policy
5. Pearce II. J.Robinson, R.B. and Mittal - Strategic Management.

OUTCOMES

Fail to plan leads to plan to fail. Student will learn various facets of Strategic management right from formulation to implementation through this course.

BLC 3112 FUNDAMENTALS OF MARKETING MANAGEMENT

L	T	P	C
4	1	0	5

OBJECTIVES:

The object of the course is to familiarize the students with the basic concepts and principles of marketing and to develop their conceptual and analytical skills to be able to manage marketing operations of a business firm.

MODULE I INTRODUCTION 10

Nature, scope and Importance of Marketing- functions and Problems Modern Marketing Concepts - Marketing Environment and Marketing System.

MODULE II CONSUMER BEHAVIOR 10

Consumer Behavior- Consumer Buying Decision Process- Market Segmentation - Marketing Research and Marketing Mix- Product Mix- Classification of Products - Product Planning - stages in New Product Development - reasons for New Product Failure.

MODULE III PRICE IN MARKETING 10

Price Mix-Factors Affecting Price of a Product - Kinds of Pricing - Pricing Policies- Channel of Distribution - Meaning Importance and Nature - Selection of Distribution Channel - Marketing Middlemen Functions and Types.

MODULE IV ADVERTISING AND PROMOTION 10

Promotion Mix - Advertising - Meaning Importance, Types, Media Decisions - Personal Selling Nature, Importance and Process - Sales Promotion.

MODULE V MARKETING OF SERVICES 10

Marketing of services - Characteristics - Classification of services - Marketing Mix for Service Customer Relationship Management- concept, Nature and Managing Relationship.

TOTAL HOURS : 50

REFERENCES:

1. Dr. Rajan Nair and Sanjith Nair - Marketing
2. Dr. C.B.Gupta and Dr Rajan Nair Dess - Marketing Management

3. Philip Kotler - Marketing Management
4. Dr. Sherlekar - Marketing Management
5. V.S.Ramaswamy and S. Nama Kumari - Principles of Marketing
6. Sontakki C.N. Marketing Management
7. Crrainfied - Marketing Management

OUTCOMES:

Selling of goods and services is the essence of any business. Student should will learn the marketing aspects in this course.

SEMESTER – VI

BLC 3201	**LAW OF EVIDENCE**	**L**	**T**	**P**	**C**
		4	**1**	**0**	**5**

OBJECTIVES:

Proving /Disproving a case is based on the evidence . In a trial before the Court of Law, relevant evidence has to be placed according to the procedure established under the Indian Evidence Act. The object of this course is to focus on evidentiary value of Evidence in the Administration of Justice.

MODULE I INTRODUCTION 10

Indian Evidence Act, 1872 – scope, object and applicability of Indian evidence act and exclusion – Statutory definition. Indian Law of Evidence and English Law of Evidence – Comparison – Constitutional perspective of Evidence – Golden Rule Evidence, Presumption of Law and fact – Kinds of Evidence.

MODULE II RELEVANCE AND ADMISSIBILITY 10

Relevance of facts and admissibility of facts – Resgestae – Hearsay.Occasion, cause and effect etc., - Motive, preparation and conduct –explanatory facts – Acts of conspirators – When facts not otherwise relevant become relevant – Facts determining quantum of damages – customs – State of mind, body or bodily feeling – Similar facts – Course of business. Admission and confession.

MODULE III EVIDENCE 10

Relevancy of statement made by person who cannot be called as witness. Relevance of Judgments of Courts. Relevance of opinion of third persons – Export Cases. Law of Forensic Science – Forensic Institutions – Principles of Forensic Science proof and Forensic technology – Forensic science and criminal Justice system – Criminal trial, Scientific Examination and Expert witness u/s 112A. Relevance of character in civil and criminal cases.

MODULE IV DIFFERENT TYPES OF 'EVIDENCES' 10

Facts which need not be proved – Judicial notice – Modes of Proof – Oral Evidence – Hearsay evidence – Exceptions – Primary and Secondary evidence – Documentary evidence – Documents – Public and private documents – Presumptions as to the documents – Exclusion of oral evidence by documentary evidence . Burden of proof – Rules relating to burden of proof and Doctrine of Estoppel.

MODULE V FACTS AND PROOFS 10

Facts which need not be proved – Judicial notice – Modes of Proof – Oral Evidence – Hearsay evidence – Exceptions – Primary and Secondary evidence – Documentary evidence – Documents – Public and private documents – Presumptions as to the documents – Exclusion of oral evidence by documentary evidence . Burden of proof – Rules relating to burden of proof and Doctrine of Estoppel.

TOTAL HOURS : 50

REFERENCES:

1. Ratanlal : Law of Evidence
2. Avatar Singh : Law of Evidence
3. Vepa Sarathi : Law of Evidence
4. Dr.V.Krishnamachari : Law of Evidence
5. P.S. Achutan Pillai : Law of Evidence
6. B.R. Swarma : Forensic Science in criminal trial and Investigation
7. Sankar : Law of Evidence (2 Volumes)
8. Sir John Woodroffee and Syed Amir Ali : Law of Evidence (4 Volumes)
9. Walls H.J. : Forensic Science

OUTCOMES:

Evidence is crucial in proving a case or disproving the same. The student will learn about Indian Evidence Act and provisions through this course.

BLC 3202	LABOUR LAW I	L	T	P	C
		4	1	0	5

OBJECTIVES:

Healthy Industrial relation is essential in the progress of the country. As the Labour are venerable for exploitation, successive governments passing various legislations to govern labour management relations to avert industrial disputes and unrest. The course is designed keeping in view of these aspects.

MODULE I EVALUATION OF LABOUR LEGISLATIONS 10

Origin and development of labour legislation - Object and nature of labour legislation - Evolution of concept of master and servant relationship - Theory of Laissez Faire and state regulation of labour legislation and its special features - Role of ILO in setting up Standards.

MODULE II TRADE UNIONS- COLLECTIVE BARGAINING 10

Definitions - History of Trade Union Movement - Registration of Trade Unions - Rights and Liabilities of Trade Unions - Immunities and Privileges of a Registered Trade Union – Trade Union funds - Collective bargaining - Amalgamation and Dissolution of Trade Unions Recognition of Trade Unions.

MODULE III INDUSTRIAL DISPUTES ACT, 1947 10

Scope and applicability and definitions - Appropriate Government; workmen; industry; industrial disputes; award; settlement; Public Utility service; Strike; Lock out; Retrenchment; Lay off; Closure - Machinery for the settlement of industrial disputes – Works Committees, conciliation officers – Board of Conciliation, Court of Inquiry – Labour Court, Industrial Tribunal – National Industrial Tribunal – Reference Power of the Government – Voluntary Arbitration - Unfair labour practices.

MODULE IV INDUSTRIAL EMPLOYMENT(STANDING ORDERS)ACT, 1946 10

Scope and Definitions - Procedure for Certification of Standing Orders - Duration and modification of Certified Standing Orders - Domestic enquiry and disciplinary proceedings.

MODULE V LAW RELATING TO WAGES 10

1. Minimum Wages Act, 1948

Theories of Wages and Wage Policy - Concept of wages - Living wage, Fair wage and

Minimum wage - Fixation of minimum rates of wages - Methodology; procedure;

Advisory Boards - Inspectors, powers, claims - Exceptions and offences

2. Payment of Wages Act, 1936

Definitions - Deductions - Authorities under the Act - Inspectors and their powers - Penalty

TOTAL HOURS : 40

REFERENCES:

1. Industrial Disputes Act, 1947.
2. Trade Union Act, 1926
3. Industrial Employment (Standing Orders) Act, 1946
4. Minimum Wages Act, 1948
5. Payment of Wages Act, 1936.
6. Madhavan Pillai : Labour and Industrial Law
7. S.N. Mishra : Labour and Industrial Law
8. V.G.Goswami : Labour Law
9. O.P. Malhotra : Industrial Disputes Act
10. Srivastsava : Law Relating to Trade Union
11. Srivastsava : Industrial Employment (Standing Orders) Act

OUTCOMES:

The student will know about various Laws that govern labour management relations, through this course. He will have a fair idea about trade union movement its origin functioning etc.

BLC 3203	ADMINISTRATIVE LAW	L	T	P	C
		4	1	0	5

OBJECTIVES:

Today we are living in a 'administrative age' where there is rising tendency to transfer more and more powers to executive which include quasi-judicial as well as quasi-legislative which has become inevitable in modern democratic state. Therefore, there has been a tremendous increase in powers and functions of the administrative authorities and the obvious result is full of danger of its degeneration and unwanted encroachment on human rights and liberties. Hence, there requires adequate control, safeguard through procedural fairness, judicial review and remedies to those affected by the administration. This syllabus has been prescribed with these objectives.

MODULE I INTRODUCTION TO ADMINISTRATIVE LAW 10

1. Definition, Nature, Scope - Origin and Development Sources -Administrative Law and Constitutional Law

2. Rule of Law Concept, Evaluation of Dicey's concept of Rule of Law, Modern conception of Rule of Law, Rule of Law in U.K., U.S.A. and India, Rule of Law vis-à-vis Administrative Law

3. Doctrine of Separation of Powers – Meaning, Origin, Montesquieu's Doctrine of Separation of Powers, System of checks and balances

4. Classification of Administrative Action a. Nature of Powers–Executive, Legislative and Judicial

b. Legislative function–Quasi Legislative functions – Administrative Directions.

c. Judicial function – Quasi Judicial functions – Tribunals and Administrative Justice

d. Executive function – Ministerial functions and discretionary functions.

MODULE II DELEGATED LEGISLATION 10

Meaning, Nature, Origin, Development and causes of growth of delegated legislation, Types of Delegated Legislation and Constitutionality of Delegated Legislation-Delegated Legislation and Conditional Legislation, Sub-Delegation-Restraints on Delegation of Legislative Power, Doctrine of Excessive Delegation-Control over Delegated Legislation – Judicial, Procedural and Legislative Control-Administrative directions and Delegated Legislation

MODULE III PROCEDURAL FAIRNESS AND JUDICIAL REVIEW 10

A. Principles of Natural Justice

Concept, Parameters and application of the Principles of Natural Justice-Rule against Bias-Audi Alteram Partem or the Rule of Fair Hearing – Meaning, Object, Ambit and Ingredients of Fair Hearing, Institutional Decision, Post-Decision Hearing-Reasoned Decisions- Exceptions to the Rule of Natural Justice-Effects of Breach of Natural Justice

B. Administrative Process and Judicial Review

1) Meaning and need for Judicial Review

2) Scope of Judicial Review

Jurisdiction of the Supreme Court -Writ Jurisdiction-Appeal by Special Leave (Art. 136)-Scope and Object of Article 136- Jurisdiction of the High Court

3) Judicial Review of Administrative Action through Writs- cope of the Writ Jurisdiction -Against whom the Writ lies-Territorial extent of Writ Jurisdiction -Relief against an Interim Order – Interim Relief [Art. 226(3)]-*Locus-standi*-Kinds of Writ - Grounds for issue of Writs

4) Principles for the Exercise of Writ Jurisdiction Alternative Remedy-Laches or Dela-*Res Judicata*

5) Public Interest Litigation and *Locus-Standi*

6) Doctrine of Legitimate Expectation and Doctrine of Proportionality

C. Statutory Remedies

a) Injunction- Declaration against the Government - Exclusion of Civil Suits

D. Privileges and Immunities of Government in Legal Proceedings

Privilege to withhold documents - Miscellaneous Privileges of the Government-Notice, Limitation, Enforcement of Court Order- Binding nature of Statutes over the States action-Promissory Estoppel- Right to Information

E. Judicial Control of Administrative Discretion

Meaning, Nature and need of Administrative discretion -Ground and Extent of Judicial Review -Fundamental Rights and Discretionary Powers

F. Liability of the State

Liability of the State in Torts and Contracts.

MODULE IV OMBUDSMAN, LOKPAL, LOKAYUKTA AND CENTRAL VIGILANCE COMMISSION 10

Meaning, Object, Main characteristics, Need and Utility-Origin and development of the Institution -Ombudsman in New Zealand- Ombudsman in England (Parliamentary Commissioner)- Ombudsman in India –Lokpal-Lokayukta in States-Central Vigilance Commission

MODULE V ADMINISTRATIVE TRIBUNALS AND PUBLIC UNDERTAKING **10**

(A) Administrative Tribunals

Meaning, Nature, Main characteristics, Origin and development (U.S.A., U.K. and India)-Franks Committee- Tribunal and Court, Similarity and Difference-Reason for growth of Administrative Tribunals-Merits and Demerits of Administrative Tribunal-Procedure and powers of Administrative Tribunal (U.K., U.S.A. and India)-Tribunal under Constitution -High Court's Superintendence over Tribunals-Appeal to Supreme Court by Special Leave-Working of the Administrative Tribunal Administrative Tribunals under Administrative Tribunals Act, 1985-Administrative Procedure Act in U.S.A.-Domestic Tribunal

(B) Public Undertaking

Object, Importance, Characteristics, Classification, Reason for the growth -working of Public Corporations-Rights, Duties and Liabilities of Public Corporations-Controls over Public Corporations, Government Control, Parliamentary Control, Judicial Control, Public Control-Role of Ombudsman in Public Undertaking

TOTAL HOURS : 60

REFERENCES:

1. M.P. Jain and S.N. Jain – Principles of Administrative Law
2. S.P. Sathe – Administrative Law
3. I.P. Massey – Administrative Law
4. C.K. Takwani – Administrative Law
5. Kailash Rai - Administrative Law
6. Wade – Administrative Law
7. De Smith – Administrative Law
8. Foulkes – Administrative Law
9. Indian Law Institute – Cases and Material of Administrative Law
10. Markose – Judicial Control of Administrative action
11. Griffith and Street – Administrative Law
12. Report of the Law Commission – First Report Second Report –
13. Fourteenth Report

OUTCOMES:

Student will learn how to protect the common man or a little man from administrative excesses. He knows various methods and forums to protect the legal interests of a common man. He knows the methods and techniques to keep the administrative authorities within their limits to ensure Rule of Law and Constitutional Governance.

BLC 3204 PROFESSIONAL ETHICS AND BAR BENCH RELATIONS AND ACCOUNTANCY FOR LAWYERS (CLINICAL COURSE - I)

L	T	P	C
2	1	2	5

OBJECTIVES:

The object of this course is to familiarize the student about ethics to be followed in Legal Profession. Bar and the Bench are equally important in justice dispensing system and certain Do's and Don'ts were prescribed. The student will study as many as 50 selected decisions of the Bar Council of India on professional ethics. The paper is divided into four modules

MODULE I PROJECT ON PROFESSIONAL ETHICS

Student has to write 50 selected decisions of Bar Council of India on the matters relating to Professional Ethics- Disciplinary Proceedings. It is written submission of record. (50 Marks)

MODULE II LECTURE SESSIONS 20

Lecture sessions will be arranged with Practicing Advocates, Senior Advocates and Teaching Faculty on Profession, Ethics, Need and Purpose, Accountancy for Lawyers, and Important decisions of Supreme Court, High Courts and Bar Council of India Disciplinary Proceedings.

MODULE III INTERNAL EXAMINATION

Internal Examination will be held for marks 25 on the subjects discussed

MODULE IV VIVA VOCE EXAMINATION

Viva Voce Examination for 25 marks.

TOTAL HOURS : 20

REFERENCE:

1. Mr. Krishna Murtyiyer - 'Advocacy'
2. Indian Bar Review: Selected Disciplinary Proceedings
3. The Contempt Law And Practice
4. The Bar Council Of India Code Of Ethics.

OUTCOMES:

Student will learn court etiquette, ethics to be observed in profession and consequences of non-observance of professional conduct.

BLC 3211 PUBLIC FINANCE L T P C
4 1 0 5

OBJECTIVES:

This course intends to focus on basic knowledge about the components of public finance and the financial administration. The student should get an overview of the working of the Public Economics and need to understand the changing trends in the Public Finance.

MODULE I INTRODUCTION TO PUBLIC ECONOMICS 10

Meaning, Nature, Scope and Importance - Need for Public Secot - Provisions of Public Goods, Private Goods, Social Goods, Merit Goods and Mixed Goods- Principles of Maximum social Advantage - Musgrave's views- Hicks Optima of Public Finance.

MODULE II PUBLIC REVENUE 10

Classification of Public Revenue - Tax- Non-Tax - Comparison of Direct and Indirect Tax- Problems of Double Taxation - Principles of Fiscal Neutrality- Boven and Lindhal Models - Incidents and Impacts of Taxes - Shifting of Incidents- GST as a source of Public Revenue- its importance- Advantages.

MODULE III PUBLIC EXPENDITURE AND PUBLIC DEBT 10

Meaning- Classification- Canon of Public Expenditure- Causes and Effects of Public Expenditure on Economics Growth- Wagners Law- Public Debt- Classification- Effects- Burden of Public Debt- Public Debt Management- Redemption - Method of Repayment.

MODULE IV CENTER STATE FINANCIAL RELATIONS 10

Principles of Federal Finance- Constitutional Provisions-Distribution of Resources - Finance Commission - 80th Amendment of the Constitutional Act, 2000 - Taxes under Article 268 and 269- Centre and State- Conflict of Interest on Finance- Planning Commission - role of Nithi Ayog. Taxes of Centre and State Governments.

MODULE V UNION BUDGET AND FISCAL POLICY 10

Meaning, Component, Techniques of Budgeting - Zero Based Budgeting - BUdget Deficit - Deficit Financing - Effects- Budget Maintenance Act - fiscal Policy - Meaning Objectives - Instruments - Resource Mobilisation- Saving

Instrument - Effects.

TOTAL HOURS : 50

REFERENCES:

1. B.P. Tyagi - Public Finance
2. Richard A. Musgrave, Peggy B. Musgrave- Public Finance in Theory and Practice.
3. Harvey S. Rosen - Public Finance
4. John Cullis and Philip Jones- Public Finance and Public Choice
5. Singh S. K. - Public Finance in Thory and Practice
6. Sunderam K.P.M> and K.K.Andly- Public finance in Thory and Practice
7. Mithani D.M. - Principles of Public Finance and Fiscal Policy

OUTCOMES:

Role of Finance has become significant in the post LPG era. By going through this course, the student can 'uncover' the issues behind public finance- budgeting- fiscal policies- public debts- management- role of 'Niti Ayog'. Policy of the Governments in succession can be well analyzed with the 'inputs' in this course.

SEMESTER VII

		L	T	P	C
BLC 4201	**TRANSFER OF PROPERTY LAW**	**4**	**1**	**0**	**5**

OBJECTIVES:

This course will explain about transfer of immovable properties between living persons. It covers various principles of transfer of property and doctrines for specific transfer. The Easement Act explains various modes of acquisition of easementary rights and its end.

MODULE I GENERAL PRINCIPLES OF TRANSFER 10

Concept of Property- Definition of Transfer of Property - Kinds of Interest - Conditional Transfer - Doctrine of Election - Ostensible Owner- Bonafide purchase- Lis Pendens- fraudulent Transfer - Doctrine of Part Performance and other General Principles of Transfer.

MODULE II SPECIFIC TRANSFERS - TRANSFER OF ABSOLUTE INTEREST 10

Sale: Definition of Sale- rights Liabilities of Seller and Buyer

Gift: Definition of Gift: Definition - Onerous Gift - Universal Donee- Death Bed Gift- Suspension and Revocation of Gift-Exchange:

MODULE III TRANSFER OF LIMITED INTEREST - SPECIFIC TRANSFER 10

Mortgage: Different kinds of Mortgages - Redemption - Clog on Redemption- Partial Redemption- Rights and Liabilities of Mortgagor and Mortgagee including Doctrine of Consolidation - Marshalling - Contribution- Subrogation: Charge: Lease: Different Rights and Liabilities of Lessor and Leasee- Determination of Lease- Doctrine of Holding Over; Actionable Claim

MODULE IV INDIAN EASEMENT ACT 10

Definition - Acquisition of Easement- Easement of Necessity and Quasi Easements - Easement by Prescription - Exinction - suspension and Revival of Easements and License

MODULE V INDIAN REGISTRATION ACT AND STAMP ACT 10

Registration its validity- Consequences of Non- Registration- Procedure to Registration of Transfer of Property- Valuation - Stamp-

TOTAL HOURS : 50

REFERENCES:

1. Vepa P. Saradhi: Law of Transfer of Property Act
2. Shah: Principles of Transfer
3. G.C.V.Subba Rao - Law of Property
4. Mitra B.B. Transfer of Property
5. Goyle - Transfer of Property
6. C.L. Gupta - Law of Transfer of Property
7. Khatiar - Law of Easements

OUTCOMES:

Transfer of immovable property between living persons is often tend to lead to litigation. This student will know the basic law that governs transfer of property between living persons and registration process.

BLC 4102 INTELLECTUAL PROPERTY LAW

L	T	P	C
4	1	0	5

OBJECTIVES:

The Course intends to introduce different categories of Intellectual Property, the minimum standard to identify the 'issues' of protection. It exposes the student on the procedural requirements for the acquisition of rights under IPR. It may a copy right, patent, Trade Mark or Industrial Design. In case of any violation or infringement of the 'Rights Conferred' under I.P.R, the remedies available to the 'Claimant' will also be studies.

MODULE I INTELLECTUAL PROPERTY 15

Meaning and Concept of Intellectual Property - Need for Protection - The World Intellectual Property Organization (WIPO) Convention - Origin and Functions of World Trade Organization (WTO) -Trade Related Intellectual Property Rights (TRIPS) Agreement of WTO and its effects on Intellectual Property Law in India, Dispute Settlement Mechanism.

MODULE II PATENTS 15

The Patents Act 1970 - Object - Definitions - Salient Features - Patentable and Non-Patentable Inventions. Product Patent, Process Patent-Persons entitled to apply for Patents, Provisional and Complete Specifications, Opposing grant of Patent, Secrecy in certain inventions - Patent Office- Powers of Controller - Grant and Sealing of Patents- Rights of Patentees- Rights of Co-Owners of Patents- Term of Patent- Patents of Addition, Assignment and Transmission- Registrar of Patents- Amendment of Applications and Specificants, Restoration of Lapsed Patents- Rights of Patentees of Lapsed Patents which have been Restored, Surrender and Revocation of Patents- Compulsory Licenses, Exclusive Marketing Rights, Licenses of Right, Acquisition of Inventions by Central Government - Remedies for Infringement of Patents - Patent Agents, Scientific Advisers, International Arrangements - International Law - Rights of Plant Breeders and Farmers- National Law on Biological Diversity.

MODULE III TRADE MARKS 15

The Trade Mark Act (1999), Object, Definition, Salient Features, Marks Registrable and Non- Registrable, Conditions for Registration, Absolute and Relative Grounds for Refusal of Registration, Procedure for, and Duration of Registration. Effects of Registration - Powers and Functions of Registrar -

Distinctiveness, Deceptive Similarity, Concurrent Registration, Rectification and Correction of Registrar, Assignment and Transmission - Use of Trademarks and Registered Users, Collective Marks, Registration of Certification of Marks, Trade Mark Agents- Appellate Board - Infringement Action, Passing Off, - International Treaties - Geographical Indication of Goods(Registration and Protection) Act (1999) Objects, Definitions, Conditions for Registration, Prohibition of Registration of Certain Geographical Indications Procedure for and Duration of Registration - Effects of Registration - Special Provisional Relating to Trademark and Prior Users, Remedies for Infringement, International Law.

MODULE IV COPYRIGHT 10

The Copyright Act, (1957) and Recent Amendments: Works in which Copyright Subsists; Meaning of Copyright; Ownership and Rights of the Owner; assignment; Term of Copyright, Powers and Functions of Copy Right Board- Registration of Copyright; Compulsory Licenses; License to Produce and Publish Translations, Copyright Societies- Rights of Broadcasting Organisations and of Performers - International Copyright - Acts Constituting and not Constituting Infringement; Remedies for Infringement.

MODULE V INDUSTRIAL DESIGNS 05

The Designs Act 2000- Definitions - Registration of Designs - Copyright in Registered Designs - Piracy of Registered Designs - Remedies - Powers and Duties of Controller- International Law - Semi Conductor Integrated Circuit Layout.

TOTAL HOURS : 60

REFERENCES:

Acts:

1. The Patent Act, 1970, The Trade Marks Act, 1999, The Copyright Act,1957, The Designs Act, 2000
2. Dr. S.R. Myneni - Law of Intellectual Property
3. P.Narayana - Intellectual Property Law in India
4. Dr.B.L. Wadehra - Law relating to Patents, Trademarks, Copyright, Design and Geographical Indications.
5. Vikas Vashisht - Law and practice of Intellectual Property in India
6. W.R. Cornish - Cases and Materials on Intellectual Property

7. Allison Comkeman- The Legal Proction of Trade Secrets
8. David I. Bainbridge - Intellectual Property
9. Arad Sherman and Lionel Bently - the Making of Modern Intellectual Property Law

OUTCOMES:

Student will get an idea of IPR legal frame-work in respect of Patents, Trademarks, Copyright and Industrial Designs- Practices and Procedures in filling. Remedies available in case of any violation/ infringement

BLC 4103 LABOUR LAW II

L	T	P	C
4	1	0	5

OBJECTIVES:

Concept of Social Security is based on ideals of human dignity and social justice. The quest for Social security and freedom from want and distress has been the consistent urge of man through ages. Social Security is part of social justice. The core objective of this course is to explain various Social Security and Welfare Legislations in India.

MODULE I SOCIAL SECURITY AND LABOUR WELFARE 10

Concept- Evolution and Constituents of Social Security - Object of social Security Laws - Social security and Constitution of India- ILO on Social security

MODULE II SOCIAL SECURITY : INDUSTRIAL INJURIES 10

The Employees' Compensation Act, 1923 - Scope and Objects- coverage and Definitions - Liability of the Employer to Pay compensation - Personal Injurty, Accident arising out of and in the course of employment, Doctrine of Notional Extension and Occupational Diseases - Determination and Distribution of Compensation - Principle employer's Right of Indemnity- commissioner's Powers and Functions.

MODULE III SOCIAL SECURITY 10

The Employee's state Insurance Act, 1948: Objects, application and 'seasonal Facgtory' Definition - E.S.I. Corporation - E.S.I. Funds - Payment of Contributions - ESI Benefits - Adjudication of Disputes - ESI Court - Penalties.

MODULE IV OTHER SOCIAL SECURITY LEGISLATIONS 10

The Maternity Benefits Act, 1961; Object and Application - Eligibility and Maternity Benefits - Notice of Claim Prohibition against Dismissal, wage Deduction - Powers and Duties of Inspectors

Employees Provident Funds and Miscellaneous Provisions Act, 1952; Scope, Coverage, Application and Definitions - Authorities, their Powers and Functions Contributions - employees Provident Fund Scheme. Employees' Pension Scheme and Deposit Linked Insurance Scheme - Penalties.

Payment of Bonus Act 1965:

Bonus Commission - Definitions and Coverage - Kinds of Bonus- Calculation of Bonus- Available Surplus, allocable Surplus, Set on and set Off- Forfeiture of

Bonus- Prior Charges- Machinery

Payment of Gratuity Act, 1972: background, Object and definitons - Eligibility for Payment of gratuity- Forfeiture, Exemption, Determination- Controlling Authority- Penalties.

MODULE V LABOUR WELFARE LEGISLATIONS 50

Factories Act, 1948: Background and Definitions - Formalities to start a Factory - Health, Safety and Welfare Measures- Working Hours - Employment of Young Persons - Annual Leave with Wages - Special Provisions.

The Tamilnadu Shops and Establishment Act, 1947: Applicability and Persons covered by this Act- Opening and Closing Hours, Employment of Young Persons- working Hours- Public Holidays- Safety- and Cleanliness - Leave and Annual Leave with Wages.

TOTAL HOURS : 50

REFERENCES:

1. S.N. Mishra - Labour and Industrial Laws
2. V.G. Goswami - Labour Law
3. Madhavan Pillai - Labour and Industrial Law
4. S.C. Srivastava - Social Security and Labour Laws
5. K.D. Srivastava - The Employees' Compensation Act,1923 and The Employees' Provident Funds and Miscellaneous Provision Act,1961, The Payment of Bonus Act,1965, Payment of Gratuity, 1972, Factories Act,1948.

OUTCOMES:

The student will learn about various legislations that govern Social Security aspects of Industrial workers.

BLC 4104 LAW OF BANKING L T P C
4 1 0 5

OBJECTIVES:

Focus of this course will be on 'Banking' its regulation through legislations. In the era of Globalisation the Banking Sector registered a tremendous growth along with a host of problems. Student will learn about RBI regulations. Recent changes in NI Act etc.

MODULE I INTRODUCTION 10

History of Banking – Different types of Banks including foreign companies – Nationalisation of major banks.

RBI's control over commercial banks – Special status of RBI and State Bank of India – Subsidiary Banks.

MODULE II LEGAL CONCEPTS OF BANKER VS CUSTOMER 10

Definition of Banker & Customer and relationship between them – Special types of customer – Banker as Borrower – Different types of accounts – Duties and rights of the Bankerand different types of instruments – Banker – Paying Banker and Collecting Banker.

MODULE III BANKING AND RELATED ACTIVITIES 10

Subsidiary business operations of bankers with special reference to Safety Deposit Lockers – Liability of Banker in case of bank robberies and fraud by bank employees – Vicarious liability of the bank employees – Vicarious liability of the bank – Recovery of loans and advances – Recovery of debts due to banks, Financial Institutions Act, 1993.

MODULE IV BANKERS OMBUDSMAN AND DRT 10

Effect of winding up of Banking Companies – Rights of customers on winding up of companies – Necessity for reforms in Indian Banking Law to meet global challenges – Banking ombudsman – Debt Recovery Tribunal – SARFAI Act.

MODULE V NI ACT AND ITS RECENT AMENDMENTS 10

Definition and characteristics – Parties to negotiable instruments – Presentation – Negotiation

discharge and dishonour – Liability – Various kinds of crossing – effect of crossing of cheque –Rights of holder and holder in due course against Banker – Civil and

criminal liability for dishonour of cheques under Section 138 to Section 142 of the Amended Negotiable Instruments
Act.

TOTAL HOURS : 50

REFERENCE:

1. Tannan's – Banking law and Practice in India (India Law House, New Delhi)
2. Bhashyan & Adiga – Negotiable Instruments (Bharat Law House Pvt. Ltd., New Delhi.)
3. Sir John Paget - Law of Banking
4. H.P. Sheldon - The Practice and Law of Banking

OUTCOMES:

Through this course, the student will learn about the law that governs banking activities.

BLC 4105 ALATERNATIVE DISPUTE RESOLUTION MECHANISM (Clinical Course II)

L	T	P	C
2	1	2	5

OBJECTIVES:

This course offers an opportunity to know the mechanism to settle the legal issues through alternative methods like Arbitration, Negotiation and Conciliation. Students is expected to acquire certain skills in this regard. Course is designed to simulate the student mind.

MODULE I ARBITRATION 15

Case Study in Arbitration Center (Practical/Simulation Exercise)
(Three exercises 10 marks each; 30 marks

MODULE II VIVA VOCE/ PRESENTATION OF CASES OBSERVED 10

The student has to present the cases he observed- and he has to face viva-voce on case studies (10 marks)

MODULE III INTERNAL EXAMINATION ON THE SUBJECT 10

Internal Examination will be held on ADR. (it is for 10 marks)

SUBMISSION OF RECORD ON ADR- ON INTERNATIONAL ARBITRATION- ARBITRATION ACT- RULES ETC. (50 MARKS)

TOTAL HOURS : 50

REFERENCES:

1. O.P. Malhotra and Indu Malhotra - Arbitration to Conciliation
2. P.C.Markanda - Law Relating to Arbitration and Conciliation
3. Justice Dr. B.P. Saraf and Justice S.M. Jhunjhunwala - Law of Arbitration and Conciliation.
4. S.K. Chawla - Law of Arbitration and Conciliation

SEMESTER VIII

		L	T	P	C
BLC 4201	**COMPETITION LAW**	**4**	**1**	**0**	**5**

OBJECTIVES:

Competition Commission of India came into existence replacing Monopolies Restrictive Trade Practices Commission. The objective of the course is to ensure the student should know the legal dimensions of Competition Law and functions of Competitive Commission of India that ensures fair trade practices and facilitates healthy competition in the business arena. Student will know about Anti-Competition Policies.

MODULE I INTRODUCTION 15

Objective and Nature of Competition Laws- Origin of Competition Laws- Anti Trust Legislation in USA. UK Competition Act, 1998- MRPTAct,1969- Raghavan Committee Report 2000,Competation Act-2002, Distinction between Competition Act Vs MRTP Act, Object and Scope of Competition Act,2002.

MODULE II ANTI COMPETITIVE AGREEMENTS 10

Definition - Tie in Arrangement - Exclusive Supply Agreement - Exclusive Distribution Agreement - Refusal to Deal - Resale Price Maintenance - Cartel - Bid rigging Exceptions - Protection of IPR.

MODULE III ABUSE OF DOMINANT POSITION 10

Meaning of Dominant position - Unfair or Discriminatory trade Practices - Provisions under MRTP and Consumer Protection Act - Limiting Protection or Technical or Scientific Supplementary Obligations- Protection of other Markets - Predatory Price - Unfair Prices.

MODULE IV REGULATION OF COMBINATIONS 10

Acquisition - Merger - Amalgamations - Ban on Combinations - Non Competition Clauses in Merger and Acquisition - Restrictive Trade Practices - Unfair Trade Practices.

MODULE V COMPETITION COMMISSION OF INDIA 10

Composition - Duties, Power and Functions of the Commission - Contraventions of the Orders of the Commission - Penalties- Competition Appellate Tribunal- Competition Advocacy - Miscellaneous. Important guidelines and cases decided

by Competition Commission of India.

TOTAL HOURS : 55

REFERENCES:

Acts:

1. MRTP Act, 1969
2. Competition Act, 2002
3. Ramappa- Competition Law of India
4. S.M. Durgar: Commentaries on MRTP Law, Competition Law and Consumer Protection
5. Avatar Sing: Competition Law
6. Tripathi - Competition Law
7. Universal's Guide- Competition Law in Law
8. P.K. Mujumdar: Law of Consumer Protection in India.

OUTCOMES:

Student will learn about Competition Commission in India and its emergence, its role, functions.

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BLC 4202 ENVIRONMENTAL LAW L T P C
4 1 0 5

OBJECTIVES:

The course will help the student to know about legal and regulatory mechanism that intends to protect environment. Course can be divided into International Environmental Law and Indian Environmental Law. Legal mechanism to strengthen the ongoing 'Green' efforts at local, national and global levels.

MODULE I INTRODUCTION 10

Environment- Environmental Law- Factors responsible for degradation of Environment - Need to protect, preserve and conserve Environment. International Environmental Law: Stockholm Declaration on Human Environment-1972- Rio Declaration on Environment and Development - 1992, Johannesburg Summit on Sustainable Development - 2002, Agenda-21- Rio Plus 20 - Our Common Future-1987. UNDP- GEF

MODULE II INDIAN ENVIRONMENTAL LAW 10

Constitutional Provisions- 42 Amendment- 48A-51A (g), Extensive Interpretation of Article 21. Judicial Activism- Public Interest Litigation. Doctrines pronounced by the Supreme Court- 'Absolute Liability'- 'Sustainable Development' - 'Public Trust Doctrine'

MODULE III LEGISLATIVE FRAME-WORK 10

Anti Polllution Laws: Air and Water (Prevention and Controll of Pollution) Acts- Pollution Control Boards- their structure and functions

Environmental Protection Act- 1986- its high lights- Powers and Functions of Central Government- Merits and Demerits... various Authorities under this Act, rules notified under this Act. Coastal Regulatory Zone Notification, Noise Pollution Rules, Municipal Solid Water Management Rules, Bio-Medical Waste Rules- E- Waste- Environmental Impact Assessment- Environmental Clearance- National Green Tribunals.

MODULE IV CONSERVATION AND PROTECTION 10

Forest Act-1927 and Amendments- Wild Life Protection Act-1972 - Forest Conservation Act-1980- Biological Diversity Act-2002 - Prevention of Cruelty to Animals act-1960- Leading cases on Forest, Wild Life and Cruelty against

Animals.

MODULE V REMEDIES FOR ENVIRONMENTAL POLLUTION 10

Common Law Remedies- under Law of Tort- Penal Remedies under IPC and Cr.P.C.- Remedies under Constitutional Law- Article 32- Article 226- Public Interest Litigation - Judicial Activism- Leading Environmental Cases.

TOTAL HOURS : 50

REFERENCE:

1. P. Leelakrishnan- Environmental Law in India
2. P. Leela Krishnan - Environmental Case-Book
3. S. Shantakumar - Environmental Law - An Introduction
4. Jaiswal - Environmental Law
5. Sashtry- Environmental Law in India
6. N. Maheswara Swami- Law Relating to Environmental Pollution and Protection.
7. Alan Bopyle and Patricia Bernie - International Law and Environment
8. Philippe Sands - Principles of International Environmental Law
9. Elli Louka - International Environmental Law
10. R.N. Choudhry - Law of Forests in India

OUTCOMES:

This course will help the student to understand legal and regulatory mechanism in place. With all clarity on concepts of pollution, protection, conservation and the Doctrines enshrined by the Supreme Court of India-it enrich the students knowledge base.

BLC 4203 MARITIME LAW

L	T	P	C
4	1	0	5

Objectives

The object of this course is to introduce the basics of Indian Maritime Law to the students. Maritime Law gaining significance as a separate branch of law. Student will know about Admiralty Law, The Merchant Shipping Act, 1958- International treaties, Conventions and Protocols relevant to Indian Maritime Law and their applicability. Law governing Marine Pollution, Marine fishing etc

.

MODULE I INTRODUCTION TO ADMIRALTY 10

Admiralty Act- Admiralty Jurisdiction of High Courts- International Convention for Arrest of Ships, Wrongful arrest - release from Arrest- Security for Release from Arrerst - Action in Rem; Action in Personam in Maritime Context- Maritime Claims, Limkitation of Liability, Damage done by or to a ship, Salvage, Loss of Life or Personal Injury- recent Admiralty Act- its salient features.

MODULE II THE MERCHANT SHIPPING ACT-1958 10

The Merchant Shipping Act-1958 - Structure of Shipping Administration in India- DG of Shipping- Mercantile Marine Department, Surveyors, Seamen's Welfare Officers - Major and Minor Ports, Application of National and State Laws at Ports- Registration of Indian Ships- Transfer of Ownership - National Character and Flag.

MODULE III INTERNATIONAL LAW AND CONVENTIONS 10

International Treaties, Conventions and Protocols relevant to Indian Maritime Law, their objectives applicability and legal status. Maritime Legislation based on these treaties, Conventions and Protocols-

MODULE IV MARINE POLLUTION 10

International Convention on the Prevention of Marine Pollution by Dumping of Waste Convention-1972- Maritime Lien

MODULE V MARINE FISHING 10

Jurisdictional issues and relevant provisions under Indian Laws- The Territorial Waters, Continental Shelf, Exclusive Economic Zone and Maritime Zones Act-1976 - The Maritime Zones of India (Regulation of Fishing by Foreign Vessals) Act,1981- Suppression of Unlawful Acts Against Safety of Maritime Navigation

and Fixed Platforms on Continental Shelf Act,2002

TOTAL HOURS : 50

REFERENCES:

Acts:

1. The Merchant Shipping Act, 1958
2. The Territorial waters, Continental Shelf, Exclusive Economic Zone and other Maritime Zones Act, 1976
3. the Maritime Zones of India (Regulation of Fishing by Foreign Vessels) Act,1981
4. Suppression of Unlawful Acts Against Safety of Maritime Navigation and Fixed Platforms on Continental Shelf Act,2002
5. Fisheries Act
6. International Convention on the Prevention of Marine Pollution by Dumping of Waste Convention,1972
7. United Nations Convention on the Law of the Sea (UNCLOS)

OUTCOMES:

Basics of Maritime Laws will be known to the student in respect of marine fishing, marine pollution, International obligations, merchant shipping etc. He will be familiar with jurisdictional issues relating to the Sea.

BLC 4205 INTERNATIONAL TRADE LAW

L	T	P	C
4	1	0	5

OBJECTIVES:

In the Era of LPG, Trade is global. In the context of world economic integration and the new order it is essential to know the International Trade Regime, International Trade Agreements - International Trade Practices and various bilateral and regional agreements in place. The student will learn- regulatory mechanism, dispute settlement bodies. This course offers basic inputs in the International Trade Law.

MODULE I GENESIS OF INTERNATIONAL TRADE LAW 10

Origin and Development - Theories - UN XConventions - Unification of International Trade Law- International Commercial Contracts- International sale of Goods - foreign Direct Investments(FDI) - Transnational Companies - Electronic Business Transactions - Elements of International Taxation - Risk Analysis of International Trade.

MODULE II INTERNATIONAL ECONOMIC INSTITUTIONS 10

Structure and Functions of International Economic Institutions - International Trade Organization(ITO)- WTO- GATT- New International Economic Order (NIEO)- International Monetary Fund (IMF)- International Bank for Reconstruction anhd Development (IBRD)- International Investments.

MODULE III WORLD TRADE ORGANISATION 10

Structure and Functions of WTO. Covered Agreements- Subsidies- Dumping and Anti-Dumping- General Agreement of Trade and Services (GATS)- Trade Related Intellectual Property Rights (TRIPS), Trade Related Investiment Measures (TRIMs), Trade in Agriculture- Technical Barriers of Trade (TBT)- UN Committee on Trade and Environment (UNCTE)- UN Committee on Trade and Development (UNCTAD)- Summits of the WTO.

MODULE IV BILATERAL AND REGIONAL TRADE 10

Regional Arrangements under the UN - Most Favoured Nation (MFN) Clause- South Asian Association for Regional Cooperation (SAARC)- Association for South Eastern Asian Nations (ASEAN)- European Union (EU)- Organisation for Petroleum Exporting Countries (OPEC)- North American Free Trade Agreement (NAFTA)- South Asian Free Trade Agreement (SAFTA)

MODULE V SETTLEMENT OF DISPUTES IN INTERNATIONAL TRADE **10**

Methods of Dispute Settlement - Alternative Dispute Resolution (ADR) and International

Trade- UNCTRAL-International Arbitration, Conciliation, Mediation and Litigation - Online Dispute Resolution- Dispute Settlement Body in WTO - Appellate Body (AB)- Consultation - Trade and Environment Controversies- Enforcement and Compliance

TOTAL HOURS : 50

REFERENCES:

1. Dr.Myneni SR - International Trade Law
2. Indira Carr, Peter Stone - International Trade Law
3. Gupta. R.K.- World Trade Organisation.
4. Autar Krishen Koul - Guide to WTO and GATT
5. Jayanth Bagachi- World Trade Organisation : An Indian Perspective
6. C. Singhania- foreign Collaborations and Investments in India Law and Procedure
7. Correa, Carlos. M. - IPRs the WTO and Developing Countries
8. Day, D.M. and Griffin, Bernardettee- The Law of International Trade
9. Anupam Goyal- The WTO and International Environmental Law: Towards Conciliation.
10. Petersmann, Ernst Ulrich - The GATT/WTO Dispute Settlement Systems: International Law, International Organisations and Dispute Settlement

OUTCOMES:

Student will learn the basic frame-work of International Trade Regulation-varies Agencies- their role and functions. Student will learn about 'Dispute Settlement Mechanism'. It provides basic understanding on issues relating to International Trade Law.

BLC 4205 CYBER LAWS AND FORENSIC

L	T	P	C
4	1	0	5

OBJECTIVES:

In this digital era, the regulatory framework analysis has become vital. This course helps in understanding the regulations relating to E-Contracts, E-Banking, Intellectual Property Issues, Cyber Crimes and E-Taxation. The course intends to analyze the need of cyberspace regulation both Jurisdictional and Jurisprudential aspects of Cyberspace.

MODULE I INTRODUCTION **10**

Cyber Space Introduction and UNCITRAL Model Law- Information Technology Act, 2013 with recent Amendments- Jurisdictional Issues- Digital Signatures- Regulation of Certifying Authorities- Cyber Regulation Appellate Tribunal.

MODULE II ON LINE CONTRACTS **10**

Formation of Online Contracts- E-Banking transactions-Online Payment Options- Online Advertising- Electronic and Digital Signature- Taxation Issues in "Cyber Space- Indirect Tax- tax Evasion- Double Tax- International Tax- Permanent Establishment- Protection of Trade secrets and Deceptive Trade Practices.

MODULE III CYBER CRIMES **10**

Understanding Cyber Crimes- Actus Reus and MensRea- Types of Crimes in the Internet- Against Person, Against Property, Against Government- Digital Evidence- Investigation and Adjudication of Cyber Crimes in India- Cyber Arbitration - Cyber Conflict Investigation.

MODULE IV INTELLECTUAL PROPERTY RIGHTS AND CYBER SPACE **10**

Copy Right issues in the Internet - Protection of Computer Software- Caching- International Regime - OSS- DMCA- DATA PROTECTION DIRECTIVES- Trademark Issus in the Internet - Domain Name; Registration- Domain Name- Registration- Domain Name Dispute- ICANN -UDRP Policy- Linking - Framing - Met tagging - Database issues in the internet.

MODULE V CONTEMPORARY ISSUES **10**

Convergence Technologies- Cloud Computing - Online Digital Libraries - Access to Internet - A Human Right Issue - Issue of Censorship - Privacy issues

- National Security and Social Security.

TOTAL HOURS : 50

REFERENCES:

1. Nandan Kamath **-** Law relating to Computer- Internet and E-Commerce.
2. S.K. Verma & Raman Mital - Legal Dimensions of Cyber space
3. Rahul Mahathan - The Law relating to Computer and Internet.
4. Justice Yatindra singh - Cyber Laws
5. Edtu Chris reed and Joh Angel - Computer Law
6. Roger Leroy Miller & Gaylord A. Jentz - Law for E-Commerce

OUTCOMES:

The Student will know and understand the Cyber related Law, regulatory mechanism and cyber crimes. He can follow the ongoing developments and cyber related issues.

SEMESTER IX

BLC 5101	**LAW OF INSURANCE**	**L**	**T**	**P**	**C**
		4	**1**	**0**	**5**

OBJECTIVES:

The focus of this course is to explain legal dimensions of Insurance Contract in respect of its formation, performance and discharge. As the Insurance sector is opened for private players as part of reforms significant changes have taken place. The IRDA apex regulatory body is striving to balance the interests of the general public and the insurance companies.

MODULE I INTRODUCTION 10

.Insurance Meaning -Risk Management _ Kinds of Risks- Insurable Interest- Insurance and Assurance- Parties of Insurance- Insurance and Contract Law- Principles of 1. Uberrimae fidae, 2. Indemnity, 3. Subrogation, 4. Contribution, 5. Proximate Cause - Cover Note and Slip.

MODULE II FIRE INSURANCE CONTRACT 10

Meaning of the term "Fire" - Fire Policies- Perils Insured- Fire Claims- Scope of Applicability of Special Principles to Contract of Fire Insurance. Standard Fire Policy ' Average' in Fire Insurance Contract.

MODULE III MARINE INSURANCE CONTRACT 10

Significance of Marine Insurance- Maritime Peerils- Subject matter covered by Marine Policy- KInds of Marine POlicies - Scope and Applicability of Special Principles to Contract of Marine Insurance - Principles of 'Change of Voyage' and 'Deviation' - Total Loss - Partial Loss- Marine Insurance Act 1963 with special reference to Bill of Lading and Counter Part.

MODULE IV LIFE INSURANCE CONTRACT 10

Introduction- Concept- Life Insurance-Significance-Kinds-Extent of apaplicability of Special Principles to Life Insurance. 'Suicide" clause. 'Medical insurance' policies. Assignment and Nomination- Constitution. IRDA- Role and Functions

.

MODULE V MOTOR VEHICLE INSURANCE 10

Introduction- The MV Act-1988. Compulsory III Party Insurance of Motor Vehicles- No Fault Liability- Motor Accident Claims Tribunals.

TOTAL HOURS : 50

REFERENCES:

1. KVS Sarma: Modern Law of Insurance
2. M.N.Srinivasan- Law of Insurance
3. Srinivasan and Murty: Law of Insurance
4. Haardy Ivany- Law of Insurance

OUTCOMES:

Student will learn the concept of Insurance and how it penetrated into various facets. They will learn about Life Insurance, Marine Insurance and Fire Insurance. Student will understand the role and functions of IRDA that regulates Insurance sector in India.

BLC 5102	LAW OF CRIMES II CRIMINAL PROCEDURE CODE & JUVENILE JUSTICE	L	T	P	C
		4	1	0	5

OBJECTIVES:

The law of Criminal Law is indented to provide a mechanism for the enforcement of criminal law. Without proper procedural law, the Substantial Criminal law which defines offences and provides punishments for them would be almost worthless. Every threat does not deter. Without deterrent effect, the Criminal law will have hardly any meaning or justification. Thus the law of Criminal Procedure is meant to be complementary to Criminal Law and has been designated to ensure the process of its administration.

MODULE I CRIMINAL PROCEDURE CODE-TYPES AND FUNCTIONARIES **10**

. Aquisitorial, inquisitorial – brief history about the code-definition-main functionaries of the code- powers of superior police officers and aid to the magistrates and police.

MODULE II PRE-TRIAL PROCEEDINGS **10**

Stages of Investigation - process compelling for the presence of the presence of accused for investigation and trial - arrest-procedure for arrest - rights of arrested persons consequences of non - compliance of arrest procedures – search and seizure – process of investigation by police – investigation of unnatural and suspicious death – Local jurisdiction of the Courts in Inquires and Trials **–** cognizance of offence and commencement of proceedings – bail procedures – types of bail - General Provision regarding bond of accused and sureties.

MODULE III TRAIL PROCEDURE **10**

Stages of Investigation - process compelling for the presence of the presence of accused for investigation and trial - arrest-procedure for arrest - rights of arrested persons consequences of non - compliance of arrest procedures – search and seizure – process of investigation by police – investigation of unnatural and suspicious death – Local
jurisdiction of the Courts in Inquires and Trials **–** cognizance of offence and commencement of proceedings – bail procedures – types of bail - General

Provision
regarding bond of accused and sureties.

MODULE IV APPEAL PROCEDURES 10

Types of Appeals - Reference and Transfer of Criminal Cases - Execution, Suspension, Remission and Commutation of Sentences – Execution of Sentence death penalty and Imprisonment – Execution of Sentence of fine - Preventive and Precautionary Measures for keeping peace and good behavior – Maintenance procedures – conditions for claiming maintenance – cancellation of maintenance – Muslim Women Protection of Rights on Divorce Act.

MODULE V JUVENILE JUSTICE (CARE AND PROTECTION) ACT, 2001 & PROBATION OF OFFENDERS ACT,1958 10

Juvenile Justice (Care and Protection) Act, 2001 and Probation of Offenders Act, 1958

Introduction – Object – definitions – Statutory bodies for juveniles under the Act Reformative institutions for juveniles – Special offences – Probation –Object and meaning – Criminal court and probation – Duties of Probation officers - Report of the probation officers - conditions and cancellation of probation.

TOTAL HOURS : 50

REFERENCES:

Books:

1. Ratanlal : Code of Criminal Procedure
2. Sarkar : Code of Criminal Procedure
3. Kelkar R.V. : Outlines of Criminal Procedure
4. Basu : Code of Criminal Procedure
5. Dr.Nandhal's : Code of Criminal Procedure (3 Volumes)
6. P. Ramanatha Iyer : Code of Criminal Procedure (3 Volumes)
7. Sohonis : Code of Criminal Procedure (4 Volums)
8. R.B. Sethi : Probation of Offenders Act
9. Consuls : Probation of Offenders Act and Rules.
10. M.K.Chakrabarathi : Probation System in the Administration of CriminalJustice
11. Vedkumari (IT) : Treaties on the Juvenile Justice Act.
12. S.K. Swasthi : Judgements of Juvenile Justice Act 1986.

OUTCOMES:

Students will learn the procedure that is followed in Criminal Justice Administration in the Country. They will also learn special procedure that is followed in Juveniles justice system that is in place.

BLC 5103	CIVIL PROCEDURE CODE AND LIMITATION ACT	L	T	P	C
		4	1	0	5

OBJECTIVES:

The course intends to understand the legislative measures in procedure. The course also helps in understanding the procedures to be followed by the civil courts from the institution of suits till the final disposal. The course tries to understand the computation of limitation period for the institution of suit, appeal and applications along with exclusion

MODULE I INTRODUC TION 10

Definitions – Civil Nature - Jurisdiction of Civil Court – Place of Suing – Institution of Suits – Presentation of Plaint – Parties to the suit-principles of res subjudice and res judicata.

MODULE II PLEADINGS AND PROCEEDINGS 10

Plaint – Written Statement – Service of Summons – Appearance and Non-Appearance of Parties - – Discovery, Inspection and Production of Documents – Admission – Production, Impounding - and Returning of Documents- transfer of suits-decree and judgment -Remand – Restitution – -Appeals: first appeal, second appeal, appeals from orders and appeals to Supreme Court – Reference – Review – Revision

MODULE III SUITS IN PARTICULAR CASES 10

Suits by and against government and public officer – Suits by indigent person – suits by or against minors and lunatics, aliens and foreign rulers, soldiers, corporation, Firms, trustees, executors and administrators-suits relating to family matters, mortgages, public nuisance and public charities- interpleader suits-summary procedure.

MODULE IV EXECUTION 10

General principles, courts by which decree may be executed, payment under decree, application for execution, mode of execution, stay of execution, questions to be determined by executing court, arrest and detention, attachment of property sale and delivery of property, distribution of assets.

MODULE V LIMITATION ACT 10

Definitions – Limitation of Suits – Appeals – Computation of Period of Limitation

– Acquisition of ownership by possession.

TOTAL HOURS : 50

. REFERENCES:

Acts:

1. Code of Civil Procedure, 1908
2. Limitation Act, 1963

Books

1. K. Takwani : Civil Procedure Code
2. Mulla : Code of Civil Procedure
3. M. P. Jain : Code of Civil Procedure
4. Pattabiraman : Code of Civil Procedure
5. Taxmann : Code of Civil Procedure
6. M. P. Tandon : Code of Civil Procedure
7. C. K. Takkar : Code of Civil Procedure
8. P. Basu : Law of Limitation

OUTCOMES:

Procedural Laws are essential to understand how the law will put into motion through courts. Student will get an idea about procedure followed by civil courts

BLC 5104 LAND LAWS L T P C
4 1 0 5

OBJECTIVES:

Land Laws of Tamilnadu along with Land Acquisition Act and Real Estate Regulation Act are significant laws. Students should know the laws relating to land acquisition, real estate, rent control, lease etc. Bone of contention is land in significant number of cases. Hence, the student is expected to know the law relating to land.

MODULE I BACKGROUND OF LAND ADMINISTRATION 10

Concept of Land-Kinds-Ownership and Possession of Land- Land Reforms and Constitutional History- Eminent Domain- Right to Property under Article 31 A-31 B- 31 C of the Constitution- Article 300 A; Ninth Schedule-Early Revenue Administration in Tamilnadu-Grants- Inams -Zamindari System- Permanent Settlement -Ryotwari-Rights and Liabilities of Ryotwari Pattadar- Tamilnadu Estates (Abolition and Conversion into Ryotwai) Act, 1948.

MODULE II LAND ACQUISITION 10

Land Acquisition, Rehabilitation and Resettlement Act-2013 (LARR Act,2013)- Compensation - payment-

MODULE III ENACTMENTS AND CULTIVATING TENANTS 10

The Tamilnadu Cultivating Tenants Protections Acts- 1989-1983-2010-
The Tamilnadu Cultivating Tenants (Payment of Fair Rent) Act, 1956- Rights and Liabilities of Cultivating Tenants and Land Owner- Fair Rent- Alteration or Revision of Fair Rent-Kaiaeruvamdar and Mattuvaramdar- Rent Court- Rent Tribunals- Exceptions - Powers of the High Court.

MODULE IV LAND AND LAND CEILING 10

Tamilnadu Land Reforms Fixation of Ceiling on Land Act-1961; Amended Act 1971- Definitions and Ceiling Area, Family, Stridhana Property, Standard Acre etc. Fixation of Ceiling on Land Holdings, Land Board, Industrail Undertakings- Publication of Settlement- Land Tribuinal - Authorised Officer - Determination of Compnesation - Exemptions- Special Appellate Tribunal- Courts - Penal Provisions.

MODULE V RENT CONTROL ACT AND RERA ACT 10

The TN Buildings (Lease and Rent Control) Act, Grounds for Eviction- Agreed

Rent- Jurisdiction of Rent Controller, Execution- Proceedings by Legal Representatives or Against Legal representatives.

Real-Estate Regulation Act- an Overview-

Societies or Association of Apartment Owners, its Bye-Laws and Functions.

TOTAL HOURS : 50

REFERENCES:

1. K.Venkata Rao - The Tamilnadu Land Reforms Act
2. V.N. Krishna Moorthy- The TN Buildings Lease and Rent Control Act, 1960
3. Prof. A. Chandrasekar - Land Laws of Tamilnadu.
4. Maheswara Swamy - 'Land Laws' & ' Land Acquisition under the Constitution of India.'

OUTCOMES:

The students will learn the law of the land in literal sense. It includes land acquisition, ceiling, tenancy- rent-control, real-estate etc. He will also know about the legal mechanism in place to resolve the issues relating to Land, Rent Control, Real Estate.

BLC 5105	MOOT COURTS (CLINICAL COURSE III)	L	T	P	C
		4	1	0	5

OBJECTIVES:

Very purpose of this paper is to equip the student to the real-time experience in the field of Law. Student has to argue three moot-problems in Moot Court and has to attend and observe two case trials in the court, ie. one civil and one criminal. He has to attend and observe Advocate Office/Law Firm for at least 15 days as an Intern. He has to record pre-trial preparations.

MODULE I MOOT COURT (30 MARKS) 15

Student need to required to do at least three Moot Courts in a year with 10 marks for each. Usually one in Civil, one in Criminal and one in Constitutional matters. the Moot Court work will be on assigned problem and it will be evaluated for 5 marks for written submissions and 5 marks for oral Advocacy.

MODULE II OBSERVANCE OF TRAIL IN TWO CASES (30 MARKS) 10

Students may be required to attend two trials in the court. They can do so in their IV year and V year of Course. They need to maintain a record and enter various steps observed during their observation on different dates. The Scheme will carry 30 marks. (one civil proceeding and one criminal trial) Each carries 15 marks that includes attendance, record, diary etc.

MODULE III INTERVIEWING TECHNIQUES AND PRE-TRIAL PREPARATIONS AND INTERNSHIP (30 MARKS) 10

Each student will observe two interviewing sessions of clients at the Lawyer's Office/ Legal Aid Office/ Law Firm and record the proceedings in a diary, which will carry 15 marks. Each student will further observe the preparation of documents and Court papers by the Advocate and the procedure for the filing of the Suit/Petition. This will be recorded in the diary, which will carry 15 marks.

MODULE IV VIVA-VOCE EXAMINATION (10 MARKS) 05

A Viva Voce Examination on all the above three components. Records and Diaries submitted by the student will be verified and the student has to answer and substantiate their work-done.

TOTAL HOURS : 40

OUTCOMES:

The student will have a firsthand account of court procedures, practices of office of the Advocate and the court-room etiquette.

SEMESTER X

BLC 5201 INTERPRETATION OF STATUTES L T P C

4 1 0 5

OBJECTIVES:

Interpretation of Statutes evolved into certain rules and principles to clarify ambiguities, inconsistencies, contradictions and lacunas. Legislative drafting often tend to give rise to all these 'doubts'. This core of this subject is to unlock the locks put by the Legislature through certain principles, rules etc. Legislative expression will reflect in the form of a Statute and it needs to be understood and given effect in the same tone. The guiding principles behind interpretation of Tax Laws, Penal Laws and Welfare Laws may differ in approach but the central idea of interpretation remains the same. This paper provides those inputs that are very much essential.

MODULE I LAW MAKING 10

Legislature, Executive and the Judiciary _ Principles of Utility- Law and Public Openion- Law and Social Control- Relevance of John Rawls and Robert Nozick- Individual interest to Community Interest- Law and Morals- Meaning, Objectives and Scope of 'Interpretation' 'construction' and 'Statute' - Public Opinion and Law Making.

MODULE II NATURE AND KINDS OF INDIAN LAWS 10

Statutory, Non Statutory, Codified, Un-codified, State made, State Recognized Laws- Parts of the Statute-Commencement- Extent-Operation and Repeal and Revival of Statutes- Purpose of Statutory Interpretation-Basic sources of Statutory Interpretation- The General Clauses Act, 1897; Nature, Scope and Relevance- Definition clauses in various Legislations; Nature and Imperative Rule.

MODULE III RULES OF STATUTORY INTERPRETATION 10

Literal Rule- Golden Rule - Mischief Rule and Strict Construction of Penal Laws and Taxation Laws - Internal Aids and External Aids of Interpretation.

MODULE IV INTERPRETATION OF CONSTITUTION AND INTERNATIONAL INSTRUMENTS 10

Principles and theories - Interpretation of Constitution- Reading DPSP and FR. Interpretation of International Instruments- Presumption in favour of

Constitutionality of a Statute- Presumption against violation of International Law- Presumption against retrospective operation of law- Presumption against Ouster of Jurisdiction of Courts.

MODULE V LEGISLATIVE DRAFTING 10

Principles and Process of Legislative Drafting - Simplicity, Preciseness, Consistency, Alignment with Existing Law- Brevity- Drafting General Laws and Special Laws-Rules and Orders.

TOTAL HOURS : 50

REFERENCES:

Acts:

1. General Clauses Act - 1897
2. Constitution of India, 1950

Books:

1. Maxwell - Interpretation of Statutes
2. G.P.Sing- Principles of Statutory Interpretation
3. P.M. Bakshi - Interpretation of Statutes
4. Jeremy Bentham - Theories of Legislation
5. Dicey - Law and Public Opinion
6. Indian Law Institute - The Drafting of Laws
7. P.K. Tripathi - Spotlights on Constitutional Interpretation
8. Thornton G.C. - Legislative Drafting

Outcomes:

The student will learn how to read, understand, interpret various Laws including Constitution of India and International Instruments as well. It is will enrich him with all skills that are required to unlock the legislative intent. He will learn the basics in legislative drafting too.

BLC 5202 RIGHT TO INFORMATION ACT L T P C
4 1 0 5

OBJECTIVES:

Right to Information Act is an Act that can be used as a weapon against mal-administration, abuse of power and corrupt practices. In real sense it empowers the people with a right to be informed. Object of this course is to familiarize the student about this Act to enable them to make use of its to empower the people.

MODULE I CONSTITUTIONAL PROVISIONS 10

Fundamental Rights - Article 19- Article 21 and its interpretation. Right to Know- Right to be Informed - Right to Information - Right to Information Vis-a-Vis Right to Life.

MODULE II LEGISLATIVE PROVISIONS 10

Right to information- in Consumer Laws; Right to Information; Environmental Laws; Right to Information Administrative Law. Right to information Criminal Law. Public Interest Vs. Private Interest, Law of Evidence- Section 123; 'Affairs of the State"

MODULE III HIGH LIGHTS OF RIGHT TO INFORMATION ACT 10

Procedure to file application- first appeal- second appeal- penal provisions-etc.

MODULE IV AUTHORITIES UNDER RTI 10

Central Information Commission; State Information Commissions, Powers and Functions.

MODULE V ANTI - CORRUPTION LAWS 10

Issues relating corruption in Administration, Various anti Corruption Laws, Whistleblowers Protection Act, Powers and Functions of CVC.

TOTAL HOURS : 50

REFERENCES

OUTCOMES:

The student will know how to 'move' the authorities to unearth the 'facts' and 'figures' laying in the bureaucracy so as to fight against mal-administration, abuse of power and corruption.

BLC 5203 LAW OF TAXATION

L	T	P	C
4	1	0	5

OBJECTIVES:

The course intends to understand the taxing system in India. Tax Laws helps to government to generate funds for the development of the country and at the same time they tax the people directly or indirectly. The student should know important Tax Laws. Student will learn basics relating to Income Tax Act and Goods and Services Tax etc.

MODULE I GENERAL INTRODUCTION 10

What is Tax and What is Fee. Income Tax Act and Finance Act- Canons of Taxation - Kinds of Taxes- Direct and Indirect Taxes- Applicability of Doctrines under the Constitution to Taxation Laws - Interpretation of Tax Laws

MODULE II THE INDIAN INCOME TAX ACT - 1961- I 10

Concepts under IT Act. Income-Agricultural Income- Casual Income- Assesse Person- Residential Status- Previous Year- Assessment Year- General Charging Section- Specific Charging Section- Exemptions- Income from ' House Property Income from Business or Profession, Income from 'Capital Gains'- Income from other sources-Procedure for Assessment- deduction allowed in certain cases-

MODULE III THE INDIAN INCOME TAX ACT - 1961- II 10

Filing Procedures- Tax Tribunals- Appeal Provisions under I.T.Act. - Grievance Procedure-

MODULE IV GOODS AND SERVICES ACT-2017 I 10

Goods and Services Act-2017 its highlights- significance- merits- filling procedures- legal mechanism.

MODULE V INTERPRETATION OF TAX LAWS- PRINCIPLES 10

.How to Interpret Tax Legislations. General guidelines; Principles; Authoarities- Quasi-Judicial- Tribunals. Courts.

TOTAL HOURS : 50

REFERENCES:

1. Sukumar Battacharya - Income Tax Law - Practice
2. N.A. Palkowala - Income Tax

3. Manoharan - Income Tax Act
4. Dinager Pagre - Direct Taxes and Indirect Taxes
5. Taxmann- Income Tax Act
6. Girish Ahuja - Law and Procedure: Professional Approaches to Direct Taxes

OUTCOMES:

The student will learn the Law relating to Taxes in India. He will know about highlights of Income Tax andf GST and filing of returns procedures etc. Student will also know about and quasi-judicial authorities, tribunals and judicial mechanism in place to address the legal issues.

BLC 5204 CRIMINOLOGY AND PENOLOGY L T P C
4 1 0 5

OBJECTIVES:

Criminology, Penology and Criminal Law are interlinked. Scientific study of criminal behaviors of the person who tends to commit crime is the core and essence of this subject. Basically Criminal Law provides definition and punishment for the crime. The criminology reveals the reasons that constitute the crime either individually or socially. The penal sanctions depend upon the characteristics of the criminal and the ability to reform through punishments. Thus the course provides the students to understand the criminal behaviour and imposition of punishments scientifically.

MODULE I INTRODUCTION 10

Meaning and Significance of Crime- Concept of Crime and basis of Criminalization- Definition of Crime- Criminology- Criminological Reminiscence; Global Scenario- Renaissance- Modern Age - Focus on the need for Criminological Study- Ingredients of Crime - Distinguish Crime and Non-Crime- Classification of Crimes-Development of Criminal Law- Sources of Crime Data- Crime Reporting- Uses of Crime Data- Schools of Criminology.

MODULE II CAUSES OF CRIME 10

Individual centric causes- Social Centric Causes-Theories on Crime causation- Juvenile Delinquency- Juvinile Justice (Care and Protection of Children) Act- Case Law-

MODULE III TYPES OF CRIME 10

Corruption: White - Collar Crime and Blue Collar Crime- Implication of White Collar Crimes- - White Collar Crimes- Detection and Investigation and Trails of White Collar Crimes. -.Crime and Women: Female Criminality- Crimes of Passion- Prostitution- Immoral Traffic Prevention Act- Medical Termination of Pregnancy Act- PNDT (Regulation) Act- Domestic Violence Act- Criminal Law Amendment Act-2013. Terrorism; Definition-Nature-Causative Factors- Kinds- Measures to combat. Communal Violence-causes and cures. Drugs and Crimes- NDPS Act- Cyber Crimes- Trafficking in women and Children, Human Organ Crimes- International Crimes and Environmental Crimes.

MODULE IV POLICE AND CRIMINAL JUSTICE SYSTEM 10

Organizational structure of Indian Police- set-up- bureaucracy-Crimes by police-

Crime Record Bureaus- Need for police reforms. Social Defense.

MODULE V CORRECTIONAL INSTITUTION AND CRIME PREVENTION **10**

.Prison system in India- Probation and Parole- Origin- Probation of Offenders Act, 1958- Prison Reforms. Boaster School. Prevention of Crime and Delinquency.

TOTAL HOURS : 50

REFERENCES

OUTCOMES:

Crime is considered to be a threat to the society. The student know about different types of crimes that the country. He will learn about the police system and prison systems in place.

BLC 5205	DRAFTING, PLEADING & CONVEYANCING (Clinical Course - IV)	L	T	P	C
		4	1	0	5

OBJECTIVES:

Drafting skills are essential for an Advocate. Students are expected to learn, improve their drafting skills that are essential to enter into the profession of Advocacy. This course will help them in this regard. Class room instruction is followed by record writing. This is part of Clinical Legal Education course of Bar Council of India, which is mandatory. The student has to submit a hand-written record.

MODULE I INTRODUCTION 10

A. Drafting: General Principles of Drafting and relevant substantive rules shall be taught.

B. Pleadings: a) Civil: Plaint, Written Statement, Interlocutory Application, Original Petition, Affidavit, Execution, Petition, Memorandum of Appeal and Revision. Petition under Article 226 and 32 of the Constitution of India.

b) Criminal: complaint, Criminal Miscellaneous Petition, Bail Application, Memorandum of Appeal and Revision.

c.. Conveyancing: sale Deed, Mortgage Deed, Lease Deed, Gift Deed, Promissory Note, Power of Attorney, Will, Trust Deed.

d. Drafting of Writ Petition and PIL Petition

METHOD OF INSTRUCTION

Instructions class and simulation exercises, preferably with assistance of practicing lawyers/ retired judges will be provided for the students.

Apart from teaching the relevant provisions of law, the course may included not less than 15 practical exercises in Drafting carrying a total of 45 marks (3 marks for each) and 15 exercises in Conveyancing carrying another 45 marks (3 marks for each exercise) remaining 10 marks will be allotted for Viva Voce.

Total Number of Hours: 30

B.S. Abdur Rahman Crescent Institute of Science & Technology

Deemed to be University u/s 3 of the UGC Act, 1956

REGULATIONS 2017

FOR

LAW DEGREE PROGRAMMES

(Recognized by Bar Council of India)

CURRICULUM AND SYLLABI

B.Com.LL.B (Hons)

CRESCENT SCHOOL OF LAW

VISION

The Vision of Crescent School of Law is to produce promising and credible Law Graduates with potential knowledge and skills to meet the requirements of contemporary times. The present world that is global, competitive and complex and the 'issues' that are the confronting was also on the same span. Hence, the Crescent School of Law contemplates to train young minds with strong fundamentals, sound legal knowledge and skill-set to deal, answer and fight for just and legal causes.

The vision of Crescent School of Law is to produce competent law graduates who can be instrumental in delivering goods as Advocates, Judicial Officers, Legal Advisors and Law Officers/Executives not only in legal arena but in Corporate and Business world as well.

Crescent School of Law espouses the cause of translating the Constitutional values into a reality. It cherishes a just and equitable society where every individual has a place to survive and flourish. Hence, for Crescent, Law is more of social engineering.

MISSI0N

- To train the students a competent legal/corporate professionals with all necessary in-puts with a holistic approach.
- To provide excellent academic ambience where the students can learn and excel.
- To equip the students to meet the challenges of profession by exposing them to contemporary issues through discussions, debates and by organizing work-shops, seminars and moot-courts etc.
- To encourage a spirit of enquiry, research inquisitiveness with interdisciplinary approach to find solutions to the legal/social issues.

PROGRAMME EDUCATIONAL OBJECTIVES

- To provide a strong foundations of social sciences to ensure comprehensive understanding of 'Law' as a unique discipline.
- To equip the students with required knowledge and skills to meet the demands of the Legal, Corporate and Business world.
- To infuse confidence and competencies among the students to analyze various legal and social issues and offer legal solutions.
- To train the student as an active responsible citizen to uphold the values of democracy.
- To provide a strong foundation in Accounting, Business Laws and Taxation to the students
- To provide career oriented education to students so that they can either go for jobs or engage in self-employment.

PROGRAMME OUTCOMES

On successful completion of the programme, the graduates will be able to

- Establish as legal professionals to take up responsibilities in legal/corporate arena.
- Demonstrate a clear understanding of law and its underlining principles with conceptual clarity.
- Apply the knowledge and principles into real-life/ practical situations and to find solutions that are legal and valid.
- Defend and uphold democratic spirit and constitutional values and fight for them within and outside the Court.
- Apply strong conceptual base in commerce and business
- Demonstrate leadership quality in the choosen field of career

B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE & TECHNOLOGY,

B.COM LL.B (Hons.)

CURRICULUM & SYLLABUS, REGULATIONS 2017

SEMESTER I

Sl. No.	Course Code	Course Title	L	T	P	C	
1.	SSC1184	Principles of Economics	4	1	0	5	
2.	BLC1101	Principles of Management and Human Resources Management	4	1	0	5	
3.	BLC1102	Introduction to Law	4	1	0	5	
4.	BLC1103	General Principles of Contract	4	1	0	5	
5.	BLC1104	Law and Language	4	1	0	5	**25**

SEMESTER II

Sl. No.	Course Code	Course Title	L	T	P	C	
1.	ENC1286	Business English	4	1	0	5	
2.	SSC1281	Introduction to Sociology	4	1	0	5	
3.	BLC1201	Law of Torts & Accident Claims under The Motor Vehicles Act	4	1	0	5	
4	BLC1202	Special Contracts	4	1	0	5	
5	BLC1203	Principles of Accounting	4	1	0	5	
6	GEC1212	Environmental Studies	2	0	0	2	27

SEMESTER III

Sl. No.	Course Code	Course Title	L	T	P	C
1.	BLC2101	Law of Crimes-I(IPC)	4	1	0	5
2.	BLC2102	Family Law-I	4	1	0	5
3.	BLC2103	Constitutional Law-I	4	1	0	5

4	SSC2181	Introduction to Political Science	4	1	0	5	
5	BLC2105	Financial Market and Marketing Management	4	1	0	5	**25**

SEMESTER IV

Sl. No.	Course Code	Course Title	L	T	P	C	
1.	BLC2201	Managerial Economics	4	1	0	5	
2.	BLC2202	Jurisprudence	4	1	0	5	
3.	BLC2203	Family Law-II	4	1	0	5	
4.	BLC2204	Constitutional Law-II	4	1	0	5	
5.	BLC2206	Cost and Management Accounting	4	1	0	5	
6.	BLC2205	Internship – I	0	0	2	2	**27**

SEMESTER V

Sl. No.	Course Code	Course Title	L	T	P	C	
1.	BLC3101	Public International Law	4	1	0	5	
2.	BLC3102	Company Law	4	1	0	5	
3.	BLC3103	Human Rights	4	1	0	5	
4.	BLC3104	Financial Management	4	1	0	5	
5.	BLC3105	Practical Auditing	4	1	0	5	**25**

SEMESTER VI

Sl. No.	Course Code	Course Title	L	T	P	C	
1.	BLC3201	Law of Evidence	4	1	0	5	
2.	BLC3202	Labour Law – I	4	1	0	5	
3.	BLC3203	Administrative Law	4	1	0	5	
4.	BLC3204	Professional Ethics, Bar Bench Relations and Accountancy for Lawyers. (Practical Training Paper)	2	0	3	5	
5.	BLC3206	Customs and Excise Laws	4	1	0	5	

6.	BLC3205	Internship – II	0	0	2	2	**27**

SEMESTER VII

Sl. No.	Course Code	Course Title	L	T	P	C	
1.	BLC4101	Transfer of Property Law	4	1	0	5	
2.	BLC4102	Intellectual Property Law	4	1	0	5	
3.	BLC4103	Labour Law – II	4	1	0	5	
4.	BLC4104	Law of Banking	4	1	0	5	
5.	BLC4105	Alternative Dispute Resolution Mechanism (Practical Training Paper)	2	0	3	5	**25**

SEMESTER VIII

Sl. No.	Course Code	Course Title	L	T	P	C	
1.	BLC4201	Competition law	4	1	0	5	
2.	BLC4202	Environmental law	4	1	0	5	
3.	BLC4203	Maritime Law	4	1	0	5	
4.	BLC4204	International Trade Law	4	1	0	5	
5.	BLC4205	Cyber Law and Forensic	4	1	0	5	
6.	BLC4206	Internship – III	0	0	2	2	**27**

SEMESTER IX

Sl. No.	Course Code	Course Title	L	T	P	C	
1.	BLC5101	Law of Insurance	4	1	0	5	
2.	BLC5102	Law of Crimes-II(Cr.P.C.)	4	1	0	5	
3.	BLC5103	Civil Procedure Code & Limitation Act	4	1	0	5	
4.	BLC5104	Land Laws	4	1	0	5	
5.	BLC5105	Moot Court (Practical Training Paper)	0	0	5	5	**25**

SEMESTER X

Sl. No.	Course Code	Course Title	L	T	P	C	
1.	BLC5201	Interpretation of Statutes	4	1	0	5	

2.	BLC5202	Right to Information Act	4	1	0	5	
3.	BLC5203	Law of Taxation	4	1	0	5	
4.	BLC5204	Criminology and Penology	4	1	0	5	
5.	BLC5205	Drafting Pleading and Conveyancing.(Practical Training Paper)	2	0	3	5	
6.	BLC5206	Internship – IV	0	0	2	2	**27**

TOTAL CREDITS : 260

SEMESTER I

SSC1184	**PRINCIPLES OF ECONOMICS**	**L**	**T**	**P**	**C**
		4	**1**	**0**	**5**

OBJECTIVES:

- To introduce the basic concepts of economics and economic systems.
- To provide an idea about demand, supply and market equilibrium.
- To familiarize the concept of consumer behavior, cardinal, ordinal and revealed preference analysis.
- To give an overview about the production, distribution, pricing and different forms of markets.
- To provide basic understanding about the Indian economy.

MODULE I NATURE AND SCOPE OF ECONOMICS 10

Definitions: Wealth, Welfare, Scarcity and Growth – Micro Economics and Macro Economics - Normative and Positive Economics Basic economic problems - production possibilities- Basic features of prevalent economic systems- capitalism, socialism, mixed economy – Gandhian economic principles.

MODULE II PRICES AND MARKETS 10

. Demand – Individual demand and market demand - Demand curve-Law of demand – Exceptions to the Law of Demand – Law of Supply –Individual supply and market supply – Market equilibrium - shift in demand, supply and price – Elasticity of demand – meaning, degrees and measurement

MODULE III CONSUMER BEHAVIOR 10

Consumption - meaning - Utility – Cardinal and Ordinal – Law of Diminishing Marginal Utility. Law of Equi-marginal Utility –Indifference Curve Analysis-consumers surplus.

MODULE IV PRODUCTION, PRODUCT PRICING, DISTRIBUTION AND MARKETS 10

Production – basic concepts of costs – opportunity cost – Production function – Short run and Long run – Returns to a factor-Law of variable proportions -Laws of returns to scale - economies and diseconomies of scale - internal and external economies of scale-Main market forms - Perfect Competition,

Monopoly, Monopolistic Competition, Oligopoly and Duopoly.

MODULE V INDIAN ECONOMY 10

Indian Economy-Problems-Features– Population-Causes-Trends-Consequences-Population Policy-2000, Poverty Alleviation Programmes - Concepts-Causes-Measurement-Trends - unemployment- causes-types-trends programmes - HDI.

TOTAL HOURS : 50

REFERENCES:

1. Samuelson. P.A. Nordhaus (2009), Economics, Tata McGraw Hill
2. Mankiw, Gregory (recent edition), Principles of Economics, Cengage Learning, Delhi
3. Case & Fair (2007), Principles of Economics, Pearson Education, Delhi
4. Koutsoyiannis (1979), Modern Microeconomics ,Macmillan Press Ltd .London
5. Indian Economy- Ruddar Dutt and KPM Sundaram

OUTCOMES:

- Students will gain about the basic concepts of economics and economic system
- Students will have an exposure about the market forces and market equilibrium.
- They will learn about the consumer behavior and utility analysis.
- Students will understood about the production, pricing, distribution and different forms markets.
- Students will an overview about Indian economy and its relevant policies.

BLC1101	PRINCIPLES OF MANAGEMENT AND HUMAN RESOURCE MANAGEMENT	L	T	P	C
		4	1	0	5

OBJECTIVES:

This course is an introduction to the management function. It will focus on the theory and functional concepts of management including planning, organizing, leadership and control. This course will also review the human resource management. It deals with human capital and its constitution, organization and productive usage as part of management function. Basic knowledge on functional management is the essence of this course.

MODULE I **10**

Definition of Management- Nature and Scope – Science or Art-Development of Management Thought-Contributions of Fayol and Taylor- Functions of Management- Types of Business Organisation-Planning-Objectives-Process of Management by objectives- strategies, Policies and Planning Premises Forecasting-Decision Making- Management by Exception, Managerial Levels and Managerial Skill

MODULE II **10**

Nature and Purpose – Formal and Informal Organisation- Organisation Chart-Structures and Process- Departmentalisation by different strategy-Decentralisation and Centralisation- Delegation of Authority-Staffing-Selection-Process and Techniques-Co-ordination-Need Types and Techniques for Excellent Co-ordination-Controlling-Meaning and Importance-Control Process- Span of Control, Control Techniques

MODULE III **10**

Nature and Scope of HRM-Difference between Personnel Management and HRM-Human Resource Selection- HRM & HRD, Concept of Human resource planning , sources and Techniques of recruitment-Interview Techniques-Placement-Induction-Training. Methods-Techniques-Identification of the Training needs- Training and Development- Performance Appraisal-Career Development.

MODULE IV **10**

Remuneration- Components of Remuneration-Incentives-Benefit-Motivation-Welfare and Social Security Measures-Human Factors-Creativity-Intellectual skills-

Innovation Information Communication and Technology (ICT)- Job Evaluation, ESOPS

MODULE V **10**

Functions of Trade Unions – Forms of Collective Bargaining-Workers Participation in Management- Types and Effectiveness-Industrial Disputes and Settlements –HR Audit-Nature-Benefit-Approaches- Code of Discipline

TOTAL HOURS : 60

TEXT BOOKS:

1. C.B.Gupta –Management Theory and Practice
2. L.M.Prasad- Principls and Practice of Management
3. P.C. Tripathi and P.N. Pandy – Principles of Management

REFERENCES:

1. P.C.Tripathi- Human Resource Development
2. T.V.Rao- Human Resource Development
3. Dr N.Premavathy- Human Resource Management

OUTCOMES:

- Student will get an idea about ‘Management’ as a function and its challenging tasks.
- Student can understand and observe the current trends in Management with historical background.
- Student acquaints with management principles and methods and techniques.
- Student will familiarize with management functions such as planning, organizing, leading and controlling.

BLC1102	INTRODUCTION TO LAW	L	T	P	C
		4	1	0	5

OBJECTIVES:

This papers aims at introducing fundamental concepts of Law. Law-its definition-scope-nature-purpose-functions-sources-classification - Legal system - law making process. The beginners in Law will be exposed to tools of understanding the Statues and Judgments. The focus is on providing insights in to the basics as such.

MODULE I INTRODUCTION TO LAW 12

Concept of Law - its definition; Law its Scope; Law its nature; Law and its purpose; Law and its relationship with Political Science, Economics, Sociology, History and other social sciences. Law and Custom; Law and Morality; Law and Justice' Law its Sources

MODULE I CLASSIFICATION OF LAW 12

Basic Law-Ordinary Law; Substantive Law and Procedural Law; Domestic (Municipal) Law and International Law, Civil Law and Criminal Law, Public Law and Private Law, Public International Law and Private International Law; What is Common Law; World legal order - Major legal systems in the World.

MODULE III CONCEPT OF STATE AND ITS POWER 12

State and its characteristics; Constitution and the Constitutional Law; Separation of Powers, Custom as a source of Law, Legislation as a source of Law. Legislative process - Law making bodies, / Rule Making power of the Executive nd the Law declared by the Court. Definition of Law, Definition of State (Article 12), What is an Ordinance. Striking features of Indian Constitution – Article 32 as a Fundamental Right.

MODULE IV Hierarchy of Courts - CONCEPT OF RIGHT 12

Higher Judiciary-Subordinate Judiciary – Supreme Court and its power - Law Declared by the Supreme Court - Stare Decisis – Precedent – High Court – Powers – Tribunals – Quasi – Judicial Authorities – Commissions – ADR Mechanisms – Lok – Adalat, Ombudsman.

Rights-Divine Rights, Natural Rights, Human Rights, Fundamental Rights, Constitutional Rights, Legal Rights, Rights arise out of Procedure etc. Rights and Duties

MODULE V INTERPRETATION OF STATUTES 12

How to interpret/ understand an Act/Law. Parts of the Statute and their relevance in interpretation. General rules of Interpretation. Classification of statutes – Welfare, Penal and Tax Laws.

TOTAL HOURS : 60

TEXT BOOKS:

1. Madabhushi Sridhar: Legal Language and Legal Writing- Asia Law House
2. "Kush-kaira' "Law for Common Man:
3. 'Law for Layman" by Kush Kaira and Ayushi Gaur.
4. Prof. N.V.Pranjape "Jurisprudence"
5. V.D.Mahajan " Jurisprudence"
6. Adam Podgorcki – "Law and Society.

OUTCOMES:

- Student will get initiated into the subject of Law as a unique discipline.
- Familiarizes Law with different aspects, areas and their scope.
- Acquaintance and development of legal inquisitive interest in various facets of Law
- Can able to track and follow legislative & judicial trends and appreciate.

BLC1103 GENERAL PRINIPLES OF CONTRACTS L T P C

4 1 0 5

OBJECTIVES:

Law of Contracts stands as a basis on which whole spectrum of law in general and business, trade, commerce and corporate law in particular. As the whole web of contractual relations are governed by the Law of Contracts, it is essential for law students to have conceptual clarity on concepts and general principles that govern contracts. Legal dimension of – how a contract will be formed – how it will be performed – how it can be discharged – and what are redressal mechanisms available to the aggrieved parties.

MODULE I ESSENTIALS OF A CONTRACT 12

Basic Nature of Contract – Formation of Contract – Offer, Acceptance, Revocation, Lapse of offer and Acceptance – Intention to create Legal Relationship – Terms of Contracts & Standard form Contracts.

MODULE II CONSIDERATION AND LEGALITY 12

Consideration – past, present, future consideration – Privity as to consideration - Value & Adequacy of consideration, Rule in Pinnel's case – Exceptions to consideration – Capacity to contract – Free consent – Factors which vitiate free consent – Objects of a Contract – Unlawful & illegal objects or considerations – Valid, Voidable, Void Agreements.

MODULE III PERFORMANCE & ENFORCEMENT 12

Performance of Contract – Privity of Contract – Tender of performance - Time as essence to performance – Law relating to time, place & order of performance – Performance of reciprocal promises, contingent contracts, joint promises – appropriation of payments.

MODULE IV TERMINATION OF CONTRACT 12

Discharge of contracts – by – Impossibility of performance – Discharge by Agreement - Novation, Recission, Alteration – Discharge by Breach - Waiver – Accord & Satisfaction – Material Alteration – Damages – Types and Measure.

MODULE V LEGAL -REDRESSAL 12

Quasi contracts – Quantum Meruit – Specific Relief Act, 1963 - recovery of

possession - specific performance of contracts-rectification, Cancellation of Instruments - Rescission-Declaratory Decrees - Injunctions.

TOTAL HOURS : 60

TEXT BOOKS:

1. Dr. Avatar Singh – Law of Contract & Specific Relief.
2. Anson's Law of Contract.
3. Venkatesh Iyer – Indian Contract Law
4. M. Krishnan Nair – Indian Contract Law.

Bare Acts:

1. Indian Contract Act, 1872
2. Specific Relief Act, 1963

REFERENCES:

1. Cheshire & Fifoot – Law of Contracts.
2. Mulla – Indian Contract Act.
3. Sarkar – Specific Relief Act..
4. Basu – Specific Relief Act.
5. Smith & Thomas – A Casebook on Contract.

OUTCOMES:

The student will have conceptual clarity on matters relating to legally enforceable contracts. (Formation-Performance-Discharge of a contract)

- Will be familiarized with the redressal mechanisms available to the aggrieved parties in case of breach of contract.

BLC 1104	LAW AND LANGUAGE	L	T	P	C
		4	1	0	5

OBJECTIVES:

- To train students to use appropriate vocabulary in academic and technical/legal contexts.
- To facilitate students to speak effectively while exchanging ideas and making presentations.
- To develop students' listening skill for comprehending and analyzing information.
- To develop their reading skill through sub skills like skimming, scanning and critical reading of a text.
- To sharpen their academic writing skills.
- To expose them to the correct usage of language and help them to apply that knowledge appropriately.

MODULE I **7**

L: Listening for general information

S : Self Introduction, Introducing one another.

R: Predicting the content

W: Paragraph Writing

Language Focus: Affixes, Simple Present tense , Connective & Prepositions.

Language-significance-English as a legal language-distinctive features of English as a legal language - Basics of Law

MODULE II **7**

L: Listening for specific information (from dialogues)

S: Exchanging opinion.

R: Skimming technical Passages

W: Argumentative Writing (using the concept of Flipped Learning), Letter to the Editor.

Language Focus: Idioms, use of Modals, Simple Past tense & use of "Wh" and question tags.

Indian Languages as Legal Language - Legal Terms

MODULE III **8**

L: Learning the ways of describing images and presenting specific information

(focusing on note making)

S: Making Presentations using visuals.

R : Scanning short texts for gist of information

W: Letter of Invitation, Expository Writing

Language Focus: Homophones, Homographs, Simple Future & Collocations.

Latin Expressions - Doctrines and Legal Maxims

MODULE IV **8**

L: Understanding prepared presentation techniques through videos

S: Short Presentations.

R: Reading for coherence and cohesion

W: Letter seeking permission for Industrial Visit

Language Focus: S-V agreement, Euphemism

Confused wordings, Phrases, Idioms, Synonyms, Legal Jargon - Terminology - Vocabulary in Law of Torts

MODULE V **8**

L : Understanding Non- Verbal Communications while listening to narration of incidents.

S: Narrating an experience

R: Inferential Reading

W: Process Description – Transcoding a Flow chart.

Language Focus: Interchange of Active & passive voice, Impersonal Passive voice.

Legal jargon in Family Law - Business Law

MODULE VI **7**

L: Learning Story telling techniques (stories & visuals) through audio files

S: Discussion in groups

R: Reading for critical appreciation

W: Developing an idea, Slogan writing, Interpreting a Bar Chart.

Language Focus: If clause and phrasal verbs.

Legal jargon in Cyber Law - International Law - Procedural Laws

TOTAL HOURS : 45

REFERENCES:

1. Carol Rosenblun Perry (2011). The Fine Art of Technical Writing. Create Space Independent Publishing Platform, New Delhi.
2. Dutt, P.K. Rajeevan. G and Prakash , C.L.N. (2007) A course in

Communication Skills. Cambridge Univesity Press, India.
3. Sen, Leena. (2004) Communication Skills. Prentice Hall, New Delhi.
4. Matt Firth, Chris Sowton et.al. (2012). Academic English: An Integrated Skills Course for EAP. Cambridge University Press, Cambridge.
5. Legal Language- Dr Madabhushi Sridhar-Asia Law House, Hyderabad
6. Legal Language and Legal Writing Dr S.R.Myneni- Asia Law House, Hyderabad.
7. Avatar Sing-College Law Dictionary
8. Ramanatha Aiyer P - The Law Lexicon
9. Dr Rega Surya Rao: Lecturers on Legal Language and Legal Writing, Asia Law House, Hyderabad
10. Glanville Williams: Learning the Law
11. Dr. Anirud Prasad: Outlines of Legal Language in India

OUTCOMES:

After completion of the course, students will have the ability to

- Demonstrate their range of vocabulary in academic and Technical/legal contexts
- Exchange ideas and make presentations
- Comprehend and respond appropriately to listening tasks.
- Read a text efficiently and process information.
- Create and draft different kinds of academic documents
- Communicate effectively using grammatically correct expressions.

SEMESTER II

ENC1286	**BUSINESS ENGLISH**	**L**	**T**	**P**	**C**
		4	**1**	**0**	**5**

OBJECTIVES:

The objectives of teaching a business English language are reflected, first, in developing oral and written language skills in the business context: of reading, listening, speaking, writing and, second, in raising a consciousness of cultural differences in the language in various business/corporate cultures. The objective of teaching business English language is to strengthen the oral and written linguistic skills in a business environment.

MODULE I COMMUNICATION 8

Definition – Methods – Types – Principles of effective communication – Barriers of communications – Relevance and importance of Business communication - Four skills of language Acquisition – understanding spoken language –oral and written. Business Vocabulary.

MODULE II TYPES OF COMMUNICATION 8

Communication in a Globalised world after LPG (Liberalization, Privatization and Globalization) –Modern forms of Communication – Different types of Presentations: eg. Talking about a product, transaction with a client, Arguing a case – Types of writing: Fax - Email – Video Conferencing – Internet – Websites and their use in Business.

MODULE III BUSINESS LETTERS 8

Kinds of Business Letters - Layout – Interview – Appointment – Acknowledgement – Promotion – Enquiries – Replies – Orders – Sales – Circular – Complaints.

MODULE IV CORRESPONDENCE 8

Bank Correspondence – Insurance Correspondence – Agency Correspondence -Correspondence with Shareholders – correspondence with Directors.

MODULE V REPORTING WRITING 8

Reports Writing – Agenda, Minutes of Meeting – Memorandum – Office Order

–Circular – Notes-

MODULE VI

Case law- Identification of case Law from different resources to get case law- Law Websites-Different Law Journals- and their names- Abbreviations...Law **10** Digests-Encyclopedias-How to Use Law Library

TOTAL HOURS : 50

TEXT BOOKS:

1. Rajendra Pal & J. S. Korlahalli, Essentials of Business Communication, Sultan Chand & Sons, New Delhi.
2. Shirley Taylor, Communication for Business, Pearson Publications, New Delhi
3. Bovee, Thill, Schatzman, Business Communication Today, Pearson Education Private Ltd.,
4. Penrose, Rasbery, Myers, Advanced Business Communication,
5. Simon Collin, Doing Business on the Internet, Kogan Page Limited, London
6. Mary Ellen Guffey, Business Communication – Process and Product, International Thomson Publishing, Ohio.
7. David Annousamy, The Language Ridddle.

OUTCOMES:

The students are given an understanding of various types of correspondence writing reports, tabling minutes, officer orders etc.. the modern forms of communication and the ways of communication through it for business purpose are also covered. Students will be familiar with the principles of effective communication and can overcome barriers.

SC1281	INTRODUCTION TO SOCIOLOGY	L	T	P	C
		4	1	0	5

OBJECTIVES:

- To acquaint the students with concepts and perspectives of Sociology
- To explain the reflection of society in Individuals and vice versa
- To present a portrayal of the Social Inequality and Stratification
- To explicate the dimensions, forms and Social Control and Deviance.
- To examine the causality and magnitude of social problem facing the contemporary India.

MODULE I INTRODUCTION 10

Sociology-Definition, scope and importance; Elements of social formation-Society, Community, Groups and Association; Associative Social Process- Co-operation, Accommodation and Assimilation; Dissociative Social Process- Competition and Conflict.

Culture-definition, characteristics, functions, types, cultural lag and civilization;

MODULE II SOCIAL INSTITUTION AND SOCIALIZATION 10

. Family- definition, types, characteristics, functions of family; Joint Family- definition features, utility, changes; Marriage- definition, characteristics, marriage as sacrament or contract; Socialization – definition, process, stages, agencies and anticipatory socialization; Social Control- definition, characteristics, importance, types & agencies.

MODULE III SOCIAL INEQUALITY AND STRATIFICATION 10

Concepts- inequality, hierarchy, differentiation, Social Exclusion, and Social Stratification. Forms of Social Stratification- Caste, Class and Estate. Gender and Social Stratification- sex and gender, patriarchy, factors perpetuating gender stratification; Globalization and gender inequality.

MODULE IV SOCIAL CONTROL AND SOCIAL DEVIANCE 10

Social Control: Definition - nature of social control – types of social control – agencies of social control. Social Deviance: Definition and types of deviance – factors facilitating deviance – social significance of deviant behaviour – contemporary development in deviance – mass media and social deviance

MODULE V SOCIAL PROBLEMS IN INDIA 10

Social Problem-Definition, nature, social disorganization; Population explosion-causes, effects, relationship with development; Child Labour- causes, magnitude and consequences; Unemployment-nature , types, causes and effects; Gender issues- social status of women, violence against women and women in work place; Contemporary issues- communalism, terrorism and corruption.

TOTAL HOURS :50

TEXT BOOKS:

1. Giddens A. 1989. “Sociology” Cambridge: Polity Press.
2. Heald Haralambos, R.M(2014) . ‘‘Sociology Themes and Perspectives”, Oxford, New Delhi-92
3. Bhushan Vidya and D.R. Sachdeva (2012). ‘‘Fundamental of Sociology”, Pearson, Delhi.
4. Ahuja Ram. 1999. *Social problems in India*, Rawat Publication: New Delhi.
5. Ahuja Ram. 2014. *Society in India,*, Rawat Publication: New Delhi.

REFERENCES:

1. Das Gupta, Samir and Paulomi Saha (2012), ‘‘An Introduction to Sociology”, Pearson, Delhi
2. Bottomore, T.B. 1972. *Sociology- A Guide to Literature and Problems*, New Delhi,
3. Atal, yogesh (2006), “Changing Indian Society” Rawat Publications, Jaipur

OUTCOMES:

On successful completion of this course,

- Students will have exposure to the fundamentals tenets of Sociology.
- Students will be trained to understand social reality with sociological perspective.
- Students will gain knowledge about Social Inequality and Stratification
- Students will be exposed to the social problems encountered in contemporary India
- Students will gain exposure to the dynamics of Social control and Social Deviance

BLC1201	LAW OF TORTS & ACCIDENT CLAIMS UNDER THE MOTOR VEHICLES ACT.	L	T	P	C
		4	1	0	5

OBJECTIVES:

The law is nothing but balancing interests. In civil litigation claims under law of Contracts and Law of Torts are numerous. Tort law is an un-codified law and conceptual in content. Tort law attempts to adjust for legal injury done, by awarding damages to a successful plaintiff who demonstrates that the defendant was the cause of plaintiff's losses. Concepts of Negligence, Nuisance and Liability were among other things in this subject of study. Accident claims under Motor Vehicles Act will also be studied.

MODULE I **GENERAL PRINCIPLES** **12**

Nature & Scope, Definition, Distinction between Tort & Crime – Tort & Contract, foundation of Tortuous Liability – Elements of Torts – General defenses.

MODULE II **LIABILITY FOR THE BY OTHER WRONG COMMITTED PERSON** **12**

. Vicarious liability - Joint tortfeasors- Capacity to sue and be sued - Remedies.

MODULE III **SPECIFIC TORTS** **12**

Negligence, Contributory Negligence, Nuisance, Remoteness of damage. Nervous-shock.

MODULE IV **TORTS AGAINST HUMAN BEING(S) & PROPERTY** **12**

Assault, Battery, Distress, Malicious - Prosecution, Conspiracy, False Imprisonment- Defamation - Trespass: To land, to goods, passing off-No fault liability- Strict liability, Absolute liability - Recent Trends – Law relating to Motor Vehicles - Accident Claims

MODULE V **MOTOR VEHICLE ACT, 1988** **12**

Insurance of motor vehicle against third party risk –claim-Tribunals- Offences-penalties and procedure.

TOTAL HOURS : 60

TEXT BOOKS:

1. B. M. Gandhi : Law of Torts
2. P. S. A. Pillai : The Law of Torts
3. Ratanlal and Dhiraj Lal : The Law of Torts
4. R. K. Bangia : Law of Torts including Motor Vehicles Act
5. Motor Vehicle Act, 1988

REFERENCES:

1. Ramaswamy Iyer : Law of Tort
2. Winfield : Law of Tort
3. Salmond : Law of Tort

OUTCOMES:

Student will have conceptual clarity and its application, will study the general defenses' available in tort claims. students will be able to understand the litigations for the civil wrong.

BLC1202 **SPECIAL CONTRACTS** **L T P C**

4 1 0 5

OBJECTIVES:

The scope and ambit of special contract is growing in every sphere of business activity in general. In this paper the student will learn the special types of contracts including Indemnity, Guarantee; Bailment; Agency and Partnership. The paper also deals aspects relating to 'Sale of Goods'.

MODULE I **INDEMNITY AND GUARANTEE** **12**

- Definition - English and Indian Definitions
- Distinction between Indemnity and Guarantee.
- Rights of the Indemnity Holder.
- Rights of the Indemnifier.
- Implied indemnity dealt with Section 59,145,164 and 222 of the Indian Contract Act.
- Codification not exhaustive-principles of equity applicable.
- Definition - English and Indian definitions.
- Essentials and nature of guarantee.
- Distinction between guarantee and indemnity - guarantee and insurance.
- Elements of consideration in a contract of guarantee.
- Nature and quantum of surety's liability.
- Kinds of guarantee and their incidents.
- Surety ship arises on contract and not on notice-position in English Law.
- Duty of disclosure in guarantee.
- Rights of surety against principal debtor-credit-co-sureties-difference in
- English Law-Circumstances – Discharge of Surety.

MODULE II **BAILMENT** **12**

- Definition - Indian and English definitions.
- Essentials of bailment and classification of bailment.
- Distinction between bailment and pledge-deposit-sale-agency.
- Rights and duties of the bailor and bailee-difference in English Law.
- Pledge-definition-Rights of the Pawners and Pawnee.

- Pledge by non-pawners.
- Lien-kinds of lien-their nature and incidents - How lost

MODULE III SALE OF GOODS ACT 12

- Definition of sale and agreement to sell - distinction between sale and agreement to sell - Contract of work and layout. Hire purchase agreement - Bailment - Exchange - Gift.
- Definition - goods – specific goods-future goods-Mercantile agent-Documents - title of goods.
- How is sale made - rules for fixing price and effect of goods getting damages or perished in a contract of sale?
- Stipulation as to time and other stipulation.
- Conditions and warranties – Effect of breach – Ex-post facto warranty – when condition is treated as warranty.
- Implied conditions and warranties – in a contact of sale – Exemption clauses effect of fundamental breach.
- Rule as to passing off property.
- Sale by non-owners, exception to ‘Nemo Dat Quod Non Habet”
- Rules as to delivery.
- Unpaid vendor – his Rights or lien and stoppage in transit.
- Remedies available to seller and buyer.
- Auction sale

MODULE IV AGENCY 12

- Definition of contract of agency – Creation of agency-kinds of agency.
- Distinction between Agent and servant and independent contractor.
- Who may be an agent-kinds of Agent – Authority of the different kinds of Agent – Authority of Agents – Ostensible and emergency authority – delegation of authority – delegates ‘non protest delegare’ – sub agent –substituted agent.
- Essential of ratification and its effect.
- Effect of notice to agent – necessary conditions to bind Principal.
- Principal and third parties – The doctrine of undisclosed principal and concealed Principal.
- Termination of agency and when it becomes irrevocable.

MODULE V PARTNERSHIP 12

- Authority of partners – implied and emergency.
- Liability of the partners of the acts of the firm and for the wrongful acts of other partner – nature of liability.
- Principle of agency in partnership.
- Partnership property – Tests.
- Settlement of accounts – goodwill and its disposal – distribution of assets.
- Retirement of partners.
- Dissolution of firm and modes and circumstances.
- Effect of non – registration of firm.

TOTAL HOURS : 60

TEXT BOOKS:

1. The Law of Contracts – Dr. Avatar Singh
2. Sale of Goods Act – Mulla
3. Law of Contracts – Krishna Nair
4. Law of Contracts – Anson

OUTCOMES:

- Student should able to understand special nature of contracts; duties and rights arise out to these contracts. Performance and discharge of contracts and remedies available in case of any breach.

BLC1203	PRINCIPLES OF ACCOUNTING	L	T	P	C
		4	1	0	5

OBJECTIVES:

To facilitate the understanding of Accounting in General

- To give a comprehensive understanding of the system of Financial Accounting
- To understand the intermediate concepts for assets, liabilities and stockholders' equity
- To develop skill, related to problem solving and critical thinking

MODULE I INTRODUCTION TO ACCOUNTING 10

Meaning and scope of Accounting, Basic Accounting Concepts and Conventions, Objectives of Accounting, Accounting Transactions, Double Entry Book Keeping - Journal, Ledger, Preparation of Trial Balance

MODULE II ACCOUNTS 10

Preparation of Final Accounts of a Sole Trading Concern, Closing Stock, Adjustments, Outstanding and Prepaid items, Depreciation, bad debts, Provision for Bad and Doubtful Debts, Provision for Discount on Debtors, Provision for Discount on creditors, Interest on Capital and Drawings, Abnormal Loss of stock.

MODULE III RECTIFICATION OF ERRORS 10

Classification of Errors, Rectification of Errors, Preparation of Suspense Account - Profit & loss adjustment Account.

MODULE IV RECONCILIATION STATEMENT 10

Introduction, Procedure for reconciling the cash book balance with the pass book balance, Methods of Bank Reconciliation Statement

MODULE V DEPRECIATION ACCOUNTING 10

Depreciation, Meaning, Causes, Methods, Straight Line Method, Written down Value Method, Change in method of depreciation (retrospective and prospective method) Insurance claims Insurance claims, Average Clause (Loss of stock only)

TOTAL HOURS : 50

TEXT BOOKS:

1.Financial Accounting By P.C. Tulsian, Pearson

REFERENCES:

1.Financial Accounting by Hanif and Mukherjee, Mcgraw Hill Education
2.T.S.Reddy&A.Murthy (2015) Financial Accounting, Margham Publications, Chennai.
3.Jain&Narang (2015) Financial Accounting, Kalyani Publishers, New Delhi

OUTCOME:

The student will grasp the purpose and methods of accounting that is the core of all business environment. The student will be equipped with recording, classifying and summarizing business transactions that are legal, regular and valid. Thus helps in making business decisions accurate and ensures flaw less tax planning.

GEC 1212	ENVIRONMENTAL STUDIES	L	T	P	C
		2	0	0	2

OBJECTIVES:

The student will be conversant with the

- various natural resources, availability, utilization and its current scenario
- different ecosystems, energy transfer, values, threats and conservation of biodiversity
- levels of different pollutants and its impact and the causes and effects of natural disasters
- impacts of human population, impact assessment, human rights and environmental acts and sustainable development

MODULE I NATURAL RESOURCES 8

Land resources: land degradation, soil erosion and desertification - Forest resources: use and over-exploitation, deforestation - Water resources: use and over-utilisation of surface and ground water, conflicts over water (inter-state and international), dams (benefits and problems), water conservation (rainwater harvesting and watershed management) - Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources, mining - Food resources: world food problems, changes in land use by agriculture and overgrazing, modern agriculture and its effects, fertilizer and pesticide problems, water logging and salinity - Energy resources: increasing energy needs, renewable and non-renewable, use of alternate energy sources.

MODULE II ECOSYSTEM AND BIODIVERSITY 8

Ecosystem- energy flow in the ecosystem - food chains, food webs and ecological pyramids - characteristics, structure and function of (a) Terrestrial ecosystems (forest, grassland, desert) and (b) Aquatic fresh water ecosystems (pond, lake, river) (c) Aquatic salt water ecosystems (ocean, estuary) - ecological succession.

Biodiversity - genetic, species and ecosystem diversity – hot-spots of biodiversity –biogeographic classification of India - endangered, endemic, extinct and invasive species of India - red data book - values of biodiversity: consumptive, productive, social, ethical, aesthetic and option values - threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts - conservation of biodiversity: in-situ and

ex-situ conservation of biodiversity

MODULE III ENVIRONMENTAL POLLUTION AND NATURAL DISASTER **8**

Definition, cause, effects and control measures of (a) air pollution (b) water pollution (c) soil pollution (d) marine pollution (e) noise pollution (f) thermal pollution (g) nuclear hazards - ill-effects of fireworks and upkeep of clean environment - solid waste management: types (urban, industrial, biomedical and electronic wastes), collection, processing and disposal (incineration, composting and land-fill) - natural disaster and management: flood, cyclone, drought, landslide, avalanche, volcanic eruptions, earthquake and tsunami.

MODULE IV HUMAN POPULATION, HEALTH AND SOCIAL ISSUES **6**

Population and population growth, population variation among nations, population explosion, family welfare programme.

Human health: air-borne, water borne diseases, infectious diseases, risks due to chemicals in food and environment.

Sustainable development - environmental legislation and laws: water act, air act, wildlife protection act, forest conservation act, environment protection act - environmental impact assessment, steps in EIA - human rights - women and child welfare.

TOTAL HOURS : 30

TEXT BOOKS:

1. Erach Bharucha, Textbook for Environmental Studies For Undergraduate Courses of all Branches of Higher Education for University Grants Commission, Orient Blackswan Pvt Ltd, Hyderabad, India, 2013.
2. Benny Joseph, Environmental Studies, Tata McGraw-Hill Education, India, 2009.
3. Ravikrishnan A, Environmental Science and Engineering, Sri Krishna Publications, Tamil Nadu, India, 2015.
4. Raman Sivakumar, Introduction to Environmental Science and Engineering, McGraw Hill Education, India, 2009.
5. Venugopala Rao P, Principles of Environmental Science and Engineering, Prentice Hall India Learning Private Limited; India, 2006.

6. Anubha Kaushik and Kaushik C.P., Environmental Science and Engineering, New Age International Pvt Ltd., New Delhi, India, 2009.

REFERENCES:

1. Masters G.M., Introduction to Environmental Engineering and Science, Prentice Hall, New Delhi, 1997.
2. Henry J.G. and Heike G.W., Environmental Science and Engineering, Prentice Hall International Inc., New Jersy, 1996.
3. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co. Boston, USA, 2016.

OUTCOMES:

The student will be able to

- Predict the scenario of various natural resources and suggest remedies to curb the exploitation of these resources.
- Identify food chain and web and its role in various ecosystems, assess the impacts on biodiversity and provide solutions to conserve it.
- analyse the impacts of pollutants in the environment and propose suitable method to alleviate the pollutants and the natural disasters.
- assess on the impact of human population and the health related issues and the ethics to be followed for sustainable life.

SEMESTER III

BLC 2101	LAW OF CRIMES-I (IPC)	L	T	P	C
		4	1	0	5

OBJECTIVES:

Crime and Law are so closely connected with each other that it is very difficult to understand one without knowing the other. Student should have clarity on concepts relating to crime, criminal and punishment.

MODULE I INTRODUCTION- GENERAL DEFENCES 10

Nature and Scope of Criminal Law: Definition-Essential Elements- Strict Responsibility-MensRea-Intention and Negligence-Recklessness and Knowledge-Offences without Conduct- Punishment Objectives- Basis and Types-Theories of Punishment- Justification of Punishment- General Defences- Justifiable defenses-Private defence- Joint and Constructive Liability- Abetment-Conspiracy-Attempt-corporate Liability- Jurisdiction-Territorial-Extra Territorial Personal and Admiralty.

MODULE II OFFENCES AGAINST HUMAN BODY: **10**

Culpable Homicide and Murder- Suicide-Causing Miscarriage-Hurt-Wrongful Restraint and Wrongful Confinement- Assault- Kidnapping-Abduction and Rape

MODULE III GENERAL OFFENCES 10

Offences against State- Offences against Public Peace- Unlawful Assembly- Riot-Affray- Offences against election- Bribery- inpersonation- Offences relating to Religion- Offences against Public Justice- Administration of Justice-Giving and Fabricating the false Evidence- disappearance of Evidence.

MODULE IV OFFENCES AGAINST PROPERTY 10

.Offences against Property: Theft-Extortion-Robbery and Dacoity-Criminal Misappropriation of Property and Trust-Cheating Mischief-offences relating to Documents.

MODULE V OFFENCES RELATING TO MARRIAGE AND REPUTATION: 10

Mock or Deceitful Marriage-Bigamy-Adultery-Cruelty by Husband or Relatives-Defamation- Intimidation - Attempt to Commit Offences- Thug.

TOTAL HOURS : 50

REFERENCES:

ACTS:

- Indian Penal Code
- Kenny- Outlines of Criminal Law
- Ratan Lal : Indian Penal Code
- M.K.D. Gour - Criminal Law
- Atchuthan Pillai - Criminal Law
- B.M.Gandhi- Indian Penal Code
- Glanville William - Criminal Law
- Russel - Criminal Law
- Ejaz's Law of Crimes
- Nigam- Law of Crimes (Volume I)
- Dr. H.S. Gour- Penal Law of India
- Raghavan V.V. - Law of Crimes

OUTCOMES:

Student can understand the basis on which the criminal law is based. Various offences and the punishment thereof.

BLC2102 **FAMILY LAW I** **L T P C**
3 1 0 4

OBJECTIVES:

To understand the Family as an Institution and various personal laws that govern issues relating to marriage, divorce, adoption and maintenance, minority and guardianship are the subject matter of this course. Student will go through Acts that govern and the decision of higher judiciary on various matter

MODULE I **8**

Application of various personal laws- Traditional and modern sources of Hindu Law and Muslim Law – The Classical Schools of Hindu Law and Muslim Law – Origin of the Schools – Main Schools and sub-Schools – Effect of Migration

MODULE II **LAW ON MARRIAGE**

Nature of Marriage – Various forms of marriage and requirements for a valid marriage on a comparative analysis – Void, voidable and valid marriage in different religious texts and statutes – Laws and Issues on marriage under the Special Marriage Act – Unisex marriage and question on living together – The demand of dowry and the concept of dower under the relevant personal laws – ceremonies of marriage under various religious systems.

MODULE III **LAW ON DIVORCE & MAINTENANCE**

Restitution of Conjugal Rights, Judicial Separation, Nullity of Marriage and

Divorce – Various grounds and procedure on a comparative analysis – Court's jurisdiction and procedure for the issues raised on marriage and divorce – In Camera proceedings – Decree on proceedings – Maintenance under Hindu, Muslim and Christian Laws – Permanent alimony – Maintenance during pendency of the suit - Maintenance under the Special Marriage Act, the Hindu Adoptions and Maintenance Act and the Code of Criminal Procedure. Structure, procedure and jurisdiction of Family Courts – The Family Courts Act

MODULE IV **LAW ON LEGITIMACY OF CHILDREN AND ADOPTION** **12**

Legitimacy of children born of void and voidable marriages – Their rights and legal issues – Adoption in different religious groups – Requisites, conditions, procedure of

adoption – Effect of adoption – Inter-Country adoption

MODULE V **LAW ON MINORITY AND GUARDIANSHIP** **12**

Guardian under the Hindu Minority and Guardianship Act, 1956 – Definition- types of guardians – Guardianship under Muslim Law – Procedure for appointment and their powers – Guardian under the Guardian and Wards Act 1890

Total Hours –60

TEXT BOOKS:

Books

Mulla - Hindu Law

N.R. Raghavachari - Hindu Law

Dr. Paras Diwan - Family Law

Mulla - Principles of Mahomedan Law

Fyzee - Outlines of Mahomedan Law

Kusum - Family Law Lectures – Family Law I

Mayne - Hindu Law & Usage

Mitra - Hindu Law

REFERENCES:

References:

Acts:

The Hindu Marriage Act, 1955

The Hindu Adoptions and Maintenance Act, 1956

The Hindu Minority and Guardianship Act, 1956

The Special Marriage Act, 1954

The Guardian and Wards Act, 1890

The Dissolution of Muslim Marriage Act, 1939

The Christian Marriage Act 1872

Indian Divorce Act, 1869

Indian Majority Act, 1875

The Muslim Women (Protection Of Rights On Divorce) Act, 1986

The Family Courts Act, 1984

The Dowry Prohibition Act, 1961

The Hindu Widows' Remarriage Act 1856

Prohibition of Child Marriage Act, 2006

OUTCOMES:

Student will get clarity on family as an institution and legal issues arise out of family relations. He can understand changing facets of family as a social unit and legal issues that surface.

BLC 2103 CONSTITUTIONAL LAW- I

L	T	P	C
4	1	0	5

OBJECTIVES:

This course enables the student to understand and appreciate the importance of Constitutional Law as a Fundamental Law of the Land. It gives emphasis on fundamental rights which are non-negotiable and Directive Principles of State Policy that promotes good governance. It ignites the minds of student on issues that are detrimental to make democracy vibrant.

MODULE I CLASSIFICATION OF CONSTITUTION AND GOVERNMENTS 12

Classification of Constitution and Governments. Definition and meaning of Constitution - Kinds of Constitution - Meaning of Constitutionalism- Features of Indian Constitution. Constitution and the Constitutional Law. Preamble-meaning-scope-importance-objectives and values, Union and its Territories (Art 1 to 4)- Citizenship (Article 5 to 11) Definition and meaning of State (Article 12) Definition and meaning of Law (Article 13)

MODULE II PREAMBLE, BASIC STRUCTURE-JUDICIAL REVIEW 12

Doctrine of Basic Structure, Development of Basic Structure theory- Doctrine of Eclipse-Severability and Ultravires- Judicial Review-

MODULE III FUNDAMENTAL RIGHTS - I 12

Fundamental Rights - Article 14- Right to Equality-General Equality Clasuse under Article 14- Reasonable Classification- Protective Discrimination-Reservation and Social Justice under Article 15 and 16. Untouchability under Article 17. Right to Freedom: Freedom of Speech and Expression Article 19-Scope and Ambit- Reasonable restrictions- Right to strike-Bundh-Hartal- Right to Information. Rights of the Accused: Article 20 Ex-post Facto- Double jeopardy-Self incrimination.

MODULE IV FUNDAMENTAL RIGHTS - II 12

Right to Life under Article 21- Life and Liberty-Meaning and Scope- Procedure established by Law- Judicial Interpretation- Maneka Gandhi's Case and its consequences on Constitutional Law. Article 21 A: Right to Education. Land

mark cases in which Right to Life has given a wider scope. Preventive Detention Laws- Exceptions- Safeguards.

Freedom of Religion Article 25 to 28. Secularism-Judicial Interpretation- Cultural and Educational Rights of the Minorities- Recent trends on Minority Educational Institutions. Right to Constitutional remedies Article 32 and Article 226.

MODULE V **12**

. Director Principles of State Policy and Fundamental Duties Relationship between Part III and Part IV. Relevance of Fundamental Duties.

TOTAL HOURS : 60

REFERENCES:

- M.P. Jain Indian Constitutional Law
- Dr. V.N. Shukla- Constitution of India
- J.N. Pande - Indian Constitutional Law
- DD Basu- Shorter Constitution of India
- Granville Austin- working of Democratic Constitution - A History of Indian Experience
- Constituent Assembly Debates Vol. 1 to 12
- H.M. Seervai - Constitution of India
- G. Austin- Indian Constitution: Cornerstone of a Nation.
- Report of the National Commission to Review the Working of the Constitution. (NCRWC-2002)
- D.J. De- The Constitutional Law of India Vol I and Vol II.

OUTCOMES:

The student will get an understanding the importance of Fundamental Rights the essence of democratic spirit and Directive Principles of State Policy the core of good governance.

SSC 2181 INTRODUCTION TO POLITICAL SCIENCE L T P C
4 1 0 5

OBJECTIVES:

Political Science has close link with Legal Studies. The Course intends to make the student to understand the basic concepts connected with Political Science such as, state and its functions, origin of state, various theories of its origin different forms of governments. Concepts like Sovereignty, Liberty, Equality, Citizenship, Rights and Duties. It also focuses on International facets of political science such as Realism, Political Power, National Power, Balance of Power, Diplomacy, Cold War and Alliance and the Structure and Functions of International and Regional Institutions.

MODULE I INTRODUCTION- NATURE, SCOPE, SIGNIFICANCE STATE AND ITS ELEMENTS-FUNCTIONS 10

Meaning, Nature, Scope and Significance of Political Science- Political Science and other Social Sciences, Theories of the origin of State- Divine Origin Theory- Force Theory- Patriarchal and Matriarchal theories- Social Contract Theories of Hobbes, Locke and Rousseau- Evolutionary Theory. Approaches to study of Political Science- Traditional Approach- Modern Approach- Marxist Approach. Elements of State, State and Society- State and Nation- State and Functions.

MODULE II EQUALITY-JUSTICE-RIGHTS AND DUTIES- LIBERTY 10

Equality- Extent of Equality in Modern Times. Rights and Duties-Rights recognized by the State- Human Rights recognized by International bodies Basic Political Concepts: Sovereignty- Characteristics and types of Sovereignty- Justice- Meaning and Kinds of Justice- Liberty- Meaning- Kinds of Liberty- Civil Liberty- Political Liberty-Safeguards of Liberty.

MODULE III VARIOUS FORMS OF GOVERNMENTS 10

Classification of Government. Merits and demerits of Democracy- Merits and demerits of Monarchy, Merits and demerits of Dictatorship- Role of Law in Governance. Laissez Faire theory- Welfare governments-Parliamentary form of government- Presidential form of government- Unitary and Federal systems. Unicameral and Bicameral legislatures- Role of political parties- public opinion

MODULE IV INTERNATIONAL FACETS 10

Introduction to International Relations- Relationship between International Relations and International Law. Theories of International Relations- Moralistic Theory Merits

and Demerits- Realistic' Theory- Concept of Political Power of the State- Concept of National Power, Elements of National Power- Limitations of National Power- role of Political Power in International Relations- Two World-Wars and their Impact.

MODULE V GLOBAL SCENARIO 10

Bi-Polar World- Cold War- end of the Cold War- Unipolar world and Multi-polar World- Balance of Power- Non-Aligned movement - UNO and its structure and its role in International Peace and Security- Non State Actors- Terrorism- Human Rights and Environmental issues.

OUTCOMES: TOTAL HOURS : 50

* Student can understand and appreciate the relationship between political science and law.
* Student can understand political science basic in Global context.
* Student can understand the issues that the world is facing.

REFERENCES:

1. Amal ray and Mohit Battacharya - Political Theory: Ideals and Institutions.
2. Norman, D. Palmer and Howard, C. Perkins- International Relations: - The World Community in Transition.
3. A.C.Kapoor - Principles of Political Science
4. Hans J. Margenthan - Politics among Nations
5. Baylis - Introduction to International Relations

BLC 2105 FINANCIAL MARKET AND MARKETING MANAGEMENT

L	T	P	C
4	1	0	5

OBJECTIVES:

Knowledge about financial services, markets and their concepts and functions, are essential to the students. This course is designed to understand the information and ideas about financial market and marketing management practices in prevailing situation.

MODULE I INTRODUCTION TO FINANCIAL SERVICES 10

Financial Service- Meaning - Importance- types- financial Service and Economic Development - Financial Instruments- financial Services Sector- Problems- Challenges- Reforms- Financial Markets and Capital Markets in India.

MODULE II MERCHANT BANKING AND VENTURE CAPITAL FINANCE 10

Merchant Banking- concept-Origin and Growth- Scope of Merchant Banking and Services-Issues-Issues Management- Underwriting- Importance - Methods - Venture Capital Finance - Concept and Growth of Venture Capital Finance in India - Leasing- type and Methods - Leasing and Borrowing -Credit Rating - Importance - factoring- Arrangements - Purpose and Procedures of Credit Rating - Short Term and Long Term Instruments - role of CRISIL- ICRA- and other Credit Rating Agencies.

MODULE III MUTUAL FUNDS AND FOREIGN EXCHANGE MARKET 10

Mutual Funds- Concept - Objectives - Importance - Mutual Fund Schemes - Mutual Funds and Money Markets-Portfolios - Concepts - Importance- Classification - Portfolio Management- Debt Securitization - SEBI- Introduction Functions Role of SEBI- NSDL-CSDL- foreign Exchange Market - Importance - Currency Swap-forward Contract and Future Contract- Money Laundering- Importance.

MODULE IV INTRODUCTION TO MARKETING MANAGEMENT 10

Marketing Management- Meaning- Importance- fundamentals- Approaches- Factors Affecting Marketing Functions- Market Mix-Buyers Behavior and Motives- consumer goods and Industrial Goods- Market Segmentation-

Targeting- Positioning.

MODULE V THE PRODUCT AND MARKETING CHANNELS 10

The Product-Meaning-Characteristics and Classifications- New Product Process - Product Life Cycle- Branding- Packaging- Physical Distribution - Importance and Kinds- Marketing Channels- Promotion- Advertisement - Publicity- Direct Selling and Sales Promotion.

TOTAL HOURS : 50

REFERENCE

1. Dr. S. Premavathi, " Financial Management" Jeyanth Publications
2. E.F. Brisham, " Fundamentals of Management. CBS International Editor-New Delhi, India
3. I.M. Pandey - " Financial Management" Vikas Publishing Private Limited, New Delh

OUTCOMES:

The student will know about financial markets and marketing operations through this course. He will knowledge about securities, mutual funds, portfolio management etc. He will know about the role of SEBI as a regulatory authority.

SEMESTER - IV

BLC 2201	**MANAGERIAL ECONOMICS**	**L**	**T**	**P**	**C**
		4	**1**	**0**	**5**

OBJECTIVES:

The aim is to strengthen the analytical skills of the students by integrating the theoretical knowledge with decision making.

MODULE I NATURE AND SCOPE OF MANAGERIAL ECONOMICS 15

Meaning, Nature and Scope - Scarcity- Choice and Allocation - Decision Making Techniques - Marginalism- Equi-Marginalism and Opportunity Cost- Risk and Uncertainties

MODULE II DEMAND ANALYSIS AND FORECASTING 10

Demand Theory- Types of Demand- Demand Elasticity - Elasticity of Demand and Marginal Revenue - Users of Elasticity - Decision Making - Estimation of Demand and Function - Demand Forecasting - Quantitative and Qualitative Techniques.

MODULE III PRODUCTION ANALYSIS 10

Production Function - returns of Factors - Production Decision - Isoquant-Isocost - Production Possibility - Expansion Path - Optimum Product Mix of Multy-Product Firm - C.S. Function.

MODULE IV COST, REVENUE AND PROFIT ANALYSIS 05

Cost Theories - Applications and Types of Costs - Derivation of Cost Functions - Revenue - Concepts- Functions - Break Even Analysis - Economics Scale vs. Economics of Scope. Profit Maximization- Vs Sales Maximization- Accounting Profit Vs. Economic Profit - theories of Firm.

MODULE V MARKET STRUCTURE AND PRODUCT PRICING xx

Features - Output - Princing Decisions in Different Markets- Equilibrium of Firm and Industry - Monopoly Power- Welfare Triangle - Pricing and Output Decisions- Differentiate Pricing - Mark up Pricing - government Ingtervention and Pricing.

TOTAL HOURS : 40

REFERENCES:

1. Rangarajan - Principles of Macro Economics

2. P.L. Mehta - Managerial Economics
3. Joel Dean - Managerial Economics
4. Stephen Robbins and Timothy Judge- Organisational Behaviour
5. Fired Luthana - Organisational Behaviour

OUTCOMES:

The student will have a grasp over functional economics in any business establishments with the above in-puts.

BLC 2202	JURISPRUDENCE	L	T	P	C
		4	1	0	5

OBJECTIVES:

Jurisprudence is the study of Law of the Law. Its philosophy and science. It clarifies legal concepts and concerns. Different Schools of Law and their relevance in the contemporary legal world.

MODULE I NATURE, DEFINITION AND SCHOOLS OF JURISPRUDENCE **12**

Nature and definition of jurisprudence – Analytical positivism, Natural law school, Historical school, Sociological school – Economic interpretation of law, Indian jurisprudence – Concept of dharma, PIL, social justice and compensatory jurisprudence.

MODULE I NATURE AND PURPOSE OF LAW **12**

Nature and definition of law, constitutional law and international law and their nature. Justice, critical studies, feminist jurisprudence and Art 142 of Constitution – The administration of justice.

MODULE III SOURCES OF LAW **12**

Legislation – Nature of legislation – Supreme and subordinate legislation – Relation of legislation to other sources, codification and the interpretation of enacted law. Precedent – The authority of precedents – Circumstances destroying or weakening the binding force of precedent, the hierarchy of authority – Ratio decidendi and judicial reasoning. Custom: Kinds of custom, conventional custom, local custom, custom and prescription – The general custom

MODULE IV LEGAL CONCEPTS I **12**

Legal Rights and Duties – Right – Duty correlation – Persons – Nature of personality – Status of unborn, Minor, Llunatic, Drunken and Dead persons – Corporate Personality Possession and Ownership

MODULE V LEGAL CONCEPTS II 12

Title, Property, Liability, Obligation and the Procedure Law.

TOTAL HOURS : 60

TEXT BOOKS:

. 1. Salmond - Jurisprudence
2. Paton - Jurisprudence
3. H.L.A. Hart - Concept of law
4. Dias - Jurisprudence
5. Bodenheimer - Jurisprudence
6. V.D.Mahajan - Jurisprudence
7. Tripathi - Jurisprudence

OUTCOMES:

Student will get clarity on the concepts and concerns of Law and its philosophy. It demystifies certain notions and inculcates scientific legal attitude.

BLC 2203 FAMILY LAW – II L T P C
4 1 0 5

OBJECTIVES:

The main objective of this course is to make the students to indentify and understand the scheme of succession under the Hindu, Muslim and Christian Laws. Further, with reference to un- codified Hindu Law, the matters relating to Joint Family System, Coparcenaries,, Karta and his powers, partition and the Hindu Religions Endowments are given in the syllabus for understanding the changes effected after the passing of the Hindu Succession Act, 1956 and other related laws. Under Muslim Law the matters relating to wakfs, wills, Gifts and pre-Emption are given in separate chapters in addition to the Sunni and Shia Law of Inheritance. With reference to Christian Law, a Part of the Indian succession Act, 1925 relating to Law of Wills and the Christian Law of Inheritance are given in separate chapters.

MODULE I JOINT HINDU FAMILY 12

Institution of joint family – Coparcenary system – Classification of properties – Karta – Status, powers and duties – Principle of survivorship and succession – Partition.

MODULE I INTESTATE SUCCESSION 12

General principles of succession under Hindu Law, Muslim Law and Christian Law – Statutory conditions of disinheritance and disentitlement – Comparative analysis of right to property of women under different Religious and Statutory law. Dwelling house and Right of Pre-emption.

MODULE III TESTAMENTARY SUCCESSION 12

Testamentary succession under Hindu, Muslim and Christian Law – Limitation to testamentation under various religious and statutory law – Will and administration of will – Codicil – Lapse,
– Probate, letters of administration and succession certificate.

MODULE IV GIFT UNDER ISLAMIC LAW 12

Hiba – Nature and characteristics of Hiba – Subject matter of Hiba – Hiba-biliwaz, Hiba-ba-shart-ul-iwaz – Revocation of gift.

MODULE V RELIGIOUS ENDOWMENTS AND WAKF 12

Hindu religious endowments – Wakf – Meaning – Formalities of creation –

Types and administration of wakf – Mutawalli and his powers – Muslim religious institutions and offices.

TOTAL HOURS : 60

REFERENCES:

Acts:

1. The Hindu Succession Act, 1956 with recent amendments
2. Indian Succession Act, 1925
3. The Hindu Women's Right to Property Act, 1937
    a. The Wakf Acts.

Books:

1. Mulla - Principels Hindu Law
2. N.R. Raghavachari - Hindu Law
3. D.H. Chaudhari - The Hindu Succession Act, 1956
4. Fyzee - Outlines of Mahomedan Law
5. Dr. Paras Diwan - Family Law
6. Prof. G.C.V. Subba Rao - Family Law in India
7. Paruck - Indian succession Act
8. R. Swaroop - Hindu Law of Succession
9. Poonam Pradhan Saxera - Family Law Lectures Family Law II

OUTCOMES:

The student will have idea on issues relating to succession among Hindus, Muslims and Christians etc. He knows the Law that governs religious endowments and Wakfs.

BLC 2204	CONSTITUTIONAL LAW II	L	T	P	C
		4	1	0	5

OBJECTIVES:

The very objective of this course is to introduce, explain and enlighten the student on the matters relating to Constitutional governance in India. Union government, State governments and their relations, Powers and Functions of Constitutional Bodies will be discussed.

MODULE I OFFICE OF THE PRESIDENT AND OFFICE OF THE GOVERNOR 10

The Union Executive - The President – Election, Term of Office, Powers and functions, Impeachment – Immunities – Pardoning power - Ordinance making power - President and Union Council of Ministers-The State Executive - Governor – Appointment, Powers and functions - Immunities – Pardoning power – Removal of Governor, Doctrine of Pleasure - State Council of Ministers

MODULE II PARLIAMENT AND STATE LEGISLATURES 10

Composition of Parliament and State legislatures – Office of the Speaker – Qualification/Disqualification of Members - Legislative Procedures, Legislative Privileges – Judicial interpretations – Anti Defection law, X Schedule Union Judiciary-Supreme Court of India (Articles 124-147) – Composition, Appointment and Removal of Judges of Supreme Court - Writ Jurisdiction of Supreme Court under Art 32 - Appellate Jurisdiction of Supreme Court – Civil, Criminal and in other Matters - Statutory Appeals and Enlargement of Jurisdiction - Special Leave to Appeal (Art. 136) - Power of Review (Art. 137) - Advisory Jurisdiction (Art. 143) - Public Interest Litigation – Compensatory Jurisprudence - Independence of Judiciary - Tribunals
State Judiciary -High Courts in the States - Composition, Appointment and Removal of Judges - Writ Jurisdiction of High Courts under Art. 226.

MODULE III DIVISION OF POWERS 10

Distribution of Legislative Powers - Doctrine of Territorial Nexus - Subject matter of laws made by Parliament and Legislatures of States - Doctrine of Harmonious Construction - Doctrine of Pith and Substance – Doctrine of Occupied Field- Colourable Legislation - Parliament’s Power to Legislate in State List – Implied and Residuary Power - Doctrine of Repugnancy.

Administrative relations – Full faith and credit clause – Centre and inter-state conflict management Fiscal Relations – Sharing of tax – Grants-in-Aid – Restriction on the power of state legislatures – Doctrine of immunity of Instrumentality – Borrowing powers – Constitutional Limitations Freedom of Trade, Commerce and Intercourse (Art. 301-307) - Meaning of Freedom of trade, commerce and intercourse - Power of Parliament – Restrictions.

MODULE IV EMERGENCY 10

Emergency Provisions- National Emergency - Duty of the Union to protect the States against external aggression and internal disturbance - Power of Union Executive to issue directions and the effect of non- compliance.

State Emergency - Imposition of President's Rule in States – Grounds, Limitations, Parliamentary Control, Judicial Review (Articles 356-357) –

Financial Emergency (Article 360)

Emergency and suspension of fundamental rights

MODULE V CONSTITUTIONAL BODIES 10

Organisation, powers and function of Election Commission of India, Union Public Service Commission, State Public Commission, Comptroller and Auditor General, Attorney General & Advocate General– Constitutional safeguards for Civil Servants Art 311 - Protection against arbitrary dismissal, removal, or reduction in rank – Exceptions to Art 311 – Role of Finance Commission – Planning Commission- Niti Ayog – Inter- state Council – National Development Council – Local Self Government (Panchayat Raj)

TOTAL HOURS : 40

REFERENCES:

1. M. P. Jain- Indian Constitutional Law – Relevant Volumes
2. D.D.Basu, Shorter Constitution of India,
3. Virendra Grover, Centre – State Relations.
4. M.P.Singh(ed.), V.N.Shukla, Constitutional Law of India
5. Granville Austin, Working a Democratic Constitution - A History of the Indian Experience (1999)
6. Constitutent Assembly Debates Vol. 1 to 12 (1989)
7. M.V.V. Ramana, Inter-State River Water Disputes in India
8. Anirudh Prasad, Centre-State Relations in India

9. Reports of the Sarkaria, M.M.Punchi, Santhanam Commisssion on Centre-State Relations
10. H.M.Seervai, Constitution of India, Vol.1-3(1992), Tripathi, Bombay
11. Palanithurai , G. Dynamics of New Panchayati Raj Systems In India Vol. I & II
12. D. N. Banerjee, Some Aspects of the Indian Constitution
13. G. Austin, Indian Constitution: Cornerstone of a Nation (1972).
14. S.C.Kashyap, Parliamentary Procedure Law Privilege Practice & Precedents
15. Dr. V. N. Shukla – Constitution of India
16. N.A.Subramaniam – Case law on the Indian Constitution
17. T. K. Tope – Constitutional Law
18. D.J. De – The Constitution of India Vol. I and II
19. Administrative Reforms Committee Vol I and II
20. Report of the National Commission to Review the Working of the Constitution (NCRWC) (2002)

OUTCOMES:

Student will learn the scheme of Constitutional Frame-work- in respect of President, PM- Governors-State Governments- Emergency Provisions- Center - State Relations- Powers and Functions of Constitutional Bodies.

BLC 2206	COST AND MANAGEMENT ACCOUNTING	L	T	P	C
		4	1	0	5

OBJECTIVES:

Cost Accounting is an important management function to take appropriate decisions. Accurate cost of goods and services and control of cost are 'necessary in-puts' in essential to increase the profit earning capacity of the firm as well as to keep the reputation of the firm. This will help in preparation of budget and to exercise budgetary controls.

MODULE I COST ACCOUNTING 10

Definition, Meaning and Objectives- Distinction between Cost and Financial Accounting- elements of Cost and Preparation of Cost sheets and Tender- Management - Definition and Objectives - Distinction between Management and Financial Accounting.

MODULE II MATERIALS 10

Stores Records - Purchase Order - Goods Received - Note - Bin Card - Store Ledger - Purchase, Receipt and Inspection - Inventory Control - ABC Analysis - Economic Ordering Quantity - Maximum, Minimum and Reordering Levels- Methods of Pricing.

MODULE III LABOUR 10

Importance of Labour Cost Control - Various methods of Wage Payment - Calculation of Wages - Methods of Incentives for Schemes.

MODULE IV OVERHEADS 10

Factory, Administration, Selling and Distribution of Overheads- Classification- Allocation and Apportionment - Redistribution (Secondary Distribution) Absorption of Overheads including Machine Hour Rate.

MODULE V MARGINAL COSTING 10

The concept - Break-Even Analysis - Break-Even Chart- Importance and Assumptions - Application of Profit Volume Ratio- Different Types of Problems (Special Emphasis on decision making problems) Budget, Budgetary Control; Procedure and Utility - Preparation of different types of Budget including flexible Budget.

TOTAL HOURS : 50

REFERENCES

1. Jain S.P. and Narang K.L. - Cost Accounting
2. T.S.Reddy and Y. Hariprasada Reddy - Cost Accounting
3. N.K. Prasad andV.K. Prasad - Cost Accounting
4. Saxena and Vashist - Cost Accounting
5. Wheldon A.J. cost Accounting and Costing Methods
6. Iyengar S.P. Cost Accounting : Principles and Practice
7. Khanna B.S. Pandy I.M. Ahuja G.K. and Arora M.N. - Practical Costing
8. Hansen/Mewen - Cost Management Accounting and Control.

OUTCOMES:

The student will learn about the concept of costing and its significance in management decisions. Basic concepts will help them to understand pricing and profit making etc.

SEMESTER V

BLC 3101 PUBLIC INTERNATINAL LAW L T P C

4 1 0 5

OBJECTIVES:

International Law regulates the relations between and among States. The object is this course is that the student should understand the nature and scope of IL and its ever increasing significance. Student will learn about UNO - International treaties- Law of the Sea-Space-Refugee Law. It also looks into State as a subject and Individual as a subject of IL.

MODULE I NATURE AND SCOPE 10

International Law – Definition, Basis and Nature – Codification – International Law Commission – Sources of International Law – Relationship between International Law & Municipal Law – Theories and State Practice.

MODULE II STATE AND INDIVIDUAL AS A SUBJECT OF IL 10

State and Individual as a subject – Rights and Duties / Responsibilities – State Recognition – Theories – Kinds and legal effects – Nationality – Acquisition and loss related issues – Extradition Asylum - Territorial Sovereignty – Modes of acquisition and loss of territory – State Jurisdiction – State Succession and liability.

MODULE III LAW OF THE SEA- AIR AND SPACE 10

Law of the Sea - Air & Space Law; Diplomatic Law – Agents Consulars, Immunities and Privileges – Refugee Law.

MODULE IV FORMATION OF TREATIES AND OBSERVANCE 10

Concept - Definition of International Treaties – Formation of Treaties and its stages – Reservation, observance of Treaties, Interpretation of Treaties – Suspension and Termination of Treaties.

MODULE V UNITED NATIONS ORGZANISATION ITS FRAMEWORK. 10

Origin, Nature & Scope of International Organizations – League of Nations, United Nations and its organs – International Tribunals.

TOTAL HOURS : 40

REFERENCES:

1. Starke – International Law
2. S.K. Kapoor – International Law
3. K.K. Bhattachary – International Law
4. Agarwal – International Law
5. Oppenheim – International Law
6. Brierly - International Law
7. Schewrenberger - International Law
8. Salient Documents in International Law – R.P. Anand
9. Antonio Cassese – International Law
10. Ian Brownlie - International Law
11. R.P. Anand – New States in International Law
12. D.J. Haris – Cases Materials in International Law
13. Commentary on the Statute of ICJ – Andreas Zimmermann
14. Malcom N. Shah – An introduction to International Law.

OUTCOMES:

The student will learn about different facets of International Law and its frame-work in this course. He will also understand the UN Mechanism and how it works.

BLC 3102 **COMPANY LAW** **L T P C**
4 1 0 5

OBJECTIVES:

Corporate Governance plays an significant role in Commerce, Business and Management Studies. The object of this course is to help the students to understand the structure of a Corporate Organisation. To comprehend the legal aspects pertaining to forming, administrating and winding of a company.

MODULE I **INTRODUCTION, DEFINITION &TYPES OF COMPANIES** **10**

Corporate personality, the Companies Act 1956 as repealed by Companies Act 2013, Definition of Company, Types of Association, Illegal association, Classes of company, One Person Company.

MODULE II **FORMATION OF A COMPANY** **10**

Formation of a company – Promoters, Registration, Incorporation, Memorandum of Association Articles of association, Prospectus &Deposits, Application and Allotment of shares.

MODULE III **SHARES AND DIVIDENDS** **10**

Shares – Application and allotment of shares- members and shareholders ,shares and share capital- debentures, charges and debenture holder, dividends, borrowings, lending, investments, contracts.

MODULE IV **DIRECTORS AND BOARD** **10**

Directors- Independent Directors, Women directors and Managerial Personnel, Meetings, Accounts and Audit- Internal Auditing, National financial Reporting Authority, E- Filing and Information Technology Act 2000, Corporate Social Responsibility, Majority shareholders powers and minority share holders rights, Prevention of Oppression and Mismanagement, Investigation, Powers of Inspectors, Powers of NCLT, Insider
trading.

MODULE V **WINDING UP OF A COMPANY -** **10**

Compromises, arrangements and amalgamations – mergers and acquisitions, Winding up and kinds of winding up- Administration of NCLT and CLAT and special courts - powers of liquidators removal of names of companies from register of

companies, Defunct companies and restoration, revival and rehabilitation of sick companies.

TOTAL HOURS : 40

REFERENCES:

1. Gower :Company Law
2. Mayson,French&Ryamn :Company Law
3. Palmer : Company Law
4. Avatar Singh : Company Law

OUTCOMES:

Students will learn about the formation, administration and winding up of a Company as a legal person thereby he will have a basic idea on corporate governance.

BLC 3103	HUMAN RIGHT	L	T	P	C
		4	1	0	5

OBJECTIVES:

The objective of the course is to introduce the Human Rights Law and facilitate to understand the working of both national and international Human Rights Law. The student will be introduced a theories of Human Rights and its practice.

MODULE I EVOLUTION OF HUMAN RIGHTS 10

General – Origin and development –– The MagnaCarta – Bill of Right – Petition of Right – American Revolution – The French Revolution – Opposition to the concept of natural rights –

United Nations Charter based institutions – Centre for Human Rights – United Nations Universal Declaration of Human Rights - specialized agencies – Origin and preparation of international bill of human rights – Adoption of the International Covenants on Human Rights and Protocols thereto – Universal Declaration of human rights – International covenant on economic, social and cultural rights –

International covenant on civil and political rights – Instrumentality of enforcement of the covenants.

MODULE II HUMAN RIGHTS- FUNDAMENTAL RIGHTS 15

A. The right to life, liberty and security of person – Provision of the United Nations Instruments – Right to life does not include right to die –Meaning and content of personal liberty in Article 21 – Second option protocol to the International Covenant on Civil and Political Rights –Problems of extra – legal execution –

   Abolition of slavery and slavery-like practice – Abolition of certain types forced or compulsory – Provisions of the United Nations instruments – ILO Forced Labour Convention 1930 and 1957 – Exploitation of Children: Article 24 of the Constitution.

B. Protection against torture and other forms of cruelty Inhuman or degrading treatment or punishment – Constitution of the committee against torture – Protection of prisoners in India.

C. Protection against arbitrary arrest and detention – provisions of international human rights instruments – Indian Constitution – Right to be produced before

a Magistrate within 24 hours of his arrest – Right not to be detained beyond twenty four hours without the authority of Magistrate Preventive detention – Communication of the grounds of detention – Detenu's right of representation – Subjective satisfaction of the detaining authority.

D. Freedom of thought, Conscience and Religion or Belief-Provisions of the United Nations instruments – Conscientious objection to military service Conscientious objection to military of police service which were used to enforce apartheid – Elimination of intolerance and discrimination based on religion or belief – Freedom to manage religious affairs.

E. Freedom of association including trade union rights – The International Covenant on Civil and Political Rights –CRC Provisions of ILO instruments – Scope of right to form association – Freedom to form association vis-a-vis armed forces and police-reasonable restrictions.

F. Human rights in the administration of justice – United Nations standards and norms-Strategies for effective implementations – Guidelines on the role of prosecutions – Declaration of basis principles of justice for victims of crime and abuse of power – Equality before the law and equal protection of laws – Prohibition of discrimination on certain grounds – Equal pay for equal work – Enabling provisions for weaker section of the society

Special provisions, for women and children – Special provisions for advancement of socially and educationally backward classes and Scheduled Caste and Scheduled Tribes.

MODULE III **INTERNATIONAL LABOUR ORGANISATION (ILO)** **10**

A. Right to work – Provisions on ILO instruments – International covenants The declaration of elimination of discrimination against women.

B. Right to education – UNESCO – Conventions – Educational rights of women and children.

C. Right to culture – Declaration of the principles of cultural co-operation – UNESCO recommendations.

MODULE IV **WOMEN, MINORITIES, DISABLED PERSONS** **15**

A. Rights of women – Objective equality – UN development fund of women

– World conferences on women – Nairobi strategy.

B. Rights of the Child – 1959 declaration – UN Children's Fund – UNICEF Convention of right of the child – Right against exploitation – 1990 declaration.

C. Rights of the disabled persons – Mentally retarded persons – Aged persons etc.

D. Rights of minorities – National, ethnic, religious, linguistic etc.,

E. Human rights Act, 1993 – National Human Rights Commission – India – Powers and functions

MODULE V HUMANITARIAN LAW 15

Origin and development of International Humanitarian Law – Geneva Conventions – Defenseless person, wounded, sick, medical personnel etc., - Repatriation – Prisoners of war – International armed conflicts – obstacles. Origin and development – Rights, Responsibilities of Refugees – Juridical status – UNRWA and UNHCR – Legal status of refugees in India

TOTAL HOURS : 60

REFERENCES:

1. Cransten – Human Rights toda
2. Galius Esejoifer – Protection of human rights under the law
3. John Locke – Civil Government
4. Richte – Natural rights
5. Raphael D.D., Macmillan – Human Rights Old and New
6. R. Dworkin – Taking rights seriously
7. Dr. U. Chandra – Human Rights, Allahabad Law Agency
8. Paras Diwan – Human Rights and Law

OUTCOMES:

The student will learn about the evaluation, frame work of Human Rights Law at Global level in general and in Indian context in particular both in theory and practice.

BLC 3104 FINANCIAL MANAGEMENT L T P C
4 1 0 5

OBJECTIVES:

This course is all about financial management that includes capital structure - debts and equity proportion. This will help the student to calculate cost of capital and determine divided and various dividend models. Calculation of working capital requirement and forecasting the requirement.

MODULE I INTRODUCTION 10

Meaning, Objectives and Importance of Finance - Sources of Finance- Functions of Financial Management- Role of Financial Manager in Financial Management.

MODULE II CAPITAL 10

Capital Structures Planning - Factors Affecting Capital Structures- Determining Debt and Equity Proportion - Theories of Capital Structures - Leverage Concept.

MODULE III CAPITAL STRUCTURE 10

Cost of Capital- Cost of Equity - Cost of Preference Capital - Cost of Debt - Cost of Retained Earnings - Weighted Average or Composite Cost of Capital (WACC)

MODULE IV DIVIDEND 10

Dividend Policies- Factors Affecting Dividend Payment - Company Laaw Provision on Dividend Payment - Various Dividend Models (Walter's Gordon's - M.M. Hypothesis)

MODULE V WORKING CAPITAL 10

Working Capital- Components of Working Capital- working Capital Operating Cycle - factors Influencing Working Capital - Determining (or) Forecasting of Working Capital Requirements.

TOTAL HOURS : 50

REFERENCES:

1. I.M. Pandey, Financial Management
2. S.N.Maheswari - finacial Management
3. Dr. Radha - Financial Management
4. Dr. N. Premavathy - financial Management

5. Prasanna Chandra - financial Management
6. Y.Khan and Jain - Financial Management

OUTCOMES:

The student will learn about financial management, capital structures, dividend and related aspects through this course, which is essence of any business activity.

BLC 3105 PRACTICAL AUDITING

L	T	P	C
4	1	0	5

OBJECTIVES:

Auditing as a separate and distinct branch of study, involves critical and intelligent examination of financial 'health' of any business/corporate establishment. The process of Auditing is a safeguard against mal (mis)-functioning of any firm. the object of this course, student is expected to know about the process-method-analysis-of auditing to know, understand, improve and develop business operations.

MODULE I INTRODUCTION 10

Meaning-Definition of Auditing. Distinction between Auditing and Accounting.- Objectives - Advantages and Limitations of Audit - Scope of Audit- Classifications of Audit - Audit Planning, Meaning - Audit Programme, - Meaning Objectives and Contents- Audit Note Book, contents, Usefulness of Audit Note Book, Audit Working Papers, Meaning. Ownership and Custody- test Checking and routine Checking, Meaning - Internal Control, Meaning Definition, Objectives, Technique for Evaluation of Internal control System - Internal Check, Meaning, Objectives, Difference Between Internal Control, Internal Check and Internal Audit.

MODULE II PROCESS IN AUDITING 10

Vouching, Meaning and Definitions, Objectives- Trading Transactions - Audit of Ledger- Scrutinizing of Ledgers- Vouching of Cash Receipts and Payments - Vouching of Outstanding Assets and Liability - Verification, Meaning objectives and Process - valuation of Assets and Liabilities - Distinction between Verification and Valuation.

MODULE III DEPRECIATION 10

Depreciation and Reserves - Meaning - Auditor's Duty with regard to Depreciation - reserves and Provisions - Distinguish Reserves and Provision - Depreciation of Wasting Assets.

MODULE IV AUDITOR 10

Appointment of Auditors- Appointment of First Auditor - Appointment by Central Government - Filling of Casual Vacancy - Appointment by special Resolution- Reappoingtment and Compulsory Re-Appointment- Ceiling on the number of Auditors - removal of Auditor - Remuneration - Auditors Lien - qualification and

Disqualification - duties of the Company Auditor - Rights and Powers of Auditors - Different Classes of Auditors - Audit Report - Preparation and Presentation.

MODULE V ELECTRONIC DATA PROCESSING (EDP) 10

EDP Audit - Meaning - Division of Auditing in EDP environment - Impact of Computerization on Audit Approach - Online Computer system Audit - types of Online computer Systems - Audit Around with the Computers - Procedure of Audit under EDP System.

TOTAL HOURS : 40

REFERENCES:

1. B.N. Tandon - Practical Auditing
2. Dr. Radha - Practical Auditing
3. Dr. N. Premavathy- Practical Auditing
4. D.P. Jain - Auditing
5. Ravinder Kumar and Virender Sharma - Auditing Principles and Practice
6. Kamal gupta - Contemporary Auditing

OUTCOMES:

The student will learn the basics of Auditing, its purpose, statutory norms including EDP system of Auditing.

SEMESTER – VI

BLC 3201	**LAW OF EVIDENCE**	**L**	**T**	**P**	**C**
		4	**1**	**0**	**5**

OBJECTIVES:

Proving /Disproving a case is based on the evidence . In a trial before the Court of Law, relevant evidence has to be placed according to the procedure established under the Indian Evidence Act. The object of this course is to focus on evidentiary value of Evidence in the Administration of Justice.

MODULE I INTRODUCTION 10

Indian Evidence Act, 1872 – scope, object and applicability of Indian evidence act and exclusion – Statutory definition. Indian Law of Evidence and English Law of Evidence – Comparison – Constitutional perspective of Evidence – Golden Rule Evidence, Presumption of Law and fact – Kinds of Evidence.

MODULE II RELEVANCE AND ADMISSIBILITY 10

Relevance of facts and admissibility of facts – Resgestae – Hearsay.Occasion, cause and effect etc., - Motive, preparation and conduct –explanatory facts – Acts of conspirators – When facts not otherwise relevant become relevant – Facts determining quantum of damages – customs – State of mind, body or bodily feeling – Similar facts – Course of business. Admission and confession.

MODULE III EVIDENCE 10

Relevancy of statement made by person who cannot be called as witness. Relevance of Judgments of Courts. Relevance of opinion of third persons – Export Cases. Law of Forensic Science – Forensic Institutions – Principles of Forensic Science proof and Forensic technology – Forensic science and criminal Justice system – Criminal trial, Scientific Examination and Expert witness u/s 112A. Relevance of character in civil and criminal cases.

MODULE IV DIFFERENT TYPES OF 'EVIDENCES' 10

Facts which need not be proved – Judicial notice – Modes of Proof – Oral Evidence – Hearsay evidence – Exceptions – Primary and Secondary evidence – Documentary evidence – Documents – Public and private documents – Presumptions as to the documents – Exclusion of oral evidence by documentary evidence . Burden of proof – Rules relating to burden of proof and Doctrine of Estoppel.

MODULE V FACTS AND PROOFS 10

Facts which need not be proved – Judicial notice – Modes of Proof – Oral Evidence – Hearsay evidence – Exceptions – Primary and Secondary evidence – Documentary evidence – Documents – Public and private documents – Presumptions as to the documents – Exclusion of oral evidence by documentary evidence . Burden of proof – Rules relating to burden of proof and Doctrine of Estoppel.

TOTAL HOURS : 50

REFERENCES:

1. Ratanlal : Law of Evidence
2. Avatar Singh : Law of Evidence
3. Vepa Sarathi : Law of Evidence
4. Dr.V.Krishnamachari : Law of Evidence
5. P.S. Achutan Pillai : Law of Evidence
6. B.R. Swarma : Forensic Science in criminal trial and Investigation
7. Sankar : Law of Evidence (2 Volumes)
8. Sir John Woodroffee and Syed Amir Ali : Law of Evidence (4 Volumes)
9. Walls H.J. : Forensic Science

OUTCOMES:

Evidence is crucial in proving a case or disproving the same. The student will learn about Indian Evidence Act and provisions through this course.

BLC 3202	LABOUR LAW I	L	T	P	C
		4	1	0	5

OBJECTIVES:

Healthy Industrial relation is essential in the progress of the country. As the Labour are venerable for exploitation, successive governments passing various legislations to govern labour management relations to avert industrial disputes and unrest. The course is designed keeping in view of these aspects.

MODULE I EVALUATION OF LABOUR LEGISLATIONS 10

Origin and development of labour legislation - Object and nature of labour legislation - Evolution of concept of master and servant relationship - Theory of Laissez Faire and state regulation of labour legislation and its special features - Role of ILO in setting up Standards.

MODULE II TRADE UNIONS- COLLECTIVE BARGAINING 10

Definitions - History of Trade Union Movement - Registration of Trade Unions - Rights and Liabilities of Trade Unions - Immunities and Privileges of a Registered Trade Union – Trade Union funds - Collective bargaining - Amalgamation and Dissolution of Trade Unions Recognition of Trade Unions.

MODULE III INDUSTRIAL DISPUTES ACT, 1947 10

Scope and applicability and definitions - Appropriate Government; workmen; industry; industrial disputes; award; settlement; Public Utility service; Strike; Lock out; Retrenchment; Lay off; Closure - Machinery for the settlement of industrial disputes – Works Committees, conciliation officers – Board of Conciliation, Court of Inquiry – Labour Court, Industrial Tribunal – National Industrial Tribunal – Reference Power of the Government – Voluntary Arbitration - Unfair labour practices.

MODULE IV INDUSTRIAL EMPLOYMENT(STANDING ORDERS)ACT, 1946 10

Scope and Definitions - Procedure for Certification of Standing Orders - Duration and modification of Certified Standing Orders - Domestic enquiry and disciplinary proceedings.

MODULE V LAW RELATING TO WAGES 10

1. Minimum Wages Act, 1948

Theories of Wages and Wage Policy - Concept of wages - Living wage, Fair wage and

Minimum wage - Fixation of minimum rates of wages - Methodology; procedure;

Advisory Boards - Inspectors, powers, claims - Exceptions and offences

2. Payment of Wages Act, 1936

Definitions - Deductions - Authorities under the Act - Inspectors and their powers - Penalty

TOTAL HOURS : 40

REFERENCES:

1. Industrial Disputes Act, 1947.
2. Trade Union Act, 1926
3. Industrial Employment (Standing Orders) Act, 1946
4. Minimum Wages Act, 1948
5. Payment of Wages Act, 1936.
6. Madhavan Pillai : Labour and Industrial Law
7. S.N. Mishra : Labour and Industrial Law
8. V.G.Goswami : Labour Law
9. O.P. Malhotra : Industrial Disputes Act
10. Srivastsava : Law Relating to Trade Union
11. Srivastsava : Industrial Employment (Standing Orders) Act

Outcomes:

The student will know about various Laws that govern labour management relations, through this course. He will have a fair idea about trade union movement its origin functioning etc.

BLC 3203 ADMINISTRATIVE LAW

L	T	P	C
4	1	0	5

OBJECTIVES:

Today we are living in a 'administrative age' where there is rising tendency to transfer more and more powers to executive which include quasi-judicial as well as quasi-legislative which has become inevitable in modern democratic state. Therefore, there has been a tremendous increase in powers and functions of the administrative authorities and the obvious result is full of danger of its degeneration and unwanted encroachment on human rights and liberties. Hence, there requires adequate control, safeguard through procedural fairness, judicial review and remedies to those affected by the administration. This syllabus has been prescribed with these objectives.

MODULE I INTRODUCTION TO ADMINISTRATIVE LAW 10

1. Definition, Nature, Scope - Origin and Development Sources -Administrative Law and Constitutional Law

2. Rule of Law Concept, Evaluation of Dicey's concept of Rule of Law, Modern conception of Rule of Law, Rule of Law in U.K., U.S.A. and India, Rule of Law vis-à-vis Administrative Law

3. Doctrine of Separation of Powers – Meaning, Origin, Montesquieu's Doctrine of Separation of Powers, System of checks and balances

4. Classification of Administrative Action a. Nature of Powers–Executive, Legislative and Judicial

b. Legislative function–Quasi Legislative functions – Administrative Directions.

c. Judicial function – Quasi Judicial functions – Tribunals and Administrative Justice

d. Executive function – Ministerial functions and discretionary functions.

MODULE II DELEGATED LEGISLATION 10

Meaning, Nature, Origin, Development and causes of growth of delegated legislation, Types of Delegated Legislation and Constitutionality of Delegated Legislation-Delegated Legislation and Conditional Legislation, Sub-Delegation-Restraints on Delegation of Legislative Power, Doctrine of Excessive Delegation-Control over Delegated Legislation – Judicial, Procedural and Legislative Control-Administrative directions and Delegated Legislation

MODULE III PROCEDURAL FAIRNESS AND JUDICIAL REVIEW 10

A. Principles of Natural Justice

Concept, Parameters and application of the Principles of Natural Justice-Rule against Bias-Audi Alteram Partem or the Rule of Fair Hearing – Meaning, Object, Ambit and Ingredients of Fair Hearing, Institutional Decision, Post-Decision Hearing-Reasoned Decisions- Exceptions to the Rule of Natural Justice-Effects of Breach of Natural Justice

B. Administrative Process and Judicial Review

1) Meaning and need for Judicial Review

2) Scope of Judicial Review

Jurisdiction of the Supreme Court -Writ Jurisdiction-Appeal by Special Leave (Art. 136)-Scope and Object of Article 136- Jurisdiction of the High Court

3) Judicial Review of Administrative Action through Writs- cope of the Writ Jurisdiction -Against whom the Writ lies-Territorial extent of Writ Jurisdiction -Relief against an Interim Order – Interim Relief [Art. 226(3)]-*Locus-standi*-Kinds of Writ -Grounds for issue of Writs

4) Principles for the Exercise of Writ Jurisdiction Alternative Remedy-Laches or Dela-*Res Judicata*

5) Public Interest Litigation and *Locus-Standi*

6) Doctrine of Legitimate Expectation and Doctrine of Proportionality

C. Statutory Remedies

a) Injunction- Declaration against the Government - Exclusion of Civil Suits

D. Privileges and Immunities of Government in Legal Proceedings

Privilege to withhold documents - Miscellaneous Privileges of the Government-Notice, Limitation, Enforcement of Court Order- Binding nature of Statutes over the States action-Promissory Estoppel- Right to Information

E. Judicial Control of Administrative Discretion

Meaning, Nature and need of Administrative discretion -Ground and Extent of Judicial Review -Fundamental Rights and Discretionary Powers

F. Liability of the State

Liability of the State in Torts and Contracts.

MODULE IV OMBUDSMAN, LOKPAL, LOKAYUKTA AND CENTRAL VIGILANCE COMMISSION 10

Meaning, Object, Main characteristics, Need and Utility-Origin and development of the Institution -Ombudsman in New Zealand- Ombudsman in England (Parliamentary Commissioner)- Ombudsman in India –Lokpal-Lokayukta in States-Central Vigilance Commission

MODULE V ADMINISTRATIVE TRIBUNALS AND PUBLIC UNDERTAKING **10**

(A) Administrative Tribunals

Meaning, Nature, Main characteristics, Origin and development (U.S.A., U.K. and India)-Franks Committee- Tribunal and Court, Similarity and Difference-Reason for growth of Administrative Tribunals-Merits and Demerits of Administrative Tribunal-Procedure and powers of Administrative Tribunal (U.K., U.S.A. and India)-Tribunal under Constitution -High Court's Superintendence over Tribunals-Appeal to Supreme Court by Special Leave-Working of the Administrative Tribunal Administrative Tribunals under Administrative Tribunals Act, 1985-Administrative Procedure Act in U.S.A.-Domestic Tribunal

(B) Public Undertaking

Object, Importance, Characteristics, Classification, Reason for the growth -working of Public Corporations-Rights, Duties and Liabilities of Public Corporations-Controls over Public Corporations, Government Control, Parliamentary Control, Judicial Control, Public Control-Role of Ombudsman in Public Undertaking

TOTAL HOURS : 60

REFERENCES:

1. M.P. Jain and S.N. Jain – Principles of Administrative Law
2. S.P. Sathe – Administrative Law
3. I.P. Massey – Administrative Law
4. C.K. Takwani – Administrative Law
5. Kailash Rai - Administrative Law
6. Wade – Administrative Law
7. De Smith – Administrative Law
8. Foulkes – Administrative Law
9. Indian Law Institute – Cases and Material of Administrative Law
10. Markose – Judicial Control of Administrative action
11. Griffith and Street – Administrative Law
12. Report of the Law Commission – First Report Second Report –
13. Fourteenth Report

OUTCOMES:

Student will learn how to protect the common man or a little man from administrative excesses. He knows various methods and forums to protect the legal interests of a common man. He knows the methods and techniques to keep the administrative authorities within their limits to ensure Rule of Law and Constitutional Governance.

BLC 3204 PROFESSIONAL ETHICS AND BAR BENCH RELATIONS AND ACCOUNTANCY FOR LAWYERS (CLINICAL COURSE - I)

L	T	P	C
2	1	2	5

OBJECTIVES:

The object of this course is to familiarize the student about ethics to be followed in Legal Profession. Bar and the Bench are equally important in justice dispensing system and certain Do's and Don'ts were prescribed. The student will study as many as 50 selected decisions of the Bar Council of India on professional ethics. The paper is divided into four modules

MODULE I PROJECT ON PROFESSIONAL ETHICS

Student has to write 50 selected decisions of Bar Council of India on the matters relating to Professional Ethics- Disciplinary Proceedings. It is written submission of record. (50 Marks)

MODULE II LECTURE SESSIONS 20

Lecture sessions will be arranged with Practicing Advocates, Senior Advocates and Teaching Faculty on Profession, Ethics, Need and Purpose, Accountancy for Lawyers, and Important decisions of Supreme Court, High Courts and Bar Council of India Disciplinary Proceedings.

MODULE III INTERNAL EXAMINATION

Internal Examination will be held for marks 25 on the subjects discussed

MODULE IV VIVA VOCE EXAMINATION

Viva Voce Examination for 25 marks.

TOTAL HOURS : 20

REFERENCE:

1. Mr. Krishna Murtyiyer - 'Advocacy'
2. Indian Bar Review: Selected Disciplinary Proceedings
3. The Contempt Law And Practice
4. The Bar Council Of India Code Of Ethics.

OUTCOMES:

Student will learn court etiquette, ethics to be observed in profession and consequences of non-observance of professional conduct.

BLC 3206 CUSTOMS AND EXCISE LAWS L T P C
4 1 0 5

OBJECTIVES:

The main source of government revenue is Excise and Customs Duty. The mode of levying, assessing and collection of Tax is the essence of this Course. Now the trade is global and tax matters need to be balanced between the State and the assesses. The whole process is prone to give rise of 'litigation'. It is essential to have basic knowledge about these twin tax laws.

MODULE I INTRODUCTION 10

Constitutional Law Principles - Art. 265 - 286 - Relevant Entries of VII Schedule of the Constitution of India.

MODULE II CUSTOMS ACT - PRELIMINARY 10

Definitions - Officers - Customs Ports, Airports, Warehouses- Regulations- Prohibition on import and export - Prevention and detection of illegal import - Notified goods - Prevention and detention of illegal export - specified goods - Indicating amount of duty in the price of goods- regulations on Conveyances carrying imported and exported goods - Clearance of imported and exported goods - Regulations relating to Warehouses - government or Certified ware houses.

MODULE III CUSTOMS ACT- LEVY AND COLLECTION 10

Dutiable Goods - Valuation of Goods- Exemption Determination - Abatement - Remission - Assessment of Duty-Refund of Duty - Customs Clearance- Recovery of Duty - Advance Rulings - Duty During Transit - Duty Drawback- Special Economic Zones - coastal Goods - Baggage.

MODULE IV CENTRAL EXCISE ACT 10

Basic Concepts - Basic conditions of Liability - Definitions- Levy and Collection of Excise Duty- amount of Duty - valuation of Methods of Excisable Goods - Remission of Duty - Indicating Amount of Duty in the Price of Goods - Power to Grant Exemption from Duty - CENVAT- Credit- Registration - Restriction on Possession of Goods- Presumption Advance Ruling - Assessment od Duty (Rules) special Economic Zone.

MODULE V ENFORCEMENT UNDER CUSTOMS ACT & CENTRAL EXCISE ACT 10

Power of Search , Seizure, Arrest, Confiscation and Penalty under both Acts -

Settlement of Cases- Appeal - Appellate- tribunal - Revision by Central Government - Appeal Supreme Court

TOTAL HOURS : 50

REFERENCES:

Acts:

1. Banerjea and Mukerjea - Central Excise Manual
2. Datey (Taxman) guide to Central Excise Procedures
3. P.L. Malik - Customs Act
4. Kapin Singhania (Taxman) - Customs Tariff in India
5. Sethi - Central Excise Act and rules
6. Kapil Singhania - Central Excise TYariff
7. Bharat's Service Tax Manual
8. Bharat's- guide to GST Regime
9. Mukerjea - Customs Act
10. Customs Manual

OUTCOMES:

Student will learn about two important tax legislations through this course. He will know about the legal mechanism as well as enforcement machinery of these two legislations.

SEMESTER VII

BLC 4201	TRANSFER OF PROPERTY LAW	L	T	P	C
		4	1	0	5

OBJECTIVES:

This course will explain about transfer of immovable properties between living persons. It covers various principles of transfer of property and doctrines for specific transfer. The Easement Act explains various modes of acquisition of easementary rights and its end.

MODULE I GENERAL PRINCIPLES OF TRANSFER 10

Concept of Property- Definition of Transfer of Property - Kinds of Interest - Conditional Transfer - Doctrine of Election - Ostensible Owner- Bonafide purchase- Lis Pendens- fraudulent Transfer - Doctrine of Part Performance and other General Principles of Transfer.

MODULE II SPECIFIC TRANSFERS - TRANSFER OF ABSOLUTE INTEREST 10

Sale: Definition of Sale- rights Liabilities of Seller and Buyer

Gift: Definition of Gift: Definition - Onerous Gift - Universal Donee- Death Bed Gift- Suspension and Revocation of Gift-Exchange:

MODULE III TRANSFER OF LIMITED INTEREST - SPECIFIC TRANSFER 10

Mortgage: Different kinds of Mortgages - Redemption - Clog on Redemption- Partial Redemption- Rights and Liabilities of Mortgagor and Mortgagee including Doctrine of Consolidation - Marshalling - Contribution- Subrogation: Charge: Lease: Different Rights and Liabilities of Lessor and Leasee- Determination of Lease- Doctrine of Holding Over; Actionable Claim

MODULE IV INDIAN EASEMENT ACT 10

Definition - Acquisition of Easement- Easement of Necessity and Quasi Easements - Easement by Prescription - Exinction - suspension and Revival of Easements and License

MODULE V INDIAN REGISTRATION ACT AND STAMP ACT 10

Registration its validity- Consequences of Non- Registration- Procedure to Registration of Transfer of Property- Valuation - Stamp-

TOTAL HOURS : 50

REFERENCES:

1. Vepa P. Saradhi: Law of Transfer of Property Act
2. Shah: Principles of Transfer
3. G.C.V.Subba Rao - Law of Property
4. Mitra B.B. Transfer of Property
5. Goyle - Transfer of Property
6. C.L. Gupta - Law of Transfer of Property
7. Khatiar - Law of Easements

OUTCOMES:

Transfer of immovable property between living persons is often tend to lead to litigation. This student will know the basic law that governs transfer of property between living persons and registration process.

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BLC 4102 INTELLECTUAL PROPERTY LAW

L	T	P	C
4	1	0	5

OBJECTIVES:

The Course intends to introduce different categories of Intellectual Property, the minimum standard to identify the 'issues' of protection. It exposes the student on the procedural requirements for the acquisition of rights under IPR. It may a copy right, patent, Trade Mark or Industrial Design. In case of any violation or infringement of the 'Rights Conferred' under I.P.R, the remedies available to the 'Claimant' will also be studies.

MODULE I INTELLECTUAL PROPERTY 15

Meaning and Concept of Intellectual Property - Need for Protection - The World Intellectual Property Organization (WIPO) Convention - Origin and Functions of World Trade Organization (WTO) -Trade Related Intellectual Property Rights (TRIPS) Agreement of WTO and its effects on Intellectual Property Law in India, Dispute Settlement Mechanism.

MODULE II PATENTS 15

The Patents Act 1970 - Object - Definitions - Salient Features - Patentable and Non-Patentable Inventions. Product Patent, Process Patent-Persons entitled to apply for Patents, Provisional and Complete Specifications, Opposing grant of Patent, Secrecy in certain inventions - Patent Office- Powers of Controller - Grant and Sealing of Patents- Rights of Patentees- Rights of Co-Owners of Patents- Term of Patent- Patents of Addition, Assignment and Transmission- Registrar of Patents- Amendment of Applications and Specificants, Restoration of Lapsed Patents- Rights of Patentees of Lapsed Patents which have been Restored, Surrender and Revocation of Patents- Compulsory Licenses, Exclusive Marketing Rights, Licenses of Right, Acquisition of Inventions by Central Government - Remedies for Infringement of Patents - Patent Agents, Scientific Advisers, International Arrangements - International Law - Rights of Plant Breeders and Farmers- National Law on Biological Diversity.

MODULE III TRADE MARKS 15

The Trade Mark Act (1999), Object, Definition, Salient Features, Marks Registrable and Non- Registrable, Conditions for Registration, Absolute and Relative Grounds for Refusal of Registration, Procedure for, and Duration of Registration. Effects of Registration - Powers and Functions of Registrar -

Distinctiveness, Deceptive Similarity, Concurrent Registration, Rectification and Correction of Registrar, Assignment and Transmission - Use of Trademarks and Registered Users, Collective Marks, Registration of Certification of Marks, Trade Mark Agents- Appellate Board - Infringement Action, Passing Off, - International Treaties - Geographical Indication of Goods(Registration and Protection) Act (1999) Objects, Definitions, Conditions for Registration, Prohibition of Registration of Certain Geographical Indications Procedure for and Duration of Registration - Effects of Registration - Special Provisional Relating to Trademark and Prior Users, Remedies for Infringement, International Law.

MODULE IV COPYRIGHT 10

The Copyright Act, (1957) and Recent Amendments: Works in which Copyright Subsists; Meaning of Copyright; Ownership and Rights of the Owner; assignment; Term of Copyright, Powers and Functions of Copy Right Board- Registration of Copyright; Compulsory Licenses; License to Produce and Publish Translations, Copyright Societies- Rights of Broadcasting Organisations and of Performers - International Copyright - Acts Constituting and not Constituting Infringement; Remedies for Infringement.

MODULE V INDUSTRIAL DESIGNS 05

The Designs Act 2000- Definitions - Registration of Designs - Copyright in Registered Designs - Piracy of Registered Designs - Remedies - Powers and Duties of Controller- International Law - Semi Conductor Integrated Circuit Layout.

TOTAL HOURS : 60

REFERENCES:

Acts:

1. The Patent Act, 1970, The Trade Marks Act, 1999, The Copyright Act,1957, The Designs Act, 2000
2. Dr. S.R. Myneni - Law of Intellectual Property
3. P.Narayana - Intellectual Property Law in India
4. Dr.B.L. Wadehra - Law relating to Patents, Trademarks, Copyright, Design and Geographical Indications.
5. Vikas Vashisht - Law and practice of Intellectual Property in India
6. W.R. Cornish - Cases and Materials on Intellectual Property

7. Allison Comkeman- The Legal Proction of Trade Secrets
8. David I. Bainbridge - Intellectual Property
9. Arad Sherman and Lionel Bently - the Making of Modern Intellectual Property Law

OUTCOMES:

Student will get an idea of IPR legal frame-work in respect of Patents, Trademarks, Copyright and Industrial Designs- Practices and Procedures in filling. Remedies available in case of any violation/ infringement

BLC 4103 LABOUR LAW II

L	T	P	C
4	1	0	5

OBJECTIVES:

Concept of Social Security is based on ideals of human dignity and social justice. The quest for Social security and freedom from want and distress has been the consistent urge of man through ages. Social Security is part of social justice. The core objective of this course is to explain various Social Security and Welfare Legislations in India.

MODULE I SOCIAL SECURITY AND LABOUR WELFARE 10

Concept- Evolution and Constituents of Social Security - Object of social Security Laws - Social security and Constitution of India- ILO on Social security

MODULE II SOCIAL SECURITY : INDUSTRIAL INJURIES 10

The Employees' Compensation Act, 1923 - Scope and Objects- coverage and Definitions - Liability of the Employer to Pay compensation - Personal Injurty, Accident arising out of and in the course of employment, Doctrine of Notional Extension and Occupational Diseases - Determination and Distribution of Compensation - Principle employer's Right of Indemnity- commissioner's Powers and Functions.

MODULE III SOCIAL SECURITY 10

The Employee's state Insurance Act, 1948: Objects, application and 'seasonal Facgtory' Definition - E.S.I. Corporation - E.S.I. Funds - Payment of Contributions - ESI Benefits - Adjudication of Disputes - ESI Court - Penalties.

MODULE IV OTHER SOCIAL SECURITY LEGISLATIONS 10

The Maternity Benefits Act, 1961; Object and Application - Eligibility and Maternity Benefits - Notice of Claim Prohibition against Dismissal, wage Deduction - Powers and Duties of Inspectors

Employees Provident Funds and Miscellaneous Provisions Act, 1952; Scope, Coverage, Application and Definitions - Authorities, their Powers and Functions Contributions - employees Provident Fund Scheme. Employees' Pension Scheme and Deposit Linked Insurance Scheme - Penalties.

Payment of Bonus Act 1965:

Bonus Commission - Definitions and Coverage - Kinds of Bonus- Calculation of Bonus- Available Surplus, allocable Surplus, Set on and set Off- Forfeiture of

Bonus- Prior Charges- Machinery

Payment of Gratuity Act, 1972: background, Object and definitons - Eligibility for Payment of gratuity- Forfeiture, Exemption, Determination- Controlling Authority- Penalties.

MODULE V LABOUR WELFARE LEGISLATIONS 50

Factories Act, 1948: Background and Definitions - Formalities to start a Factory - Health, Safety and Welfare Measures- Working Hours - Employment of Young Persons - Annual Leave with Wages - Special Provisions.

The Tamilnadu Shops and Establishment Act, 1947: Applicability and Persons covered by this Act- Opening and Closing Hours, Employment of Young Persons- working Hours- Public Holidays- Safety- and Cleanliness - Leave and Annual Leave with Wages.

TOTAL HOURS : 50

REFERENCES:

1. S.N. Mishra - Labour and Industrial Laws
2. V.G. Goswami - Labour Law
3. Madhavan Pillai - Labour and Industrial Law
4. S.C. Srivastava - Social Security and Labour Laws
5. K.D. Srivastava - The Employees' Compensation Act,1923 and The Employees' Provident Funds and Miscellaneous Provision Act,1961, The Payment of Bonus Act,1965, Payment of Gratuity, 1972, Factories Act,1948.

OUTCOMES:

The student will learn about various legislations that govern Social Security aspects of Industrial workers.

BLC 4104 LAW OF BANKING L T P C
4 1 0 5

OBJECTIVES:

Focus of this course will be on 'Banking' its regulation through legislations. In the era of Globalisation the Banking Sector registered a tremendous growth along with a host of problems. Student will learn about RBI regulations. Recent changes in NI Act etc.

MODULE I INTRODUCTION 10

History of Banking – Different types of Banks including foreign companies – Nationalisation of major banks.

RBI's control over commercial banks – Special status of RBI and State Bank of India – Subsidiary Banks.

MODULE II LEGAL CONCEPTS OF BANKER VS CUSTOMER 10

Definition of Banker & Customer and relationship between them – Special types of customer – Banker as Borrower – Different types of accounts – Duties and rights of the Bankerand different types of instruments – Banker – Paying Banker and Collecting Banker.

MODULE III BANKING AND RELATED ACTIVITIES 10

Subsidiary business operations of bankers with special reference to Safety Deposit Lockers – Liability of Banker in case of bank robberies and fraud by bank employees – Vicarious liability of the bank employees – Vicarious liability of the bank – Recovery of loans and advances – Recovery of debts due to banks, Financial Institutions Act, 1993.

MODULE IV BANKERS OMBUDSMAN AND DRT 10

Effect of winding up of Banking Companies – Rights of customers on winding up of companies – Necessity for reforms in Indian Banking Law to meet global challenges – Banking ombudsman – Debt Recovery Tribunal – SARFAI Act.

MODULE V NI ACT AND ITS RECENT AMENDMENTS 10

Definition and characteristics – Parties to negotiable instruments – Presentation – Negotiation

discharge and dishonour – Liability – Various kinds of crossing – effect of crossing of cheque –Rights of holder and holder in due course against Banker – Civil and criminal liability for dishonour of cheques under Section 138 to Section 142 of the

Amended Negotiable Instruments
Act.

TOTAL HOURS : 50

REFERENCE:

1. Tannan's – Banking law and Practice in India (India Law House, New Delhi)
2. Bhashyan & Adiga – Negotiable Instruments (Bharat Law House Pvt. Ltd., New Delhi.)
3. Sir John Paget - Law of Banking
4. H.P. Sheldon - The Practice and Law of Banking

OUTCOMES:

Through this course, the student will learn about the law that governs banking activities.

BLC 4105 ALATERNATIVE DISPUTE RESOLUTION MECHANISM (Clinical Course II)

L	T	P	C
2	1	2	5

OBJECTIVES:

This course offers an opportunity to know the mechanism to settle the legal issues through alternative methods like Arbitration, Negotiation and Conciliation. Students is expected to acquire certain skills in this regard. Course is designed to simulate the student mind.

MODULE I ARBITRATION **15**

Case Study in Arbitration Center (Practical/Simulation Exercise)
(Three exercises 10 marks each; 30 marks

MODULE II VIVA VOCE/ PRESENTATION OF CASES OBSERVED **10**

The student has to present the cases he observed- and he has to face viva-voce on case studies (10 marks)

MODULE III INTERNAL EXAMINATION ON THE SUBJECT **10**

Internal Examination will be held on ADR. (it is for 10 marks)

SUBMISSION OF RECORD ON ADR- ON INTERNATIONAL ARBITRATION- ARBITRATION ACT- RULES ETC. (50 MARKS) **10**

TOTAL HOURS : 50

REFERENCES:

1. O.P. Malhotra and Indu Malhotra - Arbitration to Conciliation
2. P.C.Markanda - Law Relating to Arbitration and Conciliation
3. Justice Dr. B.P. Saraf and Justice S.M. Jhunjhunwala - Law of Arbitration and Conciliation.
4. S.K. Chawla - Law of Arbitration and Conciliation

SEMESTER VIII

BLC 4201	**COMPETITION LAW**	**L**	**T**	**P**	**C**
		4	**1**	**0**	**5**

OBJECTIVES:

Competition Commission of India came into existence replacing Monopolies Restrictive Trade Practices Commission. The objective of the course is to ensure the student should know the legal dimensions of Competition Law and functions of Competitive Commission of India that ensures fair trade practices and facilitates healthy competition in the business arena. Student will know about Anti-Competition Policies.

MODULE I INTRODUCTION 15

Objective and Nature of Competition Laws- Origin of Competition Laws- Anti Trust Legislation in USA. UK Competition Act, 1998- MRPTAct,1969- Raghavan Committee Report 2000,Competation Act-2002, Distinction between Competition Act Vs MRTP Act, Object and Scope of Competition Act,2002.

MODULE II ANTI COMPETITIVE AGREEMENTS 10

Definition - Tie in Arrangement - Exclusive Supply Agreement - Exclusive Distribution Agreement - Refusal to Deal - Resale Price Maintenance - Cartel - Bid rigging Exceptions - Protection of IPR.

MODULE III ABUSE OF DOMINANT POSITION 10

Meaning of Dominant position - Unfair or Discriminatory trade Practices - Provisions under MRTP and Consumer Protection Act - Limiting Protection or Technical or Scientific Supplementary Obligations- Protection of other Markets - Predatory Price - Unfair Prices.

MODULE IV REGULATION OF COMBINATIONS 10

Acquisition - Merger - Amalgamations - Ban on Combinations - Non Competition Clauses in Merger and Acquisition - Restrictive Trade Practices - Unfair Trade Practices.

MODULE V COMPETITION COMMISSION OF INDIA 10

Composition - Duties, Power and Functions of the Commission - Contraventions of the Orders of the Commission - Penalties- Competition Appellate Tribunal- Competition Advocacy - Miscellaneous. Important guidelines and cases decided

by Competition Commission of India.

TOTAL HOURS : 55

REFERENCES:

Acts:

1. MRTP Act, 1969
2. Competition Act, 2002
3. Ramappa- Competition Law of India
4. S.M. Durgar: Commentaries on MRTP Law, Competition Law and Consumer Protection
5. Avatar Sing: Competition Law
6. Tripathi - Competition Law
7. Universal's Guide- Competition Law in Law
8. P.K. Mujumdar: Law of Consumer Protection in India.

OUTCOMES:

Student will learn about Competition Commission in India and its emergence, its role, functions.

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BLC 4202 ENVIRONMENTAL LAW L T P C
4 1 0 5

OBJECTIVES:

The course will help the student to know about legal and regulatory mechanism that intends to protect environment. Course can be divided into International Environmental Law and Indian Environmental Law. Legal mechanism to strengthen the ongoing 'Green' efforts at local, national and global levels.

MODULE I INTRODUCTION 10

Environment- Environmental Law- Factors responsible for degradation of Environment - Need to protect, preserve and conserve Environment. International Environmental Law: Stockholm Declaration on Human Environment-1972- Rio Declaration on Environment and Development - 1992, Johannesburg Summit on Sustainable Development - 2002, Agenda-21- Rio Plus 20 - Our Common Future-1987. UNDP- GEF

MODULE II INDIAN ENVIRONMENTAL LAW 10

Constitutional Provisions- 42 Amendment- 48A-51A (g), Extensive Interpretation of Article 21. Judicial Activism- Public Interest Litigation. Doctrines pronounced by the Supreme Court- 'Absolute Liability'- 'Sustainable Development' - 'Public Trust Doctrine'

MODULE III LEGISLATIVE FRAME-WORK 10

Anti Polllution Laws: Air and Water (Prevention and Controll of Pollution) Acts- Pollution Control Boards- their structure and functions

Environmental Protection Act- 1986- its high lights- Powers and Functions of Central Government- Merits and Demerits... various Authorities under this Act, rules notified under this Act. Coastal Regulatory Zone Notification, Noise Pollution Rules, Municipal Solid Water Management Rules, Bio-Medical Waste Rules- E- Waste- Environmental Impact Assessment- Environmental Clearance- National Green Tribunals.

MODULE IV CONSERVATION AND PROTECTION 10

Forest Act-1927 and Amendments- Wild Life Protection Act-1972 - Forest Conservation Act-1980- Biological Diversity Act-2002 - Prevention of Cruelty to Animals act-1960- Leading cases on Forest, Wild Life and Cruelty against

Animals.

MODULE V REMEDIES FOR ENVIRONMENTAL POLLUTION 10

Common Law Remedies- under Law of Tort- Penal Remedies under IPC and Cr.P.C.- Remedies under Constitutional Law- Article 32- Article 226- Public Interest Litigation - Judicial Activism- Leading Environmental Cases.

TOTAL HOURS : 50

REFERENCE:

- P. Leelakrishnan- Environmental Law in India
- P. Leela Krishnan - Environmental Case-Book
- S. Shantakumar - Environmental Law - An Introduction
- Jaiswal - Environmental Law
- Sashtry- Environmental Law in India
- N. Maheswara Swami- Law Relating to Environmental Pollution and Protection.
- Alan Bopyle and Patricia Bernie - International Law and Environment
- Philippe Sands - Principles of International Environmental Law
- Elli Louka - International Environmental Law
- R.N. Choudhry - Law of Forests in India

OUTCOMES:

This course will help the student to understand legal and regulatory mechanism in place. With all clarity on concepts of pollution, protection, conservation and the Doctrines enshrined by the Supreme Court of India-it enrich the students knowledge base.

BLC 4203 MARITIME LAW

L	T	P	C
4	1	0	5

Objectives

The object of this course is to introduce the basics of Indian Maritime Law to the students. Maritime Law gaining significance as a separate branch of law. Student will know about Admiralty Law, The Merchant Shipping Act, 1958- International treaties, Conventions and Protocols relevant to Indian Maritime Law and their applicability. Law governing Marine Pollution, Marine fishing etc

.

MODULE I INTRODUCTION TO ADMIRALTY 10

Admiralty Act- Admiralty Jurisdiction of High Courts- International Convention for Arrest of Ships, Wrongful arrest - release from Arrest- Security for Release from Arrerst - Action in Rem; Action in Personam in Maritime Context- Maritime Claims, Limkitation of Liability, Damage done by or to a ship, Salvage, Loss of Life or Personal Injury- recent Admiralty Act- its salient features.

MODULE II THE MERCHANT SHIPPING ACT-1958 10

The Merchant Shipping Act-1958 - Structure of Shipping Administration in India- DG of Shipping- Mercantile Marine Department, Surveyors, Seamen's Welfare Officers - Major and Minor Ports, Application of National and State Laws at Ports- Registration of Indian Ships- Transfer of Ownership - National Character and Flag.

MODULE III INTERNATIONAL LAW AND CONVENTIONS 10

International Treaties, Conventions and Protocols relevant to Indian Maritime Law, their objectives applicability and legal status. Maritime Legislation based on these treaties, Conventions and Protocols-

MODULE IV MARINE POLLUTION 10

International Convention on the Prevention of Marine Pollution by Dumping of Waste Convention-1972- Maritime Lien

MODULE V MARINE FISHING 10

Jurisdictional issues and relevant provisions under Indian Laws- The Territorial Waters, Continental Shelf, Exclusive Economic Zone and Maritime Zones Act-1976 - The Maritime Zones of India (Regulation of Fishing by Foreign Vessals) Act,1981- Suppression of Unlawful Acts Against Safety of Maritime Navigation

and Fixed Platforms on Continental Shelf Act,2002

TOTAL HOURS : 50

REFERENCES:

Acts:

1. The Merchant Shipping Act, 1958
2. The Territorial waters, Continental Shelf, Exclusive Economic Zone and other Maritime Zones Act, 1976
3. the Maritime Zones of India (Regulation of Fishing by Foreign Vessels) Act,1981
4. Suppression of Unlawful Acts Against Safety of Maritime Navigation and Fixed Platforms on Continental Shelf Act,2002
5. Fisheries Act
6. International Convention on the Prevention of Marine Pollution by Dumping of Waste Convention,1972
7. United Nations Convention on the Law of the Sea (UNCLOS)

OUTCOMES:

Basics of Maritime Laws will be known to the student in respect of marine fishing, marine pollution, International obligations, merchant shipping etc. He will be familiar with jurisdictional issues relating to the Sea.

BLC 4205 INTERNATIONAL TRADE LAW

L	T	P	C
4	1	0	5

OBJECTIVES:

In the Era of LPG, Trade is global. In the context of world economic integration and the new order it is essential to know the International Trade Regime, International Trade Agreements - International Trade Practices and various bilateral and regional agreements in place. The student will learn- regulatory mechanism, dispute settlement bodies. This course offers basic inputs in the International Trade Law.

MODULE I GENESIS OF INTERNATIONAL TRADE LAW 10

Origin and Development - Theories - UN XConventions - Unification of International Trade Law- International Commercial Contracts- International sale of Goods - foreign Direct Investments(FDI) - Transnational Companies - Electronic Business Transactions - Elements of International Taxation - Risk Analysis of International Trade.

MODULE II INTERNATIONAL ECONOMIC INSTITUTIONS 10

Structure and Functions of International Economic Institutions - International Trade Organization(ITO)- WTO- GATT- New International Economic Order (NIEO)- International Monetary Fund (IMF)- International Bank for Reconstruction anhd Development (IBRD)- International Investments.

MODULE III WORLD TRADE ORGANISATION 10

Structure and Functions of WTO. Covered Agreements- Subsidies- Dumping and Anti-Dumping- General Agreement of Trade and Services (GATS)- Trade Related Intellectual Property Rights (TRIPS), Trade Related Investiment Measures (TRIMs), Trade in Agriculture- Technical Barriers of Trade (TBT)- UN Committee on Trade and Environment (UNCTE)- UN Committee on Trade and Development (UNCTAD)- Summits of the WTO.

MODULE IV BILATERAL AND REGIONAL TRADE 10

Regional Arrangements under the UN - Most Favoured Nation (MFN) Clause- South Asian Association for Regional Cooperation (SAARC)- Association for South Eastern Asian Nations (ASEAN)- European Union (EU)- Organisation for Petroleum Exporting Countries (OPEC)- North American Free Trade Agreement

(NAFTA)- South Asian Free Trade Agreement (SAFTA)

MODULE V SETTLEMENT OF DISPUTES IN INTERNATIONAL TRADE **10**

Methods of Dispute Settlement - Alternative Dispute Resolution (ADR) and International

Trade- UNCTRAL-International Arbitration, Conciliation, Mediation and Litigation - Online Dispute Resolution- Dispute Settlement Body in WTO - Appellate Body (AB)- Consultation - Trade and Environment Controversies- Enforcement and Compliance

TOTAL HOURS : 50

REFERENCES:

1. Dr.Myneni SR - International Trade Law
2. Indira Carr, Peter Stone - International Trade Law
3. Gupta. R.K.- World Trade Organisation.
4. Autar Krishen Koul - Guide to WTO and GATT
5. Jayanth Bagachi- World Trade Organisation : An Indian Perspective
6. C. Singhania- foreign Collaborations and Investments in India Law and Procedure
7. Correa, Carlos. M. - IPRs the WTO and Developing Countries
8. Day, D.M. and Griffin, Bernardettee- The Law of International Trade
9. Anupam Goyal- The WTO and International Environmental Law: Towards Conciliation.
10. Petersmann, Ernst Ulrich - The GATT/WTO Dispute Settlement Systems: International Law, International Organisations and Dispute Settlement

OUTCOMES:

Student will learn the basic frame-work of International Trade Regulation-varies Agencies- their role and functions. Student will learn about 'Dispute Settlement Mechanism'. It provides basic understanding on issues relating to International Trade Law.

BLC 4205 CYBER LAWS AND FORENSIC

L	T	P	C
4	1	0	5

OBJECTIVES:

In this digital era, the regulatory framework analysis has become vital. This course helps in understanding the regulations relating to E-Contracts, E-Banking, Intellectual Property Issues, Cyber Crimes and E-Taxation. The course intends to analyze the need of cyberspace regulation both Jurisdictional and Jurisprudential aspects of Cyberspace.

MODULE I INTRODUCTION **10**

Cyber Space Introduction and UNCITRAL Model Law- Information Technology Act, 2013 with recent Amendments- Jurisdictional Issues- Digital Signatures- Regulation of Certifying Authorities- Cyber Regulation Appellate Tribunal.

MODULE II ON LINE CONTRACTS **10**

Formation of Online Contracts- E-Banking transactions-Online Payment Options- Online Advertising- Electronic and Digital Signature- Taxation Issues in "Cyber Space- Indirect Tax- tax Evasion- Double Tax- International Tax- Permanent Establishment- Protection of Trade secrets and Deceptive Trade Practices.

MODULE III CYBER CRIMES **10**

Understanding Cyber Crimes- Actus Reus and MensRea- Types of Crimes in the Internet- Against Person, Against Property, Against Government- Digital Evidence- Investigation and Adjudication of Cyber Crimes in India- Cyber Arbitration - Cyber Conflict Investigation.

MODULE IV INTELLECTUAL PROPERTY RIGHTS AND CYBER SPACE **10**

Copy Right issues in the Internet - Protection of Computer Software- Caching- International Regime - OSS- DMCA- DATA PROTECTION DIRECTIVES- Trademark Issus in the Internet - Domain Name; Registration- Domain Name- Registration- Domain Name Dispute- ICANN -UDRP Policy- Linking - Framing - Met tagging - Database issues in the internet.

MODULE V CONTEMPORARY ISSUES **10**

Convergence Technologies- Cloud Computing - Online Digital Libraries -

Access to Internet - A Human Right Issue - Issue of Censorship - Privacy issues - National Security and Social Security.

TOTAL HOURS : 50

REFERENCES:

1. Nandan Kamath **-** Law relating to Computer- Internet and E-Commerce.
2. S.K. Verma & Raman Mital - Legal Dimensions of Cyber space
3. Rahul Mahathan - The Law relating to Computer and Internet.
4. Justice Yatindra singh - Cyber Laws
5. Edtu Chris reed and Joh Angel - Computer Law
6. Roger Leroy Miller & Gaylord A. Jentz - Law for E-Commerce

OUTCOMES:

The Student will know and understand the Cyber related Law, regulatory mechanism and cyber crimes. He can follow the ongoing developments and cyber related issues.

SEMESTER IX

BLC 5101 LAW OF INSURANCE

L	T	P	C
4	1	0	5

OBJECTIVES:

The focus of this course is to explain legal dimensions of Insurance Contract in respect of its formation, performance and discharge. As the Insurance sector is opened for private players as part of reforms significant changes have taken place. The IRDA apex regulatory body is striving to balance the interests of the general public and the insurance companies.

MODULE I INTRODUCTION 10

.Insurance Meaning -Risk Management _ Kinds of Risks- Insurable Interest- Insurance and Assurance- Parties of Insurance- Insurance and Contract Law- Principles of 1. Uberrimae fidae, 2. Indemnity, 3. Subrogation, 4. Contribution, 5. Proximate Cause - Cover Note and Slip.

MODULE II FIRE INSURANCE CONTRACT 10

Meaning of the term "Fire" - Fire Policies- Perils Insured- Fire Claims- Scope of Applicability of Special Principles to Contract of Fire Insurance. Standard Fire Policy ' Average' in Fire Insurance Contract.

MODULE III MARINE INSURANCE CONTRACT 10

Significance of Marine Insurance- Maritime Peerils- Subject matter covered by Marine Policy- KInds of Marine POlicies - Scope and Applicability of Special Principles to Contract of Marine Insurance - Principles of 'Change of Voyage' and 'Deviation' - Total Loss - Partial Loss- Marine Insurance Act 1963 with special reference to Bill of Lading and Counter Part.

MODULE IV LIFE INSURANCE CONTRACT 10

Introduction- Concept- Life Insurance-Significance-Kinds-Extent of apaplicability of Special Principles to Life Insurance. 'Suicide" clause. 'Medical insurance' policies. Assignment and Nomination- Constitution. IRDA- Role and Functions

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MODULE V MOTOR VEHICLE INSURANCE 10

Introduction- The MV Act-1988. Compulsory III Party Insurance of Motor Vehicles- No Fault Liability- Motor Accident Claims Tribunals.

TOTAL HOURS : 50

REFERENCES:

1. KVS Sarma: Modern Law of Insurance
2. M.N.Srinivasan- Law of Insurance
3. Srinivasan and Murty: Law of Insurance
4. Haardy Ivany- Law of Insurance

OUTCOMES:

Student will learn the concept of Insurance and how it penetrated into various facets. They will learn about Life Insurance, Marine Insurance and Fire Insurance. Student will understand the role and functions of IRDA that regulates Insurance sector in India.

BLC 5102 **LAW OF CRIMES II** **L T P C**

CRIMINAL PROCEDURE CODE &

JUVENILE JUSTICE

4 1 0 5

OBJECTIVES:

The law of Criminal Law is indented to provide a mechanism for the enforcement of criminal law. Without proper procedural law, the Substantial Criminal law which defines offences and provides punishments for them would be almost worthless. Every threat does not deter. Without deterrent effect, the Criminal law will have hardly any meaning or justification. Thus the law of Criminal Procedure is meant to be complementary to Criminal Law and has been designated to ensure the process of its administration.

MODULE I **CRIMINAL PROCEDURE CODE-TYPES AND FUNCTIONARIES** **10**

. Aquisitorial, inquisitorial – brief history about the code-definition-main functionaries of the code- powers of superior police officers and aid to the magistrates and police.

MODULE II **PRE-TRIAL PROCEEDINGS** **10**

Stages of Investigation - process compelling for the presence of the presence of accused for investigation and trial - arrest-procedure for arrest - rights of arrested persons consequences of non - compliance of arrest procedures – search and seizure – process of investigation by police – investigation of unnatural and suspicious death – Local jurisdiction of the Courts in Inquires and Trials **–** cognizance of offence and commencement of proceedings – bail procedures – types of bail - General Provision regarding bond of accused and sureties.

MODULE III **TRAIL PROCEDURE** **10**

Stages of Investigation - process compelling for the presence of the presence of accused for investigation and trial - arrest-procedure for arrest - rights of arrested persons consequences of non - compliance of arrest procedures – search and seizure – process of investigation by police – investigation of unnatural and suspicious death – Local
jurisdiction of the Courts in Inquires and Trials **–** cognizance of offence and commencement of proceedings – bail procedures – types of bail - General Provision

regarding bond of accused and sureties.

MODULE IV APPEAL PROCEDURES 10

Types of Appeals - Reference and Transfer of Criminal Cases - Execution, Suspension, Remission and Commutation of Sentences – Execution of Sentence death penalty and Imprisonment – Execution of Sentence of fine - Preventive and Precautionary Measures for keeping peace and good behavior – Maintenance procedures – conditions for claiming maintenance – cancellation of maintenance – Muslim Women Protection of Rights on Divorce Act.

MODULE V JUVENILE JUSTICE (CARE AND PROTECTION) ACT, 2001 & PROBATION OF OFFENDERS ACT,1958 10

Juvenile Justice (Care and Protection) Act, 2001 and Probation of Offenders Act, 1958

Introduction – Object – definitions – Statutory bodies for juveniles under the Act Reformative institutions for juveniles – Special offences – Probation –Object and meaning – Criminal court and probation – Duties of Probation officers - Report of the probation officers - conditions and cancellation of probation.

TOTAL HOURS : 50

REFERENCES:

Books:

1. Ratanlal : Code of Criminal Procedure
2. Sarkar : Code of Criminal Procedure
3. Kelkar R.V. : Outlines of Criminal Procedure
4. Basu : Code of Criminal Procedure
5. Dr.Nandhal's : Code of Criminal Procedure (3 Volumes)
6. P. Ramanatha Iyer : Code of Criminal Procedure (3 Volumes)
7. Sohonis : Code of Criminal Procedure (4 Volums)
8. R.B. Sethi : Probation of Offenders Act
9. Consuls : Probation of Offenders Act and Rules.
10. M.K.Chakrabarathi : Probation System in the Administration of CriminalJustice
11. Vedkumari (IT) : Treaties on the Juvenile Justice Act.
12. S.K. Swasthi : Judgements of Juvenile Justice Act 1986.

OUTCOMES:

Students will learn the procedure that is followed in Criminal Justice Administration in the Country. They will also learn special procedure that is followed in Juveniles justice system that is in place.

BLC 5103 CIVIL PROCEDURE CODE AND LIMITATION ACT

L	T	P	C
4	1	0	5

OBJECTIVES:

The course intends to understand the legislative measures in procedure. The course also helps in understanding the procedures to be followed by the civil courts from the institution of suits till the final disposal. The course tries to understand the computation of limitation period for the institution of suit, appeal and applications along with exclusion

MODULE I INTRODUC TION 10

Definitions – Civil Nature - Jurisdiction of Civil Court – Place of Suing – Institution of Suits – Presentation of Plaint – Parties to the suit-principles of res subjudice and res judicata.

MODULE II PLEADINGS AND PROCEEDINGS 10

Plaint – Written Statement – Service of Summons – Appearance and Non-Appearance of Parties - – Discovery, Inspection and Production of Documents – Admission – Production, Impounding - and Returning of Documents- transfer of suits-decree and judgment -Remand – Restitution – -Appeals: first appeal, second appeal, appeals from orders and appeals to Supreme Court – Reference – Review – Revision

MODULE III SUITS IN PARTICULAR CASES 10

Suits by and against government and public officer – Suits by indigent person – suits by or against minors and lunatics, aliens and foreign rulers, soldiers, corporation, Firms, trustees, executors and administrators-suits relating to family matters, mortgages, public nuisance and public charities- interpleader suits-summary procedure.

MODULE IV EXECUTION 10

General principles, courts by which decree may be executed, payment under decree, application for execution, mode of execution, stay of execution, questions to be determined by executing court, arrest and detention, attachment of property sale and delivery of property, distribution of assets.

MODULE V LIMITATION ACT 10

Definitions – Limitation of Suits – Appeals – Computation of Period of Limitation

– Acquisition of ownership by possession.

TOTAL HOURS : 50

. REFERENCES:

Acts:

1. Code of Civil Procedure, 1908
2. Limitation Act, 1963

Books

1. K. Takwani : Civil Procedure Code
2. Mulla : Code of Civil Procedure
3. M. P. Jain : Code of Civil Procedure
4. Pattabiraman : Code of Civil Procedure
5. Taxmann : Code of Civil Procedure
6. M. P. Tandon : Code of Civil Procedure
7. C. K. Takkar : Code of Civil Procedure
8. P. Basu : Law of Limitation

OUTCOMES:

Procedural Laws are essential to understand how the law will put into motion through courts. Student will get an idea about procedure followed by civil courts

BLC 5104 LAND LAWS L T P C
4 1 0 5

OBJECTIVES:

Land Laws of Tamilnadu along with Land Acquisition Act and Real Estate Regulation Act are significant laws. Students should know the laws relating to land acquisition, real estate, rent control, lease etc. Bone of contention is land in significant number of cases. Hence, the student is expected to know the law relating to land.

MODULE I BACKGROUND OF LAND ADMINISTRATION 10

Concept of Land-Kinds-Ownership and Possession of Land- Land Reforms and Constitutional History- Eminent Domain- Right to Property under Article 31 A-31 B- 31 C of the Constitution- Article 300 A; Ninth Schedule-Early Revenue Administration in Tamilnadu-Grants- Inams -Zamindari System- Permanent Settlement -Ryotwari-Rights and Liabilities of Ryotwari Pattadar- Tamilnadu Estates (Abolition and Conversion into Ryotwai) Act, 1948.

MODULE II LAND ACQUISITION 10

Land Acquisition, Rehabilitation and Resettlement Act-2013 (LARR Act,2013)- Compensation - payment-

MODULE III ENACTMENTS AND CULTIVATING TENANTS 10

The Tamilnadu Cultivating Tenants Protections Acts- 1989-1983-2010-
The Tamilnadu Cultivating Tenants (Payment of Fair Rent) Act, 1956- Rights and Liabilities of Cultivating Tenants and Land Owner- Fair Rent- Alteration or Revision of Fair Rent-Kaiaeruvamdar and Mattuvaramdar- Rent Court- Rent Tribunals- Exceptions - Powers of the High Court.

MODULE IV LAND AND LAND CEILING 10

Tamilnadu Land Reforms Fixation of Ceiling on Land Act-1961; Amended Act 1971- Definitions and Ceiling Area, Family, Stridhana Property, Standard Acre etc. Fixation of Ceiling on Land Holdings, Land Board, Industrail Undertakings- Publication of Settlement- Land Tribuinal - Authorised Officer - Determination of Compnesation - Exemptions- Special Appellate Tribunal- Courts - Penal Provisions.

MODULE V RENT CONTROL ACT AND RERA ACT 10

The TN Buildings (Lease and Rent Control) Act, Grounds for Eviction- Agreed

Rent- Jurisdiction of Rent Controller, Execution- Proceedings by Legal Representatives or Against Legal representatives.

Real-Estate Regulation Act- an Overview-

Societies or Association of Apartment Owners, its Bye-Laws and Functions.

TOTAL HOURS : 50

REFERENCES:

1. K.Venkata Rao - The Tamilnadu Land Reforms Act
2. V.N. Krishna Moorthy- The TN Buildings Lease and Rent Control Act, 1960
3. Prof. A. Chandrasekar - Land Laws of Tamilnadu.
4. Maheswara Swamy - 'Land Laws' & ' Land Acquisition under the Constitution of India.'

OUTCOMES:

The students will learn the law of the land in literal sense. It includes land acquisition, ceiling, tenancy- rent-control, real-estate etc. He will also know about the legal mechanism in place to resolve the issues relating to Land, Rent Control, Real Estate.

BLC 5105	MOOT COURT (CLINICAL COURSE III)	L	T	P	C
		4	1	0	5

OBJECTIVES:

Very purpose of this paper is to equip the student to the real-time experience in the field of Law. Student has to argue three moot-problems in Moot Court and has to attend and observe two case trials in the court, ie. one civil and one criminal. He has to attend and observe Advocate Office/Law Firm for at least 15 days as an Intern. He has to record pre-trial preparations.

MODULE I MOOT COURT (30 MARKS) 15

Student need to required to do at least three Moot Courts in a year with 10 marks for each. Usually one in Civil, one in Criminal and one in Constitutional matters. the Moot Court work will be on assigned problem and it will be evaluated for 5 marks for written submissions and 5 marks for oral Advocacy.

MODULE II OBSERVANCE OF TRAIL IN TWO CASES (30 MARKS) 10

Students may be required to attend two trials in the court. They can do so in their IV year and V year of Course. They need to maintain a record and enter various steps observed during their observation on different dates. The Scheme will carry 30 marks. (one civil proceeding and one criminal trial) Each carries 15 marks that includes attendance, record, diary etc.

MODULE III INTERVIEWING TECHNIQUES AND PRE-TRIAL PREPARATIONS AND INTERNSHIP (30 MARKS) 10

Each student will observe two interviewing sessions of clients at the Lawyer's Office/ Legal Aid Office/ Law Firm and record the proceedings in a diary, which will carry 15 marks. Each student will further observe the preparation of documents and Court papers by the Advocate and the procedure for the filing of the Suit/Petition. This will be recorded in the diary, which will carry 15 marks.

MODULE IV VIVA-VOCE EXAMINATION (10 MARKS) 05

A Viva Voce Examination on all the above three components. Records and Diaries submitted by the student will be verified and the student has to answer and substantiate their work-done.

TOTAL HOURS : 40

OUTCOMES:

The student will have a firsthand account of court procedures, practices of office of the Advocate and the court-room etiquette.

SEMESTER X

BLC 5201 INTERPRETATION OF STATUTES L T P C

4 1 0 5

OBJECTIVES:

Interpretation of Statutes evolved into certain rules and principles to clarify ambiguities, inconsistencies, contradictions and lacunas. Legislative drafting often tend to give rise to all these 'doubts'. This core of this subject is to unlock the locks put by the Legislature through certain principles, rules etc. Legislative expression will reflect in the form of a Statute and it needs to be understood and given effect in the same tone. The guiding principles behind interpretation of Tax Laws, Penal Laws and Welfare Laws may differ in approach but the central idea of interpretation remains the same. This paper provides those inputs that are very much essential.

MODULE I LAW MAKING 10

Legislature, Executive and the Judiciary _ Principles of Utility- Law and Public Openion- Law and Social Control- Relevance of John Rawls and Robert Nozick- Individual interest to Community Interest- Law and Morals- Meaning, Objectives and Scope of 'Interpretation' 'construction' and 'Statute' - Public Opinion and Law Making.

MODULE II NATURE AND KINDS OF INDIAN LAWS 10

Statutory, Non Statutory, Codified, Un-codified, State made, State Recognized Laws- Parts of the Statute-Commencement- Extent-Operation and Repeal and Revival of Statutes- Purpose of Statutory Interpretation-Basic sources of Statutory Interpretation- The General Clauses Act, 1897; Nature, Scope and Relevance- Definition clauses in various Legislations; Nature and Imperative Rule.

MODULE III RULES OF STATUTORY INTERPRETATION 10

Literal Rule- Golden Rule - Mischief Rule and Strict Construction of Penal Laws and Taxation Laws - Internal Aids and External Aids of Interpretation.

MODULE IV INTERPRETATION OF CONSTITUTION AND INTERNATIONAL INSTRUMENTS 10

Principles and theories - Interpretation of Constitution- Reading DPSP and FR. Interpretation of International Instruments- Presumption in favour of

Constitutionality of a Statute- Presumption against violation of International Law- Presumption against retrospective operation of law- Presumption against Ouster of Jurisdiction of Courts.

MODULE V LEGISLATIVE DRAFTING 10

Principles and Process of Legislative Drafting - Simplicity, Preciseness, Consistency, Alignment with Existing Law- Brevity- Drafting General Laws and Special Laws-Rules and Orders.

TOTAL HOURS : 50

REFERENCES:

Acts:

1. General Clauses Act - 1897
2. Constitution of India, 1950

Books:

1. Maxwell - Interpretation of Statutes
2. G.P.Sing- Principles of Statutory Interpretation
3. P.M. Bakshi - Interpretation of Statutes
4. Jeremy Bentham - Theories of Legislation
5. Dicey - Law and Public Opinion
6. Indian Law Institute - The Drafting of Laws
7. P.K. Tripathi - Spotlights on Constitutional Interpretation
8. Thornton G.C. - Legislative Drafting

Outcomes:

The student will learn how to read, understand, interpret various Laws including Constitution of India and International Instruments as well. It is will enrich him with all skills that are required to unlock the legislative intent. He will learn the basics in legislative drafting too.

BLC 5202 RIGHT TO INFORMATION ACT L T P C
4 1 0 5

OBJECTIVES:

Right to Information Act is an Act that can be used as a weapon against mal-administration, abuse of power and corrupt practices. In real sense it empowers the people with a right to be informed. Object of this course is to familiarize the student about this Act to enable them to make use of its to empower the people.

MODULE I CONSTITUTIONAL PROVISIONS 10

Fundamental Rights - Article 19- Article 21 and its interpretation. Right to Know- Right to be Informed - Right to Information - Right to Information Vis-a-Vis Right to Life.

MODULE II LEGISLATIVE PROVISIONS 10

Right to information- in Consumer Laws; Right to Information; Environmental Laws; Right to Information Administrative Law. Right to information Criminal Law. Public Interest Vs. Private Interest, Law of Evidence- Section 123; 'Affairs of the State"

MODULE III HIGH LIGHTS OF RIGHT TO INFORMATION ACT 10

Procedure to file application- first appeal- second appeal- penal provisions-etc.

MODULE IV AUTHORITIES UNDER RTI 10

Central Information Commission; State Information Commissions, Powers and Functions.

MODULE V ANTI - CORRUPTION LAWS 10

Issues relating corruption in Administration, Various anti Corruption Laws, Whistleblowers Protection Act, Powers and Functions of CVC.

TOTAL HOURS : 50

REFERENCES

OUTCOMES:

The student will know how to 'move' the authorities to unearth the 'facts' and 'figures' laying in the bureaucracy so as to fight against mal-administration, abuse of power and corruption.

BLC 5203 LAW OF TAXATION

L	T	P	C
4	1	0	5

OBJECTIVES:

The course intends to understand the taxing system in India. Tax Laws helps to government to generate funds for the development of the country and at the same time they tax the people directly or indirectly. The student should know important Tax Laws. Student will learn basics relating to Income Tax Act and Goods and Services Tax etc.

MODULE I GENERAL INTRODUCTION 10

What is Tax and What is Fee. Income Tax Act and Finance Act- Canons of Taxation - Kinds of Taxes- Direct and Indirect Taxes- Applicability of Doctrines under the Constitution to Taxation Laws - Interpretation of Tax Laws

MODULE II THE INDIAN INCOME TAX ACT - 1961- I 10

Concepts under IT Act. Income-Agricultural Income- Casual Income- Assesse Person- Residential Status- Previous Year- Assessment Year- General Charging Section- Specific Charging Section- Exemptions- Income from ' House Property Income from Business or Profession, Income from 'Capital Gains'- Income from other sources-Procedure for Assessment- deduction allowed in certain cases-

MODULE III THE INDIAN INCOME TAX ACT - 1961- II 10

Filing Procedures- Tax Tribunals- Appeal Provisions under I.T.Act. - Grievance Procedure-

MODULE IV GOODS AND SERVICES ACT-2017 I 10

Goods and Services Act-2017 its highlights- significance- merits- filling procedures- legal mechanism.

MODULE V INTERPRETATION OF TAX LAWS- PRINCIPLES 10

.How to Interpret Tax Legislations. General guidelines; Principles; Authoarities- Quasi-Judicial- Tribunals. Courts.

TOTAL HOURS : 50

REFERENCES:

1. Sukumar Battacharya - Income Tax Law - Practice
2. N.A. Palkowala - Income Tax

3. Manoharan - Income Tax Act
4. Dinager Pagre - Direct Taxes and Indirect Taxes
5. Taxmann- Income Tax Act
6. Girish Ahuja - Law and Procedure: Professional Approaches to Direct Taxes

OUTCOMES:

The student will learn the Law relating to Taxes in India. He will know about highlights of Income Tax andf GST and filing of returns procedures etc. Student will also know about and quasi-judicial authorities, tribunals and judicial mechanism in place to address the legal issues.

BLC 5204 CRIMINOLOGY AND PENOLOGY L T P C
4 1 0 5

OBJECTIVES:

Criminology, Penology and Criminal Law are interlinked. Scientific study of criminal behaviors of the person who tends to commit crime is the core and essence of this subject. Basically Criminal Law provides definition and punishment for the crime. The criminology reveals the reasons that constitute the crime either individually or socially. The penal sanctions depend upon the characteristics of the criminal and the ability to reform through punishments. Thus the course provides the students to understand the criminal behaviour and imposition of punishments scientifically.

MODULE I INTRODUCTION 10

Meaning and Significance of Crime- Concept of Crime and basis of Criminalization- Definition of Crime- Criminology- Criminological Reminiscence; Global Scenario- Renaissance- Modern Age - Focus on the need for Criminological Study- Ingredients of Crime - Distinguish Crime and Non-Crime- Classification of Crimes-Development of Criminal Law- Sources of Crime Data- Crime Reporting- Uses of Crime Data- Schools of Criminology.

MODULE II CAUSES OF CRIME 10

Individual centric causes- Social Centric Causes-Theories on Crime causation- Juvenile Delinquency- Juvinile Justice (Care and Protection of Children) Act- Case Law-

MODULE III TYPES OF CRIME 10

Corruption: White - Collar Crime and Blue Collar Crime- Implication of White Collar Crimes- - White Collar Crimes- Detection and Investigation and Trails of White Collar Crimes. -.Crime and Women: Female Criminality- Crimes of Passion- Prostitution- Immoral Traffic Prevention Act- Medical Termination of Pregnancy Act- PNDT (Regulation) Act- Domestic Violence Act- Criminal Law Amendment Act-2013. Terrorism; Definition-Nature-Causative Factors- Kinds- Measures to combat. Communal Violence-causes and cures. Drugs and Crimes- NDPS Act- Cyber Crimes- Trafficking in women and Children, Human Organ Crimes- International Crimes and Environmental Crimes.

MODULE IV POLICE AND CRIMINAL JUSTICE SYSTEM 10

Organizational structure of Indian Police- set-up- bureaucracy-Crimes by police- Crime Record Bureaus- Need for police reforms. Social Defense.

MODULE V CORRECTIONAL INSTITUTION AND CRIME PREVENTION **10**

.Prison system in India- Probation and Parole- Origin- Probation of Offenders Act, 1958- Prison Reforms. Boaster School. Prevention of Crime and Delinquency.

TOTAL HOURS : 50

REFERENCES

OUTCOMES:

Crime is considered to be a threat to the society. The student know about different types of crimes that the country. He will learn about the police system and prison systems in place.

BLC 5205	DRAFTING, PLEADING & CONVEYANCING (Clinical Course - IV)	L	T	P	C
		4	1	0	5

OBJECTIVES:

Drafting skills are essential for an Advocate. Students are expected to learn, improve their drafting skills that are essential to enter into the profession of Advocacy. This course will help them in this regard. Class room instruction is followed by record writing. This is part of Clinical Legal Education course of Bar Council of India, which is mandatory. The student has to submit a hand-written record.

MODULE I Introduction **10**

A. Drafting: General Principles of Drafting and relevant substantive rules shall be taught.

B. Pleadings: a) Civil: Plaint, Written Statement, Interlocutory Application, Original Petition, Affidavit, Execution, Petition, Memorandum of Appeal and Revision. Petition under Article 226 and 32 of the Constitution of India.

b) Criminal: complaint, Criminal Miscellaneous Petition, Bail Application, Memorandum of Appeal and Revision.

c.. Conveyancing: sale Deed, Mortgage Deed, Lease Deed, Gift Deed, Promissory Note, Power of Attorney, Will, Trust Deed.

d. Drafting of Writ Petition and PIL Petition

Method of instruction

Instructions class and simulation exercises, preferably with assistance of practicing lawyers/ retired judges will be provided for the students.

Apart from teaching the relevant provisions of law, the course may included not less than 15 practical exercises in Drafting carrying a total of 45 marks (3 marks for each) and 15 exercises in Conveyancing carrying another 45 marks (3 marks for each exercise) remaining 10 marks will be allotted for Viva Voce.

Total Number of Hours: 30

B.S. Abdur Rahman Crescent Institute of Science & Technology

Deemed to be University u/s 3 of the UGC Act, 1956

REGULATIONS 2016

CURRICULUM AND SYLLABI

B.B.A

FINANCIAL SERVICES

VISION AND MISSION OF THE DEPARTMENT OF MANAGEMENT

VISION

Department of Management Studies aspires to become Management Institution of national repute, providing industry-oriented, socially-responsible & research inclined management professionals.

MISSION

- To offer UG and research programmes of industrial and social relevance
- To provide functional specific knowledge through industry scenario study and analysis / multiple pedagogies
- To enhance managerial and soft skill that augment the overall professional development
- To encourage and support in fulfilling the drive for teaching and research
- To pursue consultancy projects and collaborative research

PROGRAMME EDUCATIONAL OBJECTIVES:

- To provide necessary ambiance for a holistic teaching-learning approach to match the international standards of education.
- To provide strong foundation in Management of Financial Services and to enable comprehensive understanding and application of the concepts applied in financial service industry.
- To equip students with managerial skills like teamwork, leadership, communication and analytical skills for performing functional tasks efficiently and effectively.
- To equip the students with essential knowledge from other relevant disciplines of management in order to infuse a multi-disciplinary approach.

PROGRAMME OUTCOMES:

On successful completion of the programme, the graduates will be able to:

- Identify and analyse issues in the organization at basic level.
- Apply functional knowledge in completing routine tasks of the organization.
- Classify financial information into parts for further analysis.
- Display effective presentation skills, communication skills and team work.
- Display understanding of the functioning of financial services sector at basic level.
- Display analytical skills and competency in the application of financial tools.
- Display awareness on contemporary issues and concerns of the business and society

B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE & TECHNOLOGY

B.B.A FINANCIAL SERVICES

CURRICULUM & SYLLABI, REGULATIONS 2016

SEMESTER I

Sl. No.	Course Code	Course Title	L	T	P	C	
1	MSC 1101	Accounting – I	5	0	0	4	
2	MSC 1102	Management Concepts and Practices	4	0	0	3	
3	MSC 1103	Fundamentals of Managerial Economics	4	0	0	3	
4	MSC 1104	Basic Statistics	5	0	0	4	
5	MSC 1105	Corporate Communication	4	0	0	3	
6	MSC 1106	IT for Business and Accounting	3	0	0	2	
7	MSC 1107	IT for Business and Accounting - Lab	0	0	2	2	**21**

SEMESTER II

Sl. No.	Course Code	Course Title	L	T	P	C
1	MSC 1201	Accounting - II	5	0	0	4
2	MSC 1202	Business Mathematics	5	0	0	4
3	MSC 1203	Organizational Behaviour	4	0	0	3
4	MSC 1204	Applied Macro Economics	4	0	0	3
5	MSC 1205	Indian Financial System	4	0	0	3
6	MSC 1206	Excel Applications for Business	2	0	0	2

7	MSC 1207	Excel Applications for Business - Lab	0	0	4	2	
8	GEC1212	Environmental Studies	2	0	0	2	**23**

SEMESTER III

Sl. No.	Course Code	Course Title	L	T	P	C	
1	MSC 2101	Marketing Management	4	0	0	3	
2	MSC 2102	Introduction to Financial Management	5	0	0	4	
3	MSC 2103	Human Resource Management	4	0	0	3	
4	MSC 2104	Introduction to Entrepreneurship	4	0	0	3	
5	MSC 2105	Fundamentals of Foreign Trade	4	0	0	3	
6	MSC 2106	Cost Accounting	5	0	0	4	**20**

SEMESTER IV

Sl. No.	Course Code	Course Title	L	T	P	C	
1	MSC 2201	Business Research Methods	5	0	0	4	
2	MSC 2202	Derivatives and Commodity Market	4	0	0	3	
3	MSC 2203	Enterprise Resource Planning	5	0	0	4	
4	MSC 2204	Financial Services	4	0	0	3	
5	MSC 2205	Managerial Accounting	4	0	0	3	
6	MSC 2206	Introduction to Financial Planning	4	0	0	3	**20**

SEMESTER V

Sl. No.	Course Code	Course Title	L	T	P	C	
1	MSC 3101	Introduction to Business Law	5	0	0	4	
2	MSC 3102	Business Ethics and Values	5	0	0	4	
3	MSC 3103	Insurance and Risk Management	5	0	0	4	
4	MSC 3104	Cost Management	5	0	0	4	
5	MSC 3105	Fundamental Analysis and Technical Analysis	5	0	0	4	**20**

SEMESTER VI

Sl. No.	Course Code	Course Title	L	T	P	C	
1	MSC 3201	Fundamentals of Business Taxation	5	0	0	4	
2	MSC 3202	Introduction to International Finance	4	0	0	3	
3	MSC 3203	Investment Banking and Operations	4	0	0	3	
4	MSC 3204	Financial Modelling Using Excel	2	1	0	3	
5	MSC 3205	Financial Modelling Using Excel – Lab	0	0	4	2	
6	MSC 3206	Project Work	-	-	-	5	20

TOTAL CREDITS – 124

SEMESTER I

		L	T	P	C
MSC 1101	**ACCOUNTING – I**	**4**	**0**	**0**	**4**

OBJECTIVES:

- Acquaint students with the basic knowledge of the accounting principles and the accounting process.
- Familiarize students with subsidiary books and the Bank Reconciliation Statement.
- Demonstrate how final accounts of proprietary concerns are prepared.

MODULE I INTRODUCTION TO ACCOUNTING **9**

Introduction; Meaning and Definition; Objectives of Accounting; Need for Accounting; Functions of Accounting; Users of Accounting Information; Limitations of Accounting; Accounting Principles: Accounting Concepts and Accounting Conventions. Indian Accounting Standards and International Financial Reporting Standards – Brief Overview only

MODULE II JOURNAL, LEDGER AND TRIAL BALANCE **12**

Journal, Rules of Debit and Credit, Compound Journal Entry; Opening Entry; Ledger, Posting, Rules Regarding Posting, Balancing Ledger Accounts; Advantages of Ledger, Meaning and Importance of Trial balance, Preparation of the Trial Balance

MODULE III SUBSIDIARY BOOKS **12**

Meaning and Significance of Subsidiary Books; Types of Subsidiary Books: Purchases Book Sales Book, Purchase Returns Book, Sales Return Book, Bills Receivable Book, Bills Payable Book, Cash Book (Simple Cash Book, Double Column Cash Book, Three Column Cash Book and Petty Cash Book) and Journal proper

MODULE IV RECTIFICATION OF ERRORS AND BANK RECONCILIATION STATEMENT **12**

Meaning of Accounting Errors, Types of Accounting Errors, Rectification of Errors – Before Preparation of Trial Balance and After Preparation of Trial Balance

Meaning and objective of bank reconciliation statement; Importance of bank reconciliation statement; Causes of difference between cash book balance and pass book balance; Techniques of preparing bank reconciliation statement

MODULE V FINAL ACCOUNTS OF PROPRIETARY CONCERNS 15

Final Accounts: Trading Account, Profit & Loss Account and Balance Sheet; Preparation of Trading Account, Profit & Loss Account and Balance Sheet with the adjustments relating to: closing stock, outstanding expenses, prepaid expenses, accrued incomes, unearned incomes, depreciation, bad debts, provision for bad debts, provision for discount on debtors, interest on capital, and interest on drawings

TOTAL HOURS – 60

REFERENCES:

1. S. N. Maheshwari and S. K. Maheshwari., “An Introduction to Accountancy”, Vikas Publishing House, 2016.
2. R. L. Gupta and V. K. Gupta., “Financial Accounting: Fundamentals”, Sultan Chand Publishers, 2016.
3. Rajesh Agarwal and R Srinivasan., “Accounting Made Easy”, McGraw Hill, 2014.

OUTCOMES:

At the end of this course, the student will be able to:

- Apply the basic accounting principles and identify the steps in the accounting process.
- Prepare subsidiary books and the Bank Reconciliation Statement.
- Prepare final accounts of proprietary concerns.

MSC 1102	MANAGEMENT CONCEPTS AND PRACTICES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Explain the concept and nature of Management and state various perspectives on management given by famous authors.
- Discuss the evolution and process of management stated by famous management authors.
- Explain the concept of principles of management and its application in the present business scenario.
- Illustrate the role of effective communication in management.

MODULE I INTRODUCTION TO MANAGEMENT 9

Introduction and Nature of Management, Definition & Meaning-By P. F. Drucker, Koontz O'Donnel, S. George, Management as an Art, Science and Profession, Distinction between Administration and Management, Importance & Functions of Management

MODULE II EVOLUTION OF MANAGEMENT 9

Evolution of Management- Thought, Pre Scientific Management era, Scientific Management & Contribution of F. W. Taylor, Process Management & contribution of Henri Fayol, HR movement - Hawthorne experiments, Contributions of Behavioral scientists- Abraham Maslow, Peter Drukker, Douglas Mc. Gregor

MODULE III PLANNING AND DECISION MAKING 9

Nature & Definition of Planning- Koontz o'Donnel, Hart, Alfred &Beaty, Importance and limitations, Planning process, Types of Plans- on the basis of use, functions, time (meaning only), Meaning of Decision making, Steps in decision making, Types of decisions- Programmed-Non-programmed; Strategic-tactical, Individual-Group, Policy Operation, Organizational-Personal

MODULE IV ORGANIZING & DEPARTMENTATION 9

Meaning & Definition- Koontz O'Donnell & McFarland, Organizing - Nature, Purpose & Principles, Types of Organization (Formal & Informal), Types of Authority relationships- Line, Functional, Line& staff, Committees, Meaning and

types of Departmentation, Centralization and De-centralization (Meaning Only)

MODULE V ELEMENTS OF DIRECTING, CO-ORDINATION AND CONTROL **9**

Meaning & Importance of Directing, Leadership: Meaning & Styles, Motivation: importance & Theories (Maslow, Herzberg. McGregor), Communication- Meaning, Objectives & Types of communication, Meaning, Principles and techniques of Co-ordination, Meaning, Need & steps in Controlling

TOTAL HOURS – 45

REFERENCES:

1. Dr P. N. Reddy, Prof H R Appannaiah, P C Tripathi., “Essentials of Management”, Himalaya Publications, 2014.
2. L. M. Prasad., “Principles and Practice of Management”, Sultan Chand & Sons, 2015
3. R. Srinivasan and S. A. Chunawalla., “Management: Principles and Practice”, Himalaya Publications, 2014.
4. P. C. Tripathi and P. N. Reddy., “Principles of Management”, Tata McGraw Hill, 2015

OUTCOMES:

At the end of this course, the student will be able to:

- Outline the concept and nature of Management and recognize various perspectives on management given by famous authors.
- Identify the steps involved in the process of management.
- Apply the principles of management in the present business scenario.
- Analyse the role of effective communication in management.

MSC 1103	FUNDAMENTALS OF MANAGERIAL ECONOMICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Outline the concept of Economics, Managerial Economics and the role of a manager in using the concept of economics in managerial decision making.
- Explain the concept and application of Law of Demand, Demand Forecasting, Supply Management, Consumption, Production and Cost.
- Describe the tools and techniques used for forecasting demand, production levels and identifying the cost.
- Illustrate the functioning of different market structures and its application in the present business scenario.

MODULE I INTRODUCTION TO MANAGERIAL ECONOMICS 9

Meaning & Definition, Features of Managerial Economics, Scope of Managerial Economics, Objectives and practical uses of Managerial Economics, Role and Responsibilities of Business Economist to modern Business Management

MODULE II THEORY OF DEMAND AND DEMAND FORECASTING 9

Meaning- determinants - demand schedule - demand curve, Law of Demand- exceptions- shifts in demand and movements in demand, Elasticity of demand- meaning- types, Price elasticity of demand- meaning-degrees-measurement: Total outlay- Point Method, Income elasticity of demand, Cross elasticity of demand, Demand Forecasting- Meaning- levels- objective, Method of estimation-Survey Method and Statistical method, Forecasting for a new product

MODULE III THEORY OF CONSUMPTION 9

Consumption - meaning, features –types, Role of consumer under open and closed economy, Theory of consumer Behaviour, Cardinal Approach: Gossen first law and second law, Concept of consumer surplus, Ordinal approach – Hicks and Allen model, Meaning of ICA properties - consumer's equilibrium, Concept of MRS– substitution effect- Income effect -price effects, Concept of Engle's law

MODULE IV THEORY OF PRODUCTION AND COST 9

Meaning of production function- classification- fixed factors-variable factors, Law of

variable proportion, Concept of Iso-quant and Iso-cost - producer's equilibrium, Managerial equilibrium- MRTS- optimal combination, Economies of scale- meaning- Internal and External economies of scale, Supply- meaning- determinants, Law of supply, Cost: Meaning- concepts-Computation of costs.

MODULE V MARKET STRUCTURE 9

price determination simultaneous changes in demand and supply – importance of time element- short run and long run equilibrium, Imperfect competition – Monopoly- meaning- features- short and long run equilibrium – price and output determination under Discriminating Monopoly, Oligopoly- meaning – features- kinked demand curve, Duopoly-meaning- features

TOTAL HOURS – 45

REFERENCES:

1. D. M. Mithani., "Business Economics", Himalaya Publishing House, 2015.
2. M. L. Jhingan., "International Economics", Fourth Edition, Vrinda Publication Pvt. Limited, 2016.
3. Varshney and Maheshwari., "Managerial Economics", Sultan Chand, 2014.
4. K. K. Dewett., "Modern Economic Theory", Fourth Edition, S Chand & Co Ltd, 2006.

OUTCOMES:

At the end of this course, the student will be able to:

- State the role of manager in effective management of organisation using the concepts of managerial economics.
- Describe the meaning of demand, supply, production and cost with respect to Managerial Economics.
- Identify different market structures and its impact on the business organisation.

MSC 1104	BASIC STATISTICS	L	T	P	C
		4	0	0	4

OBJECTIVES:

- Make students familiar with the measures of central tendency and dispersion.
- Enable students to analyse bi-variate and uni-variate data.
- Provide basic knowledge of quantitative tools and their applications in business and management.

MODULE I INTRODUCTION TO STATISTICS & ORGANIZATION OF DATA **12**

Definition of Statistics, Functions, Limitations, Scope of statistics in Business, Industry and Economics, Concept of Data, Variable population, Sample, Concept of Classification of data - Types, Frequency distributions, Tabulation of Data, Parts of table, Requisites of a good table

MODULE II ANALYSIS OF UNI-VARIATE DATA **15**

Measures of Central Tendency: Introduction, Types of Central Tendency Measures, qualities of good measure of Central tendency, Arithmetic mean – Computation using Direct shortcut and step-deviation method, problems on missing frequencies (one or two), properties of AM, problems on combined Mean, corrected Mean, Weighted AM – Simple problems of Weighted AM, Median – computation for raw data, discrete and continuous data, problems on missing frequencies, Mode – computation of mode for raw data, discrete and continuous data – for Uni-modal distribution, problems on Grouping and analysis table; Measures of Dispersion: Introduction, Types of dispersion measures – concept absolute and relative measures, Qualities of good measure of dispersion, Range – Concept and simple problems, Quartile deviation – computation of QD and its coefficient for raw, discrete and continuous data, Standard Deviation – Computation of SD and its coefficient for raw, discrete and continuous data

MODULE III TIME SERIES ANALYSIS **9**

Objectives and uses of Time series analysis, Components of Time series, Measurement of Trend by Moving averages method and Least squares method to Linear

MODULE IV ANALYSIS OF BI VARIATE DATA- CORRELATION 12

Correlation – Meaning & Types, Spearman's Rank correlation, Karl Pearson's co efficient of correlation, Probable error, Concurrent deviation method

MODULE V ANALYSIS OF BI VARIATE DATA- REGRESSION 12

Regression – Meaning, Regression lines, Properties of Regression lines and regression coefficient, Related problems on regression lines and Regression coefficient

TOTAL HOURS – 60

REFERENCES:

1. Sancheti D. C. & Kapoor V. K., "Business Mathematics", Sultan Chand & Sons, 2015.
2. V. K. Khanna, QaziZameeruddin, S. K. Bhambri., "Business Mathematics", Second Edition, Vikas Publishing House Pvt Limited, 2009.
3. R. S. Soni., "Essential Business Mathematics & Business Statistics", ANE Books, 2012.
4. J. K. Singh., "Business Mathematics", Second Edition, Himalaya Publishing House, 2012.

OUTCOMES:

At the end of this course, the student will be able to:

- Compute the measures of central tendency and dispersion.
- Analyse bi-variate and uni-variate data.
- Apply quantitative tools and techniques in business and management.

MSC 1105	CORPORATE COMMUNICATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Introduce students to the communication process.
- Familiarize students with different methods, models and theories of communication.
- Enable students to understand different types of business correspondence and write business reports.

MODULE I COMMUNICATION IN BUSINESS **6**

Introduction, Communication Process, Essentials of Business Communication, Barriers to Business Communication

MODULE II METHODS, MODELS AND THEORIES OF COMMUNICATION **12**

Models of communication, Shannon's Model of the communication Process, Derivative Models of the Communication Process, New Model of the Communication Process, Defining Communication Theories. Types of Communication: Verbal Communication, Nonverbal Communication, Types of Communication Based on Style and Purpose

MODULE III ENGLISH GRAMMAR **9**

Remedial English - I: Parts of Speech (Nouns, Pronouns, Adjectives, Verbs, Adverbs, Prepositions, Conjunctions, and Interjections) Reading Skills – II: Sentences, Subject-Verb Agreement, Active and Passive Voice, Direct and Indirect Speech

MODULE IV BUSINESS CORRESPONDENCE **9**

Communication in an Organization: Types of Communication Meetings, Memo, Circulars and Notices Business Correspondence: General Rules for All Business Correspondence, Guidelines for the Basic Cover Letter, Guidelines for Information Interviewing, Networking Letters, Guidelines for Thank You Letters, Guidelines for Job Offer, Acceptance Letters, Guidelines for Letters Declining a Job Offer, Style in Business Correspondence

MODULE V BUSINESS REPORT WRITING 9

Cover Letters, Business Report Writing, The purpose of statistical studies, sample of business correspondence

TOTAL HOURS – 45

REFERENCES:

1. Varinder Kumar and Bodh Raj, “Business Communication”, Kalyani Publishers, 2014.
2. “Business Communication”. ICMR Publications.
3. Mary Ellen Guffey , “Essentials of Business Communication” with Student CD-ROM, South-Western Educational Publication, 2003.
4. John M. Penrose, Robert J. Myers, Robert W. Rasberry., “Business Communication for Managers: An Advanced Approach”, South Western Educational Publishing, 2003.

OUTCOMES:

At the end of this course, the student will be able to:

- Identify the steps in the communication process.
- Apply different methods, models and theories of communication.
- Make different types of business correspondence and write business reports.

MSC 1106 IT FOR BUSINESS AND ACCOUNTING

L	T	P	C
2	0	0	2

OBJECTIVES:

- Introduce students to the basics of information technology and fundamentals of computer .
- Familiarize students with data organization, Data Base Management System, data communication and computer networks.
- Enable students to understand the Computerised Accounting System.

MODULE I BASICS OF INFORMATION TECHNOLOGY (IT) 6

Concepts of data, information and computer based information system. Deployment of IT in various business sectors (Banking, Travel & Tourism, Retailing and Insurance); Impact of information technology on business (business data processing and storage, intra-organisational and inter-organisational communication by using network technology, business process and knowledge process outsourcing); Information system – Definition, Framework and features, Types of Information System -Transaction Processing System (TPS), Management Information System (MIS), Decision Support System (DSS), Knowledge Management System (KMS); Application of information system(s) at managerial level (operational, tactical and strategic); Basic concepts of Cloud computing – Definition, types of cloud (public cloud & private cloud), applications (types of industries preferring cloud computing), types of security involved in cloud computing).

MODULE II FUNDAMENTALS OF COMPUTER 6

Hardware specifications of a digital computer system: processor, cores, screen resolutions, types of monitor, primary and secondary memory; Software; Application and system software – definition and examples. Programming Languages and their features –procedural, object-oriented, scripting, mark-up; Computer codes– ASCII, UNICODE; Operating systems [characteristics & functions]; Problem-solving Tools – Flow chart – Concept, Advantages and disadvantages

MODULE III DATA ORGANIZATION AND DATA BASE MANAGEMENT SYSTEM 6

Data organization – character, field, record, file and database; Types of Data

Processing System [Serial, Batch, Real-time, Online, Centralized, Distributed] Data Base Management System: Limitations of Traditional file organization. Concept of Data Base Management System, Types of database model [E-R Model, Relational and Object-oriented]; Important terms of DBMS [Entity, Attribute, Primary Key, Foreign Key, Candidate Key, Referential integrity, Table, Relation, Views, SQL, Data Dictionary, Metadata, Entity-Relationship Diagram]. SQL commands – DDL, DCL DML, Significance of SQL as programming language

MODULE IV DATA COMMUNICATION AND COMPUTER NETWORKS 6

Data Communication: Concept of Data communications, Transmission Modes [Simplex, Half-Duplex, Full Duplex]Types of Data Transmission [Serial, Parallel, Synchronous, Asynchronous], Communication Media [Guided &Unguided], Network components – Hub, Bridge, Switch, Router, Gateway.

Computer Networks: Concepts of Internet, Intranet and Extranet, Network Architecture [P2P, Client-Server], Various Topologies: Bus, Star, Ring, Mesh, Tree; Types of network [LAN, WAN, MAN, VAN, SAN, VPN]

Basic concept of web technology: Network Addressing Concept - IP address (IPV4, IPV6). Protocol Models [OSI,TCP/IP]; Important Terms [URL, Domain Name System; UDP, HTTP, FTP, TELNET, HTML, DHTML AND XML]

MODULE V COMPUTERISED ACCOUNTING SYSTEM 6

Concept of Computerised Accounting System, Comparison between Manual and Computerised Accounting, Advantages of Computerised Accounting System, Limitations of Computerised Accounting System, Sourcing of Accounting Software, Accounting Packages: Ready to use, Customised, Tailored; Generic Considerations before Sourcing an Accounting Software; Generic Considerations before Sourcing an Accounting Software

TOTAL HOURS – 30

REFERENCES:

1. Turban, Rainer and Potter, “Introduction to Information Technology” , Wiley India, 2002.
2. “Introduction to Information Technology” – ITLESL, Pearson Education, 2012.
3. Asok K. Nadhani, “Mastering Tally ERP 9: Basic Accounts, Invoice,

Inventory", 2012.

4. Sinha and Sinha, "Fundamentals of Computers", BPB Publication, 2004.
5. K. Nadhani and K. K. Nadhani, "Implementing Tally 9 Comprehensive Guide", 2nd Edition, Bpb, 2007.

OUTCOMES:

- Understand the basics of information technology and fundamentals of computer.
- Familiarize students with data organization, Data Base Management System, data communication and computer networks.
- Enable students to understand the Computerised Accounting System.

MSC 1107	IT FOR BUSINESS AND ACCOUNTING – LAB	L	T	P	C
		0	0	4	2

OBJECTIVES:

- Introduce students to the MS Word and Power Point .
- Familiarize students with the techniques of Data Base Management Systems.
- Enable students to understand the fundamentals of Tally.

MODULE I INTRODUCTION TO MS WORD AND POWER POINT 9

Getting Started with Ms-Word, Main Menu Options, Format, Insert, Design and Page Layout; Getting Started with Power Point, Developing onscreen presentations for business projects including- automatic slide transition and custom animation

MODULE II DATABASE MANAGEMENT SYSTEM 9

Creation of Tables, Constraints Specification, Multiple Table**,** Handling-Defining Relationship [Foreign Key], Generating simple and conditional Queries, Types of queries [Update, Delete, Append], Forms, Reports, Introduction to SQL through Basic Commands

MODULE III FUNDAMENTALS OF TALLY 6

Overview**,** Installation**,** Getting Functional,Creation/Setting Up Company

MODULE IV BOOKS OF ACCOUNTS IN TALLY 9

Charts of Accounts, Accounting Masters, Voucher Entry, Day Book Summaries, Bank Reconciliation Statement

MODULE V FINAL ACCOUNTS IN TALLY 12

Trial Balance**,** Profit and Loss Statement**,** Balance Sheet

TOTAL HOURS – 45

REFERENCES:

1. Turban, Rainer and Potter, “Introduction to Information Technology”, Wiley In, 2002.
2. ITLESL, “Introduction to Information Technology”, Pearson Education, 2012.

3. Sinha & Sinha, “Fundamentals of Computers”, BPB Publication, 2004.
4. Asok K. Nadhani. Mastering Tally ERP 9: Basic Accounts, Invoice, Inventory 2012.
5. Ramesh Bangia, “Learning Tally 9, Including Version 2.1”, 1st Edition, Khanna Book Publishing Co (p) Ltd, 2007.
6. Rita Bhargava, “Tally 7.2 Including VAT TDS under New Tax System”, 2nd Edition. Cyber Tech Publications, 2006.
7. Dinesh Maidasani, “Straight to the Point Tally 9/0”, 1st Edition. Laxmi Publications, 2008.
8. A. K. Nadhani and K. K. Nadhani, Implementing Tally 9 Comprehensive Guide, 2nd Edition, Bpb, 2007.
9. Asok K. Nadhani, “Simple Tally 9”, 1st Edition. BPB Publications, 2007.

OUTCOMES:

At the end of this course, the student will be able to:

- Prepare reports using MS Word and Power Point Presentations.
- Apply the techniques of Data Base Management Systems.
- Prepare books of accounts using Tally.

SEMESTER II

MSC 1201	ACCOUNTING– II	L	T	P	C
		5	0	0	4

OBJECTIVES:

- Acquaint students with the basic understanding of accounting for share capital and debentures
- Demonstrate preparation of Company final accounts and Cash flow statement
- Familiarize students with valuation of shares and goodwill

MODULE I ACCOUNTING FOR SHARE CAPITAL 12

Share and share capital: nature and types; Accounting for share capital: issue and allotment of equity shares, private placement of shares, Public subscription of shares - over subscription and under subscription of shares; Issue at par and at premium and at discount, Calls in advance and arrears; Issue of shares for consideration other than cash; Accounting treatment of forfeiture and re-issue of shares; Disclosure of share capital in company's Balance Sheet only

MODULE II ACCOUNTING FOR DEBENTURES 12

Debentures: Issue of debentures at par, at premium and at discount; Issue of debentures for consideration other than cash; Debentures as collateral security; Interest on debentures; Redemption of debentures: Lump sum, draw of lots and conversion

MODULE III COMPANY FINAL ACCOUNTS 12

Statutory Provisions regarding preparation of Company Final Accounts; Treatment of Special Items: Managerial Remuneration, Tax deducted at source, Advance payment of Tax, Provision for Tax, Depreciation, Interest on debentures; Dividends, Rules regarding payment of dividends; Transfer to Reserves; Preparation of Profit and Loss Account and Balance Sheet as per Companies Act 2013

MODULE IV CASH FLOW STATEMENT 12

Meaning, Advantages and Disadvantages of Cash Flow Statement, Cash flow from operating activities, Cash flow from investing activities, Cash flow from financing activities, Preparation of Cash Flow Statement as per AS-3.

MODULE V VALUATION OF GOODWILL AND SHARES 12

Valuation of Goodwill: Meaning – Circumstances of Valuation– Factors influencing Valuation – Methods of Valuation: Average Profit Method, Super Profit Method, Capitalization of average Profit Method, Capitalization of Super Profit Method

Valuation of shares: Meaning – Need for Valuation – Factors Affecting Valuation – Methods of Valuation: Intrinsic Value Method, Yield Method, Earning Capacity Method, Fair Value of shares.

TOTAL HOURS – 60

REFERENCES:

1. S.N. Maheswari, Suneel K Maheshwari, Sharad K Maheswari, “An Introduction to Accountancy”, 2016.
2. S. P. Jain and K. L. Narang, “Corporate Accounting”, 2016.
3. S.P. Iyengar, “Advanced Accountancy”, 2015.
4. R. .L Gupta, “Advanced Accountancy” 2016.
5. V.K. Goyal, “Corporate Accounting”, 2015.

OUTCOMES:

At the end of this course, the student will be able to:

- Record the transactions relating issue of shares and debentures and the redemption of debentures.
- Prepare company final accounts and the cash flow statement.
- Compute the value of shares and goodwill.

MSC 1202	BUSINESS MATHEMATICS	L	T	P	C
		4	0	0	4

OBJECTIVES:

- Acquaint students with the number system and the theory of equations.
- Familiarize students with matrices and determinants algebra.
- Enable students to understand commercial arithmetic and progressions.

MODULE I NUMBER SYSTEM **9**

Introduction – Natural Numbers - Even Numbers – Odd Numbers – Integers – Prime Numbers – Rational & Irrational numbers, Real Numbers, HCF & LCM (Simple problems).

MODULE II THEORY OF EQUATIONS **12**

Introduction – Meaning - Types of Equations – Simple/ Linear Equations and Simultaneous Equations (only two variables), Elimination and Substitution Methods only. Quadratic Equation - Factorization and Formula Method ($ax^2 + bx + c = 0$ form only). Problems on Commercial Applications

MODULE III MATRICES AND DETERMINANTS **12**

Meaning – types – operation on matrices – additions – subtractions and multiplication of two matrices – transpose – determinants – minor of an element – co-factor of an element –inverse – crammers rule in two variables – application oriented problems.

MODULE IV COMMERCIAL ARITHMETIC **15**

Simple Interest, Compound Interest including half yearly and quarterly calculations, Annuities, Percentages, Bills Discounting, Ratios and proportions, duplicate-triplicate and sub-duplicate of a ratio. Proportions: third, fourth and inverse proportion - problems.

MODULE V PROGRESSIONS **12**

Introduction, Arithmetic Progression - Finding the nth term of AP and Sum to nth term of AP. Insertion of Arithmetic Mean; Geometric Progression – Finding the nth

term of GP and sum of n terms of GP and insertion of Geometric Mean .

TOTAL HOURS – 60

REFERENCES:

1. Saha, “Mathematics for Cost Accountants”, Central Publishers, 2016.
2. R.G. Saha & Others, “Methods & Techniques for Business Decisions”, VBH, 2016.
3. Dr. Sancheti & Kapoor, “Business Mathematics and Statistics”, Sultan Chand, 2016.
4. Zamarudeen, “Business Mathematics”, Vikas Publications, 2015.
5. R.S Bhardwaj, “Mathematics for Economics & Business”, 2014.
6. Madappa, Mahadi Hassan, M. Iqbal Taiyab, “Business Mathematics”, Subhash Publicaions, 2016.
7. G.R. Veena and Seema, “Business Mathematics and Statistics”, I.K. Intl Publishers, 2014.

OUTCOMES:

At the end of this course, the student will be able to:

- Identify the number system and apply the theory of equations.
- Apply matrices and determinants algebra to business scenarios.
- Understand the application of commercial arithmetic and progressions in business.

MSC 1203	ORGANISATION BEHAVIOUR	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Introduce the idea of how individual behaviour affects organizational behaviour
- Help the students understand the crucial role of people in any business
- Explore different aspects of organizational behaviour

MODULE I INTRODUCTION **9**

Nature and scope of OB, Challenges and opportunities for OB, Organization Goals, Models of OB, Impact of Global and Cultural diversity on OB**.**

MODULE II INDIVIDUAL BEHAVIOUR **9**

Individual behaviour, Personality, Perception and its role in individual decision making, Learning, Motivation, Hierarchy of needs theory, Theory X and Y, Motivation- Hygine theory, Vrooms Expectancy theory

MODULE III BEHAVIOUR DYNAMICS **9**

Interpersonal behaviour, Communication, Transaction Analysis, The Johari Window, Leadership, Its Theories and Prevailing Leadership styles in Indian Organisations.

MODULE IV GROUP BEHAVIOUR **9**

Definition and classification of Groups, Types of Group Structures, Group decision making, Teams Vs Groups, Contemporary issues in managing teams, Inter group problems in organizational group dynamics, Management of conflict**.**

MODULE V MANAGEMENT OF CHANGE **9**

Change and Organisational development, Resistance to change, Approaches to managing organizational change, Organisational effectiveness, Organisational culture, Power and Politics in Organisational Quality of work life, recent advances in OB**.**

TOTAL HOURS – 45

REFERENCES:

1. K. Aswathappa, “Organizational Behaviour”, Himalaya Publications, Ninth

Revised and Enlarged Edition, 2016.
2. Fred Luthans, “Organizational Behaviour”, 12th Edition, Tata McGraw Hill Publications, 2010.
3. Seema Sanghi, “Human Resource Management”, First Edition, Macmillan India Limited, 2012.
4. Cynthia D. Fisher , Lyle F. Schoenfeldt , James B. Shaw, “Human Resource Management”, Dreamtech Press, 2008.
5. UdayPareek, “Understanding Organizational Behaviour”, Third Edition, Oxford Press, 2012.

OUTCOMES:

At the end of this course, the student will be able to:

- Identify how individual behaviour affects organizational behaviour
- Understand the crucial role of people in any business
- Analyse different aspects of organizational behaviour

MSC 1204 APPLIED MACRO ECONOMICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- Explain the various approaches to economic theory and the concept of circular flow of Income.
- State the concept and use of the Public finance and its role in Economy of the country.
- Describe the concept of Inflation and the role of Monetary and Fiscal Policy in managing inflation in the economy.
- Outline the concept of Balance of Payment, Foreign trade, Business Cycle and its impact on the economy.

MODULE I APPROACHES TO ECONOMIC THEORY 9

Classical Vs. Modern Economic approach, Micro and Macro Meaning, Circular flow of Income- Concept of National Income: GNP, NNP, GDP, NDP, PI, DPI, PCY; National Income at factor cost and Market price, Estimation of National income- Product-Income-Expenditure, Difficulties of Estimation, National income and economic welfare

MODULE II PUBLIC FINANCE 9

Public Finance: Budget – Types, Public revenue - Tax and Non-tax, Public Expenditure- Heads of expenditure, Public Debt: Classification, Deficit financing - Taxable capacity - factors influencing taxable capacity, Quasi-government institutions finance

MODULE III MACRO ECONOMIC ENVIRONMENT 9

Meaning of Inflation - causes and effect, Cost push and demand pull inflation, Deflation – Meaning and causes, Phillips curve- stagflation- M1 and M3, Measures to control inflation - Role of Monetary policy, Fiscal policy- Instruments

MODULE IV BALANCE OF PAYMENTS AND BUSINESS CYCLES 9

Meaning- Difference- Types, Component of BOP- Current and Capital Account, Unfavourable BOP- causes, Monetary and Non-Monetary Measures, Business cycle: Meaning- definition- features, Stages of Business Cycle, Effects and

Measures to control cyclical fluctuation

MODULE V FOREIGN TRADE & DEVELOPMENT 9

Role of External Trade in Economic Development, Terms of Trade: NBTOT – GBTOT, Exchange rate- spot and forward exchange rate, Foreign capital – Role of foreign aid – types

TOTAL HOURS – 45

REFERENCES:

1. D. M. Mithani, B"usiness Economics", Himalayan Books, 2016.
2. M. L. Jhingan, "International Economics", 6th edition, Vrinda Publications, 2009.
3. Niravathi& C Ramani Nair, « International Economics", 1stedition, Interline Publishing Pvt Ltd, 2003.
4. Joel Dean, "Managerial Economics", 1st edition, PHI Learning Private Limited, 2009.
5. Varsheney and Maheswari, "Managerial Economics", Prentice-Hall of India Pvt. Ltd, 2016.
6. J. D. Varma, K. K. Dewett., "Elementary Economic Theory", 1st edition, S. Chand, 2011.
7. Petersen & Lewis, "Managerial Economics", 4th edition, Pearson, 2005.
8. G. S. Gupta, "Managerial Economics", 4th edition Deep & Deep Publication, 2011.
9. A. Koutosoyiannis, "Modern Micro Economics", 2nd edition, Macmillan, 2008.

OUTCOMES:

At the end of this course, the student will be able to:

- Illustrate the concept of GNP, NNP, GDP, NDP, PI, DPI, PCY and its relation with macro economics.
- Discuss the role of Monetary and Fiscal Policy in managing Inflation in an economy.
- Discuss the concept of Public Finance and Balance of Payment.
- Infer different market structures and its impact on the business of the organisation.

MSC 1205	INDIAN FINANCIAL SYSTEM	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Acquaint students with the components of the Indian financial system
- Familiarize students with various financial assets
- Enable students to understand the role and responsibilities of various market intermediaries
- Introduce students to different regulatory authorities operating in the Indian financial system

MODULE I INTRODUCTION TO INDIAN FINANCIAL SYSTEM 9

Financial System: Meaning and Functions; Saving-Investment Process; Components of the Financial System; Growth and Trends in Indian Financial System; Financial Sector Reforms in India, Role of Indian Financial System in Indian Economic Development

MODULE II FINANCIAL ASSETS 9

Meaning and Features of Financial Assets; Financial Assets Vs. Real Assets; Classification of Financial Assets; Equity Shares; Preference Shares, Debentures, Innovative Debt Instruments; Derivative Instruments; Non-Marketable Financial Assets, Money Market Instruments

MODULE III FINANCIAL MARKETS 9

Meaning and Functions of Financial Markets; Classifications of Financial Markets; Money Market and Capital Market; Debt Market and Equity Market; Primary Market (IPO and Book Building) and Secondary Market; Spot Market and Forward Market; Exchange Traded Market and Over the Counter Market

MODULE IV FINANCIAL INTERMEDIARIES 9

Meaning of Financial Intermediation; Functions of Financial Intermediaries; Major Financial Intermediaries and Their Roles: Commercial Banks, Non-Banking Financial Companies, Mutual Funds, and Insurance Companies, Financial Institutions, Non-Banking Financial Services Companies

MODULE V REGULATORY AUTHORITIES 9

Regulators of Indian Financial System; The Reserve Bank of India – Organization, Roles and Functions, Monetary Policy, Techniques of Monetary Control; The Securities and Exchange Board of India – Organization, Objectives, Roles, Functions and Power; Insurance Regulatory and Development Authority of India - Organisation, Power, Scope, and Functions

TOTAL HOURS – 45

REFERENCES:

1. Pathak, “Indian Financial System”, 4th Edition, 2014.
2. M. Y. Khan, “Indian Financial System”, 2013.
3. Gomez, “Financial Markets Institutions and Financial Services”, 1st edition, PHI Learning, 2008.
4. Bhole and Mahakud, “Financial Institutions and Markets”, 5th edition, McGraw Hill, 2009.
5. Ramesh Babu, “Financial Markets and Institutions”, 1st edition, Concept publishing company, 2006.

OUTCOMES:

At the end of this course, the student will be able to:

- Identify the components of the Indian financial system.
- Compare the distinguishing features of various financial assets.
- Understand the role and responsibilities of various market intermediaries.
- Recognize the roles of different regulatory authorities operating in the Indian financial system.

MSC 1206 EXCEL APPLICATIONS FOR BUSINESS

L	T	P	C
2	0	0	2

OBJECTIVES:

- Familiarize students with basic and advanced Excel functions
- Enable students to understand the application of Excel for business activities.

MODULE I INTRODUCTION TO EXCEL **6**

Excel Introduction, Understanding Workbooks and Worksheets, Introducing the Ribbon, Using Shortcut Menus, Working with Dialog Boxes, Using the Task Pane, Creating Excel Worksheet, Entering and Editing Worksheet Data, Essential Worksheet Operations

MODULE II ADVANCED EXCEL 1 **6**

Working with Cells and Ranges, Introducing Tables, Worksheet Formatting, Using Custom Number Formats, Understanding Excel Files, Using and Creating Templates, Printing Your Work, Working with Dates and Times

MODULE III ADVANCED EXCEL 2 **6**

Introducing Formulas and Functions, Creating Formulas That Count and Sum, Creating Formulas That Look Up Values, Creating Formulas for Financial Applications, Introducing Array Formulas, Visualizing Data Using Conditional Formatting, Using Data Validation

MODULE IV CREATING CHARTS AND GRAPHICS **6**

Understanding How Excel Handles Charts, Understanding Chart Types, Understanding Chart Elements, Modifying the Chart Area, Modifying the Plot Area, Working with Chart Titles, Working with a Legend, Working with Gridlines, Working with Data Series, Creating Chart Templates

MODULE V ANALYZING DATA WITH EXCEL **6**

Introducing Pivot Tables, Analyzing Data with Pivot Tables, Understanding Slicers and Slicer properties

TOTAL HOURS –30

REFERENCES:

1. John Walkenbach, Excel 2013 Bible, Wiley, PAP/CDR edition, 2013
2. JohnWalkenbach, Excel 2013 Power Programming with VBA. (Mr. Spreadsheet's Bookshelf) Wiley; PAP/CDR edition, 2013

OUTCOMES:

At the end of this course, the student will be able to:

- Use basic and advanced Excel functions to achieve efficiency in repetitive computations
- Apply Excel for creating tables, charts, and other reports useful for business activities.

MSC 1207 EXCEL APPLICATIONS FOR BUSINESS – Lab

L	T	P	C
0	0	4	2

OBJECTIVES:

- Provide students with hands-on experience of working with basic and advanced Excel functions
- Enable students to use Excel for creating tables, charts, and other reports useful for business activities.

MODULE I INTRODUCTION TO EXCEL **9**

Excel Introduction, Basic formulae: Entering and editing data, Creating and copying formulae, Creating functions easily, Formatting: Inserting/deleting rows/columns, Changing fonts, Colors and borders, Merging and aligning cells, Printing: Page break preview, Using page layout view, Headers and footers, Freezing print titles, Charts: Selecting data, Quick ways to create charts, Formatting your chart, Basic tables: Table styles, Using calculated columns, Header rows and total rows, Case Exercises/ Practical Assignments/Activities

MODULE II ADVANCED EXCEL 1 **9**

Sorting and filtering lists/tables of data, custom sort, Number formatting: Creating custom formats, The four parts of a format, Scaling numbers, Dates and times: How dates and times are stored, Useful date/time functions, Formatting dates and times, Case Exercises/ Practical Assignments/Activities

MODULE III ADVANCED EXCEL 2 **9**

Conditional formatting: Creating/using cell rules, Data bars and colour sets, Styles and themes, How themes work, Using the default styles, Creating custom styles, Validation and protection: Setting cell validation, Protecting cells/worksheets, Grouping and outlining, Cell comments, Range names and absolute references: Absolute references ($ symbol), Fixing only the row/column, Creating range names, Labelling ranges automatically

MODULE IV EXCEL FUNCTIONS **9**

Excel Functions: Introduction to Mathematical Functions, Introduction to Text Functions, Introduction to Logical & Reference Functions, Introduction to Date &

Time Functions, Introduction to Financial Functions, Introduction to Information Functions, IF and LOOKUP functions: The conditional (IF) function, Nested Ifs, Lookup functions, Case Exercises/ Practical Assignments/Activities

MODULE V TABLES AND CHARTS 9

Advanced Tables, Using calculated columns, Removing duplicates, Advanced filter, Pivot tables: Creating pivot tables, Swapping rows, columns and pages, Grouping fields, Slicers, Pivot table slicers, Changing slicer properties, Advanced charts, Creating chart templates, Combination charts, Picture charts, Custom chart types, Case Exercises/ Practical Assignments/Activities

TOTAL HOURS – 45

REFERENCES:

1. John Walkenbach, “Excel 2013 Bible”, PAP/CDR edition, Wiley, 2013.

2. John Walkenbach, “Excel 2013 Power Programming with VBA (Mr. Spreadsheet's Bookshelf)” PAP/CDR edition, Wiley, 2013.

OUTCOMES:

At the end of this course, the student will be able to:

- Perform repetitive computations efficiently using basic and advanced Excel functions
- Create tables, charts, and other reports useful for different business activities.

GEC 1212	ENVIRONMENTAL STUDIES	L	T	P	C
		2	0	0	2

OBJECTIVES:

The student will be conversant with the

- various natural resources, availability, utilisation and its current scenario
- different ecosystems, energy transfer, values, threats and conservation of biodiversity
- levels of different pollutants and its impact and the causes and effects of natural disasters
- impacts of human population, impact assessment, human rights and environmental acts and sustainable development

MODULE I **NATURAL RESOURCES** **8**

Land resources: land degradation, soil erosion and desertification - Forest resources: use and over-exploitation, deforestation - Water resources: use and over-utilisation of surface and ground water, conflicts over water (inter-state and international), dams (benefits and problems), water conservation (rainwater harvesting and watershed management) - Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources, mining - Food resources: world food problems, changes in land use by agriculture and overgrazing, modern agriculture and its effects, fertilizer and pesticide problems, water logging and salinity - Energy resources: increasing energy needs, renewable and non-renewable, use of alternate energy sources.

MODULE II **ECOSYSTEM AND BIODIVERSITY** **8**

Ecosystem- energy flow in the ecosystem - food chains, food webs and ecological pyramids - characteristics, structure and function of (a) Terrestrial ecosystems (forest, grassland, desert) and (b) Aquatic fresh water ecosystems (pond, lake, river) (c) Aquatic salt water ecosystems (ocean, estuary) - ecological succession.

Biodiversity - genetic, species and ecosystem diversity – hot-spots of biodiversity – biogeographic classification of India - endangered, endemic, extinct and invasive species of India - red data book - values of biodiversity: consumptive, productive, social, ethical, aesthetic and option values - threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts - conservation of biodiversity: in-situ and

ex-situ conservation of biodiversity

MODULE III **ENVIRONMENTAL POLLUTION AND NATURAL DISASTER** **8**

Definition, cause, effects and control measures of (a) air pollution (b) water pollution (c) soil pollution (d) marine pollution (e) noise pollution (f) thermal pollution (g) nuclear hazards - ill-effects of fireworks and upkeep of clean environment - solid waste management: types (urban, industrial, biomedical and electronic wastes), collection, processing and disposal (incineration, composting and land-fill) - natural disaster and management: flood, cyclone, drought, landslide, avalanche, volcanic eruptions, earthquake and tsunami.

MODULE IV **HUMAN POPULATION, HEALTH AND SOCIAL ISSUES** **6**

Population and population growth, population variation among nations, population explosion, family welfare programme.

Human health: air-borne, water borne diseases, infectious diseases, risks due to chemicals in food and environment.

Sustainable development - environmental legislation and laws: water act, air act, wildlife protection act, forest conservation act, environment protection act - environmental impact assessment, steps in EIA - human rights - women and child welfare.

Case studies related to current situation

TOTAL HOURS – 30

TEXT BOOKS:

1. Erach Bharucha, Textbook for Environmental Studies For Undergraduate Courses of all Branches of Higher Education for University Grants Commission, Orient Blackswan Pvt Ltd, Hyderabad, India, 2013.
2. Benny Joseph, Environmental Studies, Tata McGraw-Hill Education, India, 2009.
3. Ravikrishnan A, Environmental Science and Engineering, Sri Krishna Publications, Tamil Nadu, India, 2015.
4. Raman Sivakumar, Introduction to Environmental Science and Engineering, McGraw Hill Education, India, 2009.
5. Venugopala Rao P, Principles of Environmental Science and Engineering, Prentice Hall India Learning Private Limited; India, 2006.

6. Anubha Kaushik and Kaushik C.P., Environmental Science and Engineering, New Age International Pvt Ltd., New Delhi, India, 2009.

REFERENCES:

1. Masters G.M., Introduction to Environmental Engineering and Science, Prentice Hall, New Delhi, 1997.
2. Henry J.G. and Heike G.W., Environmental Science and Engineering, Prentice Hall International Inc., New Jersy, 1996.
3. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co. Boston, USA, 2016.

OUTCOMES:

The student will be able to

- predict the scenario of various natural resources and suggest remedies to curb the exploitation of these resources.
- identify food chain and web and its role in various ecosystems, assess the impacts on biodiversity and provide solutions to conserve it.
- analyse the impacts of pollutants in the environment and propose suitable method to alleviate the pollutants and the natural disasters.
- assess on the impact of human population and the health related issues and the ethics to be followed for sustainable life.

SEMESTER III

		L	T	P	C
MSC2101	**MARKETING MANAGEMENT**	**3**	**0**	**0**	**3**

OBJECTIVES:

- Familiarize students with the all-pervasive nature of markets and their transformation across decades
- Explore the rational, sensory & emotional triggers in consumer buying & selling habits
- Provide students with the latest information about marketing developments & practices to inculcate managerial approach to marketing problems

MODULE I INTRODUCTION TO MARKETING MANAGEMENT 9

Introduction – Meaning and nature of marketing management, objectives and importance of marketing management, marketing concepts.

Consumer Needs, Wants, and Consumer Insights: Introduction, Needs and Wants, Using Needs/Wants Insight in Marketing, Benefits Sought By Consumers, The Impact of Emotional Benefits, Consumer Insight, Possible Sources of Insights, Using Insights, Finding and Developing an Insight , The Role of an Insight in Product Development and Marketing.

MODULE II SEGMENTATION TARGETING AND POSITIONING (STP) 9

Market Segmentation and Product Positioning: Introduction, Market Segmentation, Market Targeting, Target Market Strategies, Product Positioning and Differentiation, Choosing a Differentiation and Positioning Strategy, Changing the Product Positioning, USPs.

MODULE III MARKETING MIX: PRODUCT AND PRICE 9

Products and Services: Introduction, Levels of Product and Services, Classifications, Product and Service Decisions. Branding, New Product Development and Product Life Cycle (PLC), Services Marketing: The Nature and Characteristics of a Service, Marketing Strategies for Service Firms. Pricing: Introduction - factors influencing pricing decisions and Pricing Strategies.

MODULE IV MARKETING MIX: PROMOTION 9

Marketing Communication, Integrated Marketing Communications (IMC), and Promotion Mix Strategies – Push and Pull Strategy, Advertising and Public

Relations, Personal Selling and Sales Promotion, Sales Promotion - Trade Shows, Trade Sales Promotion, Consumer Sales Promotion. Publicity and direct marketing - Direct Marketing, Benefits of Direct Marketing, Direct Marketing Channels, Public and Ethical Issues in Direct Marketing.

MODULE V MARKETING MIX: PLACE (DISTRIBUTION CHANNEL) 9

Distribution Channels: Introduction, Type of Marketing Channel, Channel Motivation, Importance of Channel of Distribution, Multiple Channels Distribution, Retail, Levels of Service, Corporate Retailing, The New Retail Environment. New trends in the area of marketing

L – 45;Total Hours –45

TEXT BOOKS:

1. Kotler, Philip and Armstrong, “Principles of Marketing”, New York: Pearson Education, 2014.

REFERENCES:

1. Ramaswamy and Namakumari, “Marketing Management”. Macmillan, 2015.
2. Arun Kumar and Meenakshi, “Marketing Management”. Vikas, 2007.
3. Lamb, Hair and Danniel. M. C., “Marketing”, 7th ed., Thomson, 2004.
4. Evans and Berman, “Marketing”, 2nd ed., Biztantra, 2005.
5. William M Pride and O C Ferrell, ”Marketing – Concepts”, 12th ed., Cengage Learning, 2005.

OUTCOMES:

At the end of this course, the student will be able to:

- Understand the all-pervasive nature of markets and their transformation across decades.
- Analyse the rational, sensory & emotional triggers in consumer buying & selling habits.
- Identify the recent marketing developments and practices to inculcate them into managerial approach.

MSC2102	INTRODUCTION TO FINANCIAL MANAGEMENT	L	T	P	C
		2	0	0	0

OBJECTIVES:

- Familiarize students with the goals of financial management.
- Provide insights into concepts such as, leverages, cost of capital, capital budgeting, and capital structure.
- Enable students to understand the techniques of estimating working capital and dividend policies and decisions.

MODULE I INTRODUCTION TO FINANCIAL MANAGEMENT 9

Meaning and Definition of Financial Management, Goals of Financial Management, The Fundamental Principle of Finance, Risk-return trade-off, Agency problem, Emerging roles of financial managers in India; Time Value of Money: Future Value, Present Value, Annuity, Perpetuity.

MODULE II CAPITAL STRUCTURE, LEVERAGES AND COST OF CAPITAL 15

Meaning of Capital Structure, factors determining capital structure, capital structure planning and policy, approaches to establish target capital structure; Different sources of Long-term Finance; Leverages: Operating leverage, financial leverage and Combined leverage, EBIT-EPS analysis; Cost of capital: Cost of equity, Cost of preference shares, Cost of debt, WACC.

MODULE III TECHNIQUES OF CAPITAL BUDGETING 12

Capital Budgeting – Meaning, Capital budgeting Process; Project Classification; Evaluation Techniques – Payback period, ARR, Discounted payback period; NPV, PI , IRR, Accept/reject criteria.

MODULE IV DIVIDEND POLICIES AND DECISIONS 12

Meaning of dividend policy, factors influencing dividend policy, objectives of dividend policy, stability of dividends, forms of dividend; Relevance V/s Irrelevance of Dividends (Relevant Theory: Walter's Model, Gordon's Model; Irrelevant Theory: MM's Approach).

MODULE V MANAGEMENT OF WORKING CAPITAL 12

Introduction, Concepts of working capital, Operating and cash conversion cycle, Permanent and variable working capital, Balanced working capital position,

Determinants of working capital, Issues in working capital management, Estimating working capital requirement.

L – 60; Total Hours –60

TEXT BOOKS:

1. Khan M. Y. and Jain P. K., “Financial Management”, McGraw Hill 2016.

REFERENCES:

1. I.M. Pandey, “Financial Management”, Vikas Publishing House.11th Edi, 2016.
2. Prasanna Chandra, “Financial Management Theory and Practice”, McGraw Hill, 2016.
3. Michael C. Ehrhardt and Eugene F. Brigham, “Corporate Finance”, 1st ed., South-Western Publication. 2016.
4. Richard A. Brealey, StewartMyersand Franklin Allen, “Principles of Corporate Finance” 11thed, McGraw Hill, 2013.

OUTCOMES: At the end of this course, the student will be able to:

- Identify the goals of financial management.
- Understand important concepts such as, capital structure, leverages, cost of capital, and capital budgeting.
- Estimate the working capital requirement for a firm and understand dividend policies and decisions of a firm.

MSC2103 HUMAN RESOURCE MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

- State the meaning, role and importance of Human Resource Management in an Organisation.
- Explain the concept of Human Resource planning and the process of recruitment, and selection of prospective employees in an organisation.
- State the purpose, need and benefits of training, induction and mentoring.
- Outline the process of Performance appraisal and its role in Compensation Management.

MODULE I INTRODUCTION TO HUMAN RESOURCE MANAGEMENT 9

Meaning - definitions, objectives and importance of HRM, functions of HRM– managerial functions – operative functions – nature and scope of HRM – HR manager, Role, qualification and qualities.

MODULE II HUMAN RESOURCE PLANNING, RECRUITMENT AND SELECTION 9

Meaning and importance of human resource planning, benefits of human resource planning, Meaning of recruitment, selection, Methods of Recruitment and Selection - Uses of tests in selection, Problems involved in placement.

MODULE III TRAINING, INDUCTION AND HRM STRATEGIES 9

Meaning of Training and Induction, Objective and purpose of induction, Need for training, benefits of training, Identification of training needs, methods of training. HRM Strategies - Human capital – emotional quotient –mentoring.

MODULE IV PROMOTION AND TRANSFERS 9

Meaning of promotion-Purposes and types – promotion policy – bases of promotion – seniority v/s merit– transfer, need –purposes –types of transfers-demotion –causes of demotion.

MODULE V PERFORMANCE APPRAISAL AND COMPENSATION 9

Meaning - objectives of performance appraisal, 360-degree appraisal, other methods of performance appraisal and limitations. Principles - techniques of wage fixation, job evaluation, compensation -meaning of compensation,

objectives and importance of compensation.

L – 45; Total Hours –45

TEXT BOOKS:

1. P. Subba Rao, “Personnel and Human Resource Management”, Himalaya Publishing House, 2015.

REFERENCES:

1. C.B.Gupta, “Human Resource Management”, Sultan chand and sons, 2014.
2. P. N. Reddy and H. R. Appannaiah, “Personnel Management”, Himalaya Publishing House, 2012.

OUTCOMES: At the end of this course, the student will be able to:

- Describe the meaning, role and importance of Human Resource Management in an Organisation.
- Identify the purpose, need and benefits of training, induction and mentoring.
- Discuss the concept of Human Resource planning and the process of recruitment, and selection of prospective employees in an organisation.
- Relate the process of Performance appraisal and its role in Compensation Management.

MSC2104 INTRODUCTION TO ENTREPRENEURSHIP

L	T	P	C
3	0	0	3

OBJECTIVES:

- Familiarise the students with the fundamentals of entrepreneurship, business principles and ideas – with a focus on global business environment.
- Help students understand the theories of entrepreneurship, entrepreneurial motivation.
- Provide insights into preparation of business plan, business growth, and global entrepreneurs.

MODULE I THEORIES OF ENTREPRENEURSHIP 9

Who is an Entrepreneur?, Theories of Entrepreneurship, Economic Entrepreneurship Theories, Psychological Entrepreneurship Theories, Personality Traits theory, Locus of Control, Need for Achievement theory, Traits of Successful Entrepreneurs, Types of Entrepreneurs, Clarence Danhof Classification, Arthur H. Cole Classification, Classification on the Basis of Ownership, Classification Based on the Scale of the Enterprise.

MODULE II ENTREPRENEURIAL MOTIVATION 9

Entrepreneurial Motivation, the Needs Framework, Entrepreneurship Development Programmes (EDPs), The Kakinada Experiment, Objectives of Entrepreneurship Development Programmes (EDPs), The Entrepreneurship Development Programme Model in India, Criteria for the Evaluation of EDPs.

MODULE III FORMING A BUSINESS PLAN 9

Forming a Business, Business Structure, Creating a Business Plan, Market Size Analysis, Funding a Business Plan, Regulations and Laws, Sustaining a Business, Customer Satisfaction, Commerce Bank, Customer Service scenario in India, Managing cash flows, Employee Buy-in, HCL, Government Incentives and Resources.

MODULE IV GROWING THE BUSINESS 9

Growing the Business, Managing Creativity, Innovation and the Sense of Ownership in a Growing Organization, Creativity and Innovation, Strategies for Growth, Organic and Inorganic Growth, Growing the business across geographical borders.

MODULE V THE GLOBAL ENTREPRENEUR 9

Laws and regulations that govern entrepreneurship, Things to know and plan before setting up a venture for the global market, Ideas to arrange for finances, Support system for entrepreneurs, Identifying opportunities in the global market, Case studies.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Hatten, Timothy S., “Small Business Management: Entrepreneurship and Beyond”, Mason, Cengage Learning, 2011.

REFERENCES:

1. Bansal, Rashmi, “Connect the Dots”, New Delhi, Westland, 2016.
2. Bansal, Rashmi, “Stay Hungry, Stay Foolish”, New Delhi, Westland, 2014.
3. Hisrich, Robert, Michael Peters and Dean Shepherd., “Entrepreneurship”, Tata McGraw-Hill Education, 2006.
4. Bohoney, Jason., “The Entrepreneurship Toolkit: Successful Approaches to Fostering Entrepreneurship”, Weidemann Associates Inc., Washington, 2011.

OUTCOMES:

At the end of this course, the student will be able to:

- Understand the fundamentals of entrepreneurship, business principles and ideas – with a focus on global business environment.
- Apply the theories of entrepreneurship and entrepreneurial motivation.
- Prepare a business plan and understand the requirements of growing a business globally.

MSC2105 FUNDAMENTAL OF FOREIGN TRADE

L	T	P	C
3	0	0	3

OBJECTIVES:

- Explain students the framework of Export Import trade.
- Illustrate various documents related to procedures in exporting and importing.
- Outline the levels of economic integration and the importance of international agreements.
- Present the regulations applicable in international business.

MODULE I AN OVERVIEW ON FOREIGN TRADE 9

Importance - nature and scope of International business; Modes of entry into International Business; Internationalisation process and managerial implications.

MODULE II CONDUCTING BUSINESS IN MULTIPLE COUNTRIES 9

Framework for analysing international business environment – Domestic, foreign and global environments and their impact on international business - UNESCO guidelines

MODULE III ECONOMIC INTEGRATION AND AGREEMENTS 9

Levels of Economic integration, NAFTA, SAFTA, ASEAN, EU and recent multilateral agreement in India's foreign trade.

MODULE IV JOINT VENTURES AND FOREIGN COLLABORATIONS 9

Joint Ventures and other forms for strategic alliances: Traditional and emerging reasons for forming strategic alliances: Pitfalls in strategic alliances; Making cross-cultural alliances work.

MODULE V REGULATIONS FOR FOREIGN TRADE 9

India Laws and Regulations Governing International Business Transactions, Taxation of foreign income; foreign investment; Setting up offices and branches abroad.

L – 45; Total Hours –45

TEXT BOOKS:

1. Ghanshyam Sharma, "*International Trade* Theory and Practice", Centrum Press, 2016.

REFERENCES:

1. M.L. Varma, "*Foreign Trade Management"*, Government of India, 2012.
2. Vaish, M.C., "Macro Economics", Vikas Publishing House, 2002.

3. Daniels, Radebaugh and Sullivan, “International Business”, Pearson Publications, 2015.

OUTCOMES: At the end of this course, the student will be able to:

- Identify the different modes available for entering international markets.
- State the documents required for international business.
- Understand the implications of international agreements.

MSC2106 COST ACCOUNTING

L	T	P	C
4	0	0	4

OBJECTIVES:

- Familiarize students with different cost concepts and the cost sheet.
- Provide insight into different techniques of material costing, labour costing, and overhead costing.
- Describe the techniques of job costing and batch costing.

MODULE I INTRODUCTION TO COST ACCOUNTING 9

Introduction, Meaning and Definition of Cost, Costing and Cost Accounting; Objectives of Costing, Comparison between Financial Accounting and Cost Accounting, Designing and Installing a Cost Accounting System; Cost Concepts, Classification of Costs, Cost Unit, Cost Centre; Elements of Cost; Preparation of Cost Sheet ;Tenders and Quotations

MODULE II MATERIAL COSTING AND CONTROL 15

Meaning, Types: Direct Material, Indirect Material; Material Control, Techniques of Inventory Control: Levels settings, EOQ, ABC Analysis, VED Analysis, Just In-Time, Perpetual Inventory System; Methods of Pricing Material Issues: FIFO, LIFO, Weighted Average Price Method and Simple Average Price Method.

MODULE III LABOUR COST 12

Meaning, Types: Direct Labour, Indirect Labour; Timekeeping, Time booking, Idle Time, Overtime, Labour Turn Over, Methods of Labour Remuneration: Time Rate System, Piece Rate System, Incentive Systems: Halsey plan, Rowan Plan & Taylor's differential Piece Rate System.

MODULE IV OVERHEADS 12

Meaning and Definition; Classification of Overheads; Allocation of Overheads, Apportionment of Overheads, Primary Overhead Distribution Summary, Secondary Overhead Distribution Summary, Repeated Distribution Method and Simultaneous Equations Method, Absorption of Factory Overheads, Methods of Absorption, Machine Hour Rate.

MODULE V JOB AND BATCH COSTING 12

Definition and Features of Job cost; Pre requisites of Job costing; Source documents, Preparation of job cost sheet; Definition of Batch costing and its

accounting procedure; Determination of economic batch size, Preparation of batch cost sheet.

L – 60; Total Hours –60

TEXT BOOKS:

1. S P Jain and K L Narang, “Cost and Management Accounting”, Jain book agency, 2016.

REFERENCES:

1. Shashi K. Gupta and R. K. Sharma, “Management Accounting”, Kalyani Publishers / LyallBk Depot, 2014.
2. Khan and Jain, “Management Accounting Text Problems & Cases”, Tata Mcgraw Hill Publishing Co Ltd, 2016.
3. M. N. Arora, “Accounting for Management”, Himalaya Publishing House, 2016.
4. M. E. Thukaram Rao, “Management Accounting”, 1st edition, New Age International Ltd. , 2009.
5. Alexander, David and Britton Anne., “Financial Reporting” 4thed., International Thomson Business Press, 2014.
6. Anthony, Robert N. and Reece, James., “Accounting Principles”, 6thed., Aitbs Delhi, 2010.
7. Ormiston Aileen and Fraser Lyn M., Understanding Financial Statements, 9th ed., Prentice-Hall, 2010.

OUTCOMES:

At the end of this course, the student will be able to:

- Understand different cost concepts and prepare cost sheet.
- Identify different techniques of material costing, labour costing, and overhead costing.
- Prepare job cost sheet and batch cost sheet.

SEMESTER IV

MSC 2201	BUSINESS RESEARCH METHODS	L	T	P	C
		4	0	0	4

OBJECTIVES:

- Outline the concept and types of research.
- Explain the difference between research methods and methodology.
- Construct hypothesis and research design.
- Describe different data collection methods.
- Apply statistical tools available for the analysis of data.
- Compile the results of a research in the form of report.

MODULE I INTRODUCTION TO BUSINESS RESEARCH 9

Research: Meaning, Purpose, Motivations; Types of research; Research Approaches; Significance of research; Research methods versus methodology; Research and scientific method; Research process; Scope of business research; Review of literature: Need and Purpose

MODULE II RESEARCH PROBLEM AND RESEARCH DESIGN 12

Selection and formulation of a research problem; Formulation of hypothesis, Operational definition of concepts; Sampling techniques; Research Design: Meaning, Nature; Components of research design

MODULE III METHODS OF DATA COLLECTION 12

Meaning and Types of Data, Collection of Primary Data; Observation Method; Interview Method; Collection of Data through Questionnaires and Schedules; Other Methods of Primary Data Collection; Collection of Secondary Data; Selection of Appropriate Method for Data Collection

MODULE IV PROCESSING AND ANALYSIS OF DATA 15

Processing Operations; Problems in Processing; Types of Analysis; Statistics in Research; Measures of Central Tendency, Dispersion, Asymmetry, and Relationship; Other Measures for Analysis of Data; Testing of Hypothesis

MODULE V INTERPRETATION AND REPORT WRITING 12

Meaning and Need for Interpretation; Techniques of Interpretation; Meaning and Significance of Report Writing; Different Steps in Report Writing; Layout of Research Report; Types of Report; Mechanics of Writing Research Report

L – 60; Total Hours –60

TEXT BOOKS:

1. Kothari, C. R., “Research Methodology - Methods and Techniques”, New Age International, 2016.

REFERENCES:

1. Chawla, Sondhi., “Research Methodology”, Vikash Publication, 2015.
2. Tony Proctor, “Essentials of Marketing Research”, 4th ed., Prentice Hall,

OUTCOMES: At the end of this course, the student will be able to:

- Outline the concept of research and identify different types of research.
- Formulate hypothesis and research design.
- Select the data collection methods appropriate for the research.
- Interpret the results from the data analysis.
- Write a research report.

MSC 2202 DERIVATIVES AND COMMODITY MARKET

L	T	P	C
3	0	0	3

OBJECTIVES:

- Explain the concept of derivative and functioning of derivative market.
- Describe different types of derivative contracts.
- Elucidate the mechanism and pricing of derivative products.
- Explain the mechanism of commodity derivatives in India.
- State the role of the derivative exchanges in India.

MODULE I INTRODUCTION TO DERIVATIVES 9

Meaning of Derivatives, Types of Derivative Contracts, History of Financial Derivatives Markets, Exchange-traded Markets and OTC Markets, Participants in a Derivative Market, Economic Function of Derivative Market, Overview of Indian Derivative Market

MODULE II FUTURES CONTRACTS, MECHANISM AND PRICING 9

Forward Contracts, Limitations of forward markets, Introduction to Futures, Distinction between Futures and Forwards Contracts, Futures Terminology, Futures Payoffs, Pricing Stock Futures, Applications of Stock Futures

MODULE III OPTIONS CONTRACTS, MECHANISM AND APPLICATION 9

Option Terminology, Comparison between Futures and Options, Options Payoffs, Application of Options, Variables affecting Option Pricing, The Black Scholes Merton Model for Option Pricing, The Greeks

MODULE IV COMMODITY DERIVATIVES 9

Introduction, Meaning, Definitions, Commodity Exchange, Role of Commodity Exchanges, Commodity Derivative Markets in India, Latest Developments

MODULE V THE DERIVATIVE EXCHANGES IN INDIA – NCDEX & MCX 9

Introduction, Meaning, Structure of NCDEX, Spot Pricing Polling, Exchange Membership, Commodities Traded on the NCDEX Platform, Trading and Instruments of Trading, Pricing Commodity – Futures, Using commodity Futures, Clearing and Settlement System.

L – 45; Total Hours –45

TEXT BOOKS:

1. Dr. Manu Sharma, “Financial Derivatives”,2015.

REFERENCES:

1. NCFM study materials.Latest Editions.
2. John CHull , “Options, Futures, and Other Derivatives”, 9th Edition, Pearson. 2016.
3. Sunil Parameswaran, “Fundamentals of Financial Instruments: An Introduction to Stocks, Bonds, Foreign Exchange and Derivatives”, 2012.

OUTCOMES: At the end of this course, the student will be able to:

- Outline the concept of derivative and functioning of derivative market.
- Identify different types of derivative contracts.
- Perform valuation for different derivative products.
- Explicate the mechanism of commodity derivatives in India.
- Recognize the role of the derivative exchanges in India.

MSC 2203 ENTERPRISE RESOURCE PLANNING L T P C
4 0 0 4

OBJECTIVES:

- Describe the meaning, evolution, Growth and importance of ERP.
- State the requisites for implementing ERP in an Organisation.
- Explain various technologies used in ERP.
- Elucidate ERP system and its application.

MODULE I INTRODUCTION TO ERP 9

Evolution of ERP; what is ERP? Reasons for the Growth of ERP; Scenario and Justification of ERP in India; Evaluation of ERP; Various Modules of ERP; Advantage of ERP, An Overview of Enterprise

MODULE II AN OVERVIEW OF ENTERPRISE 12

Integrated Management Information; Business Modelling; ERP for Small Business; ERP for Make to Order Companies; Business Process Mapping for ERP Module Design; Hardware Environment and its Selection for ERP Implementation.

MODULE III ERP AND RELATED TECHNOLOGIES 12

Business Process Reengineering (BPR); Management Information System (MIS); Executive Information System (EIS); Decision support System (DSS); Supply Chain Management (SCM).

MODULE IV ERP SYSTEM 15

Introduction; Finance, Plant Maintenance, Quality Management, Materials Management, Introduction, SAP AG, Baan Company, Oracle Corporation, People Soft, JD Edwards World Solutions Company, System Software Associates, Inc. (SSA); QAD; A Comparative Assessment and Selection of ERP Packages and Modules.

MODULE V ERP IMPLEMENTATION LIFECYCLE 12

Issues in Implementing ERP Packages; Pre-evaluation Screening; Package Evaluation; Project Planning Phase; Gap Analysis; Reengineering; Configuration; Implementation; Team Training; Testing; Going Live; End-User Training; Post Implementation (Maintenance Mode).

L – 60; Total Hours –60

TEXT BOOKS:

1. Khalid Sheikh, “Manufacturing Resource Planning (MRP II) with Introduction to ERP; SCM”, McGraw-Hill, 2002.

REFERENCES:

1. K.B. Hendricks, V.R. Singhal, and J.K. Stratman., “The Impact of Enterprise Systems on Corporate Performance: A study of ERP, SCM, and CRM System Implementations, Journal of Operations Management”, Elsevier, 2015.
2. Christian N. Madu, “ERP and Supply Chain Management”, CHI, 2005.
3. Glynn C. Williams, “Implementing SAP ERP Sales & Distribution”, McGraw-Hill, 2008.

OUTCOMES: At the end of this course, the student will be able to:

- Recall meaning, evolution and growth of ERP applications.
- Select among the related technologies used in ERP.
  Demonstrate the application of ERP in an organization.

MSC 2204 FINANCIAL SERVICES

L	T	P	C
3	0	0	3

OBJECTIVES:

- Outline the concept of financial services and classify financial services.
- Differentiate between Leasing and Hire Purchase Financing.
- State the procedure of factoring and other fund based services.
- Describe the services provided by Merchant Bankers.
- State the role of Depositories and Credit Rating Agencies in India.

MODULE I INTRODUCTION TO FINANCIAL SERVICES 9

Meaning, nature, scope of financial Services, Types of financial services: Fund based and Fees based services, Need and the market of various financial Services, Growth of Financial Services in India, Problems faced in financial services sector

MODULE II LEASING AND HIRE-PURCHASE FINANCING 9

Leasing: Conceptual framework, Types, Legal framework, Tax aspects of leasing and Financial Evaluation: Perspectives of both Lessee and Lessor; Hire-Purchase Financing: Conceptual framework, Legal framework, and Financial Evaluation

MODULE III FACTORING AND OTHER FUND-BASED SERVICES 9

Factoring: Meaning, Concept and evolution of Factoring; Functions of a Factor; Types of Factoring; Factoring Vs Bills discounting; Advantages of Factoring: Forfeiting – an overview; Venture Capital Financing: Concept, Features, Need, Stages of financing, Exit Route; Consumer Credit and Housing Finance-An overview

MODULE IV MERCHANT BANKING SERVICES 9

Concept, Growth, Merchant Banking in India, Policy measures, Institutional Structure, Legal and Regulatory Frameworks, Role of Merchant Banker in Appraisal of Projects, Designing Capital Structure and Instruments, Issue Pricing, and Preparations of Prospectus

MODULE V CREDIT RATING AND OTHER FEE-BASED SERVICES 9

Introduction, Regulatory Framework, Credit Rating Agencies, Rating Process and Methodology, Rating Symbols and Grades; Overview of Stock Broking,

Depository Services, Custodial Services, and Corporate Restructuring

L – 45; Total Hours –45

TEXT BOOKS:

1. Khan, M .Y., "Financial Services", 4th Edition, Tata McGraw Hill, 2013.

REFERENCES:

1. Dr. Gurusamy, "Merchant Banking and Financial Services", 2nd Edition, Tata McGraw Hill, 2009.

OUTCOMES: At the end of this course, the student will be able to:

- Identify different types of financial services.
- Illustrate the difference between Leasing and Hire Purchasing.
- List the fearures of factoring and other fund based services.
- Explain the functions of Merchant Bankers in India.
- List Credit Rating Agencies and the services provided by them.

MSC 2205 MANAGERIAL ACCOUNTING

L	T	P	C
3	0	0	3

OBJECTIVES:

- Explain management accounting and its role in a business organisation and
- State the difference between Cost accounting, Management accounting and Financial accounting.
- Demonstrate the application of marginal costing for managerial decision making.
- Elucidate the concept of budgetary control, classify the budgets and apply the concept for preparing various budgets.
- Describe the application of standard costing and variance analysis.
  Elucidate financial statements analysis.

MODULE I INTRODUCTION TO MANAGERIAL ACCOUNTING 9

Meaning, nature and scope of management accounting, Goals of management accounting, Role of Management Accountant, Installation of the Management Accounting System, Tools of Management Accounting, Limitations of Management Accounting, Difference between cost accounting and Management accounting, difference between management accounting and financial accounting

MODULE II MARGINAL COSTING 9

Meaning, need and features of marginal costing, Marginal Costing Vs. Absorption Costing, Contribution, P/V ratio, Computation of profit using marginal costing and absorption costing, Break-even point, Break even chart, Angle of incidence, Margin of safety, Applications of Marginal Costing for Managerial Decision Making

MODULE III BUDGETARY CONTROL 9

Meaning - budget and budgetary control, objectives, advantages and limitations of budgetary control, Classification of budgets, Preparation of flexible budget, Sales budget and Cash budget

MODULE IV STANDARD COSTING 9

Meaning of standard cost and standard costing - Application of standard costing, Advantages and Disadvantages of standard costing, Variance analysis: Material and Labour variances only

MODULE V FINANCIAL STATEMENT ANALYSIS 9

Understanding Financial Statements and their inter-links; Meaning and Importance of

Financial Statement Analysis, Techniques of Financial Statement Analysis: Horizontal Analysis, Vertical Analysis, Trend Analysis, Ratio Analysis-Meaning and Importance, Classification of ratios: Liquidity ratios, Solvency/Capital Structure Ratios, Turnover ratios, Profitability ratios, Valuation ratios

L – 45; Total Hours –45

TEXT BOOKS:

1. Khan& Jain, “Management Accounting”, Tata Mcgraw Hill, 2016.

REFERENCES:

1. M. N. Arora, “Management Accounting”, Himalaya Publisher, 2016.
2. Shashi K. Gupta, “Management Accounting”, Kalyani Publishers, 2014.
3. Maheshwari, “Management Accounting”, Vikas Publishers, 2016.

OUTCOMES: At the end of this course, the student will be able to:

- Recognize the importance of management accounting and its role in a business.
- Compare Cost Accounting, Management Accounting and Financial Accounting.
- Apply marginal costing techniques for managerial decision making.
- Prepare different types of budgets.
- Apply techniques of standard costing and variance analysis.
- Analyse the financial statements using ratio analysis.

MSC 2206	INTRODUCTION TO FINANCIAL PLANNING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Explain the concept of financial planning, process of financial planning and the role of financial planner.
- Describe the procedure of retirement planning and the factors considered for it.
- Elucidate Investment planning, strategies used in investment planning and the role of return analysis in decision making.
- Introduce the concept of risk management and the application of tools used in risk management.
- Explain the concept of insurance, different types of insurance and their uses in financial planning.

MODULE I OVERVIEW OF FINANCIAL PLANNING 9

Meaning and Importance of Financial Planning; Major Areas of Financial Planning; Growth of Financial Planning Profession in India; Role of a Financial Planner; Financial Planning Process: Establishing and Defining Client Relationship; Collecting Client Information; Analyzing Client's Financial Status, Risk Profile, and Determining Financial Goals; Developing and Presenting Financial Planning Recommendations; Implementing Financing Planning Recommendations; Monitoring and Reviewing Client's Situation

MODULE II RETIREMENT PLANNING 9

Introduction to Retirement Planning, Analysis of Client's Life Cycle, Factors Considered in Retirement Planning, Analysis of Client's Retirement Needs, Factors and Principles of Wealth Creation, Retirement Planning Process, Pre-retirement Strategies, Post-Retirement Strategies

MODULE III INVESTMENT PLANNING I 9

Array of Investment Products, Types of Investment Risk, Product Profiling based on Inherent Risk and Tenure, Risk Profiling of Investors, Financial Asset Allocation Strategies, Investment Planning for Achieving Financial Goals, Analysis of Return: Time Weighted Return, Rupee Weighted Return, Real Return, Nominal Return, Holding Period Return, Compounded Annual Growth Rate, Yields.

MODULE IV INVESTMENT PLANNING II 9

Analysis of Risk: Beta and Portfolio Beta, Standard Deviation, Variance, Semi-Variance, Covariance, and Correlation; Active Investment Strategies, Passive Investment Strategies, Investment Portfolio Management: Risk-Return Relationship, CAPM, CML, SML, Sharpe, Trey nor and Jensen Ratios; Revision of Portfolio

MODULE V INSURANCE PLANNING 9

Meaning of Insurance, Role of Insurance in Financial Planning, Different Types of Insurance Used in Financial Planning: Auto Insurance, Homeowners Insurance, Liability Insurance, Life Insurance, Disability Insurance, Health Insurance, Long-Term Care Insurance

L – 45; Total Hours –45

TEXT BOOKS:

1. C.E. Scott Brewster, “Financial Planning Handbook”, 2015.

REFERENCES:

1. Jack R. Kapoor, Les R. Dalai, Robert J. Hughes., “Focus on Personal Finance”, 4th Revised Edition. McGraw-Hill Education, 2012.
2. S. K. Bagchi, “Wealth Management”, 1sted., Jaico Publishing House, 2009.
3. Dun, Bradstreet, “Wealth Management” 1sted., McGraw Hill, 2009.

OUTCOMES: At the end of this course, the student will be able to:

- Outline the concept of financial planning, major areas of financial planning and the role of a financial planner.
- Describe the procedure of retirement planning and the factors considered for it.
- Explicate the concept of Investment planning, strategies used in investment planning and the role of return analysis in decision making.
- Explain the concept of risk management and apply different tools of risk management.
- List types of Insurance and its uses in financial planning.

SEMESTER V

		L	T	P	C
MSC 3101	**INTRODUCTION TO BUSINESS LAW**	**4**	**0**	**0**	**4**

OBJECTIVES:

- Describe Indian contract act and its relevance in the organisations and business transactions.
- Discuss Indian Partnership act and its application for setting up a partnership firm in India.
- Explain Company law, documents required and the procedure to be followed for setting up a company in India.
- Outline the Limited Liability Partnership act and the documents required in setting up a Limited liability company.
- Discuss the role of Information technology in today's business scenario and the need and use of Information technology act in the organisation.

MODULE I INDIAN CONTRACT ACT 15

Meaning, Characteristics & Scope of the contract law, Elements of contract, Offer and acceptance, Lawful consideration, Capacity to contract, Free Consent, Lawful object. Discharge of contract including performance of contract. Breach of contract, contingent contract, quasi contract, Contract of Indemnity and Guarantee, Contract of Bailment, Contract of Agency

MODULE II INDIAN PARTNERSHIP ACT 9

Introduction, Basics of Partnership, Relations of Partners, Registration of Partnership Firms, Dissolution of Partnership Firms

MODULE III COMPANY LAW 12

Introduction, Meaning and Definition, Corporate Personality, Stages of formation of a Company: Company, Classification of Companies. Memorandum of Association, Articles of Association Distinction between Memorandum and Articles. Prospectus and Other Documents: Doctrine of Indoor Management, Shares, Debentures and Dividends: Transfer and Transmission of shares, Directors, Meetings, Winding up. Amendments.

MODULE IV THE LIMITED LIABILITY PARTNERSHIP ACT 12

Salient features of LLP, Difference between LLP & Partnership, LLP & Company, Nature of LLP, Partners & designated partners, Incorporation document,

Incorporation by Registration, Partners & their relations

MODULE V THE INFORMATION TECHNOLOGY ACT 12

Definition, Digital signature, Electronic governance, Attribution, acknowledgement & dispatch of electronic records, Regulation of certifying authorities, Digital signatures certificates, Duties of subscribers, Penalties & adjudication, Appellate tribunal, offences.

Total Hours –60

TEXT BOOKS:

1. S.S. Gulshan& G. K. Kapoor, “Business Law Including Company Law”, New Age International, 2014.

REFERENCES:

1. N. D. Kapoor, “Elements of Mercantile Law”, 3rd edition, Sultan Chand and Company, 2006.
2. Satyanarayana G, “Business Law”, 3rd edition, Apollo Publishers, 2009.. Akhileshwar Pathak, “Legal Aspects of Business”, Tata Mcgraw Hill, 5th Edition, 2013

OUTCOMES:

- Identify the relevant provisions of Indian Contract Act and the elements of Indian Contract act.
- State the legal requirement of setting up a partnership firm in India.
- List the documents required for registering a company under Companies Act.
- State the legal requirements for setting up a limited liability company in India.
- Explain the role of Information technology act and the use of Information technology act in Indian Business Environment.

MSC 3102 BUSINESS ETHICS AND VALUES

L	T	P	C
4	0	0	4

OBJECTIVES:

- State the nature, values and significance of ethics in Business Environment.
- Describe the concept of ethical decision making and the difficulties encountered in its application in business organisations.
- Explain the role and importance of ethical decision making in marketing and accounting.
- Explain the components of Business Etiquette.
  Discuss diverse business environments, challenges in diverse environment and the strategies to overcome the challenges.

MODULE I INTRODUCTION TO ETHICS AND VALUES 9

Nature of Business Ethics and Values, Significance and types of values, Ethics and Religion, Culture and Ethics, Social culture and Individual Ethics, Factors Influencing Business Ethics, Ethics as strategy, Ethics of Great Philosophers – Albert.Z.Carr, Aristotle, Niccolo Machiavelli, Karl Marx, Suntzu :The art of war of Sun Tzu, Might-equals-right approach of Karl Marx.

MODULE II ETHICAL DECISION MAKING 12

Ethical Decision Making, Difficulties in Ethical Decision Making, Power and Politics in organizations: Bases and sources of power, Coalitions, Managing Ethics: Ethics codes –Comparison of codes of Ethics, Codes of Conduct, codes of Practice, Ethics Programs, Kohlberg's Study and Business Ethics, Laws of Enforcing Ethical Conduct: Laws and Ethics, Justice –Theory of Natural Law, Law as a guide to Moral Choice, Role of the Government of India in Enforcing Ethical Behavior.

MODULE III ETHICS IN MARKETING AND ACCOUNTING 15

Ethics in Marketing –Product relative ethics, Competition Relative Ethics: Advertising as a process of competitive strategy, Piracy and predatory as a strategic choice, Ethics in Finance Accounting and Reporting, Insider Trading.

MODULE IV INTRODUCTION TO BUSINESS ETIQUETTE 12

Introduction to Business Etiquette, First Impression, Creating Professional Style and Presence, Building an Appropriate Work Wardrobe, Dress Codes, Personal Hygiene and Grooming, The Art of Meeting and Greeting, Body Language,

Remembering Names, The Art of Making Conversations, Sparking A Conversation, Handling Office Conversations, Respecting Ethnic, Cultural, and Gender Differences, Improving Your Telephone Manners, Speaking and Listening on the Phone .

MODULE V HANDLING DIVERSE ENVIRONMENTS 12

Etiquette in a Diverse Business Environment, Working in a Diverse Environment, Respecting Physical Differences, Dealing with Specific Disabilities, Respecting Racial and Ethnic Differences, Respecting Gender Differences, Handling Conflicts Introduction, Workplace Dynamics, Handling Problem Personalities, Managing Conflicts, Business Communication and Other Etiquette, Etiquette at Major Events, Travel Etiquette, Women Travellers.

Total Hours –60

TEXT BOOKS:

1. Dr. Amit Das, “Managing Business Ethics & Compliance”, 2016.

REFERENCES:

1. S.K. Sarangi, “Values & Ethics Of Profession & Business”, 2016.
2. Larry Johnson & Bob Phillips, Absolute Honesty, “Building a Corporate Culture That Values Straight Talk and Rewards Integrity”, AMACOM, 2003.
3. Paul J. Zak and Michael C. Jensen, “Moral Markets: The Critical Role of Values in the Economy”, Princeton University Press, 2008.
4. Daniel Freidman, “Morals and Markets: An Evolutionary Account of the Modern World”, Palgrave Macmillan, 2008.

OUTCOMES:

- Define ethics, values and its role in business decision making.
- Identify difficulties in ethical decision making.
- Describe the importance of ethical decision making in Marketing and accounting.
- Display the required etiquettes in business organization.
- Locate diverse environments and implement the strategies to manage the diversity.

MSC 3103 INSURANCE AND RISK MANAGEMENT

L	T	P	C
4	0	0	4

OBJECTIVES:

- Outline the concept of Insurance, risk management and the principles of risk pooling.
- Describe Insurance contract and the legal requirements of an Insurance Contract.
- Elucidate the concept of Life Insurance, components of Insurance policies and the procedure for identifying the need for Life Insurance.
- Explain General Insurance, types of general insurance and the need of general insurance in business organisations.
- State the regulatory framework for Insurance business and the role of IRDA in Insurance Industry.

MODULE I INTRODUCTION TO INSURANCE AND RISK MANAGEMENT 9

Introduction to Insurance, Basic Concepts of Insurance, Fundamental Principles of Insurance, Meaning of Risk, Types of Pure Risk, Principle of Risk Pooling, Methods of Handling Risk, Meaning and Objective of Risk Management, Steps in Personal Risk Management, Risk Control and Risk Financing

MODULE II INSURANCE CONTRACT AND LEGAL LIABILITY 12

The Insurance Contract, Important Terms in Insurance Contract, Analysis and Selection of Insurance Products, Legal Liability: Intentional Torts, Absolute Liability, Law of Negligence, Special Tort Liability Problems, Civil Justice System

MODULE III LIFE INSURANCE 12

Meaning of Life Insurance; Analysis of Life Insurance Needs; Types of Life Insurance Policies: Term Insurance, Whole Life Policy, Endowment Policy, Investment Linked Insurance; Calculation of Claim Amount and other Benefits, Other Provisions of Life Insurance Contracts

MODULE IV GENERAL INSURANCE 15

Health Insurance and Accident Insurance: Individual Health Insurance, Group Health Insurance Policies, Personal and Group Accident Insurance; Personal Disability Insurance; Property and Liability Insurance; Other Business Specific Insurance: Keyman Insurance, Professional Indemnity Insurance, Workers'

Compensation Insurance

MODULE V REGULATORY FRAMEWORK OF INSURANCE 12

IRDA Act, 1999; the Insurance Act, 1938; Public Liability Insurance Act, 1991; Employee State Insurance Act, 1948; Agency Law and Functions of an Agent; Doctrines of Waiver and Estoppels

Total Hours –60

TEXT BOOKS:

1. Dr. Sunil Kumar, “Insurance and Risk Management”, Galgotia Publishing Company, 2016.

REFERENCES:

1. Burton T. Beam, Jr., Barbara S. Poole, David L.Bickelhaupt, Robert M. Crowe, “Fundamentals of Insurance for Financial Planning” (3rd Edition), American College, 2008.
2. Etti G. Baranoff, Esther ZipporaBaranoff. “Risk Management and Insurance”, 3rd Edition, Wiley, John & Sons, Incorporated, 2010.
3. E. E. George Rejda, “Principles of Risk Management and Insurance”, 3rd Edition, Pearson Education, 2006.
4. Emmett J. Vaughan, Theresa Vaughan, “Risk Management” 3rd Edition, Wiley, John & Sons, Incorporated, 2007.
5. P. S. Palande, R. S. Shah, M. L. Lunawat, “Insurance in India: Changing Policies and Emerging Opportunities”, 3rd Edition, SAGE Publications, 2007.
5. R. R. Stephan Leimberg, Robert J. Doyle, “Tools and Techniques of Life Insurance Planning”, 3rd Edition, National Underwriter Company, 2004.

OUTCOMES:

- Illustrate the concept of Insurance, Risk Management and compare the difference between Life Insurance and General Insurance.
- List the regulatory requirements of Insurance Business and the role of IRDA.

MSC 3104 COST MANAGEMENT L T P C

4 0 0 4

OBJECTIVES:

- Outline the elements of cost and its importance in cost management.
- Explain different methods and techniques of cost control, cost management and cost accounting.
- Describe the concept of Strategic cost, business process reengineering and the strategic management issues in relation to elements of cost.
- Illustrate Activity based costing system and the concept of Life cycle costing.

  Elucidate the concepts of Just in time, Kaizen and lean cost management and their applications in the industry.

MODULE I COSTING STRATEGY 12

Influence of different cost elements on business enterprise, Importance of analysing cost elements, cost control and cost reduction: meaning, process, methods and techniques of cost control and cost reduction, cost management: areas of cost management, difference between cost management and cost accounting, role of cost accounting in strategic planning and management control.

MODULE II STRATEGIC COST AND PERFORMANCE EVALUATION 12

Integration of strategic cost management with performance evaluation, Strategic cost management issues in different elements of cost; material, labour and overheads; product design, value analysis and value engineering, strategic analysis of cost, business process re-engineering, benchmarking.

MODULE III ACTIVITY BASED COSTING SYSTEM 12

Introduction to traditional methods of overhead absorption, problems of overhead absorption system under Traditional System, introduction to ABC, Kaplan and Coopers approach to ABC, cost drivers and cost activities, allocation of overheads under ABC, Characteristics of ABC, benefits from adaptation of ABC System, problems on comparison between traditional system and ABC system

MODULE IV LIFE CYCLE COSTING 12

Meaning of LCC, factors affecting Life cycle costing, phases in product life cycle, characteristics, product life cycle and cost control, Experience curve in product life cycle costing; Project life cycle costing: Meaning, categories of project life cycle costs, optimization of project life cycle costs.

MODULE V JUST IN TIME AND KAIZEN COSTING 12

JIT – features, methodology in implementation of JIT, Benefits of JIT. Kaizen Costing: concept, procedure for implementation, evaluation, benefits of Kaizen costing. Lean Cost Management: Meaning, definition, factors, applications, procedure to implementation, comparison with traditional management system, Modern production management techniques, benefits and drawbacks of Lean Cost Management.

Total Hours –60

TEXT BOOKS:

1. Ravi. M. Kishore, “Cost Management”, Taxman, Allied Services (p) Ltd., 2016.

REFERENCES:

1. S.K.R. Paul, “Management Accounting”, New Central Book Agency Private Ltd., Calcutta, 2014.
2. Charles T. Horngren, George Foster, Srikant M. Data, “Cost Accounting: A Managerial Emphasis”, Prentice Hall of India, New Delhi.
3. Roger Cowe, “Hand Book of Management Accounting”, A Grower Handbook.
4. S. Mukherjee & A.P. Roy Chowdhury, “Advanced Cost and Management Accountancy”, New Central Book Agency, Calcutta.

OUTCOMES:

- List the elements of cost and the areas of cost management.
- Understand cost management, activity based costing, Life cycle costing, and the principles of just in time, kaizen and Lean Management.

MSC 3105	FUNDAMENTAL ANALYSIS AND TECHNICAL ANALYSIS	L	T	P	C
		4	0	0	4

OBJECTIVES:

- Describe the concept and the components of fundamental analysis and technical analysis.
- Explain the elements of macroeconomic industry and company analysis as a part of fundamental analysis.

  State the concept of technical analysis, technical indicators and the importance of conducting technical analysis in investment management

MODULE I INTRODUCTION TO FUNDAMENTAL ANALYSIS 9

Meaning, Objective, and Components of Fundamental Analysis; Fundamental Approaches to Securities Valuation: Equity Valuation: Discounted Cash Flow Techniques and Relative Valuation Techniques; Introduction to Bond Valuation and Yield Measures

MODULE II MACROECONOMIC ANALYSIS AND INDUSTRY ANALYSIS 12

Introduction to Macroeconomic Analysis, Impact of Global Economy and Government Policies, Analysing Macroeconomic Factors, Introduction to Industry Analysis, Components of Industry Analysis: Sensitivity to Business Cycle; Industry Life Cycle Analysis; Analysis of Industry Structure and Characteristics, Profit Potential of Industries: Porter Model

MODULE III COMPANY ANALYSIS 12

Introduction to Company Analysis, Strategy Analysis; Accounting Analysis; Financial Analysis: Earning and Dividend Level, Growth Performance, Valuation Multiples; Qualitative Analysis Estimation of Intrinsic Value: Estimating EPS, Establishing PE Ratio, Developing Value Anchor and Value Range, Tools for Judging Mispricing, Obstacles in Fundamental Analysis; Introduction to Equity Research in India, Merger and Acquisition Analysis

MODULE IV INTRODUCTION TO TECHNICAL ANALYSIS 15

Meaning and Basic Premises of Technical Analysis, Fundamental Analysis Vs. Technical analysis, Basic Concepts underlying chart analysis; The Dow Theory, Bar and Line Charts, Point and Figure Charts, Moving average analysis, MACD, Relative Strength analysis

MODULE V TECHNICAL INDICATORS 12

Introduction, Breadth indicators: New high and lows, Volume; Sentiment indicators: Short-Interest ratio, Mutual fund liquidity, Put/Call ratio, Trin statistics; Open interest in Futures and Options; Testing technical trading rules; Evaluation of technical analysis.

Total Hours –60

TEXT BOOKS:

1. Chandra, Prasanna, “Investment Analysis and Portfolio Management”, Tata McGraw Hill, 2015.

REFERENCES:

1. Thomsett, Michael C. “Mastering fundamental analysis”, Dearborn financial publishing, 2008.
2. Thomsett, Michael C. “Getting Started in Fundamental Analysis”, John Wiley and sons, 2006.
3. Krantz, Matt. “Fundamental Analysis”, Wiley publishing Inc., 2010.
4. Kevin, S., “Security Analysis and Portfolio Management”, Prentice Hall of India 2006.

   Murphy, John J., “Technical Analysis of the Financial Markets”, New York Institute of Finance, 2008.

OUTCOMES:

- Differentiate between fundamental analysis and technical analysis.
- List the components of fundamental analysis.

  Identify technical indicators for conducting technical analysis.

SEMESTER VI

		L	T	P	C
MSC 3201	**FUNDAMENTALS OF BUSINESS TAXATION**	**4**	**0**	**0**	**4**

OBJECTIVES:

- Explain the concept of Taxation and the components of taxation.
- Illustrate the computation of taxable income under different heads of Income.
- Discuss Customs act and Goods and Services Tax applicable in India.

MODULE I INTRODUCTION TO TAXATION 9

Introduction, Canons of Taxation, Types of Taxes, Definitions- Income, Person, Assesses, Assessment year, Pervious year, Agricultural Income (simple numerical problems). Exempted Incomes, Capital and Revenue Income and expenditure, Residential Status and Incidence of Tax

MODULE II COMPUTATION OF TAXABLE INCOME UNDER THE DIFFERENT HEADS OF INCOME 15

Income from Salary- Meaning of salary, Allowances, Perquisites, Deductions from salary (Theory and Problems);Income from House Property - Basis of Chargeability, Annual Value, Self occupied and let out property- Deductions (Theory and Problems);Profits and Gains of Business & Profession -Definitions, Concepts, Practical Aspects - Deductions expressly allowed and disallowed (Theory only); Capital Gains - Chargeability-Definitions-Practical aspects - Cost of Improvement – Indexation - Short term and long term capital gains-Exemptions (Theory only);Income from other sources - Chargeability-Deductions-Amounts not deductible (Theory only)

MODULE III COMPUTATION OF TOTAL TAXABLE INCOME OF AN INDIVIDUAL 12

Gross total Income- deductions from GTI, Calculation of tax liability- (Rates applicable for respective Assessment year) Education cesses, Refund of tax

MODULE IV CUSTOMS ACT 12

Customs Act - Meaning – Types of Custom Duties – Valuation for Customs Duty, levy and exemption from custom duty. Offences and prosecution, Baggage rules, carrying of currency, gold and goods (Theory only)

MODULE V GOODS AND SERVICES TAX ACT 12

Goods and Services Tax Act: Overview, extent and scope, Levy and Collection of Central/State Goods and Services Tax, Composition Levy, Taxable person, Power to grant exemption from tax, Remission of tax on supplies found deficient in quantity. Change in tax rates, improvements and critiques of the law. Grievance redressal system, Model tax calculations.

Total Hours –60

TEXT BOOKS:

1. Singhania, Vinod K., “Direct Taxes - Law and Practice”.Taxmann Publications.

REFERENCES:

1. Dr.Mehrotra and Dr.Goyal, “Direct Taxes – Law and Practice”, SahityaBhavan Publication.
2. Datey, V. S. “Indirect Taxes – Law and Practice”.
3. Pagare, Dinakar, “Law and Practice of Income Tax”, Sultan Chand and sons.

OUTCOMES:

- State the meaning and components of taxation.
- Solve the problems related to computation of income under different heads.
- Identify the legal requirements of Customs Act and Goods and Services Act in Indian business scenario.

MSC 3202	INTRODUCTION TO INTERNATIONAL FINANCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Describe the concept of International Finance, International Financial Market and Exchange rate determination.
- Elucidate the concepts of Inflation, Interest Rate, Exchange rate, Interest rate parity, Purchasing power parity and International Arbitrage.
- State the role and functioning of Forex Market, Currency Derivatives Markets, Eurocurrency Market, Euro credit Market, Eurobond Market and International Stock Markets

MODULE I INTRODUCTION TO INTERNATIONAL FINANCE 9

Meaning, Importance, and Scope of International finance, Goals of MNCs and Potential Conflicts with those Goals, Balance of payments: Current account, capital account & ORA, International Trade flows, International Capital Flows, Agencies facilitating international flows: IMF and World Bank

MODULE II INTERNATIONAL FINANCIAL MARKET 9

Needs and Functions of International Financial Market, Euribor and LIBOR, History of foreign exchange, Function and Structure of the FOREX markets, Foreign exchange market participants, Types of transactions and Settlements dates, Exchange rate quotations, Currency Derivatives Markets, Eurocurrency Market, Eurocredit Market, Eurobond Market, International Stock Markets, External Commercial Borrowings

MODULE III EXCHANGE RATE DETERMINATION 9

Measuring exchange rate movements, Exchange rate equilibrium, Factors influencing exchange rates, Nominal, Real and Effective exchange rates, Cross Rates, Exchange Rate Systems: Fixed, Floating, Managed Float, Pegged

MODULE IV INTERNATIONAL ARBITRAGE AND INTEREST RATE PARITY 9

International Arbitrage: Locational arbitrage, triangular arbitrage, covered interest arbitrage; Determination of forward premium or discount; Interest Rate Parity (IRP): Graphical analysis and interpretation

MODULE V RELATIONSHIP AMONG INFLATION, INTEREST RATE, AND EXCHANGE RATE 9

Purchasing Power Parity (PPP): Absolute version and Relative version,

Graphical analysis and Interpretation; Fisher Effect; International Fisher Effect (IFE): Graphical analysis and Interpretation; Comparison of IRP, PPP, and IFE. system, Model tax calculations.

Total Hours –45

TEXT BOOKS:

1. Alan C. Shapiro, Peter Moles, Dr. Jayanta Kumar Seal., "International Financial
Management", Wiley, 2016.

REFERENCES:

1. Jeff Madura, "International Financial Management", 2nd edition, Cengage Learning, 2011.
2. Vyuptakesh Sharan, "International Financial Management" 5th ed., PHI, 2011.
3. P. G. Apte, "International Finance Management", 1st edition, McGraw Hill, 2010.
4. John Holland, "International Finance Managemen,. 2nd edition, Oxford, Blackwell Publication, 1997.
5. Shapiro, "International Finance", 1st edition, Wiley India Pvt Ltd, 2008.

OUTCOMES:

- Explain the meaning and concept of International Finance, International Financial Market and Exchange rate determination.
- State the meaning of Inflation, Interest Rate, Exchange rate, Interest rate parity, Purchasing power parity and International Arbitrage.
- Describe the role and functioning of Forex Market, Currency Derivatives Markets, Eurocurrency Market, Euro credit Market, Eurobond Market and International Stock Markets.

MSC 3203	INVESTMENT BANKING AND OPERATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Outline the concept of Investment banking, functions of Investment Banker and the participants in Investment banking business in India.
- Elaborate on Global Financial Instruments and their features.
- Describe Trade Life Cycle, the trading mechanism and the clearing and settlement process.
- List the components of corporate actions and its implementation in Indian business scenario.
- Describe functions, regulatory and compliance responsibilities under risk management and lending services.

MODULE I INTRODUCTION TO INVESTMENT BANKING 9

Introduction to Investment Banking: Meaning, role and functions of Investment Banker, key functions of security trading organization, custodian, depository & securities dealing & investment banking -Various market participants – Hedge fund, Portfolio Managers, Institutional Investors

MODULE II GLOBAL FINANCIAL INSTRUMENTS 9

Global Financial Instruments – Equity, Debt, Derivatives, Forex, Commodities, SWAPS, Mortgage Backed Securities, Asset Backed Securities, CDS, Warrants, REITS, LEAPS, STRIPS

MODULE III INTRODUCTION TO TRADE LIFE CYCLE 9

Introduction to Trade life cycle- Equity & Debt Understanding the Trade execution, trade capture, trade enrichment, trade confirmation-SWIFT FIX transaction reporting function, Brokerage Calculation, Brokerage Calculation, Settlement Terminologies, Clearing & Settlement process – Settlement instructions- Types of trade settlements, Role of Custodian.

MODULE IV CORPORATE ACTIONS 9

Corporate Actions: Introduction to Corporate Actions - Mandatory & Voluntary, Corporate events - Bonus issue, stock split, right issue reverse stock split - Special Corporate action events with options –impact of corporate actions on portfolio statement

MODULE V RISK MANAGEMENT AND LENDING SERVICES

9

Risk Management and lending services: Functions of Treasury Department, Role of Risk Manager, Collateral Management Process, Margin and VAR Calculation, ISDA Norms – Regulatory and Compliance Responsibilities. Security Lending and Borrowing (SLB), Concept of Margin Funding, External – Internal reconciliation and cash management

Total Hours –45

TEXT BOOKS:

1. Pratap Subramanyam, “Investment Banking”, Latest edition, Tata McGraw-Hill Education.

REFERENCES:

1. Pratap Subramanyam, “Investment Banking: Concepts, Analysis & Cases”, Latest edition Tata McGraw-Hill Education.
2. Pratap Giri S., “Investment Banking”, Latest edition, Tata McGraw-Hill Education.

OUTCOMES:

- State the concept of Investment banking, functions of Investment Banker and the participants in Investment banking business in India.
- List Global Financial Instruments and their features.
- Explain Trade Life Cycle, the trading mechanism and the clearing and settlement process.
- Discuss the functions, regulatory and compliance responsibilities under risk management and lending services.

MSC 3204 FINANCIAL MODELLING USING EXCEL

L	T	P	C
2	1	0	2

OBJECTIVES:

- Illustrate the application of Excel for Annuity Functions, Investment Analysis Functions, Bond Functions and Depreciation Functions at basic level.
- Illustrate application of excel in conducting Sensitivity Analysis, Simulation exercises and Financial Models at basic level.

MODULE I INTRODUCTION **9**

Understanding Finance Functions present in Excel: Annuity Functions, Investment analysis functions, Bond Functions, Depreciation Functions. Making Decisions: Examples of creating Decision making formulas (Income tax calculator), Looking up values and conditional formatting. Analysing databases using Sort, Filter and Pivot Tables

MODULE II SENSITIVITY ANALYSIS USING EXCEL **9**

Scenario Manager, Other Sensitivity Analysis Features, Goal Seek, Solver, Data Tables

MODULE III SIMULATION USING EXCEL **9**

Different Statistical Distributions used in Simulation. Generating Random Numbers that follow a particular distribution; Building Models in Finance using Simulation

MODULE IV FINANCIAL MODELS PART-1 **9**

Preparing common size statements directly from Trial Balance, Forecasting Financial Statements using Excel, Analysing Financial Statements by using Spread Sheet Model

MODULE V FINANCIAL MODELS PART-2

9

Loan Ammortization Table, Financial Planning & Investments: Retirement Planner, Portfolio Structuring, Bond Pricing

Total Hours –45

TEXT BOOKS:

1. Chandan Sengupta, Financial Analysis and Modeling using Excel and VBA, Wiley, 2016..

REFERENCES:

1. Benninga, S., “Financial Modeling”, 3rd ed. Massachusetts, MIT Press, 2008.
2. Swan, Jonathan, “Practical Financial Modeling: A Guide to Current Practice”, 2nd ed. CIMA publishing Publication, 2005.
3. Musiela, Marek and Rutkowski, Marek., “Models in Financial Modeling”, 2nd ed. Springer, 2005.

OUTCOMES:

- Use of Excel for Annuity Functions, Investment Analysis Functions, Bond Functions and Depreciation Functions at basic level.
- Apply Excel tools and techniques in conducting Sensitivity Analysis, Simulation exercises and Financial Models at basic level.

MSC 3205	IT FOR BUSINESS AND ACCOUNTING - LAB	L	T	P	C
		0	0	4	2

OBJECTIVES:

- Demonstrate the application of Excel using Annuity Functions, Investment Analysis Functions, Bond Functions and Depreciation Functions at advance level.
- Perform Sensitivity Analysis, Simulation exercises and Financial Modelling using Excel.

MODULE I FINANCE FUNCTIONS IN EXCEL 9

Annuity Functions, Investment analysis functions, Bond Functions, Depreciation Functions. Creating Decision making formulas (Income tax calculator), Looking up values and conditional formatting, Analysing databases using Sort, Filter and Pivot Tables

MODULE II SENSITIVITY ANALYSIS USING EXCEL 9

Scenario Manager, Goal Seek, Solver, Data Tables

MODULE III SIMULATION USING EXCEL 9

Generating Random Numbers that follow a particular distribution, Building Models in Finance using Simulation

MODULE IV FINANCIAL MODELS PART-1 9

Preparing common size statements directly from Trial Balance using Excel, Forecasting and Analysing Financial Statements using Excel

MODULE V FINANCIAL MODELS PART-2 9

Loan Amortization Table, Portfolio Structuring, Bond Pricing

Total Hours –45

TEXT BOOKS:

1. Chandan Sengupta, “Financial Analysis and Modeling using Excel and VBA”, Wiley, 2016.

REFERENCES:

1. Benninga, S., “Financial Modeling”, 3rd ed. Massachusetts MIT Press, 2008.
2. Swan, Jonathan., “Practical Financial Modeling: A Guide to Current

Practice", 2nd ed. CIMA publishing Publication, 2005.

3. Musiela, Marek and Rutkowski, Marek., "Models in Financial Modeling", 2nd ed. Springer, 2005.

   Sengupta, Chandan, "Financial Analysis and Modeling Using Excel and VBA", Wiley, 2014.

OUTCOMES:

- Apply Annuity Functions, Investment Analysis Functions, Bond Functions and Depreciation Functions available in Excel
- Conduct Sensitivity Analysis, Simulation exercises and Financial Modelling using Excel.

B.S. Abdur Rahman Crescent Institute of Science & Technology
Deemed to be University u/s 3 of the UGC Act, 1956

REGULATIONS 2016

CURRICULUM AND SYLLABI (I & II Semesters)

B.Sc

BIO TECHNOLOGY

VISION AND MISSION OFTHE DEPARTMENT OF LIFESCIENCES

VISION

To attain new heights in biotechnology research, shaping life sciences into a premier precision tool for the future for creation of wealth and ensuring social justice-specially for the welfare of the poor

MISSION

The mission of the school of life sciences and Technology is to maximize the benefits of biotechnology to the University, the nation and the globe by being an excellent quality, comprehensive, multidisciplinary school that supports, coordinates, disseminates and advances biotechnology in the areas of social welfare and entrepreneurship.

PROGRAMME EDUCATIONAL OBJECTIVES:

- "This course will facilitate the graduates to be professionally competent in Biotechnology to solve the problems in environmental, food, biochemical and biomedical sciences.
- This course will offer students with a solid foundation in Biological Sciences, to enable them to work on applications in biotechnology as per the requirement of the industries, and also will enable the students to pursue higher studies and research.
- This course will enable students to acquire knowledge on the fundamentals of Biochemistry, Cell biology, Microbiology and Molecular biology to enable them to understand basic concept in modern biology and help them to build their carrier in this field.
- This course will facilitate the students to acquire knowledge in skill based courses such as Biofertilizer Technology, Agricultural Biotechnology, Medical Biotechnology, Herbal Technology, Disease Management and Mushroom Culture Technology enabling their skills and give confidence to them for business opportunities.
- This programme will teach students the importance of Bioethics, entrepreneurship, communication and management skills.
- This course will also offer the graduates to demonstrate their proficiency in theory and practice of bio-techniques through life-long learning and provide confidence to perform as an individual and / or member of a team with professional and ethical behavior.

PROGRAMME OUTCOMES:

- Graduates of the course will have strong background in the interface of modern biology and skill based courses and be able to use these tools in business/industry and/or institutes wherever necessary.
- Graduates will identify, formulate, research literature, and analyze complex science problems reaching substantiated conclusions using first principles of mathematics, natural science, and applied sciences.

- Graduates will demonstrate knowledge and understanding of the science and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- Graduates of the course will have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
- Graduates of the course will function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- Graduates of the course will communicate effectively on complex science activities with the science community and with the society at large.
- Graduates of the course will apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering and technology practice.
- Graduates of the course will design solutions for complex science problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.

B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE & TECHNOLOGY

B.Sc Bio Technology

CURRICULUM & SYLLABUS, REGULATIONS 2016

SEMESTER I

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1	AEC	LNC1184	Tamil – I	4	1	0	4	
2	AEC	ENC1182	General English – I	4	1	0	4	
3	PC	LSC1101	Cell Biology	4	0	0	4	
4	PC	LSC1102	Cell Biology Lab	0	0	3	2	
5	PC	LSC1103	Microbiology	4	0	0	4	
6	PC	LSC1104	Microbiology Lab	0	0	3	2	
7	PC	CHB1182	Chemistry	3	0	0	3	
8	AEC	ENC1183	Communication Skills	2	0	0	2	**25**

SEMESTER II

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1	AEC	ENC1283	English - II	4	1	0	4	
2	AEC	LNC1284	Tamil – II	4	1	0	4	
3	PC	LSC1201	Molecular Biology	4	0	0	4	
4	PC	LSC1202	Molecular Biology Lab	0	0	3	2	
5	PC	LSC1203	Bioinstrumentation	4	0	0	4	
6	PC	LSC1204	Bioinstrumentation Lab	0	0	3	2	
7	AC	LSC1205	Basics of Computers	4	0	0	4	
8	AEC	LSC1206	Confidence building behavioural skills	2	0	0	2	**26**

SEMESTER III

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1	PC	LSC2101	Biochemistry	3	2	0	4	
2	PC	LSC2102	Biochemistry Lab	0	0	3	2	
3	PC	LSC2103	Basics of Genetics	4	0	0	4	
4	PC	LSC2104	Basics of Genetics Lab	0	0	3	2	
5	AC	LSC2105	Biostatistics	3	2	0	4	
6	GE		Skill Based Electives - I	3	0	0	3	
7	PE		Open Elective -I	4	0	0	4	
8	AEC	LSC2106	Quantitative Aptitude & Reasoning -I	2	0	0	2	**25**

SEMESTER IV

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1	PC	LSC2201	Bioprocess Technology	3	2	0	4	
2	PC	LSC2202	Enzymology	3	2	0	4	
3	PC	LSC2203	Bioprocess Technology Lab	0	0	3	2	
4	PC	LSC2204	Enzymology Lab	0	0	3	2	
5	AC	LSC2205	Biophysics	3	2	0	4	
6	GE		Skill Based Electives - II	3	0	0	3	
7	PE		Open Elective -II	4	0	0	4	
8	AEC	LSC2206	Quantitative Aptitude & Reasoning -II	2	0	0	2	**23**

SEMESTER V

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1	PC	LSC3101	Plant Biotechnology	4	1	0	4
2	PC	LSC3102	Animal Biotechnology	4	1	0	4

3	PC	LSC3103	Plant Biotechnology Lab	0	0	3	2	
4	PC	LSC3104	Animal Biotechnology Lab	0	0	3	2	
5	PE		Core Elective -I	4	1	0	4	
6	PE		Core Elective -II	4	1	0	4	
7	GE	LSC3105	Environmental Science	3	0	0	3	**23**

SEMESTER VI

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1	PC	LSC3201	Immunotechnology	4	1	0	4	
2	PC	LSC3202	Genomics and Proteomics	4	1	0	4	
3	PC	LSC3203	Immunology Lab	0	0	3	2	
4	PC	LSC3204	Genomics and Proteomics lab	0	0	3	2	
5	PE		Core Elective -III	4	1	0	4	
6	PE		Core Elective -IV	4	0	0	4	
7		LSC3205	Mini Project (Review/Research)	0	0	5	3	**23**

Total Credits: 145 Credits

LIST OF PROGRAMME ELECTIVES

SKILL BASED ELECTIVES

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	GE	LSCX101	Disease Management	3	0	0	3
2.	GE	LSCX102	Cytogenetics	3	0	0	3
3.	GE	LSCX103	Biofertilizer Technology	3	0	0	3
4.	GE	LSCX201	Agricultural Biotechnology	3	0	0	3
5.	GE	LSCX202	Herbal Technology	3	0	0	3

CORE ELECTIVES

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	LSCX111	Human physiology	4	0	0	4
2.	PE	LSCX112	Medical Biotechnology	4	0	0	4
3.	PE	LSCX113	Bioinformatics	4	0	0	4
4.	PE	LSCX114	Bioethics, IPR and Biosafety	4	0	0	4
5.	PE	LSCX115	Environmental Biotechnology	4	0	0	4
6.	PE	LSCX211	Nanobiotechonology	4	0	0	4
7.	PE	LSCX212	Cancer Biology	4	0	0	4
8.	PE	LSCX213	Pharmacology	4	0	0	4
9.	PE	LSCX214	Regenerative Medicine	4	0	0	4
10	PE	LSCX215	rDNA Technology	4	0	0	4

SEMESTER I

LNC 1184	TAMIL I	L	T	P	C
		3	1	0	3

OBJECTIVES:

- சமூக மாற்றச் சிந்தனைகளை உள்ளடக்கிய தற்கால இலக்கியங்களை அறிமுகம் செய்தல்
- புதுக்கவிதை, சிறுகதை, உரைநடை ஆகிய இலக்கியங்களின் நயம் பாராட்டுதல்
- சந்திப் பிழையின்றி எழுத மாணவர்களைப் பயிற்றுவித்தல்

MODULE I இருபதாம் நூற்றாண்டு மரபுக்கவிதைகள 8

மனோன்மணியம் சுந்தரனார் - தமிழ்த்தாய் வாழ்த்து, பாரதியார் - யோக சித்தி, பாரதிதாசன் - நீங்களே சொல்லுங்கள், கண்ணதாசன் - காலக்கணிதம்

MODULE II புதுக்கவிதைகள 8

ஈரோடு தமிழன்பன் - கனாக்காணும் வினாக்கள், மீரா - ஊசிகள், வைரமுத்து - அந்தி, நா.காமராசன் - அலிகள், தாமரை - ஒரு கதவும் கொஞ்சம் கள்ளிப்பாலும், மொழிபெயர்ப்புக் கவிதைகள் - கீதாஞ்சலி, மும்பைவாசிகள் (10 கவிதைகள் மட்டும்)

MODULE III சிறுகதைகள் 8

புதுமைப்பித்தன் - பால்வண்ணம் பிள்ளை, பி.எஸ்.ராமையா - பணம் பிழைத்தது, ஜெயகாந்தன் - விதியும் விபத்தும். கி.இராஜநாராயணன் - நாற்காலி, சு.சமுத்திரம் மொழிபெயர்ப்புச் சிறுகதைகள் - காகித உறவு, மாதவிக்குட்டி - நெய்ப்பாயாசம், அந்தோன்செகாவ் - பச்சோந்தி

MODULE IV மொழிப்பயிற்சி 7

கலைச்சொல்லாக்கம், பிழை திருத்தம் (ஒருமை, பன்மை, ல-ள-ழகர, ர�றீறகர, ண-ந-னகர வேறுபாடுகள்), அயற்சொற்களைதல்

MODULE V இலக்கிய வரலாறு 7

பாடந்தழுவியது (இருபதாம் நூற்றாண்டு மரபுக் கவிதைகள், புதுக்கவிதையின் தோற்றமும் வளர்ச்சியும், சிறுகதையின் தோற்றமும் வளர்ச்சியும்)

MODULE VI படைப்பிலக்கியம 7

கவிதை எழுதுதல், சிறுகதை வரைதல்

L – 45; P – 30; TOTAL HOURS – 75

REFERENCES:

1. பொதுத்தமிழ் - செய்யுள்திரட்டு - தமிழ்த்துறை வெளியீடு
2. தமிழ் இலக்கிய வரலாறு - சோம. இளவரசு
3. சிறுகதைத் தொகுப்பு (கட்டுரைக்களஞ்சியம்)

OUTCOMES:

1. மாணவர்கள் சமூக மாற்றச் சிந்தனைகளை அறிந்துகொள்வர்
2. சந்திப்பிழைகளை நீக்கி எழுதும் திறன் பெறுவர்
3. புத்திலக்கியங்களைப் படைக்கும் திறனையும் திறனாய்வு செய்யும் திறனையும் பெறுவர்

ENC1181	GENERAL ENGLISH – I	L	T	P	C
		4	1	0	4

OBJECTIVES:

- To help the students acquire efficiency in Spoken English through role plays.
- To enable them to make Presentation effectively.
- To develop reading skills among students through extensive readers.
- To orient them in writing letters.
- To train them in appreciating and interpreting English literature.

MODULE I **8**

Oral and Written Communication – implications in real life and workplace situations Essential English Grammar - 1-6 units

MODULE II **8**

One–minute Presentations (JAM) on concrete and abstract topics that test their creative thinking (ii) Prepared p and extempore presentations
Short Story; O Henry - “Robe of Peace” (Extensive Reading)

MODULE III **8**

Role-Play – establishing a point of view - convincing someone on social issues such as preservation of water, fuel, protection of environment, gender discrimination.
Poetry: William Shakespeare - “All the World’s a Stage”

MODULE IV **7**

Letter Writing- Letter of Invitation & Permission Developing story from hints- Short Story: John Galsworthy - “Quality” (Extensive Reading)

MODULE V **14**

Précis Writing- Writing instructions and recommendations Reading Comprehension: Short Story**--**Rudyard Kipling – “The Miracle of Puran Bhagat”(Extensive Reading) Written correspondence - - e-mail writing Prose : Education, Employment, Unemployment

L – 45; P – 30; TOTAL HOURS – 75

REFERENCES:

1. Anderson, Kenneth & et.al. “Study Speaking : A Course in Spoken English for Academic Purposes” (Second Edition). Cambridge University Press, UK. 2004.
2. Sharma, R.C. & Krishna Mohan, “Business Correspondence and Report Writing”.

3. Tata MacGraw – Hill Publishing Company Limited, New Delhi. 2002
4. Hurlock, B. Elizabeth “Personality Development”. Tata McGraw Hill, New York, 2004.
5. Krishnaswamy. N, Sriraman T. Current English for Colleges. Hyderabad: Macmillan Indian Ltd, 2006.
6. Dahiya SPS. Ed. Vision in Verse- An Anthology of Poems. New Delhi: Oxford University Press, 2002
7. Murphy, Raymond. Essential English Grammar. New Delhi: Cambridge University Press, 2009.
8. Seshadri, K G Ed. Stories for Colleges. Chennai: Macmillan India Ltd, 2003.

OUTCOMES:

Students would be able to

- Actively take part in role plays
- Make effective presentation s
- Read and comprehend various texts.
- Write letters without making mistakes.
- Analyse literary texts.

LSC1101	CELL BIOLOGY	L	T	P	C
		4	0	0	4

OBJECTIVES:

- To get overview of classes of cells and structural and function aspects of membrane structure and functions.
- To develop a detailed knowledge of cell organelle.
- To develop skill to understand Cell division.
- To understand tissue organization and stem cells.

MODULE I INTRODUCTION TO CELL **12**

Discovery of cells-a brief history: Cell Theory; Basic properties of cell, Different classes of cell: Prokaryotic and eukaryotic cell; difference between plant cell and animal cell.

MODULE II CELL MEMBRANE **12**

Structure and function of plasma membrane, Transport of substances through cell membrane- osmosis, diffusion and its types, Active transport (sodium pump) and passive transport; membrane potential, measuring membrane potential, ion channels- Na^+ and K^+ channels, action potential and nerve impulse.

MODULE III CELL ORGANELLE AND CYTOSKELETON **12**

Nucleus-structure and function, concept of chromosomes; Mitochondria, Chloroplast Endoplasmic reticulum, Golgi apparatus, lysosome, Membrane transport- exocytosis and endocytosis, cytoskeleton structures- intermediate filaments, microtubules- tubulin, centrosome structure, actin filaments, muscle contraction.

MODULE IV CELL SIGNALLING **12**

Principles of cell signaling, cell surface receptors, ion channel coupled receptors, G-protein coupled receptors, GPCRs, cAMP signaling pathway, Calcium signaling pathway, Enzyme coupled receptors, RTKs, Ras pathway.

MODULE V CELL DIVISION AND CELL CYCLE **12**

Cell cycle, regulation of cell cycle, mitosis-different stages of mitosis and proteins involved, meiosis- stages of meiosis I and II; genetic recombination, Meiotic non

disjunction.

TOTAL HOURS – 60

REFERENCES:

1. Essential Cell Biology by Albert et.al. John Wiley & Sons, 4Ed, 2015
2. The Cell by Cooper. ASM Press, 4Ed, 2007
3. Cell and Molecular Biology by Karp. John Wiley & Sons, 7Ed, 2013

OUTCOMES:

At the end of this course students will be able to:

- Define components of a cell
- Understand cellular structure and functions
- Understand the mechanisms of Cell cycle control and cell division

LSC1102	CELL BIOLOGY LAB	L	T	P	C
		0	0	3	2

OBJECTIVES:

The students should be able to

1. Understand explicitly the concepts
2. Develop their skills in the preparation and identification of cell structures and their functions

LIST OF EXPERIMENTS

1. Introduction to microscopes used for cell biology studies
2. Microscopic study of cell and cell organelles
3. Cell counting and viability
4. Mitosis and the Cell Cycle in Onion Root-Tip Cells
5. Blood smear preparation
6. Buccal Smear Preparation
7. Isolation of Mitochondria
8. Isolation of Chloroplast

TOTAL HOURS - 45

REFERENCES:

Laboratory Manual

OUTCOMES:

Students will learn about

- Basic methods in cell biology
- Characterization and structure of cell isolated from various sources

LSC1103	MICROBIOLOGY	L	T	P	C
		4	0	0	4

OBJECTIVES:

- To offer a sense of the history of microbial science, its methodology and its many contributions to humanity
- To ensures the students to understand about the microbiology and diseases.

MODULE I BASICS OF MICROBIOLOGY **12**

Microbiology - history and scope– General structure & functions -viruses, bacteria, algae, fungi, protozoa –Microscopy - Principles & classification of microbes – Whittaker five kingdom classification.

MODULE II STERILIZATION **12**

Sterilization and disinfection - stain and staining methods –. Microbial media – methods of obtaining pure cultures - Phases of growth curve, Factors influencing the growth of microbes –classification of microorganisms.

MODULE III FOOD AND INDUSTRIAL MICROBIOLOGY **12**

Role of microbes in food production - Microbiology of fermented food and dairy products - Alcoholic beverages- Food spoilage and Preservation processes. Production of antibiotics, amino acids and organic Acids.

MODULE IV MEDICAL MICROBIOLOGY **12**

Pathogenesis, lab diagnosis, prevention and control of important microbial diseases. Pathogenic bacterial diseases, Fungal diseases, Viral Diseases and Protozoan diseases.

MODULE V ENVIRONMENTAL MICROBIOLOGY **12**

Role of microbes in the ecosystems – Microorganisms in soil, air and water. Sewage treatment methods - biological nitrogen fixation - biofertilizers.

TOTAL HOURS – 60

REFERENCES:

1. Microbiology: An Introduction: Tortora, Funke & Case. 7th edition, 2001

2. A. H. Patel, “Industrial microbiology”, Macmillan Publishers India, 2002.
3. Pelezar, chan, “Microbiology ”– Krieg Tata McGraw Hill Publications, 2007.
4. Prescott, Harley and Klein, “Microbiology”, McGraw Hill publications, Fifth edition, 2003.
5. Wulf Crueger and Anneliese Crueger, “Biotechnology – A textbook of Industrial Microbiology”, Panima publishing corporation, New Delhi , 2000, reprint 2005.
6. Jacquelyn G.Black, “Microbiology -Principles and Explorations” Wiley publications 2008.

OUTCOMES:

At the end of the course the students will be able to

• demonstrate a broad understanding of the diversity and range of microorganisms, the interactions between humans and microorganisms, the role of microorganisms in industrial and environmental processes, and their role in the development of the techniques that underpin modern molecular biology

• demonstrate proficiency in a set of core microbiological and molecular biologicaltechnical methods, including both an understanding of the principles of the methods and their utilisation in laboratory settings

• demonstrate familiarity with the risk assessment process, and use this information to operate safely in the laboratory environment

• collect, organise, analyse, evaluate and interpret experimental data using appropriate quantitative, technological and critical thinking skills

• communicate microbiological principles and information effectively to diverse audiences, using a variety of formats

LSC1104	MICROBIOLOGY LAB	L	T	P	C
		0	0	3	2

OBJECTIVES:

Provides an opportunity to experimentally verify the theoretical concepts already studied. It also helps in understanding the theoretical principles in a more explicit and concentrated manner. The students should be able to

• Understand explicitly the concepts

• Develop their skills in the preparation, identification and quantification of Microorganisms

LIST OF EXPRIMENTS

1. Bio-safety guideline.
2. Preparation of media for growth of various organisms.
3. Identification and culturing of various organisms
4. Staining of microorganisms. – Grams staining, spore staining, capsular staining.
5. Measure of bacterial population by turbidometry and studying the effect of temperature, pH, carbon and nitrogen.
6. Assay of antibiotics production and demonstration of antibiotic resistance.
7. Biochemical tests to identify various organisms

TOTAL HOURS – 45

REFERENCES:

Laboratory Manual

OUTCOMES:

Students will learn about

Basic methods in microbiology

Characterization and isolation of bacteria isolated from various sources

Growth kinetics of Bacteria

CHB1182	CHEMISTRY	L	T	P	C
		3	0	0	3

OBJECTIVES:

The students should be conversant with

- the basic problems like hardness, alkalinity, dissolved oxygen associated with the water used for domestic and industrial purpose and treatment process involved.
- the synthesis, properties and applications of nanomaterials.
- the importance of renewable energy sources like solar, wind, biogas, biomass, geothermal, ocean and their limitations.
- the basic analytical techniques like UV-Visible, FT-IR, NMR, AAS, AES, Circular Dichroism and XRD etc.
- photochemistry concepts related to physical processes and chemical reactions induced by photon absorption and their applications.
- basic principles of electrochemistry, cell construction and evaluation and to understand general methodologies for construction & design of electrochemical cell

MODULE I WATER TECHNOLOGY **8**

Impurities present in water, hardness : types of hardness, demerits of hard water in boilers, estimation of hardness by EDTA method (problems) – alkalinity : estimation of alkalinity (problems) – dissolved oxygen: estimation of dissolved oxygen – conditioning methods : external treatment method: – lime soda and zeolite process (principle only), Ion exchange process – Internal treatment : colloidal, carbonate, phosphate and calgon methods – drinking water: standards (BIS), treatment of domestic water {screening, sedimentation, coagulation, filtration, disinfection }– desalination: electrodialysis, reverse osmosis.

MODULE II NANOCHEMISTRY **8**

Introduction – distinction between molecules, bulk materials and nanoparticles – classification based on dimension with examples – synthesis (top-down and bottom-up approach} : sol-gel, thermolysis (hydrothermal and solvothermal), electrodeposition, chemical vapour deposition, laser ablation – properties and applications (electronic, magnetic and catalytic) – risk factors and future perspectives.

MODULE III ENERGY SOURCES **8**

Energy: past, today, and future – a brief history of energy consumption – present energy scenario of conventional and renewable energy sources – renewable energy : needs of renewable energy, advantages and limitations of renewable energy – solar energy: basics, solar energy in the past , photovoltaic, advantages and disadvantages – bioenergy: conversion, bio degradation, biogas generation, biomass gasifier, factors affecting biogas

generation, advantages and disadvantages – geothermal energy: geothermal resources (hot dry rock and magma resources, natural and artificial), advantages and disadvantages – wind energy: wind resources, wind turbines, advantages and disadvantages – ocean energy: wave energy, wave energy conversion devices, ocean thermal energy, advantages and disadvantages.

MODULE IV PHOTOCHEMISTRY 7

Introduction: absorption and emission, chromophores, auxochromes – laws of photochemistry : Grotthus-Draper law, Stark Einstein law – quantum yield (problems) – photo physical processes : fluorescence and phosphorescence - Jablonski diagram (electronic states and transitions) – quenching, annihilation – photosensitization: principle and applications – chemiluminescence, bioluminescence.

MODULE V ELECTROCHEMISTRY 7

Electrochemistry - types of electrodes (principle and working) : gas (SHE), metal/metal ion electrode, metal-metal insoluble salt (calomel electrode), ion-selective (glass electrode and fluoride ion selective electrode) – Electrolytic and galvanic cells, construction of cell, EMF measurement and applications (problems), standard cell (Weston-cadmium), reversible and irreversible cell, concentration cell. Determination of fluoride ion using fluoride ion selective electrode – Chemically modified electrodes (CMEs) : concept, approaches and applications.

TOTAL HOURS – 45

REFERENCES:

1. S. Vairam, P. Kalyani and Suba Ramesh, “Engineering Chemistry”, Wiley India Ltd., New Delhi, 2011.
2. G.A. Ozin and A.C. Arsenault, “Nanochemistry: A Chemical Approach to Nanomaterials”, RSC Publishing, Thomas Graham House, Cambridge, 2005.
3. P.C Jain & Monica Jain, Engineering Chemistry Dhanpatrai Publishing Company (P) Ltd., New Delhi (2013).
4. S S Umare & S S Dara, A text Book of Engineering Chemistry, S. Chand & Company Ltd, New Delhi, 2014.
5. G.D.Rai, “Non conventional energy sources,” Khanna Publishers, New Delhi, 2011.
6. John Twidell and Tony Weir, “Renewable Energy Resources, Taylor & Francis Ltd, London, United Kingdom, 2005
7. Principles of molecular photochemistry: An introduction, Nicholas J. Turro, V.Ramamurthy and Juan C. Scaiano, University Science Books, Sausalito, CA, 2009.

OUTCOMES:

The students will be able to

- solve problems related to hardness, alkalinity, dissolved oxygen associated with the water and

describe the treatment processes.

- classify nanomaterials and apply the nanochemistry approach to synthesize the nanomaterials.
- explain the principle and enumerate the advantages and disadvantages of various renewable energy sources.
- state the principle and illustrate the instrumentation of various analytical techniques.
- apply the concepts of photochemistry to elaborate various photo-physical and photochemical reactions.
- construct a electrochemical cell and describe the various types of electrodes and determine the fluoride content.

ENC1183	COMMUNICATION SKILLS	L	T	P	C
		2	0	0	2

OBJECTIVES:

• To help the students acquire efficiency in Spoken English with due importance to Stress, Accent and Pronunciation

• To enable them to make Presentation effectively

• To prepare them for Interviews and Group Discussions

• To train them in writing official letters , resume'writing and reports.

MODULE I **8**

Theory: Oral and Written Communication – implications in real life and workplace situations

Lab: Listening to ESL Podcast- Viewing Multimedia- Listening to BBC News- Received Pronunciation (RP/VOA/NDTV) – exposure to paralinguistic features.

MODULE II **8**

Theory:

(i) One–minute Presentations (JAM) on concrete and abstract topics that test their creative thinking

(ii) Prepared presentations and extempore presentations

Lab: viewing Presentation Tips, Interviews Skills

(iii) Group project – presentation on any social issue. The group will have to research on the history of the problem, its cause, impact and outcome hoped for and then make a presentation

MODULE III **8**

Theory: Developing persuasive skills – establishing a point of view – convincing some one on social issues such as preservation of water, fuel, protection of environment, gender discrimination.

Lab: Negotiating Skills, Expressing Opinion

MODULE IV **8**

Theory: Brainstorming – Think, pair and share activity – Discussion etiquette

63 – Assigning different roles in a GD (Note-taker, Manager, Leader and Reporter)

Lab: Viewing Group Discussion

MODULE V **13**

Theory: Written correspondence - Letter of Application and CV - e-mail writing - writing instructions and recommendations – Lab reports
Lab: Resume' writing – viewing different types – Functional, Chronological- Writing one's resume using wiki, viewing e-mail etiquette, format and style.
Theory: Technical Writing –Writing a technical Proposal – format- cover page, executive summary, time line chart, budget estimate, drafting, conclusion.

TOTAL HOURS – 45

REFERENCES:

1. Anderson, Kenneth & et.al. "Study Speaking : A Course in Spoken English for Academic Purposes" (Second Edition). Cambridge University Press, UK. 2004.
2. Sharma, R.C. & Krishna Mohan, "Business Correspondence and Report Writing". Tata MacGraw – Hill Publishing Company Limited, New Delhi. 2002.
3. Hurlock, B. Elizabeth. "Personality Development". Tata McGraw Hill, New York. 2004.
4. M. Ashraf Rizvi 'Effective Technical Communication". Tata McGraw – Hill Education, 2005.
5. 6.Gerson, Sharon & Steven M. Gerson, " Technical Writing : Process and Product" Pearson Education, New Delhi, 2004.
6. Riordan & Pauley. 'Report Writing Today'. 9th Edition. Wadsworth Cengage Learning, USA. 2005.

OUTCOMES:

On completion of the course, the students will have the ability to speak effectively and write official letters, reports and proposals.

SEMESTER II

ENC1282	**GENERAL ENGLISH II**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**3**

OBJECTIVES:

- To prepare students for Interviews and Group Discussions
- To train them in writing official letters , resume' writing and reports.
- To train them in analysing different genre of literature.

MODULE 1 **7**

Filling Money Order Challan and Bank Challan Short Story :G.K.Chesterton – The Hammer of God (Extensive Reading) Essential English Grammar – 7-12 units

MODULE 2 **8**

Brainstorming – Think, pair and share activity Poetry : Walt Whitman- I Celebrate Myself

MODULE 3 **8**

Dialogue Writing- Discussion etiquette -Assigning different roles in a GD (Note-taker, Manager, Leader and Reporter) Prose: Environment

MODULE 4 **8**

Interview skills- SWOT Analysis Letter Writing- Letter to the Editor- Letter of Application and CV

MODULE 5 **8**

Report Writing- feasibility report and survey report Short Story : Katherine Mansfield—A Cup of Tea (Extensive Reading)

MODULE 6 **6**

Technical reports –Writing a technical report – format and content

TOTAL HOURS – 45

1. M. Ashraf Rizvi ‘Effective Technical Communication”. Tata McGraw – Hill Education, 2005. Gerson, Sharon & Steven M. Gerson, “ Technical Writing : Process and Product”
2. Pearson Education, New Delhi, 2004. 6. Riordan & Pauley. ‘Report Writing Today’. 9th Edition. Wadsworth Cengage Learning, USA. 2005.
3. Krishnaswamy. N, Sriraman T. Current English for Colleges. Hyderabad: Macmillan Indian Ltd, 2006.
4. Dahiya SPS. Ed. Vision in Verse- An Anthology of Poems. New Delhi: Oxford University Press, 2002.
5. Murphy, Raymond. Essential English Grammar. New Delhi: Cambridge University Press, 2009.
6. Seshadri, K G Ed. Stories for Colleges. Chennai: Macmillan India Ltd, 2003.

OUTCOMES:

After completing the course the students would be able to

- Take part in group discussions and interviews with confidence.
- Write official letters, their application letter with CV and reports.
- Analyse various genre of literature.

LNC 1284	TAMIL II	L	T	P	C
		3	1	0	3

OBJECTIVES:

- சமூக மாற்றச் சிந்தனைகளை உள்ளடக்கிய தற்கால இலக்கியங்களை அறிமுகம் செய்தல்
- புதுக்கவிதை, சிறுகதை, உரைநடை ஆகிய இலக்கியங்களின் நயம் பாராட்டுதல்
- சந்திப் பிழையின்றி எழுத மாணவர்களைப் பயிற்றுவித்தல்

MODULE I அற இலக்கியங்கள் 8

திருக்குறள் - சொல்வன்மை (65ஆம் அதிகாரம்), நாலடியார் - அவையறிதல் (5 பாடல்கள் - 32ஆம் அதிகாரம்), பழமொழி நானூறு - இன்னா செய்யாமை (5 பாடல்கள்), இனியவை நாற்பது - முதலைந்து பாடல்கள்

MODULE II பக்தி இலக்கியங்கள் 8

தேவாரம் - மூவர் தேவாரம் (15 பாடல்கள்) அப்பர் தேவாரம், திருஞானசம்பந்தர் தேவாரம், சுந்தரர் தேவாரம் (ஒவ்வொன்றிலிருந்தும் ஐந்து பாடல்கள்), காரைக்காலம்மையார் - மூன்று பாடல்கள் (அற்புதத் திருவந்தாதி), மாணிக்க வாசகர் - திருவெம்பாவை (தேர்ந்தெடுக்கப்பெற்ற 5 பாடல்கள்), ஆண்டாள் - திருப்பாவை (தேர்ந்தெடுக்கப்பெற்ற 5 பாடல்கள்), குலசேகராழ்வார் - திருவேங்கடத்தில் பிறத்தலும் இருத்தலும் போதுமெனல் (11 பாசுரம்)

MODULE III காப்பியங்கள் 8

மணிமேகலை - ஆதிரை பிச்சையிட்ட காதை (20 அடிகள் மட்டும்), கம்பராமாயணம் - பாலகாண்டம், நாட்டுப்படலகம் (10 பாடல்கள் மட்டும்), இரட்சணிய யாத்ரிகம் - சிலுவைப்பாடு (10 பாடல்கள்), சீறா புராணம் - மானுக்குப் பிணைநின்ற படலம் (6 பாடல்கள்)

MODULE IV கட்டுரைகள் 7

உ.வே.சாமிநாதையர்-தமிழ்நாட்டு வணிகர். வ.இராமசாமி ஐயங்கார்-மூதறிஞர் இராஜகோபாலாச்சாரியார், மா.இராசமாணிக்கனார்-சித்தன்னவாசல் ஓவியங்கள், பி.எல்.சாமி-சங்க இலக்கியத்தில் அறிவயல் கலை, க.கைலாசபதி - பாரதியும் மேனாட்டுக் கவிஞரும், தொ. பரமசிவன் - சொல்லும் பொருளும்.

MODULE V இலக்கிய வரலாறு 7

அற இலக்கியங்களின் தோற்றமும் வளர்ச்சியும், சைவ வைணவ இலக்கியங்கள் தோற்றமும் வளர்ச்சியும், காப்பியங்கள் தோற்றமும் வளர்ச்சியும், உரைநடை தோற்றமும் வளர்ச்சியும்

MODULE VI **மொழிப்பயிற்சி** **7**

இலக்கணக் குறிப்புத் தருதல், வல்லினம் மிகுமிடங்களும், மிகாவிடங்களும், மொழிபெயர்ப்பு (ஆங்கிலத்திலிருந்து தமிழில் பெயர்த்தல்), கடிதங்களும் வகைகளும்

L – 45; P – 30; TOTAL HOURS – 75

REFERENCES:

1. பொதுத்தமிழ் - செய்யுள்திரட்டு - தமிழ்த்துறை வெளியீடு
2. தமிழ் இலக்கிய வரலாறு - சோம. இளவரசு
3. சிறுகதைத் தொகுப்பு (கட்டுரைக்களஞ்சியம்)

OUTCOMES:

- மாணவர்கள் சமூக மாற்றச் சிந்தனைகளை அறிந்துகொள்வர்
- சந்திப்பிழைகளை நீக்கி எழுதும் திறன் பெறுவர்
- புத்திலக்கியங்களைப் படைக்கும் திறனையும் திறனாய்வு செய்யும் திறனையும் பெறுவர்

LSC1201	MOLECULAR BIOLOGY	L	T	P	C
		4	0	0	4

OBJECTIVES:

The aim is to extend understanding of the molecular mechanisms via which genetic information is stored, expressed and transmitted among generations

MODULE I DNA REPLICATION **12**

Semiconservative mode of replication, Mechanism of Prokaryotic and Eukaryotic DNA replication, Enzymes and accessory proteins involved in DNA replication

MODULE II DNA DAMAGE AND REPAIR **12**

Chemical modifications of DNA, Ionizing radiations and DNA damage, DNA double strand breaks, DNA damage repair, Base excision repair and Nucleotide excision repair, NHEJ and homologous recombination in DNA double strand break repair

MODULE III TRANSCRIPTION **12**

Prokaryotic transcription, Eukaryotic transcription, RNA polymerase, Chain elongation models, Transcription termination in prokaryotes and eukaryotes General and specific transcription factors, Regulatory elements.

MODULE IV TRANSCRIPTION MODIFICATIONS IN RNA **12**

5'-cap formation, transcription termination, 3 '-end processing and polyadenylation, Splicing, Editing, Nuclear export of mRNA and mRNA stability.

MODULE V TRANSLATION **12**

Prokaryotic and Eukaryotic translation, the translation Machinery; Mechanisms of initiation, elongation and termination, regulation of translation

TOTAL HOURS –60

REFERENCES:

1. Molecular Biology of the Gene. James D Watson, 7Ed. Cold Spring Harbor Laboratory Press. 2014
2. Molecular Biology. Robert F Weaver, 5Ed, McGraw Hill, 2013
3. Molecular Biotechnology. Glick and Pasternak, 4Ed, ASM Press, 2010.

OUTCOMES:

Through completion of this course, the student will achieve,

- A basic understanding of the central dogma of molecular biology
- An exposure to the modern day techniques employed to study DNA and hence gene functions

LSC1202	MOLECULAR BIOLOGY LAB	L	T	P	C
		0	0	3	2

OBJECTIVES:

- To learn basic techniques in molecular biology
- To study and to differentiated the electrochemical properties of nucleic acids

LIST OF EXPERIMENTS

1. Agarose gel electrophoresis of chromosomal & plasmid DNA
2. Extraction of genomic DNA from bacteria
3. Extraction of plasmid DNA from bacteria
4. Isolation of RNA from bacteria
5. Isolation of DNA fragment from agarose gel

TOTAL HOURS –45

REFERENCES:

1. Michel R. G and Sambrook J. Molecular Coning- A laboratory manual. Cold spring harbor laboratory press, 2012.

OUTCOMES:

On the completion of the above experiments students will be able to handle DNA samples and also to isolate, purify and visualize nucleic acid.

LSC1203 BIOINSTRUMENTATION L T P C

4 0 0 4

OBJECTIVES:

The students will be exposed to basic concepts related with techniques and instrumentation widely used in Biotechnology.

MODULE I COLORIMETRY AND SPECTROSCOPY 12

Principle and application of colorimeter, ultraviolet spectroscopy, Infra-red, Nuclear magnetic resonance spectroscopy and Mass Spectroscopy (GCMS, LCMS & MSMS).

MODULE II CENTRIFUGATION AND MICROSCOPY 12

Principle of centrifugation, rotors, different types of centrifuges, preparative and analytical centrifugation, ultra centrifugation. Optical microscopy, Bright field, Dark field, phase contrast and fluorescence microscopy. Electron microscopy: Transmission and scanning electron microscopy, Atomic force microscopy.

MODULE III ELECTROPHORESIS 12

General principle, support media. Agarose gels, polyacrylamide gels. SDS PAGE, 2D PAGE Pulsed field gel electrophoresis Iso-electric focusing Capillary electrophoresis

MODULE IV RADIOISOTOPE TECHNIQUES 12

Study of radioisotopes in biological samples, autoradiography- GM counter, scintillation counters, radio –immunoassay.

MODULE V CHROMATOGRAPHY 9

Introduction: Chromatography theory and practice. Paper chromatography. Thin layer chromatography. Ion exchange chromatography. Affinity chromatography. Partition chromatography. Adsorption chromatography. Introduction to gas chromatography and HPLC. Permeation.

TOTAL HOURS – 60

REFERENCES:

1. Pierre C. ORD and CD in chemistry and biochemistry: An Introduction. Academic Press, 1972.
2. Paddock S. W. Confocal Microscopy methods & protocols.1st Ed., Human Press, 1999.
3. Murphy D. B. Fundamental of Light Microscopy & Electron Imaging. 1st Ed., Wiley-Liss, 2001.

OUTCOMES:

At the end of the course, the students will have sufficient scientific understanding of the basic concepts in instrumentation used in Biotechnology.

LSC1204	BIOINSTRUMENTATION LABORATORY	L	T	P	C
		0	0	3	2

OBJECTIVES:

- Provides an opportunity to experimentally verify the theoretical concepts of bioenergetics and protein engineering already studied. It also helps in understanding the theoretical principles in a more explicit and concentrated manner.

LIST OF EXPERIMENTS:

1. Preparation of Acetate, Tris and Phosphate Buffer systems and validation of Henderson-Hasselbach equation.
2. Reactions of amino acids – Ninhydrin, Pthaldehyde, Dansyl chloride – measurement using colorimetric and fluorimetric methods.
3. Differential estimations of carbohydrates – reducing vs non-reducing, polymeric vs oligomeric, hexose vs pentose
4. DNA determination by UV-Vis Spectrophotometer – hyperchromic effect
5. Separation of lipids by TLC.
6. Enzyme Kinetics: Direct and indirect assays – determination of K_m, V_{max} and
7. Restriction enzyme – Enrichment and Module calculation
8. Ion-exchange Chromatagraphy – Purification of IgG and Albumin
9. Gel filtration – Size based separation of proteins
10. SDS-PAGE Gel Electrophoresis

TOTAL HOURS – 45

REFERENCES:

1. Biochemical Methods: A Concise Guide for Students and Researchers, Alfred Pingoud, Claus Urbanke, Jim Hoggett, Albert Jeltsch, 2002 John Wiley & Sons Publishers, Inc,

2. Biochemical Calculations: How to Solve Mathematical Problems in General Biochemistry, 2nd Edition, Irwin H. Segel, 1976 John Wiley & Sons Publishers, Inc,

3. Principles and Techniques of Practical Biochemistry- Wilson, K. and Walker, J. Cambridge Press.

OUTCOMES:

On the completion of the above objectives student will be able to perform biochemical assays, electrochemical techniques, spectrophotometry and chromatography.

LSC 1205 BASICS OF COMPUTERS

L	T	P	C
3	1	0	4

OBJECTIVES:

To know about computer and to operate the computer.
To familiarize the office suite.

MODULE I INTRODUCTION TO COMPUTER **12**

What is Computer – Evolution – Basic Components – Memory – Software Components - Input / Output Devices - External Storage Devices – Personal Computer – Work Station - Mainframes.

MODULE II MS - WORD **12**

Introduction – User Interface – Themes and Quick Styles - Server Components Word Basics: Parts of Word Window – Formatting Features – Menus, Commands, Toolbars and their Icons – MS Word menus in focus - Word Exercise I – Word Exercise II.

MODULE III MS-EXCEL **12**

Introduction – Entering and Editing Text - Menus, Commands and Toolbars – MS Excel Menus in Focus - Excel Exercise-I – Alternate method - Entering formulas – Formatting Cells, Date Range – Inserting Headers & Footers – Saving a file and opening a file.

MODULE IV MS-POWER POINT **12**

Creating a new presentation and new slide– Opening a presentation – Deleting a slide, Copying a slide – Numbering the Slides – Saving a presentation – Changing the default directory – Printing a presentation – Working with Power Point – MS Power Point Menus in focus – Formatting in Power Point.

MODULE V MS-ACCESS **12**

Parts of an Access Window – MS Access Menus in Focus – Starting Microsoft Access – Creating a New Database – Creating Table using Table Wizard – Saving the Database - Creating Tables in design view – Query – Forms – Reports.

TOTAL HOURS – 60

REFERENCES:

1. Sanjay Saxena, “MS Office for Everyone”, Vikas Publishing House Pvt. Ltd., New Delhi, 2010, Reprinted 2010,.
2. Sinha P.K., “Computer Fundamentals”, BPB Publications, 6th Edition, New

Delhi, 2004.

OUTCOMES:

On the completion of the above objectives student will be able to operate the computer.

LSC1206	CONFIDENCE BUILDING BEHAVIOURAL SKILLS	L	T	P	C
		2	0	0	2

OBJECTIVES:

To enable the students to develop communication skills for verbal communication in the work place.

MODULE I **8**

This course is practical oriented one and exercises will be given to the students group users /individually depending upon the aspect considered. The following aspect will form the broad outline content of the syllabi. The exercises will be designed by the faculty member and coordinated by the overall course coordinator.

LAB ACTIVITIES:

- Introduction: Soft skills definition, examples
- Verbal communication: Case study, communication and discussion
- Prepared speech
- Impromptu speech
- Debate: Case studies - Attitude and Behavior: role play and exploration
- Ability to ask for help – communication and team work
- Manners and etiquette
- Organization and Planning
- Time keeping
- Conduct in workplace
- Conscientiousness
- Work output
- Professionalism
- Motivation
- Ownership of tasks
- Adaptability/flexibility

ASSESSMENT:

The assessment will be continuous and portfolio based. The students must produce the record of the work done through the course of the semester in the individual classes. The portfolio may consist of a) the individual task outline and activities, b) worked out activities c) Pre-designed sheets which may be provided by the Faculty member. The portfolio will be used by the Faculty member for

assessment. The course coordinator in consultation with the course committee shall decide at the beginning of the semester, the number of exercises, method of assessment of each and the weightage for the end semester assessment.

TOTAL HOURS – 45

OUTCOMES:

The students should be able to:

- develop verbal communication skills
- debate with other students confidently
- communicate effectively their ideas

REGULATIONS 2017

CURRICULUM AND SYLLABI (I & II Semester)

(Recognised by Pharmacy Council of India)

B.Pharm

Bachelor of Pharmacy

VISION AND MISSION OF CRESCENT SCHOOL OF PHARMACY

VISION

The Crescent School of Pharmacy aspires to be a centre of excellence in pharmaceutical education, training and research to contribute for the socio-economic progress of the nation.

MISSION

- To provide quality education and training in Pharmaceutical Science and Technology to bring out high quality pharmacists.
- To create a simulating environment with supporting infrastructure for learning of pharmacy science and technology
- To provide sound knowledge, good practical skill sets and inculcate right attitude through a well balanced curriculum, co-curricular and extracurricular activities.

PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES

PROGRAMME EDUCATIONAL OBJECTIVES

- **PEO1:** To inform students of the standards and expectations of the course
- **PEO2:** To provide students with a strong and well defined concepts in the various fields of pharmaceutical sciences
- **PEO3:** To encourage students to have enquiring minds and seek opportunities to become global citizens
- **PEO4**: To train the students to contribute towards healthcare system and counseling for prophylaxis and prevention of diseases.
- **PEO5**: To promote the development of trained human resource in Pharmaceutical Sciences for dissemination of quality education with highly professional and ethical attitude, strong communication skills, effective skills to work in a team with a multidisciplinary approach.
- **PEO6**: To encourage the students to participate in life-long learning process for a high productive career and to relate the concepts of Pharmaceutical Sciences towards serving the cause of the society.

PROGRAMME OUTCOMES

- **PO1:** Is capable of critical thinking, i.e., assessing information and applying research information to his or her work
- **PO2:** Develop and demonstrate depth and breadth of knowledge in pharmaceutical, social, behavioral, administrative, and clinical sciences.
- **PO3:** Integrate knowledge from foundational sciences to explain how specific drugs or drug classes work and evaluate their potential value in individuals and populations.
- **PO4:** Develop an ability to solve, analyze and interpret data generated from Formulation Development, Quality Control & Quality Assurance.
- **PO5:** Identify and utilize technology, human, financial, and physical resources to optimize the medication use system.
- **PO6:** Apply standards, guidelines, best practices, and established processes related to safe and effective medication use.

- **PO7:** Provide prevention, intervention, and educational strategies for individuals and communities to improve health and wellness.
- **PO8:** Using a systematic instructional design model provide effective, appropriate patient education.
- **PO9:** Encourage patients to take responsibility for and control of their health and healthcare.
- **PO10:** Assist all patients in obtaining the necessary resources, services, medications, devices, and care in a timely and cost-effective manner.
- **PO11:** Act as a public health advocate by identifying and providing patients with current health-care information.
- **PO12:** Understands the basic economic principles governing business activities and social operations in the field of health care.

PROGRAMME SPECIFIC OUT COMES

- **PSO1:** Develop ability for in-depth analytical and critical thinking in order to identify, formulate and solve the issues related to Pharmaceutical Industry, Regulatory Agencies, and Hospital Pharmacy & Community Pharmacy.
- **PSO2:** Develop written and oral communication skills in order to communicate effectively the outcomes of the Pharmaceutical problems.
- **PSO3:** Develop an understanding for the need of pharmaceutical sciences and technology towards giving quality life to people in society.

Pharmacy Council of India

New Delhi

Rules & Syllabus for the Bachelor of Pharmacy (B. Pharm) Course

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[Framed under Regulation 6, 7 & 8 of the Bachelor of Pharmacy (B. Pharm) course regulations 2014]

CHAPTER- I: REGULATIONS

1. Short Title and Commencement

These regulations shall be called as "The Revised Regulations for the B. Pharm. Degree Program (CBCS)of the Pharmacy Council of India, New Delhi". They shall come into effect from the Academic Year 2016-17. The regulations framed are subject to modifications from time to time by Pharmacy Council of India.

2. Minimum qualification for admission

2.1 First year B. Pharm:

Candidate shall have passed 10+2 examination conducted by the respective state/central government authorities recognized as equivalent to 10+2 examination by the Association of Indian Universities (AIU) with English as one of the subjects and Physics, Chemistry, Mathematics (P.C.M) and or Biology (P.C.B / P.C.M.B.) as optional subjects individually. Any other qualification approved by the Pharmacy Council of India as equivalent to any of the above examinations.

2.2. B. Pharm lateral entry (to third semester):

A pass in D. Pharm. course from an institution approved by the Pharmacy Council of India under section 12 of the Pharmacy Act.

3. Duration of the program

The course of study for B.Pharm shall extend over a period of eight semesters (four academic years) and six semesters (three academic years) for lateral entry students. The curricula and syllabi for the program shall be prescribed from time to time by Pharmacy Council of India, New Delhi.

4. Medium of instruction and examinations

Medium of instruction and examination shall be in English.

5. Working days in each semester

Each semestershall consist of not less than 100 working days. The odd semesters shall be conducted from the month of June/July to November/December and the even semesters shall be conducted from December/January to May/June in every calendar year.

6. Attendance and progress

A candidate is required to put in at least 80% attendance in individual courses considering theory and practical separately. The candidate shall complete the prescribed course satisfactorily to be eligible to appear for the respective examinations.

7. Program/Course credit structure

As per the philosophy of Credit Based Semester System, certain quantum of academic work viz. theory classes, tutorial hours, practical classes, etc. are measured in terms of credits. On satisfactory completion of the courses, a candidate earns credits. The amount of credit associated with a course is dependent upon the number of hours of instruction per week in that course. Similarly, the credit associated with any of the other academic, co/extra-curricular activities is dependent upon the quantum of work expected to be put in for each of these activities per week.

7.1. Credit assignment

7.1.1. Theory and Laboratory courses

Courses are broadly classified as Theory and Practical. Theory courses consist of lecture (L) and /or tutorial (T) hours, and Practical (P) courses consist of hours spent in the laboratory. Credits (C) for a course is dependent on the number of hours of instruction per week in that course, and is obtained by using a multiplier of one (1) for lecture and tutorial hours, and a multiplier of half (1/2) for practical (laboratory) hours. Thus, for example, a theory course having three lectures and one tutorial per week throughout the semester carries a credit of 4. Similarly, a practical having four laboratory hours per week throughout semester carries a credit of 2.

7.2. Minimum credit requirements

The minimum credit points required for award of a B. Pharm. degree is 208. These credits are divided into Theory courses, Tutorials, Practical, Practice School and Projectover the duration of eight semesters. The credits are distributed semester-wise as shown in Table IX. Courses generally progress in sequences, building competencies and their positioning indicates certain academic maturity on the part of the learners. Learners are expected to follow the semester-wise schedule of courses given in the syllabus.

The lateral entry students shall get 52 credit points transferred from their D. Pharm program. Such students shall take up additional remedial courses of 'Communication Skills' (Theory and Practical) and 'Computer Applications in Pharmacy' (Theory and Practical) equivalent to 3 and 4 credit points respectively, a total of 7 credit points to attain 59 credit points, the maximum of I and II semesters.

8. Academic work

A regular record of attendance both in Theory and Practical shall be maintained by the teaching staff of respective courses.

9. Course of study

The course of study for B. Pharm shall include Semester Wise Theory & Practical as given in Table – I to VIII. The number of hours to be devoted to each theory, tutorial and practical course in any semester shall not be less than that shown in Table – I to VIII.

Table-I: Course of study for semester I

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP101T	Human Anatomy and Physiology I– Theory	3	1	4
BP102T	Pharmaceutical Analysis I – Theory	3	1	4
BP103T	Pharmaceutics I – Theory	3	1	4
BP104T	Pharmaceutical Inorganic Chemistry – Theory	3	1	4
BP105T	Communication skills – Theory *	2	-	2
BP106RBT BP106RMT	Remedial Biology/ Remedial Mathematics – Theory*	2	-	2
BP107P	Human Anatomy and Physiology – Practical	4	-	2
BP108P	Pharmaceutical Analysis I – Practical	4	-	2
BP109P	Pharmaceutics I – Practical	4	-	2
BP110P	Pharmaceutical Inorganic Chemistry – Practical	4	-	2
BP111P	Communication skills – Practical*	2	-	1
BP112RBP	Remedial Biology – Practical*	2	-	1
	Total	**32/34$/36#**	**4**	**27/29$/30#**

#Applicable ONLY for the students who have studied Mathematics / Physics / Chemistry at HSC and appearing for Remedial Biology (RB)course**.**

$Applicable ONLY for the students who have studied Physics / Chemistry / Botany / Zoology at HSC and appearing for Remedial Mathematics (RM)course**.**

* Non University Examination (NUE)

Table-II: Course of study for semester II

Course Code	Name of the course	No. of hours	Tutorial	Credit points
BP201T	Human Anatomy and Physiology II – Theory	3	1	4
BP202T	Pharmaceutical Organic Chemistry I – Theory	3	1	4
BP203T	Biochemistry – Theory	3	1	4
BP204T	Pathophysiology – Theory	3	1	4
BP205T	Computer Applications in Pharmacy – Theory *	3	-	3
BP206T	Environmental sciences – Theory *	3	-	3
BP207P	Human Anatomy and Physiology II –Practical	4	-	2
BP208P	Pharmaceutical Organic Chemistry I– Practical	4	-	2
BP209P	Biochemistry – Practical	4	-	2
BP210P	Computer Applications in Pharmacy – Practical*	2	-	1
	Total	**32**	**4**	**29**

*****Non University Examination (NUE)

Table-III: Course of study for semester III

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP301T	Pharmaceutical Organic Chemistry II – Theory	3	1	4
BP302T	Physical Pharmaceutics I – Theory	3	1	4
BP303T	Pharmaceutical Microbiology – Theory	3	1	4
BP304T	Pharmaceutical Engineering – Theory	3	1	4
BP305P	Pharmaceutical Organic Chemistry II – Practical	4	-	2
BP306P	Physical Pharmaceutics I – Practical	4	-	2
BP307P	Pharmaceutical Microbiology – Practical	4	-	2
BP 308P	Pharmaceutical Engineering –Practical	4	-	2
	Total	**28**	**4**	**24**

Table-IV: Course of study for semester IV

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP401T	Pharmaceutical Organic Chemistry III– Theory	3	1	4
BP402T	Medicinal Chemistry I – Theory	3	1	4
BP403T	Physical Pharmaceutics II – Theory	3	1	4
BP404T	Pharmacology I – Theory	3	1	4
BP405T	Pharmacognosy and Phytochemistry I– Theory	3	1	4
BP406P	Medicinal Chemistry I – Practical	4	-	2
BP407P	Physical Pharmaceutics II – Practical	4		2
BP408P	Pharmacology I – Practical	4	-	2
BP409P	Pharmacognosy and Phytochemistry I – Practical	4	-	2
	Total	**31**	**5**	**28**

Table-V: Course of study for semester V

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP501T	Medicinal Chemistry II – Theory	3	1	4
BP502T	Industrial PharmacyI– Theory	3	1	4
BP503T	Pharmacology II – Theory	3	1	4
BP504T	Pharmacognosy and Phytochemistry II– Theory	3	1	4
BP505T	Pharmaceutical Jurisprudence – Theory	3	1	4
BP506P	Industrial PharmacyI – Practical	4	-	2
BP507P	Pharmacology II – Practical	4	-	2
BP508P	Pharmacognosy and Phytochemistry II – Practical	4	-	2
	Total	**27**	**5**	**26**

Table-VI: Course of study for semester VI

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP601T	Medicinal Chemistry III – Theory	3	1	4
BP602T	Pharmacology III – Theory	3	1	4
BP603T	Herbal Drug Technology – Theory	3	1	4
BP604T	Biopharmaceutics and Pharmacokinetics – Theory	3	1	4
BP605T	Pharmaceutical Biotechnology – Theory	3	1	4
BP606T	Quality Assurance –Theory	3	1	4
BP607P	Medicinal chemistry III – Practical	4	-	2
BP608P	Pharmacology III – Practical	4	-	2
BP609P	Herbal Drug Technology – Practical	4	-	2
	Total	**30**	**6**	**30**

Table-VII: Course of study for semester VII

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP701T	Instrumental Methods of Analysis – Theory	3	1	4
BP702T	Industrial PharmacyII – Theory	3	1	4
BP703T	Pharmacy Practice – Theory	3	1	4
BP704T	Novel Drug Delivery System – Theory	3	1	4
BP705P	Instrumental Methods of Analysis – Practical	4	-	2
BP706PS	Practice School*	12	-	6
	Total	**28**	**5**	**24**

***** Non University Examination (NUE)

Table-VIII: Course of study for semester VIII

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP801T	Biostatistics and Research Methodology	3	1	4
BP802T	Social and Preventive Pharmacy	3	1	4
BP803ET	Pharma Marketing Management	3 + 3 = 6	1 + 1 = 2	4 + 4 = 8
BP804ET	Pharmaceutical Regulatory Science			
BP805ET	Pharmacovigilance			
BP806ET	Quality Control and Standardization of Herbals			
BP807ET	Computer Aided Drug Design			
BP808ET	Cell and Molecular Biology			
BP809ET	Cosmetic Science			
BP810ET	Experimental Pharmacology			
BP811ET	Advanced Instrumentation Techniques			
BP812ET	Dietary Supplements and Nutraceuticals			
BP813PW	Project Work	12	-	6
	Total	**24**	**4**	**22**

Table-IX: Semester wise credits distribution

Semester	Credit Points
I	**27/29$/30#**
II	29
III	26
IV	28
V	26
VI	26
VII	24
VIII	22
Extracurricular/ Co curricular activities	01*
Total credit points for the program	**209/211$/212#**

* The credit points assigned for extracurricular and or co-curricular activities shall be given by the Principals of the colleges and the same shall be submitted to the University. The criteria to acquire this credit point shall be defined by the colleges from time to time.

$Applicable ONLY for the students studied Physics / Chemistry / Botany / Zoology at HSC and appearing for Remedial Mathematics course.

#Applicable ONLY for the students studied Mathematics / Physics / Chemistry at HSC and appearing for Remedial Biology course.

10. Program Committee

1. The B. Pharm. program shall have a Program Committee constituted by the Head of the institution in consultation with all the Heads of the departments.

2. The composition of the Program Committee shall be as follows:

   A senior teacher shall be the Chairperson; One Teacher from each department handling B.Pharm courses; and four student representatives of the program (one from each academic year), nominated by the Head of the institution.

3. Duties of the Program Committee:

   i. Periodically reviewing the progress of the classes.
   ii. Discussing the problems concerning curriculum, syllabus and the conduct of classes.
   iii. Discussing with the course teachers on the nature and scope of assessment for the course and the same shall be announced to the students at the beginning of respective semesters.
   iv. Communicating its recommendation to the Head of the institution on academic matters.
   v. The Program Committee shall meet at least thrice in a semester preferably at the end of each Sessionalexam (Internal Assessment) and before the end semester exam.

11. Examinations/Assessments

The scheme for internal assessment and end semester examinations is given in Table – X.

11.1. End semester examinations

The End Semester Examinations for each theory and practical coursethrough semesters I to VIII shall beconducted by the university except for the subjects with asterix symbol (*) in table I and II for which examinations shall be conducted by the subject experts at college level and the marks/grades shall be submitted to the university.

Tables-X: Schemes for internal assessments and end semester examinations semester wise

Semester I

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP101T	Human Anatomy and Physiology I– Theory	10	15	1 Hr	25	75	3 Hrs	100
BP102T	Pharmaceutical Analysis I – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP103T	Pharmaceutics I – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP104T	Pharmaceutical Inorganic Chemistry – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP105T	Communication skills – Theory *	5	10	1 Hr	15	35	1.5 Hrs	50
BP106RBT BP106RMT	Remedial Biology/ Mathematics – Theory*	5	10	1 Hr	15	35	1.5 Hrs	50
BP107P	Human Anatomy and Physiology – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP108P	Pharmaceutical Analysis I – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP109P	Pharmaceutics I – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP110P	Pharmaceutical Inorganic Chemistry – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP111P	Communication skills – Practical*	5	5	2 Hrs	10	15	2 Hrs	25
BP112RBP	Remedial Biology – Practical*	5	5	2 Hrs	10	15	2 Hrs	25
	Total	**70/75$^{\$}$/80$^{\#}$**	**115/125$^{\$}$/130$^{\#}$**	**23/24$^{\$}$/26$^{\#}$ Hrs**	**185/200$^{\$}$/210$^{\#}$**	**490/525$^{\$}$/ 540$^{\#}$**	**31.5/33$^{\$}$/ 35$^{\#}$ Hrs**	**675/725$^{\$}$/ 750$^{\#}$**

$^{\#}$Applicable ONLY for the students studied Mathematics / Physics / Chemistry at HSC and appearing for Remedial Biology (RB)course.

$^{\$}$Applicable ONLY for the students studied Physics / Chemistry / Botany / Zoology at HSC and appearing for Remedial Mathematics (RM)course.

***** Non University Examination (NUE)

Semester II

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP201T	Human Anatomy and Physiology II – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP202T	Pharmaceutical Organic Chemistry I – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP203T	Biochemistry – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP204T	Pathophysiology – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP205T	Computer Applications in Pharmacy – Theory*	10	15	1 Hr	25	50	2 Hrs	75
BP206T	Environmental sciences – Theory*	10	15	1 Hr	25	50	2 Hrs	75
BP207P	Human Anatomy and Physiology II –Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP208P	Pharmaceutical Organic Chemistry I– Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP209P	Biochemistry – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP210P	Computer Applications in Pharmacy – Practical*	5	5	2 Hrs	10	15	2 Hrs	25
	Total	**80**	**125**	**20 Hrs**	**205**	**520**	**30 Hrs**	**725**

***** The subject experts at college level shall conduct examinations

Semester III

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP301T	Pharmaceutical Organic Chemistry II – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP302T	PhysicalPharmaceuticsI –Theory	10	15	1 Hr	25	75	3 Hrs	100
BP303T	Pharmaceutical Microbiology – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP304T	Pharmaceutical Engineering – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP305P	Pharmaceutical Organic Chemistry II – Practical	5	10	4 Hr	15	35	4 Hrs	50
BP306P	Physical Pharmaceutics I – Practical	5	10	4 Hr	15	35	4 Hrs	50
BP307P	Pharmaceutical Microbiology – Practical	5	10	4 Hr	15	35	4 Hrs	50
BP308P	Pharmaceutical Engineering – Practical	5	10	4 Hr	15	35	4 Hrs	50
Total		**60**	**100**	**20**	**160**	**440**	**28Hrs**	**600**

Semester IV

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP401T	Pharmaceutical Organic Chemistry III– Theory	10	15	1 Hr	25	75	3 Hrs	100
BP402T	Medicinal Chemistry I – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP403T	Physical Pharmaceutics II – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP404T	Pharmacology I – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP405T	Pharmacognosy I – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP406P	Medicinal Chemistry I – Practical	5	10	4 Hr	15	35	4 Hrs	50
BP407P	Physical Pharmaceutics II – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP408P	Pharmacology I – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP409P	Pharmacognosy I – Practical	5	10	4 Hrs	15	35	4 Hrs	50
Total		**70**	**115**	**21 Hrs**	**185**	**515**	**31 Hrs**	**700**

Semester V

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP501T	Medicinal Chemistry II – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP502T	Industrial PharmacyI– Theory	10	15	1 Hr	25	75	3 Hrs	100
BP503T	Pharmacology II – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP504T	Pharmacognosy II – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP505T	Pharmaceutical Jurisprudence – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP506P	Industrial PharmacyI– Practical	5	10	4 Hr	15	35	4 Hrs	50
BP507P	Pharmacology II – Practical	5	10	4 Hr	15	35	4 Hrs	50
BP508P	Pharmacognosy II – Practical	5	10	4 Hr	15	35	4 Hrs	50
Total		**65**	**105**	**17 Hr**	**170**	**480**	**27 Hrs**	**650**

Semester VI

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP601T	Medicinal Chemistry III – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP602T	Pharmacology III – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP603T	Herbal Drug Technology – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP604T	Biopharmaceutics and Pharmacokinetics – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP605T	Pharmaceutical Biotechnology– Theory	10	15	1 Hr	25	75	3 Hrs	100
BP606T	Quality Assurance– Theory	10	15	1 Hr	25	75	3 Hrs	100
BP607P	Medicinal chemistry III – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP608P	Pharmacology III – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP609P	Herbal Drug Technology – Practical	5	10	4 Hrs	15	35	4 Hrs	50
Total		**75**	**120**	**18 Hrs**	**195**	**555**	**30 Hrs**	**750**

Semester VII

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP701T	Instrumental Methods of Analysis – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP702T	Industrial Pharmacy – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP703T	Pharmacy Practice – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP704T	Novel Drug Delivery System – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP705 P	Instrumental Methods of Analysis – Practical	5	10	4 Hrs	15	35	4 Hrs	50
BP706 PS	Practice School*	25	-	-	25	125	5 Hrs	150
Total		**70**	**70**	**8Hrs**	**140**	**460**	**21 Hrs**	**600**

***** The subject experts at college level shall conduct examinations

Semester VIII

Course code	Name of the course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
BP801T	Biostatistics and Research Methodology – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP802T	Social and Preventive Pharmacy – Theory	10	15	1 Hr	25	75	3 Hrs	100
BP803ET	Pharmaceutical Marketing – Theory	10 + 10 = 20	15 + 15 = 30	1 + 1 = 2 Hrs	25 + 25 = 50	75 + 75 = 150	3 + 3 = 6 Hrs	100 + 100 = 200
BP804ET	Pharmaceutical Regulatory Science – Theory							
BP805ET	Pharmacovigilance – Theory							
BP806ET	Quality Control and Standardization of Herbals – Theory							
BP807ET	Computer Aided Drug Design – Theory							
BP808ET	Cell and Molecular Biology – Theory							
BP809ET	Cosmetic Science – Theory							
BP810ET	Experimental Pharmacology – Theory							
BP811ET	Advanced Instrumentation Techniques – Theory							
BP812PW	Project Work	-	-	-	-	150	4 Hrs	150
	Total	**40**	**60**	**4 Hrs**	**100**	**450**	**16 Hrs**	**550**

11.2. Internal assessment: Continuous mode

The marks allocated for Continuous mode of Internal Assessment shall be awarded as per the scheme given below.

Table-XI:Scheme for awarding internal assessment: Continuous mode

Theory		
Criteria	**Maximum Marks**	
Attendance (Refer Table – XII)	4	2
Academic activities (Average of any 3 activities e.g. quiz, assignment, open book test, field work, group discussion and seminar)	3	1.5
Student – Teacher interaction	3	1.5
Total	**10**	**5**
Practical		
Attendance (Refer Table – XII)	2	
Based on Practical Records, Regular viva voce, etc.	3	
Total	**5**	

Table- XII: Guidelines for the allotment of marks for attendance

Percentage of Attendance	**Theory**	**Practical**
95 – 100	4	2
90 – 94	3	1.5
85 – 89	2	1
80 – 84	1	0.5
Less than 80	0	0

11.2.1. Sessional Exams

Two Sessional exams shall be conducted for each theory / practical course as per the schedule fixed by the college(s). The scheme of question paper for theory and practical Sessional examinations is given below. The average marks of two Sessional exams shall be computed for internal assessment as per the requirements given in tables – X.

Sessional exam shall be conducted for 30 marks for theory and shall be computed for 15 marks. Similarly Sessional exam for practical shall be conducted for 40 marks and shall be computed for 10 marks.

Question paper pattern for theory Sessional examinations

For subjects having University examination

I. Multiple Choice Questions (MCQs)	=	10 x 1 = 10
OR		OR
Objective Type Questions (5 x 2)	=	05 x 2 = 10
(Answer all the questions)		
I. Long Answers (Answer 1 out of 2)	=	1 x 10 = 10
II. Short Answers (Answer 2 out of 3)	=	2 x 5 = 10

Total	=	30 marks

For subjects having Non University Examination

I. Long Answers (Answer 1 out of 2)	=	1 x 10 = 10
II. Short Answers (Answer 4 out of 6)	=	4 x 5 = 20

Total	=	30 marks

Question paper pattern for practical sessional examinations

I. Synopsis	=	10
II. Experiments	=	25
III. Viva voce	=	05

Total	=	40 marks
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12. Promotion and award of grades

A student shall be declared PASSand eligible for getting gradein a course of B.Pharm.program if he/she secures at least 50% marks in that particular course including internal assessment.For example, to be declared as PASS and to get grade, the student has to secure a minimum of 50 marks for the total of 100 including continuous mode of assessment and end semester theory examination and has to secure a minimum of 25 marks for the total 50 including internal assessment and end semester practical examination.

13. Carry forward of marks

In case a studentfails to secure the minimum 50% in any Theory or Practical course as specified in 12,then he/she shall reappear for the end semester examinationof that course. However his/her marks of the Internal Assessmentshallbe carried overand he/she shall be entitled for grade obtained by him/her on passing.

14. Improvement of internal assessment

A studentshall have the opportunity to improvehis/her performance only oncein the Sessional exam component of the internal assessment. The re-conduct of the Sessional exam shall be completed before the commencement of next end semester theory examinations.

15. Re-examination of end semester examinations

Reexamination ofend semester examinationshall be conducted as per the schedule given in table XIII. The exact dates of examinations shall be notified from time to time.

Table-XIII: Tentative schedule of end semester examinations

Semester	For Regular Candidates	For Failed Candidates
I, III, V and VII	November / December	May / June
II, IV, VI and VIII	May / June	November / December

Question paper pattern for end semester theory examinations

For 75 marks paper

I. Multiple Choice Questions(MCQs) = 20 x 1 = 20
OR OR
Objective Type Questions (10 x 2) = 10 x 2 = 20
(Answer all the questions)
II. Long Answers (Answer 2 out of 3) = 2 x 10 = 20
III. Short Answers (Answer 7 out of 9) = 7 x 5 = 35

Total = 75 marks

For 50 marks paper

I. Long Answers (Answer 2 out of 3) = 2 x 10 = 20
II. Short Answers (Answer 6 out of 8) = 6 x 5 = 30

Total = 50 marks

For 35 marks paper

I. Long Answers (Answer 1 out of 2) = 1 x 10 =10
II. Short Answers (Answer 5 out of 7) = 5 x 5 = 25

Total = 35 marks

Question paper pattern for end semester practical examinations

I. Synopsis = 5
II. Experiments = 25
III. Viva voce = 5

Total = 35 marks

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16. Academic Progression:

No student shall be admitted to any examination unless he/she fulfills the norms given in 6. Academic progression rules are applicable as follows:

A student shall be eligible to carry forward all the courses of I, II and III semesters till the IV semester examinations. However, he/she shall not be eligible to attend the courses of V semester until all the courses of I and II semesters are successfully completed.

A student shall be eligible to carry forward all the courses of III, IV and V semesters till the VI semester examinations. However, he/she shall not be eligible to attend the courses of VII semester until all the courses of I, II, III and IV semesters are successfully completed.

A student shall be eligible to carry forward all the courses of V, VI and VII semesters till the VIII semester examinations. However, he/she shall not be eligible to get the course completion certificate until all the courses of I, II, III, IV, V and VI semesters are successfully completed.

A student shall be eligible to get his/her CGPA upon successful completion of the courses of I to VIII semesters within the stipulated time period as per the norms specified in 26.

A lateral entry student shall be eligible to carry forward all the courses of III, IV and V semesters till the VI semester examinations. However, he/she shall not be eligible to attend the courses of VII semester until all the courses of III and IV semesters are successfully completed.

A lateral entry student shall be eligible to carry forward all the courses of V, VI and VII semesters till the VIII semester examinations. However, he/she shall not be eligible to get the course completion certificate until all the courses of III, IV, V and VI semesters are successfully completed.

A lateral entry student shall be eligible to get his/her CGPA upon successful completion of the courses of III to VIII semesters within the stipulated time period as per the norms specified in 26.

Any student who hasgiven more than 4 chances for successful completion of I / III semester courses and more than 3 chances for successful completion of II / IV semester courses shall be permitted to attend V / VII semester classes ONLY during the subsequent academic year as the case may be. In simpler terms there shall NOT be any ODD BATCH for any semester.

Note: Grade ABshould be considered as failed and treated as one head for deciding academic progression. Such rules are also applicable for those students who fail to register for examination(s) of any course in any semester.

17. Grading of performances

17.1. Letter grades and grade points allocations:

Based on the performances, each student shall be awarded a final letter grade at the end of the semester for each course.The letter grades and their corresponding grade points are given in Table – XII.

Table – XII: Letter grades and grade points equivalent to Percentage of marks and performances

Percentage of Marks Obtained	Letter Grade	Grade Point	Performance
90.00 – 100	O	10	Outstanding
80.00 – 89.99	A	9	Excellent
70.00 – 79.99	B	8	Good
60.00 – 69.99	C	7	Fair
50.00 – 59.99	D	6	Average
Less than 50	F	0	Fail
Absent	AB	0	Fail

A learner who remains absent for any end semester examination shall be assigned a letter grade of ABand a corresponding grade point of zero. He/she should reappear for the said evaluation/examination in due course.

18. The Semester grade point average (SGPA)

The performance of a student in a semester is indicated by a number called 'Semester Grade Point Average' (SGPA). The SGPA is the weighted average of the grade points obtainedin all the courses by the student during the semester. For example, if a student takes five courses(Theory/Practical) in a semester with credits C1, C2, C3, C4 and C5 and the student's grade pointsin these courses are G1, G2, G3, G4 and G5, respectively, and then students' SGPA is equal to:

$$\text{SGPA} = \frac{C_1G_1 + C_2G_2 + C_3G_3 + C_4G_4 + C_5G_5}{C_1 + C_2 + C_3 + C_4 + C_5}$$

The SGPA is calculated to two decimal points.It should be noted that, the SGPA for any semester shall take into consideration the F and ABSgrade awarded in that semester. For example if a learner has a F or ABS grade in course 4, theSGPA shall then be computed as:

$$\text{SGPA} = \frac{C_1G_1 + C_2G_2 + C_3G_3 + C_4 * \text{ZERO} + C_5G_5}{C_1 + C_2 + C_3 + C_4 + C_5}$$

19. Cumulative Grade Point Average (CGPA)

The CGPA is calculated with the SGPA of all the VIII semesters to two decimal points and is indicated in final grade report card/final transcript showing the grades of all VIII semesters and their courses. The CGPA shall reflect the failed statusin case of F grade(s),till the course(s) is/are passed. When the course(s)is/are passedby obtaining a pass grade on subsequent examination(s) theCGPA shall only reflect the new grade and not the fail grades earned earlier.The CGPA is calculated as:

$$\text{CGPA} = \frac{C_1S_1 + C_2S_2 + C_3S_3 + C_4S_4 + C_5S_5 + C_6S_6 + C_7S_7 + C_8S_8}{C_1 + C_2 + C_3 + C_4 + C_5 + C_6 + C_7 + C_8}$$

where $C_1, C_2, C_3,\ldots$ is the total number of credits for semester I,II,III,…. and $S_1,S_2, S_3,\ldots$is the SGPA of semester I,II,III,…. .

20. Declaration of class

The class shall be awarded on the basis of CGPA as follows:

First Class with Distinction	= CGPA of. 7.50 and above
First Class	= CGPA of 6.00 to 7.49
Second Class	= CGPA of 5.00 to 5.99

21. Project work

All the students shall undertake a projectunder the supervision of a teacher and submit a report. The area of the project shall directly relate any one of the elective subject opted by the student in semester VIII. The project shall be carried out in group not exceeding 5 in number. The project report shall be submitted in triplicate (typed & bound copy not less than 25 pages).

The internal and external examiner appointed by the University shall evaluate the project at the time of the Practical examinations of other semester(s). Students shall be evaluated in groups for four hours (i.e., about half an hour for a group of five students). The projects shall be evaluated as per the criteria given below.

Evaluation of Dissertation Book:

Objective(s) of the work done		15 Marks
Methodology adopted		20 Marks
Results and Discussions		20 Marks
Conclusions and Outcomes		20 Marks
	Total	**75 Marks**

Evaluation of Presentation:

Presentation of work		25 Marks
Communication skills		20 Marks
Question and answer skills		30 Marks
	Total	**75 Marks**

Explanation: The 75 marks assigned to the dissertation book shall be same for all the students in a group. However, the 75 marks assigned for presentation shall be awarded based on the performance of individual students in the given criteria.

22. Industrial training (Desirable)

Every candidate shall be required to work for at least 150 hours spread over four weeks in a Pharmaceutical Industry/Hospital. It includes Production unit, Quality Control department, Quality Assurance department, Analytical laboratory, Chemical manufacturing unit, Pharmaceutical R&D, Hospital (Clinical Pharmacy), Clinical Research Organization, Community Pharmacy, etc. After the Semester – VI and before the commencement of Semester – VII, and shall submit satisfactory report of such work and certificate duly signed by the authority of training organization to the head of the institute.

23. Practice School

In the VII semester, every candidate shall undergo practice school for a period of 150 hours evenly distributed throughout the semester. The student shall opt any one of the domains for practice school declared by the program committee from time to time.

At the end of the practice school, every student shall submit a printed report (in triplicate) on the practice school he/she attended (not more than 25 pages). Along with the exams of semester VII, the report submitted by the student, knowledge and skills acquired by the student through practice school shall be evaluated by the subject experts at college leveland grade point shall be awarded.

24. Award of Ranks

Ranks and Medals shall be awarded on the basis of final CGPA. However, candidates who fail in one or more courses during the B.Pharm program shall not be eligible for award of ranks.Moreover, the candidates should have completed the B. Pharm program in minimum prescribed number of years, (four years) for the award of Ranks.

25. Award of degree

Candidates who fulfill the requirements mentioned above shall be eligible for award of degree during the ensuing convocation.

26. Duration for completion of the program of study

The duration for the completion of the program shall be fixed as double the actual duration of the program and the students have to pass within the said period, otherwise they have to get fresh Registration.

27. Re-admission after break of study

Candidate who seeks re-admission to the program after break of study has to get the approval from the university by paying a condonation fee.

No condonation is allowed for the candidate who has more than 2 years of break up period and he/she has to rejoin the program by paying the required fees.

CHAPTER - II: SYLLABUS

Semester I

BP101T. HUMAN ANATOMY AND PHYSIOLOGY-I (Theory)

45 Hours

Scope: This subject is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. The subject provides the basic knowledge required to understand the various disciplines of pharmacy.

Objectives: Upon completion of this course the student should be able to

1. Explain the gross morphology, structure and functions of various organs of the human body.
2. Describe the various homeostatic mechanisms and their imbalances.
3. Identify the various tissues and organs of different systems of human body.
4. Perform the various experiments related to special senses and nervous system.
5. Appreciate coordinated working pattern of different organs of each system

Course Content:

Unit I **10 hours**

- **Introduction to human body**
  Definition and scope of anatomy and physiology, levels of structural organization and body systems, basic life processes, homeostasis, basic anatomical terminology.
- **Cellular level of organization**
  Structure and functions of cell, transport across cell membrane, cell division, cell junctions. General principles of cell communication, intracellular signaling pathway activation by extracellular signal molecule, Forms of intracellular signaling: a) Contact-dependent b) Paracrine c) Synaptic d) Endocrine
- **Tissue level of organization**
  Classification of tissues, structure, location and functions of epithelial, muscular and nervous and connective tissues.

Unit II **10 hours**

- **Integumentary system**
  Structure and functions of skin
- **Skeletal system**
  Divisions of skeletal system, types of bone, salient features and functions of bones of axial and appendicular skeletal system
  Organization of skeletal muscle, physiology of muscle contraction, neuromuscular junction

- **Joints**
  Structural and functional classification, types of joints movements and its articulation

Unit III **10 hours**

- **Body fluids and blood**
- Body fluids, composition and functions of blood, hemopoeisis, formation of hemoglobin, anemia, mechanisms of coagulation, blood grouping, Rh factors, transfusion, its significance and disorders of blood, Reticulo endothelial system.
- **Lymphatic system**

  Lymphatic organs and tissues, lymphatic vessels, lymph circulation and functions of lymphatic system

Unit IV **08 hours**

Peripheral nervous system:
Classification of peripheral nervous system: Structure and functions of sympathetic and parasympathetic nervous system.
Origin and functions of spinal and cranial nerves.

- **Special senses**
  Structure and functions of eye, ear, nose and tongue and their disorders.

Unit V **07 hours**

- **Cardiovascular system**
  Heart – anatomy of heart, blood circulation, blood vessels, structure and functions of artery, vein and capillaries, elements of conduction system of heart and heart beat, its regulation by autonomic nervous system, cardiac output, cardiac cycle. Regulation of blood pressure, pulse, electrocardiogram and disorders of heart.

BP107P. HUMAN ANATOMY AND PHYSIOLOGY (Practical)

4 Hours/week

Practical physiology is complimentary to the theoretical discussions in physiology. Practicals allow the verification of physiological processes discussed in theory classes through experiments on living tissue, intact animals or normal human beings. This is helpful for developing an insight on the subject**.**

1. Study of compound microscope.
2. Microscopic study of epithelial and connective tissue
3. Microscopic study of muscular and nervous tissue
4. Identification of axial bones
5. Identification of appendicular bones

6. Introduction to hemocytometry.
7. Enumeration of white blood cell (WBC) count
8. Enumeration of total red blood corpuscles (RBC) count
9. Determination of bleeding time
10. Determination of clotting time
11. Estimation of hemoglobin content
12. Determination of blood group.
13. Determination of erythrocyte sedimentation rate (ESR).
14. Determination of heart rate and pulse rate.
15. Recording of blood pressure.

Recommended Books (Latest Editions)

1. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brothers medical publishers, New Delhi.
2. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York
3. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co,Riverview,MI USA
4. Text book of Medical Physiology- Arthur C,Guyton andJohn.E. Hall. Miamisburg, OH, U.S.A.
5. Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.

6. Textbook of Human Histology by Inderbir Singh, Jaypee brother's medical publishers, New Delhi.
7. Textbook of Practical Physiology by C.L. Ghai, Jaypee brother's medical publishers, New Delhi.
8. Practical workbook of Human Physiology by K. Srinageswari and Rajeev Sharma, Jaypee brother's medical publishers, New Delhi.

Reference Books (Latest Editions)

1. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA
2. Text book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A.
3. Human Physiology (vol 1 and 2) by Dr. C.C. Chatterrje ,Academic Publishers Kolkata

BP102T. PHARMACEUTICAL ANALYSIS (Theory)

45 Hours

Scope: This course deals with the fundamentals of analytical chemistry and principles of electrochemical analysis of drugs

Objectives: Upon completion of the course student shall be able to

- understand the principles of volumetric and electro chemical analysis
- carryout various volumetric and electrochemical titrations
- develop analytical skills

Course Content:

UNIT-I **10 Hours**

(a) Pharmaceutical analysis- Definition and scope

i) Different techniques of analysis

ii) Methods of expressing concentration

iii) Primary and secondary standards.

iv) Preparation and standardization of various molar and normal solutions- Oxalic acid, sodium hydroxide, hydrochloric acid, sodium thiosulphate, sulphuric acid, potassium permanganate and ceric ammonium sulphate

(b)Errors: Sources of errors, types of errors, methods of minimizing errors, accuracy, precision and significant figures

(c)Pharmacopoeia, Sources of impurities in medicinal agents,limit tests.

UNIT-II **10 Hours**

- **Acid base titration**: Theories of acid base indicators, classification of acid base titrations and theory involved in titrations of strong, weak, and very weak acids and bases, neutralization curves
- **Non aqueous titration**: Solvents, acidimetry and alkalimetry titration and estimation of Sodium benzoate and Ephedrine HCl

UNIT-III **10 Hours**

- **Precipitation titrations**: Mohr's method, Volhard's, Modified Volhard's, Fajans method, estimation of sodium chloride.
- **Complexometric titration**: Classification, metal ion indicators, masking and demasking reagents, estimation of Magnesium sulphate, and calcium gluconate.
- **Gravimetry**: Principle and steps involved in gravimetric analysis. Purity of the precipitate: co-precipitation and post precipitation, Estimation of barium sulphate.

- Basic Principles,methods and application of diazotisation titration.

UNIT-IV **08 Hours**

Redox titrations

(a) Concepts of oxidation and reduction

(b) Types of redox titrations (Principles and applications)

Cerimetry, Iodimetry, Iodometry, Bromatometry, Dichrometry, Titration with potassium iodate

UNIT-V **07 Hours**

- **Electrochemical methods of analysis**
  - **Conductometry**- Introduction, Conductivity cell, Conductometric titrations, applications.
  - **Potentiometry** - Electrochemical cell, construction and working of reference (Standard hydrogen, silver chloride electrode and calomel electrode) and indicator electrodes (metal electrodes and glass electrode), methods to determine end point of potentiometric titration and applications.
  - **Polarography** - Principle, Ilkovic equation, construction and working of dropping mercury electrode and rotating platinum electrode, applications

BP108P. PHARMACEUTICAL ANALYSIS (Practical)

4 Hours / Week

I **Limit Test of the following**

(1) Chloride
(2) Sulphate
(3) Iron
(4) Arsenic

II **Preparation and standardization of**

(1) Sodium hydroxide
(2) Sulphuric acid
(3) Sodium thiosulfate
(4) Potassium permanganate
(5) Ceric ammonium sulphate

III **Assay of the following compounds along with Standardization of Titrant**

(1) Ammonium chloride by acid base titration
(2) Ferrous sulphate by Cerimetry
(3) Copper sulphate by Iodometry
(4) Calcium gluconate by complexometry
(5) Hydrogen peroxide by Permanganometry
(6) Sodium benzoate by non-aqueous titration
(7) Sodium Chloride by precipitation titration

IV **Determination of Normality by electro-analytical methods**

(1) Conductometric titration of strong acid against strong base
(2) Conductometric titration of strong acid and weak acid against strong base
(3) Potentiometric titration of strong acid against strong base

Recommended Books: (Latest Editions)

1. A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press of University of London
2. A.I. Vogel, Text Book of Quantitative Inorganic analysis
3. P. Gundu Rao, Inorganic Pharmaceutical Chemistry
4. Bentley and Driver's Textbook of Pharmaceutical Chemistry
5. John H. Kennedy, Analytical chemistry principles
6. Indian Pharmacopoeia.

BP103T. PHARMACEUTICS- I (Theory)

45 Hours

Scope: This course is designed to impart a fundamental knowledge on the preparatory pharmacy with arts and science of preparing the different conventional dosage forms.

Objectives: Upon completion of this course the student should be able to:

- Know the history of profession of pharmacy
- Understand the basics of different dosage forms, pharmaceutical incompatibilities and pharmaceutical calculations
- Understand the professional way of handling the prescription
- Preparation of various conventional dosage forms

Course Content:

UNIT – I **10 Hours**

- **Historical background and development of profession of pharmacy**: History of profession of Pharmacy in India in relation to pharmacy education, industry and organization, Pharmacy as a career, Pharmacopoeias: Introduction to IP, BP, USP and Extra Pharmacopoeia.
- **Dosage forms:** Introduction to dosage forms, classification and definitions
- **Prescription:** Definition, Parts of prescription, handling of Prescription and Errors in prescription.
- **Posology:** Definition, Factors affecting posology. Pediatric dose calculations based on age, body weight and body surface area.

UNIT – II **10 Hours**

- **Pharmaceutical calculations**: Weights and measures – Imperial & Metric system, Calculations involving percentage solutions, alligation, proof spirit and isotonic solutions based on freezing point and molecular weight.

- **Powders:** Definition, classification, advantages and disadvantages,Simple & compound powders – official preparations, dusting powders, effervescent, efflorescent and hygroscopic powders, eutectic mixtures. Geometric dilutions.

- **Liquid dosage forms:** Advantages and disadvantages of liquid dosage forms. Excipients used in formulation of liquid dosage forms. Solubility enhancement techniques

UNIT – III **08 Hours**

- **Monophasic liquids:** Definitions and preparations of Gargles, Mouthwashes, Throat Paint, Eardrops, Nasal drops, Enemas, Syrups, Elixirs, Liniments and Lotions.
- **Biphasic liquids:**
- **Suspensions:** Definition, advantages and disadvantages, classifications, Preparation of suspensions; Flocculated and Deflocculated suspension & stability problems and methods to overcome.
- **Emulsions:** Definition, classification, emulsifying agent, test for the identification of type ofEmulsion, Methods of preparation & stability problems and methods to overcome.

UNIT – IV **08 Hours**

- **Suppositories**: Definition, types, advantages and disadvantages, types of bases, methods of preparations. Displacement value & its calculations, evaluation of suppositories.
- **Pharmaceutical incompatibilities**: Definition, classification, physical, chemical and therapeutic incompatibilities with examples.

UNIV – V **07 Hours**

- **Semisolid dosage forms:** Definitions, classification, mechanisms and factors influencing dermal penetration of drugs. Preparation of ointments, pastes, creams and gels. Excipients used in semi solid dosage forms. Evaluation of semi solid dosages forms

BP109P. PHARMACEUTICSI (Practical)

3 Hours / week

1 . Syrups

a) Syrup IP'66

b) Compound syrup of Ferrous Phosphate BPC'68

2. Elixirs a) Piperazine citrate elixir

b) Paracetamol pediatric elixir

3.Linctus a) Terpin Hydrate Linctus IP'66

b) Iodine Throat Paint (Mandles Paint)

4. Solutions

a) Strong solution of ammonium acetate

b) Cresol with soap solution

c) Lugol's solution

5. Suspensions

a) Calamine lotion

b) Magnesium Hydroxide mixture

c) Aluminimum Hydroxide gel

6. Emulsions a) Turpentine Liniment

b) Liquid paraffin emulsion

7. Powders and Granules

a) ORS powder (WHO)

b) Effervescent granules

c)Dusting powder

d)Divded powders

8. Suppositories

a) Glycero gelatin suppository

b) Coca butter suppository

c) Zinc Oxide suppository

8. Semisolids

a) Sulphur ointment

b) Non staining-iodine ointment with methyl salicylate

c) Carbopal gel

9. Gargles and Mouthwashes

a) Iodine gargle

b) Chlorhexidine mouthwash

Recommended Books: (Latest Editions)

1. H.C. Ansel et al., Pharmaceutical Dosage Form and Drug Delivery System, Lippincott Williams and Walkins, New Delhi.
2. Carter S.J., Cooper and Gunn's-Dispensing for Pharmaceutical Students, CBS publishers, New Delhi.
3. M.E. Aulton, Pharmaceutics, The Science& Dosage Form Design, Churchill Livingstone, Edinburgh.
4. Indian pharmacopoeia.
5. British pharmacopoeia.
6. Lachmann. Theory and Practice of Industrial Pharmacy,Lea& Febiger Publisher, The University of Michigan.
7. Alfonso R. Gennaro Remington. The Science and Practice of Pharmacy, Lippincott Williams, New Delhi.
8. Carter S.J., Cooper and Gunn's. Tutorial Pharmacy, CBS Publications, New Delhi.
9. E.A. Rawlins, Bentley's Text Book of Pharmaceutics, English Language Book Society, Elsevier Health Sciences, USA.
10. Isaac Ghebre Sellassie: Pharmaceutical Pelletization Technology, Marcel Dekker, INC, New York.
11. Dilip M. Parikh: Handbook of Pharmaceutical Granulation Technology, Marcel Dekker, INC, New York.
12. Francoise Nieloud and Gilberte Marti-Mestres: Pharmaceutical Emulsions and Suspensions, Marcel Dekker, INC, New York.

BP104T. PHARMACEUTICAL INORGANIC CHEMISTRY (Theory)

45 Hours

Scope: This subject deals with the monographs of inorganic drugs and pharmaceuticals.

Objectives: Upon completion of course student shall be able to

- know the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals
- understand the medicinal and pharmaceutical importance of inorganic compounds

Course Content:

UNIT I **10 Hours**

- **Impurities in pharmaceutical substances:** History of Pharmacopoeia, Sources and types of impurities, principle involved in the limit test for Chloride, Sulphate, Iron, Arsenic, Lead and Heavy metals, modified limit test for Chloride and Sulphate

  General methods of preparation, assay for the compounds superscripted with **asterisk (*),** properties and medicinal uses of inorganic compounds belonging to the following classes

UNIT II **10 Hours**

- **Acids, Bases and Buffers:** Buffer equations and buffer capacity in general, buffers in pharmaceutical systems, preparation, stability, buffered isotonic solutions, measurements of tonicity, calculations and methods of adjusting isotonicity.
- **Major extra and intracellular electrolytes**: Functions of major physiological ions, Electrolytes used in the replacement therapy: Sodium chloride*, Potassium chloride, Calcium gluconate* and Oral Rehydration Salt (ORS), Physiological acid base balance.
- **Dental products**: Dentifrices, role of fluoride in the treatment of dental caries, Desensitizing agents, Calcium carbonate, Sodium fluoride, and Zinc eugenol cement.

UNIT III **10 Hours**

- **Gastrointestinal agents**

  Acidifiers: Ammonium chloride* and Dil. HCl

  Antacid: Ideal properties of antacids, combinations of antacids, Sodium

Bicarbonate*, Aluminum hydroxide gel, Magnesium hydroxide mixture

Cathartics: Magnesium sulphate, Sodium orthophosphate, Kaolin and Bentonite

Antimicrobials: Mechanism, classification, Potassium permanganate, Boric acid, Hydrogen peroxide*, Chlorinated lime*, Iodine and its preparations

UNIT IV **08 Hours**

- **Miscellaneous compounds**

  Expectorants: Potassium iodide, Ammonium chloride*.

  Emetics: Copper sulphate*, Sodium potassium tartarate

  Haematinics: Ferrous sulphate*, Ferrous gluconate

  Poison and Antidote: Sodium thiosulphate*, Activated charcoal, Sodium nitrite333

  Astringents: Zinc Sulphate, Potash Alum

UNIT V **07 Hours**

- **Radiopharmaceuticals**: Radio activity, Measurement of radioactivity, Properties of α, β, γ radiations, Half life, radio isotopes and study of radio isotopes - Sodium iodide I^{131}, Storage conditions, precautions & pharmaceutical application of radioactive substances.

BP110P. PHARMACEUTICAL INORGANIC CHEMISTRY (Practical)

4 Hours / Week

I **Limit tests for following ions**

Limit test for Chlorides and Sulphates
Modified limit test for Chlorides and Sulphates
Limit test for Iron
Limit test for Heavy metals
Limit test for Lead
Limit test for Arsenic

II **Identification test**

Magnesium hydroxide
Ferrous sulphate
Sodium bicarbonate
Calcium gluconate
Copper sulphate

III **Test for purity**

Swelling power of Bentonite
Neutralizing capacity of aluminum hydroxide gel
Determination of potassium iodate and iodine in potassium Iodide

IV **Preparation of inorganic pharmaceuticals**

Boric acid
Potash alum
Ferrous sulphate

Recommended Books (Latest Editions)

1. A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press of University of London, 4th edition.
2. A.I. Vogel, Text Book of Quantitative Inorganic analysis
3. P. Gundu Rao, Inorganic Pharmaceutical Chemistry, 3rd Edition
4. M.L Schroff, Inorganic Pharmaceutical Chemistry
5. Bentley and Driver's Textbook of Pharmaceutical Chemistry
6. Anand & Chatwal, Inorganic Pharmaceutical Chemistry
7. Indian Pharmacopoeia

BP105T.COMMUNICATION SKILLS (Theory)

30 Hours

Scope: This course will prepare the young pharmacy student to interact effectively with doctors, nurses, dentists, physiotherapists and other health workers. At the end of this course the student will get the soft skills set to work cohesively with the team as a team player and will add value to the pharmaceutical business.

Objectives:

Upon completion of the course the student shall be able to

1. Understand the behavioral needs for a Pharmacist to function effectively in the areas of pharmaceutical operation
2. Communicate effectively (Verbal and Non Verbal)
3. Effectively manage the team as a team player
4. Develop interview skills
5. Develop Leadership qualities and essentials

Course content:

UNIT – I **07 Hours**

- **Communication Skills:** Introduction, Definition, The Importance of Communication, The Communication Process – Source, Message, Encoding, Channel, Decoding, Receiver, Feedback, Context

- **Barriers to communication:** Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional barriers

- **Perspectives in Communication:** Introduction, Visual Perception, Language, Other factors affecting our perspective - Past Experiences, Prejudices, Feelings, Environment

UNIT – II **07 Hours**

- **Elements of Communication:** Introduction, Face to Face Communication - Tone of Voice, Body Language (Non-verbal communication), Verbal Communication, Physical Communication

- **Communication Styles:** Introduction, The Communication Styles Matrix with example for each -Direct Communication Style, Spirited Communication Style, Systematic Communication Style, Considerate Communication Style

UNIT – III **07 Hours**

- **Basic Listening Skills:** Introduction, Self-Awareness, Active Listening, Becoming an Active Listener, Listening in Difficult Situations
- **Effective Written Communication:** Introduction, When and When Not to Use Written Communication - Complexity of the Topic, Amount of Discussion' Required, Shades of Meaning, Formal Communication
- **Writing Effectively:** Subject Lines, Put the Main Point First, Know Your Audience, Organization of the Message

UNIT – IV **05 Hours**

- **Interview Skills:** Purpose of an interview, Do's and Dont's of an interview
- **Giving Presentations:** Dealing with Fears, Planning your Presentation, Structuring Your Presentation, Delivering Your Presentation, Techniques of Delivery

UNIT – V **04 Hours**

- **Group Discussion:** Introduction, Communication skills in group discussion, Do's and Dont's of group discussion

BP111P.COMMUNICATION SKILLS (Practical)

2 Hours / week

Thefollowing learning modules are to be conducted using wordsworth® English language lab software

Basic communication covering the following topics

Meeting People

Asking Questions

Making Friends

What did you do?

Do's and Dont's

Pronunciations covering the following topics

Pronunciation (Consonant Sounds)

Pronunciation and Nouns

Pronunciation (Vowel Sounds)

Advanced Learning

Listening Comprehension / Direct and Indirect Speech

Figures of Speech

Effective Communication

Writing Skills

Effective Writing

Interview Handling Skills

E-Mail etiquette

Presentation Skills

Recommended Books: (Latest Edition)

1. Basic communication skills for Technology, Andreja. J. Ruther Ford, 2nd Edition, Pearson Education, 2011
2. Communication skills, Sanjay Kumar, Pushpalata, 1stEdition, Oxford Press, 2011
3. Organizational Behaviour, Stephen .P. Robbins, 1stEdition, Pearson, 2013
4. Brilliant- Communication skills, Gill Hasson, 1stEdition, Pearson Life, 2011
5. The Ace of Soft Skills: Attitude, Communication and Etiquette for success, Gopala Swamy Ramesh, 5thEdition, Pearson, 2013
6. Developing your influencing skills, Deborah Dalley, Lois Burton, Margaret, Green hall, 1st Edition Universe of Learning LTD, 2010
7. Communication skills for professionals, Konar nira, 2ndEdition, New arrivals – PHI, 2011
8. Personality development and soft skills, Barun K Mitra, 1stEdition, Oxford Press, 2011
9. Soft skill for everyone, Butter Field, 1st Edition, Cengage Learning india pvt.ltd, 2011
10. Soft skills and professional communication, Francis Peters SJ, 1stEdition, Mc Graw Hill Education, 2011
11. Effective communication, John Adair, 4thEdition, Pan Mac Millan,2009
12. Bringing out the best in people, Aubrey Daniels, 2ndEdition, Mc Graw Hill, 1999

BP 106RBT.REMEDIAL BIOLOGY (Theory)

30 Hours

Scope: To learn and understand the components of living world, structure and functional system of plant and animal kingdom.

Objectives: Upon completion of the course, the student shall be able to

- know the classification and salient features of five kingdoms of life
- understand the basic components of anatomy & physiology of plant
- know understand the basic components of anatomy & physiology animal with special reference to human

UNIT I **07 Hours**

Living world:

- Definition and characters of living organisms
- Diversity in the living world
- Binomial nomenclature
- Five kingdoms of life and basis of classification. Salient features of Monera, Potista, Fungi, Animalia and Plantae, Virus,

Morphology of Flowering plants

- Morphology of different parts of flowering plants – Root, stem, inflorescence, flower, leaf, fruit, seed.
- General Anatomy of Root, stem, leaf of monocotyledons & Dicotylidones.

UNIT II **07 Hours**

Body fluids and circulation

- Composition of blood, blood groups, coagulation of blood
- Composition and functions of lymph
- Human circulatory system
- Structure of human heart and blood vessels
- Cardiac cycle, cardiac output and ECG

Digestion and Absorption

- Human alimentary canal and digestive glands
- Role of digestive enzymes
- Digestion, absorption and assimilation of digested food

Breathing and respiration

- Human respiratory system
- Mechanism of breathing and its regulation
- Exchange of gases, transport of gases and regulation of respiration
- Respiratory volumes

UNIT III **07 Hours**

Excretory products and their elimination

- Modes of excretion
- Human excretory system- structure and function
- Urine formation
- Rennin angiotensin system

Neural control and coordination

- Definition and classification of nervous system
- Structure of a neuron
- Generation and conduction of nerve impulse
- Structure of brain and spinal cord
- Functions of cerebrum, cerebellum, hypothalamus and medulla oblongata

Chemical coordination and regulation

- Endocrine glands and their secretions
- Functions of hormones secreted by endocrine glands

Human reproduction

- Parts of female reproductive system
- Parts of male reproductive system
- Spermatogenesis and Oogenesis
- Menstrual cycle

UNIT IV **05 Hours**

Plants and mineral nutrition:

- Essential mineral, macro and micronutrients
- Nitrogen metabolism, Nitrogen cycle, biological nitrogen fixation

Photosynthesis

- Autotrophic nutrition, photosynthesis, Photosynthetic pigments, Factors affecting photosynthesis.

UNIT V **04 Hours**

Plant respiration: Respiration, glycolysis, fermentation (anaerobic).

Plant growth and development

- Phases and rate of plant growth, Condition of growth,Introduction to plant growth regulators

Cell - The unit of life

- Structure and functions of cell and cell organelles.Cell division

Tissues

- Definition, types of tissues, location and functions.

Text Books

a. Text book of Biology by S. B. Gokhale
b. A Text book of Biology by Dr. Thulajappa and Dr. Seetaram.

Reference Books

a. A Text book of Biology by B.V. Sreenivasa Naidu
b. A Text book of Biology by Naidu and Murthy
c. Botany for Degree students By A.C.Dutta.
d.Outlines of Zoology by M. Ekambaranatha ayyer and T. N. Ananthakrishnan.
e. A manual for pharmaceutical biology practical by S.B. Gokhale and C. K. Kokate

BP112RBP.REMEDIAL BIOLOGY (Practical)

30 Hours

1. Introduction to experiments in biology
   a) Study of Microscope
   b) Section cutting techniques
   c) Mounting and staining
   d) Permanent slide preparation
2. Study of cell and its inclusions
3. Study of Stem, Root, Leaf, seed, fruit, flower and their modifications
4. Detailed study of frog by using computer models
5. Microscopic study and identification of tissues pertinent to Stem, Root Leaf, seed, fruit and flower
6. Identification of bones
7. Determination of blood group
8. Determination of blood pressure
9. Determination of tidal volume

Reference Books

1. Practical human anatomy and physiology. by S.R.Kale and R.R.Kale.
2. A Manual of pharmaceutical biology practical by S.B.Gokhale, C.K.Kokate and S.P.Shriwastava.
3. Biology practical manual according to National core curriculum .Biology forum of Karnataka. Prof .M.J.H.Shafi

BP 106RMT.REMEDIAL MATHEMATICS (Theory)

30 Hours

Scope: This is an introductory course in mathematics. This subject deals with the introduction to Partial fraction, Logarithm, matrices and Determinant, Analytical geometry, Calculus, differential equation and Laplace transform.

Objectives: Upon completion of the course the student shall be able to:-

1. Know the theory and their application in Pharmacy
2. Solve the different types of problems by applying theory
3. Appreciate the important application of mathematics in Pharmacy

Course Content:

UNIT – I **06 Hours**

- **Partial fraction**

Introduction, Polynomial, Rational fractions, Proper and Improper fractions, Partial fraction , Resolving into Partial fraction, Application of Partial Fraction in Chemical Kinetics and Pharmacokinetics

- **Logarithms**

Introduction, Definition, Theorems/Properties of logarithms, Common logarithms, Characteristic and Mantissa, worked examples, application of logarithm to solve pharmaceutical problems.

- **Function***:*

Real Valued function, Classification of real valued functions,

- **Limits and continuity** :

Introduction , Limit of a function, Definition of limit of a function ($\in$ - δ definition) , $\lim_{x\to a}\frac{x^n - a^n}{x-a} = na^{n-1}$, $\lim_{\theta\to 0}\frac{\sin\theta}{\theta} = 1,$

UNIT –II **06 Hours**

- **Matrices and Determinant:**

Introduction matrices, Types of matrices, Operation on matrices, Transpose of a matrix, Matrix Multiplication, Determinants, Properties of determinants , Product of determinants, Minors and co-Factors, Adjoint or adjugate of a square matrix , Singular and non-singular matrices, Inverse of a matrix, Solution of system of linear of equations using matrix method, Cramer's rule, Characteristic equation and roots of a square matrix, Cayley–Hamilton theorem,Applicationof Matrices in solving Pharmacokinetic equations

UNIT – III **06 Hours**

- **Calculus**

Differentiation : Introductions, Derivative of a function, Derivative of a constant, Derivative of a product of a constant and a function , Derivative of the sum or difference of two functions, Derivative of the product of two functions (product formula), Derivative of the quotient of two functions (Quotient formula) – **Without Proof**, Derivative of x^n *w.r.t*x,where *n* is any rational number, Derivative of e^x,, Derivative of $\log_e x$, Derivative of a^x,Derivative of trigonometric functions from first principles **(without Proof)**, Successive Differentiation, Conditions for a function to be a maximum or a minimum at a point. Application

UNIT – IV **06 Hours**

- **Analytical Geometry**

Introduction: Signs of the Coordinates, Distance formula,

Straight Line : Slope or gradient of a straight line, Conditions for parallelism and perpendicularity of two lines, Slope of a line joining two points, Slope – intercept form of a straight line

Integration:

Introduction, Definition, Standard formulae, Rules of integration , Method of substitution, Method of Partial fractions, Integration by parts, definite integrals, application

UNIT-V **06 Hours**

- **Differential Equations** : Some basic definitions, Order and degree, Equations in separable form , Homogeneous equations, Linear Differential equations, Exact equations, **Application in solving Pharmacokinetic equations**
- **Laplace Transform** : Introduction, Definition, Properties of Laplace transform, Laplace Transforms of elementary functions, Inverse Laplace transforms, Laplace transform of derivatives, Application to solve Linear differential equations, **Application in solving Chemical kinetics and Pharmacokinetics equations**

Recommended Books (Latest Edition)

1. Differential Calculus by Shanthinarayan
2. Pharmaceutical Mathematics with application to Pharmacy by Panchaksharappa Gowda D.H.
3. Integral Calculus by Shanthinarayan
4. Higher Engineering Mathematics by Dr.B.S.Grewal

Semester II

BP 201T. HUMAN ANATOMY AND PHYSIOLOGY-II (Theory)

45 Hours

Scope: This subject is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. The subject provides the basic knowledge required to understand the various disciplines of pharmacy.

Objectives: Upon completion of this course the student should be able to:

1. Explain the gross morphology, structure and functions of various organs of the human body.
2. Describe the various homeostatic mechanisms and their imbalances.
3. Identify the various tissues and organs of different systems of human body.
4. Perform the hematological tests like blood cell counts, haemoglobin estimation, bleeding/clotting time etc and also record blood pressure, heart rate, pulse and respiratory volume.
5. Appreciate coordinated working pattern of different organs of each system
6. Appreciate the interlinked mechanisms in the maintenance of normal functioning (homeostasis) of human body.

Course Content:

Unit I **10 hours**

- **Nervous system**

Organization of nervous system, neuron, neuroglia, classification and properties of nerve fibre, electrophysiology, action potential, nerve impulse, receptors, synapse, neurotransmitters.

Central nervous system: Meninges, ventricles of brain and cerebrospinal fluid.structure and functions of brain (cerebrum, brain stem, cerebellum), spinal cord (gross structure, functions of afferent and efferent nerve tracts,reflex activity)

Unit II **06 hours**

- **Digestive system**

Anatomy of GI Tract with special reference to anatomy and functions of stomach, (Acid production in the stomach, regulation of acid production through parasympathetic nervous system, pepsin role in protein digestion) small intestine

and large intestine, anatomy and functions of salivary glands, pancreas and liver, movements of GIT, digestion and absorption of nutrients and disorders of GIT.

- **Energetics**

  Formation and role of ATP, Creatinine Phosphate and BMR.

Unit III

- **Respiratory system** **10 hours**

  Anatomy of respiratory system with special reference to anatomy of lungs, mechanism of respiration, regulation of respiration

  Lung Volumes and capacities transport of respiratory gases, artificial respiration, and resuscitation methods.

- **Urinary system**
  Anatomy of urinary tract with special reference to anatomy of kidney and nephrons, functions of kidney and urinary tract, physiology of urine formation, micturition reflex and role of kidneys in acid base balance, role of RAS in kidney and disorders of kidney.

Unit IV **10 hours**

- **Endocrine system**
  Classification of hormones, mechanism of hormone action, structure and functions of pituitary gland, thyroid gland, parathyroid gland, adrenal
  gland, pancreas, pineal gland, thymus and their disorders.

Unit V **09 hours**

- **Reproductive system**

  Anatomy of male and female reproductive system, Functions of male and female reproductive system, sex hormones, physiology of menstruation, fertilization, spermatogenesis, oogenesis, pregnancy and parturition

- **Introduction to genetics**

  Chromosomes, genes and DNA, protein synthesis, genetic pattern of inheritance

BP 207 P. HUMAN ANATOMY AND PHYSIOLOGY (Practical)

4 Hours/week

Practical physiology is complimentary to the theoretical discussions in physiology. Practicals allow the verification of physiological processes discussed in theory classes through experiments on living tissue, intact animals or normal human beings. This is helpful for developing an insight on the subject**.**

1. To study the integumentary and special senses using specimen, models, etc.,
2. To study the nervous system using specimen, models, etc.,
3. To study the endocrine system using specimen, models, etc
4. To demonstrate the general neurological examination
5. To demonstrate the function of olfactory nerve
6. To examine the different types of taste.
7. To demonstrate the visual acuity
8. To demonstrate the reflex activity
9. Recording of body temperature
10. To demonstrate positive and negative feedback mechanism.
11. Determination of tidal volume and vital capacity.
12. Study of digestive, respiratory, cardiovascular systems, urinary and reproductive systems with the help of models, charts and specimens.
13. Recording of basal mass index .
14. Study of family planning devices and pregnancy diagnosis test.
15. Demonstration of total blood count by cell analyser
16. Permanent slides of vital organs and gonads.

Recommended Books (Latest Editions)

1. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brothers medical publishers, New Delhi.
2. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York
3. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co,Riverview,MI USA

4. Text book of Medical Physiology- Arthur C,Guyton andJohn.E. Hall. Miamisburg, OH, U.S.A.
5. Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.
6. Textbook of Human Histology by Inderbir Singh, Jaypee brothers medical publishers, New Delhi.
7. Textbook of Practical Physiology by C.L. Ghai, Jaypee brothers medical publishers, New Delhi.
8. Practical workbook of Human Physiology by K. Srinageswari and Rajeev Sharma, Jaypee brother's medical publishers, New Delhi.

Reference Books:

1. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co, Riverview, MI USA
2. Text book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A.
3. Human Physiology (vol 1 and 2) by Dr. C.C. Chatterrje ,Academic Publishers Kolkata

BP202T. PHARMACEUTICAL ORGANIC CHEMISTRY –I (Theory)

45 Hours

Scope: This subject deals with classification and nomenclature of simple organic compounds, structural isomerism, intermediates forming in reactions, important physical properties, reactions and methods of preparation of these compounds. The syllabus also emphasizes on mechanisms and orientation of reactions.

Objectives: Upon completion of the course the student shall be able to

1. write the structure, name and the type of isomerism of the organic compound
2. write the reaction, name the reaction and orientation of reactions
3. account for reactivity/stability of compounds,
4. identify/confirm the identification of organic compound

Course Content:

General methods of preparation and reactions of compounds superscripted with asterisk (*) to be explained

To emphasize on definition, types, classification, principles/mechanisms, applications, examples and differences

UNIT-I **07 Hours**

- **Classification, nomenclature and isomerism**

  Classification of Organic Compounds

  Common and IUPAC systems of nomenclature of organic compounds

  (up to 10 Carbons open chain and carbocyclic compounds)

Structural isomerisms in organic compounds

UNIT-II10 Hours

- **Alkanes*, Alkenes* and Conjugated dienes***

  SP^3 hybridization in alkanes, Halogenation of alkanes, uses of paraffins.

  Stabilities of alkenes, SP^2 hybridization in alkenes

  E_1 and E_2 reactions – kinetics, order of reactivity of alkyl halides, rearrangement of carbocations, Saytzeffs orientation and evidences. E_1 verses E_2 reactions, Factors affecting E_1 and E_2 reactions. Ozonolysis, electrophilic addition reactions of alkenes, Markownikoff's orientation, free radical addition reactions of alkenes, Anti Markownikoff's orientation.

  Stability of conjugated dienes, Diel-Alder, electrophilic addition, free radical addition reactions of conjugated dienes, allylic rearrangement

UNIT-III10 Hours

- **Alkyl halides***

  SN_1 and SN_2 reactions - kinetics, order of reactivity of alkyl halides, stereochemistry and rearrangement of carbocations.

  SN_1 versus SN_2 reactions, Factors affecting SN_1 and SN_2 reactions

  Structure and uses of ethylchloride, Chloroform, trichloroethylene, tetrachloroethylene, dichloromethane, tetrachloromethane and iodoform.

- **Alcohols*-** Qualitative tests, Structure and uses of Ethyl alcohol, Methyl alcohol, chlorobutanol, Cetosteryl alcohol, Benzyl alcohol, Glycerol, Propylene glycol

UNIT-IV10 Hours

- **Carbonyl compounds* (Aldehydes and ketones)**

  Nucleophilic addition, Electromeric effect, aldol condensation, Crossed Aldol condensation, Cannizzaro reaction, Crossed Cannizzaro reaction, Benzoin condensation, Perkin condensation, qualitative tests, Structure and uses of Formaldehyde, Paraldehyde, Acetone, Chloral hydrate, Hexamine, Benzaldehyde, Vanilin, Cinnamaldehyde.

UNIT-V **08 Hours**

- **Carboxylic acids***

  Acidity of carboxylic acids, effect of substituents on acidity, inductive effect and qualitative tests for carboxylic acids ,amide and ester

  Structure and Uses of Acetic acid, Lactic acid, Tartaric acid, Citric acid, Succinic acid. Oxalic acid, Salicylic acid, Benzoic acid, Benzyl benzoate, Dimethyl phthalate, Methyl salicylate and Acetyl salicylic acid

- **Aliphatic amines* -** Basicity, effect of substituent on Basicity. Qualitative test, Structure and uses of Ethanolamine, Ethylenediamine, Amphetamine

BP208P. PHARMACEUTICAL ORGANIC CHEMISTRY -I (Practical)

4 Hours / week

1. Systematic qualitative analysis of unknown organic compounds like
    1. Preliminary test: Color, odour, aliphatic/aromatic compounds, saturation and unsaturation, etc.
    2. Detection of elements like Nitrogen, Sulphur and Halogen by Lassaigne's test
    3. Solubility test
    4. Functional group test like Phenols, Amides/ Urea, Carbohydrates, Amines, Carboxylic acids, Aldehydes and Ketones, Alcohols, Esters, Aromatic and Halogenated Hydrocarbons, Nitro compounds and Anilides.
    5. Melting point/Boiling point of organic compounds
    6. Identification of the unknown compound from the literature using melting point/ boiling point.
    7. Preparation of the derivatives and confirmation of the unknown compound by melting point/ boiling point.
    8. Minimum 5 unknown organic compounds to be analysed systematically.
2. Preparation of suitable solid derivatives from organic compounds
3. Construction of molecular models

Recommended Books (Latest Editions)

1. Organic Chemistry by Morrison and Boyd
2. Organic Chemistry by I.L. Finar , Volume-I
3. Textbook of Organic Chemistry by B.S. Bahl & Arun Bahl.
4. Organic Chemistry by P.L.Soni
5. Practical Organic Chemistry by Mann and Saunders.
6. Vogel's text book of Practical Organic Chemistry
7. Advanced Practical organic chemistry by N.K.Vishnoi.
8. Introduction to Organic Laboratory techniques by Pavia, Lampman and Kriz.
9. Reaction and reaction mechanism by Ahluwaliah/Chatwal.

BP203 T. BIOCHEMISTRY (Theory)

45 Hours

Scope: Biochemistry deals with complete understanding of the molecular levels of the chemical process associated with living cells. The scope of the subject is providing biochemical facts and the principles to understand metabolism of nutrient molecules in physiological and pathological conditions. It is also emphasizing on genetic organization of mammalian genome and hetero & autocatalytic functions of DNA.

Objectives: Upon completion of course student shell able to

1. Understand the catalytic role of enzymes, importance of enzyme inhibitors in design of new drugs, therapeutic and diagnostic applications of enzymes.
2. Understand the metabolism of nutrient molecules in physiological and pathological conditions.
3. Understand the genetic organization of mammalian genome and functions of DNA in the synthesis of RNAs and proteins.

Course Content:

UNIT I **08 Hours**

- **Biomolecules**

  Introduction, classification, chemical nature and biological role of carbohydrate, lipids, nucleic acids, amino acids and proteins.

- **Bioenergetics**

  Concept of free energy, endergonic and exergonic reaction, Relationship between free energy, enthalpy and entropy; Redox potential.

  Energy rich compounds; classification; biological significances of ATP and cyclic AMP

UNIT II **10 Hours**

- **Carbohydrate metabolism**

  Glycolysis – Pathway, energetics and significance

  Citric acid cycle- Pathway, energetics and significance

  HMP shunt and its significance; Glucose-6-Phosphate dehydrogenase (G6PD) deficiency

  Glycogen metabolism Pathways and glycogen storage diseases (GSD)

  Gluconeogenesis- Pathway and its significance

  Hormonal regulation of blood glucose level and Diabetes mellitus

- **Biological oxidation**

  Electron transport chain (ETC) and its mechanism.

Oxidative phosphorylation & its mechanism and substrate level phosphorylation

Inhibitors ETC and oxidative phosphorylation/Uncouplers

UNIT III **10 Hours**

- **Lipid metabolism**

  β-Oxidation of saturated fatty acid (Palmitic acid)

Formation and utilization of ketone bodies; ketoacidosis

De novo synthesis of fatty acids (Palmitic acid)

Biological significance of cholesterol and conversion of cholesterol into bile acids, steroid hormone and vitamin D

Disorders of lipid metabolism: Hypercholesterolemia, atherosclerosis, fatty liver and obesity.

- **Amino acid metabolism**

  General reactions of amino acid metabolism: Transamination, deamination & decarboxylation, urea cycle and its disorders

  Catabolism of phenylalanine and tyrosine and their metabolic disorders (Phenyketonuria, Albinism, alkeptonuria, tyrosinemia)

  Synthesis and significance of biological substances; 5-HT, melatonin, dopamine, noradrenaline, adrenaline

  Catabolism of heme; hyperbilirubinemia and jaundice

UNIT IV **10 Hours**

- **Nucleic acid metabolism and genetic information transfer**

  Biosynthesis of purine and pyrimidine nucleotides

  Catabolism of purine nucleotides and Hyperuricemia and Gout disease

  Organization of mammalian genome

  Structure of DNA and RNA and their functions

  DNA replication (semi conservative model)

  Transcription or RNA synthesis

  Genetic code, Translation or Protein synthesis and inhibitors

UNIT V **07 Hours**

- **Enzymes**

  Introduction, properties, nomenclature and IUB classification of enzymes

  Enzyme kinetics (Michaelis plot, Line Weaver Burke plot)

  Enzyme inhibitors with examples

  Regulation of enzymes: enzyme induction and repression, allosteric enzymes regulation

  Therapeutic and diagnostic applications of enzymes and isoenzymes

  Coenzymes –Structure and biochemical functions

BP 209 P. BIOCHEMISTRY (Practical)

4 Hours / Week

1. Qualitative analysis of carbohydrates (Glucose, Fructose, Lactose, Maltose, Sucrose and starch)
2. Identification tests for Proteins (albumin and Casein)
3. Quantitative analysis of reducing sugars (DNSA method) and Proteins (Biuret method)
4. Qualitative analysis of urine for abnormal constituents
5. Determination of blood creatinine
6. Determination of blood sugar
7. Determination of serum total cholesterol
8. Preparation of buffer solution and measurement of pH
9. Study of enzymatic hydrolysis of starch
10. Determination of Salivary amylase activity
11. Study the effect of Temperature on Salivary amylase activity.
12. Study the effect of substrate concentration on salivary amylase activity.

Recommended Books (Latest Editions)

1. Principles of Biochemistry by Lehninger.
2. Harper's Biochemistry by Robert K. Murry, Daryl K. Granner and Victor W. Rodwell.
3. Biochemistry by Stryer.
4. Biochemistry by D. Satyanarayan and U.Chakrapani
5. Textbook of Biochemistry by Rama Rao.
6. Textbook of Biochemistry by Deb.
7. Outlines of Biochemistry by Conn and Stumpf
8. Practical Biochemistry by R.C. Gupta and S. Bhargavan.
9. Introduction of Practical Biochemistry by David T. Plummer. (3rd Edition)
10. Practical Biochemistry for Medical students by Rajagopal and Ramakrishna.
11. Practical Biochemistry by Harold Varley.

BP 204T.PATHOPHYSIOLOGY (THEORY)

45Hours

Scope: Pathophysiology is the study of causes of diseases and reactions of the body to such disease producing causes.This course is designed to impart a thorough knowledge of the relevant aspects of pathology of various conditions with reference to its pharmacological applications, and understanding of basic pathophysiological mechanisms. Hence it will not only help to study the syllabus of pathology, but also to get baseline knowledge required to practice medicine safely, confidently, rationally and effectively.

Objectives: Upon completion of the subject student shall be able to –

1. Describe the etiology and pathogenesis of the selected disease states;
2. Name the signs and symptoms of the diseases; and
3. Mention the complications of the diseases.

Course content:

Unit I **10Hours**

- **Basic principles of Cell injury and Adaptation:**
  Introduction, definitions, Homeostasis, Components and Types of Feedback systems, Causes of cellular injury**,**Pathogenesis (Cell membrane damage, Mitochondrial damage, Ribosome damage, Nuclear damage)**,**Morphology of cell injury – Adaptive changes (Atrophy, Hypertrophy, hyperplasia, Metaplasia, Dysplasia)**,**Cell swelling, Intra cellular accumulation, Calcification, Enzyme leakage and Cell Death Acidosis &Alkalosis,Electrolyte imbalance

- **Basic mechanism involved in the process of inflammation and repair:**
  Introduction, Clinical signs of inflammation, Different types of Inflammation,Mechanism of Inflammation – Alteration in vascular permeability and blood flow, migration of WBC's,Mediators of inflammation,Basic principles of wound healing in the skin,Pathophysiology of Atherosclerosis

Unit II **10Hours**

- **Cardiovascular System:**
  Hypertension, congestive heart failure, ischemic heart disease (angina,myocardial infarction, atherosclerosis and arteriosclerosis)
- **Respiratory system:**Asthma, Chronic obstructive airways diseases.
- **Renal system:**Acute and chronic renal failure .

Unit II **10Hours**

- **Haematological Diseases:**
  Iron deficiency, megaloblastic anemia (Vit B12 and folic acid), sickle cell anemia, thalasemia, hereditary acquired anemia, hemophilia
- **Endocrine system:** Diabetes, thyroid diseases, disorders of sex hormones
- **Nervous system:** Epilepsy, Parkinson's disease, stroke, psychiatric disorders: depression, schizophrenia and Alzheimer's disease.
- **Gastrointestinal system:** Peptic Ulcer
-

Unit IV **8 Hours**

- Inflammatory bowel diseases, jaundice, hepatitis (A,B,C,D,E,F) alcoholic liver disease.
- **Disease of bones and joints:** Rheumatoid arthritis, osteoporosis and gout
- **Principles of cancer:** classification, etiology and pathogenesis of cancer
- **Diseases of bones and joints:**Rheumatoid Arthritis, Osteoporosis,Gout

- **Principles of Cancer:** Classification, etiology and pathogenesis of Cancer

Unit V **7 Hours**

- **Infectious diseases:**Meningitis,Typhoid, Leprosy, Tuberculosis

Urinary tract infections

- **Sexually transmitted diseases:**AIDS, Syphilis, Gonorrhea

Recommended Books (Latest Editions)

1. Vinay Kumar, Abul K. Abas, Jon C. Aster; Robbins &Cotran Pathologic Basis of Disease; South Asia edition; India; Elsevier; 2014.
2. Harsh Mohan; Text book of Pathology; 6th edition; India; Jaypee Publications; 2010.
3. Laurence B, Bruce C, Bjorn K. ; Goodman Gilman's The Pharmacological Basis of Therapeutics; 12th edition; New York; McGraw-Hill; 2011.
4. Best, Charles Herbert 1899-1978; Taylor, Norman Burke 1885-1972; West, John B (John Burnard); Best and Taylor's Physiological basis of medical practice; 12th ed; united states;
5. William and Wilkins, Baltimore;1991 [1990 printing].
6. Nicki R. Colledge, Brian R. Walker, Stuart H. Ralston;Davidson's Principles and Practice of Medicine; 21st edition; London; ELBS/Churchill Livingstone; 2010.
7. Guyton A, John .E Hall; Textbook of Medical Physiology; 12th edition; WB Saunders Company; 2010.
8. Joseph DiPiro, Robert L. Talbert, Gary Yee, Barbara Wells, L. Michael Posey; Pharmacotherapy: A Pathophysiological Approach; 9th edition; London; McGraw-Hill Medical; 2014.
9. V. Kumar, R. S. Cotran and S. L. Robbins; Basic Pathology; 6th edition; Philadelphia; WB Saunders Company; 1997.
10. Roger Walker, Clive Edwards; Clinical Pharmacy and Therapeutics; 3rd edition; London; Churchill Livingstone publication; 2003.

Recommended Journals

1. The Journal of Pathology. ISSN: 1096-9896 (Online)
2. The American Journal of Pathology. ISSN: 0002-9440
3. Pathology. 1465-3931 (Online)
4. International Journal of Physiology, Pathophysiology and Pharmacology. ISSN: 1944-8171 (Online)
5. Indian Journal of Pathology and Microbiology. ISSN-0377-4929.

BP205 T. COMPUTER APPLICATIONS IN PHARMACY (Theory)

30 Hrs (2 Hrs/Week)

Scope: This subject deals with the introduction Database, Database Management system, computer application in clinical studies and use of databases.

Objectives: Upon completion of the course the student shall be able to

1. know the various types of application of computers in pharmacy
2. know the various types of databases
3. know the various applications of databases in pharmacy

Course content:

UNIT – I **06 hours**

Number system: Binary number system, Decimal number system, Octal number system, Hexadecimal number systems, conversion decimal to binary, binary to decimal, octal to binary etc, binary addition, binary subtraction – One's complement ,Two's complement method, binary multiplication, binary division

Concept of I nformation Systems and Software : Information gathering, requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process life cycle, planning and managing the project

UNIT –II **06 hours**

Web technologies:Introduction to HTML, XML,CSS and Programming languages, introduction to web servers and Server Products

Introduction to databases, MYSQL, MS ACCESS, Pharmacy Drug database

UNIT – III **06 hours**

Application of computers in Pharmacy – Drug information storage and retrieval, Pharmacokinetics, Mathematical model in Drug design, Hospital and Clinical Pharmacy, Electronic Prescribing and discharge (EP) systems, barcode medicine identification and automated dispensing of drugs, mobile technology and adherence monitoring

Diagnostic System, Lab-diagnostic System, Patient Monitoring System, Pharma Information System

UNIT – IV **06 hours**

Bioinformatics: Introduction, Objective of Bioinformatics, Bioinformatics Databases, Concept of Bioinformatics, Impact of Bioinformatics in Vaccine Discovery

UNIT-V **06 hours**

Computers as data analysis in Preclinical development:
Chromatographic dada analysis(CDS), Laboratory Information management System (LIMS) and Text Information Management System(TIMS)

BP210P. COMPUTER APPLICATIONS IN PHARMACY (Practical)

1. Design a questionnaire using a word processing package to gather information about a particular disease.
2. Create a HTML web page to show personal information.
3 Retrieve the information of a drug and its adverse effects using online tools
4 Creating mailing labels Using Label Wizard , generating label in MS WORD
5 Create a database in MS Access to store the patient information with the required fields Using access
6. Design a form in MS Access to view, add, delete and modify the patient record in the database
7. Generating report and printing the report from patient database
8. Creating invoice table using – MS Access
9. Drug information storage and retrieval using MS Access
10. Creating and working with queries in MS Access
11. Exporting Tables, Queries, Forms and Reports to web pages
12. Exporting Tables, Queries, Forms and Reports to XML pages

Recommended books (Latest edition):

1. Computer Application in Pharmacy – William E.Fassett –Lea and Febiger, 600 South Washington Square, USA, (215) 922-1330.
2. Computer Application in Pharmaceutical Research and Development –Sean Ekins – Wiley-Interscience, A John Willey and Sons, INC., Publication, USA
3. Bioinformatics (Concept, Skills and Applications) – S.C.Rastogi-CBS Publishers and Distributors, 4596/1- A, 11 Darya Gani, New Delhi – 110 002(INDIA)
4. Microsoft office Access - 2003, Application Development Using VBA, SQL Server, DAP and Infopath – Cary N.Prague – Wiley Dreamtech India (P) Ltd., 4435/7, Ansari Road, Daryagani, New Delhi - 110002

BP 206 T. ENVIRONMENTAL SCIENCES (Theory)

30 hours

Scope: Environmental Sciences is the scientific study of the environmental system and the status of its inherent or induced changes on organisms. It includes not only the study of physical and biological characters of the environment but also the social and cultural factors and the impact of man on environment.

Objectives: Upon completion of the course the student shall be able to**:**

1. Create the awareness about environmental problems among learners.
2. Impart basic knowledge about the environment and its allied problems.
3. Develop an attitude of concern for the environment.
4. Motivate learner to participate in environment protection and environment improvement.
5. Acquire skills to help the concerned individuals in identifying and solving environmental problems.
6. Strive to attain harmony with Nature.

Course content:

Unit-I **10hours**

The Multidisciplinary nature of environmental studies

Natural Resources

Renewable and non-renewable resources:

Natural resources and associated problems

a) Forest resources; b) Water resources; c) Mineral resources; d) Food resources; e) Energy resources; f) Land resources: Role of an individual in conservation of natural resources.

Unit-II **10hours**

Ecosystems

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Introduction, types, characteristic features, structure and function of the ecosystems: Forest ecosystem; Grassland ecosystem; Desert ecosystem; Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit- III **10hours**

Environmental Pollution: Air pollution; Water pollution; Soil pollution

Recommended Books (Latest edition):

1. Y.K. Sing, Environmental Science, New Age International Pvt, Publishers, Bangalore
2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
3. Bharucha Erach, The Biodiversity of India, Mapin Pu blishing Pvt. Ltd., Ahmedabad – 380 013, India,
4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
5. Clark R.S., Marine Pollution, Clanderson Press Oxford
6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p
7. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
8. Down of Earth, Centre for Science and Environment

SEMESTER III

BP301T. PHARMACEUTICAL ORGANIC CHEMISTRY –II (Theory)

45 Hours

Scope: This subject deals with general methods of preparation and reactions of some organic compounds. Reactivity of organic compounds are also studied here. The syllabus emphasizes on mechanisms and orientation of reactions. Chemistry of fats and oils are also included in the syllabus.

Objectives: Upon completion of the course the student shall be able to

1. write the structure, name and the type of isomerism of the organic compound
2. write the reaction, name the reaction and orientation of reactions
3. account for reactivity/stability of compounds,
4. prepare organic compounds

Course Content:

General methods of preparation and reactions of compounds superscripted with asterisk (*) to be explained

To emphasize on definition, types, classification, principles/mechanisms, applications, examples and differences

UNIT I **10 Hours**

- **Benzene and its derivatives**
  - **A.** Analytical, synthetic and other evidences in the derivation of structure of benzene, Orbital picture, resonance in benzene, aromatic characters, Huckel's rule
  - **B.** Reactions of benzene - nitration, sulphonation, halogenation- reactivity, Friedelcrafts alkylation- reactivity, limitations, Friedelcrafts acylation.
  - **C.** Substituents, effect of substituents on reactivity and orientation of mono substituted benzene compounds towards electrophilic substitution reaction
  - **D.** Structure and uses of DDT, Saccharin, BHC and Chloramine

UNIT II **10 Hours**

- **Phenols*** - Acidity of phenols, effect of substituents on acidity, qualitative tests, Structure and uses of phenol, cresols, resorcinol, naphthols
- **Aromatic Amines* -** Basicity of amines, effect of substituents on basicity, and synthetic uses of aryl diazonium salts
- **Aromatic Acids* –**Acidity, effect of substituents on acidity and important reactions of benzoic acid.

UNIT III

10 Hours

- **Fats and Oils**

a. Fatty acids – reactions.

b. Hydrolysis, Hydrogenation, Saponification and Rancidity of oils, Drying oils.

c. Analytical constants – Acid value, Saponification value, Ester value, Iodine value, Acetyl value, Reichert Meissl (RM) value – significance and principle involved in their determination.

UNIT IV **08 Hours**

- **Polynuclear hydrocarbons:**

a. Synthesis, reactions

b. Structure and medicinal uses of Naphthalene, Phenanthrene, Anthracene, Diphenylmethane, Triphenylmethane and their derivatives

UNIT V **07 Hours**

- **Cyclo alkanes***

Stabilities – Baeyer's strain theory, limitation of Baeyer's strain theory, Coulson and Moffitt's modification, Sachse Mohr's theory (Theory of strainless rings), reactions of cyclopropane and cyclobutane only

BP305P. PHARMACEUTICAL ORGANIC CHEMISTRY -II (Practical)

4 Hrs/week

I Experiments involving laboratory techniques

- Recrystallization
- Steam distillation

II Determination of following oil values (including standardization of reagents)

- Acid value
- Saponification value
- Iodine value

III **Preparation of compounds**

- Benzanilide/Phenyl benzoate/Acetanilide from Aniline/ Phenol /Aniline by acylation reaction.
- 2,4,6-Tribromo aniline/Para bromo acetanilide from Aniline/
- Acetanilide by halogenation (Bromination) reaction.
- 5-Nitro salicylic acid/Meta di nitro benzene from Salicylic acid / Nitro benzene by nitration reaction.
- Benzoic acid from Benzyl chloride by oxidation reaction.
- Benzoic acid/ Salicylic acid from alkyl benzoate/ alkyl salicylate by hydrolysis reaction.
- 1-Phenyl azo-2-napthol from Aniline by diazotization and coupling reactions.
- Benzil from Benzoin by oxidation reaction.
- Dibenzal acetone from Benzaldehyde by Claison Schmidt reaction
- Cinnammic acid from Benzaldehyde by Perkin reaction
- *P*-Iodo benzoic acid from *P*-amino benzoic acid

Recommended Books (Latest Editions)

1. Organic Chemistry by Morrison and Boyd
2. Organic Chemistry by I.L. Finar , Volume-I
3. Textbook of Organic Chemistry by B.S. Bahl & Arun Bahl.
4. Organic Chemistry by P.L.Soni
5. Practical Organic Chemistry by Mann and Saunders.
6. Vogel's text book of Practical Organic Chemistry
7. Advanced Practical organic chemistry by N.K.Vishnoi.

8. Introduction to Organic Laboratory techniques by Pavia, Lampman and Kriz.

BP302T. PHYSICAL PHARMACEUTICS-I (Theory)

45Hours

Scope: The course deals with the various physica and physicochemical properties, and principles involved in dosage forms/formulations. Theory and practical components of the subject help the student to get a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms.

Objectives: Upon the completion of the course student shall be able to

1. Understand various physicochemical properties of drug molecules in the designing the dosage forms
2. Know the principles of chemical kinetics & to use them for stability testing nad determination of expiry date of formulations
3. Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms.

Course Content:

UNIT-I **10 Hours**

Solubility of drugs: Solubility expressions, mechanisms of solute solvent interactions, ideal solubility parameters, solvation & association, quantitative approach to the factors influencing solubility of drugs, diffusion principles in biological systems. Solubility of gas in liquids, solubility of liquids in liquids, (Binary solutions, ideal solutions) Raoult's law, real solutions. Partially miscible liquids, Critical solution temperature and applications. Distribution law, its limitations and applications

UNIT-II **10Hours**

States of Matter and properties of matter: State of matter, changes in the state of matter, latent heats, vapour pressure, sublimation critical point, eutectic mixtures, gases, aerosols – inhalers, relative humidity, liquid complexes, liquid crystals, glassy states, solid-crystalline, amorphous & polymorphism.

Physicochemical properties of drug molecules: Refractive index, optical rotation, dielectric constant, dipole moment, dissociation constant, determinations and applications

UNIT-III **08 Hours**

Surface and interfacial phenomenon: Liquid interface, surface & interfacial tensions,

surface free energy, measurement of surface & interfacial tensions, spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB Scale, solubilisation, detergency, adsorption at solid interface.

UNIT-IV **08Hours**

Complexation and protein binding: Introduction, Classification of Complexation, Applications, methods of analysis, protein binding, Complexation and drug action, crystalline structures of complexes and thermodynamic treatment of stability constants.

UNIT-V **07 Hours**

pH, buffers and Isotonic solutions: Sorensen's pH scale, pH determination (electrometric and calorimetric), applications of buffers, buffer equation, buffer capacity, buffers in pharmaceutical and biological systems, buffered isotonic solutions.

BP306P. PHYSICAL PHARMACEUTICS – I (Practical)

4 Hrs/week

1. Determination the solubility of drug at room temperature
2. Determination of pKa value by Half Neutralization/ Henderson Hasselbalch equation.
3. Determination of Partition co- efficient of benzoic acid in benzene and water
4. Determination of Partition co- efficient of Iodine in CCl_4 and water
5. Determination of % composition of NaCl in a solution using phenol-water system by CST method
6. Determination of surface tension of given liquids by drop count and drop weight method
7. Determination of HLB number of a surfactant by saponification method
8. Determination of Freundlich and Langmuir constants using activated char coal
9. Determination of critical micellar concentration of surfactants
10. Determination of stability constant and donor acceptor ratio of PABA-Caffeine complex by solubility method
11. Determination of stability constant and donor acceptor ratio of Cupric-Glycine complex by pH titration method

Recommended Books: (Latest Editions)

1. Physical Pharmacy by Alfred Martin
2. Experimental Pharmaceutics by Eugene, Parott.
3. Tutorial Pharmacy by Cooper and Gunn.
4. Stocklosam J. Pharmaceutical Calculations, Lea &Febiger, Philadelphia.
5. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, MarcelDekkar Inc.
6. Liberman H.A, Lachman C, Pharmaceutical Dosage forms. Disperse systems, volume 1, 2, 3. Marcel Dekkar Inc.
7. Physical Pharmaceutics by Ramasamy C and ManavalanR.
8. Laboratory Manual of Physical Pharmaceutics, C.V.S. Subramanyam, J. Thimma settee
9. Physical Pharmaceutics by C.V.S. Subramanyam
10. Test book of Physical Phramacy, by Gaurav Jain & Roop K. Khar

BP 303 T. PHARMACEUTICAL MICROBIOLOGY (Theory)

45Hours

Scope:

- Study of all categories of microorganisims especially for the production of alchol antibiotics, vaccines, vitamins enzymes etc..

Objectives: Upon completion of the subject student shall be able to;

1. Understand methods of identification, cultivation and preservation of various microorganisms
2. To understand the importance and implementation of sterlization in pharmaceutical processing and industry
3. Learn sterility testing of pharmaceutical products.
4. Carried out microbiological standardization of Pharmaceuticals.
5. Understand the cell culture technology and its applications in pharmaceutical industries.

Course content:

Unit I **10 Hours**

Introduction, history of microbiology, its branches, scope and its importance.
Introduction to Prokaryotes and Eukaryotes
Study of ultra-structure and morphological classification of bacteria, nutritional requirements, raw materials used for culture media and physical parameters for growth, growth curve, isolation and preservation methods for pure cultures, cultivation of anaerobes, quantitative measurement of bacterial growth (total & viable count).
Study of different types of phase constrast microscopy, dark field microscopy and electron microscopy.

Unit II **10 Hours**

Identification of bacteria using staining techniques (simple, Gram's &Acid fast staining) and biochemical tests (IMViC).

Study of principle, procedure, merits, demerits and applications of physical, chemical gaseous,radiation and mechanical method of sterilization.

Evaluation of the efficiency of sterilization methods.

Equipments employed in large scale sterilization.

Sterility indicators.

Unit III **10 Hours**

Study of morphology, classification, reproduction/replication and cultivation of Fungi and Viruses.

Classification and mode of action of disinfectants

Factors influencing disinfection, antiseptics and their evaluation. For bacteriostatic and bactericidal actions

Evaluation of bactericidal & Bacteriostatic.

Sterility testing of products (solids, liquids, ophthalmic and other sterile products) according to IP, BP and USP.

Unit IV **08 Hours**

Designing of aseptic area, laminar flow equipments; study of different sources of contamination in an aseptic area and methods of prevention, clean area classification.
Principles and methods of different microbiological assay. Methods for standardization of antibiotics, vitamins and amino acids.
Assessment of a new antibiotic.

Unit V **07Hours**

Types of spoilage, factors affecting the microbial spoilage of pharmaceutical products, sources and types of microbial contaminants, assessment of microbial contamination and spoilage.

Preservation of pharmaceutical products using antimicrobial agents, evaluation of microbial stability of formulations.

Growth of animal cells in culture, general procedure for cell culture, Primary, established and transformed cell cultures.

Application of cell cultures in pharmaceutical industry and research.

BP 307P.PHARMACEUTICAL MICROBIOLOGY (Practical)

4 Hrs/week

1. Introduction and study of different equipments and processing, e.g., B.O.D. incubator, laminar flow, aseptic hood, autoclave, hot air sterilizer, deep freezer, refrigerator, microscopes used in experimental microbiology.
2. Sterilization of glassware, preparation and sterilization of media.
3. Sub culturing of bacteria and fungus. Nutrient stabs and slants preparations.
4. Staining methods- Simple, Grams staining and acid fast staining (Demonstration with practical).
5. Isolation of pure culture of micro-organisms by multiple streak plate technique and other techniques.
6. Microbiological assay of antibiotics by cup plate method and other methods
7. Motility determination by Hanging drop method.
8. Sterility testing of pharmaceuticals.
9. Bacteriological analysis of water
10. Biochemical test.

Recommended Books (Latest edition)

1. W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientific publications, Oxford London.
2. Prescott and Dunn., Industrial Microbiology, 4th edition, CBS Publishers & Distributors, Delhi.
3. Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill edn.
4. Malcolm Harris, Balliere Tindall and Cox: Pharmaceutical Microbiology.
5. Rose: Industrial Microbiology.
6. Probisher, Hinsdill et al: Fundamentals of Microbiology, 9th ed. Japan
7. Cooper and Gunn's: Tutorial Pharmacy, CBS Publisher and Distribution.
8. Peppler: Microbial Technology.
9. I.P., B.P., U.S.P.- latest editions.
10. Ananthnarayan : Text Book of Microbiology, Orient-Longman, Chennai
11. Edward: Fundamentals of Microbiology.
12. N.K.Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi
13. Bergeys manual of systematic bacteriology, Williams and Wilkins- A Waverly company

BP 304 T. PHARMACEUTICAL ENGINEERING (Theory)

45 Hours

Scope: This course is designed to impart a fundamental knowledge on the art and science of various unit operations used in pharmaceutical industry.

Objectives: Upon completion of the course student shall be able:

1. To know various unit operations used in Pharmaceutical industries.
2. To understand the material handling techniques.
3. To perform various processes involved in pharmaceutical manufacturing process.
4. To carry out various test to prevent environmental pollution.
5. To appreciate and comprehend significance of plant lay out design for optimum use of resources.
6. To appreciate the various preventive methods used for corrosion control in Pharmaceutical industries.

Course content:

UNIT-I **10 Hours**

- **Flow of fluids:** Types of manometers, Reynolds number and its significance, Bernoulli's theorem and its applications, Energy losses, Orifice meter, Venturimeter, Pitot tube and Rotometer.
- **Size Reduction:** Objectives, Mechanisms & Laws governing size reduction, factors affecting size reduction, principles, construction, working, uses, merits and demerits of Hammer mill, ball mill, fluid energy mill, Edge runner mill & end runner mill.
- **Size Separation:** Objectives, applications & mechanism of size separation, official standards of powders, sieves, size separation Principles, construction, working, uses, merits and demerits of Sieve shaker, cyclone separator, Air separator, Bag filter & elutriation tank.

UNIT-II **10 Hours**

- **Heat Transfer:** Objectives, applications & Heat transfer mechanisms. Fourier's law, Heat transfer by conduction, convection & radiation. Heat interchangers & heat exchangers.

- **Evaporation:** Objectives, applications and factors influencing evaporation, differences between evaporation and other heat process. principles, construction, working, uses, merits and demerits of Steam jacketed kettle, horizontal tube evaporator, climbing film evaporator, forced circulation evaporator, multiple effect evaporator& Economy of multiple effect evaporator.

- **Distillation:** Basic Principles and methodology of simple distillation,flash distillation, fractional distillation, distillation under reduced pressure, steam distillation & molecular distillation

UNIT- III **08 Hours**

- **Drying:** Objectives, applications & mechanism of drying process, measurements & applications of Equilibrium Moisture content, rate of drying curve. principles, construction, working, uses, merits and demerits of Tray dryer, drum dryer spray dryer, fluidized bed dryer, vacuum dryer, freeze dryer.

- **Mixing:** Objectives, applications & factors affecting mixing, Difference between solid and liquid mixing, mechanism of solid mixing, liquids mixing and semisolids mixing. Principles, Construction, Working, uses, Merits and Demerits of Double cone blender, twin shell blender, ribbon blender, Sigma blade mixer, planetary mixers, Propellers, Turbines, Paddles & Silverson Emulsifier,

UNIT-IV **08 Hours**

- **Filtration:** Objectives, applications, Theories & Factors influencing filtration, filter aids, filter medias. Principle, Construction, Working, Uses, Merits and demerits of plate & frame filter, filter leaf, rotary drum filter, Meta filter & Cartridge filter, membrane filters and Seidtz filter.
- **Centrifugation:** Objectives, principle & applications of Centrifugation, principles, construction, working, uses, merits and demerits of Perforated basket centrifuge, Non-perforated basket centrifuge, semi continuous centrifuge & super centrifuge.

UNIT- V **07 Hours**

- **Materials of pharmaceutical plant construction, Corrosion and its prevention:** Factors affecting during materials selected for Pharmaceutical plant construction, Theories of corrosion, types of corrosion and there prevention. Ferrous and nonferrous metals, inorganic and organic non metals, basic of material handling systems.

Recommended Books: (Latest Editions)

1. Introduction to chemical engineering – Walter L Badger & Julius Banchero, Latest edition.
2. Solid phase extraction, Principles, techniques and applications by Nigel J.K. Simpson- Latest edition.
3. Unit operation of chemical engineering – Mcabe Smith, Latest edition.
4. Pharmaceutical engineering principles and practices – C.V.S Subrahmanyam et al., Latest edition.
5. Remington practice of pharmacy- Martin, Latest edition.
6. Theory and practice of industrial pharmacy by Lachmann., Latest edition.
7. Physical pharmaceutics- C.V.S Subrahmanyam et al., Latest edition.
8. Cooper and Gunn's Tutorial pharmacy, S.J. Carter, Latest edition.

BP308P - PHARMACEUTICAL ENGINEERING (Practical)

4 Hours/week

I. Determination of radiation constant of brass, iron, unpainted and painted glass.
II. Steam distillation – To calculate the efficiency of steam distillation.
III. To determine the overall heat transfer coefficient by heat exchanger.
IV. Construction of drying curves (for calcium carbonate and starch).
V. Determination of moisture content and loss on drying.
VI. Determination of humidity of air – i) From wet and dry bulb temperatures –use of Dew point method.
VII. Description of Construction working and application of Pharmaceutical Machinery such as rotary tablet machine, fluidized bed coater, fluid energy mill, de humidifier.
VIII. Size analysis by sieving – To evaluate size distribution of tablet granulations – Construction of various size frequency curves including arithmetic andlogarithmic probability plots.
IX. Size reduction: To verify the laws of size reduction using ball mill and determining Kicks, Rittinger's, Bond's coefficients, power requirement and critical speed of Ball Mill.
X. Demonstration of colloid mill, planetary mixer, fluidized bed dryer, freeze dryer and such othermajor equipment.
XI. Factors affecting Rate of Filtration and Evaporation (Surface area, Concentration and Thickness/ viscosity
XII. To study the effect of time on the Rate of Crystallization.
XIII. To calculate the uniformity Index for given sample by using Double Cone Blender.

SEMESTER IV

BP401T. PHARMACEUTICAL ORGANIC CHEMISTRY –III (Theory)

45 Hours

Scope: This subject imparts knowledge on stereo-chemical aspects of organic compounds and organic reactions, important named reactions, chemistry of important hetero cyclic compounds. It also emphasizes on medicinal and other uses of organic compounds.

Objectives: At the end of the course, the student shall be able to

1. understand the methods of preparation and properties of organic compounds
2. explain the stereo chemical aspects of organic compounds and stereo chemical reactions
3. know the medicinal uses and other applications of organic compounds

Course Content:

Note: To emphasize on definition, types, mechanisms, examples, uses/applications

UNIT-I **10 Hours**

Stereo isomerism

Optical isomerism –

Optical activity, enantiomerism, diastereoisomerism, meso compounds

Elements of symmetry, chiral and achiral molecules

DL system of nomenclature of optical isomers, sequence rules, RS system of nomenclature of optical isomers

Reactions of chiral molecules

Racemic modification and resolution of racemic mixture.

Asymmetric synthesis: partial and absolute

UNIT-II **10 Hours**

Geometrical isomerism

Nomenclature of geometrical isomers (Cis Trans, EZ, Syn Anti systems)

Methods of determination of configuration of geometrical isomers.

Conformational isomerism in Ethane, n-Butane and Cyclohexane.

Stereo isomerism in biphenyl compounds (Atropisomerism) and conditions for optical activity.

Stereospecific and stereoselective reactions

UNIT-III **10 Hours**

Heterocyclic compounds:

Nomenclature and classification

Synthesis, reactions and medicinal uses of following compounds/derivatives

Pyrrole, Furan, and Thiophene

Relative aromaticity and reactivity of Pyrrole, Furan and Thiophene

UNIT-IV **8 Hours**

Synthesis, reactions and medicinal uses of following compounds/derivatives

Pyrazole, Imidazole, Oxazole and Thiazole.

Pyridine, Quinoline, Isoquinoline, Acridine and Indole. Basicity of pyridine

Synthesis and medicinal uses of Pyrimidine, Purine, azepines and their derivatives

UNIT-V **07 Hours**

Reactions of synthetic importance

Metal hydride reduction ($NaBH_4$ and $LiAlH_4$), Clemmensen reduction, Birch reduction, Wolff Kishner reduction.

Oppenauer-oxidation and Dakin reaction.

Beckmanns rearrangement and Schmidt rearrangement.

Claisen-Schmidt condensation

Recommended Books (Latest Editions)

1. Organic chemistry by I.L. Finar, Volume-I & II.
2. A text book of organic chemistry – Arun Bahl, B.S. Bahl.
3. Heterocyclic Chemistry by Raj K. Bansal
4. Organic Chemistry by Morrison and Boyd
5. Heterocyclic Chemistry by T.L. Gilchrist

BP402T. MEDICINAL CHEMISTRY – I (Theory)

45 Hours

Scope: This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasizes on structure activity relationships of drugs, importance of physicochemical properties and metabolism of drugs. The syllabus also emphasizes on chemical synthesis of important drugs under each class.

Objectives: Upon completion of the course the student shall be able to

1. understand the chemistry of drugs with respect to their pharmacological activity
2. understand the drug metabolic pathways, adverse effect and therapeutic value of drugs
3. know the Structural Activity Relationship (SAR) of different class of drugs
4. write the chemical synthesis of some drugs

Course Content:

Study of the development of the following classes of drugs, Classification, mechanism of action, uses of drugs mentioned in the course, Structure activity relationship of selective class of drugs as specified in the course and synthesis of drugs superscripted (*)

UNIT- I **10 Hours**

Introduction to Medicinal Chemistry

History and development of medicinal chemistry

Physicochemical properties in relation to biological action

Ionization, Solubility, Partition Coefficient, Hydrogen bonding, Protein binding, Chelation, Bioisosterism, Optical and Geometrical isomerism.

Drug metabolism

Drug metabolism principles- Phase I and Phase II.

Factors affecting drug metabolism including stereo chemical aspects.

UNIT- II **10 Hours**

Drugs acting on Autonomic Nervous System

Adrenergic Neurotransmitters:

Biosynthesis and catabolism of catecholamine.

Adrenergic receptors (Alpha & Beta) and their distribution.

Sympathomimetic agents: SAR of Sympathomimetic agents

Direct acting: Nor-epinephrine, Epinephrine, Phenylephrine*, Dopamine,

Methyldopa, Clonidine, Dobutamine, Isoproterenol, Terbutaline, Salbutamol*, Bitolterol, Naphazoline, Oxymetazoline and Xylometazoline.

- Indirect acting agents: Hydroxyamphetamine, Pseudoephedrine, Propylhexedrine.
- Agents with mixed mechanism: Ephedrine, Metaraminol.

Adrenergic Antagonists:

Alpha adrenergic blockers: Tolazoline*, Phentolamine, Phenoxybenzamine, Prazosin, Dihydroergotamine, Methysergide.

Beta adrenergic blockers: SAR of beta blockers, Propranolol*, Metibranolol, Atenolol, Betazolol, Bisoprolol, Esmolol, Metoprolol, Labetolol, Carvedilol.

UNIT-III **10 Hours**

Cholinergic neurotransmitters:

Biosynthesis and catabolism of acetylcholine.

Cholinergic receptors (Muscarinic & Nicotinic) and their distribution.

Parasympathomimetic agents: SAR of Parasympathomimetic agents

Direct acting agents: Acetylcholine, Carbachol*, Bethanechol, Methacholine, Pilocarpine.

Indirect acting/ Cholinesterase inhibitors (Reversible & Irreversible): Physostigmine, Neostigmine*, Pyridostigmine, Edrophonium chloride, Tacrine hydrochloride, Ambenonium chloride, Isofluorphate, Echothiophate iodide, Parathione, Malathion.

Cholinesterase reactivator: Pralidoxime chloride.

Cholinergic Blocking agents: SAR of cholinolytic agents

Solanaceous alkaloids and analogues: Atropine sulphate, Hyoscyamine sulphate, Scopolamine hydrobromide, Homatropine hydrobromide, Ipratropium bromide*.

Synthetic cholinergic blocking agents: Tropicamide, Cyclopentolate hydrochloride, Clidinium bromide, Dicyclomine hydrochloride*, Glycopyrrolate, Methantheline bromide, Propantheline bromide, Benztropine mesylate, Orphenadrine citrate, Biperidine hydrochloride, Procyclidine hydrochloride*, Tridihexethyl chloride, Isopropamide iodide, Ethopropazine hydrochloride.

UNIT- IV **08 Hours**

Drugs acting on Central Nervous System

A. Sedatives and Hypnotics:

Benzodiazepines: SAR of Benzodiazepines, Chlordiazepoxide, Diazepam*, Oxazepam, Chlorazepate, Lorazepam, Alprazolam, Zolpidem

Barbiturtes: SAR of barbiturates, Barbital*, Phenobarbital, Mephobarbital, Amobarbital, Butabarbital, Pentobarbital, Secobarbital

Miscelleneous:

Amides & imides: Glutethmide.

Alcohol & their carbamate derivatives: Meprobomate, Ethchlorvynol.

Aldehyde & their derivatives: Triclofos sodium, Paraldehyde.

B. Antipsychotics

Phenothiazeines: SAR of Phenothiazeines - Promazine hydrochloride, Chlorpromazine hydrochloride*, Trifluprомazine, Thioridazine hydrochloride, Piperacetazine hydrochloride, Prochlorperazine maleate, Trifluoperazine hydrochloride.

Ring Analogues of Phenothiazeines: Chlorprothixene, Thiothixene, Loxapine succinate, Clozapine.

Fluro buterophenones: Haloperidol, Droperidol, Risperidone.

Beta amino ketones: Molindone hydrochloride.

Benzamides: Sulpieride.

C. Anticonvulsants: SAR of Anticonvulsants**,** mechanism of anticonvulsant action

Barbiturates: Phenobarbitone, Methabarbital. **Hydantoins:**

Phenytoin*, Mephenytoin, Ethotoin **Oxazolidine diones:**

Trimethadione, Paramethadione **Succinimides:**

Phensuximide, Methsuximide, Ethosuximide* **Urea and**

monoacylureas: Phenacemide, Carbamazepine*

Benzodiazepines: Clonazepam

Miscellaneous: Primidone, Valproic acid , Gabapentin, Felbamate

UNIT – V **07 Hours**

Drugs acting on Central Nervous System

General anesthetics:

Inhalation anesthetics: Halothane*, Methoxyflurane, Enflurane, Sevoflurane, Isoflurane, Desflurane.

Ultra short acting barbitutrates: Methohexital sodium*, Thiamylal sodium, Thiopental sodium.

Dissociative anesthetics: Ketamine hydrochloride.*

Narcotic and non-narcotic analgesics

Morphine and related drugs: SAR of Morphine analogues, Morphine sulphate, Codeine, Meperidine hydrochloride, Anilerdine hydrochloride, Diphenoxylate hydrochloride, Loperamide hydrochloride, Fentanyl citrate*, Methadone hydrochloride*, Propoxyphene hydrochloride, Pentazocine, Levorphanol tartarate.

Narcotic antagonists: Nalorphine hydrochloride, Levallorphan tartarate, Naloxone hydrochloride.

Anti-inflammatory agents: Sodium salicylate, Aspirin, Mefenamic acid*, Meclofenamate, Indomethacin, Sulindac, Tolmetin, Zomepriac, Diclofenac, Ketorolac, Ibuprofen*, Naproxen, Piroxicam, Phenacetin, Acetaminophen, Antipyrine, Phenylbutazone.

BP406P. MEDICINAL CHEMISTRY – I (Practical)

4 Hours/Week

I Preparation of drugs/ intermediates

1 1,3-pyrazole

2 1,3-oxazole

3 Benzimidazole

4 Benztriazole

5 2,3- diphenyl quinoxaline

6 Benzocaine

7 Phenytoin

8 Phenothiazine

9 Barbiturate

II Assay of drugs

1 Chlorpromazine

2 Phenobarbitone

3 Atropine

4 Ibuprofen

5 Aspirin

6 Furosemide

III Determination of Partition coefficient for any two drugs

Recommended Books (Latest Editions)

1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2. Foye's Principles of Medicinal Chemistry.
3. Burger's Medicinal Chemistry, Vol I to IV.
4. Introduction to principles of drug design- Smith and Williams.
5. Remington's Pharmaceutical Sciences.
6. Martindale's extra pharmacopoeia.

7. Organic Chemistry by I.L. Finar, Vol. II.
8. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5.
9. Indian Pharmacopoeia.
10. Text book of practical organic chemistry- A.I.Vogel.

BP 403 T. PHYSICAL PHARMACEUTICS-II (Theory)

45Hours

Scope: The course deals with the various physica and physicochemical properties, and principles involved in dosage forms/formulations. Theory and practical components of the subject help the student to get a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms.

Objectives: Upon the completion of the course student shall be able to

1. Understand various physicochemical properties of drug molecules in the designing the dosage forms
2. Know the principles of chemical kinetics & to use them for stability testing nad determination of expiry date of formulations
3. Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms.

Course Content:

UNIT-I **07 Hours**

Colloidal dispersions: Classification of dispersed systems & their general characteristics, size & shapes of colloidal particles, classification of colloids & comparative account of their general properties. Optical, kinetic & electrical properties. Effect of electrolytes, coacervation, peptization& protective action.

UNIT-II **10 Hours**

Rheology: Newtonian systems, law of flow, kinematic viscosity, effect of temperature, non-Newtonian systems, pseudoplastic, dilatant, plastic, thixotropy, thixotropy in formulation, determination of viscosity, capillary, falling Sphere, rotational viscometers

Deformation of solids: Plastic and elastic deformation, Heckel equation, Stress, Strain, Elastic Modulus

UNIT-III **10 Hours**

Coarse dispersion: Suspension, interfacial properties of suspended particles, settling in suspensions, formulation of flocculated and deflocculated suspensions. Emulsions and theories of emulsification, microemulsion and multiple emulsions; Stability of emulsions, preservation of emulsions, rheological properties of emulsions and emulsion formulation by HLB method.

UNIT-IV **10Hours**

Micromeretics: Particle size and distribution, mean particle size, number and weight distribution, particle number, methods for determining particle size by different methods, counting and separation method, particle shape, specific surface, methods for determining surface area, permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness & flow properties.

UNIT-V **10 Hours**

Drug stability: Reaction kinetics: zero, pseudo-zero, first & second order, units of basic rate constants, determination of reaction order. Physical and chemical factors influencing the chemical degradation of pharmaceutical product: temperature, solvent, ionic strength, dielectric constant, specific & general acid base catalysis, Simple numerical problems. Stabilization of medicinal agents against common reactions like hydrolysis & oxidation. Accelerated stability testing in expiration dating of pharmaceutical dosage forms. Photolytic degradation and its prevention

BP 407P. PHYSICAL PHARMACEUTICS- II (Practical)

3 Hrs/week

1. Determination of particle size, particle size distribution using sieving method
2. Determination of particle size, particle size distribution using Microscopic method
3. Determination of bulk density, true density and porosity
4. Determine the angle of repose and influence of lubricant on angle of repose
5. Determination of viscosity of liquid using Ostwald's viscometer
6. Determination sedimentation volume with effect of different suspending agent
7. Determination sedimentation volume with effect of different concentration of single suspending agent
8. Determination of viscosity of semisolid by using Brookfield viscometer
9. Determination of reaction rate constant first order.
10. Determination of reaction rate constant second order
11. Accelerated stability studies

Recommended Books: (Latest Editions)

1. Physical Pharmacy by Alfred Martin, Sixth edition
2. Experimental pharmaceutics by Eugene, Parott.
3. Tutorial pharmacy by Cooper and Gunn.
4. Stocklosam J. Pharmaceutical calculations, Lea & Febiger, Philadelphia.
5. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, Marcel Dekkar Inc.
6. Liberman H.A, Lachman C, Pharmaceutical dosage forms. Disperse systems, volume 1, 2, 3. Marcel Dekkar Inc.
7. Physical Pharmaceutics by Ramasamy C, and Manavalan R.

BP 404 T. PHARMACOLOGY-I (Theory)

45 Hrs

Scope: The main purpose of the subject is to understand what drugs do to the living organisms and how their effects can be applied to therapeutics. The subject covers the information about the drugs like, mechanism of action, physiological and biochemical effects (pharmacodynamics) as well as absorption, distribution, metabolism and excretion (pharmacokinetics) along with the adverse effects, clinical uses, interactions, doses, contraindications and routes of administration of different classes of drugs.

Objectives: Upon completion of this course the student should be able to

1. Understand the pharmacological actions of different categories of drugs
2. Explain the mechanism of drug action at organ system/sub cellular/ macromolecular levels.
3. Apply the basic pharmacological knowledge in the prevention and treatment of various diseases.
4. Observe the effect of drugs on animals by simulated experiments
5. Appreciate correlation of pharmacology with other bio medical sciences

Course Content:

UNIT-I **08 hours**

1. General Pharmacology

a. Introduction to Pharmacology- Definition, historical landmarks and scope of pharmacology, nature and source of drugs, essential drugs concept and routes of drug administration, Agonists, antagonists(competitive and non competitive), spare receptors, addiction, tolerance, dependence, tachyphylaxis, idiosyncrasy, allergy.

b. Pharmacokinetics- Membrane transport, absorption, distribution, metabolism and excretion of drugs .Enzyme induction, enzyme inhibition, kinetics of elimination

UNIT-II **12 Hours**

General Pharmacology

a. Pharmacodynamics- Principles and mechanisms of drug action. Receptor theories and classification of receptors, regulation of receptors. drug receptors interactions signal transduction mechanisms, G-protein–coupled receptors, ion channel receptor, transmembrane enzyme linked receptors, transmembrane JAK-STAT binding receptor and receptors that regulate transcription factors, dose response relationship, therapeutic index, combined effects of drugs and factors modifying drug action.
b. Adverse drug reactions.
c. Drug interactions (pharmacokinetic and pharmacodynamic)
d. Drug discovery and clinical evaluation of new drugs -Drug discovery phase, preclinical evaluation phase, clinical trial phase, phases of clinical trials and pharmacovigilance.

UNIT-III **10 Hours**

2. Pharmacology of drugs acting on peripheral nervous system

a. Organization and function of ANS.

b.Neurohumoral transmission,co-transmission and classification of neurotransmitters.

c. Parasympathomimetics, Parasympatholytics, Sympathomimetics, sympatholytics.

d. Neuromuscular blocking agents and skeletal muscle relaxants (peripheral).

e. Local anesthetic agents.

f. Drugs used in myasthenia gravis and glaucoma

UNIT-IV **08 Hours**

3. Pharmacology of drugs acting on central nervous system

a. Neurohumoral transmission in the C.N.S.special emphasis on importance of various neurotransmitters like with GABA, Glutamate, Glycine, serotonin, dopamine.

b. General anesthetics and pre-anesthetics**.**

c. Sedatives, hypnotics and centrally acting muscle relaxants.

d. Anti-epileptics

e. Alcohols and disulfiram

UNIT-V **07 Hours**

3. Pharmacology of drugs acting on central nervous system

a. Psychopharmacological agents: Antipsychotics, antidepressants, anti-anxiety agents, anti-manics and hallucinogens.

b. Drugs used in Parkinsons disease and Alzheimer's disease.

c. CNS stimulants and nootropics.

d. Opioid analgesics and antagonists

e. Drug addiction, drug abuse, tolerance and dependence.

BP 408 P.PHARMACOLOGY-I (Practical)

4Hrs/Week

1. Introduction to experimental pharmacology.
2. Commonly used instruments in experimental pharmacology.
3. Study of common laboratory animals.
4. Maintenance of laboratory animals as per CPCSEA guidelines.
5. Common laboratory techniques. Blood withdrawal, serum and plasma separation, anesthetics and euthanasia used for animal studies.
6. Study of different routes of drugs administration in mice/rats.
7. Study of effect of hepatic microsomal enzyme inducers on the phenobarbitone sleeping time in mice.
8. Effect of drugs on ciliary motility of frog oesophagus
9. Effect of drugs on rabbit eye.
10. Effects of skeletal muscle relaxants using rota-rod apparatus.
11. Effect of drugs on locomotor activity using actophotometer.
12. Anticonvulsant effect of drugs by MES and PTZ method.
13. Study of stereotype and anti-catatonic activity of drugs on rats/mice.
14. Study of anxiolytic activity of drugs using rats/mice.
15. Study of local anesthetics by different methods

Note: All laboratory techniques and animal experiments are demonstrated by simulated experiments by softwares and videos

Recommended Books (Latest Editions)

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology,.Churchil Livingstone Elsevier
2. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata Mc Graw-Hill
3. Goodman and Gilman's, The Pharmacological Basis of Therapeutics
4. Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs, The Point Lippincott Williams & Wilkins
5. Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews-Pharmacology

6. K.D.Tripathi. Essentials of Medical Pharmacology, JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.

7. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher

8. Modern Pharmacology with clinical Applications, by Charles R.Craig& Robert,

9. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.

10. Kulkarni SK. Handbook of experimental pharmacology. VallabhPrakashan,

BP 405 T.PHARMACOGNOSY AND PHYTOCHEMISTRY I (Theory)

45 Hours

Scope: The subject involves the fundamentals of Pharmacognosy like scope, classification of crude drugs, their identification and evaluation, phytochemicals present in them and their medicinal properties.

Objectives: Upon completion of the course, the student shall be able

1. to know the techniques in the cultivation and production of crude drugs
2. to know the crude drugs, their uses and chemical nature
3. know the evaluation techniques for the herbal drugs
4. to carry out the microscopic and morphological evaluation of crude drugs

Course Content:

UNIT-I **10 Hours**

Introduction to Pharmacognosy:

(a) Definition, history, scope and development of Pharmacognosy

(b) Sources of Drugs – Plants, Animals, Marine & Tissue culture

(c) Organized drugs, unorganized drugs (dried latex, dried juices, dried extracts, gums and mucilages, oleoresins and oleo- gum -resins).

Classification of drugs:

Alphabetical, morphological, taxonomical, chemical, pharmacological, chemo and sero taxonomical classification of drugs

Quality control of Drugs of Natural Origin:

Adulteration of drugs of natural origin. Evaluation by organoleptic, microscopic, physical, chemical and biological methods and properties.

Quantitative microscopy of crude drugs including lycopodium spore method, leafconstants, camera lucida and diagrams of microscopic objects to scale with camera lucida.

UNIT-II **10 Hours**

Cultivation, Collection, Processing and storage of drugs of natural origin:

Cultivation and Collection of drugs of natural origin

Factors influencing cultivation of medicinal plants.

Plant hormones and their applications.

Polyploidy, mutation and hybridization with reference to medicinal plants

Conservation of medicinal plants

UNIT-III **07 Hours**

Plant tissue culture:

Historical development of plant tissue culture, types of cultures, Nutritional requirements, growth and their maintenance.

Applications of plant tissue culture in pharmacognosy.

Edible vaccines

UNIT IV **10 Hours**

Pharmacognosy in various systems of medicine:

Role of Pharmacognosy in allopathy and traditional systems of medicine namely, Ayurveda, Unani, Siddha, Homeopathy and Chinese systems of medicine.

Introduction to secondary metabolites:

Definition, classification, properties and test for identification of Alkaloids, Glycosides, Flavonoids, Tannins, Volatile oil and Resins

UNIT V **08 Hours**

Study of biological source, chemical nature and uses of drugs of natural origin containing following drugs

Plant Products:

Fibers - Cotton, Jute, Hemp

Hallucinogens, Teratogens, Natural allergens

Primary metabolites:

General introduction, detailed study with respect to chemistry, sources, preparation, evaluation, preservation, storage, therapeutic used and commercial utility as Pharmaceutical Aids and/or Medicines for the following Primary metabolites:

Carbohydrates: Acacia, Agar, Tragacanth, Honey

Proteins and Enzymes : Gelatin, casein, proteolytic enzymes (Papain, bromelain, serratiopeptidase, urokinase, streptokinase, pepsin).

Lipids(Waxes, fats, fixed oils) : Castor oil, Chaulmoogra oil, Wool Fat, Bees Wax

Marine Drugs:

Novel medicinal agents from marine sources

BP408 P. PHARMACOGNOSY AND PHYTOCHEMISTRY I (Practical)

4 Hours/Week

1. Analysis of crude drugs by chemical tests: **(**i)Tragaccanth (ii) Acacia (iii)Agar (iv) Gelatin (v) starch (vi) Honey (vii) Castor oil
2. Determination of stomatal number and index
3. Determination of vein islet number, vein islet termination and paliside ratio.
4. Determination of size of starch grains, calcium oxalate crystals by eye piece micrometer
5. Determination of Fiber length and width
6. Determination of number of starch grains by Lycopodium spore method
7. Determination of Ash value
8. Determination of Extractive values of crude drugs
9. Determination of moisture content of crude drugs
10. Determination of swelling index and foaming

Recommended Books: (Latest Editions)

1. W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co., London, 2009.
2. Tyler, V.E., Brady, L.R. and Robbers, J.E., Pharmacognosy, 9th Edn., Lea and Febiger, Philadelphia, 1988.
3. Text Book of Pharmacognosy by T.E. Wallis
4. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, New Delhi.
5. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition, Nirali Prakashan, New Delhi.
6. Herbal drug industry by R.D. Choudhary (1996), Ist Edn, Eastern Publisher, New Delhi.
7. Essentials of Pharmacognosy, Dr.SH.Ansari, IInd edition, Birla publications, New Delhi, 2007
8. Practical Pharmacognosy: C.K. Kokate, Purohit, Gokhlae
9. Anatomy of Crude Drugs by M.A. Iyengar

SEMESTER V

BP501T. MEDICINAL CHEMISTRY – II (Theory)

45 Hours

Scope: This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasizes on structure activity relationships of drugs, importance of physicochemical properties and metabolism of drugs. The syllabus also emphasizes on chemical synthesis of important drugs under each class.

Objectives: Upon completion of the course the student shall be able to

1. Understand the chemistry of drugs with respect to their pharmacological activity
2. Understand the drug metabolic pathways, adverse effect and therapeutic value of drugs
3. Know the Structural Activity Relationship of different class of drugs
4. Study the chemical synthesis of selected drugs

Course Content:

Study of the development of the following classes of drugs, Classification, mechanism of action, uses of drugs mentioned in the course, Structure activity relationship of selective class of drugs as specified in the course and synthesis of drugs superscripted (*)

UNIT- I **10 Hours**

Antihistaminic agents: Histamine, receptors and their distribution in the humanbody

H_1–antagonists: Diphenhydramine hydrochloride*, Dimenhydrinate, Doxylamines cuccinate, Clemastine fumarate, Diphenylphyraline hydrochloride, Tripelenamine hydrochloride, Chlorcyclizine hydrochloride, Meclizine hydrochloride, Buclizine hydrochloride, Chlorpheniramine maleate, Triprolidine hydrochloride*, Phenidamine tartarate, Promethazine hydrochloride*, Trimeprazine tartrate, Cyproheptadine hydrochloride, Azatidine maleate, Astemizole, Loratadine, Cetirizine, Levocetrazine Cromolyn sodium

H_2-antagonists: Cimetidine*, Famotidine, Ranitidin.

Gastric Proton pump inhibitors: Omeprazole, Lansoprazole, Rabeprazole, Pantoprazole

Anti-neoplastic agents:

Alkylating agents: Meclorethamine*, Cyclophosphamide, Melphalan,

Chlorambucil, Busulfan, Thiotepa

Antimetabolites: Mercaptopurine*, Thioguanine, Fluorouracil, Floxuridine, Cytarabine, Methotrexate*, Azathioprine

Antibiotics: Dactinomycin, Daunorubicin, Doxorubicin, Bleomycin

Plant products: Etoposide, Vinblastin sulphate, Vincristin sulphate

Miscellaneous: Cisplatin, Mitotane.

UNIT – II **10 Hours**

Anti-anginal:

Vasodilators: Amyl nitrite, Nitroglycerin*, Pentaerythritol tetranitrate, Isosorbide dinitrite*, Dipyridamole.

Calcium channel blockers: Verapamil, Bepridil hydrochloride, Diltiazem hydrochloride, Nifedipine, Amlodipine, Felodipine, Nicardipine, Nimodipine.

Diuretics:

Carbonic anhydrase inhibitors: Acetazolamide*, Methazolamide, Dichlorphenamide.

Thiazides: Chlorthiazide*, Hydrochlorothiazide, Hydroflumethiazide, Cyclothiazide,

Loop diuretics: Furosemide*, Bumetanide, Ethacrynic acid.

Potassium sparing Diuretics: Spironolactone, Triamterene, Amiloride.

Osmotic Diuretics: Mannitol

Anti-hypertensive Agents: Timolol, Captopril, Lisinopril, Enalapril, Benazepril hydrochloride, Quinapril hydrochloride, Methyldopate hydrochloride,* Clonidine hydrochloride, Guanethidine monosulphate, Guanabenz acetate, Sodium nitroprusside, Diazoxide, Minoxidil, Reserpine, Hydralazine hydrochloride.

UNIT- III **10 Hours**

Anti-arrhythmic Drugs: Quinidine sulphate, Procainamide hydrochloride, Disopyramide phosphate*, Phenytoin sodium, Lidocaine hydrochloride, Tocainide hydrochloride, Mexiletine hydrochloride, Lorcainide hydrochloride, Amiodarone, Sotalol.

Anti-hyperlipidemic agents: Clofibrate, Lovastatin, Cholesteramine and Cholestipol

Coagulant & Anticoagulants: Menadione, Acetomenadione, Warfarin*, Anisindione, clopidogrel

Drugs used in Congestive Heart Failure: Digoxin, Digitoxin, Nesiritide, Bosentan, Tezosentan.

UNIT- IV **08 Hours**

Drugs acting on Endocrine system

Nomenclature, Stereochemistry and metabolism of steroids

Sex hormones: Testosterone, Nandralone, Progestrones, Oestriol, Oestradiol, Oestrione, Diethyl stilbestrol.
Drugs for erectile dysfunction: Sildenafil, Tadalafil.
Oral contraceptives: Mifepristone, Norgestril, Levonorgestrol
Corticosteroids: Cortisone, Hydrocortisone, Prednisolone, Betamethasone, Dexamethasone
Thyroid and antithyroid drugs: L-Thyroxine, L-Thyronine, Propylthiouracil, Methimazole.

UNIT – V **07 Hours**

Antidiabetic agents:

Insulin and its preparations

Sulfonyl ureas: Tolbutamide*, Chlorpropamide, Glipizide, Glimepiride.

Biguanides: Metformin.

Thiazolidinediones: Pioglitazone, Rosiglitazone.

Meglitinides: Repaglinide, Nateglinide.

Glucosidase inhibitors: Acrabose, Voglibose.

Local Anesthetics: SAR of Local anesthetics

Benzoic Acid derivatives; Cocaine, Hexylcaine, Meprylcaine, Cyclomethycaine, Piperocaine.

Amino Benzoic acid derivatives: Benzocaine*, Butamben, Procaine*, Butacaine, Propoxycaine, Tetracaine, Benoxinate.

Lidocaine/Anilide derivatives: Lignocaine, Mepivacaine, Prilocaine, Etidocaine.

Miscellaneous: Phenacaine, Diperodon, Dibucaine.*

Recommended Books (Latest Editions)

1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2. Foye's Principles of Medicinal Chemistry.
3. Burger's Medicinal Chemistry, Vol I to IV.
4. Introduction to principles of drug design- Smith and Williams.
5. Remington's Pharmaceutical Sciences.
6. Martindale's extra pharmacopoeia.
7. Organic Chemistry by I.L. Finar, Vol. II.
8. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1to 5.
9. Indian Pharmacopoeia.
10. Text book of practical organic chemistry- A.I.Vogel.

BP 502 T. Industrial PharmacyI (Theory)

45 Hours

Scope: Course enables the student to understand and appreciate the influence of pharmaceutical additives and various pharmaceutical dosage forms on the performance of the drug product.

Objectives: Upon completion of the course the student shall be able to

1. Know the various pharmaceutical dosage forms and their manufacturing techniques.
2. Know various considerations in development of pharmaceutical dosage forms
3. Formulate solid, liquid and semisolid dosage forms and evaluate them for their quality

Course content:

3 hours/ week

UNIT-I **07 Hours**

Preformulation Studies: Introduction to preformulation, goals and objectives, study of physicochemical characteristics of drug substances.

a. Physical properties: Physical form (crystal & amorphous), particle size, shape, flow properties, solubility profile (pKa, pH, partition coefficient), polymorphism

b. Chemical Properties: Hydrolysis, oxidation, reduction, racemisation, polymerization

BCS classification of drugs & its significant

Application of preformulation considerations in the development of solid, liquid oral and parenteral dosage forms and its impact on stability of dosage forms.

UNIT-II **10 Hours**

Tablets:

a. Introduction, ideal characteristics of tablets, classification of tablets. Excipients, Formulation of tablets, granulation methods, compression and processing problems. Equipments and tablet tooling.

b. Tablet coating: Types of coating, coating materials, formulation of coating composition, methods of coating, equipment employed and defects in coating.

c. Quality control tests: In process and finished product tests

Liquid orals: Formulation and manufacturing consideration of syrups and elixirs suspensions and emulsions; Filling and packaging; evaluation of liquid orals official in pharmacopoeia

UNIT-III **08 Hours**

Capsules:

a. ***Hard gelatin capsules:*** Introduction, Production of hard gelatin capsule shells. size of capsules, Filling, finishing and special techniques of formulation of hard gelatin capsules, manufacturing defects. In process and final product quality control tests for capsules.

b. ***Soft gelatin capsules:*** Nature of shell and capsule content, size of capsules,importance of base adsorption and minim/gram factors, production, in process and final product quality control tests. Packing, storage and stability testing of soft gelatin capsules and their applications.

Pellets: Introduction, formulation requirements, pelletization process, equipments for manufacture of pellets

UNIT-IV **10 Hours**

Parenteral Products:

a. Definition, types, advantages and limitations. Preformulation factors and essential requirements, vehicles, additives, importance of isotonicity

b. Production procedure, production facilities and controls,
aseptic processing

c. Formulation of injections, sterile powders, large volume parenterals and lyophilized products.

d. Containers and closures selection, filling and sealing of ampoules, vials and infusion fluids. Quality control tests of parenteral products.

Ophthalmic Preparations: Introduction, formulation considerations; formulation of eye drops, eye ointments and eye lotions; methods of preparation; labeling, containers; evaluation of ophthalmic preparations

UNIT-V **10 Hours**

Cosmetics: Formulation and preparation of the following cosmetic preparations: lipsticks, shampoos, cold cream and vanishing cream, tooth pastes, hair dyes and sunscreens.

Pharmaceutical Aerosols: Definition, propellants, containers, valves, types of aerosol systems; formulation and manufacture of aerosols; Evaluation of aerosols; Quality control and stability studies.

Packaging Materials Science: Materials used for packaging of pharmaceutical products, factors influencing choice of containers, legal and official requirements for containers, stability aspects of packaging materials, quality control tests.

BP 506 P. Industrial PharmacyI (Practical)

4 Hours/week

1. Preformulation studies on paracetamol/asparin/or any other drug
2. Preparation and evaluation of Paracetamol tablets
3. Preparation and evaluation of Aspirin tablets
4. Coating of tablets- film coating of tables/granules
5. Preparation and evaluation of Tetracycline capsules
6. Preparation of Calcium Gluconate injection
7. Preparation of Ascorbic Acid injection
8. Qulaity control test of (as per IP) marketed tablets and capsules
9. Preparation of Eye drops/ and Eye ointments
10. Preparation of Creams (cold / vanishing cream)
11. Evaluation of Glass containers (as per IP)

Recommended Books: (Latest Editions)

1. Pharmaceutical dosage forms - Tablets, volume 1 -3 by H.A. Liberman, Leon Lachman &J.B.Schwartz
2. Pharmaceutical dosage form - Parenteral medication vol- 1&2 by Liberman & Lachman
3. Pharmaceutical dosage form disperse system VOL-1 by Liberman & Lachman
4. Modern Pharmaceutics by Gilbert S. Banker & C.T. Rhodes, 3rd Edition
5. Remington: The Science and Practice of Pharmacy, 20th edition Pharmaceutical Science (RPS)
6. Theory and Practice of Industrial Pharmacy by Liberman & Lachman
7. Pharmaceutics- The science of dosage form design by M.E.Aulton, Churchill livingstone, Latest edition
8. Introduction to Pharmaceutical Dosage Forms by H. C.Ansel, Lea &Febiger, Philadelphia, 5thedition, 2005
9. Drug stability - Principles and practice by Cartensen & C.J. Rhodes, 3rd Edition, Marcel Dekker Series, Vol 107.

BP503.T. PHARMACOLOGY-II (Theory)

45 Hours

Scope: This subject is intended to impart the fundamental knowledge on various aspects (classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications) of drugs acting on different systems of body and in addition,emphasis on the basic concepts of bioassay.

Objectives: Upon completion of this course the student should be able to

1. Understand the mechanism of drug action and its relevance in the treatment of different diseases
2. Demonstrate isolation of different organs/tissues from the laboratory animals by simulated experiments
3. Demonstrate the various receptor actions using isolated tissue preparation
4. Appreciate correlation of pharmacology with related medical sciences

Course Content:

UNIT-I **10hours**

1. Pharmacology of drugs acting on cardio vascular system

a. Introduction to hemodynamic and electrophysiology of heart.
b. Drugs used in congestive heart failure
c. Anti-hypertensive drugs.
d. Anti-anginal drugs.
e. Anti-arrhythmic drugs.
f. Anti-hyperlipidemic drugs.

UNIT-II **10hours**

1. Pharmacology of drugs acting on cardio vascular system

a. Drug used in the therapy of shock.
b. Hematinics, coagulants and anticoagulants.
c. Fibrinolytics and anti-platelet drugs
d. Plasma volume expanders

2. Pharmacology of drugs acting on urinary system

a. Diuretics
b. Anti-diuretics.

UNIT-III **10hours**

3. Autocoids and related drugs

a. Introduction to autacoids and classification
b. Histamine, 5-HT and their antagonists.
c. Prostaglandins, Thromboxanes and Leukotrienes.
d. Angiotensin, Bradykinin and Substance P.
e. Non-steroidal anti-inflammatory agents
f. Anti-gout drugs
g. Antirheumatic drugs

UNIT-IV **08hours**

5. Pharmacology of drugs acting on endocrine system

a. Basic concepts in endocrine pharmacology.
b. Anterior Pituitary hormones- analogues and their inhibitors.
c. Thyroid hormones- analogues and their inhibitors.
d. Hormones regulating plasma calcium level- Parathormone, Calcitonin and Vitamin-D.
d. Insulin, Oral Hypoglycemic agents and glucagon.
e. ACTH and corticosteroids.

UNIT-V **07hours**

5. Pharmacology of drugs acting on endocrine system

a. Androgens and Anabolic steroids.
b. Estrogens, progesterone and oral contraceptives.
c. Drugs acting on the uterus.

6. Bioassay

a. Principles and applications of bioassay.
b.Types of bioassay
c. Bioassay of insulin, oxytocin, vasopressin, ACTH,d-tubocurarine,digitalis, histamine and 5-HT

BP 507 P. PHARMACOLOGY-II (Practical)

4Hrs/Week

1. Introduction to *in-vitro* pharmacology and physiological salt solutions.
2. Effect of drugs on isolated frog heart.
3. Effect of drugs on blood pressure and heart rate of dog.
4. Study of diuretic activity of drugs using rats/mice.
5. DRC of acetylcholine using frog rectus abdominis muscle.
6. Effect of physostigmine and atropine on DRC of acetylcholine using frog rectus abdominis muscle and rat ileum respectively.
7. Bioassay of histamine using guinea pig ileum by matching method.
8. Bioassay of oxytocin using rat uterine horn by interpolation method.
9. Bioassay of serotonin using rat fundus strip by three point bioassay.
10. Bioassay of acetylcholine using rat ileum/colon by four point bioassay.
11. Determination of PA_2 value of prazosin using rat anococcygeus muscle (by Schilds plot method).
12. Determination of PD_2 value using guinea pig ileum.
13. Effect of spasmogens and spasmolytics using rabbit jejunum.
14. Anti-inflammatory activity of drugs using carrageenan induced paw-edema model.
15. Analgesic activity of drug using central and peripheral methods

Note: All laboratory techniques and animal experiments are demonstrated by simulated experiments by softwares and videos

Recommended Books (Latest Editions)

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchil Livingstone Elsevier
2. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata Mc Graw-Hill.
3. Goodman and Gilman's, The Pharmacological Basis of Therapeutics
4. Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs, The Point Lippincott Williams & Wilkins.
5. Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews-Pharmacology.
6. K.D.Tripathi. Essentials of Medical Pharmacology, , JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.
7. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher
8. Modern Pharmacology with clinical Applications, by Charles R.Craig& Robert.
9. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.
10. Kulkarni SK. Handbook of experimental pharmacology. Vallabh Prakashan.

BP504 T. PHARMACOGNOSY AND PHYTOCHEMISTRY II (Theory)

45Hours

Scope: The main purpose of subject is to impart the students the knowledge of how the secondary metabolites are produced in the crude drugs, how to isolate and identify and produce them industrially. Also this subject involves the study of producing the plants and phytochemicals through plant tissue culture, drug interactions and basic principles of traditional system of medicine

Objectives: Upon completion of the course, the student shall be able

1. to know the modern extraction techniques, characterization and identification of the herbal drugs and phytoconstituents
2. to understand the preparation and development of herbal formulation.
3. to understand the herbal drug interactions
4. to carryout isolation and identification of phytoconstituents

Course Content:

UNIT-I **7 Hours**

Metabolic pathways in higher plants and their determination

a) Brief study of basic metabolic pathways and formation of different secondary metabolites through these pathways- Shikimic acid pathway, Acetate pathways and Amino acid pathway.
b) Study of utilization of radioactive isotopes in the investigation of Biogenetic studies.

UNIT-II **14 Hours**

General introduction, composition, chemistry & chemical classes, biosources, therapeutic uses and commercial applications of following

secondary metabolites:

Alkaloids: Vinca, Rauwolfia, Belladonna, Opium,
Phenylpropanoids and Flavonoids: Lignans, Tea, Ruta
Steroids, Cardiac Glycosides & Triterpenoids: Liquorice, Dioscorea, Digitalis
Volatile oils: Mentha, Clove, Cinnamon, Fennel, Coriander,
Tannins: Catechu, Pterocarpus
Resins: Benzoin, Guggul, Ginger, Asafoetida, Myrrh, Colophony
Glycosides: Senna, Aloes, Bitter Almond
Iridoids, Other terpenoids & Naphthaquinones: Gentian, Artemisia, taxus, carotenoids

UNIT-III **06 Hours**

Isolation, Identification and Analysis of Phytoconstituents

a) Terpenoids: Menthol, Citral, Artemisin
b) Glycosides: Glycyrhetinic acid & Rutin
c) Alkaloids: Atropine,Quinine,Reserpine,Caffeine
d) Resins: Podophyllotoxin, Curcumin

UNIT-IV **10 Hours**

Industrial production, estimation and utilization of the following phytoconstituents: Forskolin, Sennoside, Artemisinin, Diosgenin, Digoxin, Atropine, Podophyllotoxin, Caffeine, Taxol, Vincristine and Vinblastine

UNIT V **8 Hours**

Basics of Phytochemistry

Modern methods of extraction, application of latest techniques like Spectroscopy, chromatography and electrophoresis in the isolation, purification and identification of crude drugs.

BP 508 P. PHARMACOGNOSY AND PHYTOCHEMISTRY II (Practical)

4 Hours/Week

1. Morphology, histology and powder characteristics & extraction & detection of: Cinchona, Cinnamon, Senna, Clove, Ephedra, Fennel and Coriander
2. Exercise involving isolation & detection of active principles
   a. Caffeine - from tea dust.
   b. Diosgenin from Dioscorea
   c. Atropine from Belladonna
   d. Sennosides from Senna
3. Separation of sugars by Paper chromatography
4. TLC of herbal extract
5. Distillation of volatile oils and detection of phytoconstitutents by TLC
6. Analysis of crude drugs by chemical tests: **(**i) Asafoetida (ii) Benzoin (iii) Colophony (iv) Aloes (v) Myrrh

Recommended Books: (Latest Editions)

1. W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co., London, 2009.
2. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, New Delhi.
3. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition, Nirali Prakashan, New Delhi.
4. Herbal drug industry by R.D. Choudhary (1996), Ist Edn, Eastern Publisher, New Delhi.
5. Essentials of Pharmacognosy, Dr.SH.Ansari, IInd edition, Birla publications, New Delhi, 2007
6. Herbal Cosmetics by H.Pande, Asia Pacific Business press, Inc, New Delhi.
7. A.N. Kalia, Textbook of Industrial Pharmacognosy, CBS Publishers, New Delhi, 2005.
8. R Endress, Plant cell Biotechnology, Springer-Verlag, Berlin, 1994.
9. Pharmacognosy & Pharmacobiotechnology. James Bobbers, Marilyn KS, VE Tylor.
10. The formulation and preparation of cosmetic, fragrances and flavours.
11. Remington's Pharmaceutical sciences.
12. Text Book of Biotechnology by Vyas and Dixit.
13. Text Book of Biotechnology by R.C. Dubey.

BP 505 T. PHARMACEUTICAL JURISPRUDENCE (Theory)

45 Hours

Scope: This course is designed to impart basic knowledge on important legislations related to the profession of pharmacy in India.

Objectives: Upon completion of the course, the student shall be able to understand:

1. The Pharmaceutical legislations and their implications in the development and marketing of pharmaceuticals.
2. Various Indian pharmaceutical Acts and Laws
3. The regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals
4. The code of ethics during the pharmaceutical practice

Course Content:

UNIT-I **10 Hours**

Drugs and Cosmetics Act, 1940 and its rules 1945:

Objectives, Definitions, Legal definitions of schedules to the Act and Rules

Import of drugs – Classes of drugs and cosmetics prohibited from import, Import under license or permit. Offences and penalties**.**

Manufacture of drugs – Prohibition of manufacture and sale of certain drugs,

Conditions for grant of license and conditions of license for manufacture of drugs, Manufacture of drugs for test, examination and analysis, manufacture of new drug, loan license and repacking license.

UNIT-II **10 Hours**

Drugs and Cosmetics Act, 1940 and its rules 1945.

Detailed study of Schedule G, H, M, N, P,T,U, V, X, Y, Part XII B, Sch F & DMR (OA)

Sale of Drugs – Wholesale, Retail sale and Restricted license. Offences and penalties

Labeling & Packing of drugs- General labeling requirements and specimen labels for drugs and cosmetics, List of permitted colors. Offences and penalties.

Administration of the Act and Rules – Drugs Technical Advisory Board, Central drugs Laboratory, Drugs Consultative Committee, Government drug analysts, Licensing authorities, controlling authorities, Drugs Inspectors

UNIT-III **10 Hours**

- **Pharmacy Act –1948**: Objectives, Definitions, Pharmacy Council of India; its constitution and functions, Education Regulations, State and Joint state pharmacy councils; constitution and functions, Registration of Pharmacists, Offences and

Penalties

- **Medicinal and Toilet Preparation Act –1955**: Objectives, Definitions, Licensing, Manufacture In bond and Outside bond, Export of alcoholic preparations, Manufacture of Ayurvedic, Homeopathic, Patent & Proprietary Preparations. Offences and Penalties.
- **Narcotic Drugs and Psychotropic substances Act-1985 and Rules**: Objectives, Definitions, Authorities and Officers, Constitution and Functions of narcotic & Psychotropic Consultative Committee, National Fund for Controlling the Drug Abuse, Prohibition, Control and Regulation, opium poppy cultivation and production of poppy straw, manufacture, sale and export of opium, Offences and Penalties

UNIT-IV **08 Hours**

- **Study of Salient Features of Drugs and Magic Remedies Act and its rules:** Objectives, Definitions, Prohibition of certain advertisements, Classes of Exempted advertisements, Offences and Penalties
- **Prevention of Cruelty to animals Act-1960:** Objectives, Definitions, Institutional Animal Ethics Committee, CPCSEA guidelines for Breeding and Stocking of Animals, Performance of Experiments, Transfer and acquisition of animals for experiment, Records, Power to suspend or revoke registration, Offences and Penalties
- **National Pharmaceutical Pricing Authority:** Drugs Price Control Order (DPCO)-2013. Objectives, Definitions, Sale prices of bulk drugs, Retail price of formulations, Retail price and ceiling price of scheduled formulations, National List of Essential Medicines (NLEM)

UNIT-V **07 Hours**

- **Pharmaceutical Legislations –** A brief review, Introduction, Study of drugs enquiry committee, Health survey and development committee, Hathi committee and Mudaliar committee
- **Code of Pharmaceutical ethics** D efinition, Pharmacist in relation to his job, trade, medical profession and his profession, Pharmacist's oath
- **Medical Termination of Pregnancy Act**
- **Right to Information Act**
- **Introduction to Intellectual Property Rights (IPR)**

Recommended books: (Latest Edition)

1. Forensic Pharmacy by B. Suresh

2. Text book of Forensic Pharmacy by B.M. Mithal
3. Hand book of drug law-by M.L. Mehra
4. A text book of Forensic Pharmacy by N.K. Jain
5. Drugs and Cosmetics Act/Rules by Govt. of India publications.
6. Medicinal and Toilet preparations act 1955 by Govt. of India publications.
7. Narcotic drugs and psychotropic substances act by Govt. of India publications
8. Drugs and Magic Remedies act by Govt. of India publication
9.Bare Acts of the said laws published by Government. Reference books (Theory)

SEMESTER VI

BP601T. MEDICINAL CHEMISTRY – III (Theory)

45 Hours

Scope: This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasis on modern techniques of rational drug design like quantitative structure activity relationship (QSAR), Prodrug concept, combinatorial chemistry and Computer aided drug design (CADD). The subject also emphasizes on the chemistry, mechanism of action, metabolism, adverse effects, Structure Activity Relationships (SAR), therapeutic uses and synthesis of important drugs.

Objectives: Upon completion of the course student shall be able to

1. Understand the importance of drug design and different techniques of drug design.
2. Understand the chemistry of drugs with respect to their biological activity.
3. Know the metabolism, adverse effects and therapeutic value of drugs.
4. Know the importance of SAR of drugs.

Course Content:

Study of the development of the following classes of drugs, Classification, mechanism of action, uses of drugs mentioned in the course, Structure activity relationship of selective class of drugs as specified in the course and synthesis of drugs superscripted by (*)

UNIT – I **10 Hours**

Antibiotics

Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes.

β-Lactam antibiotics: Penicillin, Cepholosporins, β- Lactamase inhibitors, Monobactams

Aminoglycosides: Streptomycin, Neomycin, Kanamycin

Tetracyclines: Tetracycline,Oxytetracycline, Chlortetracycline, Minocycline, Doxycycline

UNIT – II **10 Hours**

Antibiotics

Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes.

Macrolide: Erythromycin Clarithromycin, Azithromycin.

Miscellaneous: Chloramphenicol*, Clindamycin.

Prodrugs: Basic concepts and application of prodrugs design.

Antimalarials: Etiology of malaria.

Quinolines: SAR, Quinine sulphate, Chloroquine*, Amodiaquine, Primaquine phosphate, Pamaquine*, Quinacrine hydrochloride, Mefloquine.

Biguanides and dihydro triazines: Cycloguanil pamoate, Proguanil.

Miscellaneous: Pyrimethamine, Artesunete, Artemether, Atovoquone.

UNIT – III **10 Hours**

Anti-tubercular Agents

Synthetic anti tubercular agents: Isoniozid*, Ethionamide, Ethambutol, Pyrazinamide, Para amino salicylic acid.*

Anti tubercular antibiotics: Rifampicin, Rifabutin, Cycloserine Streptomycine, Capreomycin sulphate.

Urinary tract anti-infective agents

Quinolones: SAR of quinolones, Nalidixic Acid,Norfloxacin, Enoxacin, Ciprofloxacin*, Ofloxacin, Lomefloxacin, Sparfloxacin, Gatifloxacin, Moxifloxacin

Miscellaneous: Furazolidine, Nitrofurantoin*, Methanamine.

Antiviral agents:

Amantadine hydrochloride, Rimantadine hydrochloride, Idoxuridine trifluoride, Acyclovir*, Gancyclovir, Zidovudine, Didanosine, Zalcitabine, Lamivudine, Loviride, Delavirding, Ribavirin, Saquinavir, Indinavir, Ritonavir.

UNIT – IV **08 Hours**

Antifungal agents:

Antifungal antibiotics: Amphotericin-B, Nystatin, Natamycin, Griseofulvin.

Synthetic Antifungal agents: Clotrimazole, Econazole, Butoconazole, Oxiconazole Tioconozole, Miconazole*, Ketoconazole, Terconazole, Itraconazole, Fluconazole, Naftifine hydrochloride, Tolnaftate*.

Anti-protozoal Agents: Metronidazole*, Tinidazole, Ornidazole, Diloxanide, Iodoquinol, Pentamidine Isethionate, Atovaquone, Eflornithine.

Anthelmintics: Diethylcarbamazine citrate*, Thiabendazole, Mebendazole*, Albendazole, Niclosamide, Oxamniquine, Praziquantal, Ivermectin.

Sulphonamides and Sulfones

Historical development, chemistry, classification and SAR of Sulfonamides: Sulphamethizole, Sulfisoxazole, Sulphamethizine, Sulfacetamide*, Sulphapyridine, Sulfamethoxaole*, Sulphadiazine, Mefenide acetate, Sulfasalazine.

Folate reductase inhibitors: Trimethoprim*, Cotrimoxazole.

Sulfones: Dapsone*.

UNIT – V **07 Hours**

Introduction to Drug Design

Various approaches used in drug design.

Physicochemical parameters used in quantitative structure activity relationship (QSAR) such as partition coefficient, Hammet's electronic parameter, Tafts steric parameter and Hansch analysis.

Pharmacophore modeling and docking techniques.

Combinatorial Chemistry: Concept and applications of combinatorial chemistry: solid phase and solution phase synthesis.

BP607P. MEDICINAL CHEMISTRY- III (Practical)

4 Hours / week

I Preparation of drugs and intermediates

1 Sulphanilamide

2 7-Hydroxy, 4-methyl coumarin

3 Chlorobutanol

4 Triphenyl imidazole

5 Tolbutamide

6 Hexamine

II Assay of drugs

1 Isonicotinic acid hydrazide

2 Chloroquine

3 Metronidazole

4 Dapsone

5 Chlorpheniramine maleate

6 Benzyl penicillin

III Preparation of medicinally important compounds or intermediates by Microwave irradiation technique

IV Drawing structures and reactions using chem draw®

V Determination of physicochemical properties such as logP, clogP, MR, Molecular weight, Hydrogen bond donors and acceptors for class of drugs course content using drug design software Drug likeliness screening (Lipinskies RO5)

Recommended Books (Latest Editions)

1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2. Foye's Principles of Medicinal Chemistry.
3. Burger's Medicinal Chemistry, Vol I to IV.
4. Introduction to principles of drug design- Smith and Williams.
5. Remington's Pharmaceutical Sciences.
6. Martindale's extra pharmacopoeia.

7. Organic Chemistry by I.L. Finar, Vol. II.
8. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5.
9. Indian Pharmacopoeia.
10. Text book of practical organic chemistry- A.I.Vogel.

BP602 T. PHARMACOLOGY-III (Theory)

45 Hours

Scope: This subject is intended to impart the fundamental knowledge on various aspects (classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications) of drugs acting on respiratory and gastrointestinal system, infectious diseases, immuno-pharmacology and in addition,emphasis on the principles of toxicology and chronopharmacology.

Objectives: Upon completion of this course the student should be able to:

1. understand the mechanism of drug action and its relevance in the treatment of different infectious diseases
2. comprehend the principles of toxicology and treatment of various poisoningsand
3. appreciate correlation of pharmacology with related medical sciences.

Course Content:

UNIT-I **10hours**

1. Pharmacology of drugs acting on Respiratory system

a. Anti -asthmatic drugs
b. Drugs used in the management of COPD
c. Expectorants and antitussives
d. Nasal decongestants
e. Respiratory stimulants

2. Pharmacology of drugs acting on the Gastrointestinal Tract

a. Antiulcer agents.
b. Drugs for constipation and diarrhoea.
c. Appetite stimulants and suppressants.
d. Digestants and carminatives.
e. Emetics and anti-emetics.

UNIT-II **10hours**

3. Chemotherapy

a. General principles of chemotherapy.

b. Sulfonamides and cotrimoxazole.

c. Antibiotics- Penicillins, cephalosporins, chloramphenicol, macrolides, quinolones and fluoroquinolins, tetracycline and aminoglycosides

UNIT-III **10hours**

3. Chemotherapy

a. Antitubercular agents

b. Antileprotic agents

c. Antifungal agents

d. Antiviral drugs

e.Anthelmintics

f. Antimalarial drugs

g. Antiamoebic agents

UNIT-IV **08hours**

3. Chemotherapy

l. Urinary tract infections and sexually transmitted diseases.

m. Chemotherapy of malignancy.

4. Immunopharmacology

a. Immunostimulants

b. Immunosuppressant

Protein drugs, monoclonal antibodies, target drugs to antigen, biosimilars

UNIT-V **07hours**

5. Principles of toxicology

a. Definition and basic knowledge of acute, subacute and chronic toxicity.

b. Definition and basic knowledge of genotoxicity, carcinogenicity, teratogenicity and mutagenicity

c. General principles of treatment of poisoning

d. Clinical symptoms and management of barbiturates, morphine, organophosphosphorus compound and lead, mercury and arsenic poisoning.

6. Chronopharmacology

a. Definition of rhythm and cycles.

b. Biological clock and their significance leading to chronotherapy.

BP 608 P. PHARMACOLOGY-III (Practical)

4Hrs/Week

1. Dose calculation in pharmacological experiments
2. Antiallergic activity by mast cell stabilization assay
3. Study of anti-ulcer activity of a drug using pylorus ligand (SHAY) rat model and NSAIDS induced ulcer model.
4. Study of effect of drugs on gastrointestinal motility
5. Effect of agonist and antagonists on guinea pig ileum
6. Estimation of serum biochemical parameters by using semi- autoanalyser
7. Effect of saline purgative on frog intestine
8. Insulin hypoglycemic effect in rabbit
9. Test for pyrogens (rabbit method)
10. Determination of acute oral toxicity (LD50) of a drug from a given data
11. Determination of acute skin irritation / corrosion of a test substance
12. Determination of acute eye irritation / corrosion of a test substance
13. Calculation of pharmacokinetic parameters from a given data
14. Biostatistics methods in experimental pharmacology(student's t test, ANOVA)
15. Biostatistics methods in experimental pharmacology (Chi square test, Wilcoxon Signed Rank test)

**Experiments are demonstrated by simulated experiments/videos*

Recommended Books (Latest Editions)

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchil Livingstone Elsevier
2. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata Mc Graw-Hill
3. Goodman and Gilman's, The Pharmacological Basis of Therapeutics
4. Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs. The Point Lippincott Williams & Wilkins
5. Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews-Pharmacology
6. K.D.Tripathi. Essentials of Medical Pharmacology, , JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.
7. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher Modern Pharmacology with clinical Applications, by Charles R.Craig& Robert,
8. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata,
9. Kulkarni SK. Handbook of experimental pharmacology. VallabhPrakashan,
10. N.Udupa and P.D. Gupta, Concepts in Chronopharmacology.

BP 603 T. HERBAL DRUG TECHNOLOGY (Theory)

45 hours

Scope: This subject gives the student the knowledge of basic understanding of herbal drug industry, the quality of raw material, guidelines for quality of herbal drugs, herbal cosmetics, natural sweeteners, nutraceutical etc. The subject also emphasizes on Good Manufacturing Practices (GMP), patenting and regulatory issues of herbal drugs

Objectives: Upon completion of this course the student should be able to:

1. understand raw material as source of herbal drugs from cultivation to herbal drug product
2. know the WHO and ICH guidelines for evaluation of herbal drugs
3. know the herbal cosmetics, natural sweeteners, nutraceuticals
4. appreciate patenting of herbal drugs, GMP .

Course content:

UNIT-I **11 Hours**

Herbs as raw materials

Definition of herb, herbal medicine, herbal medicinal product, herbal drug preparation
Source of Herbs
Selection, identification and authentication of herbal materials
Processing of herbal raw material

Biodynamic Agriculture

Good agricultural practices in cultivation of medicinal plants including Organic farming.
Pest and Pest management in medicinal plants: Biopesticides/Bioinsecticides.

Indian Systems of Medicine

a) Basic principles involved in Ayurveda, Siddha, Unani and Homeopathy
b) Preparation and standardization of Ayurvedic formulations viz Aristas and Asawas, Ghutika,Churna, Lehya and Bhasma.

UNIT-II **7 Hours**

Nutraceuticals

General aspects, Market, growth, scope and types of products available in the market. Health benefits and role of Nutraceuticals in ailments like Diabetes, CVS diseases, Cancer, Irritable bowel syndrome and various Gastro intestinal diseases.
Study of following herbs as health food: Alfaalfa, Chicory, Ginger, Fenugreek, Garlic, Honey, Amla, Ginseng, Ashwagandha, Spirulina

Herbal-Drug and Herb-Food Interactions: General introduction to interaction and classification. Study of following drugs and their possible side effects and interactions: Hypercium, kava-kava, Ginkobiloba, Ginseng, Garlic, Pepper & Ephedra.

UNIT-III **10 Hours**

Herbal Cosmetics

Sources and description of raw materials of herbal origin used via, fixed oils, waxes, gums colours, perfumes, protective agents, bleaching agents, antioxidants in products such as skin care, hair care and oral hygiene products.

Herbal excipients:
Herbal Excipients – Significance of substances of natural origin as excipients – colorants, sweeteners, binders, diluents, viscosity builders, disintegrants, flavors & perfumes.

Herbal formulations :
Conventional herbal formulations like syrups, mixtures and tablets and Novel dosage forms like phytosomes

UNIT- IV **10 Hours**

Evaluation of Drugs WHO & ICH guidelines for the assessment of herbal drugs
Stability testing of herbal drugs.

Patenting and Regulatory requirements of natural products:
a) Definition of the terms: Patent, IPR, Farmers right, Breeder's right, Bioprospecting and Biopiracy
b) Patenting aspects of Traditional Knowledge and Natural Products. Case study of Curcuma & Neem.

Regulatory Issues - Regulations in India (ASU DTAB, ASU DCC), Regulation of manufacture of ASU drugs - Schedule Z of Drugs & Cosmetics Act for ASU drugs.

UNIT-V **07 Hours**

General Introduction to Herbal Industry
Herbal drugs industry: Present scope and future prospects.
A brief account of plant based industries and institutions involved in work on medicinal and aromatic plants in India.

Schedule T – Good Manufacturing Practice of Indian systems of medicine
Components of GMP (Schedule – T) and its objectives
Infrastructural requirements, working space, storage area, machinery and equipments, standard operating procedures, health and hygiene, documentation and records.

BP 609 P. HERBAL DRUG TECHNOLOGY (Practical)

4 hours/ week

1. To perform preliminary phytochemical screening of crude drugs.
2. Determination of the alcohol content of Asava and Arista
3. Evaluation of excipients of natural origin
4. Incorporation of prepared and standardized extract in cosmetic formulations like creams, lotions and shampoos and their evaluation.
5. Incorporation of prepared and standardized extract in formulations like syrups, mixtures and tablets and their evaluation as per Pharmacopoeial requirements.
6. Monograph analysis of herbal drugs from recent Pharmacopoeias
7. Determination of Aldehyde content
8. Determination of Phenol content
9. Determination of total alkaloids

Recommended Books: (Latest Editions)

1. Textbook of Pharmacognosy by Trease & Evans.
2. Textbook of Pharmacognosy by Tyler, Brady & Robber.
3. Pharmacognosy by Kokate, Purohit and Gokhale
4. Essential of Pharmacognosy by Dr.S.H.Ansari
5. Pharmacognosy & Phytochemistry by V.D.Rangari
6. Pharmacopoeal standards for Ayurvedic Formulation (Council of Research in Indian Medicine & Homeopathy)
7. Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002.

BP 604 T. BIOPHARMACEUTICS AND PHARMACOKINETICS (Theory)

45 Hours

Scope: This subject is designed to impart knowledge and skills of Biopharmaceutics and pharmacokinetics and their applications in pharmaceutical development, design of dose and dosage regimen and in solving the problems arised therein.

Objectives: Upon completion of the course student shall be able to:

1. Understand the basic concepts in biopharmaceutics and pharmacokinetics and their significance.
2. Use of plasma drug concentration-time data to calculate the pharmacokinetic parameters to describe the kinetics of drug absorption, distribution, metabolism, excretion, elimination.
3. To understand the concepts of bioavailability and bioequivalence of drug products and their significance.
4. Understand various pharmacokinetic parameters, their significance & applications.

Course Content:

UNIT-I **10 Hours**

Introduction to Biopharmaceutics

Absorption; Mechanisms of drug absorption through GIT, factors influencing drug absorption though GIT, absorption of drug from Non per oral extra-vascular routes, **Distribution** Tissue permeability of drugs, binding of drugs, apparent, volume of drug distribution, plasma and tissue protein binding of drugs, factors affecting protein-drug binding. Kinetics of protein binding, Clinical significance of protein binding of drugs

UNIT- II **10 Hours**

Elimination: Drug metabolism and basic understanding metabolic pathways renal excretion of drugs, factors affecting renal excretion of drugs, renal clearance, Non renal routes of drug excretion of drugs

Bioavailability and Bioequivalence: Definition and Objectives of bioavailability, absolute and relative bioavailability, measurement of bioavailability, *in-vitro* drug dissolution models, *in-vitro-in-vivo* correlations, bioequivalence studies, methods to enhance the dissolution rates and bioavailability of poorly soluble drugs.

UNIT- III **10 Hours**

Pharmacokinetics: Definition and introduction to Pharmacokinetics, Compartment models, Non compartment models, physiological models, One compartment open model. (a). Intravenous Injection (Bolus) (b). Intravenous infusion and (c) Extra vascular administrations. Pharmacokinetics parameters - K_E ,t1/2,Vd,AUC,Ka, Clt and CL_R- definitions methods of eliminations, understanding of their significance and application

UNIT- IV **08 Hours**

Multicompartment models: Two compartment open model. IV bolus
Kinetics of multiple dosing, steady state drug levels, calculation of loading and mainetnance doses and their significance in clinical settins.

UNIT- V **07 Hours**

Nonlinear Pharmacokinetics: a. Introduction, b. Factors causing Non-linearity.
c. Michaelis-menton method of estimating parameters, Explanation with example of drugs.

Recommended Books: (Latest Editions)

1. Biopharmaceutics and Clinical Pharmacokinetics by, Milo Gibaldi.
2. Biopharmaceutics and Pharmacokinetics; By Robert F Notari
3. Applied biopharmaceutics and pharmacokinetics, Leon Shargel and Andrew B.C.YU 4th edition,Prentice-Hall Inernational edition.USA
4. Bio pharmaceutics and Pharmacokinetics-A Treatise, By D. M. Brahmankar and Sunil B.Jaiswal,Vallabh Prakashan Pitampura, Delhi
5. Pharmacokinetics: By Milo Glbaldi Donald, R. Mercel Dekker Inc.
6. Hand Book of Clinical Pharmacokinetics, By Milo Gibaldi and Laurie Prescott by ADIS Health Science Press.
7. Biopharmaceutics; By Swarbrick
8. Clinical Pharmacokinetics, Concepts and Applications: By Malcolm Rowland and
9. Thomas, N. Tozen, Lea and Febrger, Philadelphia, 1995.
10. Dissolution, Bioavailability and Bioequivalence, By Abdou H.M, Mack, Publishing Company,Pennsylvania 1989.
11. Biopharmaceutics and Clinical Pharmacokinetics-An introduction 4th edition Revised and expanded by Rebort F Notari Marcel Dekker Inn, New York and Basel, 1987.
12. Remington's Pharmaceutical Sciences, By Mack Publishing Company, Pennsylvnia

BP 605 T. PHARMACEUTICAL BIOTECHNOLOGY (Theory)

45 Hours

Scope:

- Biotechnology has a long promise to revolutionize the biological sciences and technology.
- Scientific application of biotechnology in the field of genetic engineering, medicine and fermentation technology makes the subject interesting.
- Biotechnology is leading to new biological revolutions in diagnosis, prevention and cure of diseases, new and cheaper pharmaceutical drugs.
- Biotechnology has already produced transgenic crops and animals and the future promises lot more.
- It is basically a research-based subject.

Objectives: Upon completion of the subject student shall be able to;

1. Understanding the importance of Immobilized enzymes in Pharmaceutical Industries
2. Genetic engineering applications in relation to production of pharmaceuticals
3. Importance of Monoclonal antibodies in Industries
4. Appreciate the use of microorganisms in fermentation technology

Unit I **10 Hours**

a) Brief introduction to Biotechnology with reference to Pharmaceutical Sciences.

b) Enzyme Biotechnology- Methods of enzyme immobilization and applications.

c) Biosensors- Working and applications of biosensors in Pharmaceutical Industries.

d) Brief introduction to Protein Engineering.

e) Use of microbes in industry. Production of Enzymes- General consideration - Amylase, Catalase, Peroxidase, Lipase, Protease, Penicillinase.

f) Basic principles of genetic engineering.

Unit II **10 Hours**

a) Study of cloning vectors, restriction endonucleases and DNA ligase.

b) Recombinant DNA technology. Application of genetic engineering in medicine.

c) Application of r DNA technology and genetic engineering in the production of:

i) Interferon ii) Vaccines- hepatitis- B iii) Hormones-Insulin.

d) Brief introduction to PCR

Unit III **10 Hours**

Types of immunity- humoral immunity, cellular immunity

a) Structure of Immunoglobulins

b) Structure and Function of MHC

c) Hypersensitivity reactions, Immune stimulation and Immune suppressions.

d) General method of the preparation of bacterial vaccines, toxoids, viral vaccine, antitoxins, serum-immune blood derivatives and other products relative to immunity.

e) Storage conditions and stability of official vaccines

f) Hybridoma technology- Production, Purification and Applications

g) Blood products and Plasma Substituties.

Unit IV **08Hours**

a) Immuno blotting techniques- ELISA, Western blotting, Southern blotting.

b) Genetic organization of Eukaryotes and Prokaryotes

c) Microbial genetics including transformation, transduction, conjugation, plasmids and transposons.

d) Introduction to Microbial biotransformation and applications.

e) Mutation: Types of mutation/mutants.

Unit V **07 Hours**

a) Fermentation methods and general requirements, study of media, equipments, sterilization methods, aeration process, stirring.

b) Large scale production fermenter design and its various controls.

c) Study of the production of - penicillins, citric acid, Vitamin B12, Glutamic acid, Griseofulvin,

d) Blood Products: Collection, Processing and Storage of whole human blood, dried human plasma, plasma Substituties.

Recommended Books (Latest edition):

1. B.R. Glick and J.J. Pasternak: Molecular Biotechnology: Principles and Applications of RecombinantDNA: ASM Press Washington D.C.
2. RA Goldshy et. al., : Kuby Immunology.
3. J.W. Goding: Monoclonal Antibodies.
4. J.M. Walker and E.B. Gingold: Molecular Biology and Biotechnology by Royal

Society of Chemistry.
5. Zaborsky: Immobilized Enzymes, CRC Press, Degraland, Ohio.
6. S.B. Primrose: Molecular Biotechnology (Second Edition) Blackwell Scientific Publication.
7. Stanbury F., P., Whitakar A., and Hall J., S., Principles of fermentation technology, 2nd edition, Aditya books Ltd., New Delhi

BP606TPHARMACEUTICAL QUALITY ASSURANCE (Theory)

45 Hours

Scope: This course deals with the various aspects of quality control and quality assurance aspects of pharmaceutical industries. It deals with the important aspects like cGMP, QC tests, documentation, quality certifications and regulatory affairs.

Objectives: Upon completion of the course student shall be able to:

- understand the cGMP aspects in a pharmaceutical industry
- appreciate the importance of documentation
- understand the scope of quality certifications applicable to pharmaceutical industries
- understand the responsibilities of QA & QC departments

Course content:

UNIT – I **10 Hours**

Quality Assurance and Quality Management concepts: Definition and concept of Quality control, Quality assurance and GMP

Total Quality Management (TQM): Definition, elements, philosophies

ICH Guidelines: purpose, participants, process of harmonization, Brief overview of QSEM, with special emphasis on Q-series guidelines, ICH stability testing guidelines

Quality by design (QbD): Definition, overview, elements of QbD program, tools

ISO 9000 & ISO14000: Overview, Benefits, Elements, steps for registration

NABL accreditation : Principles and procedures

UNIT - II **10 Hours**

Organization and personnel: Personnel responsibilities, training, hygiene and personal records.

Premises: Design, construction and plant layout, maintenance, sanitation, environmental control, utilities and maintenance of sterile areas, control of contamination.

Equipments and raw materials: Equipment selection, purchase specifications, maintenance, purchase specifications and maintenance of stores for raw materials.

UNIT – III **10 Hours**

Quality Control: Quality control test for containers, rubber closures and secondary packing

materials.

Good Laboratory Practices: General Provisions, Organization and Personnel, Facilities, Equipment, Testing Facilities Operation, Test and Control Articles, Protocol for Conduct of a Nonclinical Laboratory Study, Records and Reports, Disqualification of Testing Facilities

UNIT – IV **08 Hours**

Complaints: Complaints and evaluation of complaints, Handling of return good, recalling and waste disposal.

Document maintenance in pharmaceutical industry: Batch Formula Record, Master Formula Record, SOP, Quality audit, Quality Review and Quality documentation, Reports and documents, distribution records.

UNIT – V **07 Hours**

Calibration and Validation: Introduction, definition and general principles of calibration, qualification and validation, importance and scope of validation, types of validation, validation master plan. Calibration of pH meter, Qualification of UV-Visible spectrophotometer, General principles of Analytical method Validation.

Warehousing: Good warehousing practice, materials management

Recommended Books: (Latest Edition)

1. Quality Assurance Guide by organization of Pharmaceutical Products of India.
2. Good Laboratory Practice Regulations, 2nd Edition, Sandy Weinberg Vol. 69.
3. Quality Assurance of Pharmaceuticals- A compendium of Guide lines and Related materials Vol I WHO Publications.
4. A guide to Total Quality Management- Kushik Maitra and Sedhan K Ghosh
5. How to Practice GMP's – P P Sharma.
6. ISO 9000 and Total Quality Management – Sadhank G Ghosh
7. The International Pharmacopoeia – Vol I, II, III, IV- General Methods of Analysis and Quality specification for Pharmaceutical Substances, Excipients and Dosage forms
8. Good laboratory Practices – Marcel Deckker Series
9. ICH guidelines, ISO 9000 and 14000 guidelines

SEMESTER VII

BP701T. INSTRUMENTAL METHODS OF ANALYSIS (Theory)

45 Hours

Scope: This subject deals with the application of instrumental methods in qualitative and quantitative analysis of drugs. This subject is designed to impart a fundamental knowledge on the principles and instrumentation of spectroscopic and chromatographic technique. This also emphasizes on theoretical and practical knowledge on modern analytical instruments that are used for drug testing.

Objectives: Upon completion of the course the student shall be able to

1. Understand the interaction of matter with electromagnetic radiations and its applications in drug analysis
2. Understand the chromatographic separation and analysis of drugs.
3. Perform quantitative & qualitative analysis of drugs using various analytical instruments.

Course Content:

UNIT –I **10 Hours**

UV Visible spectroscopy

Electronic transitions, chromophores, auxochromes, spectral shifts, solvent effect on absorption spectra, Beer and Lambert's law, Derivation and deviations.

Instrumentation - Sources of radiation, wavelength selectors, sample cells, detectors- Photo tube, Photomultiplier tube, Photo voltaic cell, Silicon Photodiode.

Applications - Spectrophotometric titrations, Single component and multi component analysis

Fluorimetry

Theory, Concepts of singlet, doublet and triplet electronic states, internal and external conversions, factors affecting fluorescence, quenching, instrumentation and applications

UNIT –II **10 Hours**

IR spectroscopy

Introduction, fundamental modes of vibrations in poly atomic molecules, sample handling, factors affecting vibrations

Instrumentation - Sources of radiation, wavelength selectors, detectors - Golay cell, Bolometer, Thermocouple, Thermister, Pyroelectric detector and applications

Flame Photometry-Principle, interferences, instrumentation and applications

Atomic absorption spectroscopy- Principle, interferences, instrumentation and applications

Nepheloturbidometry- Principle, instrumentation and applications

UNIT –III **10 Hours**

Introduction to chromatography

Adsorption and partition column chromatography-Methodology, advantages, disadvantages and applications.

Thin layer chromatography- Introduction, Principle, Methodology, Rf values, advantages, disadvantages and applications.

Paper chromatography-Introduction, methodology, development techniques, advantages, disadvantages and applications

Electrophoresis– Introduction, factors affecting electrophoretic mobility, Techniques of paper, gel, capillary electrophoresis, applications

UNIT –IV **08 Hours**

Gas chromatography - Introduction, theory, instrumentation, derivatization, temperature programming, advantages, disadvantages and applications

High performance liquid chromatography (HPLC)-Introduction, theory, instrumentation, advantages and applications.

UNIT –V **07 Hours**

Ion exchange chromatography- Introduction, classification, ion exchange resins, properties, mechanism of ion exchange process, factors affecting ion exchange, methodology and applications

Gel chromatography- Introduction, theory, instrumentation and applications

Affinity chromatography- Introduction, theory, instrumentation and applications

BP705P. INSTRUMENTAL METHODS OF ANALYSIS (Practical)

4 Hours/Week

1. Determination of absorption maxima and effect of solvents on absorption maxima of organic compounds
2. Estimation of dextrose by colorimetry
3. Estimation of sulfanilamide by colorimetry
4. Simultaneous estimation of ibuprofen and paracetamol by UV spectroscopy
5. Assay of paracetamol by UV- Spectrophotometry
6. Estimation of quinine sulfate by fluorimetry
7. Study of quenching of fluorescence
8. Determination of sodium by flame photometry
9. Determination of potassium by flame photometry
10. Determination of chlorides and sulphates by nephelo turbidometry
11. Separation of amino acids by paper chromatography
12. Separation of sugars by thin layer chromatography
13. Separation of plant pigments by column chromatography
14. Demonstration experiment on HPLC
15. Demonstration experiment on Gas Chromatography

Recommended Books (Latest Editions)

1. Instrumental Methods of Chemical Analysis by B.K Sharma
2. Organic spectroscopy by Y.R Sharma
3. Text book of Pharmaceutical Analysis by Kenneth A. Connors
4. Vogel's Text book of Quantitative Chemical Analysis by A.I. Vogel
5. Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake
6. Organic Chemistry by I. L. Finar
7. Organic spectroscopy by William Kemp
8. Quantitative Analysis of Drugs by D. C. Garrett
9. Quantitative Analysis of Drugs in Pharmaceutical Formulations by P. D. Sethi
10. Spectrophotometric identification of Organic Compounds by Silverstein

BP 702 T. INDUSTRIAL PHARMACYII (Theory)

45 Hours

Scope: This course is designed to impart fundamental knowledge on pharmaceutical product development and translation from laboratory to market

Objectives: Upon completion of the course, the student shall be able to:

1. Know the process of pilot plant and scale up of pharmaceutical dosage forms
2. Understand the process of technology transfer from lab scale to commercial batch
3. Know different Laws and Acts that regulate pharmaceutical industry
4. Understand the approval process and regulatory requirements for drug products

Course Content:

UNIT-I **10 Hours**

Pilot plant scale up techniques: General considerations - including significance of personnel requirements, space requirements, raw materials, Pilot plant scale up considerations for solids, liquid orals, semi solids and relevant documentation, SUPAC guidelines, Introduction to platform technology

UNIT-II **10 Hours**

Technology development and transfer: WHO guidelines for Technology Transfer(TT): Terminology, Technology transfer protocol, Quality risk management, Transfer from R & D to production (Process, packaging and cleaning), Granularity of TT Process (API, excipients, finished products, packaging materials) Documentation, Premises and equipments, qualification and validation, quality control, analytical method transfer, Approved regulatory bodies and agencies, Commercialization - practical aspects and problems (case studies), TT agencies in India - APCTD, NRDC, TIFAC, BCIL, TBSE / SIDBI; TT related documentation - confidentiality agreement, licensing, MoUs, legal issues

UNIT-III **10 Hours**

Regulatory affairs: Introduction, Historical overview of Regulatory Affairs, Regulatory authorities, Role of Regulatory affairs department, Responsibility of Regulatory Affairs Professionals

Regulatory requirements for drug approval: Drug Development Teams, Non-Clinical Drug Development, Pharmacology, Drug Metabolism and Toxicology, General considerations of Investigational New Drug (IND) Application, Investigator's Brochure (IB) and New Drug Application (NDA), Clinical research / BE studies, Clinical Research Protocols, Biostatistics in Pharmaceutical Product Development, Data Presentation for FDA Submissions, Management of Clinical Studies.

UNIT-IV **08 Hours**

Quality management systems: Quality management & Certifications: Concept of Quality, Total Quality Management, Quality by Design (QbD), Six Sigma concept, Out of Specifications (OOS), Change control, Introduction to ISO 9000 series of quality systems standards, ISO 14000, NABL, GLP

UNIT-V **07 Hours**

Indian Regulatory Requirements: Central Drug Standard Control Organization (CDSCO) and State Licensing Authority: Organization, Responsibilities, Certificate of Pharmaceutical Product (COPP), Regulatory requirements and approval procedures for New Drugs.

Recommended Books: (Latest Editions)

1. Regulatory Affairs from Wikipedia, the free encyclopedia modified on 7th April available at http,//en.wikipedia.org/wiki/Regulatory_ Affairs.
2. International Regulatory Affairs Updates, 2005. available at http://www.iraup.com/about.php
3. Douglas J Pisano and David S. Mantus. Text book of FDA Regulatory Affairs A Guide for Prescription Drugs, Medical Devices, and Biologics' Second Edition.
4. Regulatory Affairs brought by learning plus, inc. available at http.//www.cgmp.com/ra.htm.

BP 703T. PHARMACY PRACTICE (Theory)

45 Hours

Scope: In the changing scenario of pharmacy practice in India, for successful practice of Hospital Pharmacy, the students are required to learn various skills like drug distribution, drug information, and therapeutic drug monitoring for improved patient care. In community pharmacy, students will be learning various skills such as dispensing of drugs, responding to minor ailments by providing suitable safe medication, patient counselling for improved patient care in the community set up.

Objectives: Upon completion of the course, the student shall be able to

1. know various drug distribution methods in a hospital
2. appreciate the pharmacy stores management and inventory control
3. monitor drug therapy of patient through medication chart review and clinical review
4. obtain medication history interview and counsel the patients
5. identify drug related problems
6. detect and assess adverse drug reactions
7. interpret selected laboratory results (as monitoring parameters in therapeutics) of specific disease states
8. know pharmaceutical care services
9. do patient counseling in community pharmacy;
10. appreciate the concept of Rational drug therapy.

Unit I: **10 Hours**

a) Hospital and it's organization

Definition, Classification of hospital- Primary, Secondary and Tertiary hospitals, Classification based on clinical and non- clinical basis, Organization Structure of a Hospital, and Medical staffs involved in the hospital and their functions.

b) Hospital pharmacy and its organization

Definition, functions of hospital pharmacy, Organization structure, Location, Layout and staff requirements, and Responsibilities and functions of hospital pharmacists.

c) Adverse drug reaction

Classifications - Excessive pharmacological effects, secondary pharmacological effects, idiosyncrasy, allergic drug reactions, genetically determined toxicity, toxicity following sudden withdrawal of drugs, Drug interaction- beneficial interactions, adverse interactions, and pharmacokinetic drug interactions, Methods for detecting

drug interactions, spontaneous case reports and record linkage studies, and Adverse drug reaction reporting and management.

d) Community Pharmacy

Organization and structure of retail and wholesale drug store, types and design, Legal requirements for establishment and maintenance of a drug store, Dispensing of proprietary products, maintenance of records of retail and wholesale drug store.

Unit II: 10 Hours

a) Drug distribution system in a hospital

Dispensing of drugs to inpatients, types of drug distribution systems, charging policy and labelling, Dispensing of drugs to ambulatory patients, and Dispensing of controlled drugs.

b) Hospital formulary

Definition, contents of hospital formulary, Differentiation of hospital formulary and Drug list, preparation and revision, and addition and deletion of drug from hospital formulary.

c) Therapeutic drug monitoring

Need for Therapeutic Drug Monitoring, Factors to be considered during the Therapeutic Drug Monitoring, and Indian scenario for Therapeutic Drug Monitoring.

d) Medication adherence

Causes of medication non-adherence, pharmacist role in the medication adherence, and monitoring of patient medication adherence.

e) Patient medication history interview

Need for the patient medication history interview, medication interview forms.

f) Community pharmacy management

Financial, materials, staff, and infrastructure requirements.

Unit III: 10 Hours

a) Pharmacy and therapeutic committee

Organization, functions, Policies of the pharmacy and therapeutic committee in including drugs into formulary, inpatient and outpatient prescription, automatic stop order, and emergency drug list preparation.

b) Drug information services

Drug and Poison information centre, Sources of drug information, Computerised services, and storage and retrieval of information.

c) Patient counseling

Definition of patient counseling; steps involved in patient counseling, and Special cases that require the pharmacist

d) Education and training program in the hospital

Role of pharmacist in the education and training program, Internal and external training program, Services to the nursing homes/clinics, Code of ethics for community pharmacy, and Role of pharmacist in the interdepartmental communication and community health education.

e) Prescribed medication order and communication skills

Prescribed medication order- interpretation and legal requirements, and Communication skills- communication with prescribers and patients.

Unit IV 8 Hours

a) Budget preparation and implementation

Budget preparation and implementation

b) Clinical Pharmacy

Introduction to Clinical Pharmacy, Concept of clinical pharmacy, functions and responsibilities of clinical pharmacist, Drug therapy monitoring - medication chart review, clinical review, pharmacist intervention, Ward round participation, Medication history and Pharmaceutical care.

Dosing pattern and drug therapy based on Pharmacokinetic & disease pattern.

c) Over the counter (OTC) sales

Introduction and sale of over the counter, and Rational use of common over the counter medications.

Unit V 7 Hours

a) Drug store management and inventory control

Organisation of drug store, types of materials stocked and storage conditions, Purchase and inventory control: principles, purchase procedure, purchase order, procurement and stocking, Economic order quantity, Reorder quantity level, and Methods used for the analysis of the drug expenditure

b) Investigational use of drugs

Description, principles involved, classification, control, identification, role of hospital pharmacist, advisory committee.

c) Interpretation of Clinical Laboratory Tests

Blood chemistry, hematology, and urinalysis

Recommended Books (Latest Edition):

1. Merchant S.H. and Dr. J.S.Quadry. *A textbook of hospital pharmacy*, 4th ed. Ahmadabad: B.S. Shah Prakakshan; 2001.
2. Parthasarathi G, Karin Nyfort-Hansen, Milap C Nahata. *A textbook of Clinical Pharmacy Practice- essential concepts and skills,* 1st ed. Chennai: Orient Longman Private Limited; 2004.
3. William E. Hassan. *Hospital pharmacy*, 5th ed. Philadelphia: Lea & Febiger; 1986.
4. Tipnis Bajaj. *Hospital Pharmacy*, 1st ed. Maharashtra: Career Publications; 2008.
5. Scott LT. *Basic skills in interpreting laboratory data*, 4thed. American Society of Health System Pharmacists Inc; 2009.
6. Parmar N.S. *Health Education and Community Pharmacy,* 18th ed. India: CBS Publishers & Distributers; 2008.

Journals:

1. Therapeutic drug monitoring. ISSN: 0163-4356
2. Journal of pharmacy practice. ISSN : 0974-8326
3. American journal of health system pharmacy. ISSN: 1535-2900 (online)
4. Pharmacy times (Monthly magazine)

BP 704T: NOVEL DRUG DELIVERY SYSTEMS (Theory)

45 Hours

Scope: This subject is designed to impart basic knowledge on the area of novel drug delivery systems.

Objectives: Upon completion of the course student shall be able

1. To understand various approaches for development of novel drug delivery systems.
2. To understand the criteria for selection of drugs and polymers for the development of Novel drug delivery systems, their formulation and evaluation

Course content:

Unit-I **10 Hours**

Controlled drug delivery systems: Introduction, terminology/definitions and rationale, advantages, disadvantages, selection of drug candidates.Approaches to design controlled release formulations based on diffusion, dissolution and ion exchange principles. Physicochemical and biological properties of drugs relevant to controlled release formulations

Polymers: Introduction, classification, properties, advantages and application of polymers in formulation of controlled release drug delivery systems.

Unit-II **10 Hours**

Microencapsulation: Definition, advantages and disadvantages, microspheres /microcapsules, microparticles, methods of microencapsulation, applications

Mucosal Drug Delivery system: Introduction, Principles of bioadhesion / mucoadhesion, concepts, advantages and disadvantages, transmucosal permeability and formulation considerations of buccal delivery systems

Implantable Drug Delivery Systems: Introduction, advantages and disadvantages, concept of implantsand osmotic pump

Unit-III **10 Hours**

Transdermal Drug Delivery Systems: Introduction, Permeation through skin, factors affecting permeation, permeation enhancers, basic components of TDDS, formulation approaches

Gastroretentive drug delivery systems: Introduction, advantages, disadvantages, approaches for GRDDS – Floating, high density systems, inflatable and gastroadhesive systems and their applications

Nasopulmonary drug delivery system: Introduction to Nasal and Pulmonary routes of drug delivery, Formulation of Inhalers (dry powder and metered dose), nasal sprays, nebulizers

Unit-IV **08 Hours**

Targeted drug Delivery: Concepts and approaches advantages and disadvantages, introduction to liposomes, niosomes, nanoparticles, monoclonal antibodies and their applications

Unit-V **07 Hours**

Ocular Drug Delivery Systems: Introduction, intra ocular barriers and methods to overcome –Preliminary study, ocular formulations and ocuserts

Intrauterine Drug Delivery Systems: Introduction, advantages and disadvantages, development of intra uterine devices (IUDs) and applications

Recommended Books: (Latest Editions)

1. Y W. Chien, Novel Drug Delivery Systems, 2nd edition, revised and expanded, Marcel Dekker, Inc., New York, 1992.
2. Robinson, J. R., Lee V. H. L, Controlled Drug Delivery Systems, Marcel Dekker, Inc., New York, 1992.
3. Encyclopedia of Controlled Delivery. Edith Mathiowitz, Published by Wiley Interscience Publication, John Wiley and Sons, Inc, New York. Chichester/Weinheim
4. N.K. Jain, Controlled and Novel Drug Delivery, CBS Publishers & Distributors, New Delhi, First edition 1997 (reprint in 2001).
5. S.P. Vyas and R.K. Khar, Controlled Drug Delivery -concepts and advances, Vallabh Prakashan, New Delhi, First edition 2002.

Journals

1. Indian Journal of Pharmaceutical Sciences (IPA)
2. Indian Drugs (IDMA)
3. Journal of Controlled Release (Elsevier Sciences)
4. Drug Development and Industrial Pharmacy (Marcel & Decker)
5. International Journal of Pharmaceutics (Elsevier Sciences)

SEMESTER VIII

BP801T. BIOSTATISITCS AND RESEARCH METHODOLOGY (Theory)

45 Hours

Scope: To understand the applications of Biostatics in Pharmacy. This subject deals with descriptive statistics, Graphics, Correlation, Regression, logistic regression Probability theory, Sampling technique, Parametric tests, Non Parametric tests, ANOVA, Introduction to Design of Experiments, Phases of Clinical trials and Observational and Experimental studies, SPSS, R and MINITAB statistical software's, analyzing the statistical data using Excel**.**

Objectives: Upon completion of the course the student shall be able to

- Know the operation of M.S. Excel, SPSS, R and MINITAB®, DoE (Design of Experiment)
- Know the various statistical techniques to solve statistical problems
- Appreciate statistical techniques in solving the problems**.**

Course content:

Unit-I **10 Hours**

Introduction: Statistics, Biostatistics, Frequency distribution

Measures of central tendency: Mean, Median, Mode- Pharmaceutical examples

Measures of dispersion: Dispersion, Range, standard deviation, Pharmaceutical problems

Correlation: Definition, Karl Pearson's coefficient of correlation, Multiple correlation - Pharmaceuticals examples

Unit-II **10 Hours**

Regression: Curve fitting by the method of least squares, fitting the lines y= a + bx and x = a + by, Multiple regression, standard error of regression– Pharmaceutical Examples

Probability: Definition of probability, Binomial distribution, Normal distribution, Poisson's distribution, properties - problems

Sample, Population, large sample, small sample, Null hypothesis, alternative hypothesis, sampling, essence of sampling, types of sampling, Error-I type, Error-II type, Standard error of mean (SEM) - Pharmaceutical examples

Parametric test: t-test(Sample, Pooled or Unpaired and Paired) , ANOVA, (One way and Two way), Least Significance difference

Unit-III **10 Hours**

Non Parametric tests: Wilcoxon Rank Sum Test, Mann-Whitney U test, Kruskal-Wallis test, Friedman Test

Introduction to Research: Need for research, Need for design of Experiments, Experiential Design Technique, plagiarism

Graphs: Histogram, Pie Chart, Cubic Graph, response surface plot, Counter Plot graph

Designing the methodology: Sample size determination and Power of a study, Report writing and presentation of data, Protocol, Cohorts studies, Observational studies, Experimental studies, Designing clinical trial, various phases.

Unit-IV **8 Hours**

Blocking and confounding system for Two-level factorials

Regression modeling: Hypothesis testing in Simple and Multiple regressionmodels

Introduction to Practical components of Industrial and Clinical Trials Problems: Statistical Analysis Using Excel, SPSS, MINITAB®, DESIGN OF EXPERIMENTS, R - Online Statistical Software's to Industrial and Clinical trial approach

Unit-V **7Hours**

Design and Analysis of experiments:

Factorial Design: Definition, 2^2, 2^3design. Advantage of factorial design

Response Surface methodology: Central composite design, Historical design, Optimization Techniques

Recommended Books (Latest edition):

1. Pharmaceutical statistics- Practical and clinical applications, Sanford Bolton, publisher Marcel Dekker Inc. NewYork.
2. Fundamental of Statistics – Himalaya Publishing House- S.C.Guptha
3. Design and Analysis of Experiments –PHI Learning Private Limited, R. Pannerselvam,
4. Design and Analysis of Experiments – Wiley Students Edition, Douglas and C. Montgomery

BP 802T SOCIAL AND PREVENTIVE PHARMACY

Hours: 45

Scope:
The purpose of this course is to introduce to students a number of health issues and their challenges. This course also introduced a number of national health programmes. The roles of the pharmacist in these contexts are also discussed.

Objectives:
After the successful completion of this course, the student shall be able to:

- Acquire high consciousness/realization of current issuesrelated to health and pharmaceutical problems within the country and worldwide.
- Have a critical way of thinking based on current healthcare development.
- Evaluate alternative ways of solving problems related tohealth and pharmaceutical issues

Course content:

Unit I: 10 Hours

Concept of health and disease: Definition, concepts and evaluation of public health. Understanding the concept of prevention and control of disease, social causes of diseases and social problems of the sick.

Social and health education: Food in relation to nutrition and health, Balanced diet, Nutritional deficiencies, Vitamin deficiencies, Malnutrition and its prevention.

Sociology and health: Socio cultural factors related to health and disease, Impact of urbanization on health and disease, Poverty and health

Hygiene and health: personal hygiene and health care; avoidable habits

Unit II: 10 Hours

Preventive medicine: General principles of prevention and control of diseases such as cholera, SARS, Ebola virus, influenza, acute respiratory infections, malaria, chicken guinea, dengue, lymphatic filariasis, pneumonia, hypertension, diabetes mellitus, cancer, drug addiction-drug substance abuse

Unit III: 10 Hours

National health programs, its objectives, functioning and outcome of the following: HIV AND AIDS control programme, TB, Integrated disease surveillance program (IDSP), National leprosy control programme, National mental health program, National

programme for prevention and control of deafness, Universal immunization programme, National programme for control of blindness, Pulse polio programme.

Unit IV: **08 Hours**

National health intervention programme for mother and child, National family welfare programme, National tobacco control programme, National Malaria Prevention Program, National programme for the health care for the elderly, Social health programme; role of WHO in Indian national program

Unit V: **07 Hours**

Community services in rural, urban and school health: Functions of PHC, Improvement in rural sanitation, national urban health mission, Health promotion and education in school.

Recommended Books (Latest edition)*:*

1. Short Textbook of Preventive and Social Medicine, Prabhakara GN, 2nd Edition, 2010, ISBN: 9789380704104, JAYPEE Publications
2. Textbook of Preventive and Social Medicine (Mahajan and Gupta), Edited by Roy Rabindra Nath, Saha Indranil, 4th Edition, 2013, ISBN: 9789350901878, JAYPEE Publications
3. Review of Preventive and Social Medicine (Including Biostatistics), Jain Vivek, 6th Edition, 2014, ISBN: 9789351522331, JAYPEE Publications
4. Essentials of Community Medicine—A Practical Approach, Hiremath Lalita D, Hiremath Dhananjaya A, 2nd Edition, 2012, ISBN: 9789350250440, JAYPEE Publications
5. Park Textbook of Preventive and Social Medicine, K Park, 21st Edition, 2011, ISBN-14: 9788190128285, BANARSIDAS BHANOT PUBLISHERS.
6. Community Pharmacy Practice, Ramesh Adepu, BSP publishers, Hyderabad

Recommended Journals:

1. Research in Social and Administrative Pharmacy, Elsevier, Ireland

BP803ET. PHARMA MARKETING MANAGEMENT (Theory)

45 Hours

Scope:

The pharmaceutical industry not only needs highly qualified researchers, chemists and, technical people, but also requires skilled managers who can take the industry forward by managing and taking the complex decisions which are imperative for the growth of the industry. The Knowledge and Know-how of marketing management groom the people for taking a challenging role in Sales and Product management.

Course Objective: The course aims to provide an understanding of marketing concepts and techniques and their applications in the pharmaceutical industry.

Unit I **10 Hours**

Marketing:

Definition, general concepts and scope of marketing; Distinction between marketing & selling; Marketing environment; Industry and competitive analysis; Analyzing consumer buying behavior; industrial buying behavior.

Pharmaceutical market:

Quantitative and qualitative aspects; size and composition of the market; demographic descriptions and socio-psychological characteristics of the consumer; market segmentation& targeting.Consumer profile; Motivation and prescribing habits of the physician; patients' choice of physician and retail pharmacist.Analyzing the Market;Role of market research.

Unit II **10 Hours**

Product decision:

Classification, product line and product mix decisions, product life cycle,product portfolio analysis; product positioning; New product decisions; Product branding, packaging and labeling decisions, Product management in pharmaceutical industry.

Unit III **10 Hours**

Promotion:

Methods, determinants of promotional mix, promotional budget; An overview of personal selling, advertising, direct mail, journals, sampling, retailing, medical exhibition, public relations, online promotional techniques for OTC Products.

Unit IV **10 Hours**

Pharmaceutical marketing channels:

Designing channel, channel members, selecting the appropriate channel, conflict in channels, physical distribution management: Strategic importance, tasks in physical distribution management.

Professional sales representative (PSR):

Duties of PSR, purpose of detailing, selection and training, supervising, norms for customer calls, motivating, evaluating, compensation and future prospects of the PSR.

Unit V **10 Hours**

Pricing:

Meaning, importance, objectives, determinants of price; pricing methods and strategies, issues in price management in pharmaceutical industry. An overview of DPCO (Drug Price Control Order)and NPPA (National Pharmaceutical Pricing Authority).

Emerging concepts in marketing:

Vertical & Horizontal Marketing; RuralMarketing; Consumerism; Industrial Marketing; Global Marketing.

Recommended Books: (Latest Editions)

1. Philip Kotler and Kevin Lane Keller: Marketing Management, Prentice Hall of India, New Delhi
2. Walker, Boyd and Larreche : Marketing Strategy- Planning and Implementation, Tata MC GrawHill, New Delhi.
3. Dhruv Grewal and Michael Levy: Marketing, Tata MC Graw Hill
4. Arun Kumar and N Menakshi: Marketing Management, Vikas Publishing, India
5. Rajan Saxena: Marketing Management; Tata MC Graw-Hill (India Edition)
6. Ramaswamy, U.S & Nanakamari, S: Marketing Managemnt:Global Perspective, IndianContext,Macmilan India, New Delhi.
7. Shanker, Ravi: Service Marketing, Excell Books, New Delhi
8. Subba Rao Changanti, Pharmaceutical Marketing in India (GIFT – Excel series) Excel Publications.

BP804 ET: PHARMACEUTICAL REGULATORY SCIENCE (Theory)

45Hours

Scope: This course is designed to impart the fundamental knowledge on the regulatory requirements for approval of new drugs, and drug products in regulated markets of India & other countries like US, EU, Japan, Australia,UK etc. It prepares the students to learn in detail on the regulatory requirements, documentation requirements, and registration procedures for marketing the drug products.

Objectives: Upon completion of the subject student shall be able to;

1. Know about the process of drug discovery and development
2. Know the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals
3. Know the regulatory approval process and their registration in Indian and international markets

Course content:

Unit I **10Hours**

New Drug Discovery and development

Stages of drug discovery, Drug development process, pre-clinical studies, non-clinical activities, clinical studies, Innovator and generics, Concept of generics, Generic drug product development.

Unit II **10Hours**

Regulatory Approval Process

Approval processes and timelines involved in Investigational New Drug (IND), New Drug Application (NDA), Abbreviated New Drug Application (ANDA). Changes to an approved NDA / ANDA.

Regulatory authorities and agencies

Overview of regulatory authorities of India, United States, European Union, Australia, Japan, Canada (Organization structure and types of applications)

Unit III **10Hours**

Registration of Indian drug product in overseas market

Procedure for export of pharmaceutical products, Technical documentation, Drug Master Files (DMF), Common Technical Document (CTD), electronic Common Technical

Document (eCTD), ASEAN Common Technical Document (ACTD)research.

Unit IV **08Hours**

Clinical trials

Developing clinical trial protocols, Institutional Review Board / Independent Ethics committee - formation and working procedures, Informed consent process and procedures, GCP obligations of Investigators, sponsors & Monitors, Managing and Monitoring clinical trials, Pharmacovigilance - safety monitoring in clinical trials

Unit V **07Hours**

Regulatory Concepts

Basic terminology, guidance, guidelines, regulations, Laws and Acts, Orange book, Federal Register, Code of Federal Regulatory, Purple book

Recommended books (Latest edition):

1. Drug Regulatory Affairs by Sachin Itkar, Dr. N.S. Vyawahare, Nirali Prakashan.
2. The Pharmaceutical Regulatory Process, Second Edition Edited by Ira R. Berry and Robert P. Martin, Drugs and the Pharmaceutical Sciences,Vol.185. Informa Health care Publishers.
3. New Drug Approval Process: Accelerating Global Registrations By Richard A Guarino, MD, 5th edition, Drugs and the Pharmaceutical Sciences,Vol.190.
4. Guidebook for drug regulatory submissions / Sandy Weinberg. By John Wiley & Sons. Inc.
5. FDA Regulatory Affairs: a guide for prescription drugs, medical devices, and biologics /edited by Douglas J. Pisano, David Mantus.
6. Generic Drug Product Development, Solid Oral Dosage forms, Leon Shargel and Isader Kaufer, Marcel Dekker series, Vol.143
7. Clinical Trials and Human Research: A Practical Guide to Regulatory Compliance By Fay A. Rozovsky and Rodney K. Adams
8. Principles and Practices of Clinical Research, Second Edition Edited by John I. Gallin and Frederick P. Ognibene
9. Drugs: From Discovery to Approval, Second Edition By Rick Ng

BP 805T: PHARMACOVIGILANCE (Theory)

45 hours

Scope: This paper will provide an opportunity for the student to learn about development of pharmacovigilance as a science, basic terminologies used in pharmacovigilance, global scenario of Pharmacovigilance, train students on establishing pharmacovigilance programme in an organization, various methods that can be used to generate safety data and signal detection. This paper also develops the skills of classifying drugs, diseases and adverse drug reactions.

Objectives:

At completion of this paper it is expected that students will be able to (know, do, and appreciate):

1. Why drug safety monitoring is important?
2. History and development of pharmacovigilance
3. National and international scenario of pharmacovigilance
4. Dictionaries, coding and terminologies used in pharmacovigilance
5. Detection of new adverse drug reactions and their assessment
6. International standards for classification of diseases and drugs
7. Adverse drug reaction reporting systems and communication in pharmacovigilance
8. Methods to generate safety data during pre clinical, clinical and post approval phases of drugs' life cycle
9. Drug safety evaluation in paediatrics, geriatrics, pregnancy and lactation
10. Pharmacovigilance Program of India (PvPI) requirement for ADR reporting in India
11. ICH guidelines for ICSR, PSUR, expedited reporting, pharmacovigilance planning
12. CIOMS requirements for ADR reporting
13. Writing case narratives of adverse events and their quality.

Course Content

Unit I **10 Hours**

Introduction to Pharmacovigilance

- History and development of Pharmacovigilance
- Importance of safety monitoring of Medicine
- WHO international drug monitoring programme
- Pharmacovigilance Program of India(PvPI)

Introduction to adverse drug reactions

- Definitions and classification of ADRs
- Detection and reporting
- Methods in Causality assessment
- Severity and seriousness assessment
- Predictability and preventability assessment
- Management of adverse drug reactions

Basic terminologies used in pharmacovigilance

- Terminologies of adverse medication related events
- Regulatory terminologies

Unit II **10 hours**

Drug and disease classification

- Anatomical, therapeutic and chemical classification of drugs
- International classification of diseases
- Daily defined doses
- International Non proprietary Names for drugs

Drug dictionaries and coding in pharmacovigilance

- WHO adverse reaction terminologies
- MedDRA and Standardised MedDRA queries
- WHO drug dictionary
- Eudravigilance medicinal product dictionary

Information resources in pharmacovigilance

- Basic drug information resources
- Specialised resources for ADRs

Establishing pharmacovigilance programme

- Establishing in a hospital
- Establishment & operation of drug safety department in industry
- Contract Research Organisations (CROs)
- Establishing a national programme

Unit III **10 Hours**

Vaccine safety surveillance

- Vaccine Pharmacovigilance
- Vaccination failure
- Adverse events following immunization

Pharmacovigilance methods

- Passive surveillance – Spontaneous reports and case series
- Stimulated reporting
- Active surveillance – Sentinel sites, drug event monitoring and registries
- Comparative observational studies – Cross sectional study, case control study and cohort study
- Targeted clinical investigations

Communication in pharmacovigilance

- Effective communication in Pharmacovigilance
- Communication in Drug Safety Crisis management
- Communicating with Regulatory Agencies, Business Partners, Healthcare facilities & Media

Unit IV **8 Hours**

Safety data generation

- Pre clinical phase
- Clinical phase
- Post approval phase (PMS)

ICH Guidelines for Pharmacovigilance

- Organization and objectives of ICH
- Expedited reporting
- Individual case safety reports
- Periodic safety update reports
- Post approval expedited reporting
- Pharmacovigilance planning
- Good clinical practice in pharmacovigilance studies

Unit V **7 hours**

Pharmacogenomics of adverse drug reactions

- Genetics related ADR with example focusing PK parameters.

Drug safety evaluation in special population

- Paediatrics
- Pregnancy and lactation
- Geriatrics

CIOMS

- CIOMS Working Groups
- CIOMS Form

CDSCO (India) and Pharmacovigilance

- D&C Act and Schedule Y
- Differences in Indian and global pharmacovigilance requirements

Recommended Books (Latest edition):

1. Textbook of Pharmacovigilance: S K Gupta, Jaypee Brothers, Medical Publishers.
2. Practical Drug Safety from A to Z By Barton Cobert, Pierre Biron, Jones and Bartlett Publishers.
3. Mann's Pharmacovigilance:Elizabeth B. Andrews, Nicholas, Wiley Publishers.
4. Stephens' Detection of New Adverse Drug Reactions: John Talbot, Patrick Walle, Wiley Publishers.
5. An Introduction to Pharmacovigilance: Patrick Waller,Wiley Publishers.
6. Cobert's Manual of Drug Safety and Pharmacovigilance: Barton Cobert,Jones& Bartlett Publishers.
7. Textbook of Pharmacoepidemiolog edited by Brian L. Strom, Stephen E Kimmel, Sean Hennessy,Wiley Publishers.
8. A Textbook of Clinical Pharmacy Practice -Essential Concepts and Skills:G. Parthasarathi, Karin NyfortHansen,Milap C. Nahata
9. National Formulary of India
10. Text Book of Medicine by Yashpal Munjal

11. Text book of Pharmacovigilance: concept and practice by GP Mohanta and PK Manna

12. http://www.whoumc.org/DynPage.aspx?id=105825&mn1=7347&mn2=7259&mn3=7297
13. http://www.ich.org/
14. http://www.cioms.ch/
15. http://cdsco.nic.in/
16. http://www.who.int/vaccine_safety/en/
17. http://www.ipc.gov.in/PvPI/pv_home.html

BP 806 ET. QUALITY CONTROL AND STANDARDIZATION OF HERBALS (Theory)

Scope: In this subject the student learns about the various methods and guidelines for evaluation and standardization of herbs and herbal drugs. The subject also provides an opportunity for the student to learn cGMP, GAP and GLP in traditional system of medicines.

Objectives: Upon completion of the subject student shall be able to;

1. know WHO guidelines for quality control of herbal drugs
2. know Quality assurance in herbal drug industry
3. know the regulatory approval process and their registration in Indian and international markets
4. appreciate EU and ICH guidelines for quality control of herbal drugs

Unit I **10 hours**

Basic tests for drugs – Pharmaceutical substances, Medicinal plants materials and dosage forms

WHO guidelines for quality control of herbal drugs.

Evaluation of commercial crude drugs intended for use

Unit II **10 hours**

Quality assurance in herbal drug industry of cGMP, GAP, GMP and GLP in traditional system of medicine.

WHO Guidelines on current good manufacturing Practices (cGMP) for Herbal Medicines

WHO Guidelines on GACP for Medicinal Plants.

Unit III **10 hours**

EU and ICH guidelines for quality control of herbal drugs.

Research Guidelines for Evaluating the Safety and Efficacy of Herbal Medicines

Unit IV **08 hours**

Stability testing of herbal medicines.Application of various chromatographic techniques in standardization of herbal products.

Preparation of documents for new drug application and export registration

GMP requirements and Drugs & Cosmetics Act provisions.

Unit V **07 hours**

Regulatory requirements for herbal medicines.

WHO guidelines on safety monitoring of herbal medicines in pharmacovigilance systems

Comparison of various Herbal Pharmacopoeias.

Role of chemical and biological markers in standardization of herbal products

Recommended Books: (Latest Editions

1. Pharmacognosy by Trease and Evans
2. Pharmacognosy by Kokate, Purohit and Gokhale
3. Rangari, V.D., Text book of Pharmacognosy and Phytochemistry Vol. I , Carrier Pub., 2006.
4. Aggrawal, S.S., Herbal Drug Technology. Universities Press, 2002.
5. EMEA. Guidelines on Quality of Herbal Medicinal Products/Traditional Medicinal Products,
6. Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002.
7. Shinde M.V., Dhalwal K., Potdar K., Mahadik K. Application of quality control principles to herbal drugs. International Journal of Phytomedicine 1(2009); p. 4-8.
8. WHO. Quality Control Methods for Medicinal Plant Materials, World Health Organization, Geneva, 1998. WHO. Guidelines for the Appropriate Use of Herbal Medicines. WHO Regional Publications, Western Pacific Series No 3, WHO Regional office for the Western Pacific, Manila, 1998.
9. WHO. The International Pharmacopeia, Vol. 2: Quality Specifications, 3rd edn. World Health Organization, Geneva, 1981.
10. WHO. Quality Control Methods for Medicinal Plant Materials. World Health Organization, Geneva, 1999.
11. WHO. WHO Global Atlas of Traditional, Complementary and Alternative Medicine. 2 vol. set. Vol. 1 contains text and Vol. 2, maps. World Health Organization, Geneva, 2005.
12. WHO. Guidelines on Good Agricultural and Collection Practices (GACP) for Medicinal Plants. World Health Organization, Geneva, 2004.

BP 807 ET. COMPUTER AIDED DRUG DESIGN (Theory)

45 Hours

Scope: This subject is designed to provide detailed knowledge of rational drug design process and various techniques used in rational drug design process.

Objectives: Upon completion of the course, the student shall be able to understand

- Design and discovery of lead molecules
- The role of drug design in drug discovery process
- The concept of QSAR and docking
- Various strategies to develop new drug like molecules.
- The design of new drug molecules using molecular modeling software

Course Content:

UNIT-I **10 Hours**

Introduction to Drug Discovery and Development

Stages of drug discovery and development

Lead discovery and Analog Based Drug Design

Rational approaches to lead discovery based on traditional medicine, Random screening, Non-random screening, serendipitous drug discovery, lead discovery based on drug metabolism, lead discovery based on clinical observation.

Analog Based Drug Design: Bioisosterism, Classification, Bioisosteric replacement. Any three case studies

UNIT-II **10 Hours**

Quantitative Structure Activity Relationship (QSAR)

SAR versus QSAR, History and development of QSAR, Types of physicochemical parameters, experimental and theoretical approaches for the determination of physicochemical parameters such as Partition coefficient, Hammet's substituent constant and Tafts steric constant. Hansch analysis, Free Wilson analysis, 3D-QSAR approaches like COMFA and COMSIA.

UNIT-III **10 Hours**

Molecular Modeling and virtual screening techniques

Virtual Screening techniques: Drug likeness screening, Concept of pharmacophore mapping and pharmacophore based Screening,

Molecular docking: Rigid docking, flexible docking, manual docking, Docking based screening. *De novo* drug design.

UNIT-IV **08 Hours**

Informatics & Methods in drug design

Introduction to Bioinformatics, chemoinformatics. ADME databases, chemical, biochemical and pharmaceutical databases.

UNIT-V **07 Hours**

Molecular Modeling: Introduction to molecular mechanics and quantum mechanics.Energy Minimization methods and Conformational Analysis, global conformational minima determination.

Recommended Books (Latest Editions)

1. Robert GCK, ed., "Drug Action at the Molecular Level" University Prak Press Baltimore.
2. Martin YC. "Quantitative Drug Design" Dekker, New York.
3. Delgado JN, Remers WA eds "Wilson & Gisvolds's Text Book of Organic Medicinal & Pharmaceutical Chemistry" Lippincott, New York.
4. Foye WO "Principles of Medicinal chemistry 'Lea & Febiger.
5. Koro lkovas A, Burckhalter JH. "Essentials of Medicinal Chemistry" Wiley Interscience.
6. Wolf ME, ed "The Basis of Medicinal Chemistry, Burger's Medicinal Chemistry" John Wiley & Sons, New York.
7. Patrick Graham, L., An Introduction to Medicinal Chemistry, Oxford University Press.
8. Smith HJ, Williams H, eds, "Introduction to the principles of Drug Design" Wright Boston.
9. Silverman R.B. "The organic Chemistry of Drug Design and Drug Action" Academic Press New York.

BP808ET: CELL AND MOLECULAR BIOLOGY (Elective subject)

45 Hours

Scope:

- Cell biology is a branch of biology that studies cells – their physiological properties, their structure, the organelles they contain, interactions with their environment, their life cycle, division, death and cell function.
- This is done both on a microscopic and molecular level.
- Cell biology research encompasses both the great diversity of single-celled organisms like bacteria and protozoa, as well as the many specialized cells in multi-cellular organismssuch as humans, plants, and sponges.

Objectives: Upon completion of the subject student shall be able to;

- Summarize cell and molecular biology history.
- Summarize cellular functioning and composition.
- Describe the chemical foundations of cell biology.
- Summarize the DNA properties of cell biology.
- Describe protein structure and function.
- Describe cellular membrane structure and function.
- Describe basic molecular genetic mechanisms.
- Summarize the Cell Cycle

Course content:

Unit I **10Hours**

a) Cell and Molecular Biology: Definitions theory and basics and Applications.
b) Cell and Molecular Biology: History and Summation.
c) Properties of cells and cell membrane.
d) Prokaryotic versus Eukaryotic
e) Cellular Reproduction
f) Chemical Foundations – an Introduction and Reactions (Types)

Unit II **10 Hours**

a) DNA and the Flow of Molecular Information
b) DNA Functioning
c) DNA and RNA
d) Types of RNA
e) Transcription and Translation

Unit III **10 Hours**

a) Proteins: Defined **and** Amino Acids
b) Protein Structure

c) Regularities in Protein Pathways
d) Cellular Processes
e) Positive Control and significance of Protein Synthesis

Unit IV **08 Hours**

a) Science of Genetics
b) Transgenics and Genomic Analysis
c) Cell Cycle analysis
d) Mitosis and Meiosis
e) Cellular Activities and Checkpoints

Unit V **07 Hours**

a) Cell Signals: Introduction
b) Receptors for Cell Signals
c) Signaling Pathways: Overview
d) Misregulation of Signaling Pathways
e) Protein-Kinases: Functioning

Recommended Books (latest edition):

1. W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientific publications, Oxford London.
2. Prescott and Dunn., Industrial Microbiology, 4th edition, CBS Publishers & Distributors, Delhi.
3. Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill edn.
4. Malcolm Harris, Balliere Tindall and Cox: Pharmaceutical Microbiology.
5. Rose: Industrial Microbiology.
6. Probisher, Hinsdill et al: Fundamentals of Microbiology, 9th ed. Japan
7. Cooper and Gunn's: Tutorial Pharmacy, CBS Publisher and Distribution.
8. Peppler: Microbial Technology.
9. Edward: Fundamentals of Microbiology.
10. N.K.Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi
11. Bergeys manual of systematic bacteriology, Williams and Wilkins- A Waverly company
12. B.R. Glick and J.J. Pasternak: Molecular Biotechnology: Principles and Applications of RecombinantDNA: ASM Press Washington D.C.
13. RA Goldshy et. al., : Kuby Immunology.

BP809ET. COSMETIC SCIENCE(Theory)

45Hours

UNIT I **10Hours**

Classification of cosmetic and cosmeceutical products

Definition of cosmetics as per Indian and EU regulations, Evolution of cosmeceuticals from cosmetics, cosmetics as quasi and OTC drugs

Cosmetic excipients: Surfactants, rheology modifiers, humectants, emollients, preservatives. Classification and application

Skin: Basic structure and function of skin.

Hair: Basic structure of hair. Hair growth cycle.

Oral Cavity: Common problem associated with teeth and gums**.**

UNIT II **10 Hours**

Principles of formulation and building blocks of skin care products:

Face wash,

Moisturizing cream, Cold Cream, Vanishing cream and their advantages and disadvantages.Application of these products in formulation of cosmecuticals.

Antiperspants & deodorants- Actives & mechanism of action.

Principles of formulation and building blocks of Hair care products:

Conditioning shampoo, Hair conditioner,anti-dandruff shampoo.

Hair oils.

Chemistry and formulation of Para-phylene diamine based hair dye.

Principles of formulation and building blocks of oral care products:

Toothpaste for bleeding gums, sensitive teeth. Teeth whitening, Mouthwash.

UNIT III **10 Hours**

Sun protection, Classification of Sunscreens and SPF.

Role of herbs in cosmetics:

Skin Care: Aloe and turmeric

Hair care: Henna and amla.

Oral care: Neem and clove

Analytical cosmetics: BIS specification and analytical methods for shampoo, skin-cream and toothpaste**.**

UNIT IV **08 Hours**.

Principles of Cosmetic Evaluation:Principles of sebumeter, corneometer. Measurement of TEWL, Skin Color, Hair tensile strength, Hair combing properties

Soaps,and syndet bars. Evolution and skin benfits.

UNIT V **07 Hours**

Oily and dry skin, causes leading to dry skin, skin moisturisation. Basic understanding of the terms Comedogenic, dermatitis.

Cosmetic problems associated with Hair and scalp: Dandruff, Hair fall causes

Cosmetic problems associated with skin: blemishes, wrinkles, acne, prickly heat and body odor.

Antiperspirants and Deodorants- Actives and mechanism of action

References

1) Harry's Cosmeticology, Wilkinson, Moore, Seventh Edition, George Godwin.
2) Cosmetics – Formulations, Manufacturing and Quality Control, P.P. Sharma, 4th Edition, Vandana Publications Pvt. Ltd., Delhi.
3) Text book of cosmelicology by Sanju Nanda & Roop K. Khar, Tata Publishers.

BP810 ET. PHARMACOLOGICAL SCREENING METHODS

45 Hours

Scope: This subject is designed to impart the basic knowledge of preclinical studies in experimental animals including design, conduct and interpretations of results.

Objectives

Upon completion of the course the student shall be able to,

- Appreciate the applications of various commonly used laboratory animals.
- Appreciate and demonstrate the various screening methods used in preclinical research
- Appreciate and demonstrate the importance of biostatistics and researchmethodology
- Design and execute a research hypothesis independently

Unit –I	**08 Hours**
Laboratory Animals: Study of CPCSEA and OECD guidelines for maintenance, breeding and conduct of experiments on laboratory animals, Common lab animals: Description and applications of different species and strains of animals. Popular transgenic and mutant animals. Techniques for collection of blood and common routes of drug administration in laboratory animals, Techniques of blood collection and euthanasia.	
Unit –II	**10 Hours**
Preclinical screening models a. Introduction: Dose selection, calculation and conversions, preparation of drug solution/suspensions, grouping of animals and importance of sham negative and positive control groups. Rationale for selection of animal species and sex for the study. b. **Study of screening animal models for** Diuretics, nootropics, anti-Parkinson's,antiasthmatics, **Preclinical screening models:** for CNS activity- analgesic, antipyretic,anti-inflammatory, general anaesthetics, sedative and hypnotics, antipsychotic, antidepressant, antiepileptic, antiparkinsonism, alzheimer's disease	

Unit –III **Preclinical screening models:** for ANS activity, sympathomimetics, sympatholytics, parasympathomimetics, parasympatholytics, skeletal muscle relaxants, drugs acting on eye, local anaethetics	
Unit –IV **Preclinical screening models:** for CVS activity- antihypertensives, diuretics, antiarrhythmic, antidyslepidemic, anti aggregatory, coagulants, and anticoagulants Preclinical screening models for other important drugs like antiulcer, antidiabetic, anticancer and antiasthmatics.	
Research methodology and Bio-statistics Selection of research topic, review of literature, research hypothesis and study design Pre-clinical data analysis and interpretation using Students 't' test and One-way ANOVA. Graphical representation of data	**05 Hours**

Recommended Books (latest edition):

1. Fundamentals of experimental Pharmacology-by M.N.Ghosh
2. Hand book of Experimental Pharmacology-S.K.Kulakarni
3. CPCSEA guidelines for laboratory animal facility.
4. Drug discovery and Evaluation by Vogel H.G.
5. Drug Screening Methods by Suresh Kumar Gupta and S. K. Gupta
6. Introduction to biostatistics and research methods by PSS Sundar Rao and J Richard

BP 811 ET. ADVANCED INSTRUMENTATION TECHNIQUES

45 Hours

Scope: This subject deals with the application of instrumental methods in qualitative and quantitative analysis of drugs. This subject is designed to impart advanced knowledge on the principles and instrumentation of spectroscopic and chromatographic hyphenated techniques. This also emphasizes on theoretical and practical knowledge on modern analytical instruments that are used for drug testing.

Objectives: Upon completion of the course the student shall be able to

- understand the advanced instruments used and its applications in drug analysis
- understand the chromatographic separation and analysis of drugs.
- understand the calibration of various analytical instruments
- know analysis of drugs using various analytical instruments.

Course Content:

UNIT-I **10 Hours**

Nuclear Magnetic Resonance spectroscopy

Principles of H-NMR and C-NMR, chemical shift, factors affecting chemical shift, coupling constant, Spin - spin coupling, relaxation, instrumentation and applications

Mass Spectrometry- Principles, Fragmentation, Ionization techniques – Electron impact, chemical ionization, MALDI, FAB, Analyzers-Time of flight and Quadrupole, instrumentation, applications

UNIT-II **10 Hours**

Thermal Methods of Analysis: Principles, instrumentation and applications of ThermogravimetricAnalysis (TGA), Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC)

X-Ray Diffraction Methods: Origin of X-rays, basic aspects of crystals, X-ray

Crystallography, rotating crystal technique, single crystal diffraction,powder diffraction, structural elucidation and applications.

UNIT-III **10 Hours**

Calibration and validation-as per ICH and USFDA guidelines

Calibration of following Instruments

Electronic balance, UV-Visible spectrophotometer, IR spectrophotometer,

Fluorimeter, Flame Photometer, HPLC and GC

UNIT-IV **08 Hours**

Radio immune assay: Importance, various components, Principle, different methods, Limitation and Applications of Radio immuno assay

Extraction techniques:General principle and procedure involved in the solid phase extraction and liquid-liquid extraction

UNIT-V **07 Hours**

Hyphenated techniques-LC-MS/MS, GC-MS/MS, HPTLC-MS.

Recommended Books (Latest Editions)

1. Instrumental Methods of Chemical Analysis by B.K Sharma
2. Organic spectroscopy by Y.R Sharma
3. Text book of Pharmaceutical Analysis by Kenneth A. Connors
4. Vogel's Text book of Quantitative Chemical Analysis by A.I. Vogel
5. Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake
6. Organic Chemistry by I. L. Finar
7. Organic spectroscopy by William Kemp
8. Quantitative Analysis of Drugs by D. C. Garrett
9. Quantitative Analysis of Drugs in Pharmaceutical Formulations by P. D. Sethi
10. Spectrophotometric identification of Organic Compounds by Silverstein

BP 812 ET. DIETARY SUPPLEMENTS AND NUTRACEUTICALS

No. of hours :3 **Tutorial:1** **Credit point:4**

Scope :

This subject covers foundational topic that are important for understanding the need and requirements of dietary supplements among different groups in the population.

Objective:

This module aims to provide an understanding of the concepts behind the theoretical applications of dietary supplements. By the end of the course, students should be able to :

1. Understand the need of supplements by the different group of people to maintain healthy life.
2. Understand the outcome of deficiencies in dietary supplements.
3. Appreciate the components in dietary supplements and the application.
4. Appreciate the regulatory and commercial aspects of dietary supplements including health claims.

UNIT I **07 hours**

a. Definitions of Functional foods, Nutraceuticals and Dietary supplements. Classification of Nutraceuticals, Health problems and diseases that can be prevented or cured by Nutraceuticals i.e. weight control, diabetes, cancer, heart disease, stress, osteoarthritis, hypertension etc.
b. Public health nutrition, maternal and child nutrition, nutrition and ageing, nutrition education in community.
c. Source, Name of marker compounds and their chemical nature, Medicinal uses and health benefits of following used as nutraceuticals/functional foods: Spirulina, Soyabean, Ginseng, Garlic, Broccoli, Gingko, Flaxseeds

UNIT II **15 hours**

Phytochemicals as nutraceuticals: Occurrence and characteristic features(chemical nature medicinal benefits) of following

a) Carotenoids- α and β-Carotene, Lycopene, Xanthophylls, leutin
b) Sulfides: Diallyl sulfides, Allyl trisulfide.
c) Polyphenolics: Reservetrol
d) Flavonoids- Rutin , Naringin, Quercitin, Anthocyanidins, catechins, Flavones
e) Prebiotics / Probiotics.: Fructo oligosaccharides, Lacto bacillum
f) Phyto estrogens : Isoflavones, daidzein, Geebustin, lignans
g) Tocopherols
h) Proteins, vitamins, minerals, cereal, vegetables and beverages as functional foods: oats, wheat bran, rice bran, sea foods, coffee, tea and the like.

UNIT III **07 hours**

a) Introduction to free radicals: Free radicals, reactive oxygen species, production of free radicals in cells, damaging reactions of free radicals on lipids, proteins, Carbohydrates, nucleic acids.

b) Dietary fibres and complex carbohydrates as functional food ingredients..

UNIT IV **10 hours**

a) Free radicals in Diabetes mellitus, Inflammation, Ischemic reperfusion injury, Cancer, Atherosclerosis, Free radicals in brain metabolism and pathology, kidney damage, muscle damage. Free radicals involvement in other disorders. Free radicals theory of ageing.

b) Antioxidants: Endogenous antioxidants – enzymatic and nonenzymatic antioxidant defence, Superoxide dismutase, catalase, Glutathione peroxidase, Glutathione Vitamin C, Vitamin E, α- Lipoic acid, melatonin
Synthetic antioxidants: Butylated hydroxy Toluene, Butylated hydroxy Anisole.

c) Functional foods for chronic disease prevention

UNIT V **06 hours**

a) Effect of processing, storage and interactions of various environmental factors on the potential of nutraceuticals.

b) Regulatory Aspects; FSSAI, FDA, FPO, MPO, AGMARK. HACCP and GMPs on Food Safety. Adulteration of foods.

c) Pharmacopoeial Specifications for dietary supplements and nutraceuticals.

References:

1. Dietetics by Sri Lakshmi
2. Role of dietary fibres and neutraceuticals in preventing diseases by K.T Agusti and P.Faizal: BSPunblication.
3. Advanced Nutritional Therapies by Cooper. K.A., (1996).
4. The Food Pharmacy by Jean Carper, Simon & Schuster, UK Ltd., (1988).
5. Prescription for Nutritional Healing by James F.Balch and Phyllis A.Balch 2nd Edn., Avery Publishing Group, NY (1997).
6. G. Gibson and C.williams Editors *2000 Functional foods* Woodhead Publ.Co.London.
7. Goldberg, I. *Functional Foods*. 1994. Chapman and Hall, New York.
8. Labuza, T.P. 2000 Functional Foods and Dietary Supplements: Safety, Good Manufacturing Practice (GMPs) and Shelf Life Testing in *Essentials of Functional Foods* M.K. Sachmidl and T.P. Labuza eds. Aspen Press.
9. Handbook of Nutraceuticals and Functional Foods, Third Edition (Modern Nutrition)
10. Shils, ME, Olson, JA, Shike, M. 1994 *Modern Nutrition in Health and Disease*. Eighth edition. Lea and Febiger

Semester VIII – Elective course on Pharmaceutical Product Development

No of Hours: 3 Tutorial:1 Credit points:4

Unit-I **10 Hours**

Introduction to pharmaceutical product development, objectives, regulations related to preformulation, formulation development, stability assessment, manufacturing and quality control testing of different types of dosage forms

Unit-II **10 Hours**

An advanced study of Pharmaceutical Excipients in pharmaceutical product development with a special reference to the following categories

i. Solvents and solubilizers
ii. Cyclodextrins and their applications
iii. Non - ionic surfactants and their applications
iv. Polyethylene glycols and sorbitols
v. Suspending and emulsifying agents
vi. Semi solid excipients

Unit-III **10 Hours**

An advanced study of Pharmaceutical Excipients in pharmaceutical product development with a special reference to the following categories

i. Tablet and capsule excipients
ii. Directly compressible vehicles
iii. Coat materials
iv. Excipients in parenteral and aerosols products
v. Excipients for formulation of NDDS

Selection and application of excipients in pharmaceutical formulations with specific industrial applications

Unit-IV **08 Hours**

Optimization techniques in pharmaceutical product development.A study of various optimization techniques for pharmaceutical product development with specific examples.Optimization by factorial designs and their applications.A study of QbD and its application in pharmaceutical product development.

Unit-V **07 Hours**

Selection and quality control testing of packaging materials for pharmaceutical product development- regulatory considerations.

Recommended Books (Latest editions)

1. Pharmaceutical Statistics Practical and Clinical Applications by Stanford Bolton, CharlesBon; Marcel Dekker Inc.
2. Encyclopedia of Pharmaceutical Technology, edited by James swarbrick, Third Edition,Informa Healthcare publishers.
3. Pharmaceutical Dosage Forms, Tablets, Volume II, edited by Herbert A. Lieberman andLeon Lachman; Marcel Dekker, Inc.
4. The Theory and Practice of Industrial Pharmacy, Fourth Edition, edited by Roop kKhar, S P Vyas, Farhan J Ahmad, Gaurav K Jain; CBS Publishers and Distributors Pvt.Ltd. 2013.
5. Martin's Physical Pharmacy and Pharmaceutical Sciences, Fifth Edition, edited by Patrick J. Sinko, BI Publications Pvt. Ltd.
6. Targeted and Controlled Drug Delivery, Novel Carrier Systems by S. P. Vyas and R. K.Khar, CBS Publishers and Distributors Pvt. Ltd, First Edition 2012.
7. Pharmaceutical Dosage Forms and Drug Delivery Systems, Loyd V. Allen Jr., Nicholas B.Popovich, Howard C. Ansel, 9th Ed. 40
8. Aulton's Pharmaceutics – The Design and Manufacture of Medicines, Michael E. Aulton,3rd Ed.
9. Remington – The Science and Practice of Pharmacy, 20th Ed.
10. Pharmaceutical Dosage Forms – Tablets Vol 1 to 3, A. Liberman, Leon Lachman andJoseph B. Schwartz
11. Pharmaceutical Dosage Forms – Disperse Systems Vol 1 to 3, H.A. Liberman, Martin, M.R and Gilbert S. Banker.
12. Pharmaceutical Dosage Forms – Parenteral Medication Vol 1 & 2, Kenneth E. Avis andH.A. Libermann.
13. Advanced Review Articles related to the topics.

REGULATIONS 2016

CURRICULUM AND SYLLABI

B.C.A

DATA SCIENCE

VISION AND MISSION OF THE INSTITUTION

VISION

B.S. Abdur Rahman Crescent Institute of Science and Technology aspires to be a leader in Education, Training and Research in Engineering, Science, Technology and Management and to play a vital role in the Socio-Economic progress of the Country.

MISSION

- To blossom into an internationally renowned Institution
- To empower the youth through quality education and to provide professional leadership
- To achieve excellence in all its endeavors to face global challenges
- To provide excellent teaching and research ambience
- To network with global institutions of Excellence, Business, Industry and Research Organizations
- To contribute to the knowledge base through Scientific enquiry, Applied research and Innovation

VISION AND MISSION OF THE DEPARTMENT OF COMPUTER APPLICATIONS

VISION

Aspires to provide quality education in the field of computer applications with state of the art computational facilities and undertake quality research in collaboration with industries and universities to produce committed professionals and academicians to meet the needs of the industries and society.

MISSION

The Department of Computer Applications, endeavors

- To disseminate knowledge through education and training of graduates in the field of computer applications.
- To focus on teaching - learning, research and consultancy to promote excellence in computer applications.
- To foster graduates with opportunities required to explore, create and face challenges of IT related industries.
- To equip the graduates with the necessary skills in communication, team work and leadership qualities to meet the needs of the IT related sector globally.
- To disseminate the outcome of projects and research work undertaken by the department through appropriate measures for the benefit of society and industry.

PROGRAMME EDUCATIONAL OBJECTIVES:

The students of BCA- Data Science Programme would be able to

- Produce graduates who will be competent professionals in IT industry, academics, government, or entrepreneurs.
- Adapt to the fast changing world of Information Technology needs.
- Become effective collaborators and through innovative methodologies, they will be able to address the social, technical and business challenges.
- Be a good team player and in course of time will be able to lead the team to find solutions and improvements in their field of expertise.
- Communicate efficiently and effectively.
- Function in multiple disciplinary teams.
- Understand the need for lifelong learning and IT skill up gradation, through taking up certifications or higher education.
- Understand professional and ethical responsibilities.

PROGRAMME OUTCOMES:

On successful completion of the programme, the graduates will have

- Ability to apply the knowledge of mathematics, science and information technology concepts..
- Have basic knowledge of programming and create first level programs.
- To Fulfill the concept of Statistics and Probability with Statistical Analysis.
- Implement Statistical concept for Data Analysis using tools.
- Knowledge of RDBMS with programming language used for Data Science.
- Applying data analysis on Big Data.
- Have knowledge of Artificial Intelligence with Machine Learning Algorithms.
- Ability to communicate efficiently with team.

B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE & TECHNOLOGY

B.C.A DATA SCIENCE

CURRICULUM & SYLLABUS, REGULATIONS 2016

SEMESTER I

Sl. No.	Course Code	Course Title	L	T	P	C	
1	ENC1182	General English – I	3	0	0	3	
2	MAC1187	Algebra, Calculus and Trigonometry	3	1	0	4	
3	CAC1102	Computer Fundamentals & Organization	3	0	0	3	
4	CAC1103	Programming in C	3	0	0	3	
5	CAC1121	Operating System	3	1	0	4	
6	CAC1122	Programming in C Lab	0	0	4	2	
7	CAC1123	Linux& Shell Programming Lab	0	0	4	2	**21**

SEMESTER II

Sl. No.	Course Code	Course Title	L	T	P	C
1	ENC1283	General English – II	3	0	0	3
2	MAC1288	Probability and Statistics	3	1	0	4
3	CAC1221	Introduction to Data Science	3	1	0	4
4	CAC1203	OOPS with C++	3	0	0	3
5	CAC1204	Data Structures using C	3	0	0	3
6	CAC1222	Programming in C++ Lab	0	0	4	2

7	CAC1223	Data Structures and Algorithms Lab	0	0	4	2	
8	CAC1256	Environmental Studies	2	0	0	2	
9	CAC1224	Communication Skills	3	0	0	-	**23**

SEMESTER III

Sl. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	
1	CAC2101	Reasoning and Thinking	3	0	0	3	
2	CAC2121	Database Management Systems	3	0	0	3	
3	CAC2105	Computer Networks	3	0	0	3	
4	CAC2122	Linear Algebra	3	1	0	4	
5	CAC2123	Scientific Programming Using R	3	0	0	3	
6	CAC2124	Database Management Systems Lab	0	0	4	2	
7	CAC2125	Scientific Programming Using R Lab	0	0	4	2	**20**

SEMESTER IV

Sl. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	CAC2221	Inferential Statistics	3	0	0	3
2	CAC2222	NoSQL Databases	3	0	0	3
3	CAC2223	Big Data Analytics	3	0	0	3
4	CAC2224	Cloud Computing	3	1	0	4

5	CAC2225	Exploratory Data Analysis	3	1	0	4	
6	CAC2226	Inferential Statistics Lab	0	0	4	2	
7	CAC2227	Big Data Analytics Lab	0	0	4	2	
8	CAC2228	Employability Skills	3	0	0	-	**21**

SEMESTER V

Sl. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	
1	CAC3121	Times Series Analysis	3	0	0	3	
2	CAC3122	Data Analytics using MS Excel and SQL	3	0	2	4	
3	CAC3123	Machine Learning Algorithms	3	0	0	3	
4		Elective – I	3	0	0	3	
5		Elective – II	3	1	0	4	
6	CAC3124	Times Series Analysis Lab	0	0	4	2	
7	CAC3125	Machine Learning Algorithms Lab	0	0	4	2	**21**

SEMESTER VI

Sl. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**	
1		Elective – III	3	0	0	3	
2	CAC3221	Project and Viva-Voce	0	0	0	16	**19**

TOTAL CREDITS – 125

LIST OF PROGRAMME ELECTIVES

ELECTIVE I

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	CACX40	Internet of Things	3	0	0	3
2.	PE	CACX10	Artificial Intelligence	3	0	0	3
3.	PE	CACX16	Mobile Computing	3	0	0	3

ELECTIVE II

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	CACX41	Python Programming	3	1	0	4
2.	PE	CACX42	Java Programming	3	1	0	4
3.	PE	CACX43	Data Visualization	3	1	0	4

ELECTIVE III

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	CACX44	Data Science Project Management	3	0	0	3
2.	PE	CACX45	Software Engineering	3	0	0	3
3.	PE	CACX46	Agile Methodology	3	0	0	3

ENC1182	GENERAL ENGLISH - I	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To help the students acquire efficiency in Spoken English through role plays.
- To enable them to make Presentation effectively.
- To develop reading skills among students through extensive readers.
- To orient them in writing letters.
- To train them in appreciating and interpreting English literature.

MODULE I **7**

Oral and Written Communication – implications in real life and workplace situations
Essential English Grammar - 1-6 units

MODULE II **8**

One–minute Presentations (JAM) on concrete and abstract topics that test their creative thinking (ii) Prepared presentations and extempore presentations
Short Story ; O Henry - “Robe of Peace” (Extensive Reading)

MODULE III **8**

Role-Play – establishing a point of view - convincing someone on social issues such as
preservation of water, fuel, protection of environment, gender discrimination.
Poetry: William Shakespeare - “All the World’s a Stage”

MODULE IV **8**

Letter Writing- Letter of Invitation & Permission
Developing story from hints- Short Story : John Galsworthy - “Quality” (Extensive Reading)

MODULE V **8**

Précis Writing- Writing instructions and recommendations
Reading Comprehension: Short Story**--**Rudyard Kipling – “The Miracle of Puran Bhagat”(Extensive Reading)

MODULE VI **6**

Written correspondence - - e-mail writing

Prose : Education, Employment, Unemployment

TOTAL HOURS – 45

TEXT BOOKS:

1. 'Prism: Spoken and Written Communication, Prose & Poetry', Orient Longman

REFERENCES:

1. Anderson, Kenneth & et.al. "Study Speaking : A Course in Spoken English for
2. Academic Purposes" (Second Edition). Cambridge University Press, UK. 2004.
3. Sharma, R.C. & Krishna Mohan, "Business Correspondence and Report Writing".
4. Tata MacGraw – Hill Publishing Company Limited, New Delhi. 2002
5. Hurlock, B. Elizabeth. "Personality Development". Tata McGraw Hill, New York. 2004.
6. Krishnaswamy. N, Sriraman T. **Current English for Colleges.** Hyderabad: Macmillan Indian Ltd, 2006.
7. Dahiya SPS. Ed. **Vision in Verse- An Anthology of Poems**. New Delhi: Oxford University Press, 2002
8. Murphy, Raymond. **Essential English Grammar**. New Delhi: Cambridge University Press, 2009.
9. Seshadri, K G Ed. **Stories for Colleges.** Chennai: Macmillan India Ltd, 2003.

OUTCOMES:

Students would be able to

- Actively take part in role plays
- Make effective presentation s
- Read and comprehend various texts.
- Write letters without making mistakes.
- Analyse literary texts.

MAC1187	ALGEBRA, CALCULUS AND TRIGONOMETRY	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To develop the skills of students in applying basic concepts in chosen topics of mathematics that are imperative for effective understanding of application oriented topics.
- To understand the basic concepts of matrices and know the importance of rank of matrix in data science.
- To know the importance of equation in data science models and its transformation.
- To understand the importance of differential calculus in estimation of linear models and to find the optimal values in minima and maxima.
- To know the basic concepts of integral calculus in statistical distribution functions.
- Laying the foundation for learning concepts of Trigonometry and inverse functions.

MODULE I MATRICES **(9+3)**

Symmetric – Skew-Symmetric - Orthogonal and Unitary matrices - Rank of a Matrix -Consistency - Characteristic equation - Eigenvalues and Eigenvectors - properties -Cayley Hamilton's Theorem (proof not needed) - Simple applications.

MODULE II THEORY OF EQUATIONS **(9+3)**

Partial Fractions - Theory of equations- Polynomial Equations with real Coefficients -Irrational roots - Complex roots - Symmetric functions of roots - Transformation of equation by increasing or decreasing roots by a constant - Reciprocal equations.

MODULE III DIFFERENTIAL CALCULUS **(9+3)**

Rules of differentiation - Derivative of implicit function - Successive differentiation nth derivatives - Leibnitz theorem (without proof) and applications - maxima and minima of functions of two variables - Partial differentiation - Euler's Theorem.

MODULE IV INTEGRAL CALCULUS **(9+3)**

Integration of rational functions - algebraic expressions involving only one irrational quantity- rational functions of sinx and cosx - Trigonometric substitutions - Bernoulli's formula for integration by parts - reduction formulae - properties of definite integral -Evaluation of double and triple integrals.

MODULE V TRIGONOMETRY **(9+3)**

De Moivre's theorem and its application - Circular and Hyperbolic functions – Inverse circular and hyperbolic functions - Expansion of trigonometric functions in terms of power and multiples - Separation of real and imaginary parts of logarithmic -trigonometric and inverse trigonometric functions - Summation of series including C+iS method.

TOTAL HOURS – 60

TEXT BOOKS:

1. Narayanan, S. and Manicavachagom Pillay, T.K. (2015) Calculus Vol. I,II &III S.Viswanathan (Printers & publishers) Pvt. Ltd., Chennai.
2. Venkataraman, M.K., "Higher Mathematics for Engineering and Science", Third Edition, The National Publishing Co., Madras, 1986.
3. Kandasamy P, K. Thilagavathi and K. Gunavathy- Allied Mathematics aper-I, First semester, 1/e, S. Chand & Co., New Delhi, 2003

REFERENCES:

1. Stewart J - Single Variable Calculus (4th edition) Brooks / Cole, Cenage Learning 2010.
2. Tom M. Apostol - Calculus, Vol. I (second edition) John Wiley and Sons, Inc., Jan 2007.
3. Burnside W.S. and A.W. Panton - The Theory of Equations, Dublin University Press, 1954.
4. MacDuffee, C.C. - Theory of Equations, John Wiley & Sons Inc., 1954.
5. Ushri Dutta, A.S.Muktibodh and S.D. Mohagaonkar: Algebra and Trigonometry, PHI India, 2006.

OUTCOMES:

On completion of the course the students will be able to

- Understand how Eigen values and vectors are calculated and its importance in data science.
- Classify and solve polynomial equations of different types.
- Differentiate different types of functions.
- Integrate rational and trigonometric functions and to evaluate definite integrals (double and triple).
- Demonstrate the application of Demoivre's theorem and find the sum of series of trigonometric functions.

CAC1102	COMPUTER FUNDAMENTALS &ORGANIZATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide the basic knowledge of how a computer works is very important for any fresh networking or operating system professional.
- To provide the functional knowledge of a computers working and its main building parts are paramount.
- To understand the basics of computers of today may come with variety of features but the basic working principles remain the same.
- To explore the fundamentals of organization of a computer and the principles and building units of a computer (its hardware).
- To understand the basics of networking and MS Office.

MODULE I GENERAL FEATURES OF A COMPUTER 9

General features of a computer, Generation of computers, Personal computer, workstation, mainframe computer and super computers. Computer applications – data processing, information processing, commercial, office automation, industry and engineering, healthcare, education, graphics and multimedia.

MODULE II COMPUTER ORGANIZATION 9

Computer organization, central processing unit, computer memory – primary memory and secondary memory, Secondary storage devices – Magnetic and optical media, Input and output units, OMR, OCR, MICR, scanner, mouse, modem.

MODULE III COMPUTER HARDWARE AND SOFTWARE 9

Computer hardware and software, Machine language and high level language, Application software, computer program, operating system, Computer virus, antivirus and computer security, Elements of MS DOS and Windows OS, Computer arithmetic, Binary, octal and hexadecimal number systems, Algorithm and flowcharts, illustrations, elements of a database and its applications, Basic Gates (Demorgans theorems, duality theorem, NOR, NAND, XOR, XNOR gates), Boolean expressions and logic diagrams, Types of Boolean expressions

MODULE IV MS OFFICE 9

Word processing and electronic spread sheet, An overview of MSWORD, MSEXCEL and MSPOWERPOINT

MODULE V INTRODUCTION TO NETWORKING 9

Network of computers, Types of networks, LAN, Intranet and Internet, Internet applications, World Wide Web, E-mail, browsing and searching, search engines, multimedia applications

TOTAL HOURS – 45

REFERENCES:

1. Alexis Leon and Mathews Leon (1999) : Fundamentals of information Technology, Leon Techworld Pub.
2. Jain, S K (1999) : Information Technology “O” level made simple, BPB Pub
3. Jain V K (2000) “O” Level Personal Computer software, BPB Pub.
4. Rajaraman, V (1999): Fundamentals of Computers, Prentice Hall India
5. Hamacher, Computer Organization McGrawhill
6. Alexis Leon: Computers for everyone. Vikas, UBS
7. Anil Madaan : Illustrated Computer Encyclopedia. Dreamland Pub
8. Sinha. Computer Fundamentals BPB Pub.

OUTCOMES:

Students are provided learning experiences that enable them to:

- Get in-depth knowledge about the general features of a computer.
- Be introduce them to various features of computer,
- Insight to the different software and hardware components of a computer will take them a step ahead in terms of what they can accomplish from their learning.
- Provides knowledge about fundamentals of organization of a computer.
- Provides knowledge of software in MS-Office.

CAC1103	PROGRAMMING IN C	L	T	P	C
		3	0	0	3

OBJECTIVES:

- The object oriented platforms and event driven systems use procedural languages for coding integral command content.
- C is an important procedural language and was developed initially to write the UNIX operating system.
- UNIX operating system, C compiler and all UNIX application programs are written in C.
- C is popular because, it is easy to learn, produces efficient programs, can handle low-level activities, and can be compiled on a variety of platforms.
- This course focuses on all the basic concepts, syntax and constructs of the C language.
- For students, who are new to programming, this unit can be considered as the starting point before taking up any other programming oriented units.

MODULE I OVERVIEW OF PROGRAMMING **9**

Introduction to computer based problem solving, Program design and implementation issues- Flowcharts & Algorithms, Top down design & stepwise refinement, **Programming environment** – Machine language, assembly language, high level languages, Assemblers, Compilers, Interpreters

MODULE II FUNDAMENTALS OF C PROGRAMMING **9**

Overview of C, Data Types, Constants & Variables, Operators & Expressions, **Control constructs**-if then, for, while, **Arrays**- single & multidimensional arrays, **Functions**-fundamentals – general form, function arguments, return value, **Basic I/O**-formatted and Unformatted I/O, **Advanced features**- Type modifiers and storage class specifiers for data types, Bit operators, ? operator, &operator, * operator, Type casting, type conversion.

MODULE III ADVANCED PROGRAMMING TECHNIQUES **9**

Control constructs- Do while, Switch statement, break and continue, exit() function, go to and label, **Scope rules**- Local & global variables, scope rules of functions, **Functions**-parameter passing, call by value and call by reference, calling functions

with arrays, argc and argv, recursion- basic concepts, ex-towers of Hanoi

MODULE IV DYNAMIC DATA STRUCTURES IN C 9

Pointers- The & and * operator, pointer expression, assignments, arithmetic, comparison, malloc vs calloc, arrays of pointers, pointers to pointers, initializing pointers, pointers to functions, function retuning pointers, **Structures**- Basics, declaring, referencing structure elements, array of structures, passing structures to functions, structure pointers, arrays and structures within structures, **Unions** – Declaration, uses, enumerated data-types, typedef

MODULE V ADDITIONAL FEATURES 9

File Handling – The file pointer, file accessing functions, fopen, fclose, puc, getc, fprintf, **C Preprocessor-** #define, #include, #undef, Conditional compilation directives, **C standard library and header files**: Header files, string functions, mathematical functions, Date and Time functions

TOTAL HOURS – 45

TEXT BOOKS:

1. Let us C by Yashwant Kanetka, 6th Edition, PBP Publication

REFERENCES:

1. The C programming Language by Richie and Kenninghan, 2004, BPB Publication
2. Programming in ANSI C by Balaguruswamy, 3rd Edition, 2005, Tata McGraw Hill

OUTCOMES:

- Students will learn how to write simple programs using C Language and execute them.
- Student will be able to understand the development of procedural codes is important in several commercial app developments.
- The students will be implementing the concepts explained here to create simple to complex programs.
- Student will get basic knowledge of C to learn, produces efficient programs, can handle low-level activities, and can be compiled on a variety of platforms.
- Understands the concepts of dynamic data structures using C.
- Student will understand the several high level languages and frameworks

CAC1121	OPERATING SYSTEM	L	T	P	C
		3	1	0	4

OBJECTIVES:

- The operating system is the most important program that runs on a computer.
- Every general-purpose computer must have an operating system to run other programs.
- Operating systems perform basic tasks, such as recognizing input from the keyboard.
- Sending output to the display screen, keeping track of files and directories on the disk, and controlling peripheral devices such as disk drives and printers.
- This course covers the concept of operating system and its applications.

MODULE I **INTRODUCTION TO OPERATING SYSTEM** **12**

Objectives and Functions of OS, Evolution of OS in the pretext of evolution of UNIX, OS Structures, OS Components, OS Services, System calls, System programs, commands to monitor and perform the operations,Virtual Machines.

MODULE II **PROCESS MANAGEMENT – PROCESSES AND THREADS** **12**

Processes in Unix environment: Process concept, Process scheduling, Co-operating processes, Inter process Communication Threads in Unix environment: Introduction to Threads, Single and Multi-threaded processes CPU Scheduling in Unix environment: Basic concepts, Scheduling criteria, Scheduling Algorithms, Multiple Processor Scheduling, Real-time Scheduling

MODULE III **PROCESS MANAGEMENT – SYNCHRONIZATION AND DEADLOCKS** **12**

Process Synchronization in Unix: Mutual Exclusion, Critical – section problem, Synchronization hardware, Semaphores, Classic problems of synchronization, Critical Regions, Monitors, OS Synchronization, Atomic Transactions. Deadlocks: System Model, Deadlock characterization, Methods for handling Deadlocks, Deadlock prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

MODULE IV **STORAGE MANAGEMENT** **12**

Memory Management in the Unix environment: Logical and physical Address Space,

Swapping, Contiguous Memory Allocation, Paging, Segmentation with Paging. Virtual Memory Management in Unix: Demand paging, Process creation, Page Replacement Algorithms, Allocation of Frames, Thrashing.

File-System Interface in UNIX: File concept, Access Methods, Directory structure, File-system Mounting, File sharing, Protection and consistency semantics. File-System Implementation: File-System structure. Directory Implementation, Allocation Methods, Free-space Management, Efficiency and Performance, Recovery. Disk Management: Disk Structure, Disk Scheduling, Disk Management, Swap-Space Management, Disk Attachment, stable-storage Implementation

MODULE V PROTECTION AND SECURITY 12

Protection: Goals of Protection, Domain of Protection, Security: Security Problem, User Authentication, One – Time Password, Program Threats, System Threats.

TOTAL HOURS – 60

TEXT BOOKS:

1. Operating System Concepts and design by Milan Milonkovic, II Edition, McGraw Hill 1992.
2. Operation System Concepts by Tanenbaum, 2nd Edition, Pearson Education.
3. Operating System by Silberschatz / Galvin / Gagne, 6th Edition,WSE (WILEY Publication)

REFERENCES:

1. Operating System by William Stallings, 4th Edition, Pearson Education.
2. Operating System by H.M.Deitel , 2nd Edition,Pearson Education
3. Operating System by Abraham Silberschatz and peter Baer Galvin, 8th Edition, Pearson Education 1989
4. Operating Systems by Nutt, 3/e Pearson Education 2004

OUTCOMES:

- After learning the fundamental concepts in Operating system including how OS has evolved over the years and different components of OS.
- Students will continue to more significant functions of OS like Process management,

storage and memory management etc.

- This will provide the necessary information for students to extract maximum benefits out of the OS while developing programs, working with applications and etc.
- To enable the students to have a hands on practical exposure to the Linux Red Hat Enterprise and make them prepared for the RHCE Certification.
- Student will be able to understand the security and protection of operating system.
- Students can learn storage management.

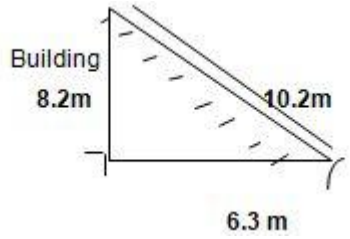
CAC1122	PROGRAMMING IN C LAB	L	T	P	C
		0	0	4	2

OBJECTIVES:

- For students, who are new to programming, this unit can be considered as the starting point before taking up any other programming oriented units.
- The students will be implementing the concepts explained here to create simple to complex programs.

LIST OF PROGRAMS

1. A cow is tied to a pole centered in field using 45 m rope. Write a C program to compute the total area that the cow is capable of grazing.
2. A ladder is laid onto a building such that the distance between the ladder and building is 6.3 m. The length of ladder is 10.2 m as shown below.Write a C program to calculate the area of triangle so formed.



3. Write a C program to find whether a given number is Odd or Even. Also if entered number is even, print half of that number and if odd, print double the number as output.
4. Rahul's birthday falls on 28th February 1994. Write a C program to check if given year is a leap year or not.
5. Heights of two classmates Priya and Lavanya are 163 cm and 171 cm respectively. Write a C program to find the person who is shorter among the two.
6. A patient is suffering from high fever with 104.2 F. Write a C program to find his body temperature in Celsius.
7. Write a C program to find Odd & Even numbers in n series.
8. A user has password 4221899 as his login credential for a banking website. His password is about to expire. He has to change his password and has decided that the new password would be the reverse of the existing one. Write a C program to display the newly changed password.
9. Write a C program to display a series such that the sum of two consecutive

numbers equals the next number in series. Let the first two numbers be 0 and 1.

10. Write a C program to find sum and average of first 99 numbers.
11. Write a C program to multiply consecutive numbers in series beginning from 1 till any n value as input.
12. Write a C program to find the sum of digits in a debit card's cvv number.
13. 5 passengers travelling to Bangalore have booked tickets in bus. The names of those members are Ajay, Pooja, Rohan, Arun and Sukanya and their respective age are 23,21,19,25 and 30.Write a C program to display these data using an array.
14. Rainfall received in few areas in Chennai were recorded as 31 cm, 11.64 cm, 16.87 cm, 28 cm and 23.5 cm. Write a C program to calculate total amount of rainfall and average rainfall received that day.
15. A health survey was conducted to record the weights of students in a class. Six among them had weights above 70 kg and they were recorded as 74 kg, 87kg, 79kg, 71 kg, 85 kg and 93kg. Write a C program to find the greatest weight using an array.
16. Consider an array in following order:
    58, 51, 35, 78, 15, 22 and 85. Write a C program to search the value 35.
17. The heights of ten students were marked as 163cm, 171 cm, 158 cm, 167cm, 175cm, 160cm, 173 cm, 149 cm, 180cm and 154cm.Write a C program to sort the given heights in ascending or descending order.
18. Consider the CAT 1 exam marks of 5 subjects for 5 students. Similarly CAT 2 exam marks as 2nd matrix. Write a C program to find the total marks obtained in CAT1 and CAT2 by those 5 students.
19. Ayisha has 5 five stars and 4 kitkats. Ashwin has 10 five stars and 3 kitkats. Both of them ate 2 five stars and 2 kitkats each. Write a C program to find the remaining chocolates left using matrix.
20. The quantity of stationary sold for 3 days are shown.Write a C program to find the product of the quantity of items mentioned below in the form of matrix.

Day/Item	Pen	Pencil	Eraser
Day 1	10	5	5
Day 2	8	4	2
Day 3	5	10	10
Day/Item	Notebook	Whitener	Marker
Day 1	3	6	5

Day 2	2	1	3
Day 3	5	4	15

21. A faculty entered marks of 6 students for 6 subjects in form of matrix. Later she realized that the order was incorrect(the rows and columns were interchanged). Write a C program to find the correct matrix of marks.
22. Write a C program to find factorial of a given number using Recursion.
23. Consider an array in following order:
    25, 33, 53, 65, 83, 87 and 92. Write a C program to search the value 83.
24. Write a C program to check if a given string is read the same both from the beginning as well as when read backwards.
25. Write a C program to store and display the student mark details for 3 students including name, department,subjects and respective marks using Structure.
26. Write a C program to input details(name, department,salary) for 3 employees into a file created and read the contents from the file to display all the details along with average salary of those employees on output terminal using suitable file handling functions.
    Create a scenario based on real time domain.

TOTAL HOURS :30

OUTCOMES:

- Students will write programs in C Language for lab experiments in this course and execute them.

CAC1123	LINUX & SHELL PROGRAMMING LAB	L	T	P	C
		0	0	4	2

OBJECTIVES:

- The students will be implementing the concepts of UNIX experiments.
- Explained here to create simple to complex programs the course provides an overview of the Linux Operating System.

LIST OF PROGRAMS

1. 1. Execute 25 basic commands of UNIX.
2. Basics of functionality and modes of VI Editor.
3. Create a file called vegetables and add the contents as follows
    - Brinjal
    - Carrot
    - Onion
    - Potato
    - Tomato

   Create one more file called Fruits and add the contents as follows
    - Apple
    - Banana
    - Cherry
    - Kiwi
    - Peach

a. Display the contents of the vegetables file on screen
b. Concatenate vegetables and fruits file and display the result
c. Show the difference between fruits and Vegetables
d. Add the content in the Fruits file as Mango, Grape

4. Create a directory called foods
    a) Move **vegetables and fruits to foods directory**
    b) Remove **vegetables** files from **foods**
    c) Comes out from foods
    d) List all the files from this directory
    e) Display all hidden files from the directory

5. Display the detailed result for the below

   a. Get manual help and display the detailed information about bash
   b. Display the time to be taken for executing a file
   c. Change the mode of a fruits file to Read only to all users
   d. Count the number of words in vegetables file.
   e. Count the Number of Characters in Fruits file.

6. Create a file called marklist and add the following data

SNo	Name	Subject	Marks
1.	ABCD	Physics	100
2.	XYZ	Chemistry	90
3.	MNO	Biology	88
4.	EFG	Computer	88

   a. Print the 3rd and 4th column on the screen alone
   b. Print a row which has ‘r’ character
   c. Print all columns
   d. Search **Computer** from the marklist file
   e. Replace ‘i’ to ‘x’ in the file marklist
   f. Remove a marklist from the directory

7. Create a file in vi editor and do the following

   a) Type 1-10 numbers and repeat it for two times using macros
   b) Find the current working directory inside vi editor
   c) Open two files horizontally
   d) Add line numbers
   e) Split the window
   f) Search all the occurrences of the word TEXT

8. Create a file in vi editor and do the following

   a) Insert a line in the beginning and end of line
   b) Yank the last line of the text and paste as first line.
   c) List all the files with detailed information from this directory inside vi editor
   d) Change all the occurrences of the word TEXT to UNIX
   e) Swap first and second paragraph

9. Disk related commands and communication commands in Unix
   a) Find the disk used space in your directory .
   b)Find disk free space in your directory with options.
   c) Send message to all users ,"To shutdown the System"
   d) Block other user from writing in your terminal
   e) Find the disk usage
10. Write a shell program to print all odd numbers between 10-30 .
11. Write a shell program that prompts user for a starting value and counts up from there and execute it.
12. Write a shell program to execute shell program which displays the menu and executes the option selected by user.

Menu

- who
- pwd
- ls –l
- who am i
- ls -a

13. Write a shell program to accept user name and reports if user log has logged in.
14. Create a data file called employee in the format given below:

a. EmpCode Character

b. EmpName Character

c. Grade Character

d. Years of experience Numeric

e. Basic Pay Numeric

$vi employee

A001	ARJUN	E1	01	12000.00
A006	Anand	E1	01	12450.00
A010	Rajesh	E2	03	14500.00

A002	Mohan	E2	02	13000.00
A005	John	E2	01	14500.00
A009	Denial Smith	E2	04	17500.00
A004	Williams	E1	01	12000.00

Perform the following functions on the file:

a. Sort the file on EmpCode.

b. Sort the file on

(i) Decreasing order of basic pay

(ii) Increasing order of years of experience.

c. Display the number of employees whose details are included in the file.

d. Display all records with ‘smith’ a part of employee name.

e. Display all records with EmpName starting with ‘B’.

f. Display the records on Employees whose grade is E2 and have work experience of 2 to 5 years.

g.Store in ‘file 1’ the names of all employees whose basic pay is between 10000 and 15000.

h.Display records of all employees who are not in grade E2.

15. Create a scenario based on real time domain.

TOTAL HOURS –30

OUTCOMES:

- To use Linux desktop and GNU tool chain with Eclipse IDE.
- Cross compile Linux kernel and port it to target board.
- Add applications and write customized application for the Linux kernel in the target board.

SEMESTER II

ENC1283	**GENERAL ENGLISH-II**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

- To prepare students for Interviews and Group Discussions
- To train them in writing official letters, resume' writing and reports.
- To train them in analysing different genre of literature.

MODULE I **7**

Filling Money Order Challan and Bank Challan
Short Story :G.K.Chesterton – The Hammer of God (Extensive Reading)
Essential English Grammar – 7-12 units

MODULE II **8**

Brainstorming – Think, pair and share activity
Poetry **:** Walt Whitman- I Celebrate Myself

MODULE III **8**

Dialogue Writing- Discussion etiquette -Assigning different roles in a GD (Note-taker, Manager, Leader and Reporter)
Prose**:** Environment

MODULE IV **8**

Interview skills- SWOT Analysis
Letter Writing- Letter to the Editor- Letter of Application and CV

MODULE V **8**

Report Writing- feasibility report and survey report
Short Story : Katherine Mansfield—A Cup of Tea (Extensive Reading)

MODULE VI **6**

Technical reports –Writing a technical report – format and content

TOTAL HOURS – 45

REFERENCES:

1. M. Ashraf Rizvi ‘Effective Technical Communication”. Tata McGraw – Hill Education, 2005. Gerson, Sharon & Steven M. Gerson, “ Technical Writing : Process and Product”
2. Pearson Education, New Delhi, 2004. 6. Riordan & Pauley. ‘Report Writing Today’. 9th Edition. Wadsworth Cengage Learning, USA. 2005.
3. Krishnaswamy. N, Sriraman T. **Current English for Colleges.** Hyderabad:
4. Macmillan Indian Ltd, 2006.
5. Dahiya SPS. Ed. **Vision in Verse- An Anthology of Poems**. New Delhi: Oxford
6. University Press, 2002.
7. Murphy, Raymond. **Essential English Grammar**. New Delhi: Cambridge
8. University Press, 2009.
9. Seshadri, K G Ed. **Stories for Colleges.** Chennai: Macmillan India Ltd, 2003.

OUTCOMES:

Students would be able to

- Take part in group discussions and interviews with confidence.
- Write official letters, their application letter with CV and reports.
- Analyse various genre of literature.

MAC1288	PROBABILITY AND STATISTICS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To impart knowledge about the basic concepts of probability in solving application oriented problems
- To provide an understanding on the concepts of statistics

Recap Introduction to Probability (4)

Sample space - events - algebraic operations on events - definition of probability - Conditional probability - addition and multiplication theorems of probability – Baye's theorem.

MODULE I RANDOM VARIABLES AND DISTRIBUTION FUNCTIONS (10+3)

Discrete and continuous random variables - distribution function and its properties - probability mass function and probability density function - discrete and continuous probability distributions - Binomial, Geometric, Poisson, Uniform, Exponential and Normal distributions.

MODULE II MOMENTS AND MOMENT GENERATING FUNCTIONS (8+3)

Expectation of a random variable – probability generating function – properties - moment generating function.

MODULE III TWO DIMENSIONAL RANDOM VARIABLES (6+3)

Joint, marginal and conditional distribution functions - independence of random variables.

MODULE IV DESCRIPTIVE STATISTICS (8+3)

Types of data - primary and secondary data - classification and representation of data -formation of frequency distribution - various measures of central tendency, dispersion - and their merits and demerits - concept of skewness and kurtosis.

MODULE V CORRELATION AND CURVE FITTING (9+3)

Correlation coefficient and regression - rank correlation - curve fitting by least square methods - fitting a straight line, parabola, power curve and exponential curves. (no derivation, numerical problems only)

TOTAL HOURS – 60

TEXT BOOKS:

1. Richard Arnold Johnson, Irwin Miller, John E. Freund , Miller & Freund's

2. Probability and Statistics for Engineers, Prentice Hall, 2011.
3. Dr. P. Kandaswamy, Dr. K. Thilagavathy and Dr. K. Gunavathy, Probability and Queuing Theory, Revised edition, S. Chand Publishing, 2013.
4. T. Veerarajan, Probability, Statistics and Random Processes, Tata McGraw Hill, 2nd edition.

REFERENCES:

1. Goon, A.M., M. K. Gupta and B. Das Gupta Fundamentals of Statistics- Vol. I, World Press Ltd, Kolkata, 2002.
2. Gupta, S.C. and V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi, 2002.
3. Hogg, R.V. and A. Craig, Introduction to Mathematical Statistics, McMillan Publishing co., Inc. 1978.
4. Mood A.M., F.A. Graybill and D.C. Boes, Introduction to Theory of Statistics McGraw Hill Book Co., 1974.
5. Sheldon M. Ross, Introduction to Probability and Statistics for Engineers and Scientists, Fourth Edition, Elsevier.

OUTCOMES:

On completion of the course the students will be able to

- solve basic problems in probability and fundamentals of statistics.
- solve problems using standard probability distributions.
- find the marginal and conditional distributions of two dimensional random
- variables.
- calculate rank correlation and fitting curves for the given data.
- use method of moments and moment generating functions.

CAC1221	INTRODUCTION TO DATA SCIENCE	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To understand the overview and definition of Data Science with its crucial role in current business world.
- To understand the importance of mathematics & Statistics in Data Science.
- To understand the role of machine learning techniques in Data Science and its different types.
- To know the integrated role of computers and its components in Data Science
- To understand the flow and process model of data science project management.

MODULE I **10**

Data Science - An Overview

Introduction to Data Science, Definition and description of Data Science, history and development of Data Science, terminologies related with Data Science, basic framework and architecture, difference between Data Science and business analytics, importance of Data Science in today's business world, primary components of Data Science, users of Data Science and its hierarchy, overview of different Data Science techniques, challenges and opportunities in business analytics, different industrial application of Data Science techniques.

MODULE II **15**

Mathematics and Statistics in Data Science

Role of mathematics in Data Science, importance of probability and statistics in Data Science, important types of statistical measures in Data Science : Descriptive, Predictive and prescriptive statistics, introduction to statistical inference and its usage in Data Science, application of statistical techniques in Data Science, overview of linear algebra : matrix and vector theory, role of linear algebra in Data Science, exploratory data analysis and visualization techniques, difference between exploratory and descriptive statistics, EDA and visualization as key component of Data Science.

MODULE III **15**

Machine Learning in Data Science

Role of machine learning in Data Science, different types of machine learning techniques

and its broad scope in Data Science : Supervised, unsupervised, reinforcement and deep learning, difference between different machine learning techniques, brief introduction to machine learning algorithms, importance of machine learning in today's business, difference between machine learning classification and prediction.

MODULE IV **10**

Computers in Data Science

Role of computer science in Data Science, various components of computer science being used for Data Science, role of relation data base systems in Data Science: SQL, NoSQL, role of data warehousing in Data Science, terms related with data warehousing techniques, importance of operating concepts and memory management, various freely available software tools used in Data Science : R, Python, important proprietary software tools, different business intelligence tools and its crucial role in Data Science project presentation.

MODULE V **10**

Machine Learning in Data Science

Role of machine learning in Data Science, different types of machine learning techniques and its broad scope in Data Science : Supervised, unsupervised, reinforcement and deep learning, difference between different machine learning techniques, brief introduction to machine learning algorithms, importance of machine learning in today's business, difference between machine learning classification and prediction.

TOTAL HOURS – 60

TEXT BOOKS:

1. Data Smart: Using Data Science to Transform Information into Insight 1st Edition by John W. Foreman. (2015) Wiley Publication.
2. Data Science from Scratch: First Principles with Python 1st Edition by Joel Grus .

REFERENCES:

1. Data Science For Dummies by Lillian Pierson (2015)
2. Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking by Foster Provost, Tom Fawcett

OUTCOMES:

- After completing this course, students will be able to appreciate the need of data science in day to day life.
- They will be able to understand the process and components of data science project.
- Student will the Learn importance of probability and statistics in data science
- Student will be able to understand the machine learning in today's business world.
- Understands the various components of computer science being used for data science
- Student will bale to understand the execution flow of a data science project

CAC1203	OOPS WITH C++	L	T	P	C
		3	0	0	3

OBJECTIVES:

- The main objective is to learn the basic concept and techniques which form the object oriented programming paradigm.
- Object-oriented programming is a new way of thinking about problem using models organizes around real world concept.
- The Fundamental construct is the object which combines both data-structure and behaviour in a single entity which is in contrast to conventional programming in which data-structure and behaviour are loosely connected.

MODULE I Introduction **9**

Evolution of programming methodologies-Procedure oriented versus Object Oriented Programming-characteristics of OOP, Basics of OOP, Merits and Demerits of OOP. **Data Types:** Different data types, operators and expressions in C++, Keywords in C++. **Input and Output:** Comparison of stido.h and iostream.h, cin and cout. **Decision and loop:** Conditional statement - if-else statement, nested if-else statement, switch, break, continue, and goto statements, Looping statements- for loop, while loop, Do-while loop. **Arrays, String and Structures :** fundamentals-Single dimensional, multi-dimensional arrays, fundamentals of strings, different methods to accept strings, different string manipulations, array of strings, Basics of structures-declaring and defining structure- Accessing structure members, array of structures, Unions difference between structures and Unions, Enumerated data types-declaration and their usage.

MODULE II **9**

Class: Definition-defining the class, defining data members and member functions, Access specifier-private, public, protected, objects as function arguments, returning objects from the function, scope resolution operator, and member function defined outside the class, difference between class and structure, array as class member data, Array of objects. **Functions in C++ :** Function definition, function declaration, Built-in functions, user defined functions, calling the function, passing parameter-actual and formal, different methods of calling the function call by value, call by reference using reference as parameter and pointer as parameter, overload

function-different types of arguments-different number of arguments, inline function, default argument, storage classes-automatic, external, static, register. **Constructor and Destructor:** Constructors-constructor with argument, constructor without arguments, constructor with default arguments, Dynamic constructor, constructor overloading, copy constructor, destructors, Manipulating private data members.

MODULE III **9**

Operator overloading: Defining operator overloading, overloading unary operator, overloading binary operator, manipulation of string using overloaded operator, rules for overloading operator.Data conversion: conversion between Basic types, conversion between objects & Basic types, conversion between objects of different classes. **Inheritance:** Base Class & derived class, defining derived classes, protected access specifier, public inheritance and private inheritance-member accessibility, constructors and destructors in derived classes, Level of inheritance-single inheritance, multiple inheritance, multi-level inheritance, hierarchical inheritance, hybrid inheritance.

MODULE IV **9**

Pointer: Pointer declaration and Access, Pointer to void, pointer and arrays, pointer constant and pointer variable, pointer and functions, pointer, call by pointer arrays, array of pointers to string, printer sort, memory management-new and delete, pointer to object-referencing members using pointers, self-containing class, this pointer, returning values using this pointer. **Virtual function:** Normal member functions accessed with pointers, virtual member function access, late binding, pure virtual function, abstract class, virtual base class. **Friend functions and static function:** Purpose, defining friend functions, friend classes, static function, accessing static function numbering positive objects.

MODULE V **9**

Templates and Exception Handling: Introduction to templates, class templates, function templates, Member function templates, Template arguments, Exception handling. **Console IO Operator:**C++ stream and C++ stream classes, unformatted I/O operators, formatted I/O operators-manipulators-user defined manipulators. **Files :** Class for file stream operators, opening and closing a file, file nodes, writing an object to disk, reading an object from disk, binary versus character files, I/O with multiple object, stream class, file pointer-specifying the position, specifying the

object, tellg() function, seekg() function. Command line arguments.

TOTAL HOURS – 45

TEXT BOOKS:

1. E. Balaguruswamy: Object Oriented Programming with C++, Tata McGraw Hill. Publications
2. Strousstrup: The C++ Programming Language, Pearson Edition, 3rd Edition
3. Lafore Robert: Object Oriented Programming in Turbo C++, Galgotia Publications

REFERENCES:

1. Lippman: C++ Primer, 3/e Pearson Education
2. C++ completer reference by Herbert Schildt, Tata McGraw Hill Publications.
3. Let us C++ by Yeshwanth Kanetkar

OUTCOMES:

- Students will learn how to write and execute programs using C++ Language.
- Student will be able to understand Merits and Demerits of OOP.
- Understands the concepts of arrays, strings & structure
- Will get to know the concepts of defining data members and member functions in a class
- Student will be able to understand the concepts of operator overloading
- Student can analyze the pointer declaration & addressing of variables.

CAC1204	DATA STRUCTURES USING C	L	T	P	C
		3	0	0	3

OBJECTIVES:

- A data structure is a particular way of storing and organizing data in a computer so that it can be used efficiently.
- Different kinds of data structures are suited to different kinds of applications and some are highly specialized to specific tasks.
- This course covers the basic concepts of different data structures which are the basic building blocks of Programming and problem solving.

MODULE I INTRODUCTION TO DATA STRUCTURES **9**

Definition, Classification of data structures: primitive and non primitive, Elementary data organization, Time and space complexity of an algorithm (Examples), String processing. Dynamic memory allocation and pointers: Definition of dynamic memory allocation, Accessing the address of a variable, Declaring and initializing pointers, Accessing a variable through its pointer, Meaning of static and dynamic memory allocation, Memory allocation functions: malloc(), calloc(), free() and realloc(). Recursion: Definition, Recursion in C (advantages), Writing Recursive programs – Binomial coefficient, Fibonacci, GCD.

MODULE II SEARCHING AND SORTING **9**

Basic Search Techniques: Sequential search: Iterative and Recursive methods, Binary search: Iterative and Recursive methods, Comparison between sequential and binary search. Sort: General background and definition, Bubble sort, Selection sort, Insertion sort, Merge sort, Quick sort

MODULE III STACK AND QUEUE **9**

Stack – Definition, Array representation of stack, Operations on stack: Infix, prefix and postfix notations, Conversion of an arithmetic expression from Infix to postfix, Applications of stacks. Queue: Definition, Array representation of queue, Types of queue: Simple queue, Circular queue, Double ended queue (deque) , Priority queue , Operations on all types of Queues

MODULE IV LINKED LIST **9**

Definition, Components of linked list, Representation of linked list, Advantages

and Disadvantages of linked list. Types of linked list: Singly linked list, doubly linked list, Circular linked list, Operations on singly linked list: creation, insertion, deletion, search and display.

MODULE V TREE GRAPHS AND THEIR APPLICATIONS: 9

Definition : Tree, Binary tree, Complete binary tree, Binary search tree, Heap Tree terminology: Root, Node, Degree of a node and tree, Terminal nodes, Non-terminal nodes, Siblings, Level, Edge, Path, depth, Parent node, ancestors of a node. Binary tree: Array representation of tree, Creation of binary tree. Traversal of Binary Tree: Preorder, Inorder and postorder. Graphs, Application of Graphs, Depth First search, Breadth First search.

TOTAL HOURS – 45

REFERENCES:

1. Weiss, Data Structures and Algorithm Analysis in C, II Edition, Pearson Education, 2001
2. Lipschutz: Schaum's outline series Data structures Tata McGraw-Hill
3. Robert Kruse Data Structures and program designing using 'C'
4. Trembley and Sorenson Data Structures
5. E. Balaguruswamy Programming in ANSI C.
6. Bandyopadhyay, Data Structures Using C Pearson Education, 1999
7. Tenenbaum, Data Structures Using C. Pearson Education, 200
8. Kamthane: Introduction to Data Structures in C. Pearson Education 2005.
9. Hanumanthappa M., Practical approach to Data Structures, Laxmi Publications, Fire Wall media 2006
10. Langsam, Ausenstein Maoshe & M. Tanenbaum Aaron Data Structures using C and C++ Pearson Education

OUTCOMES:

- Students will benefit from the knowledge of Data Structures.
- Understands the data structure different operating one can perform on these like searching, sorting, stacking.
- This forms a very strong foundation for programming in different languages that the students will take up in subsequent semesters or in any other course.

- Understand the concepts of Stack Queue.
- Student will able to analyze which sorting technique will be used.
- Student will get the knowledge of Tree Graphs and their Applications

CAC1222	PROGRAMMING with C++ LAB	L	T	P	C
		0	0	4	2

OBJECTIVES:

The aim of the course is to

- Understand and solve logical & mathematical problems through C++ language
- Strengthen knowledge of a procedural programming language.
- Design and develop solutions to intermediate level problems
- Develop their skills in software development using a procedural language
- Get programming skill of object oriented technology with the usage of C++.

LIST OF PROGRAMS

1. Number of vowels and number of characters in a string.
2. Write a function called zeros maller () that is passed with two introduce arguments by reference and set the smaller of the number to zero. Write a man() program to access this function.
3. Demonstration of array of object.
4. Using this pointer to return a value (return by reference).
5. Pointer sort.
6. Demonstration of virtual function.
7. Demonstration of static function.
8. Accessing a particular record in a student's file.
9. Using different methods to write programs to implement function overloading with default arguments for the following problems :

a) To find whether a given number is prime.

b) To find the factorial of a number

10. Write a program to create a database for a bank account contains Name, Account no, Account type, Balance, Including the following a) Constructors b) destructors call) default constructors d) input and output function ; input and output for 10 people using different methods.
11. Create a class to hold information of a husband and another for the wife. Using friend functions give the total salary of the family.
12. Write a program to overload the following operators (any 3)

a) Binary operator '+' to concatenate 2 strings

b) Relational operator '<' to find whether one data is less than the other

c) Unary operator '++' to find the next date of a given date.

13. Create a base class for a stack and implement push and pop operation. Include a derived class to check for stack criteria such as a) stack empty b)stack full c) stack overflow d) stack underflow.

14. Create a database using concepts of files for a student including the following fields : Student- name, Student's Reg No, Student's Attendance (overall % of attendance); and enter data for 10 students and output the same in proper format.

15. Using operator overloading concept implement arithmetic manipulation on two complex numbers.

16. Create a scenario based on real time domain.

TOTAL HOURS –30

OUTCOMES:

After completion of this course, the students would be able to

- Create classes and objects in C++.
- Implement inheritance, polymorphism and object relationship in C++.
- Design methods and procedure.
- Manipulate data through file in C++.
- Trained to write programs to produce the desired result

CAC1223	DATA STRUCTURES AND ALGORITHMS LAB	L	T	P	C
		0	0	4	2

OBJECTIVES:

The aim of the course is to:

- Understand the implementation of recursive functions and strings.
- Introduce the implementation of linked list and the various operations.
- Implement stack and queue using dynamic memory allocation.
- Introduce the Binary Search Tree implementation using C.
- Learn to implement various sorting and searching algorithms.

LIST OF PROGRAMS

1. Given with two numbers 36 and 60, write recursive function using C to find GCD of two numbers.
2. Write a recursive function using C program to display a series such that the sum of two consecutive numbers equals the next number in series. Let the first two numbers be 0 and 1.
3. Use a recursive function for the towers of Hanoi with three discs.
4. Two strings “Welcome” and “World” are provided. Write a program using pointers to find the length of a string and to concatenate the two strings.
5. String1 is stored with “Greater”. Write a program using pointers to copy string1 to string2 and to extract “Great” from string2.
6. Consider an array in following order:
   25, 33, 53, 65, 83, 87 and 92. Write a C program to insert the value 88 and remove 65.
7. Write a C Program using dynamic variables and pointers, to construct a singly linked list consisting of the following information n each node: student id (integer), student name (character string) and semester (integer). The operations to be supported are:
   a. The insertion operation
      i. At the front of a list
      ii. At the back of the list
      iii. At any position in the list

b. Deleting a node based on student id. If the specified node is not present in the list an error message should be displayed. Both the options should be demonstrated.

c. Searching a node based on student id and updating the information content. If the specified node is not present in the list an error message should be displayed. Both situations should be displayed.

d. Displaying all the nodes in the list.

8. The heights of ten students were marked as 163cm, 171 cm, 158 cm, 167cm, 175cm, 160cm, 173 cm, 149 cm, 180cm and 154cm. Find the difference while sorting the given heights in ascending or descending order using
    - Insertion sort
    - Selection Sort
    - Merge Sort
9. Write a C program to implement the following operations in stacks:
    - Push
    - Pop
    - Display
10. Write a C program to implement the following operations in queue:
    - Insert
    - Delete
    - Display

11. Create a binary search tree and traversing it using in order,pre order and post order.

12. Create a scenario based on real time domain.

TOTAL HOURS –30

OUTCOMES:

- At the end of the course, the students will be able to:
- Design and implement programs using recursive functions and strings.
- Implement linear data structures like stack, queue and linked list.
- Develop programs to implement Binary Search Tree.
- Implement searching algorithms.
- Implement and compare various sorting algorithms.
- Sort N numbers using merge sort

CAC1256 ENVIRONMENTAL STUDIES L T P C

2 0 0 2

OBJECTIVES:

To impart knowledge on

- Various natural resources, availability, utilization and its current scenario.
- Different ecosystems, energy transfer.
- Values, threats and conservation of biodiversity.
- Levels of different pollutants and its impact and the causes and effects of natural disasters

MODULE I NATURAL RESOURCES 8

Land resources: land degradation, soil erosion and desertification - Forest resources: use and over-exploitation, deforestation - Water resources: use and over-utilisation of surface and ground water, water conservation (rainwater harvesting and watershed management) - Food resources: world food problems, changes in land use by agriculture and overgrazing, modern agriculture and its effects - Energy resources: increasing energy needs, renewable and non-renewable, use of alternate energy sources.

MODULE II ECOSYSTEM 8

Ecosystem- energy flow in the ecosystem - food chains, food webs and ecological pyramids - characteristics, structure and function of (a) Terrestrial ecosystems (forest, grassland, desert) and (b) Aquatic fresh water ecosystems (pond, lake, river) (c) Aquatic salt water ecosystems (ocean, estuary) - ecological succession.

MODULE III BIODIVERSITY AND ITS CONSERVATION 8

Biodiversity - genetic, species and ecosystem diversity – hot-spots of biodiversity –bio geographic classification of India - endangered, endemic, extinct and invasive species of India - red data book - values of biodiversity: consumptive, productive, social, ethical, aesthetic and option values - threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts -

conservation of biodiversity: in-situ and ex-situ conservation of biodiversity

MODULE IV ENVIRONMENTAL POLLUTION AND NATURAL DISASTER **6**

Definition, cause, effects and control measures of (a) air pollution (b) water pollution (c) soil pollution (d) marine pollution (e) noise pollution (f) thermal pollution (g) nuclear hazards - ill-effects of fireworks and upkeep of clean environment - solid waste management: types (urban, industrial, biomedical and electronic wastes), collection, processing and disposal (incineration, composting and land-fill).

Natural disaster and management: flood, cyclone, drought, landslide, earthquake and tsunami.

Case studies related to current situation.

TOTAL HOURS – 30

TEXT BOOKS:

1. Erach Bharucha, Textbook for Environmental Studies For Undergraduate Courses of all Branches of Higher Education for University Grants Commission, Orient Blackswan Pvt Ltd, Hyderabad, India, 2013.
2. Benny Joseph, Environmental Studies, Tata McGraw-Hill Education, India, 2009.
3. Ravikrishnan A, Environmental Science and Engineering, Sri Krishna Publications, Tamil Nadu, India, 2015.
4. Raman Sivakumar, Introduction to Environmental Science and Engineering, McGraw Hill Education, India, 2009.
5. Venugopala Rao P, Principles of Environmental Science and Engineering, Prentice Hall India Learning Private Limited; India, 2006.
6. Anubha Kaushik and Kaushik C.P., Environmental Science and Engineering, New Age International Pvt Ltd., New Delhi, India, 2009.
7. Rajah G, Basic Environmental Studies, Margham Publications, Chennai, 2016.

REFERENCE BOOKS:

1. Masters G.M. and **Wendell P.,** Introduction to Environmental Engineering and Science, **3rd** Edition, Prentice Hall, New Delhi, 2007.
2. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co. Boston, USA, 2016.

OUTCOMES:

At the end of the course the student will be able to

- Predict the scenario of various natural resources and suggest remedies to curb the exploitation of these resources.
- Identify food chain and web and its role in various ecosystems.
- Assess the impacts on biodiversity and provide solutions to conserve it.
- Analyze the impacts of pollutants in the environment and propose suitable method to alleviate the pollutants and the natural disasters.

CAC1224	COMMUNICATION SKILLS	L	T	P	C
		3	0	0	0

OBJECTIVES:

- The objective of this course is to make students feel the significance of communicating well and how it can have a profound effect in both our professional and personal lives.
- Students will learn various aspects of managerial writing including report writing.
- Business writing like Quote creation, Business letters, Orders, Complains and etc. are also taught to students.

MODULE I TECHNICAL VOCABULARY 9

Technical Vocabulary, Punctuation, Numerical Expressions, Expanding Acronyms and Abbreviations, Concord, 'If' clauses, Infinitives. Homonyms, Homographs and Homophones, Telephone conversations, Reading Comprehensions, Making of an advertisement.

MODULE II BASIC SKILLS-READING AND SPEAKING SKILLS 9

Reading and interpretation, Intensive reading,. Writing reviews on books and films, Descriptions, Process description, Summarizing, Instructions, Oral presentations. Debate.

MODULE III BASIC SKILL: TECHNICAL WRITING SKILL 9

Letters – formal, informal, Cover Letter and CV, Synonyms and Antonyms, Indefinite Adjectives, Non-verbal communication, Interactive sessions. Role Plays, Critical reading, Listening and Note taking.

MODULE IV BASIC SKILL: LISTENING AND SPEAKING SKILLS 9

Active and Passive Voice, Impersonal Passive, Essay Writing, Comprehension Passage, Editing, Correction of errors, Direct and Indirect, Conversations , Dialogue writing, Discourse Markers. Group activities.

MODULE V TECHNICAL WRITING AND COMMUNICATION 9

Reports – Types, structure, data collection, content, form, Definitions, extended definition, Recommendations, Memos, Checklists. Group Discussions, Listening and

comprehending the conversations.

TOTAL HOURS –45

TEXT BOOKS:

1. Department of English, Anna University, Mindscapes, 'English for Technologists and Engineers', Orient Longman Pvt. Ltd, Chennai: 2012.
2. Department of Humanities and Social Sciences, Anna University, ''English for Engineers and Technologists'' Combined Edition (Volumes 1 and 2), Chennai: Orient Longman Pvt. Ltd., 2006.
3. M.Ashraf Rizvi, "Effective Technical Communication",Tata mcGraw-Hill Publishing Company Limited, New Delhi.2009.

REFERENCES:

1. Sumant. S, 'Technical English', Second Edition, McGraw-Hill Education (India) Pvt. Ltd., 2008.
2. Dr. M. Hariprasad," Communicative English "Third Edition, Neelkamal Publications, PVT. LTD.,2007.
3. Sangeeta Sharma , Binod Mishra, 'Communication Skills for Engineers and Scientists, PHI Learning Private Limited., New Delhi, 2009.

OUTCOMES:

- Students shall overcome their inhibitions and limitations in communication and become effective communicators.
- They will learn to compose letters in English error-free and communicate effectively with their peers, colleagues, managers and so on, via appropriate business communication forms.
- Student will able to understand the Basic skills-reading and speaking skills.
- Student will understand the concept of Basic skill: technical writing skill.
- Student will able understand Basic skill: listening and speaking skills.
- At the end of the semester students will be able to Technical writing and communication.

SEMESTER-III

CAC2101 REASONING AND THINKING

L	T	P	C
3	0	0	3

OBJECTIVES:

- It is the objective of the course to introduce to the students, concepts like Reasoning and thinking.
- which are very important for any individual in every aspect and walk of life
- To assists them in taking the right decisions, approach every problem with diligence and perform action accordingly.

MODULE I VERBAL ABILITY **9**

Synonyms**,** Antonyms and One word substitutes

MODULE II BASIC QUANTITATIVE APTITUDE **9**

Speed, Time and Distance, Time and Work, Linear Equations, Progressions (Sequences & Series), Permutation and Combination, Probability, Functions, Set Theory, Number Systems, LCM and HCF, Percentages, Collection and Scrutiny of data: Primary data, questionnaire and schedule; secondary data, their major sources including some government publications

MODULE III LOGICAL REASONING - I **9**

Number and Letter Series, Calendars, Clocks, Cubes, Venn Diagrams, Binary Logic, Seating Arrangement, Logical Sequence, Logical Matching, Logical Connectives, Syllogism. Blood Relations; concept of a statistical population and sample from a population; qualitative and quantitative data.

MODULE IV MEASURES OF CENTRAL TENDENCY **9**

Objective of averaging, characteristics of good average, types of average, arithmetic mean of grouped and ungrouped data, correcting incorrect values, weighted arithmetic mean

Median - median of grouped and ungrouped data merit and limitation of median, computation of quartile, decile and percentileMode - calculation of mode of grouped and ungrouped data, merits and limitation of mode, relationship between mean, median and mode. Geometric mean and Harmonic mean.

MODULE V PRESENTATION OF DATA 9

Construction of tables with one or more factors of classification; Diagrammatic and Graphical representation of non-frequency data; Frequency distribution, cumulative frequency distribution and their graphical representation - histogram, Column Graphs, Bar Graphs, Line Charts, Pie Chart, Data Interpretation – Introduction and approach

TOTAL HOURS =45

TEXT BOOKS:

1. Bajpai, N. Business Statistics, Pearson, 2010
2. Sharma J.K., Business Statistics, Pearson Education India, 2010.
3. Richard I Levin, David S. Rubin: Statistics for Management, Pearson Prentice Hall Education Inc. Ltd, NewDelhi, 5th Ed.

REFERENCES:

1. Anderson; David R, Dennis J. Sweeney and Thomas A. Williams, Quantitative Methods for Business, Prentice-Hall, WestPublishing Company, 1996.
2. CAT Complete course, UPKAR publications

OUTCOMES:

At the end of this course, the students will be able to:

- Understand Verbal ability activities and concepts
- Participate in solving questions in aptitude
- Solve logical reasoning questions.

CAC2121 DATABASE MANAGEMENT SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

The aim of the course is to

- Provide an introduction to the management of database systems.
- Understand the fundamentals of relational systems including data models, database architectures, and database manipulations.
- Provide knowledge about relational database model.
- Learn the basic concepts of databases in general with an emphasis on relational databases, modeling techniques and writing queries.
- Understand Normalization techniques, Transaction processing, Concurrency Control techniques and Recovery of databases against crashes are also covered.

MODULE I INTRODUCTION 9

Purpose of Database System -– Views of data – Data Models – Database Languages –– Database System Architecture – Database users and Administrator – Entity– Relationship model (E-R model) – E-R Diagrams -- Introduction to relational databases

MODULE II RELATIONAL MODEL 9

The relational Model – The catalog- Types– Keys - Relational Algebra – Domain Relational Calculus – Tuple Relational Calculus - Fundamental operations – Additional Operations- SQL fundamentals, Oracle data types, Data Constraints, Column level & table Level Constraints, working with Tables, Defining different constraints on the table, Defining Integrity Constraints in the ALTER TABLE Command, Select Command, Logical Operator, Range Searching, Pattern Matching, Oracle Function, Grouping data from Tables in SQL, Manipulation Data in SQL. Joining Multiple Tables (Equi Joins), Joining a Table to itself (self Joins), Sub queries Union, intersect & Minus Clause,

MODULE III SQL VIEWS, INDEX AND TRIGGERS 9

Creating view, Renaming the Column of a view, Granting Permissions, - Updating, Selection, Destroying view Creating Indexes, Creating and managing User, Integrity – Triggers - Security – Advanced SQL features –Embedded SQL– Dynamic SQL-

Missing Information– Views – Introduction to Distributed Databases and Client/Server Databases

MODULE IV DATABASE DESIGN 9

Functional Dependencies – Non-loss Decomposition – Functional Dependencies – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form-Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form

MODULE V TRANSACTIONS 9

Transaction Concepts - Transaction Recovery – ACID Properties – System Recovery – Media Recovery – Two Phase Commit - Save Points – SQL Facilities for recovery –Concurrency – Need for Concurrency – Locking Protocols – Two Phase Locking – Intent Locking – Deadlock- Serializability – Recovery Isolation Levels – SQL Facilities for Concurrency.

TOTAL HOURS =45

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, Fifth Edition, Tata McGraw Hill,2006
2. Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, Fourth Edition, Pearson/Addision Wesley.2007
3. Raghu Ramakrishnan, “Database Management Systems”, Third Edition, McGraw Hill.2003

REFERENCES:

1. S. Sumathi, S. Esakkirajan, "Fundamentals of Relational Database Management Systems", Springer Science & Business Media.
2. N. P. Singh, C.S. Gupta, "Relational Database Management Systems", Abhishek Publications, 15-May-2014

OUTCOMES:

The student will be able to:

- Write queries, transactions and different modelling techniques in a relational database.
- Normalize data and know its techniques.
- Find the familiarity with relational database model.
- Understand fundamentals of relational systems including data models.

CAC2105	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

This course provides a comprehensive introduction to

- Basics of networking and networking technology
- Networking and its underlying principles.
- Fundamentals of layered models, devices used in networks and their wireless connectivity.
- The ways to troubleshoot network related issues.
- Protocols, standards and the models associated with networking technology and their troubleshooting mechanisms.

MODULE I NETWORKING FUNDAMENTALS 9

Basics of Network & Networking, Advantages of Networking, Types of Networks, Network Terms- Host, Workstations, Server, Client, Node, Types of Network Architecture- Peer-to-Peer & Client/Server, Workgroup Vs. Domain. Network Topologies, Types of Topologies, Logical and physical topologies, selecting the Right Topology, Types of Transmission Media, Communication Modes, Wiring Standards and Cabling- straight through cable, crossover cable, rollover cable, media connectors (Fiber optic, Coaxial, and TP etc.) Introduction of OSI model, Seven layers of OSI model, Functions of the seven layers, Introduction of TCP/IP Model, TCP, UDP, IP, ICMP, ARP/RARP, Comparison between OSI model & TCP/IP model. Overview of Ethernet Addresses

MODULE II BASICS OF NETWORK DEVICES 9

Network Devices- NIC- functions of NIC, installing NIC, Hub, Switch, Bridge, Router, Gateways, And Other Networking Devices, Repeater, CSU/DSU, and modem, Data Link Layer: Ethernet, Ethernet standards, Ethernet Components,Point-to-Point Protocol(PPP),PPP standards, Address Resolution Protocol, Message format, transactions, Wireless Networking: Wireless Technology, Benefits of Wireless Technology, Types of Wireless Networks: Ad-hoc mode, Infrastructure mode, Wireless network Components: Wireless Access Points, Wireless NICs, wireless LAN standards: IEEE 802.11a, IEEE 802.11b, IEEE 802.11g, wireless LAN

modulation techniques, wireless security Protocols: WEP,WPA, 802.1X, Installing a wireless LAN

MODULE III BASICS OF NETWORK, TRANSPORT AND APPLICATION LAYERS **9**

Network Layer: Internet Protocol (IP), IP standards, versions, functions, IPv4 addressing, IPv4 address Classes, IPv4 address types, Subnet Mask, Default Gateway, Public & Private IP Address, methods of assigning IP address, IPv6 address, types, assignment, Data encapsulation, The IPv4 Datagram Format, The IPv6 Datagram Format, Internet Control Message Protocol (ICMP), ICMPv4, ICMPv6, Internet Group Management Protocol (IGMP),Introduction to Routing and Switching concepts, Transport Layer: Transmission Control Protocol(TCP), User Datagram Protocol (UDP), Overview of Ports & Sockets, Application Layer: DHCP, DNS, HTTP/HTTPS, FTP, TFTP, SFTP, Telnet, Email: SMTP, POP3/IMAP, NTP

MODULE IV WAN TECHNOLOGY **9**

What Is a WAN?, WAN Switching, WAN Switching techniques Circuit Switching, Packet Switching etc., Connecting to the Internet : PSTN, ISDN, DSL, CATV, Satellite-Based Services, Last Mile Fiber, Cellular Technologies, Connecting LANs : Leased Lines, SONET/SDH, Packet Switching, Remote Access: Dial-up Remote Access, Virtual Private Networking, SSL VPN, Remote Terminal Emulation, Network security: Authentication and Authorization, Tunneling and Encryption Protocols, IPSec, SSL and TLS, Firewall, Other Security Appliances, Security Threats

MODULE V NETWORK OPERATING SYSTEMS AND TROUBLESHOOTING NETWORK **9**

Network Operating Systems: Microsoft Operating Systems, Novell NetWare, UNIX and Linux Operating Systems, Macintosh Networking, Trouble Shooting Networks: Command-Line interface Tools, Network and Internet Troubleshooting, Basic Network Troubleshooting : Troubleshooting Model, identify the affected area, probable cause, implement a solution, test the result, recognize the potential effects of the solution, document the solution, Using Network Utilities: ping, traceroute, tracert, ipconfig, arp, nslookup, netstat, nbtstat, Hardware trouble shooting tools, system monitoring tools.

TOTAL HOURS =45

TEXT BOOKS:

1. CCNA Cisco Certified Network Associate: Study Guide (With CD) 7th Edition (Paperback), Wiley India, 2011
2. CCENT/CCNA ICND1 640-822 Official Cert Guide 3 Edition (Paperback), Pearson, 2013.

REFERENCES :

1. Routing Protocols and Concepts CCNA Exploration Companion Guide (With CD) (Paperback), Pearson, 2008

2. CCNA Exploration Course Booklet : Routing Protocols and Concepts, Version 4.0 (Paperback), Pearson, 2010

OUTCOMES:

The student will be able to:

- Develop knowledge and skills required to take up vendor certifications in the networking domain.
- Understand how communication works in data networks
- Learn the role of protocols in networking.
- Analyze the services and features of the various layers of data networks

CAC2122 **LINEAR ALGEBRA**

L	T	P	C
3	1	0	4

OBJECTIVES:

- To understand the basic concepts of vector spaces and matrices
- To understand the inverse of matrix and its application in data science
- To understand the system of linear equation and its representation in business studies
- To understand the importance of Eigen values and Eigen Vectors in dimension reduction techniques.
- To understand the basic concepts in application of tree in data science.

MODULE I **9**

Introduction to Linear Algebra, Field Theory: Characteristic of a field, Subfield and prime field, Extension of fields, Finite and infinite extensions, Algebraic element,

MODULE II **9**

Minimal polynomial of an algebraic element, Algebraic and transcendental extensions, Splitting fields, Multiple roots, Separable and inseparable extensions, Finite fields, Galois theory, Mono-morphisms and their linear independence, Normal extensions, Fundamental theorem of Galois theory.

MODULE III **9**

Vector Spaces: Vector spaces, Subspaces, Quotient spaces, Linear dependence, Basis, Dimension, Algebra of linear transformations, Matrix representation of linear transformations, Change of basis.

MODULE IV **9**

Canonical Forms: Linear transformations and their characteristic roots and vectors, Minimal polynomial of a linear transformation, Geometric and algebraic multiplicity, Singular and non-singular transformations,

MODULE V **9**

Minimal polynomial of a vector relative to a linear transformation, Triangular form, Jordan canonical form. Applications of Linear Algebra in data science.

TEXT BOOKS:

1. Linear Algebra concepts and methods – Martin Anthony, Michele Harvey, Cambridge University Press

2. Singh, Surjeet and ZameeruddinQazi, Modern Algebra, Vikas Publishing House, (2006).

3. Hoffmann, K. and Kunze R., Linear algebra, PHI, (2011).

REFERENCES:

1. Bhattacharya, P.B., Jain, S.K. and Nagpaul, S.R. Basic Abstract Algebra, Cambridge University Press (1997).

2. Luthar, I.S., and Passi, I.B.S., Algebra (Vol. 4), Narosa Publishing House (2004).

OUTCOMES:

Upon completion of this course, the student will be able to:

- Put a matrix into reduced row echelon form using row operations
- Recognize consistent and inconsistent systems of equations by the row echelon form of the augmented matrix
- Understand the importance of Eigen values and Eigen vectors in data dimension reduction techniques.
- Understand the application of cosine projection in producing the non-correlated variables.
- Apply graph theory in data mining techniques.
- Understand tree structures and its importance in data science.

CAC2123 SCIENTIFIC PROGRAMMING USING R

L	T	P	C
3	0	0	3

OBJECTIVES:

The student will be able to:

- Understand the R programming environment and data important R Statistical Packages.
- Know functions writing in R and important points in Comments and commands.
- Understand the important programming concepts of R, class and objects.
- Work with basic R commands, packages, accessing R packages, writing R functions, debugging, profiling R code, and organizing and commenting R code.

MODULE I **9**

Introduction to scientific programming, R basics, code editors for R, finding help, control structures, conditional executions, loops.

MODULE II **9**

Functions in R, useful utilities, debugging utility, regular expressions, interpreting character string as expression, time-date-sleep, calling external software with system commands, running R commands.

MODULE III **9**

Object oriented programming in R, define class and objects in R, assign generics and methods.

MODULE IV **9**

Packages in R, installation process of various packages in R, data science packages in R, Building R packages.

MODULE V **9**

Comparison of R with other scientific programming software, implementation of various industry use cases of scientific programming using R.

TEXT BOOKS:

1. Mark Gardener, Beginning R: The Statistical Programming Language (2013).
2. Roger Peng R Programming for Data Science (2016)

REFERENCES:

3. Grolemund, Garrett, Hands-On Programming with R (2014)
4. Garrett Wickham, Garrett Grolemund, R for Data Science (2017)

OUTCOMES:

Upon completion of the course, students will be able to

- Know how to install R packages and invoking the same for data analysis.
- Program in R and how to use R for effective data analysis.
- Know the important statistical packages for data analytics.
- Know the data management like importing different data types and exporting the same into different file format.
- Understand the environment and describe generic programming language concepts as they are implemented in a high-level statistical language.
- Implement various concepts learnt in earlier courses like statistics and probability, linear algebra etc.

CAC2124 DATABASE MANAGEMENT SYSTEMS LAB

L	T	P	C
0	0	4	2

OBJECTIVES:

The Students will be able to:

- Provide practical experience to students and reinforce the theory concepts.

LIST OF PROGRAMS:

1. Create User in Oracle Database and grant and revoke the privileges and use of commit save point rollback command.
2. Create the following:
   - Synonym sequences and Index
   - Create alter and update views.
3. Create PL/SQL program using cursors, control structure, exception handling
4. Create following:
   - Simple Triggers
   - Package using procedures and functions.
5. Create the table for
   - COMPANY database
   - STUDENT database and Insert five records for each attribute.
6. Illustrate the use of SELECT statement
7. Conditional retrieval - WHERE clause
8. Query sorted - ORDER BY clause
9. Perform following:
   - UNION, INTERSECTION and MINUS operations on tables.
   - UPDATE, ALTER, DELETE, DROP operations on tables

10. Query multiple tables using JOIN operation.
11. Grouping the result of query - GROUP BY clause and HAVING clause
12. Query multiple tables using NATURAL and OUTER JOIN operation.
13. Create a scenario based on real time domain

OUTCOMES:

- Students will work on the tasks provided to them in the form of experiments and write programs to produce the desired result.

CAC2125 SCIENTIFIC PROGRAMMING USING R Lab

L	T	P	C
0	0	4	2

OBJECTIVES:

The Aim of the course is to:

- Provide students a hands-on exposure to scientific programming using R.
- Provide wider knowledge to know about data structures in R and its types.
- Know about the statistical modeling with real time data.
- Know the customized graphical techniques in R using inbuilt graph packages.

LIST OF PROGRAMS:

1. Install and configure R, set working directory.
2. Implement basic R operations (data input, missing values, importing data into R)
3. Use R as a calculator
4. Explore various functionalities of dataframes
5. Explore various functionalities of plots
6. Formal data exploration in R
7. Data summary in R
8. Sampling distribution and central limit theorem in R
9. Linear regression model in R
10. Data visualization using ggplots in R.
11. Create a scenario based on real time domain

Case Study - 1
Scientific Programming using R Lab

The air pollution is one of the main causes of serious respiratory problem in the world especially difficulty in breathing in asthmatic patients. Several cities are on the radar of WHO (World Health Organization), which are about to touch the dangerous level. Sadly, India is one of the countries with maximum number of most polluted cities in the world.

Especially, on the onset of Diwali, the air quality index of Chennai soars to new heights. This year the air quality index has already crossed last year's post Diwali index.

To know the intricacies of the problem, we decided to do an analytical study for the factors that contribute most to air pollution in Chennai.

In this article, we share a case study on "Identifying Patterns in Chennai's Air Pollution", in which we closely studied the air quality data for Chennai, identified patterns, factors that lead to rise in air pollution across three key locations in Chennai.

On this occasion of Diwali, we want to sensitize the readers towards celebrating environmentally safe Diwali this year.

The rate at which urban air pollution has grown across India is alarming. A vast majority of cities are caught in the toxic web as air quality fails to meet health-based standards. Almost all cities are reeling under severe particulate pollution while newer pollutants like oxides of nitrogen and air toxics have begun to add to the public health challenge.

According to WHO, India ranks among the world's most polluted countries. Out of the 20 most polluted cities in the world, 13 are in India. In which, Chennai is the one among the most polluted city in India today.

Exposure to particulate matter for a long time can lead to respiratory and cardiovascular diseases such as asthma, bronchitis, lung cancer and heart attack. Last year, the Global Burden of Disease study pinned outdoor air pollution as the fifth largest killer in India, after high blood pressure, indoor air pollution, tobacco smoking, and poor nutrition. In 2010, about 620,000 early deaths in India occurred from air pollution-related diseases. The Central Pollution Control Board (CPCB) sponsored the study that links the pollutants, pm 10 (particulate matter smaller than 10 microns), the cause of these diseases. The central regulatory authority recently regulated stricter norms for a number of air toxins and pollutants but omitted revision of the standard for pm 10.

We feel, if we closely study the Air Quality Data, we should be able to identify patterns (spike in air pollution levels) and identify correlating factors on key levels of Air Pollution across Chennai. Also as part of the exercise, we wanted to study the impact of Government sponsored Initiatives like 'Odd-Even' Pilot Project Phase II. The Phase I of the 'Odd- Even' experiment was a huge success in terms of people compliance and reduction of traffic congestion, it had very little impact on the Air Pollution levels during the Campaign period.

It is also important to understand the behaviour of meteorological parameters in the planetary boundary layer because, atmosphere is the medium in which air pollutants are transported away from the source, which is governed by the meteorological parameters such as atmospheric wind speed, wind direction, and temperature.

Air pollutants are being let out into the atmosphere from a variety of sources, and the concentration of pollutants in the ambient air depends not only on the quantities that are emitted but also the ability of the atmosphere, either to absorb or disperse these pollutants.

There were conflicting reports in media on the actual cause of air pollution in Chennai. Some sections claimed vehicles as the main source of pollution, while others held road dust & construction debris responsible. But the root cause of the problem is Industrial pollution.

Through this study, we hope to develop some insights that can help organizations (State / Central Pollution Control Boards & NGOs) to advocate more stringent policies to control air pollution.

- Study Air Pollution Data for various locations in Chennai to identify patterns of spike in Air Pollution levels w.r.t to various monitored parameters
- Identify the Meteorological factors that correlate with the air pollution levels for the respective locations using R Functions
- Explore the possibility of developing a Predictive Model for predicting the levels for key pollutants like PM 5 using suitable R predictive model.
- Explore the factors which most impact on air pollution PM 5 using R PCA analysis and Factor Analysis.

Case Study - 2
Scientific Programming using R Lab

High concentrations of certain harmful algae in rivers constitute a serious ecological problem with a strong impact not only on river life forms, but also on water quality. Being able to monitor and perform an early forecast of algae blooms is essential to improving the quality of rivers.

With the goal of addressing this prediction problem, several water samples were collected in different European rivers at different times during a period of approximately 1 year. For each water sample, different chemical properties were measured as well as the frequency of occurrence of seven harmful algae. Some other characteristics of the water collection process were also stored, such as the season of the year, the river size, and the river speed.

One of the main motivations behind this application lies in the fact that chemical monitoring is cheap and easily automated, while the biological analysis of the samples to identify the algae that are present in the water involves microscopic examination, requires trained manpower, and is therefore both expensive and slow. As such, obtaining models that are able to accurately predict the algae frequencies based on chemical properties would facilitate the creation of cheap and automated systems for monitoring harmful algae blooms.

Another objective of this study is to provide a better understanding of the factors influencing the algae frequencies. Namely, we want to understand how these frequencies are related to certain chemical attributes of water samples as well as other characteristics of the samples (like season of the year, type of river, etc.).

The data available for this problem was collected in the context of the ERUDIT1 research Network and used in the COIL 1999 international data analysis competition. It is available from several sources, such as in the UCI Machine Learning Repository of data sets.2 There are two main datasets for this problem. The first consists of data for 200 water samples. To be more precise, each observation in the available datasets is in effect an aggregation of several water samples collected from the same river over a period of 3 months, during the same season of the year. Each

observation contains information on 11 variables. Three of these variables are nominal and describe the season of the year when the water samples to be aggregated were collected, as well as the size and speed of the river in question. The eight remaining variables are values of different chemical parameters measured in the water samples forming the aggregation.

Exercise:

1. Load the Data into R
2. Visualize and summarize data and interpret
3. Find Data normality assumptions
4. Remove the Observations with Unknown Values
5. Fill in the Unknowns with the Most Frequent Values
6. Fill in the Unknown Values by Exploring Correlations
7. Fill in the Unknown Values by Exploring Similarities between Cases

OUTCOMES:

After completing this lab, students will be able to:

- Work on R, use its features in the field of data science.
- Understand the statistical model building and post testing.
- Understand the graphical techniques in R.

SEMESTER-IV

CAC2221 **INFERENTIAL STATISTICS** **L T P C**

3 0 0 3

OBJECTIVES:

- To understand the basic concepts of statistical inference and different estimation methods.
- To understand testing of hypothesis with important terminologies related with testing of hypothesis.
- To know the difference between large and small sample test.
- To know about the non-parametric testing procedures.

MODULE I **9**

Introduction to Statistical Inference, Estimation of Parameters, Point estimation, Properties of a good estimate, Methods of estimation: Maximum Likelihood method, Interval estimation: Confidence Interval for mean, variance and proportion.

MODULE II **9**

Testing of hypothesis: Introduction, Type I and Type II error, Null hypothesis and Alternative hypothesis, Simple and Composite hypothesis, Critical Region of the test, Significance level of the test, Power of the test, p value, Procedure for a statistical test.

MODULE III **9**

Large Sample test: Test for specified mean, test for equality of means, test for a specified proportion, and test for equality of proportions (Derivations not required).

MODULE IV **9**

Small sample Test: Test for specified mean, test for equality of means, Paired t test, test for specified variance, and test for equality of variances (Derivations not required).

MODULE V **9**

Chi Square Test: Goodness of fit, test for independence, test of homogeneity,

Analysis of Variance: Introduction, one way classification, two-way classification. (Derivations not required).

TEXT BOOKS:

1. S.C. Gupta and V.K. Kapoor: Fundamentals of Mathematical Statistics, Sultan, Chand & Sons.
2. S.P. Gupta: Statistical Methods, Sultan, Chand & Sons.
3. Rao C R (1985) Linear Statistical Inference and its Applications (2^{nd} edition), Wiley Eastern Limited.

REFERENCES:

1. Miller and Freund: Probability and Statistics for Engineers, Pearson Education.
2. B.L. Agarwal: Basic Statistics, New Age International (P) Ltd.
3. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers.

OUTCOMES:

- After completing this course, students will be able to:
- Implement the concepts of inferential statistics in real world scenarios.
- They will be able to apply hypothesis testing
- Implement various statistical tools to test the homogeneity and independence.
- Student will able to understand the Testing of hypothesis.
- Student will able to analyze test for equality of variances.

CAC2222 **NOSQL DATABASES**

L	T	P	C
3	0	0	3

OBJECTIVES:

The course is aimed at:

- Provide students an exposure to unstructured data.
- Work with query unstructured database.

MODULE I: INTRODUCING NOSQL **9**

The value of Relational Databases, Disadvantages of Relational Databases, A Brief History of NoSQL, Features of NoSQL : Features of NoSQL, ACID vs. BASE, Managing Different Data Types

MODULE II: DATA MODELS **9**

Aggregates, key-value and document data models, Column-Family Stores, relationships, graph databases, schema-less databases, materialized views. Distribution models: Single Server, sharding, master-slave replication, peer-peer replication, sharding and replication

MODULE III: UPDATE AND READ CONSISTENCY **9**

Update Consistency, Read Consistency. Relaxing Consistency: Relaxing Consistency, Relaxing Durability

MODULE IV: NOSQLDATABASES **9**

Key-Value Databases, Document Databases, Column-Family Stores

MODULE V: GRAPH DATABASES **9**

Graph Databases, Beyond NoSQL.

TEXT BOOKS:

1. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence",Copyright © 2013 Pearson Education, Inc. 2012.
2. NoSQL For Dummies®, 2015 by John Wiley & Sons, Inc
3. Professional NoSQL, Shashank Tiwari, Wrox
4. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.

REFERENCES:

1. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
2. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
3. “MongoDB: The Definitive Guide” by Kristina Chodorow

OUTCOMES:

At the end of the course, the students will be able to:

- Identify the use of unstructured data.
- Know the knowledge of features of NO SQl Data Base.
- Know the Key-Value Databases, Document Databases.
- Learn various concepts of Graph Databases .
- Analyze the advantage & disadvantages of Relational database .

CAC2223 **BIG DATA ANALYTICS**

L	T	P	C
3	0	0	3

OBJECTIVES:

This course aimed to:

- Introduce the concepts of big data analytics to the students.
- Introduces the big data framework, its characteristics and use cases associated with it.
- A concise introduction to Hadoop framework will prepare students to handle industry scenarios of big data analytics.

MODULE I

Introduction to Big Data, Characteristics and its Use Case **9**

Introduction – Why Big data - What is big data – Facts about Big Data - importance of Big Data Evaluation of Big Data – Market Trends – Sources of Data Explosion – Types of Data – Case Study for Netflix and the house of card. Need of Big Data – Big Data and its sources – Characteristics of Big Data – Difference between Traditional IT Approach and Big Data Technology – Capabilities of Big Data – Handling Limitations of Big Data - Technologies Supporting Big Data - Big Data Use Cases.

MODULE II

Introduction to Hadoop **9**

Introduction – Why Hadoop – What is Hadoop – History and Milestone of Hadoop – Core Components of Hadoop – Difference between Regular File System and HDFS – Common Hadoop Shell Commands – Hadoop Configuration.

MODULE III

Hadoop Distributed File System (HDFS) **9**

Concepts and Architecture - Data Flow (File Read, File Write) - Fault Tolerance - Java Base API - Different Daemons in Hadoop cluster (NameNode, Secondary NameNode, Job Tracker, Task Tracker and DataNode) - Loading a dataset into the HDFS.

MODULE IV

Introduction to YARN and MapReduce **9**

What is YARN – YARN Infrastructure - Introduction of MapReduce – Analogy of MapReduce – MapReduce Architecture - Example of MapReduce –Sorting, Shuffling – Reducing – Combiner – Partitioner – Creating MapReduce program by using Eclipse.

MODULE V

Introduction to Big Data Streaming **9**

Real time Big Data Streaming, Big data streaming framework, data streaming process, tools for big data streaming, industry use cases for big data streaming.

TEXT BOOKS:

1. Seema Acharya (Author), Subhashini Chellappan, Big Data and Analytics (2015). Wiley Publication.
2. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data (2015), EMC Education Services

REFERENCES:

1. Big Data, Black Book: Covers Hadoop 2, MapReduce, Hive, YARN, Pig, R and Data Visualization (2016), DT Editorial Services
2. Tom White, Hadoop: The Definitive Guide, 4th Edition (2015)

OUTCOMES:

At the end of the course, the students will be able to:

- Understand the characteristics of big data.
- Explore Hadoop framework and its components.
- Use HDFS and Map Reduce to analyze various industry use cases of big data analytics.
- Understand the YARN Infrastructure.
- Learning different Sorting, Shuffling.

CAC2224 **CLOUD COMPUTING**

L	T	P	C
3	1	0	4

OBJECTIVES:

- Cloud computing is a colloquial expression used to describe a variety of different computing concepts that involve a large number of computers involves a large number of computers that are connected through a real-time communication network.
- In science, cloud computing is a synonym for distributed computing over a network and means the ability to run a program on many connected computers at the same time.
- This course covers basic concepts of cloud types, services and security etc.

MODULE I: Introduction **9**

Introduction to Cloud Computing, History and Evolution of Cloud Computing, Types of clouds, Private Public and hybrid clouds, Cloud Computing architecture, Cloud computing infrastructure, Merits of Cloud computing, , Cloud computing delivery models and services (IaaS, PaaS, SaaS), obstacles for cloud technology, Cloud vulnerabilities, Cloud challenges, Practical applications of cloud computing.

MODULE II: Cloud Computing Companies and Migrating to Cloud **9**

Web-based business services, Delivering Business Processes from the Cloud: Business process examples, Broad Approaches to Migrating into the Cloud, The Seven-Step Model of Migration into a Cloud, Efficient Steps for migrating to cloud., Risks: Measuring and assessment of risks, Company concerns Risk Mitigation methodology for Cloud computing, Case Studies

MODULE III: Cloud Cost Management and Selection of Cloud Provider **9**

Assessing the Cloud: software Evaluation, System Testing, Seasonal or peak loading, Cost cutting and cost-benefit analysis, selecting the right scalable application. Considerations for selecting cloud solution. Understanding Best Practices used in selection of Cloud service and providers, Clouding the Standards

and Best Practices Issue: Interoperability, Portability, Integration, Security, Standards Organizations and Groups associated with Cloud Computing, Commercial and Business Consideration

MODULE IV: Governance in the Cloud **9**

Industry Standards Organizations and Groups associated with Cloud Computing, Need for IT governance in cloud computing, Cloud Governance Solution: Access Controls, Financial Controls, Key Management and Encryption, Logging and Auditing, API integration. Legal Issues: Data Privacy and Security Issues, Cloud Contracting models, Jurisdictional Issues Raised by Virtualization and Data Location, Legal issues in Commercial and Business Considerations

MODULE V: Ten cloud do an do nots **9**

Don't be reactive, do consider the cloud a financial issue, don't go alone, do think about your architecture, don't neglect governance, don't forget about business purpose, do make security the centerpiece of your strategy, don't apply the cloud to everything, don't forget about Service Management, do start with a pilot project.

TEXT BOOKS:

1. Cloud Computing: Principles and Paradigms, Rajkumar Buyya, James Broberg, Andrzej M. Goscinski,, John Wiley and Sons Publications, 2011

REFERENCES:

1. Brief Guide to Cloud Computing, Christopher Barnett, Constable & Robinson Limited, 2010
2. Handbook on Cloud Computing, Borivoje Furht, Armando Escalante, Springer, 2010

OUTCOMES:

At the end of the course, the students will be able to:

- Learn the underlying principles of Cloud Technology and various types of cloud computing architecture and types.

- Evaluate between different cloud solutions offered by various providers based on their merits and demerits.
- Understand the Cloud Cost Management and Selection of Cloud Provider.
- Understand the IT governance in cloud computing.
- Track the Ten cloud do an do nots**.:**

LIST OF PROGRAMS: **15**

Study the basic cloud architecture and represent it using a case study

1. Enlist Major difference between SAAS PAAS & Iaas also submit a research done on various companies in cloud business and the corresponding services provided by them , tag them under SAAS , Paas & Iaas.
2. Study and present a report on Jolly cloud.
3. Present a report on obstacles and vulnerabilities in cloud computing on generic level
4. Present a report on Amazon cloud services.
5. Present a report on Microsoft cloud services.
6. Present a report on cost management on cloud
7. Enlist and explain legal issues involved in the cloud with the lelp of a case study
8. Explain the process of migrating to cloud with a case study.
9. Present a report on google cloud and cloud services
10. Create a scenario based on real time domain

CAC2225 **EXPLORATORY DATA ANALYSIS** **L T P C**

3 1 0 4

OBJECTIVES:

This course is aimed to:

- Understand difference between EDA and summary statistics in context of interpretation.
- Understand the importance of data pre-processing for Exploratory Data Analysis.
- Understand the significance of missing value imputations in better EDA interpretations.
- Understand the importance measure of central tendency in describing the quick view of data set.
- Understand the importance of measure of dispersion and its interpretation in spread ness of data.

MODULE I **9**

Introduction to Exploratory Data Analysis, Difference between classic data analysis and exploratory data analysis, difference between summary analysis and data exploratory analysis.

MODULE II **9**

Basic EDA assumptions, importance of underlying assumptions, techniques for testing assumptions, interpretation of 4-Plot, consequences of non-randomness, non-fixed parameters like location and variation parameters, consequences related to distributional assumptions.

MODULE III **9**

EDA techniques, analysis questions, graphical techniques, auto correlation plot for random data, moderate correlation, strong and autoregressive correlation, sinusoidal correlation, Various Plot.

MODULE IV **9**

Graphical techniques for EDA, Quantitative techniques, ANOVA, Bartlett's test, probability distributions, family of probability distribution, location and scale parameters, estimation of parameters, various distributions.

MODULE V **9**

EDA case studies – Random distribution, Random walk, standard resistor, Heat flow meter.

LIST OF PROGRAMS:

1. Explore and implement interpretation of 4-Plot,
2. Explore and comment on consequences of non-randomness, non-fixed parameters like location and variation parameters, consequences related to distributional assumptions.
3. Explore and implement various parameters of summary analysis in a given business scenario.
4. Explore and implement EDA techniques of analysis questions in a given business scenario
5. Explore and implement EDA graphical techniques in a given business scenario
6. Explore and implement EDA technique of auto correlation plot for random data in a given business scenario
7. Explore and implement EDA technique of moderate correlation in a given business scenario
8. Explore and implement EDA technique of strong and autoregressive correlation in a given business scenario
9. Explore and implement EDA technique of sinusoidal correlation in a given business scenario
10. Explore and implement ANOVA in a given business scenario.
11. Create a scenario based on real time domain

TEXT BOOKS:

1. Exploratory Data Analysis by John W. Tukey (1977) – 2016 Reprint.
2. Exploratory Data Analysis with R by Roger Peng (2016).

REFERENCES:

1. Think Stats: Exploratory Data Analysis (2nd edition) by Allen B. Downey (2014)

OUTCOMES:

After completing this course, students will be able to:

- Do exploratory data analysis on a given dataset, they will be able to implement various probability distributions,
- Do autocorrelation and ANOVA.
- Understand the EDA techniques & different kinds of techniques for testing.
- Understands the EDA case studies.

CAC2226 **INFERENTIAL STATISTICS LAB**

L	T	P	C
0	0	4	2

OBJECTIVES:

This lab is aimed at:

- Provide students a hands-on exposure to the concepts of inferential statistics.
- To calculate the parameters using different estimation techniques.
- To form null and alternative hypothesis based on problem situation.
- To use ChiSquare test for goodness fit.
- To calculate Z and t test for large and small sample testing procedure.

LIST OF PROGRAMS:

1. Estimation of Parameters, Point estimation for a given dataset using R.
2. Implement Maximum Likelihood method using R.
3. Find Confidence Interval for mean, variance and proportion for a given dataset using R.
4. Implement Null hypothesis and Alternative hypothesis using R.
5. Implement Simple and Composite hypothesis using R.
6. Find Critical Region of the test, Significance level of the test using R.
7. Perform Test for specified mean, test for equality of means for a given dataset using R.
8. Perform test for a specified proportion, test for equality of proportions for a given dataset using R.
9. Perform Test for specified mean, test for equality of means for a given dataset using R.
10. Implement Chi Square Test to check the goodness of the test.

Case study – 1

Inferential Statistics.

Field Experiment – Inference on Sorghum Variety

An experiment was conducted in RBD to study the comparative performance of fodder sorghum under rainfed conditions of different tropical region of Tamil Nadu under Department of Agriculture. The rearranged data are given below.

a. Estimate the linear model for the better variety.

b. Fit One way and two-way ANOVA.

c. Analyse the post ANOVA test to find the higher yielding variety.

Green matter yield of sorghum, Kg/plot.						
Variety	Replication				Total	Mean
	I	II	III	IV		
African tall	22.9	25.9	39.1	33.9	121.8	30.4
Co-11	29.5	30.4	35.3	29.6	124.8	31.2
FS-1	28.8	24.4	32.1	28.6	113.9	28.5
K-7	47.0	40.9	42.8	32.1	162.8	40.7
Co-24	28.9	20.4	21.1	31.8	102.2	25.6
Total	157.1	142.0	170.4	156.0	625.5	31.3

Analyse the difference between one way and two-way ANOVA and suggest which one of them is suitable for estimating linear model.

Case study – 2

Independence of Attributes among different Race.

1. 100 individuals of a particular race were tested with an intelligence test and classified into two classes. Another group of 120 individuals belong to another race were administered the same intelligence test and classified into the same two classes. The following are the observed frequencies of the two races:

Race	Intelligence		
	Intelligent	Non-intelligent	Total
Race I	42	58	100
Race II	55	65	120
Total	97	123	220

Test whether the intelligence is anything to do with the race.

2. From the following table, showing the number of plants having certain characters. Test the hypothesis that the following colour is independent of shape of the leaf.

Colour of the flower	Shape of the leaf	
	Flat	Curved
Orange	115	32
Violet	29	14

3. A health status survey in a few villages revealed that the normal serum protein value of children in that locality is 7.0 g/100ml. A group of 16 children who received high protein food for a period of six months had serum protein values shown below. Can we consider that the mean serum protein level of those who were fed on high protein diet is different from that of the general population?

S.No. (Child No.)	1	2	3	4	5	6	7	8
Protein level (g%)	7.10	7.70	8.20	7.56	7.05	7.08	7.21	7.25

S.No. (Child No.)	9	10	11	12	13	14	15	16
Protein level (g%)	7.36	6.59	6.85	7.90	7.27	6.56	7.93	8.56

OUTCOMES:

- After completing this lab, students will be able to work on inferential statistics using R, use its features in the field of data science.
- Parametric and non-parametric statistical testing procedure.
- Chisquare test for goodness of fit for statistical model.

CAC2227 **BIG DATA ANALYTICS LAB** **L T P C**
0 0 3 2

OBJECTIVES:

- This lab is aimed at providing students a hands-on exposure to big data analytics.

LIST OF PROGRAMS:

1. Install and configure Hadoop, set working directory and various processes.
2. Implement basic commands in Hadoop to manipulate big data.
3. Set up Hadoop cluster configuration.
4. Implement HDFS and explore its characteristics
5. Explore the properties of YARN
6. Import data from MySQL into HDFS
7. Import data from MS Excel into HDFS
8. Implement reducer in Hadoop
9. Implement partitioner in Hadoop
10. Implement nested MapReduce
11. Create a scenario based on real time domain

Case study1:

Experiment 1:

Due to the advent of new technologies, devices, and communication means like social networking sites, the amount of data produced by mankind is growing rapidly every year. The amount of data produced by us from the beginning of time till 2003 was 5 billion gigabytes. If you pile up the data in the form of disks it may fill an entire football field. The same amount was created in every two days in 2011, and in every ten minutes in 2013. This rate is still growing enormously. Though all this information produced is meaningful and can be useful when processed, it is being neglected. By 2020, 1.7 megabytes of data will be created every second, for every person on earth. There are different uses of Big Data, but not only limited to, Industry influencers, academicians, and other prominent stakeholders certainly agree that big data has become a big game changer in most, if not all, types of modern industries over the last few years. As big data continues to permeate our day-to-day lives, there has

been a significant shift of focus from the hype surrounding it to finding real value in its use.

Considering Big Data in general, explain different use cases for below mentioned domain and comment how companies are converting Big Data into profit:

- Healthcare
- Education
- Agriculture
- Space Technology

Experiment 2:

Prepare infrastructure for setting up single node Hadoop cluster.

Experiment 3:

Install all the software to set up single node Hadoop cluster.

Experiment 4:

Configuration of single node Hadoop cluster and testing by creating directory at HDFS location

Experiment 5:

You need to find the location of below Hadoop configuration file and understand the purpose of different attributes mentioned in below xml files.
hdfs-site.xml
core-site.xml
yarn-site.xml

Experiment 6:

You need to perform 20 basics Hadoop commands on single node Hadoop cluster.
(Faculty will share commands)

Experiment 7:

Install IDE to code and compile map reduce framework.

Experiment 8:

You need to program Mapper Class, Reducer Class and Driver Class for map reduce word count Job.

Experiment 9:

You need to find out word count job for the given input file provided by faculty.

Experiment 10:

You need to trouble shoot log file generated in experiment Number 09 and note all the steps involved in job execution

Experiment 11:

You need execute word count job based on 0 reducer, 2 reducer, Default reducer & 4 reducer and observe different outputs.

Case Study 2:

Consider a scenario, you are working for a startup company. Your cluster size is 10 Node. Number of data node in your cluster is 09. The size of each data node of your cluster is 2 TB. Currently you are working on 5 Tb of Data with Replication factor 03. Recently you got a new project from your client. You are expecting 20Tb of data to be processed in your cluster.

Based on above scenario, you need to explain below:

1. How many data node you are going to add in your cluster?
2. What will be your new cluster size?
3. What will be your new data size considering Replication factor?
4. What will be your new data size considering only original data (without replication)?
5. What will be your total number of task tracker in your cluster?

OUTCOMES:

After completing this lab, students will be able to:

- Work on big data analytics; use its features in the field of data science.

CAC2228 **EMPLOYABILITY SKILLS**

L	T	P	C
3	-	-	-

OBJECTIVES:

- To be qualified for employment and to work in a corporate sector demands not only the technical knowledge and experience but interpersonal skills like speaking skills.
- Professional etiquettes and so on. In this course, students will be taught how to develop these skills and apply them in our everyday interactions with people, both in our personal and professional lives.

MODULE I: Speaking skills **9**

Group Discussions; Importance of Group Discussions; Difference between Group Discussion, Panel Discussion and Debate; Format of GD as used in national level recruitment boards, Rules, ambience and normal practices, Dos and Don'ts in Group Discussions, Traits Evaluated in GDs

MODULE II: Etiquette and Mannerism **9**

Introduction; Professional etiquette – Etiquette at meetings, Dining, Involuntary Awkward Actions; Technology Etiquette – Phone, Email, Social Media, Video Conferencing, Web interview

MODULE III: Professional Presentations **9**

Nature of Oral Presentation; Planning a Presentation, Preparing the Presentation; Delivering the Presentation

TEXT BOOKS:

1. Objective English: 3 rd Edition, Edgar Thorpe and Showick Thorpe, Pearson Publishers, 2010 print.
2. Presentation skills. The essential guide for students, Patsy Mc Carthy & Caroline Hatcher, Sage publications, 2002.

REFERENCES:

1. Soft Skills – An integrated approach to Maximise Personality, Gajendra Singh Chauhan & Sangeeta Sharma, Wiley Publications

OUTCOMES:

At the end of this program, students will able to:

- Participate in various group discussions.
- Participate in debates and get familiar with patterns and interactive methods.
- Get knowledge and presentation skills.
- Understand the Traits Evaluated in GDs.
- Learn different ways of Delivering the Presentation.

*** Note: This is a value added Course**

SEMESTER-V

CAC3121 TIME SERIES ANALYSIS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the basic concepts of time series analysis.
- To understand the elementary time series models and model evaluation techniques.
- To understand the integration process of non-stationary data set.
- To understand the importance of ARMA and ARIMA models for forecasting.
- To understand the basic concepts and estimation procedure for VAR models.
- To understand the method to select the appropriate number of order of variables.
- To understand the ARCH and GARCH models.

MODULE I **9**

Introduction to Time Series: Definition, Examples, Components of time series, Trend, Seasonal, Cyclic and Irregular Variations, Determination of trend: Method of moving average, method of least squares, Determination of seasonality: Ratio to trend method, Ratio to moving average method, Exponential Smoothing: Simple exponential Smoothing, Holt Winter's Smoothing Procedure.

MODULE II **9**

Stationarity, Auto covariance, Autocorrelation functions and its properties, Partial Autocorrelation function, Test for stationarity, Test for randomness, Spectral density Function.

MODULE III **9**

Models of Time series: Autoregressive (AR) models, Moving average (MA) models, Properties such as stationarity, invertibility, ACF, PACF, Spectral density function.

MODULE IV **9**

Box-Jenkins analysis of time series: Model identification using ACF and PACF, Estimation of parameters of AR, MA and ARMA models by method of MLE and

method of least squares, fitting of the models, residual analysis and diagnostic checking. Autoregressive integrated moving average (ARIMA) models: Definition and elementary properties.

MODULE V **9**

Non Linear Time Series Models, ARCH and GARCH Models: definition and basic properties, Multivariate Time Series Models: Introduction, Stationary Multivariate Time Series, Vector Autoregressive Models, Vector ARMA Models, Co-integration.

TEXT BOOKS:

1. C. Chatfield: The Analysis of Time Series - An Introduction Chapman and Hall.
2. G.E.P. Box, G.M. Jenkins and G.C. Reinsel: Time Series Analysis, Forecasting and Control, John Wiley & Sons Publications.
3. P.J. Brockwell .and R.A. Davis**:** Time Series: Theory and Methods, Springer-Verlag.

REFERENCES:

1. Chris Brooks: Introductory Econometrics for Finance, Cambridge University Press.
2. S.P. Gupta: Statistical Methods, Sultan, Chand & Sons.

OUTCOMES:

- Understand the different elementary models related to time series analysis.
- Apply different model evaluation technique to identify better model to forecast.
- Understand the importance of stationarity in building time series models.
- Understand the use of Granger Causality and Johensen Cointegration method.
- Apply VAR model to the dynamic behaviour of financial time series conditions.
- Select the order of Vector Auto Regression model for better forecast of time series data.
- Build the model using ARCH and GARCH technique for non-constant variance data.

CAC3122 DATA ANALYSIS USING MS EXCEL AND SQL

L	T	P	C
3	1	3	4

OBJECTIVES:

- To understand the general purpose of MS Excel and its built in functions for data analysis.
- To understand the importance of ROC curve and its use in finding the fitness of classification model.
- To know the basics of macros in MS Excel.
- To understand the working knowledge in MS Excel for linear regression analysis.
- To understand the importance of SQL in Data Analytics.
- To know the importance of SQL in Data mining models.

MODULE I **9**

Introduction to data analytics, MS Excel as tool for data analytics, basic data analytics operations in MS Excel like sort, filter, conditional filtering, charts, pivot tables, tables, what-if analysis, solver, analysis toolpak.

MODULE II **9**

Binary classification in MS Excel, AUC (Area under the receiver operating characteristic (ROC) curve, information measures using entropy, linear regression, basics of macros and VBA in excel.

MODULE III **9**

Data analytics using SQL, , basic data analytics operations in SQL like sort, filter, conditional filtering, charts, pivot tables, tables, what-if analysis, solver, analysis toolpak.

MODULE IV **9**

Data mining models in SQL, association rules in SQL, linear regression in SQL, AUC and RoC in SQL. Unstructured data analysis in SQL

MODULE V **9**

Advance topics of data analytics using excel like power pivot table, power query for

data, importing data using excel. Industry use cases from data science like market basket analysis.

LIST OF PROGRAMS:

1. Implement Binary classification in MS Excel,
2. Implement AUC (Area under the receiver operating characteristic (ROC) curve in Excel
3. Explore information measures using entropy in Excel
4. Implement linear regression in Excel
5. Explore and implement basic macros in Excel
6. Explore and implement various options of VBA in excel.
7. Implement basic data analytics operations in SQL like sort, filter, conditional filtering, charts, pivot tables, tables, what-if analysis, solver, analysis toolpak.
8. Implement association rules in SQL
9. Implement linear regression in SQL
10. Implement AUC and RoC in SQL

TEXT BOOKS:

1. Data Analysis Using SQL and Excel, 2nd Edition by Gordon S. Linoff (2015), Wiley publication.
2. Microsoft Business Intelligence Tools for Excel Analysts 1st Edition by Michael Alexander, Jared Decker and Bernard Wehbe.

REFERENCES:

3. Learning SQL: Master SQL Fundamentals 2nd Edition by Alan Beaulieu
4. Head First SQL: Your Brain on SQL -- A Learner's Guide by Lynn Beighley (2007)

OUTCOMES:

- After completing this course, students will be able to do data analytics using MS Excel and SQL.

- In this course, you will learn how to perform data analysis using Excel's most popular features. You will learn how to create pivot tables from a range with rows and columns in Excel.
- Pivots are used in many different industries by millions of users who share the goal of reporting the performance of companies and organizations.
- In addition, Excel formulas can be used to aggregate data to create meaningful reports.
- To complement, pivot charts and slicers can be used together to visualize data and create easy to use dashboards.

CAC3123 **MACHINE LEARNING ALGORITHMS** **L T P C**

3 0 0 3

OBJECTIVES:

- To understand the basic concepts of statistical learning methods and models.
- To understand the importance of supervised learning in multivariate data sets.
- To understand the estimation procedure for multiple regression coefficients
- To understand the assumptions in estimating regression coefficients using OLS method.
- To understand the importance of supervised learning in classifying class labels for prediction.
- To understand the different algorithms related to classification techniques.
- To understand the concepts of hypothesis testing in model coefficients.

MODULE I **9**

Introduction to Machine Learning

Introduction to machine learning, types of learning, Learning Input-Output Functions, Designing a learning system, perspectives and issues in machine learning. Basic algorithms methods, Inferring Rudimentary Rules, Simple Probabilistic Modelling, Divide and Conquer: Constructing Decision Trees, Covering Algorithms: Constructing Rules, Mining Association Rules, Linear Models, Instance-based Learning, Clustering, Multi-Instance Learning.

MODULE II **9**

Supervised Learning Algorithms

Supervised Machine Learning Algorithms, working of supervised machine learning algorithm, Naive Bayes algorithm, decision tree, Support Vector Machines, KNN, Random Forest algorithm.

MODULE III **9**

Unsupervised Learning Algorithms

Unsupervised Machine Learning Algorithms, working of unsupervised machine learning algorithm, clustering, neural networks, Blind Signal Separation Techniques like Principal Component Analysis, Singular Value Decomposition.

MODULE IV **9**

Reinforcement Learning Algorithms

Reinforcement Machine Learning Algorithms, working of reinforcement machine learning algorithm, Finite Markov Decision Processes, Dynamic Programming, Monte Carlo Methods,

MODULE V **9**

Machine Learning Use-cases

Machine learning in business, Use cases of machine learning implementation in various industry domains: Banking, Finance, Retail, Healthcare, Manufacturing, E-commerce, Human Resource.

TEXT BOOKS:

1. Machine Learning by Tom M. Mitchell. 2014 Reprint. McGraw-Hill Science
2. Data Mining: Practical Machine Learning Tools and Techniques by Ian H Witten, Eibe Frank, Mark A Hall, Christopher J Pal. Third Edition. Morgan Kaufmann Series in Data Management Systems
3. Reinforcement Learning: An Introduction by Richard S Sutton and Andrew G. Barto. (2016). MIT Press.

REFERENCES:

1. Understanding Machine Learning: From Theory To Algorithms by Shai Shalev-Shwartz (2015).
2. Simpler: Using Machine Learning Algorithms in R by Darrin Thomas (2017)

OUTCOMES:

- Understand the difference between continuous class label and discrete class label classification methods.
- Predict the continuous class variable using linear regression analysis.
- Predict the binary class variable using decision tree and random forest.

- Understand the importance of Logistic regression and its application in business.
- Understand the important concepts of neural networks and its prediction techniques.
- Apply the assessment method to find the better fit model for classification techniques.

CAC3221	PROJECT AND VIVA VOCE	L	T	P	C
		0	0	0	16

The students will undertake a project as part of their final semester. The students can do independent projects or can take up projects in groups of two or more depending on the complexity of the project. The maximum group size will be four and in case of team projects there should be a clear delineation of the responsibilities and work done by each project member. The projects must be approved by the mentor assigned to the student. The mentors will counsel the students for choosing the topic for the projects and together they will come up with the objectives and the process of the project. From there, the student takes over and works on the project.

If the student chooses to undertake an industry project, then the topic should be informed to the mentor, and the student should appear for intermediate valuations. Prior to undertaking this project the students undergo a bridge course.

Bridge Course:

The bridge course ensures that all the students have the correct prerequisite knowledge before their industry interface. The purpose of a bridge course is to prepare for a healthy interaction with industry and to meet their expectations. It would be difficult to establish standards without appropriate backgrounds and therefore to bridge this gap, students are put through a week mandatory classroom participation where faculty and other experts will give adequate inputs in application based subjects, IT and soft skills.

The Project:

Each student will be allotted a Faculty Guide and an Industry Guide during the internship/project work. Students need to maintain a Project Diary and update the project progress, work reports in the project diary. Every student must submit a detailed project report as per the provided template. In the case of team projects, a single copy of these items must be submitted but each team member will be required to submit an individual report detailing their own contribution to the project.

Each student/group should be allotted a supervisor and periodic internal review shall be conducted which is evaluated by panel of examiners.

Project Evaluation Guidelines:

The Project evaluator(s) verify and validate the information presented in the project report.

The break-up of marks would be as follows:

1. Internal Evaluation
2. External Assessment
3. Viva Voce

Internal Evaluation:

Internal Evaluator of project needs to evaluate Internal Project work based on the following criteria:

- Project Scope , Objectives and Deliverables
- Research Work, Understanding of concepts
- Output of Results and Proper Documentation
- Interim Reports and Presentations– Twice during the course of the project

External Evaluation:

The Project evaluator(s) perform the External Assessment based on the following criteria.

- Understanding of the Project Concept
- Delivery Skill
- The Final Project Report
- Originality and Novelty

The Final Project Report Details:

- The report should have an excel sheet that documents the work of every project member

Viva Voce

- Handling questions
- Clarity and Communication Skill

Marking Scheme:

1. **Internal Evaluation:** 35% of Total Marks
2. **External Evaluation:** 50% of Total Marks
3. **Viva Voce:** 15 % of Total Marks

For e.g., If the total mark for the project is 100, then

- ❖ Internal Evaluation = 35 marks

The break-up of marks is shown below:-

- Interim Evaluation 1: 10 marks
- Interim Evaluation 2: 10 marks
- Understanding of concepts: 5 marks
- Programming technique: 5 marks
- Execution of code : 5 marks

- ❖ External Evaluation = 50 marks

The break-up of marks is shown below:-

- Project Report: 15 marks
- Explanation of project working: 10 marks
- Execution of code: 10 marks – (if done in industry, a stand-alone module can be reprogrammed and submitted. Error rectification etc. can be included by the evaluator)
- Participation in coding: 15 marks

- ❖ Viva Voce = 15 marks

The break-up of marks is shown below: -

- Questions related to project: 10 marks
- Questions related to technology: 5 marks

The Project evaluator(s) verifies and validates the information presented in the project report.

ELECTIVE - I

CACX40 INTERNET OF THINGS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the concept of “Internet of Things” to the students.
- To understand the basic ecosystems and landscape in IoT.
- To understand the real time use cases in IoT
- To know the different domains, where IoT plays a crucial role.

MODULE I **9**

Introduction to IoT: What is IoT, IoT architecture, Characteristics of IOT systems, Prevalent IoT architectures, IoT applications, Overview of different technologies involved for IoT realization.

MODULE II **9**

History of IoT: The transition from mainframes and personal computing, Planet lab and origins of distributed computing; Robotics, AI and Cyber Computing Infrastructure; M2M communications; P2P networks; Universal identification and RFID; Autonomic computing, Pervasive computing, Ubiquitous computing; Wireless Sensor Networks; The emergence of IoT.

MODULE III **9**

IOT state of the art: The IoT ecosystem and landscape; IOT business models and its usage in various domains; Technology Enablers for IOT – Mobility, Analytics, Cloud and Social Media; IOT platforms; Security; Test methodologies; Regulations and Risks.

MODULE IV **9**

IoT Characteristics and use cases: Consumer and enterprise use cases

MODULE V **9**

IoT DOMAINS: Smart Home, Smart Buildings, smart cities, IoT in telecommunications, smart manufacturing, IoT in environment monitoring, smart vehicles, IoT in healthcare, smart farming, IoT in enterprises, smart transportation, smart energy, smart retail and logistics

TEXT BOOKS:

1. Vijay Madisetti, Arshdeep Bahga "Internet of things, A hands-on-approach" 2014
2. Jean-Philippe Vasseur & Adam Dunkels "Interconnecting smart objects with IP", Morgan Kaufmann Publishers, 2010

REFERENCES:

1. Cuno Pfister, "Getting Started with the Internet of Things" , Maker Media Inc, 2011
2. Adrian Mcewen and Hakim, "Designing the Internet of Things", Wiley publication, 2013

OUTCOMES:

- After the completion of this course, students will be able to explore IoT as the framework to link things across the globe.
- They will be able to talk about various business use cases that may be implemented in IoT.
- IoT provides the scale of data that machines require in order to learn.
- IoT will accelerate dematerialization by enabling us to work smarter.
- Student will be knowing the Consumer and enterprise use cases.
- Student can able to Apply effective techniques to create IoT based projects

CACX10 **ARTIFICIAL INTELLIGENCE**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the importance and basic concepts of Artificial Intelligence.
- To know the important artificial intelligence algorithms in analysis.
- To understand the importance of knowledge representation in Artificial intelligence.
- To know the basic concepts of machine learning in Artificial intelligence.

MODULE I **9**

Overview: foundations, scope, problems, and approaches of AI. Intelligent agents: reactive, deliberative, goal-driven, utility-driven, and learning agents, Artificial Intelligence programming techniques

MODULE II **9**

Problem-solving through Search: forward and backward, state-space, blind, heuristic, problem-reduction, A, A*, AO*, minimax, constraint propagation, neural, stochastic, and evolutionary search algorithms, sample applications.

MODULE III **9**

Knowledge Representation and Reasoning: ontologies, foundations of knowledge representation and reasoning, representing and reasoning about objects, relations, events, actions, time, and space; predicate logic, situation calculus, description logics, reasoning with defaults, reasoning about knowledge, sample applications.

MODULE IV **9**

Planning: planning as search, partial order planning, construction and use of planning graphs, Representing and Reasoning with Uncertain Knowledge: probability, connection to logic, independence, Bayes rule, bayesian networks, probabilistic inference, sample applications.

MODULE V **9**

Decision-Making: basics of utility theory, decision theory, sequential decision problems, elementary game theory, sample applications. Machine Learning and

Knowledge Acquisition: learning from memorization, examples, explanation, and exploration. Learning nearest neighbor, naive Bayes, and decision tree classifiers, Q-learning for learning action policies, applications.

TEXT BOOKS:

1. Artificial Intelligence: A Modern Approach, 3rd Edition, by Stuart Russell and Peter Norvig.
2. Luger, G. F., & Stubblefield, W. A., Artificial Intelligence - Structures and Strategies for Complex Problem Solving. New York, NY: Addison Wesley, 5th edition (2005).

REFERENCES:

1. Nilsson, N. J., Principles of Artificial Intelligence. Palo Alto, CA: Tioga (1981).
2. Rich, E., & Knight, K., Artificial Intelligence. New York: McGraw-Hill (1991).

OUTCOMES:

- After completing this course, students will be able to explore artificial intelligence in day to day life.
- Student will be able to identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem.
- Student will be able to formalize a given problem in the language/framework of different AI methods.
- Implement basic AI algorithms Design and perform an empirical evaluation of different algorithms on a problem formalization
- Student can state the conclusions that the evaluation supports.
- Student will know about the virtual assistant is an exciting development in the field.

CACX16 **MOBILE COMPUTING** **L T P C**

3 0 0 3

OBJECTIVES:

- Usage of mobile devices have increased exponentially over the past decade. Most of the people have more than one mobile devices.
- The introduction of Smart Phones have created a new revolution in the telecommunication industry.

MODULE I: Mobile Network Architecture **9**

Wireless Communication Principles, Network Evolution, Radio Communication, Analog and Digital Communication, Computer Network, OSI Model, Mobile Network OSI layer functions, Mobile Network Protocol Layers, Telephony Networks, PSTN, Telecommunication Networks, Fixed Networks, Mobile Networks, Cellular Network Concepts, Cellular Networks, Cells and Base Stations, Frequency and Interface in Cells, Mobile Network Architecture, Wireless Network Generations, GSM, GPRS.

MODULE II: Mobile Device Architecture **9**

Mobile Phone Evolution, Mobile Handset Characteristics, Bluetooth , Display, Keypad, Camera, Mobile Handset Categories, Handset Components, Handset Design, Handset hardware architecture, Elements inside a Mobile Handset, Hardware Architecture Evolution, Hardware architectural trends, CPU and Memory, Internal storage, Handset Power Requirements, Power Management, Introduction and Definition to the SIM, Functions and usage of the SIM, Phones without SIMs, Key Handset software components, Device Drivers.

MODULE III: Mobile Application Development **9**

Mobile Application Development Paradigm, Mobile Programming Tools, Mobile Application Evolution, Thin Client, Fat Client, Future of Mobile App Development, Mobile Client Server App Architecture, Mobile App Programming in different languages, Mobile Programming best practices, Pros and Cons of Mobile Web App, SIM based Mobile App Development, SIM as a Platform, SIM as Service

Differentiator, Evolution of Mobile Services, Types of Mobile Services, App Server, Mobile Context of AS, AS Deployment Architecture, App Server Layers.

MODULE IV: Mobile Web Application **9**

World Wide Web, Web Application, Web Application Architecture, Web Server, Web Server Features, Web Application Server, Mobile Internet Access, Mobile Web browser Evolution, Mobile Web Development Approaches, Dynamic Content, RSS, Feed, Mobile Advertising Motivation, Dynamic Mobile Advertising, Web Service Architecture, Users on the Go, Best Development Practices.

MODULE V: Mobile Operating System **9**

Introduction to Mobile Operating Systems and why they are needed, Open Platforms, Mobile OS Features, Symbian, BlackBerry, Android, iOS, Windows, Tizen, Ubuntu, etc.

TEXT BOOKS:

1. Wireless and Mobile Network Architectures by Yi-Bang Lin and Imrich Chlamtac, Wiley-India, 2008
2. Mobile Networks Architecture by Andre Perez, Wiley, March 2012
3. Mobile Computing – Technology, Application & Service Creation by Asoke. K Talukder, Roopa R. Yavagal, Asoke K. Talukder, Tata McGraw-Hill, 2005
4. GSM - Architecture, Protocols and Services by Jörg Eberspächer, Hans-JoergV ögel, Christian Bettstetter, Christian Hartmann John Wiley & Sons, Dec-2008
5. Mobile Handset Design by Sajal K. Das, John Wiley and Sons, 2010
6. Smart Phone and Next Generation Mobile Computing by Pei Zheng and Lionel M. Ni., Morgan Kaufmann, 2006.

REFERENCES:

1. Professional Mobile Application Development by Jeff McWherter, Scott Gowell, 2012
2. Mobile Computing Principles: Designing and Developing Mobile Applications by Reza B'Far, Cambridge University, 2005
3. Mobile Applications: Architecture, Design, and Development by Valentino Lee, Heather Schneider and Robbie Schell, Pearson Education, 2004
4. Mobile Web Development by Nirav Mehta, Packt Publishing, 2008
5. Next Generation Wireless Applications: Creating Mobile Applications in a Web 2.0 and Mobile 2.0 World by Paul Golding, John Wiley & Sons, 2008
6. Head First Mobile Web by Lyza Danger Gardner, Jason Grigsby, 2011

OUTCOMES:

- Students will learn the basics of mobile networks.
- They will be able to understand the different concepts needed for the proper functioning of a mobile device.
- They will be able to identify different types of applications, the importance of mobile operating system and features of the same.
- The student can able to understand the rise in demand of mobile phones have led telecommunication companies to delve into newer technologies and standards.
- They will able to understand the basics of mobile network, device and their architecture.
- Student can able to know the course explains about the importance, features, functions and types of mobile operating systems.

ELECTIVE-II

CACX41 **PYTHON PROGRAMMING** **L T P C**

3 1 0 4

OBJECTIVES:

- To understand the basic concepts of python programming with values and varibles.
- To know the basic arithmetic operators used in Python Programming.
- To understand why Python is a useful scripting language for developers
- To understand the important functions in python programming
- To know the data structures and its usage in python programming.

MODULE I **9**

Introduction to Python Programming, development tools, values and variables, integer values, variables and assignment, identifiers, floating point types, control codes with strings, user input, Eval function, print function

MODULE II **9**

Expression and arithmetic, operator precedence and associativity, comments and errors, syntax errors, run time errors, logic errors, arithmetic operators

MODULE III **9**

Conditional execution, Boolean expressions, simple if statement, if/else, compound Boolean expressions, nested conditions, decision statements, conditional expressions. Iterations, while statement, definite vs indefinite loops, nested loops, abnormal loop termination

MODULE IV **9**

Functions, standard mathematics functions, time function, random function, importing function, writing own functions, parameter passing, custom function vs standard functions. Global variables, default variables, recursion, reusable functions, functions as data.

MODULE V **9**

Lists, List assignment, list bounds, slicing, list and functions, prime generation with list, sorting, flexible sorting, search, linear search, binary search, list permutation, random permutation, objects, string objects, list objects, custom types - geometric, handling exceptions.

LIST OF PROGRAMS

Part A

1. Write a Python program to check whether two strings are equal or not.
2. Write a Python program to display reverse string.
3. Write a Python program to find the sum of digits of a given number.
4. Write a Python program to display a multiplication table.
5. Write a Python program to display all prime numbers between 1 to 1t000.
6. Write a Python program to insert element in existing array.
7. Write a Python program to sort existing array.
8. Write a Python program to create object for Tree Set and Stack and use all methods.
9. Write a Python program to check all math class functions.

1. Write a program to execute any Windows 95 application (Like notepad, calculator etc)
2. Write a program to find out total memory, free memory and free memory after executing garbage Collector (gc).

TEXT BOOKS:

1. LEARNING TO PROGRAM WITH PYTHON by Richard L. Halterman.(2011)
2. Guttag, John. Introduction to Computation and Programming Using Python. Spring 2013 edition. MIT Press, 2013.

REFERENCES:

1. Programming Python, 4th Edition by Mark Lutz (2010) O'Reilly Media
2. Python Cookbook, 3rd Edition: Recipes for Mastering Python 3, by David Beazley and Brian K. Jones, on O'Reilly Atlas (2013)

OUTCOMES:

- After completing this course, students will be able to apply various features and components of Python programming in the field of data science.
- Student will learn how to design and program Python applications.
- Student will learn how to use lists, tuples, and dictionaries in Python programs.
- Student will learn how to identify Python object types.
- Student will learn how to use indexing and slicing to access data in Python programs.
- Student will define the structure and components of a Python program.
- Student will learn how to write loops and decision statements in Python

Elective – II

CACX42 **JAVA PROGRAMMING** **L T P C**
3 1 0 4

OBJECTIVES:

- Object oriented programming is the most proven technique for developing reliable programs.
- It helps in increased productivity, reusability of code, decrease in the development time, and reduces cost of production to an extent. The cost of maintaining such systems have also considerably decreased.
- There are many languages which used the object oriented concepts and techniques. Some of them are C++, Java, Smalltalk, Objective-C, etc. Java is a purely object oriented language.
- Systems/applications created using java programming language reduces the need for developing and maintain complex and space consuming applications.

MODULE I: Introduction **9**

History, Overview of Java, Object Oriented Programming, A simple Program, Two control statements - if statement, for loop, using Blocks of codes, Lexical issues - White space, identifiers, Literals, comments, separators, Java Key words. Data types: Integers, Floating point, characters, Boolean, A closer look at Literals, Variables, Type conversion and casting, Automatic type promotion in Expressions Arrays. **Operators:** Arithmetic operators, The Bit wise operators, Relational Operators, Boolean Logical operators, Assignment Operator, Operator Precedence. Control Statements: Selection Statements - if, Switch: Iteration Statements - While, Do-while, for Nested loops, Jump statements.

MODULE II: Classes: **9**

Class Fundamentals, Declaring objects, Assigning object reference variables, Methods, constructors, “this” keyword, finalize ( ) method A stack class, Over loading methods, using objects as parameters, Argument passing, Returning objects, Recursion, Access control, Introducing final, understanding static,

Introducing Nested and Inner classes, Using command line arguments. Inheritance: Inheritance basics, Using super, method overriding, Dynamic method Dispatch, using abstract classes, using final with Inheritance.

MODULE III: Packages. 9

Definition, Access protection importing packages, Interfaces: Definition implementing interfaces. Exception Handling: Fundamental, Exception types, Using try and catch, Multiple catch clauses, Nested try Statements, throw, throws, finally, Java's Built - in exception, using Exceptions.

MODULE IV: Multithreaded Programming. 9

The Java thread model, The main thread, Creating a thread, Creating multiple thread, Creating a thread, Creating multiple threads, Using isalive() and Join(), Thread - Priorities, Synchronization, Inter thread communication, suspending, resuming and stopping threads, using multi threading. 1/0 basics, Reading control input, writing control output, Reading and Writing files, Applet Fundamentals, the AWT package,AWT Event handling concepts The transient and volatile modifiers, using instance of using assert.

MODULE V: JAVA Database Connectivity (JDBC) 9

Database connectivity: JDBC architecture, JDBC Drivers, the JDBC API: loading a driver, connecting to a database, Creating and executing JDBC statements, Handling SQL exceptions, Accessing result sets: Types of result sets, Methods of result set interface. An example JDBC application to query a database

TEXT BOOKS:

1. The complete reference Java –2: V Edition By Herbert Schildt Pub. TMH.

REFERENCES:

1. SAMS teach yourself Java – 2: 3rd Edition by Rogers Cedenhead and Leura Lemay Pub. Pearson Education.

OUTCOMES:

- Students will learn how to write Programs using Java
- Student will learn Java has a lot of advantages of being simple, robust, platform independent, etc. Nowadays java is also found in the mobile phones.
- Student will focuses on the concepts of object oriented programming language and the different constructs for creating applications in java.
- Student will able to learn the object oriented concepts which helps in the field of programming, management of data, etc.
- Student will get help of Java programming which helps to explore object oriented nature of the language and the multi-platform versatility offered by it.

LIST OF PROGRAMS: **15**

1. Write a program to check whether two strings are equal or not.

2. Write a program to display reverse string.

3. Write a program to find the sum of digits of a given number.

4. Write a program to display a multiplication table.

5. Write a program to display all prime numbers between 1 to 1t000.

6. Write a program to insert element in existing array.

7. Write a program to sort existing array.

8. Write a program to create object for Tree Set and Stack and use all methods.

9. Write a program to check all math class functions.

1. Write a program to execute any Windows 95 application (Like notepad, calculator etc)
2. Write a program to find out total memory, free memory and free memory after executing garbage Collector (gc).

3. Write a program to copy a file to another file using Java to package classes. Get the file names at run time and if the target file is existed then ask confirmation to overwrite and take necessary actions.
4. Write a program to get file name at runtime and display number f lines and words in that file.
5. Write a program to list files in the current working directory depending upon a given pattern.
6. Create a textfileld that allows only numeric value and in specified length.
7. Create a Frame with 2 labels, at runtime display x and y command-ordinate of mouse pointer in the labels.

CACX43 **DATA VISUALIZATION** **L T P C**

3 1 0 4

OBJECTIVES:

- To know the importance of data visualization in data science reports.
- To understand uni, bi and multidimensional data visualization techniques.
- To know the important libraries in data visualization tools.
- To know important visualization tools like tableau.
- To understand the importance of use cases of data visualization.

MODULE I **9**

Introduction to data visualization, importance of data visualization in data science, seven stages of visualizing data -- acquire, parse, filter, mine, represent, refine, and interact.

MODULE II **9**

Classifying data visualization – explanatory, exploratory and hybrid, three perspectives of data visualization - the designer, the reader, and the data—shape what you create.

MODULE III **9**

Data visualization using R, data visualization libraries, features of libraries, ggplot library for data visualization.

MODULE IV **9**

Data visualization using Tableau, features of Tableau public version, configuration of Tableau, various libraries of Tableau.

MODULE V **9**

Visualization best practices, data science use cases for data visualization.

TEXT BOOKS:

1. Data Points: Visualization That Means Something by Nathan Yau . John Wiley & Sons (2013)

2. Beautiful Visualization: Looking at Data through the Eyes of Experts by Julie Steele and Noah Iliinsky .

REFERENCES:

1. Storytelling with Data: A Data Visualization Guide for Business Professionals by Cole Nussbaumer Knaflic (2014)
2. ggplot2: Elegant Graphics for Data Analysis by Hadley Wickham (2009)
3. Designing Data Visualizations: Representing Informational Relationships by Noah Iliinsky, Julie Steele (2011)

OUTCOMES:

- After completing this course, students will be able to visualize data through seven stages of data analysis process.
- They will be able to do explanatory, exploratory and hybrid types of data visualization.
- Student will understand various stages of visualizing data
- Student will able analyze features of libraries, ggplot library for data visualization.
- Student will learn the data science use cases for data visualization

Elective-III

CACX44	DATA SCIENCE PROJECT	L T P C 3 0 0 3

OBJECTIVES:

- To understand and learn various project management life cycles.
- To understand the difference between ETL and Data Science model.
- To know the important software for data science analysis.
- To know the importance of data visualization techniques in analytics reports.

MODULE I

Introduction to project management, various project management life cycles, SDLC, waterfall model, various aspects of managing a data science project.

MODULE II

Comparison of ETL project Vs Data Science, modeling data science project. Managing structured, unstructured and semi-structured data for data science project.

MODULE III

Analytics tools for data science project, comparing open source and proprietary tools.

MODULE IV

Choosing a proper data visualization tool for data science project. Working with open source tools for data visualization.

MODULE V

Various stake holders of data science project, preparing project report for CXO level people. Report presentation and closure activities of a data science project.

TEXT BOOKS:

1. Real life scenarios
2. Industry inputs from SMEs

OUTCOMES:

- After completing this course, students will be able to apply various tools and techniques to execute a data science project.
- Student will able to do project on various project management life cycles, SDLC.
- Student will be able to learn semi-structured data for data science project
- Student can able to do Analytics tools for data science project
- Student will able to do open source tools for data visualization.

CACX45 **SOFTWARE ENGINEERING** **L T P C**
3 0 0 3

OBJECTIVES:

- Software engineering incorporates various accepted methodologies to design software. This subject gives a detailed description of the entire process of developing a software project and also the issues associated after development.
- This course covers the introductory concepts of software engineering and its design.

MODULE I: Software Product and Process **9**

Introduction – S/W Engineering Paradigm – Verification – Validation – Life Cycle Models – System Engineering – Computer Based System – Business Process Engineering, Overview – Product Engineering Overview.

MODULE II: Software Requirements **9**

Functional and Non-Functional – Software Document – Requirement Engineering Process – Feasibility Studies – Software Prototyping – Prototyping in the Software Process – Data – Functional and Behavioral Models – Structured Analysis and Data Dictionary.

MODULE III: Analysis, Design Concepts and Principles **9**

Systems Engineering - Analysis Concepts - Design Process And Concepts – Modular Design – Design Heuristic – Architectural Design – Data Design – User Interface Design – Real Time Software Design – System Design – Real Time Executives – Data Acquisition System – Monitoring And Control System.

MODULE IV: Testing **9**

Taxonomy Of Software Testing – Types Of S/W Test – Black Box Testing – Testing Boundary Conditions – Structural Testing – Test Coverage Criteria Based On Data Flow Mechanisms – Regression Testing – Unit Testing –

Integration Testing – Validation Testing – System Testing And Debugging – Software Implementation Techniques

MODULE V: Software Project Management **9**

Measures And Measurements – ZIPF's Law – Software Cost Estimation – Function Point Models – COCOMO Model – Delphi Method – Scheduling – Earned Value Analysis – Error Tracking – Software Configuration Management – Program Evolution Dynamics – Software Maintenance – Project Planning – Project Scheduling– Risk Management – CASE Tools

TEXT BOOKS:

1. Ian Sommerville, "Software engineering", Seventh Edition, Pearson Education Asia, 2007

REFERENCES:

2. Roger S. Pressman, "Software Engineering – A practitioner's Approach", Sixth Edition, McGraw-Hill International Edition, 2005

OUTCOMES:

- Learners will develop knowledge about Software Development Life Cycle, which is very essential for any Software Developer to design and develop any application or software.
- This course also includes modules on Software testing which forms an essential part of SDLC
- Students are ability to apply knowledge of mathematics, science, and engineering
- Students are ability to design and conduct experiments, as well as to analyze and interpret data.
- Students are ability to function on multi-disciplinary teams.
- Students are ability to analyze, design, verify, validate, implement, apply, and maintain software system.

CACX46 **AGILE METHODOLOGY** **L T P C**

3 0 0 3

OBJECTIVES:

- To understand the important basic concepts of agile methodology.
- To know the importance of agile values and principles.
- To understand the foundations of agile delivery methods and XP and AM.
- To know the agile project development phases and identifying scope of agile project.

MODULE I

Introduction to Disciplined Agile Delivery, Context Counts--The Agile Scaling Model, Disciplined Agile Delivery (DAD) Process Framework, People First approach, Learning Oriented approach, A Hybrid Process Framework, Goal-Driven Delivery Lifecycle, Enterprise Aware

MODULE II

Introduction to Agile and Lean, Toward a Disciplined Agile Manifesto, Disciplined Agile Values, Disciplined Agile Principles, Lean Principles.

MODULE III

Foundations of Disciplined Agile Delivery, the Terminology Tar Pit, Scrum, Extreme Programming (XP), Agile Modeling (AM), Agile Data, Lean Software Development.

MODULE IV

People first approach, Roles, Rights, and Responsibilities, The Rights of Everyone, The Responsibilities of Everyone, The DAD Roles, Forming Disciplined Agile Delivery Teams.

MODULE V

Initiating a Disciplined Agile Delivery Project, the Inception Phase, Identifying a Project Vision, Identifying the Initial Scope, Identifying an Initial Technical Strategy, Initial Release Planning, Forming the Work Environment.

TEXT BOOKS:

1. S.W. Ambler, M. Lines, Disciplined Agile Delivery: A Practitioner's Guide to Agile Software Delivery in the Enterprise, IBM Press, 2012.
2. K. Beck, Test Driven Development: By Example, Addison-Wesley, 2002.
3. K. Beck, C. Andres, Extreme Programming Explained: Embrace Change, 2nd Edition, Addison-Wesley, 2004.

REFERENCES:

1. M. Cohn, Succeeding with Agile: Software Development Using Scrum, Addison-Wesley, 2010.
2. K.S. Rubin, Essential Scrum: A Practical Guide to the Most Popular Agile Process, Addison-Wesley, 2012.

OUTCOMES:

- After completing this course, students will be able to apply various features and components of agile methodology in the field of data science.
- Student will able to understand the most impactful change has come from defining new roles within the R&D department.
- Student will able analyze the teams rely less on up-front requirements and documentation than on face-to-face conversations.
- Student can identify the agile development accelerates the delivery of initial business value.
- Student can go through a process of continuous planning and feedback, is able to ensure that value is continuing to be maximized throughout the development process.

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B.ARCH SYLLABUS

REGULATIONS: 2016

VISION AND MISSION OF THE DEPARTMENT OF ARCHITECTURE

VISION

Crescent School of Architecture aims to emphasis on Curiosity, Innovation and Discovery in the field of Architecture that will connect with the profession and strives for Global standards through collaborative innovation and passion for enquiry.

MISSION

- To create opportMODULE ies for innovative academic experience which brings together academics and professional practice.
- To provide academic climate for students to understand, enquire, reflect, grow and contribute to succeed in a rapidly changing society.
- To pursue excellence in learning through contemporary foundation of liberal learning that celebrates diversity and complexity that instills empowerment on social responsibility.
- To achieve excellence in all its endeavors to face global challenges.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

Bachelor of Architecture curriculum is designed to prepare the graduates having aptitude and knowledge,

- To enable a successful professional and technical career.
- To provide high quality education to assume professional roles in architecture by offering sound knowledge in theories and applications in the field of Architecture.
- Engage in life-long learning to keep themselves abreast of new developments.
- To grow as a creative problem solvers in architectural industry.
- To put into practice and inspire high ethical values and technical standards.
- To evolve a professional capable of vision, innovation and competence keeping in view the human value system.

PROGRAMME OUTCOME (PO):

These outcomes are directly related to the profession of Architecture ,the way in which they are practiced and the knowledge components necessary for such a practice. The following list of outcomes represents the minimum learning outputs expected. The programme will produce graduates who have,

- Ability to apply creativity, innovations, develop competence in design development towards appropriate technology.
- Ability to conceptualize and coordinate designs, addressing social, cultural, environmental and technological aspects of architecture.
- Ability to analyze and apply theoretical knowledge to achieve design solutions.
- Ability to understand ethical and professional responsibilities.
- Ability to apply and integrate computer technology in design process and products.
- Ability to understand real life situation of architectural practice.
- Ability to apply visual and verbal communication skills at various stages of architectural design and project delivery process.
- Ability to work collaboratively with teams of architects and various interdisciplinary teams.
- A commitment to quality with ethical values, timelessness in architecture with continuous improvement.

CURRICULUM AND SYLLABUS FOR B. Arch
(Ten Semesters / Full Time)
CURRICULUM

SEMESTER I

S.No	Course Code	Course Name	Lecture	Studio/ Practical	Credit
Theory					
1	ARC B 1101	History of Built Environment – I	3	0	3
2	ARC B 1102	Theory of Architecture	3	0	3
Theory cum Studio					
3	ARC B 1103	Architectural Representations	1	3	3
4	ARC B 1104	Building Materials & Construction - I	2	3	4
5	ARC B 1105	Skill Development – I	1	1	2
Studio					
6	ARC B 1106	Architectural Design Studio – I	0	9	6
7	ARC B 1107	Allied Design Studio - I	1	5	4
			Total Credit		**25**

SEMESTER II

S.No	Course Code	Course Name	Lecture	Studio/ Practical	Credit
Theory					
1	ARC B 1201	Theory & Principles of Design	3	0	3
2	ARC B 1202	Environmental Studies	3	0	3
3	ARC B 1203	Theory and Design of Structures - I	3	0	3
Theory cum Studio					
5	ARC B 1204	Building Materials & Construction - II	1	4	4
6	ARC B 1205	Skill Development – II	1	1	2
Studio					
6	ARC B 1206	Architectural Design Studio– II	0	12 to 14	6
7	ARC B 1207	Allied Design Studio - II	0	3	4
			Total Credit		**25**

SEMESTER III

S.No	Course Code	Course Name	Lecture	Studio/ Practical	Credit
Theory					
1	ARC B 2301	History of Built Environment - II	3	0	3
2	ARC B 2302	Climatic Design	3	0	3
3	ARC B 2303	Theory and Design of Structures - II	3	0	3
Theory cum Studio					
4	ARCB 2304	Building Materials & Construction - III	2	4	4
Studio					
5	ARC B 2306	Architectural Design Studio – III	0	14 to16	8
6	ARC B 2307	Allied Design Studio – III & Computer Graphics	0	3	4
			Total Credit		**25**

SEMESTER IV

S.No	Course Code	Course Name	Lecture	Studio/ Practical	Credit
Theory					
1	ARC B 2401	History of Built Environment - III	3	0	3
2	ARC B 2402	Building Services - I	3	0	3
3	ARC B 2403	Structural &Construction Systems –I	3	0	3
4	ARC B 2405	Site Planning &Analysis	3	0	3
Theory cum Studio					
5	ARC B 2404	Building Materials & Construction -IV	2	4	4
Studio					
6	ARC B 2406	Architectural Design Studio – IV	0	14 to 16	8
			Total Credit		**24**

SEMESTER V

S.No	Course Code	Course Name	Lecture	Studio/ Practical	Credit
Theory					
1	ARC B 3501	History of Built Environment - IV	3	0	3
2	ARC B 3502	Building Services – II	3	0	3
3	ARC B 3503	Structural &Construction Systems II	3	0	3
4	ARC B XXXX	Elective – I	3	0	3
Theory cum Studio					
5	ARC B 3504	Building Materials & Construction -V	2	4	4

Studio					
6	ARC B 3506	Architectural Design Studio – V	0	16	8
	LEED GA	Stage I (Non Credit Course)			
			Total Credit		**24**

SEMESTER VI

S.No	Course Code	Course Name	Lecture	Studio/ Practical	Credit
Theory					
1	AR B 3601	Contemporary Built Environment	3	0	3
2	AR B 3602	Structural &Construction Systems III	3	0	3
3	AR B 3603	Estimation and Specification	3	0	3
4	AR B XXXX	Elective – II	3	0	3
Theory cum Studio					
5	AR B 3605	Architectural Acoustics & Detailing	2	4	4
Studio					
6	AR B 3606	Architectural Design – VI	0	16	8
			Total Credit		**24**

SEMESTER VII
PRACTICAL TRAINING

S.No	Course Code	Course Name	Lecture	Studio/ Practical	Credit
1	AR B 4701	Practical Training –I	-	-	10
			Total Credit		**10**

SEMESTER VIII

S.No	Course Code	Course Name	Lecture	Studio/ Practical	Credit
Theory					
1	AR B 4801	Professional Ethics & Practice - I	3	0	3
2	AR B 4802	Advanced Structures	3	0	3
3	AR B 4803	Green & Sustainable Design	3	0	3
4	AR B 4804	Research Methods	3	0	3
5	AR B XXXX	Elective – III	3	0	3
Studio					
6	AR B 4806	Architectural Design -VII	0	16	9
			Total Credit		**24**

SEMESTER IX

S.No	Course Code	Course Name	Lecture	Studio/ Practical	Credit
Theory					
1	AR B 5901	Professional Ethics & Practice-II	3	0	3
2	AR B 5902	Human Settlement Planning	3	0	3
3	AR B 5903	Urban Design	3	0	3
4	AR B XXXX	Elective -IV	3	0	3
Studio					
5	AR B 5904	Dissertation	3	0	3
6	AR B 5906	Urban Design Studio - VIII	0	16	9
			Total Credit		**24**

SEMESTER X

S.No	Course Code	Course Name	Lecture	Studio/ Practical	Credit
Theory					
1	AR B 5101	LEED AP – STAGE II	3	0	3
2	AR B XXXX	Elective -V	3	0	3
Studio					
3	AR B 5106	Architectural Thesis	0	28	14
			Total Credit		**20**

LIST OF ELECTIVES

LIST OF BASIC ELECTIVES:

1. Interior Design (Theory)
2. Art Appreciation
3. Landscape Architecture
4. Energy Efficient Architecture
5. Digital Art
6. Vernacular Architecture

LIST OF ADVANCED ELECTIVES:

1. Urban Housing
2. Architectural Conservation
3. Earthquake resistant Buildings
4. Architectural Management
5. Construction Technology
6. Safety systems and Building Automation

SEMESTER I

ARC B 1101 HISTORY OF BUILT ENVIRONMENT - I 3 0 3

AIM:

To provide knowledge about the development of architecture in India where religion played a major role in the Indian architecture styles apart from the cultural and contextual factors.

OBJECTIVES:

- To enlighten the origin of architecture in India.
- To discover the genesis of aesthetic phenomena with respect to the human needs and aspirations, time, place and culture and other factors.
- To distinguish the differences in various era which includes Ancient India, Buddhist & Jain periods, South & North Indian architecture styles.
- To know the sequence and innovations in architecture over a period of time.
- To study and analyze the architecture production of antiquity.

MODULE : I ANCIENT INDIA 9

Indus Valley Civilization: culture and pattern of settlement.- Aryan civilization – theories and debates of origin origins of early Hinduism - Vedic culture - Vedic village and rudimentary forms of bamboo and wooden construction - origins of Buddhism and Jainism

MODULE : II BUDDHIST ARCHITECTURE 9

Evolution of Buddhism, Buddhist thought, art and culture - Hinayana and Mahayana Buddhism - Evolution of building typologies- the stupa, vihara and the chaitya hall.

Architectural production during Ashoka's rule - Ashokan Pillar, Sarnath - rock cut caves at Barabar - Sanchi Stupa- Rock cut architecture in Ajanta and Ellora - Viharas at Karli - Rani gumpha, Udaigiri – Takti Bahai, Gandhara.

MODULE : III EVOLUTION OF HINDU TEMPLE ARCHITECTURE

Evolution of temple form - meaning, symbolism, ritual and social importar categories of temple - elements of temple architecture - early shrines of Chalukyan periods. Tigawa temple - Durga temple, Aihole - Virupaksha templ

Kailasanatha temple, Ellora.

MODULE : IV TEMPLE ARCHITECTURE - SOUTHERN INDIA **9**

Dravidian Order - evolution and form of Gopuram.

Rock cut productions under Pallavas: Shore temple, Mahabalipuram and Kailasanatha temple.

Chola Architecture: Brihadeeswara, Gangaikonda Cholapuram and Darasuram temples – Temple gateways of Madurai

Temple architecture of temple towns: Madurai, Srirangam and Kanchipuram. Hoysala architecture: Belur and Halebid

MODULE : V TEMPLE ARCHITECTURE - NORTHERN INDIA **9**

Indo-Aryan style: Temple architecture of Gujarat, Orissa, Madhyapradesh and Rajasthan - their salient features. Lingaraja Temple, Bhuvaneswar Sun temple, Konarak. - Somnatha temple, Gujarat - Surya kund, Modhera – Khajuraho Madhyapradesh - Dilwara temple, Mt. Abu

TOTAL SESSIONS: 45

REQUIRED READINGS:

1. Percy Brown, “Indian Architecture (Buddhist and Hindu Period)”, Taraporevala and Sons, Bombay, 1983.
2. Satish Grover, “The Architecture of India (Buddhist and Hindu Period)”, Vikas Publishing Housing Pvt. Ltd., New Delhi, 2003.
3. Christoper Tadgell, “The History of Architecture in India from the Dawn of civilization to the end of the Raj”, Longmon Group U.K.Ltd., London, 1990.

REFERENCES:

1. A.Volwahsen, “Living Architecture India (Buddhist and Hindu)”, Oxford and IBM, London, 1969.
2. George Michell, “The Hindu Temple”, BI Pub., Bombay, 1977.
3. Stella Kramrisch, “The Hindu Temple”
4. K.V. Soundarajan, “Art and Architecture of South India “
5. George Michell Ed, “Temple Towns of Tamil Nadu”
6. Dasgupta, “History of Indian Philosophy”

7. http://www.greatbuildings.com/gbc-types/styles/hindu.htmlB.Arch31
8. http://ramm.hubpages.com/hub/EVOLUTION-OF-INDIAN-TEMPLE-ARCHITECTURE5.

OUTCOMES:

- Have a comprehensive knowledge about the development of Aryan and Mauryan civilization and identify different building materials & techniques used by them.
- Have a comprehensive knowledge about the rock cut and stone architecture of Dravidian period and trace later developments in South India.
- Have a comprehensive knowledge about the development of Buddhist architecture.
- Articulate knowledge on the evolution of Hindu temple during the Gupta and Chalukyan period
- Express different plan forms of the Indo Aryan temple with the aid of sketches.

ARC B 1102 THEORY OF ARCHITECTURE 3 0 3

AIM:

To introduce the various facets of architecture and its influencing factors. Thereby, convey the concepts, themes, conception, views of Architectural thought process.

OBJECTIVES:

- To comprehend the concepts of architecture.
- To understand and analyze the principal elements of Architecture.
- To identify and examine the thought process involved in design.

MODULE I INTRODUCTION TO ARCHITECTURE 8

Definitions of Architecture - Origin of Architecture – Architecture as a discipline – Context for architecture as satisfying human needs - Functional, aesthetic and psychological - Outline of components and aspects of architectural form-site, structure, materials, services, use, circulation, expression, character, experience – Introduction to the formal vocabulary of architecture and Gestalt ideas of visual perception.

MODULE II ELEMENTS OF ARCHITECTURE 7

Understanding fundamental elements such as point, line, plane, form and space, shape, pattern, light, color, surface and texture with reference to the evolution of architectural form and space.

MODULE III ELEMENTS OF ARCHITECTURE – FORM 9

Understanding perceptual effects of specific geometric forms such as sphere, cube, pyramid, cylinder and cone and its sections as well as their derivatives with respect to the evolution of architectural form and space.

MODULE IV ELEMENTS OF ARCHITECTURE – SPACE 9

Understanding perceptual effects of specific configuration of architectural spaces – Enclosure – Internal and External, Continuous spaces – Spatial relationship and its types, Spatial organisation: Centralized, Linear, Radial Clustered, Grid – built form and open space relationships.

MODULE V PRINCIPLES OF ARCHITECTURE 12

Understanding fundamental principles such as proportion, scale, balance, symmetry/asymmetry, rhythm, axis, hierarchy, datum, MODULE y, harmony, dominance, climax – Movement with reference to the architectural form and space – detailed study of relationship between architectural form and circulation – Types of circulation – Building approach and entrance, path configuration and form, path space relationship, orientation.

TOTAL SESSIONS: 45

TEXT BOOKS:

1. Francis D.K.Ching, "Architecture-Form, Space and Order", 3rd ed. John Wiley, 2007

REFERENCES :

1. Ching, Frank (Francis D.K.), "Architectural Graphics", Van Nostrand Reinhold, New York 2003, ISBN 0471209066
2. Ching, Frank (Francis D.K.), "Drawing: A Creative Process", Van Nostrand Reinhold, New York 1990.
3. Simon Unwin, "Analysing Architecture", Rouledge, London, 2003.
4. V.S.Pramar, "Design Fundamentals in Architecture", Somaiya Publications Private Ltd.,

OUTCOMES:

- A thorough understanding on the definition of architecture and the elements of architecture.
- An exposure to the principles of architecture and applications of the same in buildings.
- Recognize the relation between of form and space and translate it into design
- Develop a design vocabulary for the various aspects of aesthetic components in design and actively apply them.

ARC B 1103 ARCHITECTURAL REPRESENTATION 1 3 3

AIM:

To develop the requisite level of proficiency in drawing which is seen as a primary communication tool in the practice of architecture and train the students in the fundamental techniques of Architectural Drawing and Free Hand Drawing. Besides, develop presentation skills, visual expression, representation, imaginative thinking and creativity through hands on working exercises with various mediums and materials.

OBJECTIVES:

- To introduce drafting procedures, graphic codes, symbols and architectural lettering.
- To enable the students learn architectural scales and their application to real objects and drawings.
- To expose the students to different projections like Orthographic, Isometric, axonometric and oblique projections.
- To understand and employ various mediums and technique of representation as it relates to art and architecture.

MODULE I –INTRODUCTION TO ARCHITECTURAL DRAWING 12

Construction of lines, line value, line types, types of lines. Line thickness. Dimension lines. Architectural and stencil lettering in varying heights and thickness and dimensioning. Types of scales, Study of scales, their use in practice and construction of Plain and Diagonal scale. Applications of scales to enlarge or to reduce the objects in drawing.

MODULE II: MEASURED DRAWING 18

Introduction to fundamentals of measured drawing, line value, lettering, drawing representation, format for presentation methods. Understanding of different scales and their uses in practice - Drawings to scale. Technique of measuring buildings and their detailing in terms of construction and ornamentation. Examples of Measured drawing of simple objects: Furniture, Class room plan, Doors, Windows, Entrance Gate, building etc.

NOTE: Exercise shall be aimed at taking the measurement of their class room/ bedroom/living room along with the furniture and drawing it to scale.

MODULE III –ARCHITECTURAL REPESEANTATION & SYMBOLS 10

Architectural representations of trees, hedges, foliage, human figure in different postures, vehicles, furniture etc. their integration to presentation drawings. Representation of building elements, openings, materials, accessories etc. terminology and abbreviation used in architectural presentation

MODULE IV – SECTIONS OF SOLIDS 15

Introduction to sections of solids - cube, prism, pyramids, cones, cylinders etc. with relation to architectural drawings and buildings. Identifying the various materials used in architectural construction and their mode of architectural representation – brick, stone, sand, steel, wood, glass, reinforcement.

NOTE: Exercise must be aimed at drawing sections of their measured drawing exercise and representing the architectural materials in their measured drawing exercise.

MODULE V - GRAPHICS 15

Isometric View: Isometric Views of Objects, building components such as Steps, Canopy etc.

Axonometric view: Axonometric view of objects, interior view of rooms etc. Exercises must involve developing a view of their measured room.

Bird's eye view,& normal eye view for the following:Cityscape, Seascape, Wildscape, Skyscape, Street views and Heritage areas.

Sketching of Historic or new built up structures of Architectural importance using different mediums.

NOTE: Exercises must involve developing a view of a building component.

TOTAL SESSIONS : 60

TEXT BOOKS:

1. I.H.Morris – Geometrical drawing for Art Students. Orient Longman – Madras 1982

2. Albert. O. Halse – Architectural Rendering Techniques McGraw-Hill Book Co. New York 1972.

3. M.S.Kumar, "Engineering drawing", DD Publications, Chennai - 600048- 2005

4. Francis D.K.Ching & Steven P Juroszek, "Design drawing", John Willey & Sons,USA, 1998

REFERENCES:

1. George K.Stegman, Harry J.Stegman, Architectural Drafting Printed in USA by American Technical Society, 1966.
2. Francis Ching, Architectural Graphics, Van Nostrand Rein Hold Company, New York, 1964.
3. C.Leslie Martin, Architectural Graphics, The Macmillan Company, New York, 1964.
4. Alwyn Cranshaw, Learn to paint with Water colours, Acrylic colours, Boats and Harbours, Sketch, Still life, landscapes, William Collins Sons and Co. Ltd., London, 1981.
5. Tokyo Musashino Academy of Art - Introduction to Pencil Drawing, Graphic - Shaw Publishing Co. Ltd., Japan, 1991.
6. Robert S.Oliver, The Complete Sketch, Van Nostrand Reinhold, New York, 1989.
7. http://www.cs.brown.edu
8. http://www.dtcc.edu/ - document, project info – Arch.dwg.

OUTCOMES:

- An understanding on the concepts of architectural drawing as well as representation skills are imparted.
- An understanding on the building representation in 2D and 3D among students in addition to preparation of measured drawing.
- To sensitize students to express skills in architecture through art.

ARC B 1104 BUILDING MATERIALS AND CONSTRUCTION- I 2 3 4

AIM:

This course is a combination of lecture & studio classes aimed at developing the students to understand various building materials and its construction techniques.

METHODOLOGY:

The course is visualized as having three essential components,

- A lecture course in materials and methods of construction.
- A construction studio wherein principles and practices shall be applied to the production of meaningful details.
- Site visits to gain knowledge about construction details.

OBJECTIVES:

- To introduce the students to building materials, their properties and application in building construction, along with the construction of some basic components of a building.
- To introduce the different components of a building and its functions.
- To inform the properties, characteristics and use of bamboo, palm, straw, etc. and methods of preservation and treatment.
- To sensitize the students to the use of these naturally occurring materials in the context of creating a green architecture and learn the application by doing relevant details of construction and drawings also.
- To encourage students to study both in classrooms & also at worksite in order to get the practical exposure.

MODULE : I INTRODUCTION TO BUILDING MATERIALS & CONSTRUCTION

12

Introduction to the buildings elements –substructure and superstructure. Understanding the elements and the role of each building element: Foundations, plinths, openings, lintels, roof, and parapet.

Introduction to Building construction drawings and building detail models.

Introduction to the natural materials buildings made up of - rocks, stone, soil, bamboo, straw bales. Understanding their usage.

NOTE: Students must submit a case study example to understand and identify materials used in the building and their method of construction etc.

MODULE : II ROCKS AND STONE **18**

Classification of rocks. Sources, Seasoning, Quarrying of stones, Dressing. Various types of stones used for construction. Characteristics of stones. Common building stones and their uses. Selection of stones. Testing of stones. Various stone finishes like dressing, polishing. Deterioration of stones. Preservation of stones. Durability. Stone veneering, Artificial stones. Stone for wall treatment.

Drawings of types of masonry - random rubble and ashlar.Drawings of stone foundation, lintel, sill, cavity walls, flooring, arches (semi-circular & segmental), corbel.

NOTE: Studio exercises must focus on understanding, identifying and developing working drawings of the usage of stone (Ashlar, rubble etc.,) for building components including detailing of arches, corbels, coping, sills, lintels, corbels, arches, cladding in small scale buildings like classrooms, snack bar and commMODULE y hall and understanding the same through case studies.

MODULE III SOIL

18

Sand - properties, uses and bulking of sand. Types of soils, Soil formation, grain size distribution, classification system. Characteristics of core, Principles of Soil Stabilization, Types of Stabilizers, Earth techniques & types, Treatment of soil.

Mud architecture: through the ages, advantages & disadvantages, Requirements and Types of mud wall building and surface protection. Detailing of walls, roofs, flooring and foundations using soils (rammed earth, compressed blocks).

NOTE: Design exercises must focus on using soil for building components including detailing of arches, walls, door and window openings in small scale buildings like classrooms, snack bar and commMODULE y hall and understanding of the same through case studies.

MODULE : IV BAMBOO **18**

Bamboo – Bamboo as plant classification, species, geographical distribution, Anatomy of Bamboo. Properties, strength, processing, harvesting, working of Bamboo tools – Treatment and preservation of Bamboo and uses of Bamboo.Cane, gate, coir, coconut - Growth, Form, Shape, Leaves, Flowering, Propagation Roofing materials – Thatch, grass, Bamboo, reeds – Basics – Case studies and applications.

NOTE: Design and Construction Techniques using bamboo for building components for small scale buildings like snack bar, tree house including detailing of doors and windows, arches, barrel walls, weave structures and understanding of the same through case studies

MODULE V: STRAW BALES **9**

Straw as a building material. Physical aspects - Basics, Fire, moisture, insects and pests proof. Plastering straw bale walls, straw bale roof.

NOTE: Design Exercises must focus on using straw bales for building components - foundations systems, Roofing options, plastering, door and window detailing for small scale buildings and understanding of the same through case studies.

TOTAL SESSIONS : 75

TEXT BOOKS:

1. S.C.Rangwala , "Engineering Materials", Charotar Publishing House - Anand 2007
2. Dr.Bala Gopal, "Building Design and Civil Engineering Drawing", Spades Publishers & Distributors, 2008
3. Dr.B.C.Punmia, "Building Construction" Laxmi Publications, 2008.
4. P.C. Varghese, Building Materials, Prentice Hall of India put Ltd New Delhi 110001, 2005.

REFERENCES

1. W.B.Mckay , "Building Construction", Vol. 1,2,3- Longmans U.K 1992.
2. R.J.S.Spencke and D.J.Cook, "Building Materials in Developing Countries", John Wiley and Sons, 1983.
3. HUDCO "All you want to know about soil stabilized mud blocks", HUD Pub., New Delhi, 1989.
4. D Narayanamurty, MODULE ed Nations Department of Economic and Social Affairs," Use of bamboo and reeds in construction", UNO Publications,1972.
5. http://www.baboo-Flooring.com
6. http://ag.avizona.edu/SWES
7. http://www/angelfite.com/in
8. http://www.idrc.ca/library/documents/104800/chapz-e.html
9. http://www/angelfite.com/inz/granite

OUTCOMES:

- Students get sensitized about the need for using ecological materials to create green architecture which will adapt itself to the surrounding environment.
- Students learn about materials, uses of materials, properties characteristics, methods of preservation, treatment and methods of construction.
- Students learn about constructing a building using mind, Bamboo, Straw bale, stone through drawing as well as doing a literature or live case study.
- Students are requested to submit drawing plates consisting of plan, elevation and section along with sketches and details showing method of construction.

ARC B 1105 SKILL DEVELOPMENTS – I 1 1 2

AIM:

To supplement additional course work and advance knowledge in the subjects offered in the semester.

OBJECTIVES

- The primary objective of this course is for communication skill development and technical writing.
- The course is aimed at providing the students with language skills which is an inescapable tool for the young technocrats to break geographical boundaries and step into global world.

COURSE CONTENT:

Seminars, Tutorials/ additional classes for any course, Guest Lectures, putting up Exhibitions, Workshops, participating in Architectural Competitions or conducting Site Visits or Study Tours.

MODULE I : INTRODUCTION 6

Skimming, scanning, inferring, predicting and responding to content - Guessing the meaning of words from contexts - Note making and vocabulary extension.

MODULE II: VOCABULARY DEVELOPMENT 6

Listening and understanding recorded, structured talks and classroom lectures - Comprehending the matter - understanding the links between different parts of speech - practice in note taking.

MODULE III: COMMUNICATION 6

Features of an effective speech-Practice in speaking fluently - Dialogue practice- simple social exchanges - short extempore talks.

MODULE IV: COMPREHENSION 6

Effective sentences-cohesive paragraphs - clear and concise writing - Introduction to technical writing-Definition, Description, Instruction - Summary Writing practice.

MODULE V – RESOURCE UTILIZATION **6**

Use of library - Role of Bibliography, Table of contents, Index etc.-use of Dictionary.

TOTAL SESSIONS : 30

TEXT BOOKS:

1. Jajatilake, C.I.V. and S. Sivasegaram, “Technical Report Writing”. Tata Mc Graw Hill Publishing Corporation Ltd., New Delhi 1979

2. Sasikumar.V. and P.V. Damija “ “Spoken English”. Tata McGraw Hill Publishing Corporation Ltd., New Delhi, 1997

REFERENCES:

1. “How to Rad Fast and Better”. Reader’s Digest, 1983

2. Stanton Nicky,”Mastering Communicaiton”. Mc Millan Master Series, London, 1996

OUTCOMES:

- Students get the ability to apply visual and verbal communication skills at various stages of architectural design and project delivery process.
- Students gains self confidence to get into the global world.

ARC B 1106 ARCHITECTURAL DESIGN STUDIO – I 0 9 6

AIM:

To introduce the meaning of "design" and relate it to "architecture" through an understanding of basic elements of architecture, the principles of design and analysis of design elements. Thereby, sensitize students to be more observant to their surroundings and promote it as a basic creative instinct in the students.

OBJECTIVES:

- To understand the elements and principles of Basic Design as the building blocks of creative design through exercises that will develop the originality, expression, skill and creative thinking.
- To enable the understanding of 3 D Composition which will help generation of a form from a two dimensional / abstract idea?
- To enable the understanding of the relationship between design and architecture which focus on understanding a building form analytically.

COURSE OUTLINE:

The course shall be conducted by giving a number of exercises in the form of design studios, seminars and creative workshops that are aimed at teaching the following:

i. Elements and Principles of Visual Composition using point, line, shape.
ii. Exploring color schemes and their application in a visual composition and in Architectural forms and spaces.
iii. Study of texture and schemes of texture both applied and stimulated and their application
iv. Study of linear and Planar forms using simple material like Mount Board, metal foil, box boards, wire string, thermocol etc.
v. Study of Solids and voids to evolve sculptural forms and spaces and explore the play of light and shade and application of color.
vi. Study of fluid and plastic forms using easily mouldable materials like clay, plaster of paris etc.
vii. Analytical appraisal of building form in terms of visual character, play of light and shade, solids and voids etc.
viii. Application of Basic design through design of simple architectural elements like entrance gates, walls, courtyards, porches, etc.

TOTAL SESSIONS: 200

REQUIRED READINGS

1. Owen Cappleman & Michael Jack Jordon, Foundations in Architecture: An Amotated Anthology of Beginning Design Project, Van Nostrand Reinhold New York, 1993.
2. Charles Wallschlacgerm & Cynthia Busic-Snyder, Basic Visual Concepts and Principles for Artists, Architects and Designers, Mc Graw Hill, New York 1992.

REFERENCES

1. V.S.Pramar, Design fundamentals in Architecture, Somaiya Publications Pvt. Ltd., New Nelhi, 1973.
2. Francis D.K.Ching - Architecture - Form Space and Order Van Nostrand Reinhold Co., (Canaa), 1979.
3. John W.Mills - The Technique of Sculpture, B.T.Batsford Limited, New York - Reinhold Publishing Corporation, London, 1966.
4. Elda Fezei, Henny Moore, Hamlyn, London, New York, Sydney, Toronto, 1972.
5. C.Lawrence Bunchy - Acrylic for Sculpture and Design, 450, West 33rd Street, New York, N.Y.10001, 1972.

OUTCOMES:

- An understanding of the qualities of different elements as well as their composite fusions.
- An ability to engage and combine the elements of design in spontaneous as well as intentionally in order to create desired qualities and effects.

AR C B 1107 ALLIED DESIGN STUDIO - I 1 5 4

To teach students the schemes/ subjects which are allied to Architectural design studio course. Output from this course will be in the form of projects.

AIM:

This course is aimed to understand the Visual & aesthetic qualities of Art and relating these to Architectural Design situation. Thereby, provide knowledge of various visual arts and its importance. It further aims at developing the freehand drawing and rendering skills in different medium and using it as tool of expressing ideas visually.

OBJECTIVES:

- Development of student's vision regarding 3-D forms (models and sculptures) in different materials for specific themes/expressions to develop creative/ imaginative thinking.
- To develop Visual practices, visual compositions using real world materials Similarity & self-similarity understanding diversity Natural & artificial forms/colors/textures; inherent/applied.
- Develop skills to understanding various tools, processes and material.
- Impart a good foundation in design through hands-on experience in designing simple two dimensional and three dimensional compositions.

NOTE: Exercises involved in Architectural Design studio need to be taken up as part of Allied design studio work wherein the Artist has to guide and teach the students in executing the exercises involved using the required tools and mediums.

MODULE I : FUNDAMENTALS 13

Introduction to different instruments, Instrument handling. Tabletop cutting, joining, and shaping Materials and media installations assembly, etc. Introduction to the fundamentals of drawing/ drafting.

MODULE II: ORGANIZATION OF SHAPES 18

Organization of shapes; Family of shapes: developing various shapes from a given geometric shape - working out composition with such developed shapes.

Expressing a given theme combining different geometric shapes; expressing

a design/pattern.

MODULE III - REPESEANTATION MEDIUM AND TECHNIQUES 15

Understanding the usage of different media like, water soluble color pencil, pen and ink, oil pastels, dry crayons etc and analyzing various campus buildings designed by internationally famous architects in terms of Depth, light, Shade, Etc.,

Understanding the various techniques in representing Indoor objects – still Life – Furniture, Equipment – Outdoor objects: Natural Forms/ Built Forms.

Understanding variety in Forms. Sketching Human Form: Anatomy and Expressions.

MODULE IV: EXPRESSION OF DESIGN 18

Development of geometric pattern by division to express them with the use of colors to expressing a given theme through design exercises.

MODULE V: MODEL MAKING 18

Introduction to various mediums/materials such as POP, wire/ matchstick, soap, clay, wood etc.

Concepts of model making - Additive model; Subtractive model out of a given geometric form. Models with linear members such as match sticks, reeds, etc. to understand geometric form and structure.

TOTAL SESSIONS: 75

TEXT BOOKS :

1. Albert O.Halse, Architectural Rendering. A techniques of contemporary – presentation McGraw Hill Book Company, New York, 1972.
2. Mulick Milind, Water colour, Jyotsna Prakasan, Mumbai 2002.
3. Jim Legitt, "Drawing Shortcuts", John Wiley & sons Inc, 2010.
4. Farey; A. Cyril, Architectural Drawing perspective and Rendering – A Hand Book for students and draftsmen.

REFERENCES:

1. Webb, Frank, "The Artist guide to Composition, "David & Charles, U.K., 1994.
2. Moivahuntly, "The artist drawing book", David & Charles, U.K., 1994.
3. Drawing a Creative Process", Ching Francis, Van Nostrand Reinhold, New York, 1990.
4. Arundell (Jan) Exploring sculpture, Mills and Boon, London/Charles, T.

Brand Ford Company, U.S.A.

COURSE OUTCOMES:

- Model making involving basic design principles & exposure to different mediums & materials of models.
- Develop skills to understanding various tools, processes and material.
- To develop visual practices, visual compositions using real world materials Similarity & self-similarity understanding diversity Natural & artificial forms/colors/textures; inherent/applied.

SEMESTER II

ARC B 1201 THEORY AND PRINCIPLES OF DESIGN 3 0 3

AIM:

To provide an understanding of architectural design process and apply the same to the process of architectural design. Thereby, impart knowledge about the various processes in architectural design.

OBJECTIVES:

- To introduce factors that lending meaning to architecture, expression, communication.
- To introduce the aspects of style, character and architectural movements
- To understand the generation of individual meaning in architecture through study of philosophies/theories and exemplary works of architects
- To introduce thorough case studies, tools for representing, analyzing and interpreting architecture.
- To actually learn to represent, analyze and interpret the architectural experience holistically through live case studies.

MODULE I MEANING IN ARCHITECTURE 6

Architecture as a vehicle of expressing, symbolism and communication- Illustrative examples

MODULE II ARCHITECTURAL CHARACTER 9

Ideas of character, style, architectural movement: Illustrative examples across various periods in history.

MODULE III WORKS OF ARCHITECTS 12

Role of individual architects in the generation of architectural form, through study of exemplary works, architectural inspirations, philosophies, ideologies and theories of architects.

MODULE IV ANALYZING ARCHITECTURE 9

Introduction to modes of understanding architecture in totality in terms of the various aspects studied before in the subject – understanding how case studies have used representational, analytic and interpretational tools

MODULE V EXPERIENCING ARCHITECTURE **9**

Understanding architecture in totality in terms of the various aspects studied in this course firsthand experience, analysis and interpretation of building

TOTAL SESSIONS: 45

TEXT BOOKS :

1. Bryan Lawson – How Designers Think – Architectural Press London, 1980.

2. Paul Alan Johnson – Theory of Architecture – concepts, Themes, and Practices.

3. Christopher Alexander – Pattern language – Oxford university press – 2003.

REFERENCES :

1. Christopher Jones – Design Methods

2. Edward De Bona – Lateral Thinking

3. Tom Heath – Methods in Architecture – John Wiley and sons – N.Y. 1984.

OUTCOMES:

- An understanding the meaning of character and style of buildings with examples.
- An exposure to students on ideologies and philosophies of architectures of contemporary architects through examples.
- An exposure to analysis and experience of architecture through case studies.

ARC B 1202 ENVIRONMENTAL STUDIES 3 0 3

AIM

To sensitize the students to understand the diversities and complexities in natural environments and the need for intervention in the context of global warming and climate change.

OBJECTIVES

- To provide an overview of natural resources, various ecosystems & its characteristics and conservation of biodiversity
- To create an awareness about impact of human activities such as pollution and its consequences.
- To stress the importance of environmental protection and sustainable development.

METHODOLOGY:

Visit to a local area to document environmental asserts-river/ forest/ grassland/ hill/ mountain.

Visit to a local polluted site - Urban/ Rural/ Industrial/ Agricultural. Study of common plants, insects, birds. Study of simple ecosystem-pond, river, hill slopes, etc. (Field work Equal to 5 lecture hours)

MODULE I INTRODUCTION TO OF ENVIRONMENTALSTUDIES 9

Definition, Scope and importance; Need for public awareness

MODULE II RENEWABLE AND NON-RENWABLE RESOURCES 9

Natural resources and associated problems: Forest resources, Water resources: Mineral resources:. Food resources:. Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies. Land resources: Role of an individual in conservation of natural resources equitable use of resources for sustainable lifestyles

9

MODULE III ECOSYSTEMS AND ENVIRONMENTAL POLLUTION

Structure and function of an ecosystem Procedures, consumers and decomposers Energy flow in the ecosystem. Ecological succession

Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem:

Causes, effects and control measures of: Air pollution Water pollution Marine pollution, Noise pollution Thermal pollution nuclear pollution

Soil waste Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management: Floods, earthquake, cyclone and landslides.

MODULE IV SOCIAL ISSUES AND THE ENVIRONMENT 9

From unsustainable to sustainable development urban problems related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and re habitation of people; its problem and concerns. Case studies. Environmental ethics: Issues and possible solutions. Climate changes, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.

MODULE V HUMAN POPULATION AND THE ENVIRONMENT 9

Population growth, variation among nations. Environment and human health. Human rights. Value education. Role of information Technology in Environment and human health. Case studies.

TOTAL SESSIONS: 45

TEXT BOOKS:

1. Miller T.G. Jr., “Environmental Sciences”, Wadsworth Publishing Co. (TB)
2. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T., “Environmental Encyclopedia”, Jaico Publ. House, Mumbai, 2001

REFERENCES:

1. Hawkins.R.E, “Encyclopedia of Indian Natural History”, Bombay Natural History Sdociety, Bombay (R).
2. Heywood, V.H & Watson, R.T. “Global Biodiversity Assesment” Cambridge Univ. Press, 1995
3. McKinney, M.L & Schoch, R.M., “Environmental Science System & Solutions”,

Web enhanced edition., 1996

4. Trivedi R.K., “Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards”, Vol I and II, Enviro Media (R).

OUTCOMES:

- The students would have understood the effects of the existing natural resources and the need for preserving them.
- Knowledge on the functions of several of ecosystems will help the students to design the processes that are eco friendly.
- Knowledge on the different types of pollution will help the young minds to device effective control measures to reduce rate of pollution.
- Educating on the various aspects of population explosion will create awareness on population control for effective utilization of the resources and the need to explore new alternate energy resources for a healthy environment.

ARC B 1203 THEORY AND DESIGN OF STRUCTURES– I 3 0 3

AIM:

To make Students to understand the behavior of structural system, material and geometric properties of structural sections.

OBJECTIVES:

- To study the effect of action of forces on a body and the concept of equilibrium of the body through exercises
- To determine the internal forces induced in truss member due to external loads by working out problems
- To calculate the sectural properties (centroid, moment of inertia, section modulus and radius of gyration) for various sections by working out problems
- To study the Stress - strain behaviors of steel and to drive the relationship between elastic constant and solving problems
- To study the structural properties of various material

MODULE I FORCES 9

Definition - Coplanar - Concurrent - Non-Concurrent - Parallel Forces - Triangular and Parallelogram Law of Forces - Equilibrium of Forces - Conditions for Static Equilibrium - Concept of Transfer of Forces in Beams, Cables,-Determinate and indeterminate structures.

MODULE II PLANE TRUSSES 9

Introduction to Determinate and Indeterminate plane trusses - Analysis of simply supported and cantilevered by method of joints

MODULE III PROPERTIES OF SECTIONS AND SOLIDS 9

Area - Centroid - C.G of Various Sections (Including Cutout Holes) - Moment of Inertia - Parallel & Perpendicular Axis Theorem - Moment of Inertia of Various Sections - Section Modulus.

MODULE IV ELASTIC PROPERTIES 9

Definition -Stress, Strain - Tensile, Compressive & Shear - Linear & Lateral Strain - Poisson's ratio - Stress Strain Curve for Mild Steel & High Tensile Steel - E,K,G and their Relationships - Application to Uniform Section

MODULE V TYPICAL STRUCTURAL MATERIALS & CONTEMPORARY ADVANCEMENT **9**

Introduction to type, Structural properties and Application of: stone - timber - bricks - other metals-concrete - composite - glass – paper

TOTAL SESSIONS: 45

TEXT BOOKS:

1. R.K. Bansal, "A text book on Strength of Materials", Lakshmi Publications, Delhi 1998

REFERENCES:

1. Junnarkar, "Mechanics of Structures" (Vol - I), 21st edition, Charotar publishing house India, 1995
2. Bansal.R.K., "Strength of Materials", Laxmi Publications Pvt Limited, India, 1990.
3. Rajput.R.K., "Strength of Materials", S.Chand &Co, New Delhi, 1996.
4. Punmia.P.C., "Strength of materials and Theory of structures", Vol 1, Laxmi publications, Delhi, 1994.
5. Ramamrutham, "Strength of Materials", Dhanpatrai & Sons, Delhi, 1990.

OUTCOMES:

- The students would have understood the structural properties of various materials.
- Knowledge on the functions and effects of forces on a body and the concept of equilibrium of the body through exercises.
- An exposure to structural properties and applications of different materials used in the building industry.

ARC B 1204 BUILDING MATERIALS AND CONSTRUCTION – II 1 4 4

AIM:

This course is a combination of lecture & studio classes aimed at developing the students understanding of materials their properties and construction techniques, for appropriate application.

OBJECTIVES:

To expose the students to TIMBER and its construction techniques, and to enable them to represent the different building components through relevant drawings.

METHODOLOGY:

The course is visualized as having three essential components viz..,

- A lecture course in materials and methods of construction
- A construction studio wherein principles and practices shall be applied to the production of meaningful details
- Preparation of working details and drawings
- Site visits to gain knowledge about construction details.

MODULE – I: TIMBER 9

Softwood and Hardwood - Secondary Timber - Physical properties and uses - Defects, Conversion, Seasoning, Decay and preservation of timber - Fire retardant treatment, anti-termite treatment.

MODULE – II TIMBER AND ALIED PRODUCTS 9

Industrial timbers - plywood, block board, particle board, fiber boards. uses - current developments.

Timber board –Plywoods – Block Boards - Particles Boards – Hard Boards - Veneers. Eco Friendly Boards – Eco Boards, Soft Boards, Nuwood, and Laminates

MODULE – III USAGE OF TIMBER AND ALIED PRODUCTS

9

Timber in Doors and Windows - Fully panelled single and double shutter doors of various types and sizes, fully glazed window and ventilators details of joints. Fixed glass and timber louvered windows.Drawings of timber joinery for

Windows, doors, ventilators. Timber partitions,

Timber in Floors – Single, double and framed floors with joints between joist with wall plate, joist with beam and sub beam with main beam, strutting of joists, use of templates, for support. Timber Boarded and parquette Floors for gymnasia and dance halls, Wall lining in soft board timber etc. for offices.

Staircases – Trade and riser and relation between them, single, double (Dog legged and open well) Timber staircases - Designed staircase -timber trusses - Lean to - close couple - Kingpost - Queen Pot - Trusses.

timber built-in-furniture - Detailing and fittings for physically handicapped.Exercises involving the above through drawing and case studies.

MODULE – IV PAINTS AND VARNISHES **3**

Paints and Varnishes – Composition, properties and uses of ordinary paints.Varnishes and wood preservatives, method of painting of timber.

MODULE – V: BAMBOO **9**

Bamboo -plant classification, species & geographical distribution -Bamboo : Anatomy, Properties, strength, working of Bamboo tools - Treatment and preservation of Bamboo and uses of Bamboo. Cane, gate, coir, coconut - Growth, Form, Shape, Leaves, Flowering, Propagation.

TOTAL SESSIONS : 45

TEXT BOOKS:

1. W.B. Mickay, “Building construction Vol 1,2 and 3”, Longmans, UK 2005.
2. R.Chudley, ”Building Construction Handbook”, Elsevier/Butterworth-Heinemann2006.
3. S.C.Rangwala, “Engineering materials”, Charotar Publishing, 2011.
4. S.P.Arora & S.P.Bindra, “Text book of Building Construction”, Ganpat Rai Publications (P) Ltd, New Delhi, 2013
5. B.C. Punmia, “Building Construction”, 2005
6. P.C. Varghese, “Building Materials”, Prentice Hall of India put Ltd New Delhi 110001, 2005

REFERENCES:

1. Don A.Watson, “Construction Materials and Processes”, McGraw Hill Co.,1992.
2. Alanwerth, “Materials”, The Mitchell Pub.Co.Ltd., London,1986.
3. http://www.ibex-ibex-intl.com

4. http://www.inika.com/chitra
5. http://www.routbdge.com
6. http://www.venturaindia.com

OUTCOMES:

- The students would gain comprehensive knowledge about timber and its allied products with its application in interior and exterior.
- An exposure to thorough details of bamboo and its treatment.
- The students would gain knowledge about paints and varnishes and its application on timber.

ARC B 1205 SKILL DEVELOPMENT – II 1 1 2

AIM:

To supplement additional course work and advances knowledge in the subjects offered in that semester.

OBJECTIVES:

- The primary objective of this course is for communication skill development and technical writing. The course is aimed at providing the students with language wherewithal which is an inescapable tool for the young technocrats to break geographical boundaries and step into global world.

COURSE CONTENT:

Seminars, Tutorials/ additional classes for any course, Guest Lectures, putting up Exhibitions, Workshops, participating in Architectural Competitions or conducting Site Visits or Study Tours.

TOTAL SESSIONS: 30

TEXT BOOKS:

1. Eric H. Glendinning & Beverly Holmstrom, "Study reading - A course in reading Skills for academic purposes", Cambridge University Press,1992.
2. John Kirkman, “Good style - writing for science and technology", E&FN Spon, an Imprint of Chapman & Hall, 1992.

REFERENCES:

1. “How to Rad Fast and Better”. Reader’s Digest, 1983
2. Stanton Nicky,”Mastering Communicaiton”. Mc Millan Master Series, London, 1996

OUTCOMES:

- Students gets the ability to apply visual and verbal communication skills at various stages of architectural design and project delivery process.
- Students gains self confidence to get into the global world.

ARC B 1206 ARCHITECTURAL DESIGN STUDIO- II 0 14 6

AIM:

To enable the conceptualization of form, space and structure through creative thinking and to initiate architectural design process deriving from first principles.

OBJECTIVES:

- To involve students in a design project(s) that will involve simple space planning and the understanding of the functional aspects of good design.
- To involve students in a small scale building project(s) which will sensitize them to intelligent planning that is responsive to the environmental context.
- To involve students in building case study by choosing appropriate examples to enable them to formulate and concretize their concepts and architectural program.
- To engage in discussion and analytical thinking by the conduct of seminars/ workshops.
- To enable the presentation of concepts through various modes and techniques that will move constantly between 2D representation and 3D modeling.

CONTENT:

Scale and Complexity: projects involving small span, single space, single use spaces with simple movement, predominantly horizontal, as well as simple function public buildings of small scale; passive energy

Areas of focus/ concern:

- architectural form and space
- aesthetic and psychological experience of form and space in terms of scale, colour, light, texture, etc.,24
- function and need: user requirements, anthropometrics, space standards, circulation
- image and symbolism

Typology/ project: shop, exhibition pavilion, children’s environment, snack bar, residence, petrol bunk, fire station,etc.,

TOTAL SESSIONS: 225

TEXT BOOKS:

1. De. Chiara and Callender, "Time-saver Standards for Building Types", McGraw-

Hill Co., New York, 1973.
2. The Handbook of Building Types., NEUFERT ARCHITECTS DATA, New International edition, second international edition. BSP Professional Books. Oxford (1980) Blackwell scientific Publications.
3. Time - Saver Standards for Architectural Design Data, seventh edition. The reference of architectural fundamentals McGraw hill international edition, architectural series (1998).
4. Ed.By.Quentin Pickard RIBA "The Architects' Hand Book", Bladewell Science Ltd., 2002

REFERENCES:

1. Handbook on Building Construction Practices (Excluding Electrical Work). Bureau of Indian Standards, New Delhi, 1997
2. National Building book of India 2005, Bureau of Indian Standards, New Delhi
3. Macmillan Encyclopedia architects, Vol II, The free press, London, 1982
4. A visual dictionary of Architecture, Francis D.K.Ching, John wiley & Sons, Inc. 1997
5. www.design basics.com/-(on house type - Americans)
6. http://www.geosystems.gatech.edu/ - (on detail design method)
7. http://www.c.s.berkely.edu/ - (on bubble diagram builder with interaction)
8. http://www.plannet.com/resources.htme - (on resource info)

OUTCOMES:

- Students gets the ability to understand and design small scale building projects.
- They will able to solve the design problem functionally.
- Gain knowledge about the design process and its various faces to solve a design problem.
- Enable to express the ideas in the form of 2D representation and 3D modelling.

ARC B 1207 ALLIED DESIGN STUDIO - II 0 3 4

AIM:

To teach students the schemes/ subjects which are allied to Architectural design studio course. Impart a good foundation in design through hands-on experience in designing simple two dimensional and three dimensional compositions. Output from this course will be in the form of projects.

OBJECTIVES:

- Development of student's vision regarding 3-D forms (models and sculptures) in different materials for specific themes/expressions to develop creative/ imaginative thinking.
- To develop Visual practices, visual compositions using real world materials Similarity & self-similarity understanding diversity Natural & artificial forms/colors/textures; inherent/applied

MODULE I: INTRODUCTION TO MACHINERY TOOLS 40

Building skills studio work culture; instruments, tabletop; cutting, joining, shaping Materials and media installations assembly. Understanding & creating awareness on environmental impacts on the nature by the daily use materials by exploring lateral thinking to use the recycling materials in to usable models and create a new product.

Introduction to carpenter’s tools, Wood working machines, use of different kinds of wood, Sawing, Planning and Shaping of wood, Making of selected joinery used in construction work, polishing of wood. Demonstration and practical lesson on soldering, brazing, forging and gas welding. Demonstration of foundry shop practice-introduction to molder’s tools, preparation of moulding sand.

Introduction to machine tools with demonstration of cutting, drilling, grinding, slotting, shaping, bending etc. Names and uses of different kinds of fitter’s tools and measuring instruments, care and maintenance, practice in chipping, filling, scraping and fitting.

MODULE : II WORKSHOP 35

Basic, design, graphic design, product design, furniture design, model making.

Use of hand tools and materials in carpentry, Glass models, masonry and model making involving basic design principles & exposure to different mediums & materials of model - making which involves making three dimensional sculptures involving the basic platonic solids and abstract sculptures using various techniques/ materials such as POP, wire/ matchstick, soap, clay, etc

TOTAL SESSIONS : 75

TEXT BOOKS:

1. Arundell (Jan), Exploring Sculpture, Mills and Boon, London/Charles T.Branford Company, USA, 1972.
2. John W.Mills, The Technique of Sculpture, B.T.Batsford Ltd., New York Reinhold Publishing Corpn., London, 1966.

REFERENCES:

1. www.design basics.com/-(on house type – Americans)
2. http://www.geosystems.gatech.edu/ - (on detail design method)
3. http://www.c.s.berkely.edu/ - (on bubble diagram builder with interaction)

OUTCOMES:

- Model making involving basic design principles & exposure to different mediums & materials of models.
- Develop skills to understanding various tools, processes and material.
- To develop visual practices, visual compositions using real world materials Similarity & self-similarity understanding diversity Natural & artificial forms/colors/textures; inherent/applied.

SEMESTER - III

ARC B 2301 HISTORY OF BUILT ENVIRONMENT - II 3 0 3

AIM:

The course outline shall follow a chronological study of architecture as it develops over the following Islamic periods: from Imperial to Mughal Architecture.

OBJECTIVES:

- To understand the different layers of history, i.e. Islamic rule in India.
- To introduce the students in diverse planning of Mosques in chronological order (till contemporary)
- To trace out the changes in history of art, culture and architecture in different states. (Example, provincial style in Gujarat, Malwa, Deccan, etc...)
- To understand the fruition of Historical structures involved in and around India.
- To figure out, the basic concepts involved in city planning, this influenced the modern town planning thus arriving the term "Urbanism" in history. (e.g. FatehpurSikri, Tughlaquabad, Mandu)
- To understand the concepts involved in setting up the Mughal garden (tomb and pleasure gardens) in formal landscape.

MODULE I INTRODUCTION TO ISLAMIC ARCHITECTURE 9

Brief History of Islam in terms of birth, spread across countries and principles - Influences on Islamic Architecture - Evolution of building types in terms of forms and functions - the mosque, the tomb, andMinaret, the madarasa, the palace, the caravanserai, vernacular architecture, the market - important.

MODULE II PRINCIPLES AND ELEMENTS 9

Principles, elements and character of Islamic architecture in terms of structure materials and methods of Construction, elements of decoration, colour, geometry, light - important examples to illustrate development of Islamic architecture.

MODULE III ISLAMIC ARCHITECTURE IN INDIA- DELHI OR IMPERIAL STYLE 9

Brief history of development and classification, different styles and regions.Development of architectural style during the rule of the Slave, Khilji, Tuqlaq, Sayyid and Lodhi Dynasties important examples for each period.

MODULE IV PROVINCIAL STYLE 9

Development of the provincial styles in different regions - Punjab, Jaunpur, Bengal, Gujarat, and Malwa, the Deccan (Bijapur, Golconda, Bidar and Gulbarga) - important examples for each style.

MODULE V MUGHAL STYLE 9

Development of the Mughal style under the different rulers - Babur, Shershah, Humayun, Akbar, Jahangir, Shahjahan, Aurangazeb - important examples - development of the Mughal garden - important examples.

TOTAL SESSIONS: 45

TEXT BOOK

1. Sir Banister Fletcher, "A History of Architecture", University of London, The Athlone Press 1996, 20th edition.
2. Percy Brown, "Indian Architecture (Buddhist and Hindu Pd.)"- Tarapore Vala and Sons Bombay 1996.
3. Satish Grover, "The Architecture of India (Buddhist and Hindu Period)", CBS Pub., 2003
4. Satish Grover, "Islamic Architecture in India", Edition 2, CBS Publishers & Distributors, 2002.
5. Salvan, George S, "Architectural Character & the History of Architecture", New ladder type curriculum, Edition,
6. Robert Hillenbrand, "Islamic Architecture", Edinburgh University Press, 1994
7. Creswell, K.A.C., "Early Muslim Architecture", Oxford, repr. 1969, and "Early Muslim Architecture II", Oxford, 1940.

REFERENCES

1. Yatin Bandya, "Concepts of Space in Traditional Indian Arch", Mapin, 2005.
2. Mitchell, George (1996) "The Hindu Temple, University of Chicago Press.
3. Spiro Kostof , "A History of Architecture : Setting and Rituals", Oxford University Press, London, 2005 (digitized - 2007).
4. Pier Luigi Nervi, "History of World Architecture Series". Harry N.Abrame Inc.

Publication, New York, 1972.
5. Meaning in Western Architecture - Christian Norberg-Schulz-Rizzoli, New York, 1974.
6. http://www.islamicart.com/pages/archcrea/index.htm
7. http://libraries.mit.edu/rvc/aka/agakhan/index.html
8. http://www.greatbuildings.com//types/styles/islamic.html
9. http://www.ets.uidaho.edu/arch499/nonwest/Islam1.html
10. http://indiagateway.com/culture/architecture.html

OUTCOMES:

The students should be able to:

- Identify and discuss the finer points and nuances of Islamic architecture and its influence on the development of Architectural sciences and styles.
- Provide an understanding on the various styles and the ruler patrons who influenced the development of this style of architecture.
- Realize the techniques and wonders behind various Islamic architectural and landscaping elements and principles and re-interpret them in today's context.
- Discuss the impact of colonialism and the wealth of architectural legacy the period introduced in India
- Critically evaluate historical principles and methods and impart that learning to create informed and relevant current architectural solutions that are meaningful and rooted in our historic and traditional knowledge and wealth.

ARC B 2302 CLIMATIC DESIGN 3 0 3

AIM:

To enable the understanding of the technical basis of the environment that exists in or around a building and to integrate the requirements of climate in building and in relation to building functions.

OBJECTIVES:

- To study human heat balance and comfort.
- To familiarize students with the design and settings for buildings for daylight and factors that influence temperature.
- To inform about the air pattern around buildings and the effect of wind on design of buildings
- To expose the students to the various design strategies for building in different types of climatic zones.

MODULE I CLIMATE AND HUMAN COMFORT 9

Factors that determine climate of a place - Components of Climate - Climate classifications for building designers in tropics - Climate characteristics. Human body heat balance – Body heat balance - Effects of climatic factors on human body heat loss - Effective temperature - & Comfort zone, Human thermal comfort - Thermal comfort factors and indices.

MODULE II DESIGN OF SOLAR SHADING DEVICES 9

Movement of sun - Locating the position of sun - Sun path diagram - Overhead period-Solar shading -Shadow angles - Design of appropriate shading devices

MODULE III HEAT FLOW THROUGH BUILDING ENVELOPE CONCEPTS 9

The transfer of heat through solids - Definitions - Conductivity, Resistivity, Specific heat, Conductance, Resistance and Thermal capacity - Surface resistance and air cavities- Air to air transmittance (U value) - Time lag and decrement

MODULE IV IMPACT OF AIR MOVEMENT DUE TO NATURAL AND BUILT FORMS 9

The wind - The effects of topography on wind patterns - Air currents around the building - Air movement through the buildings - Layout planning for air movement – Wind rose- Wind shadow- Ventilation controls and their applications in buildings- Thermally induced air currents. The use of fans - Thermally induced air currents - Stack effect, Venturi effect - Use of court yard.

MODULE V CLIMATE AND DESIGN OF BUILDINGS 9

Design strategies in warm humid climates, hot humid climates, hot and dry climates and cold climates - Climate responsive design exercises. Analysis of case studies, vernacular expression.

TOTAL SESSIONS: 45

TEXT BOOKS:

1. Koenigsberger and others, "Manual of Tropical Housing and Building" - Part I - Climate design, Orient Longman, Madras, India, 1993.
2. Bureau of Indian Standards IS 3792, "Hand book on Functional requirements of buildings other than industrial buildings", (Part I - IV), Manakbhavan, 9, Bahadur Shah Zafar Marg, New Delhi - 110002, 1987

REFERENCES:

1. Martin Evans, "Housing Climate and Comfort", Architectural Press, London, 1980
2. B. Givoni, Man, "Climate and Architecture", Architectural Sciences Series - Applied Science Publishers Ltd., London, 1981
3. B. Givoni, "Passive and Low Energy Cooling of building", Van Nortrand Reinhold New York, USA, 1994
4. Galloe, Salam and Sayigh A.M.M., "Architecture, Comfort and Energy", Elsevier Science Ltd., Oxford, U.K, 1998

COURSE OUTCOMES:

- Have a broad knowledge of climate and human and building interactions with details regarding the movement of the sun and its effect.
- Be aware of the physics of heat transfer through materials and building elements.
- Be familiar with the dynamics of air-movements in and around buildings.
- Be able to place this specialized knowledge in the context of the design of

buildings and the wider subject

- Be able to critically evaluate the wider implications of how human beings interact with their environment
- To be able to think in an innovative and creative way
- Be able to address particular practical issues such as designing of shading devices based on sun path diagram.

ARC B 2303 THEORYAND DESIGN OF STRUCTURES- II 3 0 3

AIM:

To sensitize the students to understand the diversities and complexities in natural environments and the need for intervention in the context of global warming and climate change.

OBJECTIVES

- Understanding of basic theories and principles of structural analysis
- Understanding of properties of materials relevant to structural analysis.
- Understanding of behavior of structural elements under various conditions.

SESSIONAL WORK : • Testing of various materials such as brick cement, sand etc. in the workshop. • Seminars on soils, foundations and frame structures and documentation of the same. • Plates on soil aspects.

MODULE I. BEHAVIOUR OF STRUCTURAL ELEMENTS 9

Understanding and identifications of location of forces, bending moment and bending stress in fixed beams, over hanging beams, continuous beams, portal frames etc

Deflection in simply supported beams and cantilevers with distributed and point loads. Columns and struts-short and long columns, slenderness ratio etc. Combined bending and direct stresses , axial and eccentric loads effect of eccentricity, e. g. masonry wall , chimney.

Fixed beams simple support and fixed support, advantages and disadvantages. Determination of positive and negative bending moments in fixed beams. (confine the loading to point and UDL covering full span only).

Continuous beams – negative and positive bending moments in continuous beams covering two or more spans of uniform section and simple loading by moment distribution method. Symmetrical Portal frames.Strain Energy.

MODULE II. FOUNDATION DESIGN - SOIL ASPECTS 9

Importance of the subject.Types of soils and their properties. • Methods of compaction and consolidation.

Void ratio, porosity, bulk density, moisture content, degree of saturation, liquid limit, plastic limit. Etc.Test for assessing load bearing capacity of soil.

Soil properties and characteristics relevant to the design of foundations.Criteria for selection of foundation type for different soil

conditions. Effect of water level , settlement of soil.Failure of foundation systems.Improvement of soil properties. • Design procedure for simple load bearing foundations.

MODULE III PLANE TRUSSES **9**

Introduction to Determinate and Indeterminate plane trusses - Analysis of simply supported and cantilevered by method of joints

MODULE IV TYPICAL STRUCTURAL MATERIALS & CONTEMPORARY ADVANCEMENT **9**

Introduction to type, Structural properties and Application of: stone - timber - bricks - other metals-concrete - composite - glass – paper.

TOTAL SESSIONS: 45

TEXT BOOKS:

1. R.K. Bansal, "A text book on Strength of Materials", Lakshmi Publications, Delhi 1998

REFERENCES:

1. Junnarkar, "Mechanics of Structures" (Vol - I), 21st edition, Charotar publishing house India, 1995
2. Bansal.R.K., "Strength of Materials", Laxmi Publications Pvt Limited, India, 1990.
3. Rajput.R.K., "Strength of Materials", S.Chand &Co, New Delhi, 1996.
4. Punmia.P.C., "Strength of materials and Theory of structures", Vol 1, Laxmi publications, Delhi, 1994.
5. Ramamrutham, "Strength of Materials", Dhanpatrai & Sons, Delhi, 1990.

COURSE OUTCOMES:

- Study the effect of action of forces on a body and the concept of equilibrium of the body through exercises
- Study the Stress - strain behaviors of steel and to drive the relationship between elastic constant and solving problems
- Study the structural properties of various material

ARC B 2304 BUILDING MATERIALS AND CONSTRUCTION – II 2 4 4

AIM:

The course is designed to facilitate the students with construction practices pertaining to Concrete, for appropriate application.

OBJECTIVES:

- To develop an awareness about the various ingredients and composition in concrete.
- To understand the importance and use concrete in construction, through drawings.
- To expose the students to the importance and use of concrete in the modern Construction industry.
- To familiarize the students with the modern building products and their application through drawings.

MODULE I CONCRETE TECHNOLOGY 15

Cement - Composition, strength, properties, manufacture, test and types. Sand - Composition, strength, properties, manufacture, M-Sand test and types.

MODULE II COARSE AGGREGATE 15

Coarse aggregate - Composition, strength, properties, Extraction, test and types. Water - cement ratio, workability, curing, water-proofing, gMODULE ing, Special concrete, Manufacture, contruction of formwork, Integration of steel in concrete, Joints in concrete, Concrete finishes.

MODULE III TYPES OF CONCRETE AGGREGATES & CONCRETE 15

Lightweight aggregate , High density concrete , Aerated Concrete, No-Fines Concrete, Polymer concrete, Reinforced Cement Concrete, Pre-Stressed Concrete, Ready - mixed & under water concreting - Exercise involving the same.

MODULE IV CONCRETE IN CONSTRUCTION 15

Framed Structures, Foundations, Footings, Concrete Floors,Walls&Partitions,Concrete lintels, Arches, Sunshades, Concrete Slabs, Concrete beams &Columns, Concrete Staircases - Historical overview,

sculptural

MODULE V R. C. C. CONSTRUCTION 15

Frame construction, advantages over load bearing construction, study of column grid, detailing of R. C. C. work with reinforcement for slabs, beams, columns, footing, staircases (ordinary and spiral).

TOTAL SESSIONS: 75

TEXT BOOKS:

1. Dr.B.C.Punmia, "Building Construction", Firewall Media , 2005.
2. Francis D.K.Ching, "Building Construction Illustrated" ,John Wiley & Sons Inc, 2002.
3. T.D Ahuja and G.S. Birdie, "Fundamentals of Building Construction", Dhanpat Rai Publishing Company Pvt. Ltd., New Delhi, 1996
4. R.M. Davis, "Plastics in Building Construction", Battersea College of Technology, Blackie, London, 1966
5. Barry, "Introduction to Construction of Buildings" Vol. 3, Blackwell Publishing Ltd., Oxford, 2005

REFERENCES:

1. W.B.Mckay , "Building Construction", Vol. 1,2,3- Longmans U.K 1992.
2. S.C.Rangwala, "Engineering Materials", Charotar Publishing House, India, 1997.
3. Alan Banc, "Stairs, Steps and Ramps", Butter worth Heinemann Ltd., 1996
4. M.S.Shetty, "Concrete Technology-Theory and Practice", S.Chand & Co. Ltd., New Delhi, 2005.
5. W.B.Mckay , "Building Construction" , Longmans, UK, 1981
6. Economy/companies/construction/concrete/materials
7. http://www.easyads.co.2a/yellow/india/construct
8. http://www.concrete.t.v-tokyo.ac.ip
9. www.larsentoubro.com
10. www.dalmiacement.com/index.html

COURSE OUTCOMES:

- The students will able to design medium and large span low rise structure, of RCC
- They can design RCC stair case of appropriate form and structural system.
- Incorporate structural glazing /curtain wall in the architectural design of buildings.

ARC B 2306 ARCHITECTURAL DESIGN III 0 16 8

AIM:

The aim of the course is to emphasis and evolves the methodology for architectural design with reference to the previous knowledge of function and aesthetics. The design should highlight clear approach to the design with concept, Analysis, Synthesis and clarity of details (like barrier free design considerations), along with architectural expression with use of appropriate graphic presentation techniques.

OBJECTIVES:

- To foster understanding about land and landforms and the elements of built space.
- Experimentation with shapes and forms to evolve sensitivity to built volumes.
- Focus on studying patterns in horizontal circulation in built areas, with creativity.

CONTENT:

The projects would address the study of built form and its relationship to the site, surroundings and climatic setting. Design proposals to address sensitivity to climatic and physical settings. The design problem would induce students to experiment with built and open spaces.

Design of a simple building for public activity in a non urban setting, or a situation without urban regulatory controls.

AREAS OF FOCUS/ CONCERN:

- architectural form and space
- aesthetic and psychological experience of form and space in terms of scale, colour, light, texture, etc.,
- function and need: user requirements, anthropometrics, space standards, circulation
- image and symbolism

TYPOLOGY/ PROJECT:

Residential buildings, Institutional buildings: banks, nursery or primary schools, primary health centers etc.

TOTAL SESSIONS: 225

TEXT BOOKS:

1. Joseph De Chiara, Julius Panero, Martin Zelnik, "Time Saver Standards for Interior Design and Space Planning", McGraw Hill, 2001.
2. Ernst, "Neuferts Architects Data", Blackwell, 2002
3. Ramsey et al, "Architectural Graphic Standards", Wiley 2000

REFERENCES:

1. De Chiara and Callender,"Time Saver Standards Building Types", McGraw Hill Co., 2ND Edition, 1980.
2. Andrew Alpern, "Handbook of Specialty Elements in Architecture", McGraw Hill Book Co., 1982.
3. Mark Karlen, "Space Planning Basics", John Wiley & Sons Inc, 2009.

COURSE OUTCOMES:

- Students gets the ability to understand and design small and medium scale building projects.
- They will able to solve the design problem functionally and aesthetically.
- Gain knowledge about the design process and its various faces to solve a design problem.
- Solve design solution and present in the form of drawing.
- Enable to express the ideas in the form of 2D representation and 3D modelling.

ARC B 2307 ALLIED DESIGN STUDIO - III &COMPUTER GRAPHICS 0 3 4

AIM:

To teach students the schemes/ subjects which are allied to Architectural design studio course. Also to impart a good foundation in design through hands-on experience in designing simple two dimensional and three dimensional compositions. Output from this course will be in the form of projects.

OBJECTIVES:

- Development of student's vision regarding 3-D forms (models and sculptures) in different materials for specific themes/expressions to develop creative/ imaginative thinking.

To intricuse to the students basics of computer education. Sessional work shall consist of presenting a design programme / projects done under graphics II on CAD

MODULE – 1 **30**

It deals with computer fundamentals which are necessary to be efficient with the computer. It deals with basic word processing and spread sheet function with emphasis on application like generation of letters, preparation of report etc. The course then goes on to teach graphic application other than CAD for fast and attractive presentation of themes and ideas.

MODULE - II **30**

Fundamental understanding of the computers to be expose to the extensively technical subject of the CAD. It is expected that the student before going to the second stage would have gone through fundamentals of the Architectural course.. They are now ready to embarge on a more detailed study on the intricacies of architectural. They are expected to apply their basic knowledge and convert same in to a creative output. At this stage visualization of their design is much easier and would help them to identify various error that may have possibly crept in.

MODULE – III **15**

3 D Design and design concept on this software.

TOTAL SESSIONS: 75

TEXT BOOKS:

1. Sham Tickoo, "Autocad 2009; A Problem Solving Approach" Autodesk Press; 1

edition (July 18, 2008)

2. Sham Tickoo, "3D Max Design, 2009: A tutorial Approach", CADCIM Technologies (November 15, 2008)

REFERENCES:

1. AutoCAD reference manual - Autodesk UNC, 1998.
2. AutoCAD architectural users guide - Autodesk Inc., 1998.
3. Elements of Architecture, Rob Krier , Van Nostrand Rein Hold
4. Architectural colour, Pokter
5. Form and Function and Design, Paul Jacquess Grills
6. Principles of three dimensional design , Wang Wucius , Van Nostrand Rein Hold
7. Principles of Two dimensional design, Wang Wucius, Van nostrand Rein hold.
8. Access by design, George A. Covington & Bruce Hannan , Van Nostrand Rein hold 1996.
9. Design through Discovery, Majore Elliot Bevin, Half Rinehart and Wintan, Newyork 1977.
10. Visual thinking for Architects & Engineers , Ron Kasprisin & James Pettinari - Van Nostrand Rein Hold 1995.
11. http://www.sln.fi.edu/-Computer drafting
12. http://www.ccollege.hccs.cc.tx.us/-Comp.graphic

OUTCOMES:

The students should be able to:

- Work on systems with ease of the software understanding the performance of the hardware relatively.
- Create architectural drawings required for their presentations with precision and accuracy. Revising them without spending much time.
- Work at large scale of drawings in terms of Size or complexity in details or levels of a built form.
- Create independent 3d from or convert 2d diagram in to 3d form.

SEMESTER - IV

ARC B 2401 HISTORY OF BUILT ENVIRONMENT - III 3 0 3

AIM:

The course outlines the planning, construction, function and aesthetics of historical buildings and an appreciation of architectural style as a product of the time, place and culture in the western world which creates knowledge about the art & architecture of the European, & Middle eastern cultures, which have served as the cradle of human civilization is a prime requisite for a student of architecture.

OBJECTIVES:

- To understand the evolution of Medieval history with respect to place and culture.
- To analyse the basic planning of churches (basilican and centralized concept)
- To trace out the changes in history of art, culture and architecture in different countries.(say example, Gothic ,Romanesque architecture in Italy,France and England)
- To explore, and recognise from key examples, the principal architectural styles applied to the design of churches and cathedrals in Italy.
- To study and understand how art aimed at discussing philosophical themes, social, and aesthetic currents.

MODULE I EARLY CHRISTIAN - BYZANTINE ARCHITECTURE 9

Birth and spread of Christianity - early Christian worship. Evolution of church forms. Development of the dome &pendentive in Byzantium.

Typical Church planning - 1.Basilican concept: St. Clement, Rome; St. Peters Rome, - 2.Centralized plan concept: S, Vitale, Ravenna; S. Hagia Sophia, Constantinople; St. Marks, Venice.

MODULE II MEDIEVAL ARCHITECTUIRE - ROMANESQUE 9

Formation of guilds - Factors influencing Romanesque architecture - Outline of architecture character in Italy, France and England -Examples: Pisa group, Italy; Abbaye aux Hommes, Caen; Tower of London.

MODULE III GOTHIC ARCHITECTURE 9

French gothic - Religious and social influences - Evolution of vaulting and development of structural systems -Outline of Architectural character - Examples: Notre Dame, Paris.

English gothic -Development of English gothic vaulting - Outline of Architectural character in England and Italy - Examples: Westminister Abbey, Hampton Court Palace, London; Doges Palace, Venice; Milan Cathedral.

MODULE IV RENAISSANCE ARCHITECTURE 9

Italian Renaissance - The idea of rebirth and revival of art - Outline of the Architecture during the early Renaissance, High Renaissance and Baroque Periods - Features of a typical Renaissance palace, eg. Palazzo Ricardi.

Study of the contribution of the following architects: Brunelleschi, Michaelangelo, Andrea Palladio, Example - St. Peter Rome,Villacapra in Vicenza

MODULE V FRENCH AND ENGLISH RENAISSANCE 9

Architectural character in the classical & Rococo period - Example - Chateau de Chambord, Louvre,Paris -Domestic British architecture- Study of the works Sir Christopher Wren,& Inigo Jones, Example - St. Paul's Cathedral, London. Banqueting House, Whitehall.

TOTAL SESSIONS: 45

TEXT BOOKS:

1. Sir Banister Fletcher's a History of Architecture, Authors :Sir Banister Fletcher, Dan Cruickshank.
2. Early Christian and Byzantine Architecture by Richard Krautheimer
3. Gothic Architecture,Volume 19 of Pelican History of Art,Yale University Press Pelican History of Art, AuthorPaul Frank Edition2.
4. Renaissance Architecture: The Great Ages of World Architecture,Author Bates Lowry Publisher Literary Licensing, LLC, 2011
5. Renaissance Paris: Architecture and Growth, 1475-1600, By David Thomson.

REFERENCES:

1. Yatin Bandya, "Concepts of Space in Traditional Indian Arch", Mapin, 2005.
2. Mitchell, George (1996) "The Hindu Temple, University of Chicago Press.
3. Spiro Kostof , "A History of Architecture : Setting and Rituals", Oxford University

Press, London, 2005 (digitized - 2007).
4. Pier Luigi Nervi, "History of World Architecture Series". Harry N.Abrame Inc. Publication, New York, 1972.
5. Meaning in Western Architecture - Christian Norberg-Schulz-Rizzoli, New York, 1974.

COURSE OUTCOMES:

- The students can articulate knowledge on the construction of religious and civic buildings with grammar.
- They have a comprehensive knowledge about the development of Gothic Period in France and express the synthesis of aesthetics and structure with the aid of sketches.
- They can articulate knowledge on the architectural character of Gothic style of buildings in Europe and express them with sketches of plans, elevations and sections.
- They have a comprehensive knowledge about the philosophy of Renaissance and how they influenced architecture in England and France.

ARC B 2402 BUILDING SERVICES - I 3 0 3

AIM:

The course is designed to facilitate the students with building services that supports the functioning of a building in the area of water supply and sewerage.

OBJECTIVE:

- Introduction to fundamentals of all types of services required in a building.
- Learning about various equipment and fittings available in the market.
- Preparing basic design layout of various services and typical details.

SESSIONAL WORK : • Application of above studies in preparing design layout and details, in the design done in current term

MODULE I WATER SUPPLY, DRAINAGE AND SANITATION 9

Pipes and fittings, materials, size and classification. • Different types of taps, toilet and kitchen fittings. • Connection of lines to fittings.

Under ground, overhead and internal storage tanks and supply lines. • Pumping mechanisms.

Design layout of water supply for a residence and apartment block, and calculation of supply requirements based on standards.

Introduction to sanitation and its importance. • Planning and layout of sanitary fittings in residences. • Drainage system for residences. • Waste water drainage-traps of various types details and use.

Rain water disposal and roof drain. • Sewers details of construction , inspection chambers, trap chambers. • Septic tanks.

MODULE II ELECTRICAL SERVICES 9

General distribution of electric power in towns and cities. • Electrical wiring system – different materials employed and methods of wiring. • Different electrical gadgets and fittings.

Switch board, distribution board, mains, fuse, meter, circuit breaker etc. • Single phase and Three phase distribution and circuits. • Basic electrical layout for a residence.

Earthing for electricity appliances. • Electrical installations for services such as air-conditioning systems, lifts, escalators, pumps etc.

Artificial lighting , design principles, illumination levels.Types of lamps and

fittings used. • Application of lighting system for shops, showrooms, offices, lecture halls, class rooms, stage, auditoriums etc.

MODULE III RENEWABLE ENERGY 9

Solar Energy - Solar panels, Photovoltaic cells, Conversion of solar energy into electricity Advantages and disadvantages of solar energy, Active solar heating, Passive solar heating, Passive cooling techniques in buildings, Status of solar energy in India.

Wind Energy - Conversion of wind energy into electricity, Uses of wind energy, Status of wind energy in India.

MODULE IV ELEVATORS & ESCALATORS AND CHUTES 9

Types of Lifts - Basic dimension, Traffic analysis, Round trip time, lift pit, machine room, types, lift operation, arrangement of lifts, quality & quantity of service

Escalators - basic dimension, Characteristics, arrangement and disposition- Conveyors and Walkways, Chutes.

MODULE V SPACE PLANNING 9

Space requirements - Detail of a Septic tank and sump, Rain water harvesting, Toilet detail, Kitchen plumbing details - Terrace drainage,Drainage layout of a building.

TOTAL SESSIONS: 45

TEXT BOOKS:

1. Handbook for Buildinsg Engineers in Metric Systems, NBC, New Delhi, 1998.
2. Philips Lighting in Architectural Design, McGraw Hill, New York, 1998.
3. R.G.Hopkinson and J.D.Kay, The Lighting of Buildings, Faber and Faber, London, 1998
4. Hopkinson, R.G., "Architectural Physics - Lighting", London. 1998
5. Basic Electrical Engineering, V.K.Mehta, S.Chand and Company Ltd., New Delhi, 1998.
6. G.M. Fair, J.C. Geyer and D.Okin, "Water and Waste water engineering", Volume II, John Wiley & Sons, Inc. New York, 1968

REFERENCES:

1. "Manual on sewerage and sewerage treatment", CPHEEO - Ministry of works

and housing, New Delhi, 1980.
2. S.C.Rangwala, "Water supply and sanitary engineering", Charotar publishing house, Anand, Lecture notes compiled by Chaman.L.Gupta, 1989
3. G.S. Birdie & J.S. Birdie, "Water Supply and Sanitary Engineering".

OUTCOMES:

- The students may exposed to electrical services and power distribution system inside & outside buildings.
- They get to know about importance of lighting in both indoor & outdoor spaces.
- The students obtain knowledge about various vertical transportation systems.
- It enlighten the importance of services in space planning.
- The students were trained to do electrical and plumbing layouts for the buildings.

ARC B 2403 STRUCTURAL AND CONSTRUCTION SYSTEMS - I 3 0 3

AIM:

The focus is to study the concept of shear force and bending moment in beam section, deflection of beams and theory of columns and to know the concept of indeterminate structure.

OBJECTIVE:

- To enable a student to understand the basic concepts of shear force and bending moment acting on beams subjected to various loading conditions through exercise
- To determine stress in beams and strength of sections by working out problems.
- To Calculate deflection of beams
- To study the theory of columns by working out problems
- To understand the concept of inter determinate structure and its analysis

MODULE I SHEAR FORCE & BENDING MOMENTS 9

Definition - Relation between Loading, Shear Force & Bending Moment - Simply Supported and, Cantilever Beams Subjected to Concentrated, UDL, and their Combinations.

MODULE II STRESSES IN BEAMS 9

Theory of simple bending - Bending and shear stress distribution - strength of sections - stress distribution diagrams

MODULE III DEFLECTION OF BEAMS 9

Slope and deflection at a section - Double Integration and Macaulay's method for simply supported & cantilever beams with distributed and point loads

MODULE IV THEORY OF COLUMNS 9

Short - Long Column - Euler's Method & its Limitations - Derivation of Euler's Formula - Slenderness ratio - Rankin's formula for column, effect of eccentric loading.

MODULE VSTATICALLY INDETERMINATE BEAMS 9

Introduction - Determination of degree of statically in determinacy for beams

and frames - concept of Analysis (No problems)

TOTAL SESSIONS: 45

TEXT BOOKS:

1. R.K. Bansal," A Text Book on Strength of Materials", Laxmi Publications, New Delhi, 1994.
2. B.C. Punmia, SMTS-I, "Strength of Materials", Laxmi Publications, New Delhi, 1994.

REFERENCES :

1. M.M. Ratwani & V.N. Vazirani, "Analysis of Structures", Vol. 1, Khanna Publishers - Delhi, 1987.
2. Timoshenko, S.P. and D.H. Young, "Elements of Strength of Materials", Fifth edition, East West Press, 1993.
3. A.R. Jain and B.K.Jain,"Theory and analysis of structures", Vol. 1, Nemchand and Bros, Roorkee, 1987.
4. R.K. Rajput "Strength of Materials", S.Chand & Company Ltd., New Delhi, 1996.

OUTCOMES:

- The students learn about shear stress force and bending moment.
- They may also understand the behavior of long and short columns
- The students study to find the load bearing capacity of beams and columns in a building .

ARC B 2405 SITE PLANNING AND ANALYSIS 3 0 3

AIM:

To provide an understanding of site as an element of design, its characteristics, issues and challenges, and integrate design at various scales.

OBJECTIVES

- Sensitize the students about various types of surveys, instruments used and details of survey records.
- To understand the complex relationship between topography, hydrology, vegetation and climate.
- To enable the understanding of Contour, slope analysis, grading and topography as key factors.
- To enable and analysis of site through various techniques that influences design
- Understanding of survey and analysis for effective application in large scale campus and planning projects.

MODULE I INTRODUCTION 9

Definition of plot, site, land and region as per Act - MODULE s of measurements linear and superficial scales - reconnaissance survey - importance - Field survey - revenue records - Equipments used like compass, plane table, (Theory only)

MODULE II SITE ANALYSIS 9

Importance of site Analysis - On site and off site factors - Natural - cultural and aesthetic factors, - topography, hydrology, soils, vegetation, climate, surface drainage, accessibility, size and shape, infrastructure availability - sources of water supply - means of disposal - site analysis diagram.

MODULE III GRADING AND MICRO CLIMATE 9

Contours, intervals and layers - slope analysis, watersheds, - grading process - grading criteria - consideration for function and aesthetics.

Definition of micro climate - contributory factors - land forms, vegetation, water bodies, density of built environment as modifiers.

MODULE IV DETAILED ANALYSIS 9

Hydrology and irrigation system - Soils and bearing capacity aesthetic and

visual characteristics - sieve maps - matrix analysis - composite analysis - sewage and storm water disposal.

MODULE 5 PLANNING AND LAYOUT 9

Traffic on to and from site - vehicular and pedestrian circulation - hierarchical distribution of road network - road widths and carrying capacity - PCU - turning radii - intersections geometry - parking lay out - campus and regional levels.

TOTAL SESSIONS: 45

TEXT BOOKS:

1. KEVIN LYNCH, "SITE PLANNING", MIT PRESS, CAMBRIDGE MA, 1987.
2. B.C. Punmiya, "Surveying", Vol-I, Standard Book, 1983.
3. UDPFI, guidelines, T and C.P.O, New Delhi, 2005.

REFERENCES:

1. Joseph De. Chiarra and Lee Coppleman, Planning Design Criteria Van Nostrand Reinhold Co., New York
2. Beer R, Environmental Planning for Site Development, Turner, Landscape Planning and Environmental Impact Design.

COURSE OUTCOMES:

- The students gain the knowledge about the usage and principles of various surveying instruments.
- They can understand the complex relationship between topography, hydrology, vegetation and climate.
- They can easily analysis the site through various techniques that influences design.

ARC B 2404 BUILDING TECHNOLOGY - IV 2 4 4

AIM:

To enable the students understand that Ferrous, Non-Ferrous metals and glass are equally important in construction industry by studying their properties, applications, uses and current trends in terms of theory and through drawings, sketches and field visits.

OBJECTIVES:

- To comprehend the progressive achievements from cast- iron to steel by identifying the types, properties and current developments from cast-iron to steel. (Theory)
- To understand in detail through working drawings, the types of sections in steel joints' application in foundation, columns, beams and trusses and basic on concept of space frames.
- To comprehend how Non - Ferrous metals are used in construction industry by learning their properties and applications. (Theory)
- To understand in detail through working drawings, the various types of aluminum doors, windows, ventilators, partitions and roofing system as applied in construction industry.
- To recognize through basic theoretical knowledge the composition of glass, manufacturing, types and application in construction industry.

MODULE I NON FERROUS METALS 9

Introduction AluminIum and AluminIum Alloys brief study on properties and uses Aluminum products extrusions, foils, castings, sheets, etc. brief study of other non ferrous metals like copper, bronze, brass, tin and lead, properties and uses current developments.

MODULE II CONSTRUCTION USING NON FERROUS METALS 9

Aluminum doors - Openable, Sliding, Pivoted. Aluminum windows - Openable, Sliding, Fixed, Pivoted.

Aluminum ventilators - Top hung, Bottom hung, Pivoted, Louvered, and Fixed. Aluminum partitions, False ceiling, Handrails

Aluminum roofing - North-light glazing bar, Aluminum roofing sheets.

Use of other nonferrous metals like copper, bronze, brass, etc. in architectural construction.

MODULE III GLASS **9**

Brief study on structural glazing, Glass façade, MODULE ized glazing, Frameless glasses – Spider glazing, Fin glazing, Glass canopy, Glass Entrance doors, Partitions, Staircases, etc., Curtain Walls – Curtain walls in glass, aluminum, precast concrete MODULE s etc. for buildings like laboratories, offices, cinemas etc. Patent Glazing - Patent glazing for skylights, lanterns, north light trusses etc

MODULE IV PLASTIC PRODUCTS **9**

Primary plastic building products -for walls, partitions and roofs - design and construction details.Secondary building products- for windows, doors, roof lights, domes, and handrails- design and construction details. UPVC doors & windows.

TOTAL SESSIONS: 45

TEXT BOOKS:

1. W.B. Mckay,"Building Construction", Vol.1, 2, 3, Longmans, U.K.,1981.
2. B.C.Punmia, "Building Construction", Lakshmi Publications Pvt. Ltd., N.Delhi.

REFERENCES:

1. Don A.Watson, "Construction Materials and Processes", McGraw Hill Co., 1972.
2. Alanwerth, "Materials", The Mitchell Pub. Co. Ltd., London,1986.
3. R.Chudleu, "Building Construction Handbook", British Library Cataloguing in Publication Data, London, 1990.
4. S.C. Rangawala, "Engineering Materials", Charotar Pub. House, Anand, 1997.

COURSE OUTCOMES:

- The students understand the properties and uses of ferrous and non ferrous materials.
- They aware of the progressive achievements of glass, plastics,, aluminium , its application in construction industry and present developments.
- They can learn the drafting and representation details of aluminium doors, windows, roofing and its uses in building industry.
- They can gain the knowledge of glass, plastics details and its uses in building industry.

ARC B 2406 ARCHITECTURAL DESIGN STUDIO IV 0 16 8

AIM:

To create a holistic understanding of the socio-cultural, geographic and economic aspects that shape the built environment as well as to expose the students towards the design of simple commMODULE y oriented buildings.

OBJECTIVES:

- To make a comprehensive study of a rural settlement that is an exemplar of collective design evolved organically over a period of time.
- To expose the students on the methodology of conducting various surveys covering, physical, visual characteristics and demographic aspects.
- To understand the vernacular / traditional architecture involving local materials and construction techniques.
- To emphasise on the importance of designing built form and open spaces that meet the aspirations of the commMODULE y.
- To enable the presentation of concepts through 2D and 3D presentation including sketches and model.

CONTENT:

Scale and Complexity: Projects involving public and commMODULE y oriented buildings -multi room, single use, small span, multiple storied, horizontal and vertical movement; active cum passive energy; comprehensive analysis of rural settlement in a hierarchical manner.

AREA OF CONCERN/ FOCUS:

- rural settlements and architecture
- commMODULE y oriented design
- simple public buildings (not more than Ground+ 2 floors)

TYPOLOGIES/ PROJECTS:

Rural projects that involve studies and design at settlement and building level- noon meal centre, market, primary health centre; department store, higher secondary school, campus students centre

TOTAL SESSIONS: 225

TEXT BOOKS:

1. Joseph De Chiara, Michael J Crosbie, "Time Saver Standards for Building Types", McGraw Hill Professional 2001.
2. Julius Panero, Martin Zelnik, "Human Dimension and Interior Space", Whitney Library of Design, 1975
3. Joseph De Chiara, Julius Panero, Martin Zelnik, "Time Saver Standards for Interior Design and Space Planning", McGraw Hill 2001.
4. Ernst Neuferts, "Architects Data", Blackwell 2002
5. Ramsey et al, "Architectural Graphic Standards", Wiley 2000

REFERENCES:

1. Richard P. Dober, Campus Planning
2. Kanvinde, Campus Planning in India
3. Kevin Lynch, Site planning, MIT Press, Cambridge, 1967
4. Sam F. Miller, Design Process: A Primer for Architectural and Interior Design, Van Nostrand Reinhold, 1995

OUTCOMES:

- Students gets the ability to understand and design large scale building projects.
- They will able to solve the design problem functionally and aesthetically.
- Gain knowledge about the design process and its various faces to solve a design problem in horizontal and vertical manner.
- Enable to express the ideas in the form of 2D representation and 3D modelling.

SEMESTER - V

ARC B 3501 HISTORY OF BUILT ENVIRONMENT - IV 3 0 3

AIM:

To expose the students to the origin, development and spread of modern architecture in the Western world as well the architectural production of colonialism in India. To expose to students the knowledge about impact of industrialization, invention of new materials, revolutionary thinking and philosophies of architects, emerging schools of thought, and contributions made by architects.

OBJECTIVES:

- To study modern architecture as evolving from specific aspects of movements like Arts & Crafts Movement, Art Nouveau Movement, and the pioneers of the movement.
- Discuss and independently reflect on the concept of various other philosophies like futurism, expressionism, brutalism, constructivism, and the pioneers of these philosophies through study of selected works of them.
- To acquaint students to understand the Bauhaus school of thought, contributions by leading architects like Le Corbusier, Mies Van -der - Rohe, Alvar Aalto etc through study of selected examples.
- To study the further trajectories of modern architecture in the post WWII period.
- To create an overall understanding of the architectural developments in India influenced by colonial rule - Analysis of case studies.

MODULE I LEADING TO A NEW ARCHITECTURE 9

Beginnings of modernity -Origin and development of Neo Classicism- Structural Neo classicists: Laugier, Soufflot, Schinkel, Labrouste - Romantic Neo classicists: Ledoux , Boulle, Durand, Jefferson- Industrialization and its impact-Urbanization in Europe and America- split of design education into architecture and engineering streams- Emergent new building / space types- Growing need for mass housing- Development of Industrial material and construction technologies- concrete, glass and steel- structural engineering, standardization-Industrial exhibitions- Chicago School and skyscraper development.

MODULE II REVIEWING INDUSTRIALISATION 9

Opposition to industrial arts and production - Arts and Crafts in Europe and America: Morris, Webb- Art Nouveau: Horta, Van De Velde, Gaudi, Guimard,

Mackintosh - Vienna secession: Hoffman, Olbrich- Wright's early works

MODULE III MODERN ARCHITECTURE: DEVELOPMENT AND INSTITUTIONALISATION 9

Adolf Loos and critique of ornamentation- Raumplan: Peter Behrens - Werkbund - Modern architecture and art - Expressionism: Mendelsohn, Taut, Polzeig- Futurism- Constructivism, Cubism - Suprematism- De-Stijl Bauhaus-Gropius, Meyer and Mies -CIAM I to X and its role in canonizing architecture-growth of International Style Ideas and works of Gropius, Le Corbusier, Aalto, Mies, later works of Wright

MODULE IV MODERN ARCHITECTURE: LATER DIRECTIONS 9

Post WW II developments and spread of international style - Later works of Corbusier: Brasilia, MODULE e- Works of later modernists: Louis Kahn, Paul Rudolph, Eero Saarinen

MODULE V COLONIAL ARCHITECTURE IN INDIA 9

Colonialism and its impact- early colonial architecture: forts, bungalows, cantonments - Stylistic transformations: Neo- classicism, Gothic Revival and Indo Saracenic - PWD and institutionalization of architecture - Building of New Delhi showcasing imperial power.

TOTAL SESSIONS: 45

TEXT BOOKS:

1. Kenneth Frampton, "Modern Architecture: A Critical History", Thames & Hudson, London, 1994
2. Catherine Slessor ,"Contemporary Architecture", Images Publishing, 2003.
3. Leonardo Benevolo, "History of Modern Architecture", 2 Vols. Routledge & Keganpaul, London, 1971
4. Miki Desai et. al., "Architecture and independence", Oxford University Press, 2000

REFERENCES:

1. Thomas Metcalf, "An imperial Vision", Faber & Faber/ Electa, 1980.
2. Christian Norburg Schulz., "Meaning in Western Architecture", Studio Vista.
3. Xiangbiao Zhao, "Global Architecture", Hong Kong Scientific and cultural Publishing - 2008.
4. Sigfried Giedion, "Space Time and Architecture: The Growth of a New Tradition", Harvard University Press, 1978.

OUTCOMES:

- Students gain knowledge about different concept of various other philosophies like futurism, expressionism, brutalism, constructivism, and the pioneers of these philosophies through study of selected works of them.
- They obtain overall understanding of the architectural developments in India influenced by colonial rule - Analysis of case studies.
- They also gain comprehensive knowledge of modern architecture using many movements.

ARC B 3502 BUILDING SERVICES - II 3 0 3

AIM:

The course is designed to facilitate the students with building services that supports the functioning of a building in the area of air conditioning and fire safety systems.

OBJECTIVES:

- To introduce the students to the various concepts of air conditioning.
- To expose the students to the indoor & outdoor components in air conditioning.
- To understand the importance and functioning of fire safety systems.
- To enlighten the importance of services in space planning.

MODULE I INTRODUCTION TO AIR CONDITIONING 9

Introduction to A/C conditions - basic of refrigeration systems - components of refrigeration system - compressor, condenser - control devices, evaporator - filters cooling tower - Vapour compression cycle - Concepts of cooling, , transmission heat load - internal heat gain - concepts of zoning - room air distribution - types of outlets.

MODULE II AIR CONDITIONING SYSTEMS AND ITS APPLICATIONS 9

Air conditioning system for small buildings - window types, evaporative cooler, packaged terminal MODULE s and through the wall MODULE s split system b) Systems for large building - Chilled water plant - All Air system, variable air volume, All water system Configuring/ sizing of mechanical equipment, equipment spaces and sizes for chiller plant, cooling tower, Fan room, Circulation Pumps, Pipes, ducts.

MODULE III FIRE SAFETY: DESIGN AND GENERAL GUIDELINES 9

Principles of fire behavior, Fire safety design principles _ NBC Planning considerations in buildings - Non- Combustible materials, egress systems, Exit Access - Distance between exits, exterior corridors - Maximum travel distance, Doors, Smoke proof enclosures . General guidelines for egress design for Auditoriums, concert halls, theatres, other building types, window egress, accessibility for disabled- NBC guidelines - lifts lobbies, stairways, ramp design,

fire escapes and A/C, electrical systems.

MODULE IV FIRE DETECTION AND FIRE FIGHTING INSTALLATION 9

Heat smoke detectors - sprinkler systems, Fire fighting pump and water requirements, storage - wet risers, Dry rises, Fire extinguishers & cabinets, Fire protection system - CO2 & Halon system, Fire alarm system, snorkel ladder.

MODULE V SPACE PLANNING & FACILITY MANAGEMENT 9

Space requirements -Space planning for various air conditioning components both indoor & outdoor MODULE s. space requirements for the different fire fighting equipments.

TOTAL SESSIONS: 45

TEXT BOOKS:

1. Steve Doty & Wayne C. Turner, (2009), "Energy Management Handbook", Seventh Edition, The Fairmont Pres, USA.
2. Ibrahim Dincer & Marc. A. Roren, (2007), "Exergy - Energy, Environment and Sustainable Development", Elsevier, USA.
3. William H.Severns and Julian R.Fellows, Air-conditioning and Refrigeration, John Wiley and Sons, London, 1988.

REFERENCES:

1. William H.Severns and Julian R Fellows, "Air conditioning and Refrigeration", John Wiley and Sons, London, 1988
2. "Fire Safety: National Building Code of India" published by Bureau of Indian Standard, 1983
3. A.F.C. Sherratt, "Air conditioning and Energy conservation", The Architectural Press, London, 1980
4. Andrew H Buchanan, "Design for fire safety", John Wiley & Sons Ltd., New York.

OUTCOMES:

- The students are exposed to the various concepts of air conditioning.
- Students understands the concept of building automation, safety, security and controls systems integrated to building managements systems.
- They can able to learn the use of energy in construction industry, explore energy conservation and energy efficient techniques in current trend.
  Impart knowledge on fire safety, security and fire fighting system

ARC B 3503 STRUCTURAL AND CONSTRUCTION SYSTEMS - II 3 0 3

AIM:

To facilitate the design of Reinforced concrete beams, slabs, column, and foundations by limit state method.

OBJECTIVE:

- To study the limit state design of beams
- To study the limit state design of slabs
- To study the limit state design of columns
- To study the limit state design of foundations
- To study R.C.C Arches

MODULE I LIMIT STATE DESIGN OF BEAMS 9

Concept of Elastic method, Ultimate load method and limit state method - Advantages of limit state method over other methods

Estimation of loads on beams - transfer of load from slab to beam - design of singly, doubly reinforced - design of simply supported beams - Design of continuous beams using codal coefficients - detailing - use of SP - 16 for the design.

MODULE II LIMIT STATE DESIGN OF SLABS 9

Behavior of one way slab and two way- design of one way slab and two way slab by direct design method as per BIS code.

MODULE III LIMIT STATE DESIGN OF COLUMNS 9

Estimation of loads on columns - load transfer from slab and beams to columns - long and short columns - rectangular and circular columns - columns subjected to uni-axial and bi-axial bending - design of columns using column interaction diagrams - use of SP - 16 - detailing.

MODULE IV LIMIT STATE DESIGN OF FOUNDATION 9

Types of R.C.C. foundation - individual, combined, strip footing - Design of individual column footings - Rectangular sloped footing - design of combined footings.

MODULE V R.C.C ARCHES 9

R.C.C Arches - Introduction, types & Analysis of Two & three Hinged Arches -

Introduction to shells &Folded plates - structural Action

TOTAL SESSIONS: 45

TEXT BOOKS:

1. S.N. Sinha, Reinforced Concrete Design - Tata McGraw Hill Publishing Co. Ltd.,New Delhi,1998.
2. Shah, Reinforced Concrete, Vol. 1 and 2 - Charotar Publishing House, Anand, 1998.

REFERENCES:

1. P. Dayaratnam, Design of Reinforced Concrete Structures, Oxford and IBH Publishing Co.,1983.
2. C. Sinha and S.K. Roy, Fundamentals of Reinforced Concrete, S.Chand & Co., New Delhi, 1983.
3. Dr. B.C. Punmia, Reinforced Concrete Structures, Vol, 1 & 2 Laxmi publication, Delhi, 1994.
4. IS 456:2000, Indian Standard, Plain and Reinforced Concrete - Code of Practice, Bureau of Indian Standards.
5. S. Unnikrishnan Pillai and Devados Menon, Reinforced Concrete Design - Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1999.

OUTCOMES:

- The students would have understood the different types of limit state design of beams and columns.
- Knowledge on the functions and effects of limit state design of slabs and foundation.
- An exposure to structural properties and applications of R.C.C arches used in the building industry.

ARC B 3504 BUILDING CONSTRUCTION AND TECHNOLOGY 2 4 4

AIM:

To study the various materials and construction techniques used for moisture protection, thermal protection, sound protection and protective finishes in buildings.

OBJECTIVES:

- To learn and apply the knowledge of materials and techniques for Moisture control in producing construction details for moisture protection of basements, roofs, plinths and terraces.
- To identify the different types of swimming pools and producing construction details with various fixtures for swimming pools
- To understand and apply the knowledge of materials and techniques for Thermal protection in producing construction details for thermal protection of spaces in various climatic zones.
- To understand and apply the knowledge of materials and techniques for Sound protection in producing construction details for acoustic protection of spaces in auditoriums, recording studios and theatres.
- To discern and analyze various protective and decorative coatings applied in buildings concentrating on current developments,

MODULE I MOISTURE PROTECTION 15

Introduction about damp proofing & water proofing - causes & effects of dampness - types of dampness - Various materials used for damp proofing & water proofing - Various methods of damp proofing - Drawings of construction detail and applications of damp & water proofing under various situations - Basement floors, terraces etc. Types of pools, Construction Details

MODULE II THERMAL PROTECTION 15

Introduction about thermal insulation - Heat transfer and heat gain by materials - vapour barrier- Commonly used insulation materials in buildings - Drawings of construction details and material applications of floors, walls and roofs in various situations - e.g. Cold storage, Air conditioned office spaces

MODULE III SOUND PROTECTION 15

Introduction about sound protection - basic forms of absorbents - types of absorbent materials, properties and uses, Commonly used sound insulation materials in buildings - Drawings of construction details and material

applications of floors, walls and roofs in various situations - e.g. Conference hall, Auditoriums, Recording studios

MODULE IV PROTECTIVE **15**

Paints - ingredients, types, applications, properties and uses in buildings - painting on different surfaces - defects of painting - special purpose paints - bituminous, luminous, fire retardant and resisting paints - properties,

MODULE V DECORATIVE COATINGS **15**

uses and applications of varnishes, lacquers and wall putty- Current development and specifications - Introduction, different types, properties, uses and applications of shellac - properties, uses and applications polyurethane, enamel, plastic acrylic emulsion.

TOTAL SESSIONS: 75

TEXT BOOKS:

1. Francis.D.K.Ching. Building Construction Illustrated (II ed.). New Jersey: John Wiley & Sons - 2008.
2. Lyons, A. Materials for Architects and Builders. Butterworth Heinemann Ltd - 2010.
3. P.C.Varghese. Building Materials. New Delhi: Prentice-Hall of India Pvt Ltd. 2005.
4. Punmia, B., Jain, A. K., & Jain, A. K. Building Construction. New Delhi: Firewall Media. 2005.

REFERENCES:

1. D.K.Doran, "Construction Materials Reference Book", Oxford: Butterworth Heinemann Ltd. 1995.
2. Simmons, H. L. "Olin's Construction: Principles, Materials and Methods", New Jersey: John Wiley & Sons. Inc. 2011.

OUTCOMES:

- Understand present practices and materials for damp & water proofing including in basements, swimming pools, terraces etc.
- Understand the causes for heat gain & heat loss how effectively the insulation helps in keeping the comfortable heat levels in buildings.
- Understand major defects and possible rectification is understood. The commonly

used acoustic treatments with the thrust on recording studio & auditorium

Recognize to differentiate various types of decorative coatings and its properties

ARC B 3506 ARCHITECTURAL DESIG 0 16 8

AIM:

At the intermediate stage to graduate the student further on design of buildings involving technology, structural clarity and Building Services in terms of lighting, ventilation, Movement, fire safety, security, water supply, sewage etc. and to make them hands on in computer presentation skills.

OBJECTIVES:

- To make the student understand the complexity, functioning and salient features of the Design project through organizing field visit, train them to document and present the findings.

DESIGN STUDIO

Small complexes - concept of multi planning and circulation analysis - grouping of buildings

Involving services integration, Design and detailing for movement of physically handicapped and

Elderly persons within and around buildings.

Examples: office buildings such as Bank corporate offices, BPO Centers, School of Management, film institute, Art Centre, Museums.

TOTAL SESSIONS: 225

TEXT BOOKS:

1. S. Macmillan, "Designing Better Buildings" . Routledge, 2003.
2. Digital Workflows in Architecture: Design - Assembly - Industry / Scott Marble-2012
3. Masterpieces: Office Architecture + Design Lara Menzel - 2009
4. National Building Code and Bureau of Indian standard publications.2005
5. De. Chiara and Callender, "Time-saver Standards for Building Types", McGraw-Hill Co., New York, 1973.
6. The Handbook of Building Types., NEUFERT ARCHITECTS DATA, New International edition, second international edition. BSP Professional Books. Oxford (1980) Blackwell scientific Publications.
7. Time - Saver Standards for Architectural Design Data, seventh edition. The reference of architectural fundamentals McGraw hill international edition, architectural series (1998).
8. Ed.By.Quentin Pickard RIBA "The Architects' Hand Book", Bladewell Science

Ltd., 2002

REFERENCES:

1. Digital workflows in architecture: Design - Assembly - Industry / Scott Marble
2. http://www.archdaily.com/category/institutional-architecture/
3. http://www.thehub.net.au/%7Emorrisqc/architext
4. http://www.archinet.co.uk/
5. http://archinform.de/start.en.htm

OUTCOMES:

- Work on multi planning and mass problems involving building technology
- Use computer for drawing and presentation skills using appropriate software. They will able to solve the design problem functionally

SEMESTER - VI

AR B 3601 CONTEMPORARY BUILT ENVIRONMENT 3 0 3

AIM:

To expose the students to the diverse postmodern directions in architecture in the Western world from the 1960s onwards as well as the architectural production in India from the end of colonial rule to the contemporary period.

OBJECTIVES:

1. To study the different postmodern directions in architecture and the evolution of new approaches.
2. To appreciate contemporary architectural trends.
3. To comprehend the ideas and philosophies of architects and architectural styles.
4. To understand the emerging architectural trends through the works of pioneering architects and to explore about alternative building technology practiced by various architects.
5. Lectures and site visits to acquaint students with sites and buildings in relevance to the course taught.

MODULE I INTRODUCTION 9

A brief introduction in critiquing Modernism, Conditions of Post Modernity, Various Post Modern directions / movements in architecture in different parts of the Western world and their role in defining Modern architecture such as Post Modernity, Impressionism, Expressionism, Art Nouveau, Surrealism, Abstract Expressionism, Cubism etc.

MODULE IITRENDS IN CONTEMPORARY BUILT ENVIRONMENT 9

Trends in Contemporary Architecture – Introduction and brief understanding and appreciation and comparison of contemporary trends in Indian and Western Architecture focusing on understandings, appreciations, ideas and directions through examples – a broad spectrum

MODULE III DEVELOPMENTS IN CONTEMPORARY ARCHITECTURE 9

Contemporary Architecture to be studied as development of built forms and

ornamentation, structural solutions, construction methods, plan and building façade organization in relation to aesthetic/religious/social philosophy and environmental factors. The study can focus on the general trends and or with specific examples of relevance.

MODULE IVCONTEMPORARY TRENDS IN INDIA 9

Trends in Architecture in India after Independence.Influence of Le Corbusier and Louis.I. Khan. Studies of the ideas and works of B.V. Doshi, Charles Correa, Raj Rewal, J.A.Stein, AchyutKanvinde, AnantRaje, Uttam Jain, Hasmukh Patel, Laurie Baker, Chandravarkar& Thacker, Hafeez Contractor, Nari Gandhi, ShirishBeri, Romi Khosla, RanjitSabiki, Anil Laul, Shashi Bhooshan, Jaisim, Bimal Patel etc

MODULE V CONTEMPORARY DIRECTIONS IN OTHER PARTS OF THE COUNTRY 9

Studies of the ideas and works of Robert Stern, Charles Moore, GoefferyBawa, Michael Graves, Richard Meyer, Aldo Rossi, Frank Gehry, Rob Krier, Hassan Fathy, Renzo Piano, Richard Rogers, Norman Foster, Tado Ando etc

Note:

The architectural styles and buildings to be discussed in context of their period, geographical/climatic conditions, economic and political conditions, social and religious customs, construction and technology, building material and structure.

TOTAL SESSIONS: 45

TEXT BOOKS:

1. Bill Risebero, "Modern Architecture and Design", MIT Press ,1985.
2. Kenneth Frampton, "Modern Architecture: A Critical History", Tahmes and Hudson, London, 1994.
3. James Steele, "The Complete Architecture of Balakrishna Doshi", Thames and Hudson,1998.
4. "McMillan's Encyclopedia of Architecture" ,Macmillan Publications,1990.

REFERENCES:

- Thomas Metcalf, "An Imperial Vision", Oxford University Press,2002.
- Manfredo Taferi/Franceso dal co., "Modern Architecture", Faber and Faber/Electa, 1986.
- Sigfried Giedion, "Space Time and Architecture: The Growth of a New

Tradition", Havard University Press, 1978.

- Aldo Rossi, "The Architecture of the City", MIT Press, Massachusetts, 1982.
- Charles Jencks, "The Language of Post Modern Architecture", Rizzoli, 1984.
- Christopher Alexander, "Pattern Language", Oxford University Press, 1977.
- Jon Lang,Madhavi Desai , "Architecture & Independence - India 1880 to 1980" paper bags,Oxford India 1997.
- Derek Avery, "Modern Architecture", Chaucer Press ,London , 2003.
- Robert Venturi, Complexity and Contradiction in Architecture, 1977.
- Michael Hays ed., Architecture Theory since 1968, CBA, 1999
- William Jr. Curtis, Balkrishna Doshi, An Architecture for India, Rizzoli
- Brian Brace Taylor, Geoffrey Bawa, Thames & Hudson

OUTCOMES:

- Obtain considerable knowledge on the progress of architectural philosophies globally over the past century and discuss current trends and theories knowledgably.
- Independently research trends in architecture and form critical opinions on differing ideologies and schools of thought.

Understanding of the architectural commMODULE y developments in the country after independence and sharing a common vision of architectural thoughts that shared by numerous notable architects

AR B 3602 STRUCTURAL AND CONSTRUCTION SYSTEMS III 3 0 3

AIM:

To enable the design of timber and steel structural member in a building

OBJECTIVE:

- To Introduce the design of various timber components in a buildings
- To enable the understanding of types and efficiency and strength, advantage and disadvantage of rivet and welded joints in steel.
- To enable the design of tension member and column, in a building under various condition

MODULE I TIMBER STRUCTURES - BEAMS, COLUMNS AND ROOF TRUSSES 9

Properties, strength and types of timber used as structural components in timber construction - Permissible stresses in timber -. Types of Timber Roof Trusses used for small spans.

MODULE II STEEL STRUCTURES 9

Introduction Properties of Indian standard rolled steel section - Use of IS 800 and steel tables - Permissible and stresses in tension, compression and shear. Connections: Welded and riveted connections - Types of failure

MODULE III TENSION MEMBERS 9

Steel structures - Tension members - Design of single angle and double angle sections in tension

MODULE IV COMPRESSION MEMBER 9

Steel structures - compression members - Design of compression members - Slenderness ratio - Design of simple and compound sections - Design of lacings and battens.

MODULE V BEAMS 9

Principal beams - allowable stresses - General specifications - Design of laterally supported beams.

TOTAL SESSIONS: 45

TEXT BOOKS:

1. Ramachandra .S, "Design of steel structures" Vol. I, Standard publication, New Delhi, 1992
2. Vazirani .V.N, and Ratwani .M.M, "Steel structures", Khanna Publications, New Delhi,1995

REFERENCES:

1. Arya. A.S, Ajamani .J.L, "Design of Steel Structures", Nem Chand and Bros, Roorkee, 1999
2. Duggal, "Design of Steel structures", Tata McGraw Hill Company, New Delhi, 2000
3. Lin. T.R, and Scalzi .J.B, "Design of Steel structures", Bressler Weley Eastern Pvt. Ltd., New Delhi, 1960
4. Dayaratnam. P, "Design of Steel Structures", Wheelers Publishing Company Co. Ltd, 1990
5. "Handbook of Typified Designs for Structures" with steel roof trusses, SP 38 (S&T) - 1987, BIS, New Delhi

OUTCOMES:

- The students learn the properties of structural components of timber and its uses in construction industry.
- Understand the need for steel structure, and the concept of abstract and detailed Design of steel Structure.
- Calculate the stability of tension and compression members.
- Design steel column and beams for the various Support Condition with suitable bearing loads.

AR B 3603 ESTIMATION AND SPECIFICATION 3 0 3

AIM

- To equip students with the necessary technical knowledge for calculating estimates with specifications and costing for varoius scale projects.

OBJECTIVE

- To enable understanding of methods of preparation of estimates and assesment of quantities.
- To enable writing and understanding of specification for different building typologies.
- A holistic understanding of costing and budgeting of design projects.
- Small scale projects to be undertaken to understand costing principles and terms.
- Final costingexercise to be carried out where students can undertake the costing of their studio design project

MODULE I SPECIFICATIONS 9

Necessity of specification, importance of specification, - How to write specification, - Types ofSpecification, -Principles of Specification writing, - Important aspects of the design of specification– sources of information – Classification of Specification.

MODULE I SPECIFICATION WRITING 9

Brief Specification for 1 st class, 2nd class, 3rd class building. Detailed specification for earthworkexcavation, plain cement concrete, Reinforced concrete, first class and second class brickwork,Damp proof course, ceramic tiles/marble flooring and dadoo, woodwork for doors, windowsframes and shutters, cement plastering, painting & weathering course in terrace.

MODULE III ESTIMATION 9

Types & purpose, Approximate estimate of buildings – Bill of quality, factors to be considered, -principles of measurement and billing, contingencies, measurement of basic materials like brick,wood, concrete and MODULE of measurement for various items of work – abstract of an estimate.

MODULE IVDETAILED ESTIMATE 9

Deriving detailed quantity estimates for various items of work of a building. Like

earthworkexcavation, brick work, plain cement concrete, Reinforced cement concrete works, wood work,iron works, plastering, painting, flooring, weathering course for a single storied building.

MODULE V CURRENT TRENDS **9**

Methods of contracting and its link to specification drafting - the Business Environment and thestructure in practice.Valuation, depreciation and its implications – Case studies.

TOTAL SESSIONS: 45

TEXT BOOKS:

1. Dutta, "Estimating and Costing", S.Dutta and Co., Lucknow
2. S.C.Rangwala, "Elements of Estimating and Costing", Charoter Publishing House, India.

REFERENCE BOOKS:

1. W.H.King and D.M.R.Esson, "Specification and Quantities for Civil Engineers", The English University Press Ltd.
2. T.N.Building Practice, Vol.1, Civil, Govt. Publication.
3. P.W.D. Standard specifications, Govt. Publication

OUTCOMES:

- Understand the need for estimation, and the concept of abstract and detailed estimates.
- Prepare BOQ and know to control cost and budget within the norms and standards.

Acquaint themselves about the various financial agencies and institutions

AR B 3605 ARCHITECTURAL ACOUSTICS AND DETAILING 2 4 4

AIM:

The course is designed to facilitate practical knowledge to the students to integrate sound control in relation to building functions and as a determinant of built form with emphasis on the application to architecture.

OBJECTIVE:

- To understand the science behind acoustical design.
- To expose students to understand noise control and sound transmission and absorption.
- To familiarize the students with the basic principles of acoustic design for spaces and building types.
- To provide practical exposure through case studies and working drawings.
- To develop the knowledge and skill required for understanding acoustics in buildings and its integration with architectural design.

MODULE I INTRODUCTION TO ACOUSTICS 15

Nature of sound, Transverse and longitudinal waves, Simple Harmonic motion, wave characteristics, properties of sound, behavior of sound in enclosures, reflection of sound, echoes, dispersion, sound shadows

MODULE II SOUND TRANSMISSION 15

Outdoor noise levels, acceptable indoor noise levels, sonometer, determinate of density of a given building material, absorption co-efficient and measurements, choice of absorption material, resonance, reverberation, echo, exercises involving reverberation time and absorptionco-efficient.

MODULE III NOISE CONTROL AND SOUND ABSORBTION 15

Types of noises, transmission of noise. Noise reduction: Sound isolation, transmission loss TL, TL for walls, sound leaks indoors, noise reduction between rooms, Construction details for noise reduction. Noise reduction and built form, Noise reduction through landscapes elements, landuse planning for noise control.

MODULE IVACOUSTICAL CONSIDERATIONS 15

Acoustical Considerations and design criteria - Site selection, shape,

volume,treatment for interior surfaces, basic principles in designing reinforcement systems for different building types. Walls/partitions, floors/ceilings, window/doors, insulating fittings andgadjets,machine mountingand insulation of machinery.

MODULE V ACOUSTICS AND BUILDING DESIGN **15**

Acoustic design process for different types of buildings. Detailed acoustic design for different building typologies – Small, Large Public areas and Outdoor complex areas in relations the design project dealt in Architectural Design VI. Case studies of relevant building with a report containing drawings and calculations of reverberation time etc needs to be carried out.

TOTAL SESSIONS: 75

TEXT BOOKS:

1. David Eagan "Concepts in Architectural Acoustics".
2. Neufert Architects'Data Third Edition.

REFERENCES:

1. Frederick .S, "Building Engineering and systems Design", Merritt James Ambrose.
2. Dr.V.Narasimhan, " An Introduction to Building Physics", Kabeer Printing Works, Chennai-5, 1974.

OUTCOMES:

- The students are exposed to the basics of acoustics and it relation with the buildings and its integration with architectural design.
- Able to work on acoustical Design brief for design project dealt in Architectural Design VI like Lecture Halls, Classrooms, Conference room, Theatres and Auditoriums.

AR B 3606 ARCHITECTURAL DESIGNSTUDIO VI 0 16 8

AIM:

To explore the design and form of building typologies that are the result of pressure on urban lands with a thrust on issues like urban land economics, technology and ecology.

OBJECTIVES:

- To create an awareness with regard to the design of green buildings and sustainable architecture.
- To inculcate the importance of services integration and construction in spatial planning in the context of design of High-rise buildings and service intensive buildings.
- To highlight on the importance of High rise buildings as elements of identity in urban areas and urban design principles that govern their design.
- To explore computer aided presentation techniques involving 2D and 3D drawings, walk through and models as required.

CONTENT:

- Scale and Complexity: Advanced and complex problems involving large scale Multi-storeyed buildings and complexes for Residential/ Commercial/ Institutional/ Mixed-Use in an urban context with focus on visual characteristics, service integration and sustainable practices.

AREAS OF FOCUS/ ISSUES:

- Sustainable building practices, green issues, alternative energy
- Intelligent building techniques and service integration
- Architectural Detailing
- Advanced building practices

TYPOLOGY/ PROJECT:

Office building, multi-use centre, convention center, multiplex, corporate complex, health care and hospitality building, etc.

TOTAL SESSIONS: 225

TEXT BOOKS:

1. De. Chiara and Callender, "Time-saver Standards for Building Types", McGraw-Hill Co., New York, 1973.
2. The Handbook of Building Types., NEUFERT ARCHITECTS DATA, New

International edition, second international edition. BSP Professional Books. Oxford (1980) Blackwell scientific Publications.

3. Time - Saver Standards for Architectural Design Data, seventh edition. The reference of architectural fundamentals McGraw hill international edition, architectural series (1998).
4. Ed.By.Quentin Pickard RIBA "The Architects' Hand Book", Bladewell Science Ltd., 2002

REFERENCES:

1. Handbook on Building Construction Practices (Excluding Electrical Work). Bureau of Indian Standards, New Delhi, 1997
2. National Building book of India 2005, Bureau of Indian Standards, New Delhi
3. Macmillan Encyclopedia architects, Vol II, The free press, London, 1982
4. A visual dictionary of Architecture, Francis D.K.Ching, John wiley & Sons, Inc. 1997

OUTCOMES:

- Work on multi planning and mass problems involving building technology
  Use computer for drawing and presentation skills using appropriate software

SEMESTER - VII

AR B 4701 PRACTICAL TRAINING (July to November) 10 Credits

AIM:

To provide adequate knowledge on the practice of Architectural Profession to learn the administration, managerial and professional skills and demonstrate the same in future architectural design study.

OBJECTIVES:

The training in seventh semester focusses on learning the relationship between theoretical knowledge and Practical realisation through works of renowned architects. It lays emphasis on understanding the evolution of project from conception, design development, design approval from local body, and planning authorities, preparation of details, tendering and implementation at site.

The architect / firm / institution may train the student on the following:

- Study of Nationally, Internationally famous architects of contemporary period and analyzing the relationship between their philosophy and design to be evaluated by the architect / firm.
- Preparation of drawings for approval of local body and planning authority, procedures, norms and standards.
- Detailed working drawings & service Drawings, BOQ, contract & tender document for various building components and elements.
- Understanding materials and specification recommended by the architect for a project.
- Learning the importance, procedures, and safety regulation during site inspection from the architect at site.
- Develop ability to understand and interpret drawings and clarifications required at site.
- Discussion with clients & other consultants.
- Any other input that the architect/firm/ institutions feel necessary.

Note:

The progress of training shall be assessed internally through monthly confidential reports (in the prescribed format) from the employer and a portfolio of work done by the student through an (external) Viva - Voce examinations.

TOTAL SESSIONS: 100 Days

OUTCOMES:

The students should be able to:

- Know what is happening in the field or in actual practice
- Go to various construction sites, learn and experience
- Understand the system of working and management in the office.

The choice of the place of training shall be Architectural Firms, Organizations, Development Authorities, etc. which are headed by architects.

SEMESTER - VIII

AR B 4801 PROFESSIONAL ETHICS & PRACTICE - I 3 0 3

AIM:

To provide the students a general understanding of the architectural profession and the importance of ethics in professional practice

OBJECTIVES:

- To give an introduction to the students about the architectural profession.
- To enable the students to grasp the elementary issues concerning professional practice.
- To teach the students about the importance of code of conduct and ethics in professional practice.
- To expose the students some of the important legislation which have a bearing on the practice of architectural profession.

MODULE I INTRODUCTION TO THE ARCHITECTURAL PROFESSION

Importance of Architectural Profession - Role of Architects in Society - Alternatives open on entering the profession - Registration of Architects - Architect's office and its management (location, organization structure, responsibility towards employees, consultants and associates, elementary accounts, tax liabilities).

MODULE II PROFESSIONAL ETHICS AND CODE OF CONDU(

Role of Indian Institute of Architects - Architects Act 1972 (intent, objectives, provisions with regard to architectural practice) - Council of Architecture (role and functions) importance of ethics in professional practice (Council of Architecture guide lines) - Code of conduct for architects as prescribed by Council of Architecture, pMODULE ive action for professional misconduct of an architect.

MODULE III ARCHITECT'S SERVICES & SCALE OF FEES

Mode of engaging an architect - Comprehensive services, partial services and specialized services - Scope of work of an architect - Schedule of services - Scale of fees (Council of Architecture norms) - Mode of payment - Terms and conditions of engagement.

MODULE IV ARCHITECTURAL COMPETITION

Importance of Architectural competitions - Types of competitions (open, limited, ideas competition) - Single and two stage competitions - Council of Architecture guidelines for conducting Architectural competitions -International Competitions (case studies).

MODULE V LEGAL ASPECTS & LEGISLATION 9

Copy rights and patenting - (provisions of copy right acts in India and abroad, cop right in architectural profession) - Easement - (meaning, types of casements, acquisition, extinction and protection) - Development Regulations in Second master plan for Chennai Metropolitan Area, Chennai Corporation Building rules 1972 - The Panchayat rules 1940 - Persons with Disabilities Act (provisions, responsibilities of architect and local body on creating barrier free environment).

TOTAL SESSIONS: 45

REQUIRED READING:

1. Architects Act 1972 and Amendments , upto 2002.
2. David chapel, "The Architect in Practice" , Wiley,Blackwell Pub, 2010.
3. Publications of Council of Architecture-Architects (Professional conduct) Regulations 1989, Architectural Competition guidelines
4. Roshan Namavati, "Professional practice", Lakhani Book Depot, Mumbai 1984.

REFERENCES:

1. J.J.Scott, "Architect's Practice", Butterworth, London 1985.
2. Ar. V.S. Apte, "Architectural Practice and Procedure", Padmaja Bhide, Pune, 2008.
3. Development Regulations of Second Master Plan for Chennai Metropolitan Area, 2026.
4. Chennai City Corporation Building Rules 1972.
5. Persons with Disabilities Act.
6. T.N.D.M. Buildings rules, 1972.

OUTCOMES:

- Get a proper understanding of the role played by an architect. Various types services that an architect can provide to this society

- Role of COA with regards to architect fees for different types of services will enable the students to understand the architect/client and contractor relationship.
- The important role played by the COA & IIA in the matters of conducting competitions.
- The important acts and building bylaws gives a guidance for proper built environment and value of the heritage building.
  The urban art commissions are functioning well at Delhi and other important cities in India for better architectural control and thereby preserving the importance of heritage valued building

AR B 4802 ADVANCED STRUCTURES 3 0 3

AIM:

To impart knowledge on the recent and advanced concepts / developments in structural forms and systems

OBJECTIVES:

- To understand the recent developments in structural forms.
- To increase the student's ability to identify the structural forms suitable for architectural expression.
- The students are expected to analyze and understand the nature of stresses that are developed in the major elements of advanced types of structures.

MODULE I THEORY BEHIND STRUCTURAL FORMS 9

Construction and form, Structure and Form Equilibrium under simple tension or compression, the catenary and the arch, the simply supported beam, the domical shell.

MODULE II STRUCTURE AND ARCHITECTURE 9

Relation between structure and architecture, Geometry of form and structural function, Aesthetic theories of the expression of structural function in architectural form.

MODULE IIISTRUCTURAL ELEMENTS 9

Structural elements: Beams and slabs Arches and catenaries; vaults, domes and curved membranes; Trusses, Portal frames and space frames

MODULE IVSTRUCTURAL SYSTEMS I 9

Structural Systems: single and double layer grids; braced domes, ribbed domes, plate type domes, Network domes, Lamella domes, Geodesic domes, Grid domes. Braced and folded structures

MODULE VSTRUCTURAL SYSTEMS II 9

Space frames: Folded plates, shells, cyclonical shells, Hyperbolic paraboloids, freeforms. Cable structures: Simply curved suspended roofs, combination of cables and struts.

TOTAL SESSIONS: 45

TEXTBOOKS

1. Sinha .N.C and Roy .S.K, *Fundamentals of Reinforced Concrete*, S.Chand &

Co. Ltd., New Delhi, 2001
2. Ramamruthm .S and Narayanan .R, *Reinforced Concrete Structures*, Dhanpat Rai Publications, New Delhi,1997
3. Bryan Stafford and Alex Coull, *Tall Building Structures, Analysis and Design* John Wiley & Sons, New York, 1991

REFERENCE BOOKS

1. Bandyopadhyay .J.N, Thin Shell *Structures Classical and Modern Analysis*, New Age International Publishers, New Delhi, 1998 Ramaswamy .G.S, *Design of Construction of Concrete* Shell Roofs, McGraw Hill Publishing Company, New York, 1986
2. Krishna Raju .N, *Pre Stressed Concrete*, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1988
3. Taranath .B.S, *Structural Analysis and Design of Tall Buildings*, McGraw Hill, New York, 1988.
4. Frei Otto - Tensile structures Volume 1, Pneumatic structures, Volume 2, cable structures .The MIT press, London.2008
5. Tall Building structures - Analysis & Design - Bryan Stafford smith. John wiley.
6. Structural system for tall buildings - Council on tall buildings and urban habitat - Mc GrawHill.2007
7. Pneumatic structures, Thomas Herzog - Crosby Lockwood staples, London.
8. Maintenance and Rehabilitation of RC structures by Derison Allen, Longman Publication limited, 2001.

OUTCOMES:

- The students get familiar with the basic concepts and developments in advanced structures.
- They can also learn about the structural elements in different forms of arches vaults, domes and its expression in architectural form.

  To introduce the basic concepts of Space Frames, Shells and folded plates and cable structures

AR B 4803 GREEN AND SUSTAINABLE DESIGN 3 0 3

AIM:

The course focuses on developing an understanding regarding environmental sustainability and environmentally responsible green buildings. It addresses the design concerns in architecture to develop resource-efficient buildings that have minimum adverse impact on the natural environment

OBJECTIVES:

- To understand the importance of environmentally and ecologically sensitive architecture
- To integrate sustainable planning and building principles in architectural design.
- To get introduced to agencies that work for green and sustainable architectural developments.

MODULE I INTRODUTION 9

Concepts of sustainability, Sustainable Development, Green field development: Brown field development, Principles of conservation - synergy with nature, Sustainable planning & Design, Sustainable approach to site planning and design - site inventories- relationships between site factors - development impacts from one area of the site on the other areas, Intro to Environmental Design & Planning. Sick Building Syndrome

MODULE II SUSTAINABLE CONSTRUCTION 9

Sustainable Construction, Three Dimensions. Properties, Uses and Examples of - Primary, secondary and Tertiary Sustainable Materials, Techniques of sustainable construction - technologies and design synthesis and construction methods: solar water heating panels; photovoltaic cells etc.

MODULE IIIRECYCLING AND REUSE 9

Reuse - Waste prevention, Pre building, Post building stages, Construction and Demolition recycling- Conservation of natural and building resources- types of wastes. Sourcing and recycling of building materials. Elimination of waste and minimize pollution - various Decomposing methods -environmental monitoring and testing during construction- Design facility within social and environmental thresholds-Case study of local natural body that is polluted and suitable design system to rehabilitate the same.

MODULE IV BUILDING INFRASTRUCTURE 9

Active Energy Systems in buildings, Utilities andservices,building automation. Electro-mechanical systems, lifts and transportation, captivepower plant and equipment, operation & maintenance

MODULE V RATING SYSTEMS 9

Introduction to building rating systems: building auditing, points system,components, and weight age, agencies and institutions like -LEED, BREEAM, Green Star, HQE Rating system, IGBC, GBC, TERI GRIHA etc, and Discussion of green buildings in the contexts with case examples.

TOTAL SESSIONS: 45

TEXT BOOKS

1. Bose B.C., "Integrated approach to sustainable Development". Publishers: Rajat Publications, Delhi, 2007
2. Laurie Baker's, "Chamoli Earthquake hand book", Publishers: Costford, centre of science and technology for rura development, 2000.

REFERENCES:

1. Fuller Moore, "Environmental control systems Heating, Cooling, Lighting". Publisher MC.Graw Hill, Newyork, 1992
2. Caring A.Langston Grace K.C.Ding, "Sustainable practices in built environment", 2nd Edition, Publishers: Butterworth-Heinmann Linacre House Jordanhill Oxford, 2001
3. Trivedi.R.N. Environmental Sciences, Publishers:Anmol Publications Pvt Ltd, New Delhi, 1997

OUTCOMES:

- The students are exposed to integrate sustainable planning and building principles in architectural design.
- Have a comprehensive knowledge on the evolution and impact of environmental aspects and sustainable issues.
- Be equipped to handle the architectural design process from the studies, analysis, interpretation and design in accordance to the case studies done on the green building concepts.
- Have a knowledge on the Government policies and actions towards the Sustainable society and the latest technologies involved in the Building process

Have knowledge on the organic and sustainable Building materials used in the design and execution

AR B 4804 RESEARCH METHODS 3 0 3

AIM:

The course provides students with a framework to understand some emerging concepts in architecture and projects of design complexity and equip the student with adequate architectural research methods for the realization of dissertation writing and thesis concept. During the course of study, the subject of the thesis is developed and the project articulated.

OBJECTIVES:

- To impart knowledge to students, on the tools and methods needed to handle a design project of reasonable complexity individually
- The skills required to collect, assimilate and synthesis data relevant to handle a research topics and design thesis project independently.

MODULE I INTRODUTION 9

Introduction to research methods, Types of research, Difference between design studio, dissertation and design thesis, Selection of topics for dissertation, architectural design thesis. Research topicsbased on building typologies, preparation of synopsis, Methodology of research

MODULE II RESEARCH IN ARCHITECTURE 9

Emerging concepts in architecture due changes in social, economic, technological variables. Review of design projects related to real world instances and relevant to commMODULE y at large. Review of projects of design complexity, involving themes, subthemes and architectural expression.

MODULE IIITOOLS AND METHODS 9

Scientific methods of research with special emphasis on architectural research methods. Architectural enquiry visual, observations, questionnaire formats of enquiry, Literature Review and case studies. Data analysis techniques interpretation of data.

MODULE IV PRESENTATION 9

Formats for presentation of data, case studies and analysis. Formats for presentation of thesis design- media appropriate in the architectural profession such as two dimensional drawing, physical models, three dimensional computer

models.

MODULE V REPORT WRITING 9

Techniques in report writing, presentation of contextualinformation relevant to interpretation of the data collected and design; reportingthe design development from concept to design solution, explain the relation ofthe design to existing knowledge on the topic in the form of coherently writtenreport.

TOTAL SESSIONS: 45

TEXT BOOK:

1. Linda N. Groat and David Wang, "Architectural Research Methods",2nd Edition. Publishers: John Wikey & Sons.,Inc.,Hoboken, New Jersey.

REFERENCES:

1. http://rp.design.umn.edu/resources/documents/ArchGraphStand15.pdf
2. Robert Sommer & Barbara Sommer (2002) A Practical Guide to Behavioral Research: Tools and Techniques. New York: The Oxford University Press.
3. John W. Creswell (2003) Research Design: Qualitative, Quantitative, and Mixed Method Approaches. 2nd Edition. Thousand Oaks, CA: Sage Publications.

OUTCOMES:

- The students have a comprehensive knowledge on the tools and methods of research and provide a way to frame the reports in a proper way.
- They gain knowledge to present their research and contents in a professional way.
- They also secure lots of skills required to collect, assimilate and synthesis data relevant to handle a research topics and design thesis project independently

AR B 4806 ARCHITECTURAL DESIGN- VII 0 16 9

AIM:

To enable the students to design large scale building projects in an urban environment with emphasis on advanced building services and systems, urban development regulations, building by-laws and architectural controls.

OBJECTIVES:

- To develop skills for comprehensive understanding and dealing with Architecture of a group of buildings, inter connected with elements of urban design.
- Resolution of project to integrate complexity of urban dimensions and architectural language.
- Methods of space programming, analysis, evaluation of design criteria and concepts for large projects.

CONTENT:

Detailed study of methodology for design conception, development and detailing –with special emphasis on site planning, services, HVAC systems and architectural detailing

AREA OF FOCUS / ISSUES:

- Design problem shall consider the above and planning shall deal with the masses in relation to conservation of spaces, transportation and multiple activities.
- Design must establish linkages with urban structure, urban continuity, movement structure, landscaping, people and vehicular movement's system design, economics, architectural aesthetics and details.

TYPOLOGY/ PROJECT-

Railway Station, Inter State / Regional Bus Terminus, Airport, Star Category Hotel, Sports Stadium, Large scale Exhibitions etc.

TOTAL SESSIONS: 225

TEXT BOOKS:

1. De. Chiara and Callender, "Time-saver Standards for Building Types", McGraw-Hill Co., New York, 1973.
2. The Handbook of Building Types., NEUFERT ARCHITECTS DATA, New International edition, second international edition. BSP Professional Books.

Oxford (1980) Blackwell scientific Publications.

3. Ed.By.Quentin Pickard RIBA "The Architects' Hand Book", Bladewell Science Ltd., 2002

REFERENCES:

1. S. Macmillan, 'Designing better buildings' - Routledge,2003
2. Handbook on Building Construction Practices (Excluding Electrical Work). Bureau of Indian Standards, New Delhi, 1997
3. National Building book of India 2005, Bureau of Indian Standards, New Delhi

OUTCOMES:

- Design advanced and complex problem comprising of group and multi stories structures and infrastructures.
- Use computer for drawing and presentation skills using appropriate software. Have solve the design problems in functional and aesthetical way

SEMESTER IX

AR B 5901 PROFESSIONAL ETHICS PRACTICE - II 3 0 3

AIM:

To expose the students to advanced issues concerning architectural practice such as Tendering, Contracting including alternative practices in project execution, Arbitration and Project management and to enable them to understand the implications of globalisation on architectural practice.

OBJECTIVES:

- To further the students understanding of the professional practice.
- To enable the students to grasp the advanced issues concerning professional practice such as tendering, contracting including alternative practices in project execution, arbitration and project management.
- To expose the students to the implications of globalisation on professional practice with particular reference to WTO and GATS.
- To expose the students on some of the important legislations concerning architectural practice in India as well as International laws.

CONTENT:

MODULE I TENDER 9

Types of Tenders-Open and closed tenders-Conditions of tender-Tender documents-Tender notice-Concept of EMD-Submission of tender-Tender scrutiny-Tender analysis Recommendations- E tendering (advantages, procedure, conditions).

MODULE II CONTRACT & ARBITRATION 9

Contents of Contract document (Articles of Agreement, Terms and Conditions of Contract, Important clauses - Appendix) - Arbitration (Definition, Advantages of arbitration, Sole and joint arbitrators, Role of umpires, Award, Conduct of arbitration proceedings) - Arbitration clause in contract agreement (role of architect, excepted matters) - case studies.

MODULE III NEW TRENDS IN PROJECT FORMULATION AND EXECUTION 9

Turn key offer (Expression of interest, Request for Proposal Document, Conditions for inviting turnkey offer, finalisation of the bidder) - Current

practices in Project execution [Build operate and Transfer (BOT), Build Operate Lease and Transfer (BOLT) and Build Operate and Own (BOO) and others - case studies.

MODULE IV IMPLICATIONS OF GLOBALISATION IN ARCHITECTURAL PRACTICE 9

Globalisation (meaning, advantages) - WTO and GATS and their relevance to architectural profession in India - Pre-requisites for Indian architects to work in other countries - Preparedness and infrastructure requirements for global practice - Entry of foreign architects in India (views for and against) - Information Technology and its impact on architectural practice.

MODULE V EMERGING SPECIALISATIONS FOR AN ARCHITECT 9

Construction management (Role, function, and responsibilities of a construction manager) -Project management (Concept, Objectives, Planning, Scheduling, Controlling and Role and Responsibilities of project manager) - Suitability of architect as construction / project manager -Programme evaluation review Techniques (event, activity, dummy network rules, graphical guidelines for network - PERT network).

TOTAL SESSIONS: 45

TEXT BOOKS:

1. Ar. V.S. Apte, "Architectural Practice and Procedure", Padmaja Bhide, Pune, 2008.
2. Architects Act 1972.
3. Dr. B.C. Punmiya and K.K. Khandelwal , "Project Planning and Control with PERT / CPM", Laxmi Publications, New Delhi, 1987.
4. Arbitration Act.
5. WTO and GATT guidelines.

REFERENCES:

1. Architects Act 1972.
2. Publications of Handbook on Professional practice by IIA. - 2003
3. Publications of Council of Architecture-Architects (Professional conduct) Regulations 2005. Architectural Competition guidelines
4. Roshan Namavati, Professional practice, Lakhani Book Depot, Mumbai 1984

OUTCOMES:

- Understand the properly and its implications to the owner of the property
- The issues regarding tenders architects and client role towards the contract.
- The role played by various agencies within the contractual clauses. Duties of sub contractor payments, etc.
- Disputes between client and contractor areas of disputes likely to arise - Arbitral award to be final & binding.
  Learn about the laws regarding environment along with the building norms which are already available

AR B 5902 HUMAN SETTLEMENT PLANNING 3 0 3

AIM:

To familiarize with the evolution, pattern of human settlements & the process for the improvement of human living environment and also its relevance in architecture

OBJECTIVES:

- To enable the students to comprehend the evolution of settlements, its elements & classifications.
- To understand the various levels of planning, planning principles & the process over a period of time
- To outline the scope and content of Urban planning, Urban renewal and Regional planning and the various plans to be prepared.
- To enable students to understand how planning activities are regulated in the state at various levels.

MODULE I INTRODUCTION TO THE CONCEPT OF HUMAN SETTLEMENTS **9**

Elements of human settlements context and contain - Meaning and Examples - Nature, Man, Society, shells and Network: Their sub elements, characteristics, functionaries / potentials, major aspects in spatial planning.

Classification of human settlements: Classification based on population, functions, locations, Municipal status.

MODULE II FORMS OF HUMAN SETTLEMENTS **9**

Growth and decay of human settlements: Factors influencing the growth and decay, History of settlement studies (Ancient Classical, medieval, Renaissance industrial) Structure and Form of Human settlements - Linear, Non-linear & circular, examples and their functional characteristics of Indian and European towns and cities.

MODULE III PLANNING CONCEPTS **9**

Contribution to planning thoughts & their relevance to Indian planning practice - Patric Geddes, Ebenezer Howard, CA Perry, Le Corbusier, Doxiadis - Principles and concepts with case studies.

9

MODULE IV URBAN AND REGIONAL PLANNING

Aim, objective, scope and content of Regional plan, Master plan, zonal plan, planned MODULE development (PUD) and urban renewal plan - Redevelopment, rehabilitation and conservation - Case - studies.

MODULE V LOCAL GOVERNANCE 9

Objectives, Functions, Responsibilities and Organizational structure of: (i) Village Panchayats (ii) Municipalities (iii) Corporations and (iv) Urban Development Authorities.

TOTAL SESSIONS: 45

TEXT BOOKS:

1. C.L.Doxiadis, Ekistics, "An Introduction to the Science of Human Settlements", Hutchinson, London, 1968.
2. Gallion Arthur B & Eisna Simon, "The Urban Pattern: City Planning and Housing", Cbs, 2005.
3. John Ratchiffe, An Introduction to Town and Country Planning, Random House.

REFERENCES:

1. L.R. Kadiyali, "Traffic Engineering and Transport Planning", Khanna Publishers, New. Delhi, 2000.
2. Government of India, "Report of the National Commission on Urbanisation", 1988.
3. Andro D.Thomas, "Housing and Urban Renewal", George Allen and Unwin, Sydney, 1986.
4. Rodwin, Lloyd, "Shelter, Settlements and Development" (Hemel Hempstead, MODULE ed Kingdom, Unwin Hyman Ltd.), 1987.
5. Ministry of Urban Affairs and Employment, Government of India, New Delhi, 'Urban Development Plans: Formulation & Implementation' - Guidelines - 1996.
6. Madras Metropolitan Development Authority, 'Master Plan for Madras Metropolitan Area, Second Master Plan - 1995
7. Centre for Human Settlements, Anna University, Chennai 'Development Plan for Uthokottai Taluk, Cheyyur Taluk, 1999.
8. http://www.jadavpur.edu/academics/centers_human.htm
9. http://www.virtualref.com/uncrd/558.htm
10. http://www.unescap.org/huset/m_land/index.htm

11. http://www.esa.un.org/subindex/prviewsites.asp?termcode=GH.05
12. http://www.abuildnet.com
13. http://www.buildernews.com/

OUTCOMES:

- Have a comprehensive knowledge about the history of human settlements
- Have a complete knowledge about the various planning thoughts proposed by the scholars and its successful effects
- Understand and analysis the various housing conditions of the people and the road geometries of our cities.
- Understanding the scope and content of Urban planning, Urban renewal and Regional planning and the various plans to be prepared.

- Look at the role and activities of the various nodal agencies who regulate the city growth in our state.
  Examine the various futuristic models proposed by the scholars at present

AR B 5903 URBAN DESIGN 3 0 3

AIM:

The overall aim of the course is to help students formulate an understanding of the urban forms and spaces. City planning history and theory will be examined. The contemporary needs of the society and the role of spaces will be dealt along with the need for design development and control.

OBJECTIVE:

To understand the fundamental concepts and theories of urban design and apply them in their design projects.

MODULE I INTRODUCTION- EVOLUTION AND UNDERTANDING OF THE CONCEPT OF URBAN DESIGN 9

Evolution of urban design as a discipline – Need for urban design –different realms attacched to urban design- urban design theories and key personalities and there contribution to urban design (Gordon Cullen and Kevin Lynch)

MODULE II ELEMENTS AND APPROCHES OF URBAN DESIGN 9

Urban scale, Mass and Space; Understanding components of urban fabric; Making a Visual survey; Understanding the various urban spaces in the city and their hierarchy. Special focus on streets; Expressive quality of built forms, spaces in public domain

MODULE III CONCEPTS AND TECHNIQUES IN URBAN DESIGN 9

Concets and theories of William H whyte ;spacemaking and placemaking concepts of GHEL architects (case study : Copenhagen) .understandinf different terms involved in urban Design. Current trends in urban design

MODULE IV RENEWAL, REDEVELOPMENT AND FORMULATING URBAN DESIGN POLICIES 9

Understanding urban renewal and the need for it, Scope, challenge and Implementation methods; Public participation; Townscape policies and urban design guidelines for new developments- Case studies. A brief Analysis of urban spaces in history - in the Western world (Greek, Roman, Medieval and Renaissance towns) and the Eastern world (Vedic, temple towns, medieval and Islamic towns) ; Relevance of the historical concepts in the present context ; Critical analysis of some Indian cities like New Delhi, Chandigarh etc

MODULE V URBAN DESIGN EXERCISE 9

Conducting an urban design survey, Analysis of data, Formulating urban design guidelines and drawings for an area - practical problem solving. The first part of the urban design project could deal with the Identification and documentation of areas such as riverfronts, beach fronts, market areas, bazaars or commercial & residential districts with, its surrounding areas. And second part would be to solve and provide appropriate and relevant solutions for the same.

TOTAL SESSIONS: 45

TEXT BOOKS:

1. Gordon Cullen, "The Concise townscape", The Architectural press
2. Kevin Lynch, "Image of the city"
3. Cliff Moughtin, "Urban design - Ornament and decoration", Bath Press
4. Cliff Moughtin, "Urban design - street and square", Bath Press
5. Paul Zucker , "Town and square"
6. Arthur B Gallion, "The urban pattern", CBS publishers
7. Raymond J Curran , "Architecture and the urban experience", Van Nostrand Reinhold Company
8. Christopher Alexander, "Pattern language"
9. Christopher Alexander, "The timeless way of building"

REFERENCE READINGS:

1. Rangwala, "Town Planning", Charotar publishing house
2. David Gosling, "Concepts of Urban design ", Academy editions
3. Spiro Kostof, "City shaped" , Bulfinch Press
4. Paul D. Speriregon, "Architecture of town and cities", The MIT press
5. Johnathan Barnet, "An introduction to Urban design", Harper& Row Publishers
6. Arthur B. Gallion and Simon Eisner, "The Urban Pattern - City planning and Design", Van Nostrand Reinhold Company.

OUTCOMES:

- Have a comprehensive knowledge on the evolution of urban planning and its relation today.

  Be equipped to handle the urban design studio project at a town/city, region

level from the studies, analysis, interpretation and design in accordance to the jurisprudence

AR B 5904 DISSERTATION 3 0 3

AIM:

The overall aim of the course is to prepare the students for formal report writing systematically on a particular topic related to architecture.

OBJECTIVE:

- To Widen and enrich the literature pertaining to the topic of interest
- To Prepare for their thesis

CONTENT:

As a fully, comprehensively, learnedly written essay is considered as a prelude to Architectural Thesis in the tenth semester. The course offers an opportMODULE y to relook at architecture either as a subject or profession. Concentrating on an issue of interest to the student as it relates to built environment, dissertation is primarily textual.

Alternatively the topic may consider philosophy and contribution of an architect, historical perspectives, typological changes in material, technology, essays and writings of architects, design process, development and others. Dissertation involves a field of observation, reflection of thoughts, abstraction and exposition of ideas. The Dissertation should state its objectives, followed by exhaustive documentation, arguments and may result in a hypothesis.

Students shall submit a proposal in about 1500 words (5 To 6 pages). Stating the topic to be explored and the scope. At the end of the semester (Eighth) a well written report is to be submitted which is about 15,000 words in the prescribed format. The student must be able to present and defend during evaluation.

TOTAL SESSIONS: 90

TEXT BOOKS:

1. Ian Border, Kurt Rueiden, the Dissertation, an Architectural students Hand Book, - Architectural press - 2000.

REFERENCES :

1. Linda grand and David Wang, Architectural Research Method - John Wiley Sons, 2002.

OUTCOMES:

- Impart indepth knowledge on selected topics on their interest through wide literature study.
- Focus and orient for the thesis

AR B 5906 URBAN DESIGN STUDIO 0 16 9

AIM:

To delve into the perpetuity and dynamics of urban form with a gist on the interrelationships between the disciplines of architecture and the art of creating and shaping cities and towns

OBJECTIVES:

- To understand the psychological process and aspects of the urban environment as well as their interrelationships.
- To figure out larger scale groups of buildings, streets and public spaces, etc. to make the urban areas functional, attractive, and sustainable.
- To understand urban design as a tool for making connections between people and places, movement and urban form, nature and the built fabric.
- To take design decisions in a comprehensive manner understanding their implications in the larger context.

CONTENT:

Scale and Complexity: projects involving the urban context and architecture in the urban context with an emphasis on understanding interdependencies and formulating appropriate design directions.

AREAS OF FOCUS/ ISSUES:

- exploration of relationship between building and larger context
- contemporary processes in design
- appropriate architecture
- addressing issues in urban areas - transportation, sustainability, heritage, sprawl, place making, identity, collective memory
- Mixed use programming

Typology/ project: those involving large scale urban interventions as well as large scale projects which have impact on the urban context- revitalization and renewal of urban fragments, evolving guidelines for heritage areas, adaptive reuse, urban waterfront development, transportation nodes, new commMODULE ies, multi-use urban complexes.

TOTAL SESSIONS: 225

TEXT BOOKS:

1. S. Macmillan, "Designing Better Buildings" . Routledge, 2003.

2. Digital Workflows in Architecture: Design - Assembly - Industry / Scott Marble- 2012
3. Masterpieces: Office Architecture + Design Lara Menzel - 2009
4. National Building Code and Bureau of Indian standard publications.2005

REFERENCES:

Digital Workflows in Architecture: Design - Assembly - Industry / Scott Marble

1. http://www.archdaily.com/category/institutional-architecture/
2. http://www.thehub.net.au/%7Emorrisqc/architext
3. http://www.archinet.co.uk/
4. http://archinform.de/start.en.htm

OUTCOMES:

- The students can able to design larger scale groups of buildings, streets and public spaces, etc. to make the urban areas functional, attractive, and sustainable.
- They also understand the psychological process and aspects of the urban environment as well as their interrelationships.

Use computer for drawing and presentation skills using appropriate software

SEMESTER - X

AR B 5106 ARCHITECTURAL THESIS 0 28 14

AIM:

The overall aim of the thesis is to test whether a student has acquired the requisite skill and competence in architecture before becoming a fully fledged architect.

OBJECTIVE:

The entire 5 years of architectural design crown in the thesis Project to arouse students to involve in individual research and methodology. This is to train them in handling projects independently.

TOPICS OF STUDY

The main areas of study and research can include advanced architectural design, contemporary design processes, urban design including urban-infill, rural settlements,environmental design, conservation and heritage precincts, landscape design, housing and topics related to construction technology. However, the specific thrust should be architectural design of built environment.

METHOD OF SUBMISSION

The Thesis Project shall be submitted in the form of portfolio of drawings, project report in prescribed format, models, slides and soft copy reports.

TOTAL SESSIONS: 364

TEXT BOOKS & REFERENCES:

As per requirement of Topic and as suggested by the supervisor of Thesis.

OUTCOMES:

- The students can handle large scale design problems
- Manage the profession at ease.

The students can able to come out with comprehensive design solutions

REGULATIONS 2016

CURRICULUM AND SYLLABI

B.Sc

Computer Science

VISION AND MISSION OF THE INSTITUTION

VISION

B.S. Abdur Rahman Crescent Institute of Science and Technology aspires to be a leader in Education, Training and Research in Engineering, Science, Technology and Management and to play a vital role in the Socio-Economic progress of the Country.

MISSION

- To blossom into an internationally renowned Institution
- To empower the youth through quality education and to provide professional leadership
- To achieve excellence in all its endeavors to face global challenges
- To provide excellent teaching and research ambience
- To network with global institutions of Excellence, Business, Industry and Research Organizations
- To contribute to the knowledge base through Scientific enquiry, Applied research and Innovation

VISION AND MISSION OF THE DEPARTMENT OF COMPUTER APPLICATIONS

VISION

Aspires to provide quality education in the field of computer applications with state of the art computational facilities and undertake quality research in collaboration with industries and universities to produce committed professionals and academicians to meet the needs of the industries and society.

MISSION

The Department of Computer Applications, endeavors

- To disseminate knowledge through education and training of graduates in the field of computer applications.
- To focus on teaching - learning, research and consultancy to promote excellence in computer applications.
- To foster graduates with opportunities required to explore, create and face challenges of IT related industries.
- To equip the graduates with the necessary skills in communication, team work and leadership qualities to meet the needs of the IT related sector globally.
- To disseminate the outcome of projects and research work undertaken by the department through appropriate measures for the benefit of society and industry.

PROGRAMME EDUCATIONAL OBJECTIVES:

The students of B.Sc Computer science Programme would be able to

- Communicate computing concepts and solutions to bridge the gap between industry and academic institution.
- Utilize their knowledge of computing principles to develop solutions to current and future computing problems.
- Understand professional, ethical, legal, security, and social issues and responsibilities.
- Use current techniques, skills, and tools necessary for computing practices
- apply design and development principles in the construction of software systems of varying complexity.

PROGRAMME OUTCOMES:

On successful completion of the programme, the graduates will have

- Have knowledge of computing and mathematics appropriate to the discipline
- Identify analyze a problem and define the computing requirements appropriate to its solution;
- Have use current techniques, skills, and tools necessary for computing practices;
- Be prepared for career in Information Technology oriented business or industry for graduate study in technical fields.

B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE & TECHNOLOGY

B.S.c (COMPUTER SCIENCE)

CURRICULUM & SYLLABUS, REGULATIONS 2016

SEMESTER I

Sl. No.	Course Code	Course Title	L	T	P	C	
1	ENC1182	General English - I	3	0	0	3	
2	MAC1187	Algebra, Calculus and Trigonometry	3	1	0	4	
3	CAC1151	Computer Fundamentals & Organization	3	0	0	3	
4	CAC1152	Problem Solving Techniques and Programming in C	3	1	0	4	
5	CAC1153	Introduction to Linux	3	0	0	3	
6	CAC1154	Problem Solving Techniques and Programming in C Lab	0	0	4	2	
7	CAC1155	Linux Lab	0	0	4	2	**23**

SEMESTER II

l. No.	Course Code	Course Title	L	T	P	C
1	ENC1283	General English - II	3	0	0	3
2	MAC1288	Probability and Statistics	3	1	0	4
3	CAC1251	Operating Systems	3	0	0	3
4	CAC1252	OOPS with C++	3	1	0	4
5	CAC1253	Data Structures Using C	3	0	0	3
6	CAC1254	OOPS with C++ Lab	0	0	4	2

7	CAC1255	Data Structures Using C Lab	0	0	4	2	
8	CAC1256	Environmental Studies	2	0	0	2	**21**

SEMESTER III

Sl. No.	Course Code	Course Title	L	T	P	C	
1	CAC2151	Database Management Systems	3	1	0	4	
2	CAC2152	Digital Electronics	3	0	0	3	
3	CAC2153	Computer Networks	3	0	0	3	
4	CAC2154	Fundamentals of Algorithms	3	0	0	3	
5	CAC2155	Multimedia and its Applications	3	0	0	3	
6	CAC2156	Database Management Systems Lab	0	0	4	2	
7	CAC2157	Multimedia Lab	0	0	4	2	
8	CAC2158	Communication Skills	0	0	4	2	**22**

SEMESTER IV

Sl. No.	Course Code	Course Title	L	T	P	C	
1	CAC2251	Programming in Java	3	1	0	4	
2	CAC2252	Computer Security	3	0	0	3	
3	CAC2253	Software Engineering	3	0	0	3	
4	CAC2254	Information Storage and Management	3	0	0	3	
5		Elective I	3	0	0	3	

6	CAC2255	Programming in Java Lab	0	0	4	2	**20**
7	CAC2256	Soft Skills and Personality Development	0	0	4	2	

SEMESTER V

Sl. No.	Course Code	Course Title	L	T	P	C	
1	CAC3151	C# and .NET Programming	3	1	0	4	
2	CAC3152	Web Designing	3	0	0	3	
3	CAC3153	Software Testing	3	0	0	3	
4		Elective 2	3	0	0	3	
5		Elective 3	3	0	0	3	
6	CAC3154	C# and .NET Programming Lab	0	0	4	2	
7	CAC3155	Web Designing Lab	0	0	4	2	**20**

SEMESTER VI

Sl. No.	Course Code	Course Title	L	T	P	C	
1	CAC3251	Network Security	3	1	0	4	
2	CAC3252	Data Mining and Warehousing	3	1	0	4	
3		Elective 4	3	0	0	3	
4		Elective 5	3	0	0	3	
5	CAC3253	Project	0	0	12	6	**20**

TOTAL CREDITS – 124

LIST OF PROGRAMME ELECTIVES

SEMESTER IV

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	CACX01	Advanced Computer Architecture	3	0	0	3
2.	PE	CACX02	Compiler Design	3	0	0	3
3.	PE	CACX03	Database Design	3	0	0	3
4.	PE	CACX04	E-Commerce	3	0	0	3
5.	PE	CACX05	High Performance Computer Systems	3	0	0	3
6.	PE	CACX06	Internet and Web Programming	3	0	0	3
7.	PE	CACX07	Management Information Systems	3	0	0	3
8.	PE	CACX08	Parallel Algorithms	3	0	0	3
9.	PE	CACX09	Wireless Networks	3	0	0	3

SEMESTER V

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	CACX10	Artificial Intelligence	3	0	0	3
2.	PE	CACX11	Client / Server Technology	3	0	0	3
3.	PE	CACX12	Distributed Operating System	3	0	0	3
4.	PE	CACX13	Embedded Systems	3	0	0	3
5.	PE	CACX14	Enterprise Resource Planning	3	0	0	3
6.	PE	CACX15	Mobile Commerce	3	0	0	3
7.	PE	CACX16	Mobile Computing	3	0	0	3
8.	PE	CACX17	Software Project Management	3	0	0	3
9.	PE	CACX18	Web Technology	3	0	0	3

SEMESTER VI

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	CACX19	Big Data Analytics	3	0	0	3
2.	PE	CACX20	Human Computer Interaction	3	0	0	3
3.	PE	CACX21	Software Quality Assurance	3	0	0	3
4.	PE	CACX22	Web Services and Service Oriented Architecture	3	0	0	3

ENC1181 **GENERAL ENGLISH – I** **L T P C**

4 1 0 4

OBJECTIVES:

- To help the students acquire efficiency in Spoken English through role plays.
- To enable them to make Presentation effectively.
- To develop reading skills among students through extensive readers.
- To orient them in writing letters.
- To train them in appreciating and interpreting English literature.

MODULE I **7**

Oral and Written Communication – implications in real life and workplace situations
Essential English Grammar - 1-6 units

MODULE II **8**

One–minute Presentations (JAM) on concrete and abstract topics that test their creative thinking (ii) Prepared p and extempore presentations
Short Story; O Henry - “Robe of Peace” (Extensive Reading)

MODULE III **8**

Role-Play – establishing a point of view - convincing someone on social issues such as preservation of water, fuel, protection of environment, gender discrimination.
Poetry: William Shakespeare - “All the World’s a Stage”

MODULE IV **8**

Letter Writing- Letter of Invitation & Permission Developing story from hints- Short Story: John Galsworthy - “Quality” (Extensive Reading)

MODULE V **8**

Précis Writing- Writing instructions and recommendations Reading Comprehension: Short Story**--**Rudyard Kipling – “The Miracle of Puran Bhagat”(Extensive Reading)
Written correspondence - - e-mail writing Prose : Education, Employment, Unemployment

MODULE VI **6**

Written correspondence - - e-mail writing
Prose : Education, Employment, Unemployment

TOTAL HOURS – 45

REFERENCES:

1. Anderson, Kenneth & et.al. “Study Speaking : A Course in Spoken English for Academic Purposes” (Second Edition). Cambridge University Press, UK. 2004.
2. Sharma, R.C. & Krishna Mohan, “Business Correspondence and Report Writing”.
3. Tata MacGraw – Hill Publishing Company Limited, New Delhi. 2002
4. Hurlock, B. Elizabeth “Personality Development”. Tata McGraw Hill, New York, 2004.
5. Krishnaswamy. N, Sriraman T. Current English for Colleges. Hyderabad: Macmillan Indian Ltd, 2006.
6. Dahiya SPS. Ed. Vision in Verse- An Anthology of Poems. New Delhi: Oxford University Press, 2002
7. Murphy, Raymond. Essential English Grammar. New Delhi: Cambridge University Press, 2009.
8. Seshadri, K G Ed. Stories for Colleges. Chennai: Macmillan India Ltd, 2003.

OUTCOMES:

Students would be able to

- Actively take part in role plays
- Make effective presentation s
- Read and comprehend various texts.
- Write letters without making mistakes.
- Analyse literary texts.

MAC1187	ALGEBRA, CALCULUS AND TRIGONOMETRY	L	T	P	C
		3	1	0	4

OBJECTIVES:

The course is aimed at

- Developing the skills of students in applying basic concepts in chosen topics of mathematics that are imperative for effective understanding of application oriented topics.
- Laying the foundation for learning concepts of Differentiation, Integration and Trigonometry.

MODULE I MATRICES **(9+3)**

Symmetric – Skew-Symmetric - Orthogonal and Unitary matrices - Rank of a Matrix -Consistency - Characteristic equation - Eigenvalues and Eigenvectors - properties -Cayley Hamilton’s Theorem (proof not needed) - Simple applications.

MODULE II THEORY OF EQUATIONS **(9+3)**

Partial Fractions - Theory of equations- Polynomial Equations with real Coefficients -Irrational roots - Complex roots - Symmetric functions of roots - Transformation of equation by increasing or decreasing roots by a constant - Reciprocal equations.

MODULE III DIFFERENTIAL CALCULUS **(9+3)**

Rules of differentiation - Derivative of implicit function - Successive differentiation nth derivatives - Leibnitz theorem (without proof) and applications - maxima and minima of functions of two variables - Partial differentiation - Euler’s Theorem.

MODULE IV INTEGRAL CALCULUS **(9+3)**

Integration of rational functions - algebraic expressions involving only one irrational quantity- rational functions of sinx and cosx - Trigonometric substitutions - Bernoulli's formula for integration by parts - reduction formulae - properties of definite integral -Evaluation of double and triple integrals.

MODULE V TRIGONOMETRY **(9+3)**

De Moivre's theorem and its application - Circular and Hyperbolic functions – Inverse circular and hyperbolic functions - Expansion of trigonometric functions in terms of power and multiples - Separation of real and imaginary parts of logarithmic -trigonometric and inverse trigonometric functions - Summation of series including C+iS method.

TOTAL HOURS – 60

TEXT BOOKS:

1. Narayanan, S. and Manicavachagom Pillay, T.K. (2015) Calculus Vol. I,II &III S.Viswanathan (Printers & publishers) Pvt. Ltd., Chennai.
2. Venkataraman, M.K., "Higher Mathematics for Engineering and Science", Third Edition, The National Publishing Co., Madras, 1986.
3. Kandasamy P, K. Thilagavathi and K. Gunavathy- Allied Mathematics aper-I, First semester, 1/e, S. Chand & Co., New Delhi, 2003

REFERENCES:

1. Stewart J - Single Variable Calculus (4th edition) Brooks / Cole, Cenage Learning 2010.
2. Tom M. Apostol - Calculus, Vol. I (second edition) John Wiley and Sons, Inc., Jan 2007.
3. Burnside W.S. and A.W. Panton - The Theory of Equations, Dublin University Press, 1954.
4. MacDuffee, C.C. - Theory of Equations, John Wiley & Sons Inc., 1954.
5. Ushri Dutta, A.S.Muktibodh and S.D. Mohagaonkar: Algebra and Trigonometry, PHI India, 2006.

OUTCOMES:

On completion of the course the students will be able to

- solve eigenvalue and eigenvector problems
- classify and solve polynomial equations of different types.
- differentiate different types of functions.
- integrate rational and trigonometric functions and to evaluate definite integrals (double and triple).
- demonstrate the application of Demoivre's theorem and find the sum of series of trigonometric functions.

CAC1151	COMPUTER FUNDAMENTALS &ORGANIZATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- The basic knowledge of how a computer works is very important for any fresh networking or operating system professional.
- The functional knowledge of a computers working and its main building parts are paramount.
- The computers of today may come with variety of features but the basic working principles remain the same.
- Students will explore the fundamentals of organization of a computer and the principles and building units of a computer (its hardware).
- Also, they will be introduced to the basics of networking and MS Office

MODULE I GENERAL FEATURES OF A COMPUTER **9**

General features of a computer, Generation of computers, Personal computer, workstation, mainframe computer and super computers. Computer applications – data processing, information processing, commercial, office automation, industry and engineering, healthcare, education, graphics and multimedia.

MODULE II COMPUTER ORGANIZATION **9**

Computer organization, central processing unit, computer memory – primary memory and secondary memory, Secondary storage devices – Magnetic and optical media, Input and output units, OMR, OCR, MICR, scanner, mouse, modem.

MODULE III COMPUTER HARDWARE AND SOFTWARE **9**

Computer hardware and software, Machine language and high level language, Application software, computer program, operating system, Computer virus, antivirus and computer security, Elements of MS DOS and Windows OS, Computer arithmetic, Binary, octal and hexadecimal number systems, Algorithm and flowcharts, illustrations, elements of a database and its applications, Basic Gates (Demorgans theorems, duality theorem, NOR, NAND, XOR, XNOR gates), Boolean expressions and logic diagrams, Types of Boolean expressions

MODULE IV MS OFFICE 9

Word processing and electronic spread sheet, An overview of MSWORD, MSEXCEL and MSPOWERPOINT

MODULE V INTRODUCTION TO NETWORKING 9

Network of computers, Types of networks, LAN, Intranet and Internet, Internet applications, World Wide Web, E-mail, browsing and searching, search engines, multimedia applications

TOTAL HOURS – 45

TEXT BOOKS

1. M. Morris Mano and Michael D.Ciletti, "Digital Design with an introduction to the Verilog HDL", Pearson Education, Fifth Edition, ISBN-13: 978-0-13-277420-8, 2012.
2.

REFERENCES

1. Charles H.Roth, Jr., Kinney," Fundamentals of Logic Design", Brooks Publications, Seventh Edition,. ISBN-13 :978 -1-133-62848-4,2013
2. Ashok N Kamthane, "Computer Programming", Pearson Education, 2nd Edition, ISBN 13: 9788131704370, 2012

OUTCOMES:

- Students will get in-depth knowledge about the general features of a computer.
- Student which will allow introduce them to various features of computer,
- Understand the computer concepts on which they can base their learning and design.
- Student will be able to understand the basic MS- office.
- To get a better knowledge on networking aspects
- An insight to the different software and hardware components of a computer will take them a step ahead in terms of what they can accomplish from their learning.

CAC1152	PROBLEM SOLVING TECHNIQUES AND PROGRAMMING IN C	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aims of the course are as follows

- This course is designed to provide a comprehensive study of the C programming language. It stresses the strengths of C, which provide students with the means of writing efficient, maintainable, and portable code.
- To learn and acquire art of computer programming.
- Programming language for solving a problem
- To gain experience about structured programming
- To understand various features in C

MODULE I INTRODUCTION TO COMPUTER PROBLEM SOLVING 9

Problem Solving Process - Hierarchy charts to plan the program design - Algorithms - Iterative versus recursive style - Modular Programming - Structured Programming - Algorithm representation using Psuedocode, Algorithm Testing, brief introduction to Efficiency of Algorithms - Data Verification v/s Validation – Module design – Cohesion – Coupling – Fan-in – Fan-out concepts

MODULE II FUNDAMENTAL ALGORITHMS FOR PROBLEM SOLVING 9

Algorithms for Exchanging the values – Counting – Factorial Computation – some trigonometric functions computation as a sum of series – Base Conversion of numbers – Factoring Methods – Array Techniques – Sorting Algorithms - Bubble, Selection, Insertion, Merge Sort, Quick Sort–Sequential and Binary Search Algorithms. Algorithms for implementing numerical methods such as Newton Raphson and RungaKutta Methods.

MODULE III INTRODUCTION TO 'C' 9

Overview of C – Constants, Variables and Data Types; Operators and Expressions; Managing Input/Output Operations – Formatted I/O; Decision Making – Branching - IF, Nested IF – Switch – goto; Looping- While, do, for statements

MODULE IV ARRAYS, FUNCTIONS, STRUCTURES AND UNIONS 9

Arrays – static, dynamic and multi-dimensional arrays - Character arrays and Strings – String handling Functions - User defined Functions – Recursion; Structures and Unions – Array of Structures – Structures and Functions

MODULE V POINTERS AND FILE MANAGEMENT 9

Pointers– Declaration, Accessing a variable, character strings, pointers to functions and structures; File Management in ‘C’ any programming language; Dynamic Memory allocation– Linked Lists; Preprocessor Directives; Storage Classes, Command-line Arguments, multi-file programs and use of make utility.

TOTAL HOURS – 45

TEXT BOOKS:

1. Jeri R. Hanly and Eliot B. Koffman “Problem Solving and Program Design in C” Pearson Education, VII Edition, 2012
2. R.G.Dromey "How to Solve it by Computer ", PHI, 2006.

REFERENCES:

1. Paul J. Deitel, Deitel & Associates, “C How to Program”, Pearson Education, 7th Edition, ISBN-13: 978-0132990448, 2012
2. E.Balagurusamy " Programming in ANSI C " , Sixth Edition, 2004

OUTCOMES:

At the completion of this course, the student will able to

- Study, analyze, understand logical structure and compare various programming methodologies of a computer program, and different construct to develop a program in ‘C’ language
- Write small programs related to simple/ moderate mathematical, and logical problems in ‘C’.
- Study, analyze and understand simple data structures, use of pointers, memory allocation and data handling through files in ‘C’.

CAC1153	INTRODUCTION TO LINUX	L	T	P	C
		3	0	0	3

OBJECTIVES:

At the end of this course the learner is expected:

- To gain knowledge on the basic Linux commands.
- To have a hands on experience in open office
- To have clear understanding in open source softwares

MODULE I - INTRODUCTION TO LINUX 9

What Is Linux? -The Problems with Windows -The Benefits of Linux - Proprietary Software and the GPL- GNU and Linux Together- Different Flavors of Linux- Who Uses Linux?- Understanding How Linux Differs from Windows- Using Ubuntu

MODULE II BASH SHELL 9

What Is the BASH Shell? -Working with Files-Listing Files-Copying Files and Directories -Moving Files and Directories -Deleting Files and Directories -Changing and Creating Directories-Real Files and Virtual Files. -Users and File Permissions - The File System Explained -File Searches -Using the find Command -Using the locate Command -Using the whereis Command-File Size and Free Space -Viewing File Sizes -Finding Out the Amount of Free Space.

MODULE III INITIALIZATION 9

Linux kernel and kernel initialization - system initialization – hardware support - boot loaders.

MODULE IV DEVICE HANDLING 9

Device driver basics - module utilities - file systems - MTD subsystems – busybox.

MODULE V DEVELOPMENT TOOLS 9

Embedded development environment - GNU debugger - tracing & profiling tools - binary utilities - kernel debugging - debugging embedded Linux applications - porting Linux - Linux and real time - SDRAM interface.

TOTAL HOURS – 45

TEXT BOOKS:

1. Keir Thomas and Andy Channelle with Jaime Sicam (2009), “Beginning Ubuntu
2. Karim Yaghmour, Jon Masters, Gillad Ben Yossef, Philippe Gerum, “Building

embedded Linux systems", O'Reilly, 2008.

REFERENCES:

1. Christopher Hallinan, "Embedded Linux Primer: A practical real world approach", Prentice Hall, 2007.
2. Craig Hollabaugh, "Embedded Linux: Hardware, software and Interfacing", Pearson Education, 2002.

OUTCOMES:

Students are provided learning experiences that enable them to:

- Use Linux desktop and GNU tool chain with Eclipse IDE.
- Cross compile Linux kernel and port it to target board.
- Add applications and write customized application for the Linux kernel in the target board.

CAC1154	PROBLEM SOLVING TECHNIQUES AND PROGRAMMING IN C LAB	L	T	P	C
		0	0	4	2

OBJECTIVES:

The aims of the course are as follows

- To make the student learn C programming language.
- To teach the student to write programs in C to solve the problems.
- To introduce the student to simple linear and non linear data structures such as lists, stacks, queues, trees and graphs and use the efficient for problem solving

LIST OF PROGRAMS

1. Write a C program to find the sum of individual digits of a positive integer.
2. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
3. Write a C program to calculate the following Sum:

   $Sum=1+x^2/2! +x^4/4!+x^6/6!+x^8/8!+x^{10}/10!$
4. Write a C program to find the roots of a quadratic equation.
5. Write C programs that use both recursive and non-recursive functions
   i) To find the factorial of a given integer.
   ii) To find the GCD (greatest common divisor)of two given integers.
   iii) To solve Towers of Hanoi problem.
6. Write a C program, which takes two integer operands and one operator form the user, performs the operation and then prints the result. (Consider the operators +,-,*,/,% and use Switch Statement)
7. Write a C program to find both the larges and smallest number in a list of integers.
8. Write a C program that uses functions to perform the following:
   i)Addition of Two Matrices
   ii)Multiplication of Two Matrices
9. Write a C program that uses functions to perform the following operations:
   i)To insert a sub-string in to given main string from a given position.
   ii)To delete n Characters from a given position in a given string.
10. Write a C program to determine if the given string is a palindrome or not
11. Write a C program that displays the position or index in the string S where the string T begins, or - 1 if S doesn't contain T.
12. Write a C program to count the lines, words and characters in a given text and C program to generate Pascal's triangle.

13. Write a C program to construct a pyramid of numbers.
14. 2's complement of a number is obtained by scanning it from right to left and complementing all the bits after the first appearance of a 1. Thus 2's complement of 11100 is 00100. Write a C program to find the 2's complement of a binary number.
15. Write a C program to convert a Roman numeral to its decimal equivalent.
16. Write a C program that uses functions to perform the following operations:
    i) Reading a complex number
    ii) Writing a complex number
    iii) Addition of two complex numbers
    iv) Multiplication of two complex numbers

TOTAL HOURS :45

TEXT BOOKS:

1. Reema Thareja, Computer Fundamentals and Programming in C, Oxford Press, 2012

REFERENCES:

1. Programming in C by Pradip Dey, Manas Ghosh 2nd edition Oxford University Press.
2. E.Balaguruswamy, Programming in ANSI C 5th Edition McGraw-Hill

OUTCOMES:

At the completion of this course, the student will able to

- Able to write, compile and debug programs in C language.
- Able to use different data types in a computer program.
- Able to design programs involving decision structures, loops and functions.
- Able to understand the dynamics of memory by the use of pointers.
- Able to use different data structures and create/update basic data files.

CAC1155	LINUX LAB	L	T	P	C
		0	0	4	2

OBJECTIVES:

The main objective of this course is to

- Learn and get familiar with the Unix operating system through Red hat
- Linux. UNIX basic commands working and their purpose will be defined.

LIST OF PROGRAMS

1. Write programs using the following system calls of UNIX operating system: fork, exec, getpid, exit, wait, close, stat, opendir, readdir
2. Write programs using the I/O system calls of UNIX operating system (open, read, write, etc)
3. Write C programs to simulate UNIX commands like ls, grep, etc.
4. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for FCFS and SJF. For each of the scheduling policies, compute and print the average waiting time and average turnaround time.
5. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for Priority and Round robin. For each of the scheduling policies,
6. compute and print the average waiting time and average turnaround time.

TOTAL HOURS –30

TEXT BOOKS:

1. The Design of Unix Operating System, Maurice J. Bach, Pearson Education, 2010

REFERENCES:

1. Advance UNIX, a Programmer’s Guide, S. Prata, BPB Publications, and New Delhi, 2011
2. Unix Concepts and Applications, Sumitabh Das, 2010

OUTCOMES:

- To use Linux desktop and GNU tool chain with Eclipse IDE.
- Cross compile Linux kernel and port it to target board.
- Add applications and write customized application for the Linux kernel in the target board.

SEMESTER II

ENC1283	GENERAL ENGLISH-II	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To prepare students for Interviews and Group Discussions
- To train them in writing official letters, resume' writing and reports.
- To train them in analysing different genre of literature.

MODULE I **7**

Filling Money Order Challan and Bank Challan
Short Story :G.K.Chesterton – The Hammer of God (Extensive Reading)
Essential English Grammar – 7-12 units

MODULE II **8**

Brainstorming – Think, pair and share activity
Poetry **:** Walt Whitman- I Celebrate Myself

MODULE III **8**

Dialogue Writing- Discussion etiquette -Assigning different roles in a GD (Note-taker, Manager, Leader and Reporter)
Prose**:** Environment

MODULE IV **8**

Interview skills- SWOT Analysis
Letter Writing- Letter to the Editor- Letter of Application and CV

MODULE V **8**

Report Writing- feasibility report and survey report
Short Story : Katherine Mansfield—A Cup of Tea (Extensive Reading)

MODULE VI **6**

Technical reports –Writing a technical report – format and content

TOTAL HOURS – 45

REFERENCES:

1. M. Ashraf Rizvi ‘Effective Technical Communication”. Tata McGraw – Hill Education, 2005. Gerson, Sharon & Steven M. Gerson, “ Technical Writing : Process and Product”
2. Pearson Education, New Delhi, 2004. 6. Riordan & Pauley. ‘Report Writing Today’. 9th Edition. Wadsworth Cengage Learning, USA. 2005.
3. Krishnaswamy. N, Sriraman T. **Current English for Colleges.** Hyderabad:
4. Macmillan Indian Ltd, 2006.
5. Dahiya SPS. Ed. **Vision in Verse- An Anthology of Poems**. New Delhi: Oxford
6. University Press, 2002.
7. Murphy, Raymond. **Essential English Grammar**. New Delhi: Cambridge
8. University Press, 2009.
9. Seshadri, K G Ed. **Stories for Colleges.** Chennai: Macmillan India Ltd, 2003.

OUTCOMES:

Students would be able to

- Take part in group discussions and interviews with confidence.
- Write official letters, their application letter with CV and reports.
- Analyse various genre of literature.

MAC1288 PROBABILITY AND STATISTICS L T P C
3 1 0 4

OBJECTIVES:

- To impart knowledge about the basic concepts of probability in solving application oriented problems
- To provide an understanding on the concepts of statistics

Recap Introduction to Probability (4)

Sample space - events - algebraic operations on events - definition of probability - Conditional probability - addition and multiplication theorems of probability – Baye's theorem.

MODULE I RANDOM VARIABLES AND DISTRIBUTION FUNCTIONS (10+3)

Discrete and continuous random variables - distribution function and its properties - probability mass function and probability density function - discrete and continuous probability distributions - Binomial, Geometric, Poisson, Uniform, Exponential and Normal distributions.

MODULE II MOMENTS AND MOMENT GENERATING FUNCTIONS (8+3)

Expectation of a random variable – probability generating function – properties - moment generating function.

MODULE III TWO DIMENSIONAL RANDOM VARIABLES (6+3)

Joint, marginal and conditional distribution functions - independence of random variables.

MODULE IV DESCRIPTIVE STATISTICS (8+3)

Types of data - primary and secondary data - classification and representation of data -formation of frequency distribution - various measures of central tendency, dispersion - and their merits and demerits - concept of skewness and kurtosis.

MODULE V CORRELATION AND CURVE FITTING (9+3)

Correlation coefficient and regression - rank correlation - curve fitting by least square methods - fitting a straight line, parabola, power curve and exponential curves. (no derivation, numerical problems only)

TOTAL HOURS – 60

TEXT BOOKS:

1. Richard Arnold Johnson, Irwin Miller, John E. Freund , Miller & Freund's
2. Probability and Statistics for Engineers, Prentice Hall, 2011.
3. Dr. P. Kandaswamy, Dr. K. Thilagavathy and Dr. K. Gunavathy, Probability and Queuing Theory, Revised edition, S. Chand Publishing, 2013.
4. T. Veerarajan, Probability, Statistics and Random Processes, Tata McGraw Hill, 2nd edition.

REFERENCES:

1. Goon, A.M., M. K. Gupta and B. Das Gupta Fundamentals of Statistics- Vol. I, World Press Ltd, Kolkata, 2002.
2. Gupta, S.C. and V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi, 2002.
3. Hogg, R.V. and A. Craig, Introduction to Mathematical Statistics, McMillan Publishing co., Inc. 1978.
4. Mood A.M., F.A. Graybill and D.C. Boes, Introduction to Theory of Statistics McGraw Hill Book Co., 1974.
5. Sheldon M. Ross, Introduction to Probability and Statistics for Engineers and Scientists, Fourth Edition, Elsevier.

OUTCOMES:

On completion of the course the students will be able to

- solve basic problems in probability and fundamentals of statistics.
- solve problems using standard probability distributions.
- find the marginal and conditional distributions of two dimensional random
- variables.
- calculate rank correlation and fitting curves for the given data.
- use method of moments and moment generating functions.

CAC1251	OPERATING SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

To gain knowledge about operating system, memory management and scheduling concepts and to study about the basics of OS, process management, Synchronization, memory management and File management.

MODULE I INTRODUCTION: 9

What is an operating system – operating system concepts – system calls – operating system structure

MODULE II PROCESSES AND THREADS 9

Process – Inter process communication – Scheduling; Deadlocks: Resources – Introduction to deadlocks – Deadlock detection and recovery – deadlock avoidance – Deadlock Prevention.

MODULE III MEMORY MANAGEMENT: 9

Basic memory management – Swapping – Virtual Memory – Page replacement algorithms – Implementation Issues – Segmentation.

MODULE IV INPUT / OUTPUT: 9

Principles of I/O hardware – Principles of I/O software – I/O software layers – Disks – Character oriented terminals – Graphical user interfaces – Network terminals.

MODULE V FILE SYSTEMS: 9

Files – Directories – File System Implementation – Example file systems – Case study 1: Unix and Linux; Case Study 2 : Windows 2000.

TOTAL HOURS – 45

TEXT BOOKS:

1. Abraham Silberschatz and P. B. Galvin - Operating system concepts - Addison Wesley Publication, Eighth Edition.,2012

REFERENCES:

1. Stalling William, Operating Systems: Internals and Design Principles, 7th

Edition, Prentice Hall, 2011.
2. Dietel et al, Operating Systems, 3rd Edition, Pearson Education, 2004.
3. A.S. Tanenbaum, Modern Operating Systems, 3rd Edition, Prentice Hall, 2007.

OUTCOMES:

At the completion of this course, students will be able to

- Demonstrate understanding of the concepts, structure and design of operating
- Systems Demonstrate understanding of operating system design and its impact on application system design and performance
- Demonstrate competence in recognizing and using operating system features.

CAC1252	OOPS WITH C++	L	T	P	C
		3	0	0	3

OBJECTIVES:

The aim of the course is to

- Understand the concepts of classes and object
- Define classes for a given situation and instantiate objects for specific problem solving.
- Reuse available classes after modifications if possible
- Possess skill in object oriented thought process

MODULE I INTRODUCTION TO OBJECT ORIENTED PROGRAMMING 9

Concept of Object orientation – comparison with procedural and structured programming – Classes and objects – data Abstraction, encapsulation, dynamic binding, message passing. Advantages of object orientation -Basic data types and declarations.

MODULE II CLASSES AND OBJECTS 9

Classes and objects in C++, access modifiers, static members, friend functions, Constructors and Destructors, polymorphism, Operator Overloading and type conversion

MODULE III INHERITANCE 9

Inheritance - parent and child classes, private, public and protected inheritance, multiple inheritances and multi-level inheritance, Virtual base classes. new and delete operators, objects.

MODULE IV POLYMORPHISM AND EXCEPTION HANDLING 9

Binding & Polymorphism: Early binding, Late Binding, Pointers to derived class objects, virtual functions, Pure virtual functions, exception handling in C++: try, throw and catch.

MODULE V FILE STREAM CLASSES AND TEMPLATES 9

Study of File stream classes in C++. Templates – class and function templates, Templates versus macros, String objects in C++, Standard Template Library in C++ .

TOTAL HOURS – 45

TEXT BOOKS:

1. Bjarne Stroustrup, “ Programming: Principles and Practice Using C++ “, Addison Wesley, 2nd edition, ISBN-13: 978-0321992789, 2014.

REFERENCES:

1. Bjarne Stroustrup," The C++ Programming Language", Addison Wesley, 4 th edition, ISBN-13: 978-0321563842, 2013.
2. Herbert Schildt, "C++ The Complete Reference", Tata McGraw Hill fourth Edition, 2003

OUTCOMES:

After completion of this course, the students would be able to

- Understand concepts of objects and their significance in real world
- Learn to co-relate relationship among different entities involved in a system
- Develop software in terms of objects, associations, and integrity constraints
- Identify, understand and analyze various sample development models
- Design classes and inheritances
- Real life problem formulation in terms of objects and classes
- Data handling through files

CAC1253	DATA STRUCTURES USING C	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the fundamental concepts of data structure
- To understand the basic operations of stacks and queues for real time scenario
- To comprehend the significance of sorting algorithms
- To demonstrate the understanding of various searching algorithms

MODULE I INTRODUCTION TO DATA STRUCTURES 9

Definition, Classification of data structures : primitive and non primitive. Operations on data structures. Dynamic memory allocation and pointers: Definition Accessing the address of a variable, Declaring and initializing pointers. Accessing a variable through its pointer. Meaning of static and dynamic memory allocation. Memory allocation functions: malloc, calloc, free and realloc.

MODULE II INTRODUCTION TO STACK AND QUEUE 9

Stack – Definition, Array representation of stack, Operations on stack: Infix, prefix and postfix notations- Conversion of an arithmetic expression from Infix to postfix. Applications of stacks. Queue - Definition, Array representation of queue, Types of queue: Simple queue, circular queue, double ended queue (deque) priority queue, operations on all types of Queues

MODULE III LINKED LISTS 9

Definition, Components of Linked List, Representation of Linked List, Advantages and Disadvantages of Linked List. Types of Linked List: Singly Linked Lists – Doubly Linked Lists – Circular List – Representing Stacks and Queues in C using Arrays and Linked Lists, Infix to Postfix Conversion, Postfix Expression Evaluation. Applications of Linked Lists.

MODULE IV TREES 9

Trees – Binary Trees - Terminology – Representation – Traversals – Graphs – Terminology – Representation – Graph Traversals (DFS & BFS).

MODULE V SEARCHING AND SORTING 9

Searching - Linear Search Methods - Binary Search Methods, Sorting - Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort.

TOTAL HOURS – 45

TEXT BOOKS:

1. Narasimha Karumanchi, "Data Structures and Algorithms Made Easy: Data Structure and Algorithmic Puzzles", 2nd Edition, Create Space Independent Publishing Platform, 2011.
2. Ashok N. Kamthane, "Introduction to Data Structures in C", 2nd Edition, Wiley Publications, 2008.

REFERENCES:

1. Classic Data Structures, D. Samanta, PHI Learning , New Delhi 2011
2. Data Structure made simple, Sathish Jain, Shashi Singh, BPB Publications, New Delhi 2006

OUTCOMES:

On completion of this course, students will be able to

- Describe common applications for arrays
- Apply Stack and Queue data structures for real time applications
- Analyse, evaluate and choose appropriate abstract data types and algorithms to solve particular problems

CAC1254	OOPS WITH C++ LAB	L	T	P	C
		0	0	4	2

OBJECTIVES:

- Understand and solve logical & mathematical problems through C++ language
- Strengthen knowledge of a procedural programming language.
- Design and develop solutions to intermediate level problems
- Develop their skills in software development using a procedural language
- Get programming in skill the object oriented technology with the usage of C++.

LIST OF PROGRAMS

1. Creation of classes and use of different types of functions.
2. Programs using Constructor and Destructor
3. Count the number of objects created for a class using static member function.
4. Write programs using function overloading and operator overloading.
5. Programs using inheritance.
6. Program using friend functions.
7. Program using virtual function.
8. Program using exception handling mechanism.
9. Programs using files.
10. Programs using function templates.

TEXT BOOKS

1. Bjarne Stroustrup, " Programming: Principles and Practice Using C++ ", Addison Wesley, 2nd edition, ISBN-13: 978-0321992789, 2014.

REFERENCES:

1. Bjarne Stroustrup," The C++ Programming Language", Addison Wesley, 4 th edition, ISBN-13: 978-0321563842, 2013.
2. Herbert Schildt, "C++ The Complete Reference", Tata McGraw Hill Edition, 2003

OUTCOMES:

- After completion of this course, the students would be able to Create classes and objects in C++
- Implement inheritance, polymorphism and object relationship in C++

- Design methods and procedure
- Manipulate data through file in C++
- Debug and test software.
- Develop a minor software in C++ language

CAC1255	DATA STRUCTURES USING C LAB	L	T	P	C
		0	0	4	2

OBJECTIVES:

The objective of this course is to teach the students to

- Be familiar with writing recursive methods
- Implement stack and queue using array
- Implement circular queue using array
- Implement singly linked list and doubly linked list using dynamic variables and pointers
- Implement quick sort, selection sort, insertion sort and bubble sort techniques to sort a given list of integers.
- Implementation of binary search method for a given list of integers

LIST OF PROGRAMS

1. Write a C program to demonstrate the working of stack of size N using an array. The operations to be supported are 1. PUSH 2. POP 3. DISPLAY. The program should print appropriate messages for STACK overflow and Under flow.
2. Write a C program to simulate the working of an ordinary Queue using an array. Provide the operations QINSERT, QDELETE and QDISPLAY. Check the Queue status for empty and full.
3. Write a C program to simulate the working of an Circular Queue using an array. Provide the operations CQINSERT, CQDELETE and CQDISPLAY. Check the Circular Queue status for empty and full.
4. Using dynamic variables and pointers Write a C program to construct a singly linked list consisting of the following information in each node; Roll – No (Integer), Name (Character string). The operations to be supported are :
    - Inserting a node in the front of the list
    - Deleting the node based on Roll – No
    - Searching a node based on Roll-No
    - Displaying all the nodes in the list
5. Write a C program to implement doubly linked list
6. Write a C program to sort a list of N elements of integer type using quick sort Algorithm
7. Write a C program to sort a list of N elements using Bubble sort Technique

8. Write a C program to search for an element in an array using Binary search
9. Write a C program to implement insertion sort method to sort a given list of integers in descending order.
10. Write a C program to implement selection sort method to sort a given list of integers in descending order.

TOTAL HOURS –30

TEXTBOOKS:

1. Magnifying Data Structures, Aprita Gopal , First Edition , PHI Learning, New Delhi Data Structures in C, Horowitz, Sahni, Anderson-Freed, Universities Press
2. Narasimha Karumanchi, "Data Structures and Algorithms Made Easy: Data Structure and Algorithmic Puzzles", 2nd Edition, Create Space Independent Publishing Platform, 2011.

REFERENCES:

1. Ashok N. Kamthane, "Introduction to Data Structures in C", 2nd Edition, Wiley Publications, 2008.
2. DataStructures Using C - A.S.Tanenbaum, Y. Langsam, and M.J. Augenstein, PHI/Pearson education.

OUTCOMES:

The completion of this course the students will be able to

- Write and demonstrate recursive methods
- Implement stack and queue and evaluate various operations involved in it
- Implement and execute circular queue using array
- Develop an application using singly linked list and doubly linked list
- Implement and analyze various searching techniques and sorting techniques

CAC1256	ENVIRONMENTAL STUDIES	L	T	P	C
		2	0	0	2

OBJECTIVES:

To impart knowledge on

- Various natural resources, availability, utilization and its current scenario.
- Different ecosystems, energy transfer.
- Values, threats and conservation of biodiversity.
- Levels of different pollutants and its impact and the causes and effects of natural disasters

MODULE I NATURAL RESOURCES 8

Land resources: land degradation, soil erosion and desertification - Forest resources: use and over-exploitation, deforestation - Water resources: use and over-utilisation of surface and ground water, water conservation (rainwater harvesting and watershed management) - Food resources: world food problems, changes in land use by agriculture and overgrazing, modern agriculture and its effects - Energy resources: increasing energy needs, renewable and non-renewable, use of alternate energy sources.

MODULE II ECOSYSTEM 8

Ecosystem- energy flow in the ecosystem - food chains, food webs and ecological pyramids - characteristics, structure and function of (a) Terrestrial ecosystems (forest, grassland, desert) and (b) Aquatic fresh water ecosystems (pond, lake, river) (c) Aquatic salt water ecosystems (ocean, estuary) - ecological succession.

MODULE III BIODIVERSITY AND ITS CONSERVATION 8

Biodiversity - genetic, species and ecosystem diversity – hot-spots of biodiversity – bio geographic classification of India - endangered, endemic, extinct and invasive species of India - red data book - values of biodiversity: consumptive, productive, social, ethical, aesthetic and option values - threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts - conservation of biodiversity: in-situ and ex-situ conservation of biodiversity

MODULE IV ENVIRONMENTAL POLLUTION AND NATURAL DISASTER 6

Definition, cause, effects and control measures of (a) air pollution (b) water pollution

(c) soil pollution (d) marine pollution (e) noise pollution (f) thermal pollution (g) nuclear hazards - ill-effects of fireworks and upkeep of clean environment - solid waste management: types (urban, industrial, biomedical and electronic wastes), collection, processing and disposal (incineration, composting and land-fill).

Natural disaster and management: flood, cyclone, drought, landslide, earthquake and tsunami.

Case studies related to current situation.

TOTAL HOURS – 30

TEXT BOOKS:

1. Erach Bharucha, Textbook for Environmental Studies For Undergraduate Courses of all Branches of Higher Education for University Grants Commission, Orient Blackswan Pvt Ltd, Hyderabad, India, 2013.
2. Benny Joseph, Environmental Studies, Tata McGraw-Hill Education, India, 2009.
3. Ravikrishnan A, Environmental Science and Engineering, Sri Krishna Publications, Tamil Nadu, India, 2015.
4. Raman Sivakumar, Introduction to Environmental Science and Engineering, McGraw Hill Education, India, 2009.
5. Venugopala Rao P, Principles of Environmental Science and Engineering, Prentice Hall India Learning Private Limited; India, 2006.
6. Anubha Kaushik and Kaushik C.P., Environmental Science and Engineering, New Age International Pvt Ltd., New Delhi, India, 2009.
7. Rajah G, Basic Environmental Studies, Margham Publications, Chennai, 2016.

REFERENCE BOOKS:

1. Masters G.M. and **Wendell P.,** Introduction to Environmental Engineering and Science, **3rd** Edition, Prentice Hall, New Delhi, 2007.
2. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co. Boston, USA, 2016.

OUTCOMES:

At the end of the course the student will be able to

- Predict the scenario of various natural resources and suggest remedies to curb the exploitation of these resources.

- Identify food chain and web and its role in various ecosystems.
- Assess the impacts on biodiversity and provide solutions to conserve it.
- Analyze the impacts of pollutants in the environment and propose suitable method to alleviate the pollutants and the natural disasters.

SEMESTER III

CAC2151	**DATABASE MANAGEMENT SYSTEMS**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

OBJECTIVES:

The aim of the course is to

- Provide an introduction to the management of database systems.
- Understand the fundamentals of relational systems including data models, database architectures, and database manipulations.

MODULE I INTRODUCTION 12

Database Systems vs. File Systems - View of Data - Data Models- Database Languages -Transaction Management - Database Systems Structure - History of Database Systems - Database Systems Applications - Entity Relationship Model.

MODULE II RELATIONAL DATABASES 12

SQL - Basic Structure - Set Operations - Complex Queries - Joined Queries - DDL-Embedded SQL-Dynamic SQL-Other SQL Functions-Query by Example- Integrity and Security of searching-Relational Database Design.

MODULE III DATA STORAGE AND INDEXING 12

Storage & File Structure - Disks-RAID-File Organization - Indexing &Hashing- B+ TREE-B Tree-Static Hashing-Dynamic Hashing-Multiple Key Access.

MODULE IV QUERY EVALUATION & OPTIMIZATION 12

Query Processing-Selection Operation-Sorting-Join Operation-Evaluation of Expressions

MODULE V QUERY OPTIMIZATION 12

Query Optimization Overview - Transformation of Relational Expressions -Estimating Statistics of Expression Results - Choice of Evaluation Plans

Total Hours –60

TEXT BOOK:

1. Elmasri and Navathe, "Fundamentals of Database Systems", 6th Edition, Addison-Wesley, 2011

REFERENCES:

1. Raghu Ramakrishnan & Johannesgerhrke, “Data Base Management Systems”, Mc Graw Hill International Edition, 2000.
2. C.J. Date, A. Kannan, S. Swamynathan, "An Introduction to Database Systems", 8th Edition, Pearson Education, 2006.

OUTCOMES:

At the conclusion of the course, the student will be able to:

- Understand terms related to database design and management.
- Understand the objectives of data and information management.
- Develop physical data models for relational database management systems.
- Implement relational databases using a RDBMS retrieve data using SQL.

CAC2152 DIGITAL ELECTRONICS L T P C

3 0 0 3

OBJECTIVES:

The main objective of the Course Digital Electronics is the students will learn

- through the basic understanding of Boolean Algebra and Number systems,
- introduces the student to the fundamentals of combination logic design and then to sequential circuits(both synchronous and asynchronous)
- Understandings in Flip Flops, Multiplexers, ADC and DAC

MODULE I NUMBER SYSTEMS 9

Number Systems and Codes Decimal, binary, octal, hex numbers, conversion from one to another- codes, BCD, excess 3 , gray codes conversion from one to another - Error detection codes.

MODULE II BOOLEAN ALGEBRA AND THEOREMS 9

Boolean Algebra and Theorems : Basic, Universal logic gates - Boolean theorems - sum of products , products of sums expressions , simplification by Karnaugh Map method, simplification based on basic Boolean theorems - don't care conditions.

MODULE III COMBINATIONAL DIGITAL CIRCUITS 9

Combinational Digital Circuits Arithmetic Building blocks , Basic Adders and subtractors, BCD adders - Data of processing circuits, multiplexers, demulitiplexers, encoders, decoders - TTL, CMOS digital logic families.

MODULE IV SEQUENTIAL DIGITAL CIRCUITS 9

Sequential Digital Circuits : Flip-flops , RS, Clocked SR, JK, D, T, master-slave types-shift registers, ring counters - ripple counters - synchronous counters, timer IC 555, applications.

MODULE V DAC AND ADC 9

DAC and ADC : Parameters, Accuracy, resolution - DAC, variable resister network, R-2R ladder network types - ADC, counting continuous, successive approximation, dual - slope types - comparison of various types of DAC and ADC.

Total Hours –45

TEXT BOOKS:

1. M. Morris Mano and Michael D.Ciletti, "Digital Design with an introduction to the Verilog HDL", 5th Edition, Pearson Education, 2012.

REFERENCES:

1. Donald D. Givone, "Digital Principles and Design", 13th reprint, Tata McGraw Hill, 2003.
2. S.P. Bali, Solved Problems in Digital Electronic, Sigma Series, Tata McGraw-Hill,(2005)

OUTCOMES:

A student who successfully fulfills the course requirements will have demonstrated:

- An ability to understand basic parameters of a logic Gates.
- An ability to analyze and design a CMOS logic inverter.
- An ability to analyze a TTL and ECL logic inverter.
- An ability to understand the operation of latch circuit and flip-flop circuits.
- An ability to understand the operation of different types of semiconductor memories.

CAC2153	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

This course provides a comprehensive introduction to

- Understand the underlying Network model and Communication principles.
- Switching techniques and Multiplexing approaches
- knowledge in Internetworking Devices

MODULE I NETWORK FUNDAMENTALS

A communications model - Data Communications - Data Communications Networking - computer communication architecture - standards Data Transmission - Concepts and terminology - Analog and Digital - Transmission - Transmission Impairments - Transmission media.

MODULE II PHYSICAL LAYER

Data encoding - Digital data Digital signals ,Digital data Analog signals,, Analog data Analog signals Data Communications Interface : Asynchronous and synchronous Transmission - Line configuration - Interfacing.

MODULE III DATA LINK LAYER

Data link control: Flow controls - Error Detection - Error Control - High Level Data Link Control (HDLC) - MULTIPLEXING - Frequency Division multiplexing - Synchronous time - Division multiplexing - Statistical time division multiplexing.

MODULE IV NETWORK LAYER

Circuit switching: Circuit switching networks switching concepts - Routing in circuit switched networks - Packet switching principles - Routing in packet switching - Congestion control.

MODULE V HIGH PERFORMANCE NETWORKS

Frame relay: Frame relay Protocol Architecture - Frame relay call control user data transfer - Networks functions - Congestion control, ASYNCHRONOUS TRANSFER MODE (ATM) Protocol Architecture – ATM logical connection - ATM Cells – Transmission of ATM cells - ATM adaption layer - Traffic and congestion control.

TOTAL HOURS – 45

TEXT BOOKS:

1. Larry L. Peterson and Bruce S. Davie, "Computer Networks: A Systems Approach", 4th Edition, Elsevier, 2007.

2. Forouzan: Introduction to Data Communication & Networking, McGraw-Hill, 2007.

REFERENCES:

1. Andrew S. Tanenbaum, "Computer Networks", 4 th Edition, Prentice-Hall of India, 2003.

2. James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", 3rd Edition, Pearson Education, 2006.

OUTCOMES:

Upon completion of the subject, students will be able to

Explain the importance of data communications and the Internet in supporting business communications and daily activities.

- Understand how communication works in data networks and the Internet.
- Recognize the different internetworking devices and their functions.
- Explain the role of protocols in networking.
- Analyze the services and features of the various layers of data networks

CAC2154 FUNDAMENTALS OF ALGORITHMS

L	T	P	C
3	0	0	3

OBJECTIVES:

The aim of the course is to

- introduce mathematical aspects and analysis of algorithms
- analyze sorting and searching algorithms
- study various algorithmic techniques
- devise correct and efficient algorithms for solving a given problem
- explain the NP-Completeness and deal with NP-complete problems

MODULE I INTRODUCTION **9**

Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types – Fundamentals of the Analysis of Algorithm Efficiency – Analysis Framework – Asymptotic Notations and its properties – Mathematical analysis for Recursive algorithm and Non-recursive algorithms.

MODULE II DIVIDE-AND-CONQUER **9**

Brute Force – Closest-Pair and Convex-Hull Problems-Exhaustive Search – Traveling Salesman Problem – Knapsack Problem – Assignment problem. Divide and conquer methodology – Merge sort – Quick sort – Binary search – Multiplication of Large Integers – Strassen's Matrix Multiplication.

MODULE III DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE **9**

Computing a Binomial Coefficient – Warshall's and Floyd' algorithm – Optimal Binary Search Trees – Knapsack Problem and Memory functions. Greedy Technique– Prim's algorithm- Kruskal's Algorithm- Dijkstra's Algorithm.

MODULE IV BACKTRACKING **9**

Backtracking – N-Queens problem – Hamiltonian circuit problem – Subset sum problem

MODULE V BRANCH AND BOUND **9**

Branch and bound – Assignment problem – Knapsack problem – Traveling salesman problem.

TOTAL HOURS –45

TEXT BOOKS:

1. Baase,S., Gelder,A.V., Computer Algorithms: Introduction To Design And Analysis, 3rd Edition, Pearson India.
2. Anany Levitin, Introduction to the Design and Analysis of Algorithms, 3rd Edition, Pearson Education.

REFERENCES:

1. Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, Introduction to Algorithms, 2ndEdition, PHI, 2006.
2. Introduction to the Design and Analysis of Algorithms A Strategic Approach, R.C.T. Lee, S.S. Tseng, R.C. Chang & Y.T.Tsai, TMH, 2005.

OUTCOMES:

At the completion of this course, students will be able to

- Ability to decide the appropriate data type and data structure for a given problem.
- Ability to select the best algorithm to solve a problem by considering various problem characteristics, such as the data size, the type of operations, etc.
- understand NP-Completeness and deal with NP-complete problems.

CAC2155 MULTIMEDIA AND ITS APPLICATIONS L T P C

3 0 0 3

OBJECTIVES:

- Understand the Flash/Animate working environment and its terminology.
- Explore and implement the different types of animation Flash/Animate supports.
- Learn how to import and use sound and sound effects in animation programs.
- To edit images in Photoshop

MODULE I -INTRODUCTION 9

What is multimedia: Definitions - Where to use Multimedia - Introduction to making Multimedia- The stages of a Project - What You Need – Multimedia Skills and Training: Basic Tools :Text Editing and Word Processing Tools - Painting and Drawing Tools - 3- D Modeling and Animation Tools - Image Editing Tools - Sound Editing Tools - Animation, Video and Digital Movie Tools - Helpful Accessories

MODULE II VECTOR AND RASTER GRAPHICS 9

Adding multimedia to the web-Raster image editing software Introduction -Image Basics -File Formats -GIF -JPEG -Color Palette –Color models-Layers -Creating new Images - Brushes –Grids and guides-Gradients -Scaling Images -Moving and Merging Layers - Tool Palette -Dialogs -masking –Filters –Adding text to images – Designing icons and background images.

MODULE III IMAGE HANDLING 9

Introduction –Creating Simple Vector graphics –Creating banners -Images -Working with layers –Tweening -Motion guide –Masking –Frame by Frame animation –Onion Skin Effect –Creating special effects -Text effects and animation –Action scripts.

MODULE IV ANIMATIONS AND INTERACTION 9

Creating clippings - Animations with sound effects -Adding audio or Video - Windows Media Player ActiveX Control -Real Player ActiveX control- web site with a particular theme using all the utilities -Graphics -Animations and Interaction

.

MODULE V PROJECT PLANNING 9

Estimating -Designing - Producing - Content and Talent- Acquiring Content - Using content created by others - Using Content created for a Project - Using

Talent Delivering: Testing - Preparing for Delivery - Compact Disc Technology - Wrapping It Up - Delivering on the World Wide Web.

TOTAL HOURS –45

TEXT BOOKS:

1. Richard Schrand, Photoshop 6 Visual Jumpstart, Adobe Press 2000.(II)
2. James L. Mohles, Flash 5.0 Graphics, Animation & Interaction, Macromedia 2000. (III&IV)
3. Tay Vaughan, Multimedia: Making It Work, Fourth Edition - Tata McGraw Hill Edition, 1999.(I&V)

REFERENCES:

1. Tay Vaughan , "Multimedia:Making It Work,8th Edition", McGraw Hill, 2010.
2.John F Koegelbuford, Multimedia Systems Addison Wesley - First Indian Reprint, 2000.

OUTCOMES:

On completion of the course, Students will be able to

- Create Flash/Animate banners for websites that will capture and hold viewers attention
- Create animated photo galleries.
- Incorporate audio and video and learn how to edit it within Flash/Animate.
- Design icons and background images.

CAC2156	DATABASE MANAGEMENT SYSTEMS LAB	L	T	P	C
		0	0	4	2

OBJECTIVES:

The aim of the course is

- to learn SQL (Structured Query Language) which would provide functionality to:
- to learn how to create tables which are fundamental storage blocks of data.
- to learn how to place constraints on data that is entered on tables to ensure data integrity.
- to learn how to add, change and remove data from tables.
- to learn how to select a subset of the data you want to see from the collection of tables and data.
- to learn how to combine table and group multiple rows of data in table. to learn PL/SQL which would provide the ability to do iterative
- programming at database level to:
- to write programming blocks with conditional structure, assignment structure, loop structure, etc.
- use exception Handling, Transaction oriented programs, Stored procedures, functions, packages, etc.

LIST OF PROGRAMS

1. Execute a single line and group functions for a table.
2. Execute DCL and TCL Commands.
3. Create and manipulate various DB objects for a table.
4. Create views, partitions and locks for a particular DB.
5. Write PL/SQL procedure for an application using exception handling.
6. Write PL/SQL procedure for an application using cursors.
7. Write a DBMS program to prepare reports for an application using functions.
8. Write a PL/SQL block for transaction operations of a typical application using package.
9. Design and develop an application using any front end and back end tool (make use of ER diagram and DFD).

Typical Applications – Banking, Electricity Billing, Library Operation)

TOTAL HOURS –30

OUTCOMES

At the end of this course, a student will be able to

- Use in real time business activities.
- create and do manipulation on database in any domain.
- work with table by using PL/SQL Program.
- get a clear idea about database transaction activities.

TEXTBOOK:

1.Ramez Elmasri and Shamkant B. Navathe, “Fundamentals of Database Systems”, Fifth Edition, Pearson Education, 2008.

REFERENCES:

1.Abraham Silberschatz, Henry F. Korth and S. Sudharshan, “Database System Concepts”, Sixth Edition, Tata Mc Graw Hill, 2011.

2. C.J.Date, A.Kannan and S.Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.

CAC2157	MULTIMEDIA LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- Expose students to various interactive multimedia based software such as Flash
- Gain a working knowledge of all the Adobe Flash/Animate tools and their functions.

LIST OF PROGRAMS

Exercises Using Flash

1. Drawing a Semi Circle by snap tool, spokes on a wheel.
2. Placing a text along a curved path .
3. Changing on objects shape using shape tweening, text tweening.
4. Application using buttons, animating the button
5. Tweening a using the shape hints, motion tweening
6. An application to show the masking effect in Flash
7. Slide show presentation(minimum 5 slides)
8. Creating smudge effect for an image
9. Usage of textbox, dynamic text box, buttons with action scripts.

Exercises Using Photoshop

1. Working with the clone stamp tool , custom shape
2. Using the sponge Tool
3. Removing an element from an image
4. Creating an edge mask
5. Applying Transformations
6. Correcting brightness and contrast

TOTAL HOURS – 30

TEXT BOOKS:

1.Richard Schrand, Photoshop 6 Visual Jumpstart, Adobe Press 2000.

2. James L. Mohles, Flash 5.0 Graphics, Animation & Interaction, Macromedia 2000

REFERENCES:

1. John F Koegelbuford, Multimedia Systems Addison Wesley - First Indian Reprint, 2000.

2. Walter Worth John, A - Multimedia Technologies and Applications, Ellis Horwood Ltd., London,1991.

OUTCOMES:

On completion of the course, Students will be able to

- Draw simple images prepare them for animation and add motion.
- Animate a sequence with a soundtrack.

CAC2158	COMMUNICATION SKILLS	L	T	P	C
		0	0	4	2

OBJECTIVES:

The aim of the course is to

- enable the students to speak English with correct accent and pronunciation.
- interact effectively in real life situations and in workplace.
- develop the writing ability of students by providing them the required practice.
- improve the written communication skill so as to write reports, letters etc.

MODULE I

Introduction to Communication-Need for Effective Communication. The Process of Communication:Levels of communication- Flow of communication- Use of language in communication- Communication networks- Significance of technical communication.

MODULE II

Barriers to Communication:Types of barriers- Miscommunication- Noise- Overcoming measures. Listening Skills:Listening as an active skill- Types of Listeners- Listening for general content- Listening to fill up information- Intensive Listening- Listening for specific information-Developing effective listening skills- Barriers to effective listening skills.

MODULE III

Reading Skills :Previewing techniques- Skimming- Scanning- Understanding the gist of an argument-Identifying the topic sentence- Inferring lexical and contextual meaningrecognizing coherence and sequencing of sentences- Improving comprehension skills. Writing Skills:Sentence formation- Use of appropriate diction- Paragraph and Essay Writing- Coherence and Cohesion.

MODULE IV

Technical Writing:Differences between technical and literary style, Elements of styleCommon Errors. Letter Writing: Formal, informal and demi-official letters- business letters. Job Application :Cover letter, Differences between bio-data, CV and Resume. Group Discussion:Differences between group discussion and debate; Ensuring success in group discussions.

MODULE V

Non-verbal Communication and Body Language: Forms of non-verbal

communicationInterpreting body-language cues- Kinesics- Proxemics- Chronemics- Effective use of body language. Interview Skills:Types of Interviews- Ensuring success in job interviewsAppropriate use of non-verbal communication. Presentation Skills:Oral presentation and public speaking skills- business presentations

TOTAL HOURS –20

TEXT BOOKS:

1.Deparment of English,Anna University,Mindscapes,English for Technologists & Engineers,Orient Longman Pvt.Ltd,Chennai :2012.

2.M.Ashraf Rizvi,,Effective Technical Communication,Tata McGraw Hill Publishing Company Ltd,New Delhi,2009.

REFERENCES:

1. Sangeetha Sharma,Binod Mishra,'Communication Skills for Engineers & Scientists,PHI,Learning Pvt Ltd,New Delhi,2009.
2. Sumant S,Technical English, 2nd Edition,McGraw-Hill Education Pvt Ltd,2008.

OUTCOMES:

This course will enable students to use „good" English and perform the following
Gather ideas and information, to organise ideas relevantly and coherently.

- Engage in debates.
- Participate in group discussions.
- Make oral presentations.
- Write formal letters.
- Transfer information from non-verbal to verbal texts and vice versa.
- Take part in social and professional communication.

SEMESTER IV

CAC2251	PROGRAMMING IN JAVA	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aim of the course is to

- Learn the fundamentals of the capabilities of Java and to introduce encapsulation, polymorphism, and the Java language mechanism (classes and objects) to implement it.
- Develop Java computer programs that perform various problem-solving algorithms.
- Develop the programming skills to use the Java object oriented programming methodology to produce quality computer based solutions to real problems.

MODULE I INTRODUCTION TO JAVA 12

The Confidentiality, Integrity & Availability (CIA) Triad, Cryptographic concepts, methodologies &practices, Symmetric& Asymmetric cryptography, public& private keys, Cryptographic algorithms and uses, Construction& use of Digital signatures

MODULE II CLASS AND INHERITANCE 12

The Java Class- Inheritance, Deriving Classes, Method Over-riding, Method Overloading, Access Modifiers, Abstract Class and Method, Interfaces, Packages, Imports and Class Path.

MODULE III THREADS AND EXCEPTION HANDLING 12

Exception Handling, The Try-Catch Statement, Catching more than one Exception, Generating Exceptions, Threads: Introduction, Creating Threads in Applications-Thread Priority

MODULE IV : INPUT STREAM CLASSES 12

IO Packages, Java Input Stream Classes, Java Output Stream Classes, File Class.

MODULE V APPLETS AND AWT PACKAGES 12

Creating an Executable Applet, Applets Life Cycle, AWT and Graphic methods, Fonts, Loading and Viewing Images, Loading and Playing Sound, Event Handling, Layouts

TOTAL HOURS –60

TEXT BOOKS:

1. Hortsmann & Cornell, "Core Java Advance Features VOL II", 9th Edition,

Pearson Education, 2013.

REFERENCES:

1. Patrick Naughton, "Complete Reference: JAVA 2", 8th Edition, Tata McGrawHill, 2011.
2. Andrew Lee Rubinger, Bill Burke "Enterprise JavaBeans 3.1", 6th Edition, O'Reilly Publishers, 2010.

OUTCOMES:

Upon completion of this course, students would be able to:

- Develop Java computer programs that perform various problem-solving algorithms.
- Improve the programming skills in Object Oriented language.
- Understand the concept of OOP as well as the purpose and usage principles of inheritance,
- Develop programs using the Java Collection API as well as the Java standard class library

CAC2252 COMPUTER SECURITY L T P C

3 0 0 3

OBJECTIVES:

- To provide the student with a foundation covering computer security issues
- To determine appropriate mechanisms for protecting Computer systems.
- To help organizations increase awareness of security policies and procedures.

MODULE I INTRODUCTION 8

Physical Security – Viruses – Worms – Trojan Horses –Principles of Computer Security

MODULE II IDENTITY THEFT AND PRIVACY 9

Identity Theft- Shredding – Internet Cookies –Phishing – Homograph Threat – Privacy Issues- Trust.

MODULE III ELEMENTS OF CRYPTOGRAPHY 10

Principles of Cryptography - Modular Arithmetic - Integrity Check Functions - Kirchoff's Principle – Monoalphabetic -Polyalphabetic Cipher – One Time Pad – Key distribution Problem – Diffie Hellman Key Merkle Keys- Public Key Cryptography – RSA – SSL - Digital Signatures – Encryption - Strength of Mechanisms –Performance.

MODULE IV DATABASE SECURITY 9

Introduction - Relational Databases- Access Control - Statistical Database Security – Integration with the Operating System – Privacy

MODULE V COMMUNICATION AND WEB SECURITY 9

Basics of authentication, tokens, certificate-based and biometric authentication, Protocol Design Principles - IP Security - IPsec and Network Address Translation- SSL/TLS – Xtensible Authentication Protocol - Web Services Security.

TOTAL HOURS –45

TEXT BOOK:

1.Chuck Easttom, "Computer Security Fundamentals", 2nd Edition, Pearson Education, 2012.

REFERENCES:

1. Christof Paar, Jan Pelzl, Bart Preneel, "Understanding Cryptography: A Textbook for

Students and Practitioners", 1st Edition, Springer, 2010

2. Bruce Schneider, "Applied Cryptography Protocols, Algorithms, and Source Code in C", 2nd Edition, John Wiley & Sons, 2007.

OUTCOMES:

Students who complete this course will be able to

- identify fundamental concepts of computer security.
- use the World Wide Web to know the latest security alerts and information.
- compare and contrast types of malicious code, including worms, Trojan horses, and viruses.

CAC2253	SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The aims of the course are as follows

- to define software engineering and explain its importance
- to discuss the concepts of software products and software processes
- to solve problems in a team environment through effective use of written and oral communication skills.
- to practice the lifelong learning needed in order to keep current as new issues emerge.
- to develop software in at least one application domain.

MODULE I INTRODUCTION 9

Definition of software and software engineering – Software myths –Software Engineering paradigms: Linear Sequential Model & Prototyping Model Software Project Management – Software Metrics – Software Cost Estimation – Software Project Planning.

MODULE II SOFTWARE REQUIREMENT ANALYSIS 9

Software Risks – Software Configuration Management System Analysis – Modeling the System Architecture – System Specification –Fundamentals of Requirement Analysis – Software Prototyping – Prototyping methods and tools specification – Software requirements Specifications

MODULE III STRUCTURED ANALYSIS 9

Introduction – the elements of the analysis model – data objects, attributes and relationships – Cardinality and Modality – ERD – DFD – Classical Analysis Methods : DSSD, JSD, SADT.

MODULE IV SOFTWARE DESIGN 9

Software Design and Software Engineering – Design and Software Quality – Evolution of Software Design – Design Principles. Design Concepts, Abstraction, Refinement, Modularity – Effective Modular Design, Functional Independence, Cohesion, Coupling.

MODULE V SOFTWARE TESTING METHODS 9

Software Testing Fundamentals – White Box Testing – Black Box Testing – Debugging – Software Quality: McCall's Quality Factors

TOTAL HOURS – 45

TEXT BOOKS:

1. Stephen Withal, "Software Requirement Patterns", 3rd Edition, Microsoft Press, 2011.

REFERENCES:

1. Karl & Joy Beatty," Software Requirements", 3rd Edition, Microsoft Press, 2012..
2. S.K.Kataria, Rajiv Chopra, "Object Oriented Software Engineering", 3rd Edition, 2013.

OUTCOMES:

At the completion of this course students will be able to

- understand and apply foundations of software engineering practice and process within production constraints.
- get an awareness of current industry standards and practices.
- understand and apply principles of project management for single- paired, and team processes.
- have strong oral and written communication skills to help students in preparing good quality documentation.

CAC2254	INFORMATION STORAGE AND MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce advanced Storage System, Backup and Security Managements.
- The Concept of Cloud Computing, Virtualization and other related services.
- To Explain Storage networking Technologies
  Security in cloud Environment and cloud Service management activities

MODULE I STORAGE SYSTEM

Introduction to Information Storage, virtualization, and cloud computing, Data center environment, RAID, Intelligent Storage system

MODULE II STORAGE NETWORKING TECHNOLOGIES

Fibre Channel Storage Area Network (FC SAN), IP SAN and Fibre Channel over Ethernet (FCoE), Network Attached Storage (NAS), Object based and Unified Storage

MODULE III BACKUP. REPLICATION AND ARCHIVE

Introduction to Business Continuity, Backup and Archive, Local Replication, Remote Replication

MODULE IV CLOUD COMPUTING

Cloud Computing, benefits, characteristics, deployment models, and Services, cloud challenges and migration considerations

MODULE V SECURING AND MANAGING STORAGE INFRASTRUCTURE

Securing the Information Infrastructure, framework and domains of storage security, security Implementation at storage networking, security in virtualized and cloud environments, Managing the Information Infrastructure, infrastructure monitoring and management, information lifecycle management (ILM), cloud service management activities

TOTAL HOURS –45

TEXTBOOK:

1.G. Somasundaram, Alok Shrivastava, Information Storage and Management - Storing, Managing, and Protecting Digital Information EMC Education Services,2012.

REFERENCE:

1. John W.Rittinghouse and James F.Ransome, “Cloud Computing: Implementation, Management, and Security”, CRC Press, 2010.

OUTCOMES:

Upon completion of the subject, students will be able to

- A working understanding of the Storage, Backup, virtualization, and cloud computing
- Acquire knowledge in different technologies of Storage System and Backup System
- An awareness of Security in Cloud and cloud service management activities

CAC2255 PROGRAMMING IN JAVA LAB

L	T	P	C
0	0	4	2

OBJECTIVES

The aim of the course is to

- Develop the programming skills using the object oriented programming methodology to produce quality computer based solutions to real problems.
- Utilize the advance features of Java technology.
- Work with collection API and develop fast programs.
- Develop good multithreaded programs.

LIST OF EXERCISES

1. Programs using basic data types, operators and control structures.
2. Class definitions and usage involving variety of constructors and finalizes
3. Programs involving various kinds of inheritances,
4. Program to demonstrate creation and handling of packages, their imports and Class Path.
5. Programs involving a variety of Exception Handling situations
6. Program involving creating and handling threads in applications and applets.
7. Program to demonstrate AWT/Swing graphic methods
8. Program for Loading and Viewing Images, Loading and Playing Sound
9. Programs to demonstrate various Layouts
10. Programs to demonstrate event handling

TOTAL HOURS –30

TEXT BOOKS:

1. Patrick Naughton, "Complete Reference: JAVA 2", 8th Edition, Tata McGrawHill, 2011.

REFERENCES:

1. Keyur shah, “Gateway to Java Programmer Sun Certification”, Tata McGraw Hill 2002.
2. Herbert Schildt, The Complete Reference – Java 2 , 4th Edition, Tata McGraw Hill, 2007

OUTCOMES:

After completion of this course, the students would be able to

- Understand Java and object-oriented programming language concepts.

- Write, debug, and document well-structured Java applications
- Implement Java classes from specifications
- Effectively create and use objects from predefined class libraries
- Understand the behavior of primitive data types, object references, and arrays
- Implement interfaces, inheritance, and polymorphism as programming techniques
- Apply exceptions handling

CAC2256	SOFT SKILLS AND PERSONALITY DEVELOPMENT	L	T	P	C
		0	0	4	2

OBJECTIVES:

This course is designed to

- provide attitude Control and Personal Self Esteem Improvement
- interview Motivation effective Answering and Maintaining Fluent Communication
- positive Body Language
- effective Resume Creation
- leadership Skills, Team Player Skills

MODULE I INTRODUCTION 4

Awareness of Real World Industry and Situations - Conscious Self-Awareness - Practical Visualizations - Neuro- Linguistic Programming Basics

MODULE II MOTIVATION 4

Developing Self Esteem and Self Motivation - Confident Goal Setting - Positive Attitude Development and Positive Thinking - Developing Inner Achievement Mindset.

MODULE III LEADERSHIP SKILLS 4

Types of Leadership - Leadership Process and Thinking - Innovative Thinking - Role of Competency, Discipline, Planning and Ethics - Creating Cooperation and Trust in Team Building Process – Mentoring.

MODULE IV EFFECTIVE COMMUNICATION I 4

Eliminating Stage Fright - Increasing Fluency - Increasing Focus while Listening - How to communicate as a Follower - How to communicate as a Leader - Assertive and Polite Communication

MODULE V EFFECTIVE COMMUNICATION II 4

Fluency with increased vocabulary - Group Discussion Etiquette - Advanced Group Discussions - Giving a positive Body Language - Interviews: Clear Speaking - Interviews: Handling Pressure

TOTAL HOURS –20

REFERENCES:

1. Charles Faulkner and Steve Andreas, "NLP: The New Technology of Achievement", Harper Paperbacks publishers, 1996.
2. Sarvesh Gulati, "Corporate Soft Skills" , Rupa and Co publishers.

3. P.K.Dutt, G. Rajeevan and C. L. N. Prakash, “A Course in Communication Skills”, Cambridge University Press, India 2007.

OUTCOMES:

By the end of this course students will be able to develop the following:

Awareness of Real World Industry and Situations

- Role of Competency, Discipline, Planning and Ethics
- Advanced Group Discussions
- Giving a positive Body Language
- Interviews: Clear Speaking

SEMESTER V

		L	T	P	C
CAC3151	**C# AND .NET PROGRAMMING**	**3**	**1**	**0**	**4**

OBJECTIVES:

To enable the students to learn and develop Web and Windows application for the .NET platform.

MODULE I INTRODUCTION 12

Vision and goals of .NET, Building blocks of .Net, overview of .Net applications- .Net evolution- The .Net Framework Architecture- Intermediate Language(IL)- Common Language Runtime (CLR)- JIT Compilation- Common Type System (CTS)- Common Language System (CLS)- Assemblies- IL Disassembler (ILdasm.exe)- Namespaces. C# features Working with methods- understanding method structure- calling a method- understanding parameter types- overloading methods- virtual methods- overriding methods.

MODULE II C# CLASSES 12

Constants- fields- methods- properties- events- indexers- operators- constructors- destructors- static modifiers. Class Inheritance Compiling with multiple classes- virtual and override methods- abstract methods- sealed classes- Boxing and Unboxing- Working with namespaces- Understanding interfaces- handling exceptions.

MODULE III WINDOWS APPLICATIONS 12

Understanding Windows Forms Architecture- Windows controls: Common- Containers- Menus and Tool strips- Data- Reporting. Adding and using windows controls to the form.

MODULE IV DATABASE PROGRAMMING WITH ADO.NET II 12

Understanding the Dataset classes and their relatives- Understanding OLEDB and SQL Server Support- Understanding common database operations using ADO.NET – Operations that don’t return rows- Data operations that return single- row entities- data operations that affect single-row entities- data operations returning sets of rows- data operations affecting sets of rows- operations that return hierarchical data.

MODULE V CREATING WEB APPLICATIONS WITH WEB FORMS 12

[Asp.NET]Difference between ASP and ASP.Net- Defining a web application- ASP.NET architecture- ASP.net web forms- Code behind model- Validation controls in ASP.NET- Server controls and data binding- Grid view- data repeater- data list- Data binding in ASP.NET- Data source controls- sqldata source- Data controls – grid view and details view- Login controls.

TOTAL HOURS –45

TEXT BOOKS:

1. Jeff Ferguson, Brian Patterson, Jason Beres ,C# Programming Bible , Wiley Publishing Inc., Reprint 2006.

REFERENCES:

1. Jeff Prosise, Programming .Net, 2nd Edition, WP Publishers & Distributors Pvt. Ltd, 2009.
2. Kevin Hoffman & Jeff Gabriel, Professional .Net Framework, 1st Edition, Wrox Press Publishers, 2006.

OUTCOMES:

- Upon successful completion of the course, the students would be able to
- Update the students with the latest technologies thereby make them fit for the industry
- Make the students aware of a new development platform for internet and distributed applications
- Simplify application development and deployment

B.S. Abdur Rahman Crescent Institute of Science & Technology
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REGULATIONS 2017

SYLLABI (I, II, III, IV, V Semesters)

B.DES
(INTERIOR ARCHITECTURE)

B.S. ABDUR RAHMAN INSTITUTE OF SCIENCE AND TECHNOLOGY

Vandalur, Chennai – 600048

B.DES. INTERIOR ARCHITECTURE

CURRICULUM & SYLLABUS, REGULATIONS 2017

SEMESTER I

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	**Studio**	IA C 1101	Basic Studio- I	0	0	11	**6**	
2.	**Theory cum studio**	IA C 1102	Allied Design Studio- I	2	0	4	**4**	
3.	**Theory cum studio**	IA C 1103	Workshop- I	1	0	4	**3**	
4.	**Theory cum studio**	IA C 1104	Integrated Design Studio- I	1	0	4	**3**	
5.	**Theory**	IA C 1105	Skill Development	2	0	0	**2**	
6.	**Theory**	IA C 1106	Theory of Design	3	0	0	**3**	**21**

SEMESTER II

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	**Studio**	IA C 1201	Interior Design Studio- I	0	0	11	**6**	
2.	**Theory cum studio**	IA C 1202	Allied Design Studio- II	2	0	3	**4**	
3.	**Theory cum studio**	IA C 1203	Workshop- II	1	0	3	**3**	
4.	**Theory cum studio**	IA C 1204	Integrated Design Studio- II	1	0	4	**3**	
5.	**Theory**	IA C 1205	History of Interior Design- I	3	0	0	**3**	
6.	**Theory**		Theory- Open Elective	3	0	0	**3**	**22**

SEMESTER III

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	**Studio**	IA C 2301	Interior Design Studio- II	0	0	11	**6**	
2.	**Theory cum studio**	IA C 2302	Allied Design Studio- III	2	0	3	**4**	
3.	**Theory cum studio**	IA C 2303	Workshop- III	1	0	3	**3**	
4.	**Theory cum studio**	IA C 2304	Integrated Design Studio- III	1	0	4	**3**	
5.	**Theory**	IA C 2305	Estimation & Costing	3	0	0	**3**	
6.	**Theory**		Theory- Open Elective	3	0	0	**3**	**22**

SEMESTER IV

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	**Studio**	IA C 2401	Interior Design Studio- III	0	0	12	**6**	
2.	**Theory cum studio**	IA C 2402	Allied Design Studio- IV	2	0	3	**4**	
3.	**Theory cum studio**	IA C 2403	Workshop- IV	1	0	3	**3**	
4.	**Theory cum studio**	IA C 2404	Integrated Design Studio- IV	1	0	3	**3**	
5.	**Theory**	IA C 2405	History of Interior Architecture-II	3	0	0	**3**	
6.	**Theory**		Theory- Open Elective	3	0	0	**3**	**22**

SEMESTER V

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	**Studio**	IA C 3501	Interior Design Studio- IV	0	0	17	**8**	
2.	**Theory cum studio**	IA C 3502	Allied Design Studio- V	2	0	4	**4**	
3.	**Theory cum studio**	IA C 3503	Workshop- V	1	0	4	**3**	
4.	**Theory**	IA C 3504	Integrated Design Studio- V	3	0	0	**3**	
5.	**Theory**		Theory- Open Elective	3	0	0	**3**	**21**

SEMESTER VI

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	**Studio**	IA C 3601	Interior Design Studio- V	0	0	22	**9**	
2.	**Theory cum studio**	IA C 3602	Allied Design Studio- V	2	0	6	**5**	
3.	**Theory**	IA C3606	Professional Practice : Contracts, Tenders, Competitions Arbitrations	3	0	0	**3**	
4.	**Theory**		Theory- Open Elective	3	0	0	**3**	**20**

SEMESTER VII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.		IA C 4701	Practical Training	0	0	0	**10**	**10**

SEMESTER VIII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.		IA C 4801	Interior Architectural Thesis	0	0	0	**20**	**20**

Total credits – 158

LIST OF PROFESSIONAL ELECTIVES

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	IA C X01	Vernacular Design	3	0	0	**3**
2.	PE	IA C X02	Energy Efficient Design	3	0	0	**3**
3.	PE	IA C X03	Strategies for Innovation in Design	3	0	0	**3**
4.	PE	IA C X04	Landscape Design in Interiors	3	0	0	**3**
5.	PE	IA C X05	Advanced Building Services	3	0	0	**3**
6.	PE	IA C X06	Advanced Building Energy Efficiency	3	0	0	**3**
7.	PE	IA C X07	Advanced Product design	3	0	0	**3**
8.	PE	IA C X08	Advanced Lighting design	3	0	0	**3**
9.	PE	IA C X09	Interior Architecture Photography	3	0	0	**3**
10.	PE	IA C X10	Advanced Furniture design	3	0	0	**3**

SEMESTER I

		L	T	P	C
IA C 1101	**BASIC DESIGN – I**	**0**	**0**	**11**	**6**

OBJECTIVES:

Basic Design studio aims at

- Allowing the students to develop the observational, analytical, inference & visualization skills by involving in design problems.
- Offers the transition phase for the students in which they can explore the potential creativity through design exercises.
- The phase of realization of the practical design exercise, by which they explore creating appealing harmonious interior Environment.

PHASE I: 60

- Elements and Principles –Exercises related to the same.
- Exploring color schemes and their application in a visual composition and in architectural forms and spaces.
- Study of texture and schemes of texture both applied and stimulated and their application.
- Study of linear and planar forms using simple material like mount Board, metal foil, box boards, wire string, thermocol etc.
- Study of Solids and voids to evolve sculptural forms and spaces and explore the play of light and shade and application of color.
- Analytical appraisal of building form in terms of visual character, play of light and shade, solids and voids etc.

PHASE II 65

- Application of Basic design through design of simple architectural elements.
- Introduction to Design principles & ordering systems through exercises in product Designs. E.g. Pen Holder, Book Shelves, etc.,
- Focus on understanding physical dimensions through exercises in ergonomics and anthropometric. E.g. Small scale furniture design.
- Exercises to explore the translation of verbal (adjective & verbs) to visual through compositions both in two and three dimensions.

PHASE III **55**

- Materials, Built forms and expressions.
- Understanding of built environments and its determinants.
  Single space design exercises- Typology of single room/User/Utility area E.g. Living area ,Bedroom, Toilet, Kiosk Design, etc.,
- Man and his basic living activity- Body, Activity & Enclosure.

TOTAL HOURS – 180

TEXT BOOKS:

1. Paul Zelanski& Mary Pat Fisher, "Design principles & Problems" , 2nd Ed, Thomson & Wadsworth,USA,1996
2. Owen Cappleman& Michael Jack Kordan, "Foundations in Architecture: An Annotated Anthology of beginning design projects", Van Nostrand Reinhold, New York.
3. Paul Laseau, "Graphic Thinking For Architects and Designers", John Wiley & Sons, New York, 2001.
4. Francis D.K.Ching, "Architecture - Form Space and Order", Van Nostrand Reinhold Co., (Canada), 1979.

REFERENCES:

1. John W.Mills, “The Technique of Sculpture", B.T.Batsford Limited, New York - Reinhold Publishing Corporation, London,1966.
2. C.Lawrence Bunchy, "Acrylic for Sculpture and Design", 450,West 33rd Street,New York,N.Y.10001,1972.
3. Charles Wallschlaeger&SynthiaBusic Snyder, "Basic Visual Concepts & Principles for artists, architects & designers", McGraw hill, USA, 1992.
4. Exner V., Pressel D., “Basics Spatial Design”, Birkhanser, 2009.

OUTCOMES:

- To understand various design elements and principles and applying them in two-dimensional and three-dimensional compositions.
- To understand the creative process, develop techniques and methods of creative problem solving.
- To equip the students to understand about the various anthropometric aspects, human factors & other design criteria involved in the design through small scale furniture.
- To produce the best possible solution within given limits of time.
- To acquire the knowledge of colors schemes and textures.
- To acquire a basic knowledge of art terminology to express their ideas verbally.
- To familiarize the students with design principles and ordering system through 3D modeling and the product designs.
- To develop understanding of the scale, function and options existing when designing small-scale spaces in residences such as toilets, kitchens, living, bedrooms etc.
- Increase awareness of the creative process.

IA C 1102	ALLIED DESIGN STUDIO- I	L	T	P	C
		2	0	4	4

OBJECTIVES:

Allied Design Studio aims to provide the students with the knowledge of the basic understanding of materials in Interior Design. The studio also focuses on two dimensional and three dimensional geometry and its representations through drawing.

PHASE I CONSTRUCTION TECHNIQUES & REPRESENTATIONS 50

- Exercises involve the understanding and representation of principles of geometry, orthographic projections of points, lines, and planes and solids sections of simple and complex solids and the development of the surfaces of solids.
- Exercises that helps the students to familiarize with drawing materials and equipments. Significance of precision and accuracy in technical drawings is dealt.
- Understanding of use of bricks in buildings and interiors.

PHASE II BRICKS IN BUILDING CONSTRUCTION 25

- Understanding of components of buildings through wall sections.
- Brick bonding - English and Flemish: L- junction, T- junction, intersections. Stretcher and header bond. Rat-trap bond, Creative bonding. Piers and foundations.

TOTAL HOURS – 75

TEXT BOOKS:

1. P.C. Varghese, "Building Materials", Prentice Hall of India put Ltd New Delhi 110001, 2005.
2. B.C. Punmia, "Building Construction", 2005.

REFERENCES:

1. I.H. Morris, Geometrical Drawing for Art Students, Orient Longman Chennai.
2. Ralph W. Liebing "Architectural Working Drawing", John Wiley & Sons. Inc - 2000.
3. Morgan, "Elements of structure".

OUTCOMES:

- To equip the students with various tools of drafting.
- To acquire the knowledge of basic and complex projections.
- To familiarize the students in two dimensional and three dimensional geometry and its representations through drawing.
- To develop understanding of the scale and proportion.
- To attain the knowledge on the components of building.
- To gain the technical knowledge of bricks and its bonding in buildings and interiors.

IA C 1103 **WORKSHOP- I**

L	T	P	C
1	0	4	3

OBJECTIVES:

- Workshop aims at the development of model making skills of the students to communicate and develop ideas through model making techniques.
- Not restricted to any specific medium, the course offers the platform for the students to explore their mode of model making techniques.

COURSE CONTENTS:

PHASE I **30**

- Understand material and tools by making objects which allow students to explore forms, surfaces, textures, and patterns i.e. elements and principles of design.
- Model making- Tools, materials, Techniques of Model- making. Importance of scaled models, as they are the most effective and instant way of completely communicating a concept in spite of advances in computerization.

PHASE II **30**

- This subject teaches the students to properly comprehend the three dimensional in its aesthetic and functional totality.
- Connecting with the Basic Design Studio –I exercises. The models for the end products of design can be made through the techniques learned in this workshop.

TOTAL HOURS –60

TEXT BOOKS:

1. Paul Zelanski& Mary Pat Fisher, "Design principles & Problems" , 2nd Ed, Thomson & Wadsworth,USA,1996
2. Owen Cappleman& Michael Jack Kordan, "Foundations in Architecture: An Annotated Anthology of beginning design projects", Van Nostrand Reinhold, New York.

REFERENCES:

1. Charles Wallschlaeger&SynthiaBusic Snyder, "Basic Visual Concepts & Principles for artists, architects & designers", McGraw hill, USA, 1992.
2. John W.Mills, " The Technique of Sculpture", B.T.Batsford Limited, New York - Reinhold Publishing Corporation, London,1966.

OUTCOMES:

- The students will be made to understand the materials and tools by making objects which allow them to explore forms, surfaces, textures, and patterns i.e. elements and principles of design.
- The students will be made familiar with Model making- Tools, materials and techniques of Model- making.
- Importance of scaled models.
- This subject teaches the students to properly comprehend the three dimensional in its aesthetic and functional totality.
- Connecting with the Basic Design Studio –I exercises. The models for the end products of Design can be made through the techniques learned in this workshop.

IA C 1104 INTEGRATED DESIGN STUDIO - I

L	T	P	C
1	0	4	3

OBJECTIVES:

The phase I of the course explores the use of free hand sketching and drawing as tools of visual representation. It uses geometrical analysis of objects as a means to understand shapes and proportions, as well as aspects like opacity, transparency, shades and shadows, and light and depth. Students develop skills in observation and recording through drawing with different media like pencil, pen, dry pastels and water colors.

The phase II of the course explores the use of digital media as a tool for both designing & creation. The course aims to make the students proficient in digital skills by constant practice in the various updated software. It introduces the students to the basics of software, and techniques of two dimensional drawings and representation.

COURSE CONTENTS:

PHASE I **30**

- Exercises to understand color wheels & color theory.
- Free hand Sketching.
- Understanding & representing the quality of various materials- opacity, transparency, shades and shadows, and light and depth.
- Exercises to explore various medium of presentations- pencil, pen, crayons and water colors, etc.,
- Exercise to improve the skills of observation through the recording of different types of spaces with respect to their scale, volume, form, materials and finishes.

PHASE II **30**

- Understanding the use of drawing tools, object editing, drawing objects and filing and setting drawing units, scales, lettering etc. Setting up of drawing of various simple objects with complete text and dimensioning.
- Transparent overlays, hatching utilities, assigned color and line type, use of multi-line, style, block, symbol library, manipulation for accurate drawings, incorporating the above mentioned utilities.

- Introduction to tools of productivity – Blocks. Understanding concepts of view port, concept of object linking and editing session.
- Introduction to basic presentation tools- PowerPoint techniques, communication tools.

TOTAL HOURS –60

TEXT BOOKS:

1. Jim Legitt, "Drawing Shortcuts", John Wiley & sons Inc, 2010.
2. Webb, Frank, “The Artist guide to Composition”, David & Charles, U.K., 1994.
3. Ching Francis, “Drawing a Creative Process”, Van Nostrand Reinhold, New York, 1990.
4. Alan Swann, “Graphic Design School”, Harper Collins, 1991.

REFERENCES:

1. Moivahuntly, "The artist drawing book", David & Charles, U.K., 1994.
2. Drawing a Creative Process", Ching Francis, Van Nostrand Reinhold, New York, 1990.
3. Arundell (Jan) Exploring sculpture, Mills and Boon, London/Charles, T. Brand Ford Company, U.S.A.
4. The art of drawing trees, heads, colours, mixing, drawing, landscape and painting, water colour, oil colour, etc. – The Grumbacher Library Books, New York, 1996.
5. Caldwell peter, “Pen and Ink Sketching”, B.T. Bats ford Ltd., London, 1995.

OUTCOMES:

- Enhances the skills of free hand sketching and provides an understanding on visual perception, principles and systems of order that inform two- and three-dimensional design, architectural composition.
- To familiarize the students with the concepts of 3D modeling.
- To enable them to experiment with forms, mapping, rendering and presentation techniques.
- To equip the students with various tools of sketching and rendering like pencils, pens, different medium of colors, etc.

- To practice and extend the ability to think visually and to communicate concepts, design solutions and arguments clearly and concisely through visual, verbal and written means.
- To attain the knowledge of quality of various materials- opacity, transparency, shades and shadows, and light and depth

IA C 1105	SKILL DEVELOPMENT	L	T	P	C
		2	0	0	2

OBJECTIVES:

The primary objective of this course is to improve communication skill development and technical writing.

The course is aimed at providing the students with language skills which is an inescapable tool for the young technocrats to break geographical boundaries and step into global world.

COURSE CONTENT

PHASE I **15**

- Seminars, guest lectures, putting up exhibitions, workshops, participating in architectural competitions or conducting site visits or study tours.
- INTRODUCTION: Skimming, scanning, inferring, predicting and responding to content - Guessing the meaning of words from contexts - Note making and vocabulary extension.
- VOCABULARY DEVELOPMENT: Listening and understanding recorded, structured talks and classroom lectures - Comprehending the matter - understanding the links between different parts of speech - practice in note taking.

PHASE II **15**

- COMMUNICATION: Features of an effective speech-Practice in speaking fluently - Dialogue practice- simple social exchanges - short extempore talks.
- COMPREHENSION: Effective sentences-cohesive paragraphs - clear and concise writing - Introduction to technical writing - Definition, Description, Instruction - Summary Writing practice.
- RESOURCE UTILIZATION: Use of library - Role of Bibliography, Table of contents, Index etc. - use of Dictionary.

TOTAL HOURS –30

OUTCOMES:

- Seminars, Guest Lectures, putting up Exhibitions, Workshops, participating in Architectural Competitions or conducting Site Visits or Study Tours.

- INTRODUCTION: Skimming, scanning, inferring, predicting and responding to content - Guessing the meaning of words from contexts - Note making and vocabulary extension.
- VOCABULARY DEVELOPMENT: Listening and understanding recorded, structured talks and classroom lectures - Comprehending the matter - understanding the links between different parts of speech - practice in note taking.
- COMMUNICATION: Features of an effective speech-Practice in speaking fluently - Dialogue practice- simple social exchanges - short extempore talks.
- COMPREHENSION: Effective sentences-cohesive paragraphs - clear and concise writing - Introduction to technical writing - Definition, Description, Instruction - Summary writing practice.
- RESOURCE UTILIZATION: Use of library - Role of Bibliography, Table of contents, Index etc. - use of dictionary.

IA C 1106	THEORY OF DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- The course aims to provide the basic theories and principles needed for the students while handling the design exercises.
- They are equipped with the knowledge of theories applied in the conception and development of design.
- The theoretical approach is to be interwoven with the design processes.

COURSE CONTENT:

PHASE I **15**

- Space – definition; Interior space – spatial qualities: form, scale, outlook; structuring space with interior design elements; spatial form; spatial dimension; height of space; spatial transitions – openings within wall planes, doorways, windows, stairways.
- Point, line, volume, shape, texture, color & form – in relation to light, pattern etc. and application of the same in designing interiors.

PHASE II **15**

- Ratio; proportions – golden section; relationships; scale; balance, symmetry, harmony; unity; variety; rhythm; emphasis.
- Definition, theory of standard dimension based on human figures for activities, functions, circulation, furniture design, spatial requirements etc.
- Study of Ergonomics, Design of furniture for Living, Dining, Kitchen, Office etc.

PHASE III **15**

- Design process – Analysis, synthesis, design evaluation;
- Design criteria – function and purpose, utility and economy, form and style;
- Human factors - human dimensions, distance zones, activity relationships;
- Fitting the space – plan arrangements, function, aesthetics.

TOTAL HOURS – 45

TEXT BOOKS:

1. Ching, Frank (Francis D.K.), "Architecture: Form, Space & Order", Van Nostrand Reinhold, New York. Hoboken 2007; ISBN 0471752169
2. Ching, Frank (Francis D.K.), "Drawing: A Creative Process", Van Nostrand Reinhold, New York 1990.
3. Simon Unwin, "Analysing Architecture", Rouledge, London, 2003.
4. V.S.Pramar, "Design Fundamentals in Architecture", Somaiya Publications Private Ltd.,

REFERENCES:

1. YatinPandya,"Elements of Space making", Mapin 2007.
2. Leland M.Roth, "Understanding Architecture: Its Experience History and Meaning", Craftsman house, 1994.
3. Peter von Meiss, "Elements of architecture – from form to place", Spon Press 1977.
4. Rudolf Arnheim, "The dynamics of architectural form", University of California Press, 1977.
5. NeilsPrak, "The language of Architecture", Mounton& Co., 1968.
6. . Paul Alan Johnson, "The Theory of Architecture – Concepts and themes", Van Nostrand Reinhold Co., New York, 1994.

OUTCOMES:

- The students will be taught about Space – definition; Interior space – spatial qualities: form, scale, outlook; structuring space with interior design elements; spatial form; spatial dimension; height of space; spatial transitions – openings within wall planes, doorways, windows, stairways.
- Application of the design principles like Point, line, volume, shape, texture, color & Form – in relation to light, pattern etc. in designing interiors.
- The will be encouraged to use Ratio; proportions – golden section; relationships; scale; balance, symmetry, harmony; unity; variety; rhythm; emphasis in basic design and workshop exercises.
- Definition and theory of standard dimension based on human figures for activities, functions, circulation, furniture design, spatial requirements etc. Study of Ergonomics Design of Furniture for Living, Dining, Kitchen, Office etc. will be brought in use through the workshop's model making exercises.

SEMESTER II

		L	T	P	C
IA C 1201	**INTERIOR DESIGN STUDIO - I**	**0**	**0**	**11**	**6**

OBJECTIVES:

- Interior Design studio- I facilitate the students to design spatial interventions in response to physical and visual attributes of a given site context.
- To understand the basic structural systems.
- To comprehend the services pertaining the design projects.
- As continued from the Basic Design - Phase II, the students explore creating appealing harmonious environment.

COURSE CONTENTS

PHASE I **70**

- Multi space design exercises- E.g. Types of Residence.
- Exercise to involve the development of services along with the design problem.

PHASE II **50**

- Site planning and analysis
- Contextual exploration of materials and usage.

PHASE III **60**

- Working of the basic structural systems.
- Working drawings with respect to the plumbing, electrical details.

TOTAL HOURS – 180

TEXT BOOKS:

1. Joseph De Chiara, Michael J Crosbie, Time Saver Standards for Building Types, McGraw Hill Professional 2001.
2. Julius Panero, Martin Zelnik, Human Dimension and Interior Space, Whitney Library of Design, 1975
3. Joseph De Chiara, Julius Panero, Martin Zelnik, Time Saver Standards for Interior Design and Space Planning, McGraw Hill 2001.
4. Ernst Neuferts Architects Data, Blackwell 2002

REFERENCES:

1. Hideaki Hareguchi, A Comparative analysis of 20thcentury houses, Academy Editions, 1988
2. Robert Powell, Tropical Asian House, Select Books, 1996
3. Terence Conran, The Essential House Book, Conran Octopus, 1994
4. Sam F. Miller, Design Process: A Primer for Architectural and Interior Design, Van Nostrand Reinhold, 1995.

OUTCOMES:

- The students will be able to comprehend to physical and visual attributes of a given site context.
- The students will be able to familiarize themselves with the structural systems of the projects.
- The students will be able to comprehend the services pertaining the design projects.

IA C 1202	ALLIED DESIGN STUDIO- II	L	T	P	C
		2	0	3	4

OBJECTIVES:

- Allied Design Studio aims to provide the students with the knowledge of the basic understanding of materials in Interior Design.
- This studio focuses on Doors, windows, ventilators- materials, types, construction details.
- To study about the various recent developments in Industry.

COURSE CONTENT

PHASE I **25**

- Introduction to the openings in spaces.
- Doors- types of doors- fully panelled single and double shutter doors of various types and sizes. Drawings of timber joinery for Doors with respect to material: Details of Aluminum doors - Open able, sliding, pivoted, glass entrance doors, UPVC doors.

PHASE II **25**

- Windows- fully glazed window, fixed glass and timber louvered windows. Drawings of timber joinery for windows.With respect to material: Details of Aluminum windows - openable, sliding, fixed, pivoted.

PHASE III **25**

- Ventilators- Drawings of timber joinery for ventilators, Aluminum ventilators - Top hung, bottom hung, pivoted, louvered.
- Study of various other recent developments regarding openings in spaces.

TOTAL HOURS –75

TEXT BOOKS:

1. W.B. Mickay, “Building construction Vol 1,2 and 3”, Longmans, UK 2005.
2. R.Chudley, ”Building Construction Handbook”, Elsevier/Butterworth-Heinemann2006.
3. S.C.Rangwala, “Engineering materials”, Charotar Publishing, 2011.
4. S.P.Arora&S.P.Bindra, “Text book of Building Construction”, GanpatRai Publications (P) Ltd, New Delhi, 2013
5. B.C. Punmia, “Building Construction”, 2005
6. P.C. Varghese, “Building Materials”, Prentice Hall of India put Ltd New Delhi 110001, 2005.

REFERENCES:

1. Don A.Watson, “Construction Materials and Processes”, McGraw Hill Co.,1992.
2. Alanwerth, “Materials”, The Mitchell Pub.Co.Ltd., London,1986

OUTCOMES:

- The students will be equipped with the knowledge of the basic understanding of materials in Interior Design.
- The students can comprehend the details and techniques of doors, windows, ventilators- materials, types, and construction details.
- To familiarize with various recent developments regarding the opening in spaces.

IA C 1203	WORKSHOP- II	L	T	P	C
		1	0	3	3

OBJECTIVES:

- Workshop II aim at the development of model making skills of the students to communicate and develop ideas through model making techniques.
- Not restricted to any specific medium, the course offers the platform for the students to explore their mode of model making techniques.

COURSE CONTENT:

PHASE I **25**

- Exercises related to model making.
- Understand material and tools by making objects which allow students to explore forms, surfaces, textures, and patterns i.e. elements and principles of design.
- Exploration of the model making techniques in the recent development of the Industry.

PHASE I **35**

- Textile Printing- Basic Knowledge of the fabric as interior element.
- Woodwork & Carpentry.
- Glass painting.

TOTAL HOURS – 60

TEXT BOOKS:

1. Owen Cappleman& Michael Jack Kordan, "Foundations in Architecture: An Annotated Anthology of beginning design projects", Van Nostrand Reinhold, New York.
2. John W.Mills, " The Technique of Sculpture", B.T.Batsford Limited, New York - Reinhold Publishing Corporation, London,1966.
3. C.Lawrence Bunchy, "Acrylic for Sculpture and Design", 450,West 33rd Street,New York,N.Y.10001,1972.

REFERENCES:

1. Charles Wallschlaeger&SynthiaBusic Snyder, "Basic Visual Concepts & Principles for artists, architects & designers", McGraw hill, USA, 1992.
2. John W.Mills, " The Technique of Sculpture", B.T.Batsford Limited, New York - Reinhold Publishing Corporation, London,1966.

OUTCOMES:

- The students will be able to communicate and develop ideas through model making techniques.
- The students will be equipped with the various recent model making techniques in the industry.

IA C 1204 INTEGRATED DESIGN STUDIO-II L T P C

1 0 4 3

OBJECTIVES:

- The course explores the use of digital media as a tool for both designing & creation. The course aims to make the students proficient in digital skills by constant practice in the various updated software.
- It introduces the students to the basics of three dimensional form explorations.

COURSE CONTENT

PHASE I 30

- Introduction to 3D software- tools of productivity, rendering techniques.
- Understanding the use of drawing tools, object editing, drawing objects, filing and setting drawing units, scales, limits that size and dimensioning, lettering.
- Setting up of drawing of various simple objects with complete text and dimensioning.
- Layout - way to use the fundamental drawing, editing and navigation tools to put together quick presentations.
- Leverage templates, including custom title blocks, document settings.

PHASE II 30

- Ways to light your model and add realistic reflections and finishes in shade light.
- Advance command programming – Transparent overlays, hatching utilities, assigned color and line type, use of multi-line, style, block, symbol library, manipulation for accurate drawings, incorporating the above mentioned utilities.
- Introduction to tools of productivity – Blocks. Understanding concepts of view port, concept of object linking and editing session.

TOTAL HOURS – 60

TEXT BOOKS:

1. Watt, “Fundamentals of Three-Dimensional Computer Graphics”, Addison Wesley, Massachusetts, 1989.
2. Aouad, “Computer Aided Design guide for Architecture, Engineering and construction”, Spon process, 2012.

REFERENCES:

1. Ralph Grabowski, “The Illustrated AutoCAD 2002 Quick Reference”, 1 st edition, CengageLearing, 2001.
2. Sham tikoo, “Autocad 2000: A Problem-Solving Approach”,.DelmarCengage Learning, 1999.
3. Fiorello. J. A., “CAD for Interiors beyond the basics”, Wiley publications, 2011.

OUTCOMES:

- The students becomes equipped with the exploration of digital media as a tool for both designing & Creation.
- The students become proficient in digital skills by constant practice in the various updated software.
- The students are introduced with the basics of three dimensional form explorations.

IA C 1205 HISTORY OF INTERIOR DESIGN - I

L	T	P	C
3	0	0	3

OBJECTIVE:

- The course aim to provide a brief overview of the development of Interior Architecture through various historical phases that is explained through various examples.

COURSE CONTENT:

- EARLY CLASSICAL PERIOD: Prehistoric Cave paintings – primitive designs-Interiors during Egyptian, Greek, Roman, Gothic, Early Christian & Renaissance Periods.
- MIDDLE AGES: Interiors in Romanesque, Gothic, and Renaissance periods.
- COLONIAL PERIOD: Colonial, Victorian designs, Arts & Crafts movement, Art Nouveau.
- PROJECTS: Projects based on historical styles in Interiors & assignments.

PHASE I **25**

- EARLY CLASSICAL PERIOD: Prehistoric Cave paintings – primitive designs-Interiors during Egyptian, Greek, Roman, Gothic, Early Christian & Renaissance Periods.
- MIDDLE AGES: Interiors in Romanesque, Gothic, and renaissance periods.

PHASE II **20**

- COLONIAL Period: Colonial, Victorian designs, Arts & Crafts movement, Art Nouveau.
- PROJECTS: Projects based on historical styles in Interiors & assignments.

TOTAL HOURS – 45

TEXT BOOKS:

1. Sir Banister Fletcher, A History of Architecture, University of London, The Antholone Press, 1996.
2. Spiro Kostof - A History of Architecture - Setting and Rituals, Oxford University Press, London, 1985.

3. Henri Stelerlin - The Pharaohs - PlerreTerrail - 2001.
4. G.K.Hiraskar, Great Ages of World Architecture, DhanpatRai& Sons, Delhi

REFERENCES:

1. Marco Bussagli - Rome Art and Architecture - Konemann - 2004.
2. S.Lloyd and H.W.Muller, History of World Architecture - Series, Faber and Faber Ltd., London, 1986
3. Gosta, E. Samdstrp, Man the Builder, Mc.Graw Hill Book Company, New York, 1970

OUTCOMES:

- The students become aware of the development of Interior Architecture through various historical phases that is explained through various examples.
- The students are exposed to various inspirations/ techniques/ design details of the historical examples.

IA C X01	VERNACULAR DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- The course aims in conveying traditional architecture built in various cultural and geographical regions of India with an emphasis on spatial types, use, materials, construction and building process.
- It also aims to explore the various approaches, definition, concepts and typologies of the vernacular designs of a region for better understanding, comprehension and interpretation.
- It also explores the role of indigenous materials and climate in the elements, ornamentation, layout and character of residential and public buildings.

COURSE CONTENT

PHASE I **20**

- Definition of Vernacular designs: Importance and factors determining the character of vernacular designs. Approaches and concepts used - aesthetic, anthropology, architectural, geographical, spatial, ecological, behavioral and developmental.

PHASE II **25**

- Cultural aspects, symbolism, color, art, materials of construction and construction techniques of Northern India, Gujarat, Kerala & Tamil Nadu. Examples related to the same.
- Contemporary projects by various nationally & internationally acclaimed Designers using vernacular elements & characters.

TOTAL HOURS – 45

TEXT BOOKS:

1. Minakshi, J., &Khulbushan, J. (1992.). Mud Architecture of the Indian Desert. Ahmedabad: Aadi Centre.
2. Randhawa, T. S. (1999). The Indian courtyard house. Prakash Books.

REFERENCES:

1. G.H.R.Tillotsum. (1989). The tradition of Indian Architecture Continuity, Controversy Change since 1850. New Delhi: Oxford University Press.
2. Meenakshi, M., Muthiah, S., Visalakshi, R., & Muthuraman, V. (2006). The Chettiar Heritage. Chennai: Chettiar Heritage.
3. Oliver, P. (1998). Encyclopedia of Vernacular Architecture of the World. Cambridge: Cambridge University Press.
4. V.S.Pramar. (1989). Haveli - Wooden Houses & Mansions of Gujarat. Ahmedabad: Mapin Publishing Pvt. Ltd.

OUTCOMES:

- The students understand traditional architecture built in various cultural and geographical regions of India with an emphasis on spatial types, use, materials, construction and building process.
- The students explore the various approaches, definition, concepts and typologies of the vernacular designs of a region for better understanding, comprehension and interpretation.
- The students also explores the role of indigenous materials and climate in the elements, ornamentation, layout and character of residential and public buildings.

IA C X02	ENERGY EFFICIENT DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- A growing worldwide concern for the conservation of energy & environment has led to energy efficient designs; renewable nature sources of energy (solar energy etc.) and utilizing materials that least pollute the environment.
- This course attempts to make the students understand about built environments responses to natural heating and cooling and thereby understanding principles to be implemented when designing spaces.

COURSE CONTENT:

PHASE I **10**

- Introduction to energy efficient designs and need for the day.
- Solar geometry and shading - Thermal comfort - Heat Transfer - Conservation - Day lighting - Water Heating and Photo voltaic system.

PHASE II **15**

- Passive Solar heating: General principles - Direct Gain - Thermal storage wall - Sunspace - Convective air loop - related examples.
- Passive Cooling Techniques: General principles - Ventilation - Radiation - Evaporation and Dehumidification, - Mass effect - related examples.

PHASE III **20**

- Site Planning & Developments: Land form - vegetation type and pattern - water bodies - open spaces and built spaces - urbanscape - design strategies.
- Contemporary projects by various nationally & internationally acclaimed Designers using energy efficient concepts and techniques.

TOTAL HOURS – 45

TEXT BOOKS:

1. Fuller Moore, Environmental Control Systems, McGraw Hill Inc., New Delhi, 1997.
2. Climatically Responsive Energy Efficient Architecture, PLEA/SPA, New Delhi - 1998.

REFERENCES:

1. A.Konya, Design Primer for Hot Climates, Architectual Press, London, 1988.
2. Ms.Sudha, N.K.Bansal and M.A.S.Malik - Solar Passive Building - Pergamon.
4. V.Gupta - Energy and Habitat - Wiley Eastern Limited, New Delhi.

OUTCOMES:

- The students are exposed to the growing worldwide concern for the conservation of energy & environment has led to energy efficient designs; renewable nature sources of energy (solar energy etc.) and utilizing materials that least pollute the environment.
- The students understand about built environments responses to natural heating and cooling and thereby understanding principles to be implemented when designing spaces.

SEMESTER III

IA C 2301	INTERIOR DESIGN STUDIO - III	L	T	P	C
		0	0	12	6

OBJECTIVES:

- This studio course involves generation of small-scale interior environment through research, analysis, conceptualization and design.
- The projects include exercises in spatial planning as a response to function.
- Exercises undertake organization of products/objects to explore circulation and transactions with material exploration.

COURSE CONTENT:

- The projects that help the students to identity the design process through various methods of concept development.
- Water supply & sanitation, lighting & electrical aspects of design of interiors need will be emphasized along with the design process.
- Project Typology: Shops, Cafeteria, Primary healthcare centers, Clinics, Schools, Boutiques, etc.,
- Working Drawings for the design is to be taught to the students.

TOTAL HOURS – 225

TEXT BOOKS:

1. Joseph De Chiara, Julius Panero, Martin Zelnik, "Time Saver Standards for Interior Design and Space Planning", McGraw Hill, 2001.
2. Ernst, "Neuferts Architects Data", Blackwell, 2002
3. Ramsey et al, "Architectural Graphic Standards", Wiley 2000

REFERENCES:

1. De Chiara and Callender,"Time Saver Standards Building Types", McGraw Hill Co., 2ND Edition, 1980.
2. Andrew Alpern, "Handbook of Specialty Elements in Architecture", McGraw Hill Book Co., 1982.
3. Mark Karlen, "Space Planning Basics", John Wiley & Sons Inc, 2009.

OUTCOMES:

- Students get the ability to understand and design small and medium scale building projects.
- They will able to solve the design problem functionally and aesthetically.
- Gain knowledge about the design process and its various faces to solve a design problem.
- Solve design solution and present in the form of drawing.
- Enable to express the ideas in the form of 2D representation and 3D modeling and views.

IA C 2302 ALLIED DESIGN STUDIO- III: Construction Techniques & Representations- III

L	T	P	C
2	0	3	4

OBJECTIVES:

- Allied Design Studio is to provide the students with the knowledge of the basic understanding of materials in Interior Design.
- To develop an awareness about the various ingredients and composition in concrete.
- To understand the importance and use concrete in construction, through drawings.
- To expose the students to the importance and use of concrete in the modern Construction industry.
- To familiarize the students with the modern building products and their application through drawings.

COURSE CONTENT:

PHASE I: 30

- Focus on the Representation of technical details for the process of construction in a drawing.
- The materials used, elements required, techniques of installation, designing the services in interior spaces and elements with step by step actualization on site.

PHASE II: 45

- Cement - Composition, strength, properties, Sand - Composition, strength, properties, M-Sand test and types.
- Coarse aggregate - Composition, strength, properties, Extraction, test and types. Water - cement ratio, workability, curing, water-proofing, guniting, Special concrete, construction of formwork, Integration of steel in concrete, Joints in concrete, concrete finishes.
- Lightweight aggregate , High density concrete , Aerated Concrete, No-Fines Concrete, Polymer concrete, Reinforced Cement Concrete, Pre-Stressed Concrete, Ready - mixed & under water concreting - Exercise involving the same.
- Framed Structures, Foundations, Footings, Concrete Floors, Walls & Partitions, Concrete lintels, Arches, Sunshades, Concrete Slabs, Concrete beams &Columns, Concrete Staircases.

TOTAL HOURS – 75

TEXT BOOKS:

1. Dr.B.C.Punmia, "Building Construction", Firewall Media, 2005.
2. Francis D.K.Ching, "Building Construction Illustrated", John Wiley & Sons Inc, 2002.
3. T.D Ahuja and G.S. Birdie, "Fundamentals of Building Construction", Dhanpat Rai Publishing Company Pvt. Ltd., New Delhi, 1996
4. R.M. Davis, "Plastics in Building Construction", Battersea College of Technology, Blackie, London, 1966
5. Barry, "Introduction to Construction of Buildings" Vol. 3, Blackwell Publishing Ltd., Oxford, 2005

REFERENCES:

1. W.B.Mckay , "Building Construction", Vol. 1,2,3- Longmans U.K 1992.
2. S.C.Rangwala, "Engineering Materials", Charotar Publishing House, India, 1997.
3. Alan Banc, "Stairs, Steps and Ramps", Butter worth Heinemann Ltd., 1996
4. M.S.Shetty, "Concrete Technology-Theory and Practice", S.Chand & Co. Ltd., New Delhi, 2005.
5. W.B.Mckay , "Building Construction" , Longmans, UK, 1981
6. Economy/companies/construction/concrete/materials
7. http://www.easyads.co.2a/yellow/india/construct
8. http://www.concrete.t.v-tokyo.ac.ip
9. www.larsentoubro.com
10. www.dalmiacement.com/index.html

OUTCOMES:

- The students will able to design medium and large span low rise structure, of RCC.
- They can design RCC stair case of appropriate form and structural system.
- The students will get knowledge about concrete structures.

IA C 2303 WORKSHOP III: Furniture Design - I

L	T	P	C
1	0	3	3

OBJECTIVES:

- This workshop focuses on understanding furniture design from the perspective of its evolution in history, the development of design styles, as well as the pragmatic aspects of ergonomics and comfort.
- Exercises involve appreciating classic pieces of furniture, understanding ergonomics through experience, and applying that understanding to the design of a rudimentary piece of furniture.

COURSE CONTENT:

PHASE I: THE BASICS OF FURNITURE CONSTRUCTION & TOOLS 20

- Measurement and measurement systems, Furniture Construction: Drawers, Cadenza, dining chairs, sofa, settee, cots detail.
- Preparation for finishing, Furniture Materials Specifying timber finishes etc.

PHASE II: 20

- Fabrication techniques - stapling, gluing.
- Furniture Joinery - screw joinery, nail joinery, Mortise & tenon joints, Dovetail joints, Dowel joints, Edge joints.
- Preparation of block models of furniture using wood, boards, leather, fabric, thermacol, clay, soap/wax etc.

PHASE III: 20

- Developing of a particular furniture type.
- Identifying the furniture & activity.
- Define the material & Aesthetics aspects.
- Furniture - the design data to ergonomics.

TOTAL HOURS – 60

TEXT BOOKS:

1. Interior Design, John F. Pile, Harry N.Abrams Inc Publishers, New York.
2. Interior Design Course, Mary Gilliat Coyran, Octopus Ltd., London.
3. The Encyclopaedia of Funriture, Joseph Aronson, Crwon Publishers, New York

REFERENCES:

1. Interior Design & Decoration, Sherril Whiton, Prentice Hall.
2. Interior Design, Francis D.K. Ching, John Wiley & Sons, New York.
3. Office Furniture, Susan S.Szenasy, Facts on file Inc, New York
4. Time Saver Standards for Interior Design, Joseph De Chiara, McGraw Hill, New York.

OUTCOMES:

- Students get the ability to understand and design furniture from the perspective of its evolution in history.
- They will able to solve the design problem functionally and aesthetically.
- Gain knowledge about the pragmatic aspects of ergonomics and comfort.
- Students get the ability to understanding to the design of a rudimentary piece of furniture.

IA C 2304	INTEGRATED DESIGN STUDIO - II BUILDING SERVICES - I	L 1	T 0	P 3	C 3

OBJECTIVES:

- To expose the students to the basic principles of water supply and sanitation, electrical and lighting.
- To understand the need and applications of water supply and sanitation in buildings.
- To exposure various fixtures and fittings, water supply and sanitary installations at work sites.
- Preparing basic design layout of various services and typical details. .

COURSE CONTENT:

PHASE I: WATER SUPPLY AND SANITATION 30

- House-service design, tube well, pumping of water, types of pumps, cisterns for storage, Different types of taps, toilet and kitchen fittings, Connection of lines to fittings, Underground, overhead and internal storage tanks and supply lines.
- Design layout of water supply and calculation of supply requirements based on standards.
- Introduction to sanitation and its importance, Planning and layout of sanitary fittings, Drainage system, Septic tanks, Layout, Principles of drainage, Trap type, materials and functions, Design of Septic tanks and soak pits, Ventilation of house drains, Sinks, bath tub, water closets, flushing cisterns, urinals, wash basins, bidet, shower panel etc.
- Preparation of plumbing layout of a single storey building & working drawings of various fittings and fixtures of water supply and sanitary installations.

PHASE II: LIGHTING AND ELECTRICAL 15

- Electrical wiring system – different materials employed and methods of wiring.
- Different electrical gadgets and fittings, Switch board, distribution board, mains, fuse, meter, circuit breaker etc,
- Basic electrical layout for a residence, Earthing for electricity appliances, Electrical installations for services such as air-conditioning systems, lifts, escalators, pumps etc.

PHASE III:

LIGHTING **15**

- Artificial lighting , design principles, illumination levels, Types of lamps and fittings used, Application of lighting system for shops, showrooms, offices, lecture halls, class rooms, stage, auditoriums etc - Study of projects based on different lighting concepts used in interiors.

TOTAL HOURS – 60

TEXT BOOKS:

1. Handbook for Buildinsg Engineers in Metric Systems, NBC, New Delhi, 1998.
2. Philips Lighting in Architectural Design, McGraw Hill, New York, 1998.
3. R.G.Hopkinson and J.D.Kay, The Lighting of Buildings, Faber and Faber, London, 1998
4. Hopkinson, R.G., "Architectural Physics - Lighting", London. 1998
5. Basic Electrical Engineering, V.K.Mehta, S.Chand and Company Ltd., New Delhi, 1998.
6. G.M. Fair, J.C. Geyer and D.Okin, "Water and Waste water engineering", Volume II, John Wiley & Sons, Inc. New York, 1968

REFERENCES:

1. "Manual on sewerage and sewerage treatment", CPHEEO - Ministry of works and housing, New Delhi, 1980.
2. S.C.Rangwala, "Water supply and sanitary engineering", Charotar publishing house, Anand, Lecture notes compiled by Chaman.L.Gupta, 1989
3. G.S. Birdie & J.S. Birdie, "Water Supply and Sanitary Engineering".

OUTCOMES:

- The students may expose to electrical services and power distribution system inside & outside buildings.
- They get to know about importance of lighting in indoor spaces.
- The students obtain knowledge about various vertical transportation systems.
- It enlightens the importance of services in interior space planning.
- The students were trained to do electrical and plumbing layouts for the buildings.

IA C 2305 ESTIMATION AND COSTING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To enable a student to understand estimation and specification.
- To provide the student adequate knowledge to prepare the Estimate & find the cost of overall project of works.
- To equip the students to prepare the Estimate in order to foresee the cost of the work or to implement an interior design project & also to monitor / control project cost.
- To acquaint students with methodology of writing specifications with reference to building trades, materials, workmanship and performance of different items of work and introducing the students to specifications as an integral part of contract document for building projects.

COURSE CONTENT:

PHASE I: INTRODUCTION TO ESTIMATION 10

- Estimation – definition, purpose, types of estimate, and procedure for Estimating the cost of work in order to implement an interior design project or to make products related to interior design like furniture, artifacts etc.

PHASE II: RATE ANALYSIS & ESTIMATION FORMAT 15

- Rate Analysis – definition, method of preparation, quantity & labour estimate for woodwork, steelwork, Aluminum work, glass & its rate for different, thickness & sections, finishing (enamel paint, duco paints, melamine, DU coats, Hand polishing, veneering and laminating) for walls & ceilings.
- Electrical & plumbing products, wiring, ducting etc., and laying of tiles & wall paneling in the estimate format of the project.

PHASE III: DETAILED ESTIMATE 10

- Detailed Estimate – data required, factors to be considered, methodology of preparation, abstract of Estimate, contingencies, labour charges, bill of quantities, different methods of estimate for interior design works, methods of measurement of works.

PHASE IV: INTRODUCTION TO SPECIFICATION **10**

- Specification – Definition, purpose, procedure for writing specification for the purpose of calling tenders, types of specification.
- Specification for different item related to interior design project – woodwork for furniture window frames & pelmets, partitions etc also of materials like steel aluminum glass of various kind.
- Wall paneling & false ceiling of materials like aluminum, steel, wood, electrical, plumbing, air conditioning & fire fighting equipments.

TOTAL HOURS – 45

TEXT BOOKS:

1. Indian Standard Specifications.
2. C.P.W.D. Specifications and schedule of rate analysis.
3. Specification Writing for Architects and Engineers. By Donald A.Watson.

REFERENCES:

1. Specification Writing for Architects and Surveyors by Arthur J Wilils.
1. Professional Practice by R.H.Namavati.
2. Estimating and Costing by Rangawala and B.N.Sutta.
3. Civil Engineering Contracts and Estimates by B.S.PatIl.
4. I .S.I.Handbook of measurements of building Works

OUTCOMES:

- Provide an understanding on estimation and specification
- The students get knowledge to prepare the Estimate & find the cost of overall project of works.
- Students get the ability to prepare the Estimate in order to foresee the cost of the work or to implement an interior design project & also to monitor / control project cost.
- Students get the ability to understand the methodology of writing specifications.
- The students get knowledge of specifications as an integral part of contract document for building projects.

IA C X03 STRATEGIES FOR INNOVATION IN DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- This course involves the innovation of latest technologies for interior design.
- To understand the need and applications of latest trends and concepts in current developments in interior.

COURSE CONTENT:

PHASE I:

- Concepts and Technologies - Current trends and concepts in interior Architecture- Advanced new material.
- Produce innovative design with the use of latest trends, technology, concepts, etc.
- Study of latest materials and current developments in interiors.

TOTAL HOURS – 45

TEXT BOOKS:

1. Brown, R. & Farrelly, L. (2012). Materials and Interior Design.
2. Bigelli, C. (2008).Materials for Interior Environments.
3. Bowers, H. Interior Materials and Surfaces: The Complete Guide.

REFERENCES:

1. Graphic Guide to Frame Construction (1991) Thallon, R. Newtown: The Taunton Press, Inc

OUTCOMES:

- Students get the ability to understand latest technologies for interior design.
- Gain knowledge about the latest trends and concepts in current developments in interior.
- To understand the need and applications of current trends and materials.
- The students get the knowledge about current development for interiors.

IA C X04 LANDSCAPE DESIGN IN INTERIORS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To study the concepts of interior landscaping and their application in the design of interior spaces.
- To develop an understanding about the design of interior landscape with special emphasis on the choice and care of plant materials used in the interior spaces.
- To study about the various landscaping elements and their application in interior spaces.

COURSE CONTENT:

PHASE I: INTERIOR LANDSCAPING 5

- Definition, classification of plants, indoor plants and their functions, layout & components, Floriculture –commercial, ornamental, Selection of plants & pest control.

PHASE II: PHYSICAL REQUIREMENTS OF PLANTS 10

- Physical requirements of plants – light, temperature, water, planting medium, soil separator, weight of plants, acclimatization & maintenance.
- Techniques to meet physical requirements.

PHASE III: INTERIOR LANDSCAPING ELEMENTS & PRINCIPLES 10

- Various interior landscaping elements – water bodies - pools, fountains, cascades Plants, rocks, artifacts, paving & lighting, Design guidelines- plant texture & color, plant height, plant spacing.
- Vertical landscaping, Zen garden, Japanese landscaping

.

PHASE IV: ROOF AND DECK LANDSCAPE 10

- Protection of the integrity of the roof and structure, provisions for drainage, light weight planting medium, irrigation, selection of materials, water proofing, provision for utilities and maintenance.

PHASE V: EXERCISE ON INTERIOR LANDSCAPE **10**

- Courtyard design
- An outdoor room design
- Terrace garden

TOTAL HOURS – 45

TEXT BOOKS:

1. Time saver standards for landscape architecture.
2. Planting design by Theodore D.Walker,VNR Publications New York.
3. Landscaping Principles and Practices by Jack E.Ingels,Delmar Publishers.

REFERENCES:

1. Time Saver Standards Design Data -Chiava. J. & Callender. J.
2. Construction and material handbook – P.N.Khanna
3. Garden structures – wiles Richard raphic Guide to Frame Construction (1991) Thallon, R. Newtown: The Taunton Press, Inc

OUTCOMES:

- Students get the ability to understand the concepts of interior landscaping and their application in the design of interior spaces.
- Gain knowledge about the design of interior landscape and care of plant materials used in the interior spaces.
- Enable to express the ideas of the various landscaping elements and their application in interior spaces.

SEMESTER IV

IA C 2401	**INTERIOR DESIGN STUDIO- III**	**L**	**T**	**P**	**C**
		0	**0**	**12**	**6**

OBJECTIVES:

- This studio attempts to interpret the correlation of public place and the ideas of collective presence in a civic world.
- It focuses on understanding organizations of different types and development of language that is appropriate to the public realm.
- The course concentrates on three stages of work spaces with an emphasis on planning office spaces.
- The main aim is to develop visually literate students who are proficient at analytical thinking, conceptualization and the problem-inquiry, solution cycle.
- The course also examines the connection between abstract design principles and the physical and visual environments.

COURSE CONTENT:

- The projects help the students to identity the design process through various methods of concept development.
- HVAC- Heating Ventilation Air Conditioning aspects of design of interiors need will be emphasized along with the design process.
- Project Typology: Commercial and hospitality typology: Banquet halls, Restaurants, Hotel designs.
- Working Drawings for the design is to be taught to the students for the typology of the designs.

TOTAL HOURS – 225

TEXT BOOKS:

1. Joseph De Chiara, Julius Panero, Martin Zelnik, "Time Saver Standards for Interior Design and Space Planning", McGraw Hill, 2001.
2. Ernst, "Neuferts Architects Data", Blackwell, 2002
3. Ramsey et al, "Architectural Graphic Standards", Wiley 2000

REFERENCES:

1. Andrew Alpern, "Handbook of Specialty Elements in Architecture", McGraw Hill Book Co., 1982.
2. Mark Karlen, "Space Planning Basics", John Wiley & Sons Inc, 2009.
3. Reclamation-Managing water in the west, U.S. Department of the Interior Bureau of Reclamation Denver, Colorado, September 2006
4. https://energy.gov/sites/prod/files/2013/12/f5/sustainable_guide_ch5.pdf

OUTCOMES:

- Students get the ability to understand and design medium scale building projects.
- Students get proficient at analytical thinking, conceptualization and the problem-inquiry, solution cycle.
- They can able to understand organizations of different types and development of language that is appropriate to the public realm.
- Gain knowledge about the design process and its various faces to solve a design problem.
- Solve design solution and present in the form of drawing.
- Enable to express the ideas in the form of 2D representation and 3D modeling and views

IA C 2402	ALLIED DESIGN STUDIO- IV: Construction Techniques & Representations- IV	L 2	T 0	P 3	C 4

OBJECTIVES:

- Allied Design Studio aims to provide the students with the knowledge of the basic understanding of materials in Interior Design.
- This studio also focuses on two dimensional and three dimensional geometry and its representations through drawing.
- Understanding of materials used in Buildings and interiors.
- Representations of components of buildings.
- The materials used, elements required, techniques of installation, designing the services in interior spaces and elements with step by step actualization on site.

COURSE CONTENT:

PHASE I: FERROUS METALS 10

- Properties and used of cast iron, wrought iron and steel-anticorrosive measures for steel-mechanical and heat treatment of steel-market forms of steel-structural steel, stainless steel, steel alloys - properties and uses - current developments.

PHASE II: CONSTRUCTION USING STEEL 10

- Steel staircases and handrails, balusters - Doors and windows open able - Sliding or collapsible gates, rolling shutters. - Steel in furniture and other interior uses.

PHASE III: NON FERROUS METALS 15

- Introduction Aluminum and Aluminum Alloys brief study on properties and uses Aluminum products extrusions, foils, castings, sheets, etc.
- Brief study of other non ferrous metals like copper, bronze, brass, tin and lead, properties and uses current developments.

PHASE IV: CONSTRUCTION USING NON FERROUS METALS 25

- Aluminum doors - Open able, Sliding, Pivoted. Aluminum windows - Openable, Sliding, Fixed, Pivoted.

- Aluminum ventilators - Top hung, Bottom hung, Pivoted, Louvered, and Fixed. Aluminum partitions, False ceiling, Handrails Aluminum roofing - North-light glazing bar, Aluminum roofing sheets. Use of other nonferrous metals like copper, bronze, brass, etc. in architectural construction.

PHASE V: GLASS 15

- Brief study on structural glazing, Glass façade, unitized glazing, Frameless glasses – Spider glazing, Fin glazing, Glass canopy, Glass Entrance doors, Partitions, Staircases, etc.,
- Use of glass in interiors

TOTAL HOURS – 75

TEXT BOOKS:

1. W.B. Mckay,"Building Construction", Vol.1, 2, 3, Longmans, U.K.,1981.
2. B.C.Punmia, "Building Construction", Lakshmi Publications Pvt. Ltd., N.Delhi.

REFERENCES:

1. Don A.Watson, "Construction Materials and Processes", McGraw Hill Co., 1972.
2. Alanwerth, "Materials", The Mitchell Pub. Co. Ltd., London,1986.
3. R.Chudleu, "Building Construction Handbook", British Library Cataloguing in Publication Data, London, 1990.
4. S.C. Rangawala, "Engineering Materials", Charotar Pub. House, Anand, 1997.

OUTCOMES:

- The students understand the properties and uses of ferrous and non ferrous materials.
- They aware of the progressive achievements of glass, plastics,, aluminium , its application in construction industry and present developments.
- They can learn the drafting and representation details of aluminium doors, windows, roofing and its uses in building industry.
- They can gain the knowledge of glass, plastics details and its uses in building industry.

IA C 2403 WORKSHOP IV: FURNITURE DESIGN –II

L	T	P	C
1	0	3	3

OBJECTIVES:

- This studio, through exercises and a design problem, attempts to understand the relationship of form, materials and development of dimensions in the design of furniture with reference to space.
- A critical understanding of the evolution of form in furniture involving these specifics further develops the critical appreciation of furniture pieces.

COURSE CONTENT:

PHASE I: 30

- The workshop develops from Furniture design I, which focuses on the development of furniture as integral part of Interior architecture.
- False ceiling – wall paneling.

PHASE II: 30

- Designing and detailing of Multiuse furniture design.
- Exercises evolve from being basic to more evolved design typology- Residential furniture- Eg: living room furniture , kitchen furniture, etc

TOTAL HOURS – 60

TEXT BOOKS:

1. Design After Modernism : Furniture and Interiors 1970 -2010, Judith Gura, New York, 2012.
2. Le Corbusier: Furniture and Interiors 1905-1965, Arthur Ruegg, Scheidegger & Spiess, Zurich, Switzerland,2012.
3. Donald Judd Furniture : Retrospective, Donald Judd, Museum Boymans-van Beuningen, Rotterdam, 1993, English, Dutch, German.

REFERENCES:

1. History of Modern Furniture Design, Daniela Karasova, Arbor Vitae, Prague, 2013.
2. Carrier and company positively chic interiors by Jesse Carrier and Mara Miller.
3. Furniture Design and Construction for the interior designer, by Christopher Natale,2009

4. Time Saver Standards for Interior Design, Joseph De Chiara, McGraw Hill, New York.

OUTCOMES:

- The students understand the relationship of form, materials and development of dimensions in the design of furniture with reference to space.
- They will get proficiency in the evolution of form in furniture.

IA C 2404	INTEGRATED DESIGN STUDIO - III DIGITAL TECHNOLOGY	L T P C 1 0 3 3

OBJECTIVES:

- Through a project the student is taught video, image and vector editing using editing software.
- To enable the creation of interactive patterns by introducing scripting.
- To enable synchronization of sound with patterns generated.
- To enable presentation using voice over and production of CD rooms.

COURSE CONTENT:

PHASE I: VIDEO EDITING, IMAGE EDITING & VECTOR EDITING 25

- **Tools:** Importing avis and mpegs, sequencing, cutting trimming, decrease and increase the speed of the movie, filters, transitions, output settings, saving the output with the help of video editing software like ADOBE PREMIERE.
- Image editing (pixel image types) using tools, Vector characters, bizer and grip editing, transform, fill types, text formatting, colour overlays, etc in Adobe Photoshop

PHASE II: OVERLAPPING TECHNIQUE (2D ANIMATION WITH MOVIE) 25

- **Project:** Import Movie file in the editing software like premiere and overlap the 2D Animation film created using Flash.
- Synchronize the sound and create a perfect blend of AVI and 2D Animation film.

PHASE III: SPACE GENERATION 25

- **Project:** Students would identify a metaphor (literature, movies, and music albums) and create spaces using the same.
- The proposal must be discussed with course faculty prior to presentation.

TOTAL HOURS – 75

TEXT BOOKS:

1. Photoshop 7 Bible Professional Edition, Wiley John & Son INC, New York, DekeMcClelland.
2. Flash Web Design, The Art of Motion Graph, Curtis Hillman, New Riders Publishing, Indianapolis, IN. U.S.A, 2000

REFERENCES:

1. M.E. Morris, and R.J. Hinrichs, Web Page Design, Prentice Hall, 1996.
2. Mark Von Wodtke, Mind over Media : Creative Thinking Skills for Electronic Media, McGrawhill, New York, 1993

OUTCOMES:

- The students can able to produce a good quality video using the software.
- They can acquire knowledge about scripting.
- Can prepare presentations using voice over and production of CD rooms.

IA C 2405 HISTORY OF INTERIOR ARCHITECTURE- II

L	T	P	C
3	0	0	3

OBJECTIVES:

- To study the different postmodern directions in architecture and the evolution of new approaches.
- To appreciate contemporary architectural trends.
- To study about interiors of china and Japan.
- To comprehended the styles and decorations of different states in India.

COURSE CONTENT:

PHASE I: RECENT MOVEMENTS 15

- Design movements such as Late Modernism, High Technology, Post Modernism, and De Constructivism, Minimalism, etc

PHASE II: ASIAN MOVEMENTS 10

- Interiors in China, Japan & the Islamic World – Influences of Pre Columbian

PHASE III: INDIAN TRADITIONAL DESIGNS 20

- Traditional Styles of design & decorations of homes & accessories across the states in India including Rajasthan, Gujarat, Andhra, Tamil Nadu, Kerala, Madhya Pradesh etc

TOTAL HOURS – 45

TEXT BOOKS:

1. Bill Risebero, "Modern Architecture and Design", MIT Press ,1985.
2. Kenneth Frampton, "Modern Architecture: A Critical History", Tahmes and Hudson, London, 1994.
3. Interior Design, John F. Pile, Harry Abrams Inc.

REFERENCES:

1. Manfredo Taferi/Franceso dal co., "Modern Architecture", Faber and Faber/Electa, 1986.
2. Charles Jencks, "The Language of Post Modern Architecture", Rizzoli, 1984.
3. Interior Design Course, Mary Gilliat Coyran, Octopus Ltd., London.

4. Interior Design, Francis D.K. Ching, John Wiley & Sons, New York
5. Time Saver Standards for Interior Design, Joseph De Chiara, McGraw Hill, New York.
6. Publications on Traditional Arts & Crafts of India, Ministry of Handicrafts Development, Government of India.

OUTCOMES:

- Enlighten the students with various interior design trends across the world
- Understanding the efforts and practices of famous architecture and their influence on the architecture and Interior design
- Highlight the traditional practices of designing and decoration followed in various states of India.

IA C X05 ADVANCED BUILDING SERVICES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand a built environments responses to natural heating and cooling and thereby understanding principles to be implemented when designing spaces.

COURSE CONTENT:

PHASE I: 15

Location and site level planning, Water efficiency - indoor water reuse and use reduction, Optimum energy performance - HVAC, lighting, etc

PHASE II: 10

- Renewable and reuse of material and resources - storage and collection of recyclable.

PHASE III: 20

- Constructions and demolishing of waste management planning, Building Product Disclosure and Optimization, indoor environment quality - thermal comfort, interior lighting, daylight, etc.

TOTAL HOURS – 45

TEXT BOOKS:

3. Fuller Moore, Environmental Control Systems, McGraw Hill Inc., New Delhi, 1997.
4. Climatically Responsive Energy Efficient Architecture, PLEA/SPA, New Delhi - 1998.

REFERENCES:

1. V.Gupta - Energy and Habitat - Wiley Eastern Limited, New Delhi.
2. Donald Watson, "Climatic Building Design- Energy Efficient Building Principles and Practice",McGraw-Hill,1993.
3. Energy Conservation Building Code

OUTCOMES:

- They also acquire a good understanding of the role of site planning strategies, vegetation types and water bodies in energy efficient architecture.
- They can be able to place this specialized knowledge in the context of the design of buildings and the wider environment.
- They can be able to critically analyze the implications of energy efficient architectural design in a given specific context and the wider environmental context.
- They can also be able to think in an innovative and creative way

IA C X06 ADVANCED BUILDING ENERGY EFFICIENCY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand a built environments responses to natural heating and cooling and thereby understanding principles to be implemented when designing spaces.

COURSE CONTENT:

PHASE I: 15

Location and site level planning, Water efficiency - indoor water reuse and use reduction, Optimum energy performance - HVAC, lighting, etc.

PHASE II: 10

- Renewable and reuse of material and resources - storage and collection of recyclable.

PHASE III: 20

- Constructions and demolishing of waste management planning, Building Product Disclosure and Optimization, indoor environment quality - thermal comfort, interior lighting, daylight, etc.

TOTAL HOURS – 45

TEXT BOOKS:

5. Fuller Moore, Environmental Control Systems, McGraw Hill Inc., New Delhi, 1997.
6. Climatically Responsive Energy Efficient Architecture, PLEA/SPA, New Delhi - 1998.

REFERENCES:

4. V.Gupta - Energy and Habitat - Wiley Eastern Limited, New Delhi.
5. Donald Watson, "Climatic Building Design- Energy Efficient Building Principles and Practice",McGraw-Hill,1993.
6. Energy Conservation Building Code

OUTCOMES:

- They also acquire a good understanding of the role of site planning strategies, vegetation types and water bodies in energy efficient architecture.
- They can be able to place this specialized knowledge in the context of the design of buildings and the wider environment.
- They can be able to critically analyze the implications of energy efficient architectural design in a given specific context and the wider environmental context.
- They can also be able to think in an innovative and creative way

SEMESTER V

		L	T	P	C
IA C 3501	**INTERIOR DESIGN STUDIO- IV**	**0**	**0**	**17**	**8**

OBJECTIVES:

- The course concentrates on larger scale spaces with an emphasis on planning commercial spaces.
- The main aim is to develop visually literate students who are proficient at analytical thinking, conceptualization and the problem-inquiry, solution cycle. The course also examines the connection between abstract design principles and the physical and visual environments.

COURSE CONTENT:

- The projects help the students to integrate services to achieve functional space without the compromise on interior aesthetics.
- Project Typology: Commercial and public building interiors: Showroom, Office Space, Hotel Interiors, Auditorium etc.
- Working Drawings for the design is to be taught to the students for the typology of the designs.
- Spatial and service standards for commercial and hospitality – integration of interior design schemes– contemporary interior schemes to integrate new concepts in lighting and materials.

TOTAL HOURS – 225

TEXT BOOKS:

1. Joseph De Chiara, Julius Panero, Martin Zelnik, "Time Saver Standards for Interior Design and Space Planning", McGraw Hill, 2001.
2. Robert Rengel, Shaping Interior Space, Fairchild Books & Visuals ,2002
3. Ernst, "Neuferts Architects Data", Blackwell, 2002
4. Ramsey et al, "Architectural Graphic Standards", Wiley 2000

REFERENCES:

1. Designs for 20th century Interiors – Fiona Leolie, VH Publications, London.
2. Interior Design; The New Freedom, Barbaralec Diamonstein, Rizzoli International Publications, New York, 1982.
3. National Building code of India 2005 – Bureau of Indian Standards.
4. Worldwide Interiors – International Federation of Interior Architects & Designers, Rikuyo-Sha, Japan, 1987.

5. Peter templeton & Saunders – Detailing for architectural acoustics – Architectural press, 1994.

OUTCOMES:

- Students get proficient at analytical thinking, conceptualization and the problem-inquiry, solution cycle.
- They can able to understand organizations of different types and development of language that is appropriate to the public realm.
- They gain knowledge on MEP services.
- To familiarize the students with the basic principles of acoustic design and working towards the practical approach in treating interior spaces based on the usage.

		L	T	P	C
IA C 3502	**ALLIED DESIGN STUDIO- V: Construction Techniques & Representations- V**	**2**	**0**	**4**	**4**

OBJECTIVES:

- Allied Design Studio aims in elevating the material knowledge acquired to next level by educating on the various finishes available in the industry.
- Understanding of materials and its various finishes used in buildings and interiors.
- The course focuses on applied materials understanding with the idea of non-engineering materials, their finishes, applications, techniques and processes.
- To gather knowledge on interior fittings and its various brands.

COURSE CONTENT:

PHASE I: SURFACE FINISHES - WALLS 20

- Types of wall coverings – wall cladding & wall panelling. Materials - Natural and faux, Installation technique.
- Types of wall finishes – based on climate and its exposure, durability, cost.

PHASE II: SURFACE FINISHES – FLOOR COVERINGS 20

- Types of Flooring, Flooring for different building typology, Flooring material – size, thickness and laying on site.
- Types of floor finishes based on their usage.

PHASE III: SURFACE FINISHES – FALSE CEILING 20

- False ceiling- materials, finishes and its fixing details.

PHASE IV: FITTINGS - HARDWARE 15

- Types of Kitchen and Toilet fittings – various brands.
- Door and Window coverings.
- Types of hardware and other related accessories – fixing details.

TOTAL HOURS – 75

TEXT BOOKS:

1. W.B. Mckay,"Building Construction", Vol.1, 2, 3, Longmans, U.K.,1981.

2. B.C.Punmia, "Building Construction", Lakshmi Publications Pvt. Ltd., N.Delhi.

REFERENCES:

1. Don A.Watson, "Construction Materials and Processes", McGraw Hill Co., 1972.
2. Alanwerth, "Materials", The Mitchell Pub. Co. Ltd., London,1986.

3. R.Chudleu, "Building Construction Handbook", British Library Cataloguing in Publication Data, London, 1990.

4. S.C. Rangwala, "Engineering Materials", Charotar Pub. House, Anand, 1997.

OUTCOMES:

- The students gain knowledge on various materials and its finished used in interiors.

- The students gain technical knowledge on various wall, floor and ceiling installation.
- Practical knowledge on material properties – durability, cost etc.
- Information on different brands – fixtures and fittings.

IA C 3503	WORKSHOP – V: Furniture Design- III	L	T	P	C
		1	0	4	3

OBJECTIVES:

- This studio attempts to understand the relationship of form with combination of materials and design of furniture with reference to space.
- A critical understanding of the manufacturing processes.
- It focuses on understanding furniture design from the perspective of its evolution in history, the development of design styles, with respect to various designers.

COURSE CONTENT:

PHASE I: MODULAR APPROACH TO FURNITURE DESIGN 15

- Combination of various materials in furniture design, their hardware and applications. Cost criteria of furniture design based on the material and finishes.
- Study of several modular systems available for different functions in the market.

PHASE II: FURNITURE DESIGN APPROACH 15

- Analysing manufacturing processes most frequently adopted in furniture design such as injection moulding, investment casting, sheet metal work, die casting, vacuum - forming etc.
- Study of different types of moulded or casted furniture available for different functions in the market.

PHASE III: STUDY ON DESIGNERS – FURNITURE 10

- Furniture designers and movements for various types of furniture. Charles & Ray Eames, Eero Saarinen,Jean Prouve,Paul Mccobb,Ettore Sottass,Knoll,Jens Risom etc.

TOTAL HOURS – 45

REFERENCES:

- Carol Stangler, The crafts and art of Bamboo, Rev. updated edition, Lark books, 2009.
- Peter Korn, Wood working Basics : Mastering the essentials of craftsmanship, Taunton , 2003
- Materials for Interior Environments, Corky Bingelli, John wiley and sons, 2007.
- Kilmer, Working Drawings & Details for Interiors, John Wiley & Sons., 2009
- Bradley Quinn, Mid-Century Modern: Interiors, Furniture, Design Details,
- Jim Postell, Furniture Design, Wiley publishers, 2007.
- Robbie. G. Blakemore, History of Interior Design and Furniture: From Ancient Egypt to Nineteenth-Century Europe, Wiley publishers, 2005.

OUTCOMES:

- Exploration of appropriate materials and the social and spatial impact of the furniture will be addressed.
- Gain knowledge on the manufacturing methods and techniques according to the current trends in the industry.
- Experimenting on the ideas of famous designers and applying it to the current needs with a new style.

IA C 3504 INTEGRATED DESIGN STUDIO - V L T P C
BUILDING SERVICES - III 1 0 4 3

OBJECTIVES:

- To expose students to understand noise control and sound transmission and absorption to increase the quality of the interior space.
- To familiarize the students with the basic principles of acoustic design for various interior spaces.
- To develop the practical knowledge and skills required for understanding acoustics and integrating with interior design.

COURSE CONTENT:

PHASE I:

INTRODUCTION TO ACOUSTICS 20

- Nature of sound, Transverse and longitudinal waves.
- Properties of sound, behavior of sound in enclosures, reflection of sound, echoes, dispersion, sound shadows.

PHASE II:

SOUND TRANSMISSION, NOISE CONTROL AND SOUND ABSORBTION 20

- Building material, absorption co-efficient and measurements, choice of absorption material, resonance, reverberation, echo, exercises involving reverberation time and absorption co-efficient.
- Noise reduction: Sound isolation, transmission loss TL, TL for walls, sound leaks indoors, noise reduction between rooms, Construction details for noise reduction.

PHASE III:

ACOUSTICAL CONSIDERATION 20

- Acoustical Considerations and design criteria - Room shape, volume, treatment for interior surfaces and elements of audio visual setting. Walls/partitions, floors/ceilings, window/doors insulation techniques and acoustical treatments.

- Acoustic design process for different types of interiors.

TOTAL HOURS – 60

REFERENCES:

1. Frederick .S, "Building Engineering and systems Design", Merritt James Ambrose.
2. David Eagan "Concepts in Architectural Acoustics".
3. Dr.V.Narasimhan, " An Introduction to Building Physics", Kabeer Printing Works, Chennai-5, 1974.
4. Neufert Architects'Data Third Edition.

OUTCOMES:

- To make the students understand the science behind acoustical design.
- To familiarize the students with various interior elements which lend to better hearing conditions.
- To familiarize the students with the basic principles of acoustic design and working towards the practical approach in treating interior spaces based on the usage.

IA C X07 ADVANCED PRODUCT DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the importance of design of products and accessories in the design of interiors.
- To analyze on past and current trends and to arrive at solutions for future.
- Hand skilled products and manufacturing techniques using latest technologies.

COURSE CONTENT:

PHASE I NEED OF PRODUCT DESIGN 10

- Role of products and accessories in interiors and the integration of accessories in interior design.
- Design methods in product and accessories design with an emphasis on functionality, ergonomics, aesthetics, multiple usages etc.

PHASE II PRODUCT DESIGN – STYLES 10

- Development of decorative accessories from the past to present.
- Technological advances and the influences on their design.

PHASE III DESIGN APPROACH 10

- Strategies for evolving design with integration of technical complexities and influences.
- Innovative design and application to multi products and multi materials in manufacturing interior products and lifestyle accessories.

PHASE IV MATERIAL AND DETAILING 15

- Study of materials and processes adopted in accessories design.
- Orientation to Indian as well as global context of interiors, trends and market.
- A detailed study involving all the design aspects of any of the following lifestyle accessories: luminaire design, glassware, lighting fixtures, textiles, mirrors, wall decors etc.

TOTAL HOURS – 45

REFERENCES:

1. Laura Slack, What is product Design? Roto Vision publishers, 2008
2. Treena Crochet and David Vleck, Designer's Guide to Decorative Accessories, Prentice Hall, Ist edition, 2008.
3. Michael Ashby, Kara Johnson, Materials and Design: The Art and Science of material selection in product design, Butter Worth Heinemann, 1st edition, 2002.
4. Karl. T. Ulrich, Steven D. Eppinger, Product Design and Development, McGraw-Hill Education Singapore; 4th edition, 2007
5. William Lidwell, Kritina Holden, Jill Butler ,Universal principles of Design, Rockport publishers, 2008.

OUTCOMES:

- To familiarize on various interior products available on market.
- To understand the need of products to enhance the design of interiors.
- To gain knowledge on manufacturing techniques adopted in the industry.

IA C X08 ADVANCED LIGHTING DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the importance of design of products and accessories in the design of interiors.
- To analyze on past and current trends and to arrive at solutions for future.
- Hand skilled products and manufacturing techniques using latest technologies.

COURSE CONTENT:

PHASE I INTRODUCTION TO DAY LIGHTING 10

- Nature of light – Wavelength, intensity, Flux, illumination and luminance, visual efficiency, sources of light, day light factor concept, day lighting requirements.

PHASE II ARTIFICIAL LIGHTING 15

- Different types of lights in interior and exterior - task lighting, special purpose lighting.
- Electric lamps – incandescent, fluorescent, sodium vapour, mercury, halogen and neon.
- Guidelines for lighting design and Calculation of artificial lighting.

PHASE III LUMINARES & FIXTURES 15

- Different luminaries for lighting, lighting control system.
- Impact of lighting, fixture types - free standing or portable, fixed, light fixture control.
- Lighting accessories- switches, sockets, fused connection units, lamp holders, ceiling roses etc.

TOTAL HOURS – 45

REFERENCES:

1. Gary Gordon, Interior lighting for designers, John Wiley & Sons Inc.
2. Interior lighting for Designers, Third edition – Gary Gordon & Jamco L. Nuckolls – John Wiley & Sons, New York, 1995.

OUTCOMES:

- To familiarize on various interior products available on market.
- To understand the need of products to enhance the design of interiors.
- To gain knowledge on manufacturing techniques adopted in the industry.

REGULATIONS, CURRICULAM AND SYLLABUS

M.B.A

MANAGEMENT STUDIES

(As approved by the 9th Academic Council)

JULY 2016

B.S.ABDUR RAHMAN UNIVERSITY
B.S.ABDUR RAHMAN INSTITUTE OF SCIENCE & TECHNOLOGY
(Estd.u/s 3 of the UGC Act, 1956)
(FORMERLY B.S.ABDUR RAHMAN CRESCENT ENGINEERING COLLEGE)
Seethakathi Estate, G.S.T. Road, Vandalur, Chennai - 600 048.

CURRICULUM & SYLLABI FOR M.B.A (MANAGEMENT STUDIES)

CURRICULUM

Sl. No.	Course Code	Course Title	L	T	P	C
		TRIMESTER I				
1	MSC6101	Management Concepts	**3**	**0**	**0**	**2**
2	MSC6102	Entrepreneurship Development	**2**	**0**	**2**	**2**
3	MSC6103	Managerial Economics	**3**	**0**	**0**	**2**
4	MSC6104	Quantitative Methods in Business I	**3**	**0**	**0**	**2**
5	MSC6105	Communication Skills	**2**	**0**	**2**	**2**
6	MSC6106	Financial Accounting	**3**	**0**	**0**	**2**
Career Oriented Practicals						
7	MSC6107	Computers and Business Application Lab	**0**	**0**	**3**	**1**
		Total Credit (Trimester I)				**13**
		TRIMESTER II				
1	MSC6201	Organizational Behaviour	**3**	**0**	**0**	**2**
2	MSC6202	Legal Aspects of Business	**3**	**0**	**0**	**2**
3	MSC6203	Economic Environment of Business	**3**	**0**	**0**	**2**
4	MSC6204	Quantitative Methods in Business II	**3**	**0**	**0**	**2**
5	MSC6205	Management and Cost Accounting	**3**	**0**	**0**	**2**
6	MSC6206	Marketing Management – I	**3**	**0**	**0**	**2**
Career Oriented Practicals						
7	MSC6207	Written Analysis and Communication	**0**	**0**	**3**	**1**
8	MSC6208	Current Affairs in Business	**0**	**0**	**3**	**1**
		Total Credit (Trimester II)				**14**

Sl. No.	Course Code	Course Title	L	T	P	C
		TRIMESTER III				
1	MSC6301	Management Information System	**3**	**0**	**0**	**2**
2	MSC6302	Financial Management	**3**	**0**	**0**	**2**
3	MSC6303	Marketing Management – II	**3**	**0**	**0**	**2**
4	MSC6304	Human Resources Management	**3**	**0**	**0**	**2**
5	MSC6305	Production and Operations Management	**3**	**0**	**0**	**2**
6	MSC6306	Research Methodology for Management	**3**	**0**	**0**	**2**
Career Oriented Practicals						
7	MSC6307	Psychometrics and Corporate Connect Lab	**0**	**0**	**3**	**1**
8	MSC6308	Data Analysis Lab	**0**	**0**	**3**	**1**
		Total Credit (Trimester III)				**14**

Students are to undergo summer internship after the end-term examination of III trimester. Details are given in regulation.

		TRIMESTER IV				
1	MSC7101	International Business Management	**2**	**0**	**0**	**1**
2	MSC7102	Introduction to Enterprise Resources Planning	**2**	**0**	**0**	**1**
3		Program Electives				**10**
Career Oriented Practicals						
4	MSC7103	Integrated Management Cases	**0**	**0**	**3**	**1**
5	MSC7104	Summer Internship*				**2**
		Total Credit (Trimester IV)				**15**

* Though summer internship is mentioned in the IV trimester, students have to undergo summer internship in a business organisation after the end-term examination of III trimester. Details are given in regulation.

Sl. No.	Course Code	Course Title	L	T	P	C
		TRIMESTER V				
	MSC7201	Strategic Management	**3**	**0**	**0**	**2**
		Program Electives				**10**
Career Oriented Practicals						
	MSC7202	Sales Negotiation Lab	**0**	**0**	**3**	**1**
		Total Credit (Trimester V)				**13**
		TRIMESTER VI				
	MSC7301	Project Work			**30**	**10**
		Total Credit (Trimester VI)				**10**
		TOTAL CREDITS		**79**		

LIST OF ELECTIVES IN FUNCTIONAL AREAS

Sl. No.	Course Code	Course Title	L	T	P	C
		MARKETING MANAGEMENT				
1	MSCY001	Retail Marketing	**3**	**0**	**0**	**2**
2	MSCY002	Services Marketing	**3**	**0**	**0**	**2**
3	MSCY003	Marketing Communications and Media Management	**3**	**0**	**0**	**2**
4	MSCY004	Consumer Behaviour	**3**	**0**	**0**	**2**
5	MSCY005	Product and Brand Management	**3**	**0**	**0**	**2**
6	MSCY006	Industrial Marketing	**3**	**0**	**0**	**2**
7	MSCY007	Customer Relationship Management and Marketing	**3**	**0**	**0**	**2**
8	MSCY008	Rural Marketing	**3**	**0**	**0**	**2**
9	MSCY009	Sales and Distribution Management	**3**	**0**	**0**	**2**
10	MSCY010	Digital Marketing	**3**	**0**	**0**	**2**
		FINANCIAL MANAGEMENT				
1	MSCY016	Security market and analysis	**3**	**0**	**0**	**2**
2	MSCY017	Financial Services	**3**	**0**	**0**	**2**
3	MSCY018	International Financial Management	**3**	**0**	**0**	**2**
4	MSCY019	Strategic Financial Management	**3**	**0**	**0**	**2**
5	MSCY020	Financial Reengineering	**3**	**0**	**0**	**2**
6	MSCY021	Derivatives Management	**3**	**0**	**0**	**2**
7	MSCY022	Risk Management and Insurance	**3**	**0**	**0**	**2**
8	MSCY023	Banking Management	**3**	**0**	**0**	**2**
9	MSCY024	Portfolio Management	**3**	**0**	**0**	**2**
		HUMAN RESOURCES MANAGEMENT				
1	MSCY031	Managerial Behaviour and Effectiveness	**3**	**0**	**0**	**2**
2	MSCY032	Human Resources Accounting & Audit	**3**	**0**	**0**	**2**
3	MSCY033	Performance Management and Training	**3**	**0**	**0**	**2**
4	MSCY034	Industrial Relations and Labour Legislation	**3**	**0**	**0**	**2**

Sl. No.	Course Code	Course Title	L	T	P	C
5	MSCY035	Organisational Structure and Design	**3**	**0**	**0**	**2**
6	MSCY036	Strategic Human Resource Management	**3**	**0**	**0**	**2**
7	MSCY037	International Human Resources Management and Organisational Behaviour	**3**	**0**	**0**	**2**
8	MSCY038	Negotiation Skills and Conflict Management	**3**	**0**	**0**	**2**
		SYSTEMS MANAGEMENT				
1	MSCY046	Business Analysis and Systems Development	**3**	**0**	**0**	**2**
2	MSCY047	Database Management Systems	**3**	**0**	**0**	**2**
3	MSCY048	E-Commerce Technology	**3**	**0**	**0**	**2**
4	MSCY049	Strategic Information Technologies for Management	**3**	**0**	**0**	**2**
5	MSCY050	Project Management	**3**	**0**	**0**	**2**
6	MSCY051	Web Technologies	**3**	**0**	**0**	**2**
7	MSCY052	Big Data in Management	**3**	**0**	**0**	**2**
8	MSCY053	Application of Enterprise Resource Planning	**3**	**0**	**0**	**2**
		OPERATIONS MANAGEMENT				
1	MSCY061	Supply Chain Management	**3**	**0**	**0**	**2**
2	MSCY062	Total Quality Management	**3**	**0**	**0**	**2**
3	MSCY063	Integrated Materials Management	**3**	**0**	**0**	**2**
4	MSCY064	Lean Six Sigma	**3**	**0**	**0**	**2**
5	MSCY065	Logistics Management	**3**	**0**	**0**	**2**
6	MSCY066	Services Operations Management	**3**	**0**	**0**	**2**
7	MSCY067	Product Design	**3**	**0**	**0**	**2**
8	MSCY068	System Simulation and Modelling	**3**	**0**	**0**	**2**
		ISLAMIC BANKING AND FINANCE				
1	MSCY076	Introduction of Islamic Economics	**3**	**0**	**0**	**2**
2	MSCY077	Fundamentals of Islamic Finance	**3**	**0**	**0**	**2**
3	MSCY078	Islamic Insurance (Takaful)	**3**	**0**	**0**	**2**
4	MSCY079	Islamic Bonds (Sukuk)	**3**	**0**	**0**	**2**

Sl. No.	Course Code	Course Title	L	T	P	C
5	MSCY080	Islamic Asset and Fund Management	**3**	**0**	**0**	**2**
6	MSCY081	Islamic Banking Products and Services	**3**	**0**	**0**	**2**
		ENTREPRENEURSHIP				
1	MSCY086	Entrepreneurship, Family Enterprises & Successful Ventures	**3**	**0**	**0**	**2**
2	MSCY087	Financial Institutions and Funding for Entrepreneurs	**3**	**0**	**0**	**2**
3	MSCY088	Marketing for Entrepreneurs	**3**	**0**	**0**	**2**
4	MSCY089	New Venture and Project Preparation	**3**	**0**	**0**	**2**

TRIMESTER I

MSC 6101	MANAGEMENT CONCEPTS	L	T	P	C
		3	0	0	2

OBJECTIVES:

The objectives of the course are to

- Provide insight into various functions and principles of management
- Introduce planning and decision-making techniques
- Familiarize the students with organizing and staffing activities practised in business
- Give inputs on directing and controlling functions in organizations
- Create awareness about ethical aspects in functional areas of management

MODULE I NATURE AND FUNCTIONS OF MANAGEMENT 06

Management - definition, nature, functions, levels - An overview of approaches to Management / Schools of Management thought - Types/Forms of Business Organization

MODULE II PLANNING 06

Planning: purposes, premises, steps, types/hierarchy - Management by Objectives - Management by Exception - Decision making: Importance, process.

MODULE III ORGANIZING AND STAFFING 05

Organizing: definition, process - Span of Management - Departmentalization - Organization Structure - Authority - Delegation and Decentralization - Staffing: Objectives, functions.

MODULE IV DIRECTING AND CONTROLLING 07

Directing: meaning, requirements of effective direction - Motivation: definition, types of motives, overview of theories - Leadership: definition, styles, overview of theories - Communication: types, process, barriers, principles of effective communication- Controlling: purposes, process, types, and techniques.

MODULE V ETHICS IN MANAGEMENT 06

Definition of ethics, values, moral obligations, CSR and Corporate Governance,- Major sources of ethical values in Business- Principles of ethical conduct- Factors Influencing Managerial Ethics, Marketing, Finance, HR, System: Definition and

Broad Function Performed-Overview and practical examples in the following: Ethics in Marketing, advertising and Product safety, Accounting Ethics-, Ethics in HR, Ethical practices in occupational health & safety, Ethics and CSR, Cyberspace ethics

Total Hours: 30

REFERENCES:

1. Tripathy P. C. and Reddy P. N., “Principles of Management”, 5th Edition, Tata McGraw Hill, 2012.
2. Harold Koontz & Heinz Weihrich, “Essentials of Management”, Tata McGraw Hill, 8th Edition, 2009.

OUTCOMES:

At the end of this course, the student will be able to:

- Prepare different types of functional plans and take suitable managerial decisions
- Develop organizational charts and explain staffing process.
- Choose the right ways and means to motivate and lead teams
- Apply appropriate control techniques
- Identify/ adopt ethical practices in various functional areas

MSC 6102	ENTREPRENEURSHIP DEVELOPMENT	L	T	P	C
		2	0	2	2

OBJECTIVES:

This course would help the students to:

- Realize the skills required to be an entrepreneur
- Identify the business opportunity
- Create a business model
- Acquaint the students with challenges of starting new ventures and enable them to investigate, comprehend and internalize the process of setting up a business.
- Locate market attractiveness based on the interaction with the entrepreneur

THEORY

MODULE I INTRODUCTION TO ENTREPRENEURSHIP 07

Entrepreneurship: Knowledge and skills requirement - Characteristic of successful entrepreneurs - Entrepreneurship process - Factors impacting emergence of entrepreneurship - Managerial vs. Entrepreneurial approach and emergence of entrepreneurship - Need for achievement.

MODULE II STARTING THE VENTURE 07

Generating business idea - Innovation and creativity for driving entrepreneurship - Creating value to customers - Sources of new ideas, methods of generating ideas, creative problem solving, opportunity recognition - Environmental scanning, competitor and industry analysis - Understanding risk and strategies to handle risk.

MODULE III FUNDAMENTALS OF MANAGEMENT 06

Forms of ownership - Basics of Marketing - Sources of Funds - Creative Means of Funding.

PRACTICAL

MODULE IV HISTORICAL PERSPECTIVE 08

Analysis of successful and unsuccessful Entrepreneurs through Case Studies.

MODULE V PROJECT 12

Meeting with an Entrepreneur and Preparation of Report and Presentation - A Project based on a Business Idea to be prepared.

T: 20, P: 20, Total Hours: 40

REFERENCES:

1. Hisrich, Robert D., Michael Peters and Dean Shepherded, “Entrepreneurship”, Tata McGraw Hill, 2014.
2. Rashmi Bansal, “Arise awake: the inspiring stories of young entrepreneur who graduated from college into A Business of their own”, Westland Books Private Ltd., 2015.
3. Barringer, Brace R., and R., Duane Ireland, “Entrepreneurship”, Pearson Prentice Hall, New Jersy (USA), 2012.
4. Kishore Biyani and Dipayan Baishya, “It happened in India: The story of pantaloons, Big Bazaar, Central and the great Indian consumer”, Rupa & Co., 2011.
5. Donald F. Kuratko and T. V Rao, “Entrepreneurship: A South Asian perspective”. Cengage Learning, 2012.
6. Rashmi Bansal, “Take me Home: The Inspiring story of 20 Entrepreneurs from small town India with Big Time Dream”, Westland, 2014.
7. Moloy K. Bannerjee, Siddharth Bannerjee and P. Ranganath Sastry, “Start-up City: Ten Tales of Exceptional Entrepreneurship from Bangalore's Software Miracle”, Collins Business, 2014.
8. The Portfolio Book of Great Indian Business Stories: Riveting Tales of Business Leaders and Their Times, Portfolio, 2015.
9. Shereen Bhan and Syna Denuhgara, “Young Turks: Inspiring Stories of Tech Entrepreneurs”, Random House India, 2014.
10. Ronnie Screwvala, “Dream with Your Eyes Open: An Entrepreneurial Journey Hardcover”, Rupa Publication, 2015.

WEBSITES:

1. www.ediindia.org
2. www.niesbud.nic.in
3. http://nenglobal.org

OUTCOMES:

Upon successful completion of this course, a student will be able to:

- Turn out to be an expert to recognize a business opportunity that fits the individual.
- Demonstrate the ability to provide a self-analysis in the context of an entrepreneurial career
- Construct an appropriate business model.
- Develop a well-presented business plan.
- Express the ability to find an attractive market that can be reached economically.

MSC 6103 MANAGERIAL ECONOMICS

L	T	P	C
3	0	0	2

OBJECTIVES:

The objectives of the course are to enable the students to:

- Introduce students to the fundamentals of economics relevant from managerial perspective
- Familiarize students with the importance of economic approaches in managerial decision making
- Study about the application of economic theory into practical business
- Study about the economic tools and analyses that help make better business decisions and forward planning
- Understand about the functioning of the economy in its broader sense

MODULE I INTRODUCTION 06

Definition - Nature - Scope and uses of Managerial Economics - Basic Principles of Managerial Economics.

MODULE II LAW OF DEMAND AND SUPPLY 06

Demand: Definition - Characteristics - Demand Schedule - Law of demand - factors influencing demand and exceptions to law of demand. Supply: Definition – Characteristics - Supply Schedule - Law of supply - factors influencing supply Market Equilibrium.

MODULE III ELASTICITY OF DEMAND AND SUPPLY 06

Meaning - Definition and Importance of elasticity - Methods of measuring - Determinants of elasticity - Price, Income and Cross elasticity of demand - Advertisement elasticity of demand. Demand Forecasting: Meaning and different techniques of forecasting.

MODULE IV ANALYSIS OF COSTS AND MARKET FORMS 06

Opportunity cost, implicit & explicit cost, economic cost, incremental and marginal cost, direct & indirect cost, fixed & variable cost - Production Function and Returns to Scale. Market Forms - Price & Output determination in Perfect Competition, Monopoly, price discrimination, Monopolistic Competition and Oligopoly.

MODULE V PRICING AND PROFITS 06

Pricing - Objectives and types of pricing - Profit - accounting vs. economic profit, gross vs. net profit, importance of profit.

Total Hours: 30

REFERENCES:

1. Geetika, Piyali Ghosh and Purba Roy Choudhury, “Managerial Economics”, McGraw Hill, 2nd Edition, 2011.
2. N. Gregory Mankiw, “Economics: Principles and Applications”, Cengage Learning, 6th Indian Edition, 2009.

OUTCOMES:

Students will be able to:

- understand basic concepts of economics applied in managerial decision making
- Analyze the demand and supply conditions and assess the position of a company
- Analyze real-world business problems with a systematic theoretical framework.
- Demonstrate mastery of theories of demand, supply, consumption, production, cost and market structures
- Design competition strategies, including costing, pricing, product differentiation, and market environment according to the natures of products and the structures of the markets.
- Make optimal business decisions by integrating the concepts of economics, mathematics and statistics.
- Calculate demand function, supply function, equilibrium price and quantity, production function, cost function and profit function and apply them analytically in decision making.

MSC 6104 QUANTITATIVE METHODS IN BUSINESS - I

L	T	P	C
3	0	0	2

OBJECTIVES:

The objectives of the course would be to make the students

- Learn the fundamental measures of central tendency and probability distribution
- Gain knowledge on estimating the business situations for better decision making
- Hypothesize the business environment and interpret the results
- Gain insight into the non-parametric tests such as Chi-Square, F-Test and Anova
- Learn the application of other statistical tools like correlation, regression, etc.

MODULE I FUNDAMENTALS & DISTRIBUTION 06

Measures of central tendency and dispersion: Mean, Mode, Median, Standard Deviation Distributions: Applications of Binomial distribution - Applications of Poisson distribution- Applications of Normal distribution

MODULE II ESTIMATION 06

Definition of central limit theorem and concepts - Point and Interval estimates - Application of Estimation: Point and Interval estimates for population parameter (mean) of large sample - Application of Estimation: Point and Interval estimates for population parameter (mean) of small samples.

MODULE III TESTING OF HYPOTHESIS 05

Hypothesis testing: Introduction - Large sample tests (Z-test): One sample test for mean, two samples test for mean - Small sample tests (t-test): one sample test for mean, two (independent) samples test for mean

MODULE IV CHI - SQUARE, F TEST AND ANOVA 06

Chi square test: one-way (test of independence only), Chi square test: two-way (test of independence only), F test - ANOVA: one-way, F test - ANOVA: two-way - Application in business decisions

MODULE V CORRELATION, REGRESSION AND TIME SERIES ANALYSIS 07

Simple linear Correlation- Rank Correlation - Simple linear Regression - Time series analysis: Methods of Semi-average, Weighted average, Moving averages, Least squares, Ratio–to–trend - Application in business decisions

Total Hours: 30

REFERENCES:

1. Levin R.I., Rubin D.S., Rastogi, S. and Siddiqui, M.H. “Statistics for Management”, 7th edition, Prentice Hall of India, New Delhi, 2014.
2. Srivastava, T. N. and Shailaja, R. “Statistics for Management”, 2nd Edition, Tata Mc Graw Hill, New Delhi, 2012.
3. Anderson D.R., Sweeney D.J. and Williams T.A., “Statistics for Business and Economics”, 11th edition, Thomson (South – Western) Asia, Singapore, 2012.

OUTCOMES:

On completion of the course, the students will be able to:

- Recognize and apply probability distributions, and assess if underlying assumptions for the distribution seem applicable in business areas.
- Perform basic statistical calculations and graphical analyses in all the areas of business decision making.
- Analyze research questions based on statistical data and draw relevant conclusions
- Apply the non-parametric tests such as Chi-Square, F-Test and Anova for better interpretation
- Analyze time series data and apply relevant statistical tools like correlation, regression, etc to arrive at conclusions.

MSC6105	COMMUNICATION SKILLS	L	T	P	C
		2	0	2	2

OBJECTIVES:

The objectives of the course are to enable the students to:

- Introduce the dynamics of communication in the business world
- Enhance written communication skills
- Illustrate proper business etiquettes
- Provide practical sessions in spoken English
- Provide practical sessions in listening skills

THEORY

MODULE I INTRODUCTION 06

Introduction, Communication Process, Essentials and advantages of various business communications and correspondences, Barriers to communication

MODULE II BUSINESS CORRESPONDENCE – WRITTEN 08

Creating, organizing and perfecting business messages, Letters – General Correspondence, Sales, Complaints, Letter of application and Resume, Job application Letters, Resignation, Memos, Minutes, Agendas, Enquiries, Orders, Circulars, Product review, writing a Blog,

MODULE III BUSINESS REPORTS AND ETIQIUETTES 06

Basics of report writing, structure of reports, types of reports. Purpose, Scope, Style, Contents, Visual aids in Business and Project reports, feasibility reports, reports proposals. Non-verbal etiquettes – Business cards, e-mail Etiquettes, Virtual Meetings.

PRACTICAL

MODULE IV BUSINESS CORRESPONDENCE – ORAL 10

Interactive communication – Discussions, Debates, etc Business Presentation, Management Meeting.

MODULE V LISTENING COMPREHENSION 10

Listening and typing – Listening and sequencing of sentences – Filling in the blanks - Listening and answering questions.

T: 20, P: 20, Total Hours: **40**

REFERENCES:

1. P. Subba Rao, B. Anitakar and Hinabandu, “Business Communication”, Cengage Learning, 2012.
2. Raymond V. Lesikar, John & Pettit and Mary E. Flatley, “Basic Business Communication”, Tata McGraw Hill, 2005.
3. M. Ashraf Rizvi, “Effective Technical Communication”, Tata McGraw Hill, 2005.
4. Asha Kaul, “Business Communication”, Prentice Hall of India, 2009.

OUTCOMES:

At the end of the course, the students should be able to:

- Outline the dynamics of business communication.
- Write business correspondence.
- Be familiar with the business etiquettes
- Make business presentation.
- Enhance their listening abilities.

MSC 6106 FINANCIAL ACCOUNTING

L	T	P	C
3	0	0	2

OBJECTIVES:

The objectives of the course are to enable the students to:

- To understand the basics of accounting principles and concepts
- To prepare final accounts to ascertain profit or loss of an organization
- To appreciate the importance of cash book in an organization
- To identify the reasons for preparing bank reconciliation statement

MODULE I INTRODUCTION 02

Financial Accounting - Meaning - Objectives - Users of financial accounting - Role of accountant - Limitation of Financial Accounting.

MODULE II ACCOUNTING PRINCIPLES AND ACCOUNTING SYSTEMS 06

Accounting Principles - Accounting concepts and accounting conventions - Accounting systems - meaning of cash system of accounting and mercantile system of accounting - single entry system - Double entry system - meaning and advantages.

MODULE III ACCOUNTING PROCESS AND DEPRECIATION 12

Types of accounting, Debit and credit rules of accounting - accounting equation - Journal entries - Ledger - Trial balance - preparation of trial balance - Depreciation - meaning - need for providing depreciation.

MODULE IV FINANCIAL STATEMENT 07

Financial statement - meaning - advantage and limitations of financial statement - Preparation of trading account - Profit and loss account - balance sheet with adjustment. Revised Schedule VI of International Financial Reporting Standards (IFRS).

MODULE V CASH BOOK AND BANK RECONCILIATION STATEMENT 03

Cash book - meaning and preparation of cash book. Bank Reconciliation statement - meaning and importance of bank reconciliation - causes of difference - preparation of bank reconciliation statement.

Total Hours: 30

REFERENCES:

1. S.N.Maheshwari, “Accounting for Management”, Sultan Chand & Sons, New Delhi, 2009.
2. T.S Reddy and A. Murthy, ”Financial Accounting”, Margham Publications, Chennai, 2009.
3. KL Nagarajan, N. Vinayakam , PL. Mani, ”Principles of Accountancy,” S. Chand and Company Ltd, 2008.

OUTCOMES:

At the end of the course, the students will be able to:

- Maintain accounting records in a systematic manner
- Ascertain profit or loss of an organization by preparing trading and profit & loss account.
- Depict the financial position of an organization by preparing balance sheet
- Prepare cash books with single column and double columns.
- Set right the differences between cash book and pass book using bank reconciliation statement.

MSC 6107	COMPUTERS & BUSINESS APPLICATION LAB	L	T	P	C
		0	0	3	1

OBJECTIVES

The objectives of the course will be to enable the students to:

- Learn various methods of analyzing the business data for decision making
- Get acquainted with a working knowledge of Microsoft office Excel, SPSS and Google Apps.
- Be familiar on the techniques of presenting the analyzed data in a logical structure
- Acquire basic knowledge of working online using collaborative productivity tools
- Obtain up-to-date knowledge about scheduling and planning organizational routines.

LIST OF PRACTICAL EXERCISES

Exercise No.	Exercise Topic List (Excel, SPSS & Google Apps)
1	Creation of basic spreadsheet by entering text, numbers, and simple formulas
2	Keyboard shortcuts and paste special
3	Formatting of cells and columns (freeze and unfreezing, hide, merge)
4	Usage of functions to create a spreadsheet to perform "what if?" calculations
5	Creation of different types of charts
6	Sorting data and print portions of a worksheet
7	Special Formats and Exporting Exercise to word document
8	Demonstration of basic cost analysis using Excel
9	Linking worksheets into one and to link several worksheets to a master worksheet
10	Creation and analysis of Pivot table and chart
11	Steps in analysing data with SPSS: Organizing data, Stages in Data Analysis
12	Statistical Analysis Exercise to calculate descriptive statistics
13	Preparing Descriptive Statistics, Preparing graph of the data
14	Hypothesis Testing for a Single Population
15	Hypothesis Testing to compare Two Populations mean

Exercise No.	Exercise Topic List (Excel, SPSS & Google Apps)
16	Chi-square test for goodness of fit
17	Google Drive: Introduction to cloud tools
18	Google Docs – Translation and collaboration techniques: Creating resume using add-ons
19	Google Sheets – Accessibility, Permission setting, Clipboard exercises
20	Google Sheets – Protected ranges and sheets, Script editor and add-ons
21	Google Slides – Layout setting and inserting media
22	Google Forms – Creating a vacation responder form for RSVP
23	Google Calendar – Online and mobile app integration: Creating reminders and inviting people to events

Total Hours: 30

PEDAGOGY / METHODOLOGY FOR CLASS

This course is based on the lab sessions for all of the exercises (topics) listed above. Main pedagogy for this lab would be demonstration.

ASSESSMENT COMPONENTS / METHODS

1. Lab exercises
2. Maintenance of lab record (Duly printed and signed by faculty)
3. Mid trimester and end trimester exams

OUTCOMES

After studying the course, the students would:

- Apply the different methods of business analysis for any demanding situations in organizations
- Gain insight to capture and handle the business data in an efficient manner
- Make a better interpretation of the analysis results and present them using the latest technologies
- Use the various productivity apps for effective balancing of work routines and deadlines
- Access online collaborative working platforms with ease and understanding
- Utilize real-time synchronized data without data duplication

TRIMESTER II

MSC 6201	ORGANIZATIONAL BEHAVIOUR	L	T	P	C
		3	0	0	2

OBJECTIVES:

The specific objective of the course is to:

- Understand the basic concepts in the field of organizational behavior.
- Impart knowledge about individual, group and organization dynamics to facilitate suitable behavior manifestation
- Help imbibe OB implication in the management of human resources.
- Examine the shifting context of organizations

MODULE I INTRODUCTION TO ORGANIZATIONAL BEHAVIOUR 05

Definition - Evolution of Organization Behavior - Industrial Revolution, Scientific Management, Hawthorne Studies, Human Relations Movement, Scope, Challenges and Approaches to Organization Behaviour

MODULE II INDIVIDUAL BEHAVIOUR DIMENSION 06

Mars Model of Individual Behaviour-Personality: Theories - Perception: Meaning, Perceptual Process - Values: Types, Work Attitude - Learning: Meaning, Theories - Work Motivation: Job Enrichment, Job Design, Job Satisfaction, Relating Motivation Theory to Job and Personality Types

MODULE III GROUP BEHAVIOUR DIMENSION 07

Foundations of Group behaviour: Types of Group, Stages of Group Development, Group Values- Decision Making and Consensus Building: Decision Making Styles, Consensus Competencies, Empowered and Self-Managed Teams - Leadership: Concept, Theories, Styles - Conflict: Causes, Types, Conflict Management Styles

MODULE IV ORGANIZATIONAL DIMENSION 07

Organisational Structure: Determinants, Existing and Emerging Organizational Designs - Communication: Communication Effectiveness, Dynamics in Communication - Organisational Culture and Climate: Concept, Creating and Sustaining Culture, Categories of Organizational Climate-Organization Development: Reasons for Change, Resistance to Change, Change Process, Change Management Models-Lewin's three stage framework, Hussey's Easier

Approach to change management, Organization Development Intervention Techniques.

MODULE V THE CHANGING MILIEU OF ORGANIZATIONS 05

Changing Profiles of Employees and Customers, Globalization: Threats and Opportunities-Information Technology: Benefits and Limitation-Generation and Behaviour-Diversity: Bases of Diversity, Promoting Diversity-Concerns for OB: Employee Retention, Employee Engagement, Employee Productivity, Talent Management, Work-Life Stress, Social Responsibility and Ethics: Competitive Strategy and CSR

Total Hours: 30

REFERENCES:

1. Stephen P. Robbins and Timothy A. Judge. Organizational Behaviour, 15th Edition, New Delhi: Pearson, 2013.
2. Fred Luthans, Organizational Behavior, An Evidence Based Approach, 12th Edition, New Delhi: McGraw Hill Education, 2013.
3. Udai Pareek. Understanding Organizational Behaviour, 3rd Edition, New Delhi: Oxford University Press, 2011.
4. Mirza S. Saiyadain (Editor). Organizational Behaviour, New Delhi: Tata McGraw Hill, 2010.

OUTCOMES:

The students will be able to

5. apply various approaches of organisational behaviour in handling different behaviour situations in organisations.
6. understand clearly their own personality dimensions and that of other individuals and fine tune on theirs.
7. adapt to different work environment. Will help them to synergize their team spirit. It would also help them in managing conflicts.
8. The course would facilitate the students to communicate effectively in organisations. Understand the need for change and cope up intellectually with continuous changes.
9. It would facilitate application of their OB knowledge in the management of recent issues, problems and challenges related to people, organisation and behaviour.

MSC 6202 LEGAL ASPECTS OF BUSINESS

L	T	P	C
3	0	0	2

OBJECTIVES:

The objectives of the course is to create an awareness in the students about

- The various acts relating to Indian contract, agency, sale of goods & negotiable instruments
- Important provisions in Company law and industrial law
- Various acts under industrial law
- Consumer protection act, Cyber laws and Right to information act

MODULE I MERCANTILE AND COMMERCIAL LAW 17

The Indian Contract Act 1872 - Contract - Meaning and Essentials - Classification of contracts - Essential elements of contract - Performance of contracts - Quasi contracts - Breach of contract and its remedies Agency - Nature of agency - How created, Agent's authority and liability of principal and third party: Rights and duties of principal, agents and Third party, liability of principal or agents, termination of agency.

The Sale of Goods Act 1930 - Sales contract - Transfer of title and risk of loss - conditions and Warranties - Performance of sales contracts - Rights of an unpaid seller.

Negotiable instruments Act 1881- Nature and requisites of negotiable instruments - Transfer of negotiable instruments and liability of parties, enforcement of secondary liability, holder in due course - Crossing of cheques - Discharge of negotiable instruments.

MODULE II COMPANY LAW 05

Major principles - Nature and types of companies, Formation, Memorandum and Articles of Association, Prospectus, Power, duties and liabilities of Directors, winding up of companies, Corporate Governance.

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MODULE III INDUSTRIAL LAW 02

Overview of Factories act – Payment of Wages Act – Payment of Bonus Act – Industrial Disputes act - Workmen compensation act.

MODULE IV CONSUMER PROTECTION ACT-19860 02

Rights of Consumer - Complaint - Procedure for filing Complaint - Remedial process.

MODULE V INFORMATION TECHNOLOGY ACT 2002 & RIGHT TO INFORMATION ACT 04

Important Provisions of Cyber Laws – Remedies - Important Provisions of Right to Information Act

Total Hours: 30

REFERENCES:

1. Kapoor N. D., “Elements of mercantile law”, Sultan Chand and company, New Delhi, 2007.
2. Kapoor N. D., “Business Law”, Sultan Chand and Company, New Delhi, 2011.
3. Pillai, R. S. N and Bagavathi, “Legal Aspects of Business”, S. Chand and Company Ltd., New Delhi, 2011.

OUTCOMES:

On successful completion of the course, the student would:

- Analyze various cases relating to contracts of sale & agency to take suitable decisions.
- Realize the practical implications of using negotiable instruments.
- Differentiate various forms of company & its related provisions.
- Identify, differentiate and apply suitably under various acts of industrial law.
- Understand the importance of powerful tools such RTI, IT act and Consumer protection act and apply in appropriate situations.

MSC 6203 ECONOMIC ENVIRONMENT OF BUSINESS

L	T	P	C
3	0	0	2

OBJECTIVES:

The objectives of the course are to:

- Provide the students with a fundamental knowledge of the macro-economic issues on the basis of which policy decisions can be analysed and business decisions can be made
- Make students acquainted with emerging issues of business at national and international level in view of new economic policies especially under privatization liberalization and globalization.
- Exposes students to an overview of an exchange based economy and draws out the relationship between crucial macroeconomic variables like level of income, employment, money supply, inflation, growth, investment, forex etc.
- Provide a comprehension of changing business environment resulting from monetary and fiscal policies and different economic policies introduced by the government
- Facilitate students to understand and analyse the effects of recent macro economic events and financial crises impacted the economy locally and globally

MODULE I BUSINESS ENVIRONMENT 06

Introduction, Economic and Non - Economic Environment, External Macro Environment - Social, Political, Legal, Technological, Demographic, Natural and Ecological Environment. Internal Environment.

MODULE II CIRCULAR FLOW OF INCOME AND NATIOANAL INCOME 06

Circular flow of Income: Meaning, Concepts of National Income: GNP, GDP, NNP, National Income, Personal Income and Disposable Income, Per Capita Income. Nominal GDP Vs Real GDP, Market Price Vs Factor Cost, Measurement of National Income: Value added Method, Income Method, and Expenditure Method. Growth and Development - Human Development Index (HDI).

MODULE III DEMAND FOR AND SUPPLY OF MONEY 06

Concept of Money Supply and its measurement - Measures of Money Supply - M0, M1, M2, M3, and M4. Factors determining Money Supply: RBI'S Analysis. An Overview of the functions of Central Bank and Commercial Banks.

MODULE IV UNEMPLOYMENT AND INFLATION 06

Unemployment - Measurement and Interpretation. Business Cycle - phases and features. Inflation - Meaning, characteristics, types, effects and anti-inflationary measures. Fiscal and Monetary Measures, Measurement of Inflation: Price Indices - WPI, CPI etc., Public Deficit: Various Concepts, Deficit Financing, Taxation and Subsidies: Types and its effects.

MODULE V EXTERNAL SECTOR 06

Balance of Payment, Its Constituents (Current A/c & Capital A/c), Foreign Exchange Market and Exchange Rate, Financial System: Crisis and Reform**.**

Total Hours: 30

REFERENCES:

1. C. Rangarajan and B.H.Dholakia, “Principles of Macroeconomics”, McGraw Hill, 2012, 38th Edition.
2. D. N. Dwivedi, “Macroeconomics Theory and Policy”, McGraw Hill, 2012, 6th Edition.
3. Pailwar and Veena Keshav, “Environment of Business”, 3rd Edition, PHI Learning, New Delhi, 2012.
4. H. L. Ahuja, “Economic Environment of Business” (Macro Eco.Analysis), 7th Edition, S. Chand Publishing, New Delhi.
5. Justin Paul and Parul Gupta, “Economic Environment and Policies for Business”, Tata McGraw Hill.

OUTCOMES:

Students will be able to:

- Demonstrate an advance understanding of major macro economic aspects like national income, money supply, employment etc to appreciate and analyze functioning of economy
- To acquaint with application of macro-economic principles to appreciate internal and external factors affecting business
- Understand various dimensions of macro economic variables in analyzing effects on business
- Critically analyze and interpret current events relating to globalization and international business and particularly impact of liberalization and privatization producing challenge to local economy and businesses.

- Explain as how economic, political, social and other issues impact business and how RBI and government decision with respect to monetary and fiscal policy greatly affect the business

MSC 6204 QUANTITATIVE METHODS IN BUSINESS - II

L	T	P	C
3	0	0	2

OBJECTIVES:

The objectives of the course would be to make the students

- Learn to formulate Linear Programming Problem to optimize cost and profit in a constrained environment
- Learn to optimize cost and profit with respect to transportation and resource allocation business situations
- Familiar with different types of business environment and the appropriate technique to be used for decision making
- Aware of a project environment and learn the techniques of project management
- Gain knowledge on job sequencing and equipment replacement models for decision making

MODULE I INTRODUCTION TO OPERATIONS RESEARCH AND LINEAR PROGRAMMING (LP) 06

Introduction to Applications of Operations Research in Functional Areas of Management - Linear Programming Formulation - Solution by Graphical Method - Solution by Simplex Method

MODULE II TRANSPORTATION AND ASSIGNMENT PROBLEM 06

Transportation Problem (Minimizing and Maximizing Cases) - Formulation - Balanced and Unbalanced Cases - Initial Basic Feasible Solution by N-W Corner Rule, Least Cost and Vogel's Approximation Method - Check for Optimality - Solution by MODI Method - Assignment Problem (Minimizing and Maximizing Cases) - Formulation - Balanced and Unbalanced Cases - Solution by Hungarian Method - Traveling Salesman Problem

MODULE III DECISION THEORY AND QUEUING THEORY 06

Decision Making under Risk - Decision Making under Uncertainty - Decision Tree Analysis - Queuing System - Single Server Model problems

MODULE IV PROJECT MANAGEMENT 06

Network construction - PERT - CPM - Computation of project completion time - Critical path - Floats.

MODULE V JOB SEQUENCING AND REPLACEMENT MODELS 06

Job sequencing: Problems using Johnson's algorithm (n-jobs 2-machines, n-jobs 3 -machines, n-jobs m-machines and 2-jobs n-machines) - Replacement Models -Individual Replacement Model - Group Replacement Model.

Total Hours: 30

REFERENCES:

1. Sharma, J.K. "Operations Research", Macmillan India, 3rd Edition, New Delhi, 2011
2. Hamdy. A. Taha. "Operations Research: An Introduction", Pearson Education, 9th Edition, New Delhi, 2014.
3. Natarajan, A. M. "Operations Research", Pearson Education, 2nd Edition, New Delhi.

OUTCOMES:

On completion of the course, the students will be able to:

- Formulate Linear Programming Problem to optimize cost and profit in a constrained business environment
- Optimize cost and profit with respect to transportation and resource allocation in business environment
- Appreciate different types of decision-making environment and apply relevant OR technique for effective decision making
- Estimate the project completion time for various projects by applying CPM and PERT techniques
- Make decisions regarding sequencing jobs and replacing equipments based on time and cost

MSC 6205 MANAGEMENT AND COST ACCOUNTING

L	T	P	C
3	0	0	2

OBJECTIVES:

- To understand the functions of management accounting and cost accounting
- To analyse the company's performance using Ratio analysis, fund flow and cash flow statements.
- To prepare different types of Budgets
- To plan the profit
- To know the recent developments in management and cost accounting

MODULE I INTRODUCTION 03

Management Accounting - meaning - functions - scope and limitations of Management accounting . Cost Accounting - Meaning , importance and limitations of cost accounting. Differences among Management accounting, Cost accounting and Financial accounting.

MODULE II RATIO ANALYSIS, FUND FLOW AND CASH FLOW STATEMENT 08

Ratio analysis - meaning, managerial uses, classification and limitations of ratios. Calculation of liquidity, profitability, turn over ratios. Fund flow and Cash flow statement - Need, importance, and difference between Fund flow and Cash flow statement.

MODULE III BUDGETARY CONTROL 06

Budgetary control - Need, importance, limitations and successful implementation of budgetary control. Classification of budget - preparation of Fixed and Flexible budget. Zero base budgeting - uses and limitations.

MODULE IV MARGINAL COSTING AND PROFIT PLANNING 09

Marginal Costing - Meaning, importance and applications of Marginal costing. Break Even Point Analysis - Meaning, assumptions and limitations.

MODULE V RECENT DEVELOPMENTS IN MANAGEMENT & COST ACCOUNTING 04

Recent developments in Management and Cost accounting (Theory only): Introduction to Inflation Accounting, Human Resource Accounting, Responsibility Accounting, Activity Based Costing and Target Costing.

Total Hours: 30

REFERENCES:

1. M.A.Sahaf, “Management Accounting”, Vikas Publishing House Pvt.Ltd.,New Delhi, 2010.
2. S.K.Maheshwari and S.N.Maheshwari, “A textbook of accounting for management”, Vikas Publishing House Pvt. Ltd., New Delhi, 2009.
3. Colin Drury, “Cost and Management Accounting”, Cengage Learning India Pvt.Ltd., New Delhi, 2012.

OUTCOMES:

At the end of the course, the students will be able to:

- Identify the role of management accounting and cost accounting
- Analyse the company’s performance using Ratio analysis, fund flow and cash flow statements.
- Prepare different types of Budgets
- Plan the profit for the organisation
- Distinguish the different costing methods

MSC 6206 MARKETING MANAGEMENT – I

L	T	P	C
3	0	0	2

OBJECTIVES:

The objectives of the course would be to make the students

- Familiarize with the fundamentals and core concepts of marketing
- Know about consumers and the factors that has an impact on their purchasing behaviour
- Gain insight into consumer decision making process and models
- Learn the bases of market segmentation
- Identify the strategies of differentiation, targeting and positioning

MODULE I INTRODUCTION 06

Marketing: definition, evolution, concepts, values, process, organization structure - Marketing mix for products and services - Impact of business environment on marketing. Recent trends in marketing: Online marketing / web enabled marketing, digital marketing, B2B and B2C marketing, relationship marketing, Marketing ethics

MODULE II CONSUMER AS AN INDIVIDUAL 06

Definition and purpose of Consumer behaviour studies-Consumer needs and motivation: nature- types- applications; Personality and CB - Consumer diversity - Consumer Perception theories and application to CB -Theories of learning and application - Basic CB models of attitude - Attitude change.

MODULE III CONSUMER DECISION PROCESS & POST-PURCHASE BEHAVIOUR 06

Innovation diffusion - Consumer decision making process - Models of consumer decision process: Shiffman, Howard-Sheth and Engel-Kollat-Blackwell models - Post-purchase behaviour - Consumer dissonance.

MODULE IV MARKET SEGMENTATION 06

Segmentation: Objectives, approaches, Bases - Characteristics of effective segmentation - Patterns of segmentation - Market segmentation procedure - Requirements for effective segmentation.

MODULE V DIFFERENTIATING - TARGETING- POSITIONING 06

Differentiating market offerings- Purposes- Tools for competitive differentiation- Types and number of differences to promote; Market Targeting- Factors for

evaluating and selecting market segments for targeting; Product positioning- Purposes- Principles - Positioning strategies - Perceptual mapping.

Total Hours: 30

REFERENCES:

1. Philip Kotler, “Marketing Management”, Prentice Hall of India P. (Ltd.), New Delhi, 2012.
2. William J. Stanton, “Marketing Management”, McGraw Hill Publishing, 1992.
3. M.Govindarajan, “Marketing Management” Prentice Hall of India, New Delhi 2014.
4. Rajan Sexena, “Marketing Management”, Himalaya Publishing House, New Delhi 2007.
5. V.S.Ramaswamy and S. Namakumari, "Marketing Management", 3rd Edition, Macmillan, New Delhi, 2011.
6. Leon G. Schiffman and Leslie Lazar Kanuk, “Consumer Behaviour”, Pearson Education, New Delhi, 2002.

OUTCOMES:

On successfully completing this program the student will be able to:

- Recognize and apply the knowledge of marketing concepts
- Analyze the dynamics of consumer behavior and the impact of various factors
- Identify the phases in consumer decision- making process and buying behaviour
- Choose the right base for segmenting a market
- Design strategies to differentiate, target and position the products

MSC 6207	WRITTEN ANALYSIS & COMMUNICATION	L	T	P	C
		0	0	3	1

OBJECTIVES:

The course would help the students to:

- Understand the contents of the given case
- Analyse the situations in the case
- Identify solution / decision to be taken

LIST OF EXERCISES:

1. Training the students on the following nine steps of problem solving and decision making:
    - Identification of problem
    - Establishment of problem
    - Development of objectives
    - Identification of alternative solutions
    - Determination of various criteria
    - Evaluation of all the alternatives against all the criteria
    - Ranking of the evaluated alternatives
    - Decision based on the alternatives
    - Developing contingency plan
2. After learning the above steps, giving exercises on:
    - general mini-cases
    - functional area based mini-cases
    - integrated functional area mini-cases

Total periods: 30

PEDAGOGY / METHODOLOGY FOR CLASS

1) Lectures
2) Participative learning
3) Guided training
4) Group Discussion

ASSESSMENT COMPONENTS / METHODS

Assessment pattern would be based on the following components:

1) Quality of analysis
2) Students' Participation
3) Timely submission

4) Attendance, etc.

OUTCOMES:

Students who complete this course will be able to:

- Analyze live situations as and when they would face in their organizations
- Start using the case tactic tools for efficient management
- Take an appropriate decisions for any given organizational situation / problem
- Be equipped to relate the successive cases with business practices
- Be familiar with the function of management and apply the same in their Business.
- Think systematically and logically develop alternative solutions

MSC 6208	CURRENT AFFAIRS IN BUSINESS	L	T	P	C
		0	0	3	1

OBJECTIVES:

The objectives of this lab course would be to:

- Enable the students get familiarized with the trends and developments in the business world
- Make them understand the drivers of changes in business scenario
- Provide opportunity to get knowledge on local, national and international environment of business
- Make the students role of government and society in business

LIST OF EXERCISES:

1. Industry profile
   (e.g., Automobiles, Textiles, Information Technology, Retailing, Banking, Manufacturing, Telecom, etc.) For such industries:
2. Company Locations
3. CEOs / Boards of various Companies
4. Entry / Exit of Companies
5. Mergers, Acquisitions, Take-Overs, etc.
6. Products / brands launched by companies
7. Successful Entrepreneurs
8. Government Policies, Regulations and Impact on Business
9. Inflation / Deflation
10. Stock Market
11. Comparison of Global and National Business Scenario
12. Financial Institutions & Regulatory Bodies

Total periods: 30

PEDAGOGY / METHODOLOGY FOR CLASS

A suitable mix of the following:

1) Participative learning
2) Guided training
3) Group Discussion
4) Presentation

(Throughout this course students will keep them updated with business affairs appearing in sources such as: newspapers, business magazines, television

channels, etc. This means that the students need to make it a habit to read the newspaper on daily basis and search the archives as well)

ASSESSMENT COMPONENTS / METHODS

Assessment pattern would be based on the following components:

1) Quality of presentation
2) Students' participation
3) Timely submission of presentation material
4) Quiz
5) Assignment
6) Attendance, etc.

OUTCOMES:

Students who complete this course would:

- Have updated knowledge on business affairs in a variety of industries
- Be able to analyse the dynamics of happenings in companies and business environment
- Be equipped to relate the current business practices with the subsequent courses offered in the degree programme
- appreciate the knowledge of current affairs in managing Enterprises
- Assess the different issues in business to reduce the impact in business
- Comprehend the impact of government and society on business

TRIMESTER III

MSC 6301	MANAGEMENT INFORMATION SYSTEMS	L	T	P	C
		3	0	0	2

OBJECTIVES:

The objectives of the course will be to enable the students to:

- Learn the concept of IS and their functionality in a business enterprise
- Know the need for an IS framework and its importance as a survival tool
- Acquire insight about e-commerce, M-commerce (Apps and service providers)
- Build up knowledge about the various structured methodologies which are used for planning, system design and development
- Familiarize with managing the workings of a digital firm

MODULE I INFORMATION SYSTEMS IN BUSINESS 06

Definition, Introduction to Information and Business Intelligence, Personal and Organizational Dimensions of Information – IT as A Key Resource in Business – Computer Hardware and Software - Categories of Computers by Size – Intellectual and Physical Interfaces – Porter's Five Forces Model – The Value Chain – SCM, CRM and BI.

MODULE II INTERNET TECHNOLOGIES, DATABASE MANAGEMENT SYSTEM 06

Introduction to World Wide Web, Websites, Addresses and Pages – Using Web Browser Software – Search Engines – Internet Technologies – Communications Software – The Relational Database Model – Database Management System Tools – Data Warehouses – Data Mining – Ownership over Information – Clean Data Vs Dirty Data.

MODULE III ARTIFICIAL INTELLIGENCE AND DECISION SUPPORT SYSTEM 06

Decision Support System – Components of Decision Support System – Geographical Information Systems - Artificial Intelligence – Expert Systems – Neural Networks – Fuzzy Logic – Genetic Algorithms – Intelligent Agents – Multi-Agent Systems and Agent Based Modelling.

MODULE IV THREATS TO INTELLECTUAL PROPERTY AND COMPUTER CRIME 06

Introduction to Identity Theft – Guidelines for Ethical Computer System Usage – Intellectual Property Threats – Cyber Crime Laws and Security Guidelines – Precautions On Data Protection – Computer Crime – Computer Forensics – Methods of Hiding Data Recovery and Interpretation.

MODULE V EMERGING TRENDS IN TECHNOLOGY FOR MANAGEMENT 06

Introduction to SaaS – Cloud Computing – IT Personalization Management – VoIP – Automatic Speech Recognition – Virtual Reality – CAVE – Biometrics – Digital Cash - Wearable Technology – Multi – Sate CPU's – Holographic Storage Devices – RFID – Ethics and Privacy Concerns in IT.

Total Hours: 30

REFERENCES:

1. Stephen Haag, Maeve Cummings, Amy Philips, 'Management Information Systems for the InformationAge' McGrawHill Education, 6th Indian edition
2. James A O'Brien, George M Marakas and Ramesh Behl, 'Management Information Systems' McGraw Hill Education, 10th Indian edition.
3. Kenneth C. Laudon and Jane Price Laudon, 'Management Information Systems Managing the digital firm', Pearson Education Asia, 2007
4. James AN O' Brien, 'Management Information Systems', Tata McGraw Hill, New Delhi, 2008.

OUTCOMES

After studying the course, the students would:

- Comprehend the latest technologies in IS (Information Systems) and relate their impact in organization
- Start using the various IS tools for efficient management
- Gain advantage of utilizing the mobile and android wear apps for scheduling
- Improve on using cyber security measures to avoid data theft and detection
- Utilize the recent developments in the field of system analysis, design and development such as agile development
- Use latest trends in digital enterprise management such as SCRUM

MSC 6302 FINANCIAL MANAGEMENT

L	T	P	C
3	0	0	2

OBJECTIVES:

The objectives of the course are to enable the students to:

- Understand the functions of financial management
- Know the concept of Time value of money and its impact in investment decision using Capital budgeting techniques
- Understand and apply the methods of finding costs involved in different sources of financing
- Understand and apply the concept of leverage on Earnings per share
- Provide an overview of Working capital management and its components

MODULE I INTRODUCTION 04

Financial Management - meaning, definition, objectives, scope and functions. Overview of Islamic Finance, Financial System, Sources of financing.

MODULE II INVESTMENT DECISIONS 09

Time value of money, Capital budgeting - Meaning and importance. Capital budgeting techniques - Pay Back Period , Accounting Rate of Return , Net Present Value , Internal Rate of Return and Profitability Index method. Capital Rationing.

MODULE III FINANCING DECISIONS - COST OF CAPITAL 08

Cost of capital - meaning and importance . Cost of capital - Equity, preference , debt (before tax and after tax) , retained earnings , weighted average cost of capital (book value and market value as weights).

MODULE IV LEVERAGES 05

Leverages - EBIT-EPS Calculation for different capital structure - operating, financial and combined leverages.

MODULE V LIQUIDITY DECISIONS 04

Working capital management - meaning, concepts, need for working capital, determinants of working capital. Cash management - meaning of cash, motives for holding cash. Meaning and importance of receivables management and Inventory management.

Total Hours: 30

REFERENCES:

1. Shashi K.Gupta and R.K.Sharma, “Financial Management-Theory and Practice”, Kalyani publishers, 8th revised edition, 2014.
2. S.N.Maheshwari, “Financial Management - Principles and Practice,” Sultan Chand and Sons, 14th revised edition, 2011.
3. I M Pandy, “Financial Management”, Vikas Publication House, 10th edition, 2010.
4. Prasanna Chandra, “Financial Management - Theory and practice,” Tata Mc Graw Hill Education Pvt. Ltd., 8th edition,2011.
5. M Y. Khan and P.K Jain, “Financial Management - Text, Problems and Cases,” Tata Mc Graw Hill Education Pvt. Ltd., 3rd reprint, 2012.

OUTCOMES:

At the end of the course, the students would be able to:

- Understand the functions of financial management and apply the same in their work spot.
- Apply the concept of Time value of money in Capital budgeting decisions and evaluate different projects using techniques of capital budgeting.
- Assess the cost of different sources of financing to minimize the cost involved in raising capital.
- Find the impact of leverage on Earnings per share
- Manage working capital of the business .

MSC 6303 MARKETING MANAGEMENT – II

L	T	P	C
3	0	0	2

OBJECTIVES:

The objectives of the course would be to make the students

- Provide conceptual insight into the elements of marketing mix
- Gain knowledge about the various concepts related to product and pricing
- Know about the distribution channels and their importance
- Learn about the promotional mix tools
- Familiar with the marketing strategies related to the 4Ps and competition

MODULE I PRODUCT & PRICING 06

Elements of marketing mix - Product: definition, levels, hierarchy, systems & mix, map - Product line decisions - New product development stages – Product planning - Product life cycle and Strategies - Packaging - labeling - branding: types of brands - Pricing: objectives, strategies, methods.

MODULE II PLACE (DISTRIBUTION) 06

Marketing channel: importance, functions, flows, levels, characteristics - Selection, design and management of channel members.

MODULE III PROMOTION 06

Promotion Mix: elements / promotion tools - integrated communication model - Communication process - Steps in developing effective communication - Setting promotion budget and promotion mix - Basics of advertising, sales promotion, personal selling and public relations.

MODULE IV STRATEGIC MARKETING 06

Plan, strategy and Tactics- strategic marketing and marketing management- Product- market strategies: Ansoff's Matrix -Ten principles of strategy- Michael Porter's generic strategies.

MODULE V COMPETITIVE MARKETING STRATEGIES 06

Competitive Marketing Strategies: strategies for market leader, challenger,follower and niche markets - Designing and Selecting Strategies - Porter'sfive forces theory for competition analysis - Market entry and withdrawal strategies.

Total Hours: 30

REFERENCES:

1. Philip Kotler, “Marketing Management”, Prentice Hall of India P. (Ltd.), New Delhi, 2012.
2. A. Nag, “Strategic Marketing”, Macmillan India limited, 2008.
3. S. A. Sherlekar, “Marketing Management” Himalaya Publishing House, New Delhi, 2007.
4. Rajan Sexena, “Marketing Management”, Himalaya Publishing House, New Delhi, 2007.
5. V.S. Ramaswamy and S. Namakumari, "Marketing Management", 3rd Edition, Macmillan, New Delhi, 2011.

OUTCOMES:

On successfully completing this program the student will be able to:

- Identify products and services suitable to target markets
- Choose appropriate pricing techniques
- Suggest channels for distribution of the products
- Decide promotional tool mix for various products/organizations
- Design marketing mix strategies for various competitive situations

MSC 6304 HUMAN RESOURCES MANAGEMENT

L	T	P	C
3	0	0	2

OBJECTIVES:

The specific objective of the course is to:

- Provide knowledge about the basic fundamentals of HRM.
- Discuss the various functional components of HRM
- Facilitate awareness building on Economics of Human Resources and HRP
- Stay updated with the contemporary practices in HRM.

MODULE I FUNDAMENTALS OF HRM AND HRIS 06

HRM: Evolution of HRM, Differences between HRM and Human Resource Development, Objectives and Scope of HRM, Functions of Human Resource Manager, HR Model by David Ulrich, Human Resource Information System

MODULE II ECONOMICS OF HUMAN RESOURCES AND HRP 06

Demand and Supply of Labour, Labour Market Equilibrium: Wage determination, Investment in Human Capital, Employment Contracts, Labour Unions and Collective Action, Labour Mobility, Discrimination in the Labour Market. Human Resource Planning: Objective, Process, Factors affecting HRP, Job analysis, HRP Models, HR Forecasting Methods.

MODULE III RECRUITMENT AND SELECTION 06

Difference between Recruitment and Selection, Selection Process, Types of Selection Test, Recruitment Source, Constraint on Recruitment Efforts- Recruitment Alternatives: Temporary Help Service, Employee Leasing, Independent Contractors, Placement, Induction and Socialization

MODULE IV PERFORMACE APPRAISAL AND TRAINING 06

Performance Appraisal: Definition, Performance Appraisal Process, Methods, Differences between Performance Appraisal and Performance Management, Performance Appraisal Benefits, Appraisal Errors, Appraisal Outcome- Training: Definition, Benefits of Training, On the Job and Off the Job Training Methods

MODULE V THE CONTEMPORARY PRACTICES IN HRM 06

Compensation and Reward Management, Performance-Related Pay, Competency Mapping, Balance Score Card, Knowledge Transfer, Work-Life Mentoring,

Employer Branding, Talent Management: Process, lifecycle, Talent planning, acquisition, engagement and retention. Talent poaching.

Total Hours: 30

REFERENCES:

1. Gary Dessler, “Human Resource Management”, 14th Edition, New Delhi: Prentice Hall, 2014.
2. David A. DeCenzo and Stephen P. Robbins. “Human Resource Management”, 11th Edition, New York: John Wiley and Sons, 2013.
3. Seema Sanghi. “Human Resource Management”, New Delhi: Macmillan, 2012.
4. Aswathappa K. “Human Resource and Personnel Management”, 6th Edition, New Delhi: Tata Mc Graw, 2011.
5. Saiyadain, M.S. “Human Resource Management”, 4th edition, New Delhi: Tata McGraw Hill, 2009.

OUTCOMES:

The students would be able to

- match roles and responsibilities associated with different functional areas of HRM.
- develop HR Policies and carry out Human Resources Planning effectively in organisations.
- suggest suitable recruitment and selection methods for the organisations
- develop simple performance appraisal templates for appraising employees performance and design appropriate training program modules for different jobs..
- participate in discussions confidently.

MSC 6305	PRODUCTION AND OPERATIONS MANAGEMENT	L	T	P	C
		3	0	0	2

OBJECTIVES:

The objectives of the course would be to make the students

- Learn the concepts of Production and Operations Management and other contemporary issues
- Gain knowledge on location and layout decisions, and demand forecasting.
- Gain insight into Production Planning and Control and Maintenance Management
- Get acquainted with work study procedure
- Learn the techniques of materials management and inventory control

MODULE I INTRODUCTION 04

Production Management: Definition - Production System -Production and Operations Management: Characteristics of modern production and operations function - Recent trends - Elements of operations strategies - Building operations strategies on competitive priorities.

MODULE II LOCATION, LAYOUT AND FORECASTING 07

Capacity Planning - Types of capacity - Forecasting - Qualitative and Quantitative - Facility Location: Steps - Factors to be considered - Problem on Break-Even Analysis for single plant location - Plant layout: Principles of good lay out - Factors to be considered - Types of Lay out - merits and demerits

MODULE III PRODUCTION PLANNING AND CONTROL 06

Aggregate Planning - Master Production Schedule - Materials Requirement Planning (MRP) - Resource requirement planning - shop floor planning - routing - dispatching -loading - scheduling - progress reporting - expediting - Maintenance Management: Objectives - Meaning and Characteristics of various types of maintenance - Preventive Vs. Breakdown maintenance

MODULE IV DESIGN OF WORK SYSTEMS 06

Work Study: Method study - Objectives - Steps (brief theory only) - Principles of Motion Economy -Work Measurement - Time study: Objectives - Stop Watch Method of Time Study - Problems on Standard Time Calculation

MODULE V INVENTORY MANAGEMENT AND CONTROL 07

Materials Management - Objectives - Sub-functions - Types of Inventory - Need for Inventory - Inventory Costs - Economic Order Quantity (EOQ) - Basic Inventory Models (problems on purchase and manufacturing models - without shortage) - Reorder level - Safety Stock - Selective Inventory Control - ABC Analysis

Total Hours: 30

REFERENCES:

1. Panneerselvam, R. “Production and Operations Management”, Prentice Hall of India, 3rd Edition, New Delhi, 2012.
2. Gaither Norman. “Operations Management : Concepts, Techniques & Applications”, Cengage Learning, 9th Edition, New Delhi, 2002.
3. Aswathappa, K. and Shridhara Bhat, K. “Production and Operations Management”, Himalaya Publishing House, 2nd Edition, 2011.

OUTCOMES:

After completing the course, the students will be able to:

- Appreciate basic production and operation management concepts
- Forecast demand and make better location and layout decisions
- Plan and control production and maintenance in an organization
- Standardize jobs by applying work study procedure.
- Manage materials flow and inventory in an organization

MSC 6306	RESEARCH METHODOLOGY FOR MANAGEMENT	L	T	P	C
		3	0	0	2

OBJECTIVES:

- To acquaint the students with research, its terminologies and its process.
- To introduce research designs and types best suited for investigating different types of research problems
- To familiarize with the issues and trends in business research with practical inputs.
  To inculcate positive attitude and sprit toward the research

MODULE I INTRODUCTION TO RESEARCH 06

Meaning of Business research - Objectives of research - Types of research and research process - An overview of Formulation of Research Problem, Theoretical frame work and Hypotheses development

MODULE II RESEARCH DESIGN 06

Research design - Introduction - Types of research design - Sampling - Sample size -Probability and non probability sampling.

MODULE III DATA AND METHOD OF DATA COLLECTION 06

Introduction - Primary and secondary - Primary data source and secondary data source-Collection and preparation of data - Questionnaire and interview methods and guidelines for constructing a questionnaire.

MODULE IV DATA PROCESSING AND ANALYSIS 06

Preparation of data - Editing - Coding - Validation - Presentation of data and basic analysis of data.

MODULE V RESEARCH REPORT 06

Introduction to report writing - Format of report writing - Classification of the section of report.

Total Hours: 30

REFERENCES:

1. Donald R. Cooper, Pamela S. Schindler and J. K. Sharma, “Business Research Methods”, 11th Edition, Tata Mc Graw Hill, New Delhi, 2012.

2. Alan Bryman and Emma Bell, “Business Research Methods”, 3rd Edition, Oxford University Press, New Delhi, 2011.
3. Uma Sekaran and Roger Bougie, “Research Methods for Business”, 5th Edition, Wiley India, New Delhi, 2012.
4. William G. Zikmund, Barry J. Babin, Jon C.Carr, Atanu Adhikari and Mitch Griffin, “Business Research Methods, A South Asian Perspective”, 8th Edition, Cengage Learning, New Delhi, 2012.
5. T. N. Srivastava and Shailaja Rego, “Business Research Methodology”, 2nd Edition, Tata McGraw Hill, New Delhi, 2011.

OUTCOMES:

On completion of the course the students will be able to:

- comprehend the research context with theoretical frame work and Hypotheses
- design a research proposal
- prepare and perform research surveys and collect data
  Perform suitable data anlysis
  write a research report.

MSC 6307	PSYCHOMETRICS & CORPORATE CONNECT LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To bring about holistic transformation in a student.
- To equip them for campus placement
- To hone their human skills for effective corporate adaptability
- To facilitate smooth balancing of Professional and Personal Life.

LIST OF EXERCISES ON:

1. Self-Introspection
2. Barriers and Filters of Communication
3. Managing Emotions
4. Developing Assertiveness and Self-Confidence
5. Team Work and Team Styles
6. Yoga and Meditation
7. Corporate Dressing and Grooming
8. Personality Types and Positive Attitude
9. Stress Interview
10. Time Management

Total periods: 30

PEDAGOGY / METHODOLOGY FOR CLASS

1. Debates/Discussions
2. Games and Activity.
3. Role Play
4. Case study
5. Psychometric Tests
6. Brain Storming
7. Demonstrations
8. Documentary Videos

ASSESSMENT COMPONENTS / METHODS

1. Review of exercises
2. Quiz/Puzzles
3. Interview
4. Observation

OUTCOMES:

Students who complete this course will be able to:

- Face campus interview more confidently
- Adapt to corporate expectations
- Handle difficult people and situations
- Manage their emotions and display appropriate behavior
- Handle stressful situations in personal and professional life .

MSC 6308 DATA ANALYSIS LAB

L	T	P	C
0	0	3	1

OBJECTIVES:

- To read and do statistical analysis in time series data
- To build statistical models in time series data
- To statistically analyze the relations among time series data

LIST OF EXERCISES:

1. Descriptive data analysis and interpretations
2. Test for stationarity and interpretations
3. Estimating a regression model and interpretations
4. Test for long run relationship and interpretations
5. Test for short run relationship and interpretations

Total periods: 30

PEDAGOGY / METHODOLOGY FOR CLASS

i. Related theory and reason behind the exercise
ii. Hands on demo and practice in the lab

ASSESSMENT COMPONENTS / METHODS

i. Report on the day's exercise and practice exercise
ii. End term practical exam

OUTCOMES:

Students who complete this course will be able to:

- describe the time series data
- check whether the data is suitable for doing time series analysis
- Identify the Short term relationship between various time series data
- Identify the long term relationship between various time series data
- Verify the goodness of fit in a model

MSC 7101 INTERNATIONAL BUSINESS MANAGEMENT

L	T	P	C
2	0	0	1

OBJECTIVES:

The objectives of the course would be

- To give an indication of Stages of Internationalization of Business and modes of entry
- To be familiar with the challenges of Global Sourcing in international Business
- To endow with knowledge on export, import procedure and documentation

MODULE I INTRODUCTION TO INTERNATIONAL BUSINESS 05

International Business - Reason for going Global, Entry and Stages of Internationalization of Business - Global Challenges- international business environment – An overview of GATT, WTO, IMF and World Bank.

MODULE II GLOBAL BUSINESS AND SOURCING STRATEGIES 05

Introduction to Global sourcing - sourcing strategies – sourcing structure - Need for global competitiveness – Regional and global trade block - Challenges for global business

MODULE III EXPORT, IMPORT PROCEDURE AND DOCUMENTATION 05

Export-Import Transaction-Documentation, shipping and incoterms, Methods of payments in exporting & importing, cost and sources of Export-Import Financing, Export Promotion Schemes.

Total Hours: 15

REFERENCES:

1. P. Subba Rao, “International Business Text and Cases”, 3rd revised enlarged edition, Himalaya Publishing House, Mumbai, 2013.
2. S.Tamer and Gary Knight, “International Business”, First edition, Pearson India 2009.
3. Charles W.I. Hill and Arun Kumar Jain, “International Business”, 6th Edition, Tata McGraw Hill, New Delhi, 2010.
4. John D. Daniels, Prashant Salwan, Daniel P. Sullivan and Lee H. Radebaugh, “International Business: Environments and Operations”, 12th Edition , Pearson India, 2010.

5. K. Aswathappa, “International Business”, 5th Edition, Tata McGraw Hill, New Delhi, 2012.
6. Rakesh Mohan Joshi, “International Business”, Oxford University Press, New Delhi, 2009.
7. Vyuptakesh Sharan, “International Business”, 3rd Edition, Pearson Education in South Asia, New Delhi, 2011.

OUTCOMES:

After completing the course, the students will be able to

- Recognize the Internationalization of Business and modes of entry
- Formulate Sourcing strategies
- Operate on export, import procedure and documentation

MSC 7102	INTRODUCTION TO ENTERPRISE RESOURCES PLANNING	L	T	P	C
		2	0	0	1

OBJECTIVES:

The course will enable the students:

- To introduce the concept of ERP and its functionality in a business enterprise
- To focus on applying ERP to all aspects of business
- To understand the strategies of ERP package selection

MODULE I ERP AND ENTERPRISE APPLICATIONS 05

Definition, need for an Enterprise Resource Planning System - History of ERP Systems –-Quantifiable Benefits of ERP - ERP Implementation, Lifecycle - Methodologies and Strategies for ERP Implementation .

MODULE II ERP INVESTMENT, SELECTION & CONFIGURATION 05

Benefits from A ERP Implementation - ERP Consulting Partner Selection - Onshore and in ERP Package Selection Process and Methods. ERP Solution Configuration - Final Preparations and Training of Personnel for Live Implementation.

.**MODULE III INTRODUCTION TO ERP FUNCTIONAL MODULES 05**

Overview of functional ERP modules – Human Resources – Finance – Marketing – Production – Benefits and limitations of use of ERP modules in organisations

Total Hours: 15

REFERENCES:

1. Ray, R. (2011). Enterprise Resource Planning - Text & Cases. New Delhi (India): Mcgraw-Hill Pub.
2. Leon, A. (2008). ERP demystified. New Delhi: Tata-McGraw-Hill.
3. Jaiswal, M., & Vanapalli, G. (2005). Textbook of enterprise resource planning. Delhi: Macmillan.
4. Monk, E. F., & Wagner, B. J. (2006). Concepts in enterprise resource planning. Boston, MA: Course Technology.
5. Garg, V. K., & Venkitakrishnan, N. K. (2004). Enterprise resource planning: Concepts and practice (2nd ed.). New Delhi: Prentice-Hall of India Private Limited.

OUTCOMES:

At the end of the course the student will be able to

- Recognize the various functionalities in Enterprise Resource Planning
- Develop a specific methodology on proper selection of ERP package for a organisation
- Identify modules of ERP based on their use, benefit and limitations.

MSC 7103	INTEGRATED MANAGEMENT CASES	L	T	P	C
		0	0	3	1

OBJECTIVES:

The course would help the students to:

- Understand the contents of the given case and identify the industry/actual problem
- Analyze the situations in the case using various foundation and functional area concepts
- Identify solution / decision to be taken

PEDAGOGY / METHODOLOGY FOR CLASS

Industry experts train the students on problem solving and decision making for real time/ developed cases, using the following 9 steps.

The students are to be trained on linking various concepts and techniques in the foundation and functional area courses, particularly for steps (iv),(v) and (vi)

1. Identification of problem
2. Establishment of problem
3. Development of objectives
4. Identification of alternative solutions
5. Determination of various criteria
6. Evaluation of all the alternatives against all the criteria
7. Ranking of the evaluated alternatives
8. Decision based on the alternatives
9. Developing contingency plan

Total Hours: 30

ASSESSMENT COMPONENTS / METHODS

Assessment would be based on the following components:

1. Ability to interpret / identify issues in case
2. Clarity in thought process
3. Logical thinking
4. Ability to relate with concepts / techniques learnt

OUTCOMES:

Students will be able to

- Comprehend the steps involved in rational decision making
- Apply managerial skills.
- Analyse risk and uncertainty in business scenario and suggest suitable decisions.
- Solve the problem with suitable solution.
- Develop contingency plan.

TRIMESTER V

MSC 7201	STRATEGIC MANAGEMENT	L	T	P	C
		3	0	0	2

OBJECTIVES:

The objectives of the course would be to make the students

- Impart conceptual knowledge on strategies, process and management of strategies
- Lay the basics of environmental appraisal through environmental, industry and competitive analysis
- Learn different types and levels of strategies
- understand the various factors influencing the choice of strategies
- Provide various approaches and strategies for implementation and control

MODULE I INTRODUCTION 06

Strategy - Nature and purpose of business policy - Definition - levels of operations - Process of strategic management - Strategic Intent Meaning – Hierarchy – Vision - Mission.

MODULE II ENVIRONMENT APPRAISAL 06

External environment scanning (ETOP- PEST Analysis) - Appraisal of internal environment SWOT audit - Competitive advantage- core competency - Industry analysis- Competition analysis.

MODULE III STRATEGY FORMULATION 06

Levels and choices in strategy - Grand strategies - Stability strategies - Expansion strategies - Retrenchment strategies - Combination strategies - Business level strategies: Porter’s Generic business strategy model - Business ethics: need and importance, organizational values and culture, corporate governance, corporate social responsibility.

MODULE IV STRATEGIC ANALYSIS & CHOICE ACTIVITATING STRATEGY 06

Process of making choice - Subjective factors influencing choice - Contingency strategies - Pyramid of strategy implementation - Project implementation - Procedural implementation - Resource allocation.

MODULE V IMPLEMENTATION & CONTROL 06

Various approaches to implementation of strategy - Change Management Strategies- Matching organization structure with strategy - 7S model for implementation- strategic evaluation- Strategic control process - Du Pont's control model - Balanced score card - M.Porter's approach for Globalization - Future of Strategic Management

Total Hours: 30

REFERENCES:

1. Thomas L. Wheelen and J. David hunger, "Concepts in strategic management and Business policy toward global sustainability", Pearson education, 13th Edition, 2013.
2. Azhar Kazmi, "Business Policy & Strategic Management", Tata McGraw Hill, 3rd Edition, 2008.
3. L. M. Prasad, "Strategic Management", Sultan Chand & Sons, 2008.
4. Michael E. Porter, "Competitive Strategy: Techniques for Analyzing Industries and Competitors", Simon, New Edition, 2010.

OUTCOMES:

On successfully completing this program the student will be able to:

- Define and explain various terminologies associated with strategic management
- Analyze the environments to identify the core competencies of the firm
- Appraise the resources and capabilities of the firm to confer sustainable competitive advantage and formulate strategies
- Exhibit the ability to think critically with relevance to various situations and formulate strategic decisions through real world scenarios
- Develop the ability to identify strategic issues and design appropriate course of action

MSC 7202 SALES NEGOTIATION LAB

L	T	P	C
0	0	3	1

OBJECTIVES:

The objectives of this lab course would be to make the students

- Learn the concepts of selling and negotiation
- Gain insight into consumer perception and expectation of products
- Familiarize with different aspects of sales negotiation process
- Get trained in overcoming barriers and winning sales
- Acquire knowledge on the ethical aspects of a negotiation

LIST OF EXERCISES:

Exercises involving a judicious combination of the following aspects/ stages of negotiation:

1. Pre-negotiation - Preparation, information sharing
2. Understanding consumer motivation
3. Opening for negotiation
4. Negotiation process - involving product, pricing, promotional schemes
5. Negotiation strategies (win-win / lose-win, etc)
6. Arriving Agreement
7. Overcoming barriers & break-down that create roadblocks
8. Ethical aspects
9. Communication & listening Skills for negotiations
10. Persuasive skills
11. Handling intimidation
12. Closing

Total periods: 30

PEDAGOGY / METHODOLOGY FOR CLASS

A suitable mix of the following:

1. Role plays
2. Participative learning
3. Guided training
4. Group Discussion

ASSESSMENT COMPONENTS / METODS

Assessment pattern would be based on the following components:

1. Quality of role plays

2. Students' participation
3. Quiz
4. Assignment
5. Attendance, etc.

OUTCOMES:

After doing the course, the students will be able to:

- Apply the concepts of selling and negotiation in the selling process
- Relate consumer perception and expectation aspects in the negotiation
- Negotiate deals confidently addressing the different components of negotiation
- Identify and eliminate the barriers of negotiation
- Adhere to the ethical aspects of selling and negotiation

ELECTIVES - MARKETING MANAGEMENT

MSCY 001 RETAIL MARKETING	L	T	P	C
	3	0	0	2

OBJECTIVES:

The objectives of the course would be to make the students

- Learn the concept of retailing, retail formats and recent developments in retail industry
- Gain knowledge of different dimensions of retail strategy
- Know the importance of store management and visual merchandising
- Identify customer services in retailing and understand services retailing
- Familiar with the growing e-tailing industry in India

MODULE I INTRODUCTION 06

Introduction to Retailing - Role and functions of Retailer - Retailer characteristics- Theories of Retail Development - Unorganized Vs. Organized Retailing - Retail Formats - Multi Channel Retailing - Indian Retail Scenario - Current State, Issues, Potential and Future Direction

MODULE II RETAIL STRATEGY 06

Understanding the Retail Customer- Dimensions of Retail Strategy - Retail Location- Store Site Selection - Retail Pricing - Retail Merchandising - Category Management - Role of Private Label Brands - Retail Communication

MODULE III RETAIL STORE MANAGEMENT 06

Retail Store Space Management - Store Layout and Design - Exterior and Interior Store Design Elements - Store Atmospherics - Visual Merchandising in Retail

MODULE IV CUSTOMER SERVICE & SERVICES RETAILING 06

Customer Service in Retailing - Gathering Customer Information - Significance of POS - Encouraging Loyalty - Retailing in the Service Sector - Retail Banking - Retail Insurance - Other Financial Services Retailing - Health Services Retailing - Retailing in the Hospitality Industry - Measuring Retail Service Quality.

MODULE V E- TAILING 06

Introduction - Role of Technology in Satisfying Market Demand - Structure and Developments in E- Tailing - Factors Influencing the Growth of E-Tailing - Features

of E- Tailing - Comparison of Conventional Retailing and E-Tailing - Customer Experience and Future of E- Tailing.

Total Hours: 30

REFERENCES:

1. Swapna Pradhan, “Retailing Management - Text and Cases”, Tata McGraw Hill, 4th Edition, New Delhi, 2012
2. Chetan Bajaj, Rajnish Tuli & Nidhi V. Srivastava, “Retail Management”, Oxford Higher Education, 3rd Edition, New Delhi, 2005.
3. Barry Berman, Joel R. Evans and Mini Mathur, “Retail Management: A Strategic Approach”, Pearson Education, 11th Edition, 2012.
4. David Gilbert, “Retail Marketing Management”, Pearson Education, 1st Edition, 2006.

OUTCOMES:

On successfully completing this program the student will be able to**:**

- Apply the concepts of retailing in their job for better performance
- Appropriately combine the dimensions of retail strategies to increase retail sales
- Manage the operations of a retail store effectively
- Select and implement the right customer service activity to attract and retain customers
- Recognize and adapt to the recent developments in retail industry

MSCY 002 SERVICES MARKETING

L	T	P	C
3	0	0	2

OBJECTIVES:

The objectives of the course would be to make the students

- Learn various concepts and fundamentals of services marketing
- Gain insight into customer perception and expectation of services
- Acquire knowledge necessary for designing of services
- Familiarize with the various aspects of delivering services
- Gain knowledge in the process of developing and implementing marketing strategies for different services

MODULE I INTRODUCTION 06

Definition of Service and Service Marketing - Evolution of Service Sector - Reasons for growth of Services - Types of Service Sector - Distinguishing characteristics of Services - Tangibility Spectrum - Goods vs Services and Marketing implications - Classification of Services - Marketing mix for Services - Service quality: Introduction to Gaps Model and SERVQUAL Dimensions

MODULE II SERVICE CUSTOMER 06

Customer Expectation of Services - Customer Perception of services - Segmenting Service Markets: Characteristics and Bases - Strategies for building Service Customer Relationships - Service Recovery

MODULE III SERVICE DESIGN 06

Service Life Cycle Stages - Steps in New Service Development - Types of Service Standards - Service Process - Service Blueprinting - Physical Evidence and Service scape - Tools for differentiating Services - Methods of Pricing Services

MODULE IV SERVICE DELIVERY 06

People in Services: Roles of Employees and Customers - Distributing Services: Channel Functions, Factors for Channel Selection - Promotional Mix for Services: Advertising Media for various Services, Steps in Personal Selling of Services, Sales Promotion Tools for Services

MODULE V MARKETING STRATEGIES FOR DIFFERENT SERVICES 06

Formulating Service Marketing Strategies for Health, Hospitality, Tourism, Financial, Information Technology, Educational, Entertainment and Logistics Services.

Total Hours: 30

REFERENCES:

1. Halen Woodroffe, “Services Marketing”, McMillan Publishing Co., New Delhi, 2003.
2. Valarie Zeithaml and Mary Jo Bitner, “Services Marketing”, Tata McGraw Hill, 2002.
3. Ramamohana Rao, “Services Marketing”, Pearson Education, 2005.
4. Jha, “Services Marketing”, Himalaya Publishing House, 2002.

OUTCOMES:

On successfully completing this program the student will be able to:

- Apply the concepts of services marketing in real time business situations
- Identify the expectations and perceptions of a customer towards services
- Design services according to market needs and wants
- Choose the appropriate distribution channel for delivering services
- Formulate appropriate marketing strategies needed for different services

MSCY 003	MARKETING COMMUNICATIONS AND MEDIA MANAGEMENT	L	T	P	C
		3	0	0	2

OBJECTIVES:

The objectives of the course would be to make the students

- Learn the concepts of advertising as a form of communication
- Gain knowledge on the basics of designing and execution of advertisements
- Learn to select suitable media and design media planning
- Acquire knowledge on the aspects media management
- Get insight into the concept, role and types of sales promotion tools

MODULE I INTRODUCTION 06

Integrated Marketing Communication and its role -; Advertisement - Concept and Definition - Advertisement objectives - Advertising Agency: Types - selection and remuneration - Client - Agency Relationship- The changing marketing communication environment- Marketing and New technology- New Trends in Marketing communication.

MODULE II DESIGN AND EXECUTION OF ADVERTISEMENTS 06

Advertisement brief - creative process - Message development - Different types of advertisements - Layout - Design - Appeal - Copy structure - BTL and ATL - Advertisement media: types.

MODULE III MEDIA PLANNING AND SELECTION 06

Introduction to different media- comparison of their advantages and disadvantages; Media planning-functions –process- Media planning for Consumer and Industrial goods;

Media selection-buying TV space / Airtime / radio slot; buying magazines space/ Newspaper space.

MODULE IV MEDIA MANAGEMENT 06

Selection of media vehicles based on Reach, Frequency, Cost efficiency, Circulation, Pass-along rate (Print); Media Timing – Flight, pulsing, Media scheduling, comparing- and evaluation of continuity of media options; Deciding on the most suitable media – mix- buying and negotiating the most appropriate media.

MODULE V SALES PROMOTION 06

Sales promotion: objectives, scope - Sales promotion categories: consumer-oriented, channel-oriented, company-oriented - Designing of sales promotion

techniques - Integrated promotion - Measuring the effectiveness of sales promotion - Methods of on-line sales promotions**.**

Total Hours: 30

REFERENCES:

1. George E. Belch and Michel A. Belch, “Advertising & Promotion”, McGraw Hill, Singapore, 1998.
2. Kenneth Clow and Donald Baack, “Integrated Advertisements, Promotion and Marketing communication”, Prentice Hall of India, New Delhi, 2003.
3. S.H.H. Kazmi and Satish K. Batra, “Advertising & Sales Promotion”, Excel Books, New Delhi, 2001.
4. Julian Cummings, “Sales Promotion”, Kogan Page, London, 1998.
5. S.A. Chunawala, “Advertisement & Promotion Management”, Himalaya Publishing, 2007.
6. `Chaturvedi B.K., “Media Management”, Global Vision Pub House, 2009

OUTCOMES:

On successfully completing this program the student will be able to:

- Apply the knowledge of advertising for promoting products
- Interact with the advertising agencies to design and execute suitable advertisements
- Select the right media and design media plans for effective implementation
- Manage any media related aspects and issues
- Recognize the different sales promotional tools applied in real time marketing situations

MSCY 004 CONSUMER BEHAVIOUR

L	T	P	C
3	0	0	2

OBJECTIVES:

The objectives of the course would be to make the students

- Gain conceptual knowledge on consumer behavior and research
- Learn various models and theories related to consumer behavior
- Get an insight into consumer behaviour in their social and cultural environments
- Know the process and models of consumer decision making
- Aware of related aspects of consumerism and consumer behaviour

MODULE I INTRODUCTION 0**6**

Consumer Behaviour : Concept and Need for studying - Objectives of consumer research - Consumer Research process - Approaches to the study of consumer behaviour.

MODULE II CONSUMER AS AN INDIVIDUAL 06

Consumer needs and motivation: nature, types, applications - Values and life style - Personality and CB - Consumer diversity - Consumer Perception theories and application to CB -Theories of learning and application - Basic CB models of attitude - Attitude change.

MODULE III CONSUMERS IN THEIR SOCIAL & CULTURAL ENVIRONMENT 06

Group: types, reference group, opinion leader & applications to CB - Family & family cycle - Family decision making - Influence of social class, culture and sub-culture, cross cultural aspects on CB.

MODULE IV CONSUMER DECISION PROCESS & POST-PURCHASE BEHAVIOUR 06

Innovation diffusion - Consumer decision making process - Models of consumer decision process: Shiffman, Howard-Sheth and Engel-Kollat-Blackwell models - Post-purchase behaviour - Consumer dissonance.

MODULE V RELATED ASPECTS 06

Consumerism - Consumer protection - Online consumer behaviour - Overview of Organizational Buyer Behaviour

Total Hours: 30

REFERENCES:

1. Leon G. Schiffman and Leslie Lazar Kanuk, “Consumer Behaviour”, Pearson Education, New Delhi, 2002.
2. David L. Loudon, Albert J. and Della Bitta, “Consumer Behaviour”, McGraw Hill, New Delhi, 2002.
3. K. K. Srivastava, “Consumer Behaviour in Indian Context”, Golgotia Publishing Co., New Delhi, 2002.

OUTCOMES:

At the end of the course the students will be able to:

- Analyze factors related to consumer behaviour and their purchase decisions
- Interpret the psychological behaviour of consumers as an individual using the models and theories
- Relate social and cultural environments to the consumer buying behaviour
- Apply the models of consumer decision making to identify the factors underlying consumer buying behaviour
- Identify consumer related aspects like consumer protection, online buying behaviour, etc.

MSCY 005 PRODUCT AND BRAND MANAGEMENT

L	T	P	C
3	0	0	2

OBJECTIVES:

The objectives of the course will be to make the students:

- Learn the concept and various terms related to a product
- Gain knowledge on new product development stages
- Get insight into product brand and related concepts
- Get an overview of brands from consumer perspective
- Learn about the impact of brands and managing the brands

MODULE I INTRODUCTION 06

New Product: definition, concepts, design, process - Product standardization and simplification.

MODULE II NEW PRODUCT DEVELOPMENT STAGES 06

NPD: approaches, process - Idea generation, screening & evaluation - Concept development, evaluation & testing - Markeing-strategy development - Business /Commercial analysis - Product development - Proto-type testing - Market testing - Test Marketing - Product Launch and Control - Commercialisation - Post-launch tracking and control.

MODULE III BRAND CONCEPTS 06

Concepts of Brands - Evolution - Perspectives - Brand Names and Associations - Brand Planning - Perspectives, Levels, PRIZMS - Brand Image - Brand Culture - Brand Systems - Roles - Types of brands.

MODULE IV BRAND AND CONSUMER PERSPECTIVE 06

Brand and Consumers - Buying Decision - Making and Building Brand for Superiority and Success - Need and Techniques: Brand Positioning, Brand Repositioning - Brand personality - Brand Ambassador - Brand strategies: Brand Extensions, contractions & elimination.

MODULE V BRAND IMPACT 06

Managing brand performance over the product life cycle - Brand Values - Brand loyalty - Product and Brand Failures - Commoditization of Brand - Keeping Brand Alive: Creating and Maintaining - Measuring Brand Equity - Brand Vitalization - Methods of Brand Valuation.

Total Hours: 30

REFERENCES:

1. Ramanuj Majumdar, “Product Management in India”, Prentice Hall of India, 2002.
2. Donald R. Lehmann and Russel S. Winer, “Product Management”, Tata McGraw Hill, 2005.
3. S.A. Chunawala, “Compendium of Brand Management”, Himalaya Publishing, 1998.
4. Harsh Varma, “Brand Management”, Excel Books, 2000.
5. Kevin Lane Keller, “Strategic Brand Management”, Pearson Education, 2003.
6. S. Ramesh Kumar, “Managing Indian Brands”, Vikas publishing House (P) Ltd., 2002.

OUTCOMES:

On successful completion of the program, the students will be able to:

- Recognize the need for new product development
- Identify the phases in designing and development of a product
- Appreciate the need and importance of branding a product
- Develop a new brand or reposition an existing brand from consumer perspective
- Measure the impact of a brand on the product/organization performance

MSCY 006 INDUSTRIAL MARKETING

L	T	P	C
3	0	0	2

OBJECTIVES:

The objectives of the subject will be to make the student:

- Get an overview of the various dimensions of industrial marketing
- Learn the buying behavior of industrial organizations
- Gain conceptual insight into segmentation, targeting and positioning from industrial perspective
- Learn to formulate product and distribution strategies
- Gain knowledge on designing the pricing and marketing communications

MODULE I DIMENSIONS OF INDUSTRIAL MARKETING 06

Nature of Industrial Marketing - Definition - Industrial vs Consumer marketing - Types of Industrial Customers - Characteristics of business markets - Classification of Industrial products - Industrial Marketing Environment and Strategies

MODULE II ORGANISATIONAL BUYING AND BUYER BEHAVIOUR 06

Nature of Industrial buying - Buy grid model: Buying situations, Buy Phases, Marketing strategies in various buying situations and phases - Buying centres: Buying centre roles - Webster and Wind model - Sheth model

MODULE III INDUSTRIAL MARKETING RESEARCH & S-T-P STRATEGIES 06

Marketing research process - Comparison between industrial and consumer research Industrial market Segmentation: Bases, Macro and Micro variables - Target marketing - Industrial product positioning.

MODULE IV INDUSTRIAL PRODUCT STRATEGIES & CHANNEL DECISION 06

Developing Product Strategies - Industrial Product life cycle analysis and strategies - Stages of new product development - Industrial marketing channels - Choosing right distributor - Marketing logistics: Warehouse Location and functions, Modes of Physical distribution and Transportation

MODULE V INDUSTRIAL MARKETING COMMUNICATION AND PRICING 06

Training and Compensating industrial sales people - Industrial advertising media - Sales promotion methods and strategies - Industrial pricing: Factors influencing,

Pricing strategies and policies - Commercial terms and conditions in industrial markets.

Total Hours: 30

REFERENCES:

1. Robert R. Reeder, Edward G. Brittle and Pretty H. Reedier, “Industrial Marketing - Analysis Planning and Control,” Prentice Hall of India Limited, New Delhi, 2000.
2. Krishna K. Havaldar, “Industrial Marketing,” Tata McGraw Hill, New Delhi, 2002.
3. Alexander Hill, et. al., “Industrial marketing”, AITBS, 2000

OUTCOMES:

On successful completion of the course the student will be able to:

- Recognize the characteristics of industrial consumers
- Apply various models to understand organizational buying behaviour
- Formulate strategies for segmenting, targeting and positioning industrial products
- Choose the appropriate channel for distributing industrial products
- Formulate appropriate pricing and promotional strategies for industrial products

MSCY 007	CUSTOMER RELATIONSHIP MANAGEMENT AND MARKETING	L	T	P	C
		3	0	0	2

OBJECTIVES:

The objectives of the course would be to make the students

- Learn the fundamentals of customer relationship management and marketing
- Get a deeper insight into customer attributes and their loyalty
- Learn theories and strategies associated with relationship marketing
- Gain insight into the impact of technology in managing customers
- Get an overview on the implementation and measurement practices of CRM

MODULE I BASICS OF CRM / RM BASICS 06

Customer Relationship Management (CRM): Definition, Purpose, Evolution - Schools of thought on CRM -Types of CRM - Levels of CRM -Relationship Marketing (RM) - Trust and belonging - Personal touch.

MODULE II CUSTOMER DIMENSION 06

Types of customers - Customer value: concept, types, LTV - Identifying external information sources - Customer intelligence - Customer Loyalty: meaning & categories - Loyalty ladder - Loyalty schemes - Loyalty programs - Loyalty cards - Loyalty based segmentation - Principles of trust, commitment, involvement - Customer retention: significance, factors, retention strategies, effects.

MODULE III RELATIONSHIP MARKETING AND STRATEGIES 06

Transaction Marketing vs Relationship Marketing - Bucket theory - Relationship partners - Close versus distant relationship - Relationships to brands and objects - Theories of RM - Nordic School Perspective - Six markets model - Relationship Life Cycle - Bonding for Customer Relationship / Relationship Marketing Strategies - Return on Relationships (RoR).

MODULE IV CONTACT TECHNOLOGIES AND STRATEGIES 06

Technology to manage customer contacts - Analytical CRM: Role of IT in building, maintaining & enhancing relationships - Overview of customer data management technologies - Data warehousing, mining, analyzing - Online/e-CRM relationships - Operational CRM: call centre and front desk technologies.

MODULE V CRM / RM: IMPLEMENTATION, MEASUREMENT AND ISSUES 06

CRM implementation: Planning, Roadmap, Building blocks - Frame work for building RM strategy - Voice of customer - Reasons for customer defection - Customer actions after product/service failure - Recovery strategies - CRM/RM measurement and metrics for CRM.

Total Hours: 30

REFERENCES:

1. Kumar, A., Sinha, C. and Sharma, R. (2009). Customer Relationship Management (Reprint Edition), New Delhi: Biztantra Publication (code: CRM)
2. Shainesh, G. and Jagdesh N. Sheth. (2010). Customer Relationship Management (Reprint Edition), Chennai: Macmillan Publishers India Limited (code: CRM)
3. Godson, M. (2009). Relationship Marketing, New York: Oxford University Press.

OUTCOMES:

On successful completion of the course, the students would be able to:

- Apply the concepts of customer relationship management and marketing in organizations
- Identify customer attributes and understand behavioural intentions
- Design appropriate relationship strategies by applying theories of relationship marketing
- Tap and handle information technology to manage customer data and maintain customer relationship
- Implement customer relationship practices and design metrics to measure.

MSCY 008 RURAL MARKETING

L	T	P	C
3	0	0	2

OBJECTIVES:

The objectives of the course would be to make the students

- Aware of the role and importance of rural marketing in India
- Gain insight into rural consumer buying behavior and underlying factors
- Learn to match the expectations of rural customers with the right price and product mix
- Gain knowledge to design the appropriate promotion strategies for rural markets
- Learn to choose the suitable channel to distribute products in a rural market

MODULE I INDIAN RURAL ECONOMY 06

Overview – Dimensions – Policies – Program – Reform - Role of Rural marketing in India - Development in the last few decades - Relevance and importance in the emerging scenario - future directions

MODULE II RURAL MARKETING 06

Definition - Nature-scope and attractiveness-Features - Rural Vs urban marketing - potential and changing pattern of rural marketing - Significance - limitations - Rural consumer Behavior - Influencing factors - changing trends.

MODULE III RURAL MARKET & PRODUCT SELECTION 06

Market Selection - Attractiveness of the market – Segmentation - concepts, Degree, guidelines, Targeting and positioning - Competitive marketing strategies, Product Selection - Selecting the right product-matching the expectations - Product mix - Pricing strategies-Objectives, concepts, significance and pricing policies

MODULE IV PROMOTION STRATEGIES 06

Promotion mix for Rural markets - Differences in Rural and urban communication Marketing communication mix - Communication objectives, Target audience characteristics, Designing the mix strategy, selection of Media , Execution and Evaluation of effectiveness, Impact of Information technology on rural communication

MODULE V DISTRIBUTION STRATEGIES 06

Channels of Distribution-distribution patterns of old and new channels-innovative means and approaches for rural market coverage

Total Hours: 30

REFERENCES:

1. Krishnamacharyalu C.S.G and Lalitha Ramakrishna, “Rural Marketing - Text and Cases”, Pearson Education, 2002
2. Ram Kishen, “New Perspectives in rural and agricultural Marketing”, Jaico Publishing House, Mumbai, 2005
3. Gopalsamy T. P., “Rural Marketing”, Wheeler Publishing, 2004.
4. Ramanaacharyalu, “Rural Marketing”, Pearson education, 2005.

OUTCOMES:

At the end of the program the student will be able to

- Analyze rural customer markets
- Identify the rural consumer buying behaviour and the influencing factors
- Formulate product and pricing strategies to meet the expectations of rural customers
- Design the appropriate promotion strategies for rural markets
- Choose the suitable channel to distribute products in a rural market

MSCY 009 SALES AND DISTRIBUTION MANAGEMENT

L	T	P	C
3	0	0	2

OBJECTIVES:

The objectives of the course would be to make the students

- Learn the concepts of selling and salesmanship
- Gain knowledge on different aspects of sales planning
- Get trained on the process of selling and managing sales force
- Aware of the structure and operation of the distribution channels
- Gain knowledge on designing and managing channels

MODULE I INTRODUCTION 06

Selling and Salesmanship: Definition, evolution, importance - Selling vs Marketing - Qualities of good salesperson - Roles and duties of sales officer - Career and positions in selling - Sales organization - Theories on selling - Types of selling

MODULE II SALES PLANNING 06

Personal selling Objectives - Sales forecasting - Sales budget - Sales quotas - Sales territories.

MODULE III PERSONAL SELLING PROCESS & SALES FORCE MANAGEMENT 06

Personal selling process: prospecting, pre-approach, appointment, demonstration, sales talk & demo, handling sales resistance, negotiating, closing - Overview of the functions of sales force management: recruiting, training, motivating and compensating salespersons - Sales expenses - sales contests - Sales ethics.

MODULE IV DISTRIBUTION CHANNELS: STRUCTURE AND OPERATION 06

Distribution channels: need, functions, types, selection - Channel institutions - VMS & HMS - Wholesaling: definition, need, classification, functions, strategies - Retailing: definition, need, types, formats, functions, strategies - Agents and other middlemen - Overview of the functions of physical distribution management.

MODULE V DESIGNING AND MANAGING CHANNELS 06

Designing channel systems - Channel management: conflict handling, performance and evaluation.

Total Hours: 30

REFERENCES:

1. Havaldar, Krishna K. and Cavale, Vasant M. (2011). Sales and Distribution Management, New Delhi: Tata McGraw Hill.
2. Still, Richard R., Cundiff, Edward W. and Govoni, Norman A.P., (1988). Sales Management: Decisions, Strategies, and Cases, NJ: Prentice-Hall, Englewood Cliffs.
3. Tapan K. Panda and Sunil Sahadev. (2012). Sales and Distribution Management, New Delhi: Oxford University Press.

OUTCOMES:

On successful completion of the course the student will be able to:

- Apply the concepts of selling and salesmanship in the selling process
- Arrive at a realistic and executable sales plan
- Handle the various aspects of selling process effectively
- Select the appropriate intermediaries for physical distribution
- Design and manage the distribution channel for better performance

CSC6121 DIGITAL MARKETING

L	T	P	C
3	0	0	2

OBJECTIVES:

The objectives of the course would be to make the students

- Learn the role and significance of digital marketing within a larger marketing strategy
- Gain knowledge in designing digital marketing strategies
- Learn to evaluate and implement a comprehensive digital marketing plan
- Get insight into various web marketing tools and techniques
- Get acquainted with social media and other digital marketing platforms

MODULE I DIGITAL MARKETING FUNDAMENTALS 06

Introduction to Digital Marketing - Online marketplace analysis: Micro-Environment, The Internet Macro-Environment

MODULE II DIGITAL STRATEGY DEVELOPMENT 06

Digital marketing strategy - The Internet and the Marketing Mix - Relationship Marketing using Digital Platforms

MODULE III DIGITAL MARKETING: IMPLEMENTATION & PRACTICE 06

Delivering the online customer experience - Campaign planning for digital media - Marketing communications using digital media channels - Evaluation and improvement of digital channel performance - Web Analytics - Business-to-consumer digital marketing practice - Business-to-business digital marketing practice

MODULE IV WEB MARKETING TOOLS AND TECHNIQUES 06

Web Marketing (E-commerce, Affiliate Marketing, promotional or informative web sites) - Online Advertising - Display Advertising - Email Marketing - Search Engine Optimization (SEO) and Search Engine Marketing (SEM) - Pay per click - Cost per impression - Video & Audio Marketing (Podcasting).

MODULE V SOCIAL MEDIA, CONTENT AND MOBILE MARKETING 06

Social Media Marketing - Micro Blogging - Content Marketing - Mobile Marketing - Mobile Apps - Other Digital Marketing platforms.

Total Hours: 30

REFERENCES:

1. Dave Chaffey and Fiona Ellis-Chadwick, “Digital Marketing: Strategy, Implementation and Practice”, Pearson Education, 5th Edition, 2012
2. Glen Urban, “Digital Marketing Strategy: Text and Cases”, Prentice Hall, 1st Edition, 2004.
3. Jed Alpert, “The Mobile Marketing Revolution: How your brand can have a one-to-one conversation with everyone”, Tata McGraw Hill, 1st edition, 2012.

OUTCOMES:

On successful completion of the course the student will be able to:

- Apply digital marketing concepts to market various products
- Formulate strategies for digital marketing of products
- Evaluate and implement a comprehensive digital marketing campaign
- Explore and choose appropriate web marketing tools and techniques to market products
- Design content for social media marketing and other digital marketing platforms

ELECTIVES - FINANCIAL MANAGEMENT

MSCY 016	SECURITY MARKET AND ANALYSIS	L	T	P	C
		3	0	0	2

OBJECTIVES:

The objective of the course would be to

- make an awareness on the different types of investment instruments and its valuation
- sensitize about the stock market
- give an exposure to stock market trading
- provide knowledge on the technical & fundamental analysis on the financial instruments

MODULE I INVESTMENT SETTING 04

Financial Markets- Financial Assets/Instruments – Investment Objectives- Risk and Return - Analysis of different types of Risks and Return – Measures of Return and Risk- Determinants of Required Rate of Return- Risk free rate and factors influencing the risk free rate - Risk Premium

MODULE II CAPITAL MARKET 04

Organization and Function of Equity Market, , Bond Market, Mutual Funds market and derivatives market- Primary market and Secondary Market, functions and Trading mechanism, Investor protection, Roles and Responsibilities of SEBI in Capital Market.

MODULE III VALUATION 06

Valuation of Equity Shares: Theory of Valuation - Alternative Valuation - Bond Valuation- Computing Bond Yields. Calculation of future bond prices, Yield curve, Determination of interest rates.

MODULE IV EFFICIENT MARKET HYPOTHESIS 04

Efficient Market Concept - Different forms of Efficiency- Random walk theory- Challenges to the Efficient Market Hypothesis

MODULE V FUNDAMENTAL & TECHNICAL ANALYSIS 10

Fundamental Analysis: Economic Analysis - Macro economic activity and security Markets - Economic Series and Stock Prices - Industry Analysis: Business Cycle

and Industry Sectors - Evaluating the industry life cycle - Analysis of Industry Competition Estimation of Industry Rates of Return. Company Analysis - Firm Competitive Strategies - SWOT Analysis. Analysis of Growth and Value Companies Financial Statement Analysis Major Financial Statements. Computation and Analysis of Financial Ratios. Technical Analysis: Assumptions, Advantages and Challenges – Technical Trading Rules and Indicators - Technical Analysis of Equity Markets

Total Hours: 30

REFERENCES:

1. Donald E. Fischer & Ronald J.Jordan, “Security Analysis and Portfolio Management“, 8th Edition, Prentice Hall of India (P) Ltd, 2008.
2. V.A. Avadhani, “Security Analysis and Portfolio Management” 10th Edition, Himalaya Publishing House, 2011.

OUTCOMES:

Students would be able to

- Identify different types of investment instruments and its valuation
- Trade in stock market
- Test the market for its level of efficiency
- Do technical analysis on the financial market instruments
- Do fundamental analysis on the financial performance of firms

MSCY 017 FINANCIAL SERVICES

L	T	P	C
3	0	0	2

OBJECTIVES:

The objectives of the course are to enable the students to:

- Provide an overview of the financial services sector
- Understand the concept of hire purchasing and leasing
- Appreciate the functions of merchant banking and depository services
- Identify the different types of mutual funds and the importance of credit rating
- Create awareness about various fund based services

MODULE I INTRODUCTION 02

Introduction to Financial Services: Objectives - Importance - Nature - Scope - fund based - fee based services

MODULE II HIRE PURCHASE & LEASING 09

Hire Purchase: Meaning - features - Rights - Legal, Taxation and Accounting aspects of HP. Leasing: Meaning - features - types/forms - accounting frame work- Tax implication

MODULE III MERCHANT BANKING AND DEPOSITORY SERVICES 09

Merchant banking services - capital issue management - pricing of issue - marketing of issues - SEBI - Securities Appellate Tribunal. Concept of Depository: Function - Pros & Cons -Functioning - Role of NSDL, CSDL.

MODULE IV MUTUAL FUNDS AND CREDIT RATING 03

Mutual funds: meaning, definition, objectives, advantages and types of Mutual Funds. Credit rating: definition, advantages, process and limitations - country, Business, SME, Personal.

MODULE V FUND BASED FINANCIAL SERVICES 07

Factoring: definition, functions of a factor, types. Bills discounting: concept, types of bill of exchange - Consumer finance - Chit Funds. - Real estate finance - reverse mortgaging - Venture capital financing - process - stages. Micro finance - SRO (Self Regulated Organisation) - standard and principles - scale - micro credit**.**

Total Hours: 30

REFERENCES:

1. Dr. S. Gurusamy, “Financial Services”2/E , Tata McGraw-Hill Education, 2009
2. M.Y. Khan, “Financial Services”; Tata McGraw-Hill Education, 2004
3. Machiraju, “Indian Financial System”; Vikas Publishing House, 2nd Edition, 2002.

OUTCOMES:

Students would be able to

- find the range and diversity of financial services.
- apply the concepts and procedure involved in hire purchasing and leasing in the practical scenario.
- make use of merchant banking and avail depository services as and when they require.
- take investment decision relating to different type of mutual fund based on the credit rating information.
- utilize fund based services in real life scenario.

MSCY 018 INTERNATIONAL FINANCIAL MANAGEMENT

L	T	P	C
3	0	0	2

OBJECTIVES:

The objectives of the course would be to make the students understand

- the importance of International Finance
- Foreign Exchange Market
- Exchange rate determination and forecasting
- Foreign trade financing
- Capital budgeting for multinational corporations

MODULE I INTRODUCTION 04

Multinational financial Management - objectives of MNCs - difference between domestic and International Financial Management - Reasons for increasing importance of International Finance - challenges and opportunities before an MNC.

MODULE II MARKET FOR FOREIGN EXCHANGE 06

Definition of foreign exchange market and the exchange rate - quotations at the foreign exchange market - spot market - forward market - settlement of transactions in the international market. Foreign Exchange Management Act (FEMA). Indian Forex Market - structure - exchange rate fixation.

MODULE III EXCHANGE RATE DETERMINATION AND FORECASTING 08

Theories of exchange rate determination. The need and importance for forecasting exchange rates - forecasting techniques - technical forecasting - fundamental forecasting - limitations of fundamental forecasting - market based forecasting.

MODULE IV FINANCING FOREIGN TRADE 06

Problems faced by developing countries for promoting trade. International Commercial Terms (INCOTERMS) - Credit risk - management of credit risk - Letter of Credit - types of credit to exporters. International trade financing in India - pre shipment and post shipment credits - EXIM Bank - ECGC. Capital and current account transactions

MODULE V CAPITAL BUDGETING FOR MULTINATIONAL CORPORATIONS 06

Input for multinational capital Budgeting - complexities of multinational capital budgeting exercise - factors to be considered in multinational capital budgeting. Foreign exchange exposure.

Total Hours: 30

REFERENCES:

1. Alan C.Shapiro, “Multinational Financial Management”, Wiley John Wiley & Sons Inc.,2005
2. A.K Seth, “International Financial Management,” Galgotia Publishing Company. New Delhi, 2004.
3. Jeff Madura ,“International Financial Management” Thomson Learning, 2005.
4. Reid W. Clich, Joshua D Coval, “ International Financial Management” Prentice Hall, 2004.

OUTCOMES:

At the end of this course, the students would be able to:

- Identify the importance of International Financial Management
- Perform settlement of transactions in the international markets
- Forecast exchange rates
- Manage the credit risks involved in international trade
- Analyse different projects using capital budgeting techniques for multinational corporations

MSCY 019 STRATEGIC FINANCIAL MANAGEMENT

L	T	P	C
3	0	0	2

OBJECTIVES:

The objectives of the course are to enable the students to:

- Know the determinants of fixed and working capital in an industry and causes and remedies of over and under capitalisation
- Understand how risk can be minimized by using risk adjusted techniques in capital budgeting
- Understand and apply the concept of point of indifference in capital budgeting decisions
- Know the theories behind capital structure
- Get an overview about the dividend theories

MODULE I INTRODUCTION 04

Financial Planning - meaning, principles and steps. Fixed and working capital - meaning and determinants. Over and under capitalisation - meaning, causes and remedies.

MODULE II INVESTMENT DECISIONS-RISK ANALYSIS IN CAPITAL BUDGETING 10

Appraisal of risky investments - pay back period method, risk adjusted discount rate method, certainty equivalent method , sensitivity analysis, probability technique, decision tree approach, and simulation technique.

MODULE III FINANCING DECISIONS - POINT OF INDIFFERENCE 03

Capital structure - meaning and determinants. Point of indifference - optimum capital structure.

MODULE IV FINANCING DECISIONS - CAPITAL STRUCTURE THEORIES 07

Capital structure theories - meaning and general assumptions, Net income approach, Net operating income approach, Modigiliani and Miller approach, Arbitrage process.

MODULE V DIVIDEND DECISIONS 06

Dividend - meaning and types of dividend, types of dividend policy, determinants of dividend policy. Dividend theories - Walter's Model, Gordon's Model, Modigliani and Miller's Hypothesis.

Total Hours: 30

REFERENCES:

1. Shashi K.Gupta and R.K.Sharma, "Financial Management-Theory and Practice", Kalyani publishers, 8th revised edition, 2014.
2. S.N.Maheshwari, "Financial Management - Principles and Practice," Sultan Chand and Sons, 14th revised edition, 2011.
3. M Y. Khan and P.K Jain, "Financial Management - Text, Problems and Cases," Tata Mc Graw Hill Education Pvt. Ltd., 3rd reprint, 2012.

OUTCOMES:

At the end of the course, the students would be able to:

- Ascertain the determinants of fixed and working capital requirements for a particular type of industry.
- Minimize the risk in company's projects by using risk adjusted techniques of capital budgeting.
- Find the level of Earnings before Interest and tax at which point of indifference occur for two different companies in a sector having two different capital structures.
- Prove or disprove the theories of capital structure.
- Prove or disprove the theories of dividend policies.

MSCY 020 FINANCIAL REENGINEERING

L	T	P	C
3	0	0	2

OBJECTIVES

The objectives of the course is to make the students aware of

- Process and forms of financial reengineering
- Turnaround strategies involved in coporate restructuring
- Importance Strategic cost management in financial restructuring
- Different Sources of short and long term funds
- Role of financial institutions in Financial reengineering

MODULE I INTRODUCTION 04

Financial reengineering - meaning- definition - scope - importance. Process of financial reengineering.

MODULE II CORPORATE RESTRUCTURING & TURN AROUND STRATEGIES 08

Corporate sickness - meaning - symptoms - causes - rehabilitation of sick units - problems faced by banks in rehabilitation of sick units. Turn around strategies : Mergers & Acquisition - legal aspects - financial framework.

MODULE III FINANCIAL RESTRUCTURING & STRATEGIC COST MANAGEMENT 08

Debt and Equity Restructuring, Asset Restructuring - Cost Management - objectives of cost management system -The concept of Economic Value Addition - Market Value Addition.

MODULE IV SOURCES AND COST OF CAPITAL 06

Flexibility of Capital Structure - Long term sources - equity - debentures - preference shares - long-term loans - FOREX based sources - Short term sources - Commercial paper, Inter corporate investment, public deposits. Cost of capital- equity capital - preference capital - debenture - weighted average cost of capital.

MODULE V ROLE OF FINANCIAL INSTITUTIONS IN FINANCIAL REENGINEERING 04

Role of Development Financial Institutions - Industrial Development Bank of India - Industrial Finance Corporation of India- SIDBI, Board for Industrial and Financial

Reconstruction (BIFR). Venture capital financing - meaning - special features - stages of financing - exit from venture capital investment.

Total Hours: 30

REFERENCES:

1. I.M. Pandey, “Financial Management”, Vikas Publishing House, 2009.
2. M. Y. Khan, “Financial Services”, Tata McGraw Hill, 2011.
3. S. N. Maheshwari, “Financial Management: Principles and Practice”, Sultan Chand and Sons, 2005.
4. R. C. Sekhar and A. V. Rajagopalan, “Management Accounting”, Oxford University Press, 2013.

OUTCOMES:

At the end of the course, the students will be able to

- Differentiate different forms of financial reengineering
- Identify sick unit and apply turnaround strategies to rehabilitate sick units
- Apply strategic cost management concepts in financial restructuring
- select appropriate financial institution for short and long term sources of funds.
- Appreciate the role of financial institution in the process of financial reengineering.

MSCY 021 DERIVATIVES MANAGEMENT

L	T	P	C
3	0	0	2

OBJECTIVES:

The objectives of the course are to enable the students to:

- Understand the Concept of derivatives, its types and instruments.
- Understand the markets where these instruments are traded, its mechanism & the underlying strategies
- Understand the range and diversity of derivatives market and how they relate to the needs

MODULE I DERIVATIVES - INTRODUCTION 06

Introduction - Types of derivatives - Markets - Distinction between markets - Economic functions of derivatives market - Role of derivatives market - Advantages of derivatives market -Downsides in derivatives market

MODULE II DERIVATIVES INSTRUMENTS 06

Futures and forwards - Mechanics of the market - Margin requirements - settlement of Index Futures contract- price quotations -Stock index futures - Nifty futures - Sensex futures contract Options **-** Types of options contract -- Mechanics of the market- price quotations- margin system - stock index and stock options - Swaps **-** Mechanics of the market - Interest rate swaps - currency swaps -price quotations -financial intermediary

MODULE III PRICING & VALUATION I 06

Pricing of futures and forwards - Assumptions - hedging with futures - Hedging strategies - Hedge ratio. Valuation of interest rate swaps and currency swaps - credit risk

MODULE IV PRICING & VALUATION II 06

Assumptions in option price analysis - Factors affecting option prices - Put-call parity - Options pricing & options pay off - Models - Hedging and Arbitration opportunities

MODULE V DERIVATIVE MARKET IN INDIA 06

Need for Derivative Markets in India - Evolution of Derivative Markets in India - Derivatives Instruments Traded in India - Effect of derivative market in India - Participants in Indian derivatives market - Regulations - Factors contributing to the

growth of Derivative market in India - Institutional frame work of Derivatives market in India - requirements for a successful Derivatives Market

Total Hours: 30

REFERENCES:

1. John C Hull, "Options, Futures and other Derivatives",8/E, Pearson Education, 2012.
2. Durbin, Michael (2011). All About Derivatives (2nd ed.). New York: McGraw-Hill.
3. D.C. Patwari, "Options and Futures in an Indian Perspective", Jaico Publishing House, 2004.
4. Don M. Chance, Robert Edwin Brooks, An Introduction to Derivatives and Risk Management, South-Western Cengage Learning, 2013
5. S. Kevin, Commodity And Financial Derivatives, PHI Learning Pvt. Ltd.,2010.

OUTCOMES:

The students would be able to

- Realize the range and diversity of derivative instruments available
- calculate the price of option derivatives
- mitigate the risk through Forwards and futures instruments
- mitigate the risk through options instruments
- Comprehend the current market situations

MSCY 022 RISK MANAGEMENT AND INSURANCE

L	T	P	C
3	0	0	2

OBJECTIVES:

The objectives of the course would be to make the students aware of

- Types of risk and benefits of risk management
- Various risk identification and evaluation techniques
- Different methods of risk reduction methods
- Different types of insurance policies
- Insurance accounting

MODULE I INTRODUCTION 04

Introduction to Risk Management - Nature of risk - terms and definitions. Organizing for Risk Management- Objectives of Risk Management- Scope of Risk Management- legal, financial and social benefits of managing risk.

MODULE II CLASSIFICATION AND CONTROL 05

Classifications of risk - Financial - Strategic - Operational - Market Risk. Enterprise Risk Management - Risk and opportunity - Influences and benefits of a risk management programme - Potential consequences of failing to manage risk.

MODULE III RISK MANAGEMENT PROCESS 06

Risk drivers - Internal and external influences on an organization - Risk Measurement and Pooling - Pooling and Diversification - Risk Control and Treatment - Risk avoidance - Risk reduction - Risk Retention - Risk analysis techniques - Barriers in the risk analysis process.

MODULE IV INTRODUCTION TO INSURANCE 07

Meaning- Nature, Types of Insurance- Emerging scenario - Principles of insurance- Functions of insurance - Reinsurance and double insurance - Profile of Insurance companies in India. Procedures for taking life, fire, marine insurance policy - Procedure for Settlement of claims- IRDA Act.

MODULE V MATHEMATICAL BASIS OF INSURANCE 08

Under Insurance - Premium calculation - Insurance accounting.

Total Hours: 30

REFERENCES:

1. Alka Mittal, Gupta S.L. “Principles of Insurance and Risk Management”, Sultan Chand and Sons, 2010.
2. James T.Gleason, “Risk; The New Management Imperative in Finance”, Jaico Publishing House, 2004.
3. Anand Ganguly, “Insurance Management”, New Age International, 2004.

OUTCOMES:

At the end of this course, the students would be able to

- Identify different types of risk
- Apply risk identification and evaluation techniques in the organization
- Suitably take decisions to avoid and reduce risk in the organization
- Develop enterprise risk management plan and choose appropriate insurance policy for the enterprise.
- Estimate the actual claim of stock using insurance accounting

MSCY 023 BANKING MANAGEMENT

L	T	P	C
3	0	0	2

OBJECTIVES:

The objectives of the course is to make the students understand

- The different classification of Banks and their functions
- Banking practices and Capital adequacy norms in Banks
- Different instruments used in banking operations
- Bank lending and customer protection
- Technological developments in banking.

MODULE I INTRODUCTION 04

Origin of banks. Definition and classification of banks. Functions of Central bank and Commercial bank, RBI Act 1934.

MODULE II BANKING PRACTICES AND CAPITAL ADEQUACY NORMS 08

Banker and Customer, Bank deposits - Types, Procedure for opening a bank account - KYC norms in India, Anti money Laundering, Reserve requirements. Capital adequacy in Banks - Basel I, Basel II and Basel III norms. CAMELS rating of banks, Credit risk - Market risk - Operational risk.

MODULE III BANKING INSTRUMENTS 05

Cheques - Forms, Types of crossing, Endorsement, Bank Draft, Traveller's cheque, e-cheque, Credit, debit and smart cards.

MODULE IV BANK LENDING AND CUSTOMER PROTECTION 07

Forms of bank lending, Principles of sound lending, Security for bank advances, Modes of securing advances, Banking Ombudsman Scheme - Customer Protection Act - SARFAESI Act 2002.

MODULE V DIGITAL BANKING 06

Technological developments in Indian banking - Core Banking Services (CBS), e - banking, Anywhere Anytime - banking, Electronic Clearing Service (ECS), Electronic Fund Transfer (EFT) System, Real Time Gross Settlement (RTGS), Automated Teller Machines (ATM), Internet banking and Mobile banking, Indian Financial Network (INFINET)

Total Hours: 30

REFERENCES:

1. Clifford Gomez “Banking and finance”, PHI Learning Pvt. Ltd., New Delhi, 2011.
2. Gurusamy .S “Banking Theory, Law and practice”, Vijay Nicole Imprints Pvt. Ltd., 2014.
3. Santhanam B. “Banking and financial System”, Margham Publishers,2008.
4. Sundharam and Varshney “Banking -Theory, Law and Practices” ,Sultan Chand & sons, New Delhi,2008.

OUTCOMES:

At the end of this course, the students would be able to

- Identify the different classification of banks and their functions.
- Appreciate Banking practices and capital adequacy norms in banks.
- Use the different instruments in banking operations.
- Identify the lending norms and the Banking Ombudsman Scheme available for customer protection.
- Use the different technological developments in banking operations.

MSCY 024 PORTFOLIO MANAGEMENT

L	T	P	C
3	0	0	2

OBJECTIVES:

The objective of the course would be to make the students understand:

- The process of investment & its alternatives through various informations
- Capital asset pricing model, multi factor model, and optimal portfolio selection model
- The techniques in portfolio construction
- The behaviour of investors and the stock returns.

MODULE I PORTFOLIO MANAGEMENT 06

MEANING: Investment, Speculation and Gambling, Investment objectives and investment process, Investment alternatives, Investment information - Measurement of Expected Risk and Return of Portfolio - Alternative Measures of Risk - Markowitz Portfolio Theory - The Efficient Frontier and Investor Utility

MODULE II CAPITAL ASSET PRICING MODEL 06

Overview of Capital Market Theory-Market Portfolio - Capital Asset Pricing Model-Assumptions- Security Market Line and Capital Market Line - Zero beta Model

MODULE III MULTI FACTOR MODELS 06

Arbitrage Pricing Theory (APT) Security Valuation and APT - Empirical Tests of APT- Estimating Risk in a Multi-factor Setting.

MODULE IV OPTIMAL PORTFOLIO SELECTION MODELS 06

Markowitz Theory - Sharpe's Single - Index Model - Lagrange Multiplier Theory.

MODULE V EQUITY PORTFOLIO MANAGEMENT STRATEGY 06

Passive vs. Active Management - Passive Equity Portfolio Management Strategy-Index Portfolio Construction Techniques - Tracking Error, Methods of Index Portfolio Investment. Fundamental Active Strategies - Technical Strategies - Market Anomalies - Value vs. Growth Investments - Investor Behavior and Stock Returns

Total Hours: 30

REFERENCES:

1. Dhanesh Kumar Khatri “Security Analysis and Portfolio Management (Paperback) 2012
2. Dhanesh Kumar Khatri “Investment Management and Security Analysis”: 2nd Edition Paperback - 2012
3. Prasanna Chandra “Investment Analysis and Portfolio Management (Paperback) 2012

OUTCOMES:

Students would be able to

- Identify the factors which affect the investor behaviour while constructing portfolios
- Construct a portfolio using Capital Asset Pricing Model
- Construct a portfolio using Multi Factor Models
- Select an optimal portfolio model
- Select a strategy for portfolio management

ELECTIVES - HUMAN RESOURCE MANAGEMENT

		L	T	P	C
MSCY 031	**MANAGERIAL BEHAVIOUR AND EFFECTIVENESS**	**3**	**0**	**0**	**2**

OBJECTIVES:

The course would:

- Provide inputs on the various dimensions of Managerial Job
- Create awareness concerning the importance of Professionalism
- Facilitate learning of techniques adopted by industries to measure managerial effectiveness
- Help in building emotional intelligence of students to function effectively in the corporate world.
- Help in updating knowledge about the emerging horizon for managers

MODULE I DIMENSIONS OF MANAGERIAL JOB 06

Managerial Job Dimensions: Theory proposed by Peter Drucker, Henry Fayol, Mintzberg, Fred Luthans - Managerial Skill Set: Art of Delegation; Time Management, Decision Making, Job - behaviour skills, Listening skills, Socializing, Optimizing skills - Gender - leadership myths: Benefits of Androgynous Management-Managerial behaviour models: SHL corporate leadership model-case studies.

MODULE II MANAGERS ROLE IN PROFESSIONALISM 06

Professionalism: Importance of Professionalism; Key elements of Professionalism, Managers role in managing awareness, Developing intellectual discipline, Professional discipline- Creativity and Innovation-Brain Storming, Synectics, Innovation and Entrepreneurship-Professional goals across career stages: Relationship between Age-creativity, Age-performance, Age-motivation, Career Management - case studies.

MODULE III MEASURING MANAGERIAL EFFECTIVENESS 06

Introduction to Measuring Managerial Effectiveness- the Person, Process, and Product Approach; Global measures of managerial effectiveness; Current Industrial and Government practices in the management of managerial effectiveness - case studies.

MODULE IV EMOTIONAL INTELLIGENCE FOR MANAGERS 06

Definition, Elements of Emotional Intelligence, Emotional Intelligence and Eustress, Issues linked to low Emotional Intelligence, Role of Emotional Intelligence in building team spirit; Personality and emotional Intelligence; Managing simple and complex emotions, Psychological capital - exercises.

MODULE V EMERGING HORIZONS FOR MANAGERS 06

Recent Issues and Challenges for Managers - Discussion and Presentation.

Total Hours: 30

REFERENCES:

1. Peter. F. Drucker, The Effective Executive, New York: Harper Collins, 2007.
2. Haider Yasmeen, Managerial Behavior and Effectiveness, Course Material, Chennai: Centre for Distance Education, Anna University, 2007
3. Watts, S.H. Managing Technical People, Delhi: Pearson Education,2007
4. Daniel Goleman, Emotional Intelligence, New York: Bantam Dell, 2006.

OUTCOMES:

After completing the course the students will be able to

- have a panoromic understanding of managerial job dimensions. which inturn will help them to analyze and suggest suitable managerial styles for different corporate situations .
- augment the professional skills and the course facilitates career escalation
- list the various global methods of measuring managerial effectiveness and that understanding will help them to enhance their own effectiveness.
- match their personality traits with those expected for career enhancement. They would be able to work accordingly towards personality transformation.
- comment and propose solutions for any issues pertaining managers.

MSCY 032	HUMAN RESOURCE ACCOUNTING AND AUDIT	L	T	P	C
		3	0	0	2

OBJECTIVES:

The specific objectives of the course are to make the students:

- Learn the basics and importance of HR Accounting and Audit
- Equip with the necessary skills and techniques required for managerial function of HRD Audit.
- Elaborate the various methods/tools and process of auditing the various areas of Human Resource

MODULE I INTRODUCTION 07

Introduction, HR as asset, Definition of Human Resource Accounting and Auditing, Human Resource Accounting - concepts, methods and Applications, Human Resource Accounting Vs Other Accounting. Human Capital – Introduction, Types – Intellectual Capital, Social Capital, Emotional Capital and Spiritual Capital, Conventional and Modern approaches for Human Capital Measurement, Issues in Human Capital Measurement

MODULE II HUMAN RESOURCE COST AND RETURN ON INVESTMENT 07

Human Resource Cost - Monetary Value Approach, Non Monetary Value based approach, Investment in employees - Human Resource Development, Development of HR ROI through high performance employees, Measurement of Group Value.

MODULE III HUMAN RESOURCE ACCOUNTING SYSTEM AND SCORE CARD 06

Developing Human Resource Accounting System, Implementation of Human Resource Accounting System, Integration with Other Accounting system, HR Score Card - constituents, instrument in HR Audit, Human Resource Accounting Software

MODULE IV HUMAN RESOURCE AUDIT 05

Role of Human Resource Audit in Business Environment, HR Audit - Objectives, Concepts, Benefits, Importance, HR Quality Policy Formulation – ISO 9000, Standard, Setting Audit goals, Defining audit team, Areas of HR Audit, Methodology and Instruments of HR Audit, Audit Process and Issues in HR Audit

MODULE V HUMAN RESOURCE AUDIT REPORT 05

Purpose of HR Audit Report, Preparation of Report Design, Use of HR audit report for Business Environment, Recent Advancement in Human Resource Audit and Accounting

TOTAL HOURS: 30

REFERENCES:

1. Eric. G. Flamholtz, "Human Resource Accounting" (3rd edition), USA, Kluwer Academic Publishers, 1999.
2. T.V. Rao, "HRD Audit", New Delhi, Sage Publications, 1999.
3. John McConnell, "Auditing your Human Resources Department" (2nd edition), New York, AMA's publishing division, 2011

OUTCOMES:

At the end of the course the students should be able to:

- distinguish between human resource accounting and other accounting.
- identify the human resource cost using different approaches of cost calculation.
- Design human resource accounting system for the organizations.
- Develop HR audit process
- Prepare audit report to improve the business environment.

MSCY 033	PERFORMANCE MANAGEMENT AND TRAINING	L	T	P	C
		3	0	0	2

OBJECTIVES:

The course would focus on:

- Developing knowledge about Strategic Performance Management System
- Understanding the three stages of SPM Cycle
- The Importance of Training need Analysis
- The Methodology applied for Evaluation of Training
- Creating awareness about the future trends in Training and Development

MODULE I STRATEGIC PERFORMANCE MANAGEMENT 05

Strategic Performance Management: Definition, Process, Benefits, Strategic Performance Management Development Cycle, Feasibility Analysis for SPM-Case Studies.

MODULE II STRATEGIC PERFORMANCE MANAGEMENT DEVELOPMENT CYCLE 07

Designing a Strategic Management Model - Responsibility Structure, Parenting Style, Strategic Objectives, Strategic Action Plans, Designing a Strategic Reporting Model - Critical Success Factors and Key Performance Indicators, Performance Measurement Pyramid, Result and Effort Indicators, Balanced Scorecard, Designing Performance Driven Behavioural Model - Organizational Performance - Driven Behaviour; Individual Performance - Driven Behaviour; Strategic Alignment.

MODULE III TRAINING NEED ASSESSMENT 06

Importance of Need Assessment, Methods used in Need Assessment, Need Assessment Process-Organizational Analysis; Person Analysis and Task Analysis, Competency Models

MODULE IV TRAINING EVALUATION 06

Reasons for Evaluating Training, Formative Evaluation; Summative Evaluation; Evaluation Process; Evaluating Outcome, Cognitive Outcome, Behavioural Outcome, Affective Outcome, Kirkpatrick's Four Level Framework of Evaluation Criteria, Determining Return on Investment; Measuring Human Capital and Training Activity**.**

MODULE V FUTURE OF TRAINING AND DEVELOPMENT 06

Challenges in Career Management, Cross-Cultural Preparation, Life-Long Learning, Self-Learning and Action/Outcome Based Training Program, Managing Dysfunctional Behaviors, Technology and Multimedia in Training-Discussion.

Total Hours: 30

REFERENCES:

1. Andre de Wal. “Strategic Performance Management”, New York: Palgrave Macmillan, 2007.
2. Raymond, A and Amitabh Deo. “Employee Training and Development”, New Delhi: Tata Mc Graw Hill, 2012
3. Topomoy Deb. “Training and Development, Concepts and Applications”, New Delhi: Ane Books India, 2008.
4. Irwin L. Goldstein. “Training in Organizations”, New Delhi: Cengage Learning, 2012.

OUTCOMES:

The students will be able to

- Use the feasibility analysis tool, to evaluate whether the organisation is ready to go in for strategic performance management system.
- Identify the type of Parenting Style followed by different business organizations. Formulate critical success factor and key performance indicators in their job environment.
- Design and schedule the training programme
- Measure Cognitive, Behavioral and Affective outcome of a training program.
- Discuss and comment on the technology oriented training programmes and action/outcome based training programmes.

MSCY 034	INDUSTRIAL RELATIONS AND LABOUR LEGISLATION	L	T	P	C
		3	0	0	2

OBJECTIVES:

The objectives of the course are:

- To provide information on the present scenario of industrial relations.
- To make students be aware about the causes and issues relating to Industrial conflicts and the way to resolve
- To get familiarize with the various social security and welfare measures in both statutory and non statutory practices in the industry
- To provide information about the industrial safety and preventive measures.
- To give an insight about the key labour laws

MODULE I HISTORY AND EVOLUTION OF INDUSTRIAL RELATIONSAND TRADE UNION MOVEMENT IN INDIA 04

Issues and Challenges in sustaining Cordial Industrial Relations (IR), Changing Role and Responsibilities of the Management, Union and Employees in the Stable IR. Trade Union Act- 1926, relevance and scope for improvement

MODULE II INDUSTRIAL CONFLICTS &THEIR RESOLUTION 08

Causes of Conflicts, Need for Managing and Resolution of Conflicts, Grievance Redressal Machinery as a tool for Resolving Conflict. Collective Bargaining - Industrial Disputes Act -- 1947, Manifestations of Conflicts such as Strike, Lock out, Go Slow and other Work Stoppage - Their Impacts and Resolution .

MODULE III SOCIAL SECURITY BENEFITS AND WELFARE MEASURES 06

Purposes of Various Statutory and Non Statutory Welfare Benefits. Present Trends and Practices in Extending Welfare Benefits under Settlements, Employee Provident Fund and Miscellaneous Act, 1952, The Employees state Insurance Act 1948,Payment of Gratuity Act 1972, Minimum Wages Act 1948,The Maternity Benefit Act 1961. Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013.

MODULE IV INDUSTRIAL SAFETY, HEALTH AND ENVIRONMENT 05

Accident Prevention - Education and Enforcement, Relevant Provisions and Factories Act, 1948and The Workmen's Compensation Act, 1923

MODULE V LABOUR LEGISLATIONS 07

History and Development of Labour Legislations, Uniqueness and complexities in the evolution of Indian Labour Laws. Key Labour Legislations: Industrial Establishment (Standing Orders) Act 1946. Contract Labour Regulation and Abolition Act 1970, Payment of Wages Act 1936,Child Labour Prevention and Regulation Act,1986,Equal Remuneration Act 1976, Migrant Workmen Act, 1979.

Total Hours: 30

REFERNCES:

1. C.B. Memoria, Sathish Mamoria and S.V.Gankar. Dynamics of Industrial Relations, Himalaya Publishing House, 3rd revised, 2012.
2. N.D. Kapoor Elements of Mercantile Law, Sultand Chand & Sons, 34th Reprint, 2013.
3. ArunMonappa, RanjeetNambudiri and PatturajaSelvaraj. Industrial Relations and Labour Laws, Tata McGraw Hill, 2nd Edition 2012.
4. P.N.Singh and Neeraj Kumar Employee Relations Management, Pearson, New Delhi, 2011.
5. S.K. Puri, Labour & Industrial Law, Allahabad Law Agency, New Delhi, 10th Edition, 2011.

OUTCOMES:

At the end of the course the students be should able to:

- Identify the contemporary aspects of industrial relations
- Choose the best machinery for industrial dispute settlement
- Analyze the various welfare and industrial safety measures
- List the various safety provisions to avoid accidents.
- Differentiate and apply the concepts of labour laws.

MSCY 035	ORGANISATIONAL STRUCTURE AND DESIGN	L	T	P	C
		3	0	0	2

OBJECTIVES:

The specific objectives of the course are to make the students:

- Learn how organizational goals are determined and organizational structures are framed.
- Discuss major organizational designs adopted in Multinational Companies and to know why organizations are continually being redesigned.
- To explore the effectiveness of the process of structuring and designing on the productivity and satisfaction of the employees.

MODULE I INTRODUCTION TO ORGANIZATIONS STRUCTURE AND DESIGN 07

Introduction, The evolution of Organization Theory, Organization life cycle – Models of Transformation, Organizational structure - Characteristics, Organization Design and Development - Design options; Challenges of Organizational Design, Organization Culture and Change, Features of organization; Basic - Open System model of Organization

MODULE II ORGANIZATIONAL GOALS 05

Definition, Official Vs Operative goal, Competing Goals, Benefits of organizational goals, Key Result Areas - Peter Drucker; Goal Formulation - Cyert March Approach, Coalition and Organizational goals, Side Payment, Organizational Slack, Means End Hierarchy; Goal Adaption and Change.

MODULE III DESIGNING ORGANISATIONAL STRUCTURE 05

Challenges of Design - Differentiation and Integration, Centralization and Decentralization, Standardization and Mutual Adjustment, Mechanistic and Organic Structure; Designing Organizational Structure – Authority, Control, Principles of Bureaucracy; Types of Organization Structure

MODULE IV ORGANISATION STRUCTURE: STRATEGY AND TECHNOLOGY 05

Strategy - Formulation, Implementation, Evaluation, Social System model, Rational System model, Leadership and Empowerment, Building a Learning Organization; Definition of Technology, Theories of Technology, Designing structure according to technology, Joan Woodward’s technology type, Perrows Technology Typology, Thompson: Technological Uncertainty, Impact of IT in Technological Design.

MODULE V ORGANISATION AND ITS ENVIRONMENT 04

Definition of Environment, Domain, Task Environment, Environment Design options, Theories of Environment- Resource Dependence Theory, Transaction Cost Theory, Continuance Theory, Pathological Syndromes, Population Ecology Theory, Strategic Choice Theory, Organizational System in Global Environment.

MODULE VI MANAGING ORGANIZATION EFFICIENTLY 04

Definition, Efficiency and Effectiveness, Approaches to effectiveness - Goal Approach, System Resource Approach, Stake Holder Approach, Business Process Re-engineering, Success and Failures in Organizational design, Creating a Modern Organization – Management and Leadership Challenges.

Total Hours: 30

REFERENCES:

1. Mirza .S. Saiyadain and Poornima Gupta, “Organization Structure and Design- An Indian Perspective”, New Delhi: MacMillan India Ltd, 2009.
2. Gareth.R.Jones and Mary Mathew, “Organizational Thoery, Design and Change” (6th edition), Noida: Pearson India Education Services Pvt.Ltd, 2015.
3. Stephen.P. Robbins and Mary Mathew, “Organization Theory”, New Delhi, Prentice Hall, 2009
4. Arthur G. Bedeian and Raymond F. Zammuto, “Organisations - Theory and Design”**,** Orlando: The Dryden press international edition, 1990
5. Subba Rao. P, “Management and Organisation Behaviouor” (1st edition), Mumbai: Himalaya Publishing house, 2004.

OUTCOMES:

At the end of the course the students should be able to:

- Draw open system model for organizations.
- Develop official and operative goals for organizations using key result areas.
- Draw structure of an organization by analyzing the strategy adopted.
- Design organization according to technology.
- Scan environment as an important ingredient of structuring the organization.
- Develop measures of effectiveness for the organization

MSCY 036	STRATEGIC HUMAN RESOURCE MANAGEMENT	L	T	P	C
		3	0	0	2

OBJECTIVES:

The objectives of the course are to make the students:

- Identify Strategic role of Human Resource Management in organizations.
- To generate new HR strategies to meet recent business needs.
- Learn Human Resource Information Systems and its importance in taking strategic decisions.

MODULE I INTRODUCTION TO STRATEGIC HUMAN RESOURCE MANAGEMENT 06

Definition, Objectives, Investment perspective of Human Resource Management – Traditional and Non Traditional Approaches, Roles of Strategic HR manager , Challenges in Strategic Human Resource Management; Models of strategy - Industrial Organisation Model, Resource Based Model; Process of Strategic Management

MODULE II THE EVOLVING/ STRATEGIC ROLE OF HUMAN RESOURCE MANAGEMENT 06

Difference between Strategic HRM and Traditional HRM, Linking the People with the Strategic needs of Business- 5P model; SHRM and Business Strategy; Strategic Fit, Strategic HRM model, Barriers and Outcome of Strategic HRM. Strategic Renewal - Downsizing, mergers and acquisitions, restructuring, Evaluating and Measuring the Impact of Strategic contributions on traditional HR areas

MODULE III STRATEGIES FOR HUMAN RESOURCE FUNCTIONS 06

Employee Resourcing strategy - Employer Branding, Contest recruiting, E-Recruiting, virtual hiring, Job Design strategies , Strategies for Managing Performance - High Performance Work Systems, Strategic Human Resource Development - Job Design strategies, Aggregate Planning, Talent Pipeline, Succession planning, Virtual Learning, Strategic Compensation Management.

MODULE IV TRENDS IN STRATEGIC HUMAN RESOURCE MANAGEMENT 06

Diversity Management, Cross Cultural Management, Employee Retention Strategies - Dual Career Couples, Work Life Balance, telecommuting, Flexi hours, Work from home policy, Executive education, Employee Empowerment, Job

Enrichment, Employee Assistance Programs, Autonomous Work Teams- Quality Circles, HR Metrics and Business Performance, Corporate Social Responsibility.

MODULE V HUMAN RESOURCE INFORMATION SYSTEM 06

Definition, Human Resource Information System - Life Cycle, Planning and Designing, Cost Benefit Value analysis, Pre Implementation and Implementation Stage of HRIS, Tools in HRIS development, HRIS Applications and Limitations.

Total Hours: 30

REFERENCES:

1. Jeffrey A.Mello, Strategic Human Resource Management (2nd edition), NewDelhi, Thompson Publication, 2003.
2. Michael J. Kavanagh, Mohan Thite. Human Resource Information Systems: Basics, Applications, and Future Directions, New Delhi, Sage Publications, 2009
3. Saiyadin, M.S. Human Resource Management (3rd edition), New Delhi, Tata McGraw hill, 2003.

OUTCOMES:

At the end of the course the students should be able to:

- Explain the strategic management models and process.
- Differentiate strategic and traditional HRM and frame HR strategies form business startegy.
- Develop talent management strategies for organization.
- Strategically manage diversified workforce.
- Plan and design Human Resource Information System for organizations.

MSY 037	INTERNATIONAL HUMAN RESOURCES MANAGEMENT AND ORGANISATIONAL BEHAVIOUR	L	T	P	C
		3	0	0	2

OBJECTIVES:

The course would facilitate the students to

- Learn the concept of IHRM and OB
- Be familiar with the global culture and identify the strategy to manage workforce diversity in multinational organization system
- Relate the importance of motivating employees while managing international workforce
- Identify the challenges facing the global business today with respect to human resource planning, compensation and performance management
- Explain the reason for success and failures in global assignments.

MODULE I INTRODUCTION 06

Defining IHRM – Differences between domestic HRM and IHRM – Variables that Moderate the Differences – Overview of international dimensions of OB – Exploring how cultural differences affects organization – International Organizational behavior challenges for management– Introduction on Expatriates, Non-expatriates and Inpatriates

MODULE II DIMENSIONS OF IHRM IN DIFFERENT CULTURAL BACKGROUND 06

Global staffing alternatives - Selecting and evaluating international employees, – Understanding differences in employee attitude and behaviour - Managing diversity and ethical issues in an international context – Corporate culture, Regional & national cultures, Industry specific culture and reasons for differences– Reasons for Expatriate Failure – Female Expatriates –– Dual Career Practices

MODULE III INTERNATIONAL COMPENSATION PRACTICES: MOTIVATING DIVERSITY 06

Objective of International Compensation – Key Components of an International Compensation Program – Approaches to International Compensation – Rewarding and motivating international employees – Patterns in Complexity, Challenges and Choices.

MODULE IV PERFORMANCE MANAGEMENT IN INTERNATIONAL CONTEXT 06

Performance Management of International Employees – Performance Appraisal of International Employees – Performance Culture of Different Countries-Case studies.

MODULE V INTERNATIONAL HUMAN RESOURCE MANAGEMENT TRENDS 06

Managing multicultural teams– Communicating effectively across culture – Effective leadership in a multicultural environment - Global Career Path – Reasons for accepting or rejecting Global Assignments-Role of IT in Human Resource Networking across Globe.

Total Hours: 30

REFERENCES:

1. Peter J Dowling, Marion Festing and Allen D Engle, International Human Resource Management, Cengage Learning, 2008.
2. K. Ashwathappa and Sadhana Das, International Human Resource Management, Mc. Graw Hill Companies, 2007.
3. Tony Edwards and Chris Rees, International Human Resource Management, Pearson Education, 2005.
4. Dean McFarlin and Paul Sweeney, International Organizational Behavior: Transcending Borders and Cultures, Routledge, 1st Edition, 2012.
5. Nancy J. Adler and Allison Gundersen, International Dimensions of Organizational Behavior, Cengage Learning, 5th Edition, 2007.

OUTCOMES:

At the end of the course the students would be able to:

- Analyze the importance of OB in IHRM
- Evaluate the impact of global culture in managing workforce in multinational organization system.
- Adopt the best strategy to motivate the international workforce.
- Critically analyze the impact of contemporary issues and global imperatives on human resource planning, compensation and performance management.
- Examine success and failure in global assignments.

MSCY 038	NEGOTIATION SKILLS AND CONFLICT MANAGEMENT	L	T	P	C
		3	0	0	2

OBJECTIVES:

The course would focus on:

- Identification of process by which negotiation situations emerge
- Creating knowledge about the dynamics and scope of negotiation situations
- Developing sensitivity towards the behaviour and feelings of negotiating members
- Helping students to resolve organization conflict

MODULE I INTRODUCTION TO NEGOTIATION 06

Meaning of negotiation, Negotiation process, Assumptions in negotiation, Model of Negotiation, Characteristics of effective negotiators, Skills required to negotiating effectively.

MODULE II PLANNING FOR NEGOTIATION 06

Game plan-Pre negotiation planning, During negotiation behaviour, Negotiation dance, Influence mechanism, Post negotiation under taking. National Styles of Negotiation-French, Japanese, Chinese and Americans

MODULE III PERCEPTION AND LISTENING 06

Characteristics of object of perception, Characteristics of perceiver, Freudian Theory. Overcoming perceptual problem, feedback, listening barriers, Benefits of active listening, Ethics in Negotiation, Key Factors Affecting Individual and Group Negotiation

MODULE IV CONFLICT RESOLUTION 06

Nature of conflict, Condition for cooperation, competition and conflict. Conflict management strategies: Avoidance, accommodation, Compromise, Collaboration, Competition.

MODULE V DISTRIBUTIVE AND INTEGRATIVE BARGAINING 06

Distributive Bargaining: Characteristics of distributive bargaining, distributive tactics, Ethics in distributive bargaining, Trust in negotiation, Persuasion, integrative bargaining: Characteristics, Approaches, Difficulty, and Importance. Third Party Intervention - conciliation, arbitration, adjudication, collective bargaining

Total Hours: 30

REFERENCES:

1. Mirza S. Saiyadain. Negotiation, New Delhi: McMillan 2012
2. Dean G. Pruitt. Negotiation Behaviour, New York: Academia Press, 1981
3. Roy J. Lewicki and Joseph A. Liflerer. Negotiation, Illinois, Irwin: Home wood, 1985.

OUTCOMES:

After completing the course the students would be able to

- effectively follow the negotiation process and understand the ethics of negotiation.
- list the skills required for an effective negotiation.
- plan their negotiation strategy keeping in mind the characteristic of their adversaries.
- understand the National Styles of negotiation.
- enhance their listening and perceptual ability for better negotiation
- take appropriate decision regarding the strategies to be adopted for conflict resolution
- practice integrative as against distributive systems of negotiation and will be able to negotiate salary judiciously at the time of job interview.

ELECTIVE - SYSTEMS MANAGEMENT

		L	T	P	C
MSCY 046	**BUSINESS ANALYSIS AND SYSTEMS DEVELOPMENT**	**3**	**0**	**0**	**2**

OBJECTIVES:

The objectives of the course will be to enable the students to:

- Get a “hands on” exposure to the field of ongoing business analysis through the software modules
- Gain a detailed understanding of Data flow diagrams, objects, class, Business models
- Understand the overall link(relationship) between requirement specifications and technologies
- Comprehend the issues, standards, socio-ethical implications, and best practices relating to system development
- Analyze and design a project / case study topic based on business and technical perspectives of their own selection.

MODULE I OVERVIEW OF A BUSINESS ANALYST: ROLES AND RESPONSIBILITIES 06

Definition, Introduction and Overview of The BA’s Activities Throughout the System Development Lifecycle. Roles and Responsibilities of A BA – Models and Methods of SDLC - Initiation Phase – Discovery Phase – Construction Phase – Final V & V Phase – Closeout Phase.

MODULE II FUNDAMENTALS OF BUSINESS ANALYSIS AND DEVELOPMENT 06

Fundamentals of Business Analysis – Objectives – All Links in Chain of Reasoning – Process Rules – Data Rules, Drivers Module – Objectives Module – Project Solution & Scope - Scope of The BA Role – Stakeholders – Context – Scope – User Definitions.

MODULE III THE BUSINESS ANALYST TOOLKIT 06

The BA Toolkit – Introduction to All Activity and Network Diagrams Block Diagram – Swimlane Diagram - Business Process Diagram – ER diagram - Use Cases – Activity Modelling – Conceptual Data Modelling – Key Modelling Elements – Generating Alternative Design Strategies – Selecting Best Alternative Strategy.

MODULE IV REQUIREMENTS ANALYSIS AND PROCESS MODELING 06

Identifying Requirements, Risk Analysis and Business Requirement Document Templates – Business Requirements Development Table of Contents – Business Cases, Actors, Procedures – Post Implementation Follow-ups - Business and Functional Requirements - Process Modeling – Data Usage Rules – Process Execution, Dependency and Non-Functional Components.

MODULE V FUNCTIONAL DECOMPOSITION – DATA MODELING 06

Business Process Modelling Notations – BPNM Basics, Types – Connectors – Pools, Lanes and Message Flows – Gateways and Information Flow – Process Decomposition - Data Modelling – Components – Relationships and Attributes – Lab Practical Exercises.

Total Hours: 30

REFERENCES:

1. Howard Podeswa, “The Business Analyst's Handbook”, Course Technology PTR, 2008
2. Smart BA Professional training program material
3. Enterprise Architect 11 software training material
4. Jeffrey A. Hoffer, Joey F. George, Joseph S. Valacich, “Modern System Analysis and Design”, Pearson – Prentice Hall, 2007.

OUTCOMES:

After studying the course, the students would:

- Be familiar with using software like Bizagi, Enterprise Architect and Drawlite
- Design practical DFD models for business processes in the industry
- Utilize the recent developments in the field of system analysis, design and development such as agile development and SCRUM
- Recognize the major areas of study which include concepts of system analysis
- Design and incorporate the different life cycle models for project
- Identify KPI’s and link those processes in the data model

MSCY 047 DATABASE MANAGEMENT SYSTEMS

L	T	P	C
3	0	0	2

OBJECTIVES:

The objectives of the course will be to enable the students to:

- Get introduced to the fundamentals of Database Management Systems.
- Comprehend the working of a relational model
- Recognize the structure and operations of different types of database designs
- Impart further knowledge about the objected oriented model
- Realise the imminent security issues coupled with database management.

MODULE I INTRODUCTION TO DBMS 06

Database Systems – Definition – Components – Advantages Over the File System – Objectives - Evolution

MODULE II MODELS 06

DBMS Architecture – Associations – Relationships – Mapping between Abstractions – Generalization – Classifications – Conceptual Data modeling – File Organization – Data Structure – Data Models: HDBMS, NDBMS, RDBMS, OODBMS

MODULE III DATABASE DESIGN 06

Relational Data Model – Relational Algebra – ER Diagrams – Data Dictionary – Normalization – Boyce Codd Normal Forms – Integrity – Relational Database Languages – Database Administration – File Structures and Indexing

MODULE IV OBJECT MODELLING 06

Object Oriented Concepts – Structure – Models and Databases – Object Oriented Life Cycle modeling – Objects, Classes, Patterns – Object Interaction modeling – Object Oriented Design - UML

MODULE V OPERATIONS AND MANAGEMENT 06

Client / Server and Databases - Data Warehousing - Query Processing - Concurrency Management - Heterogeneous and Homogenous Systems - Distributed Databases - Controls - Atomicity - Recovery - Security - Back-Up and Recovery

Total Hours: 30

REFERENCES:

1. Ramez Elmasri and Shamkant B. Navathe, “Fundamentals of Database Systems”, Fifth Edition, Pearson Education, 2008.
2. Abraham Silberschatz, Henry F. Korth and S. Sudharshan, “Database System Concepts”, Sixth Edition, Tata Mc Graw Hill, 2011.
3. C.J. Date, A. Kannan and S. Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.
4. AtulKahate, “Introduction to Database Management Systems”, Pearson Education, New Delhi, 2006.
5. Raghu Ramakrishnan, “Database Management Systems”, Fourth Edition, Tata Mc Graw Hill, 2010.
6. Rob Cornell, “Database Systems Design and Implementation”, Cengage Learning, 2011.

OUTCOMES:

After studying the course, the students would:

- Differentiate database systems from file systems
- Utilize the Relational modelfor preservation of information
- Relate the practical applications of the different types of databases used in business
- Use the OOD concepts to record information in synchronous manner
- Use basic data visualization tools such as ER diagrams, design security concepts etc.
- Take necessary security measures to preserve confidentiality while working with databases

MSCY 048 E-COMMERCE TECHNOLOGY

L	T	P	C
3	0	0	2

OBJECTIVES:

The objectives of the course will be to enable the students to:

- Expose the concept of electronic commerce and related technology
- Develop business requirements for technological infrastructure support needed for e-commerce
- Apply electronic and mobile commerce to conventional businesses
- Comprehend use of e-payment systems and security infrastructure in electronic commerce
- Gain insight in global e-commerce security requirments

MODULE I INTRODUCTION 06

Overview of Electronic Commerce – Driving force of Electronic Commerce – benefits, limitations and impact of electronic commerce - Types of EC Business Models - General Framework - Growth of E-Commerce

MODULE II TECHNOLOGY INFRASTRUCTURE 06

Internet - Introduction to Key Technology Concepts: Intranet, WWW, Concepts of Search Engines, Intelligent Agents, Forums, Chats, Streaming Media, Cookies - Approach to Building E-Commerce Site: Software, Hardware, Tools.

MODULE III BUSINESS APPLICATIONS IN E-COMMERCE & M-COMMERCE 06

E-Marketplaces - Retailing in E-commerce - Market Research - Advertising in E-commerce - Exchanges - Auctions - B2B E-Commerce - E-Procurement - E-Collaborations. Mobile Commerce - Characteristics of M-Commerce - Drivers of M-Commerce - Introduction to M-Commerce technology.

MODULE IV E-COMMERCE PAYMENTS AND SECURITY 06

E-Payment Systems - Principles of e-fund transfer, credit and debit card usage, E-check and unified payment systems - E-Billing presentment and payment - Security Threats: Malicious Code, Phishing, Hacking, Cybervandalism, Credit card Fraud, Spoofing, DOS, Sniffing, Insider Jobs - Technology Solutions - Encryption: Symmetric Key, Public Key, Digital Signatures, Digital Envelops, Digital Certificates.

MODULE V GLOBAL E-COMMERCE Strategy AND SOCIAL NETWORKS 06

Overview of electronic commerce strategies – electronic commerce for small and medium enterprises – relevance of social media – virtual communities – impact of social networks, Weblogs, RSS, Podcasting, Wikis, Internet Telephony, Video Conferencing

Total Hours: 30

REFERENCES:

1. Turban, E., King, D., Lee, J., & Liang, T. P. (2012). *Electronic commerce 2010: A Managerial Perspective* (6th ed.). New Delhi: Pearson Education.
2. Laudon, K. C., & Traver, C. G. (2011). *E-commerce: Business, technology, society*. New Delhi: Pearson.
3. Joseph, P. T. (2012). *E-commerce: An Indian perspective*. New Delhi: Prentice-Hall of India

OUTCOMES:

After completion of the course will enable the student in

- Identifying EC business models based on various business needs.
- Recognizing the technological requirements for developing a e-business platform.
- Establishing business know how's of the various business applications of electronic and mobile commerce alike.
- Categorize and classify the payment system and their use to relevant e-commerce companies
- Synchronize e-commerce business models with current global e-commerce strategy

MSCY 049	STRATEGIC INFORMATION TECHNOLOGY FOR MANAGEMENT	L	T	P	C
		3	0	0	2

OBJECTIVES:

The objectives of the course will be to enable the students to:

- Identify the concepts of the various technologies and methods used for business intelligence
- Learn the effective application sof information systems in business
- Get familiarized to other types of information mining such as text and document mining
- Appreciate the dynamics of social media and analytics
- Acquire fundamental knowledge about role of cloud technology in big data framework

MODULE I UNDERSTANDING IT FOR ORGANIZATIONAL ADVANTAGE 06

Definition, Introduction to Information systems after 2010 - Positioning of IT Systems in Organizations - Information Systems Concepts – Strategic Planning Models – Measuring Business Performance – Types of Information Systems – Supply Chain and Logistics Support - IT Infrastructures – Cloud Computing Concepts.

MODULE II DATA AND NETWORK INFRASTRUCTURE 06

Data, Text and Document Management – File Management Systems – Databases – DBMS Concept – Data Warehouses – Data Marts and Data Centre's – Enterprise Content Management – Introduction to Network Management – Business Networks - Wireless Broadband Networks – Network Management – Portals and Mobility.

MODULE III MOBILE COMPUTING AND WEB 2.0 06

Mobile Computing Technology – Mobile Financial Services – Digital Wallet – Mobile Shopping, Entertainment And Advertising – Location Based Services And Commerce - Mobile Enterprise Applications – Web 2.0 And Social Media – Virtual Communities – Social Networking Services – Enterprise 2.0 Tools – Social Media Objectives And Metrics.

MODULE IV BUSINESS INTELLIGENCE AND DECISION SUPPORT 06

Identifying Business Intelligence – BI Architecture – BI Analytics and Reporting – Data Visualization – Data, Text and Web Mining Concepts – Decision Making Processes – Decision Support Systems – Mobile Intelligence and BI.

MODULE V BUSINESS PROCESS MANAGEMENT 06

Business Process Management (BPM) – Service-Oriented Architecture (SOA) – Software Architecture – Information System Design – IT Project Management – Information Systems Development.

Total Hours: 30

REFERENCES:

1. Turban and Volonino, “Information Technology for Management”, John Wiley & Sons, 8th Edition.
2. James A O’Brien, George M Marakas and Ramesh Behl, ’Management Information Systems’ McGraw Hill Education, 10th Indian edition.

OUTCOMES:

After studying the course, the students would:

- Relate to the journey of data and its relative impact on business
- Acquire an understanding of how organizations use BI to sustain their competitive advantage
- Be able to analyze the importance of development of disruptive technology
- Realize the importance of calibrating data for competitive advantage
- Learn the Extraction, Transformation and Load process of data from social media
- Use analytics and cloud tools for business reports

MSCY 050 PROJECT MANAGEMENT

L	T	P	C
3	0	0	2

OBJECTIVES:

The objectives of the course will be to make the students

- Gain insight in successful IT project management and the impact of quality considerations
- Familiarize project management methodologies - tools and techniques, supplemented with examples from case studies and case analysis exercises.
- Appreciate the benefits of good project management
- Apply project management methodologies across the key knowledge areas
- Get trained in project risk and communication

MODULE I INTRODUCTION 06

Project - Project Management (PM) - Areas of Expertise - Project Management Context - Project Life Cycle and Organization - Introduction to PM Process Groups: Initiating - Planning - Executing - Monitoring & Control - Closing.

MODULE II PROJECT INTEGRATION MANAGEMENT 06

Introduction to Project Integration Management: Project Charter - Scope Statements - Directing and Managing Project Execution - Monitoring and Controlling Project Work - Integrated Change Control - Closing Projects.

MODULE III PROJECT SCOPE, TIME AND COST MANAGEMENT 06

Introduction to Project Scope Management: Scope Planning - Scope Definition - Developing WBS - WBS Dictionary - Scope Baseline - Scope Verification - Scope Control - Introduction to Project Time Management: Activity Definition & Sequencing - Resource Estimation - Duration Estimation - Schedule Development and Control - Introduction to Project Cost Management: Basic Principles of Cost Management - Cost Estimating, - Budgeting and Control.

MODULE IV PROJECT QUALITY AND PROCUREMENT 06

Introduction to Project Quality Management: Quality Planning - Quality Assurance - Quality Control - Flowchart - Histogram - Pareto Analysis - Ishikawa Diagram - Introduction to Project Procure Management: Planning Purchases - Planning Contracts - Selecting Sellers - Administrating and Closing Contracts.

MODULE V PROJECT HR, RISK & COMMUNICATION MANAGEMENT 06

Introduction to Project HR Management: HR Planning - Acquiring Project Team - Developing & Managing Project Team - Introduction to Project Risk Management: Risk Management Planning - Risk Identification. - Qualitative and Quantitative Risk Analysis - Response - Monitoring and Control - Introduction to Project Communication Management: Communication Planning - Information Distribution - Performance Distribution - Managing Stakeholders.

Total Hours: 30

REFERENCES:

1. Kathy Schwalbe, Information Technology Project Management", Course Technology, 2008.
2. Bob Hughes, Mike Cotterrel "Software Project Management", Tata McGraw-Hill, 2009.

OUTCOMES:

At the end of the course the student will be able to

- Identify the processes involved in every knowledge area of project management and match the process with project management process groups
- Use various inputs and tools and techniques to deliver real life project ouputs
- Analytically estimate resources required for a project
- Design templates for any activity and sequence them logically using appropriate techniques
- Distinguish and relate concepts to practical environment.

MSCY 051 WEB TECHNOLOGIES

L	T	P	C
3	0	0	2

OBJECTIVES:

The objectives of the course will be to make the students understand:

- Understand the fundamental concepts of a wireless computer system
- Learn about system administration and security protocols
- Apply the knowledge to network monitoring, machine - to - machine communications, quantify the value of a network such as social media
- Analyze and design a project based on business and technical perspectives
- Gain insight to managing Ethernet connections

MODULE I INTRODUCTION TO DIGITAL COMMUNICATION 06

Definition, Introduction to Digital Communication - Concept of The Internet of Things (IoT) - Machine-To-Machine Communication (M2M) - Computing Varieties - Key Trends in Technology - Moore's Law - Security in The Cloud - Data Encryption - Public Key Cryptography.

MODULE II TECHNOLOGY ECO-SYSTEM AND CDP 06

Introduction and Concept of Technological Eco System - Connected Device Platform (CDP) - Application Enablement Platform (AEP) - Data Acquisition - Methods and Challenges in Acquiring Data - Recent System Lockdowns - Smart Services -Collaborations Over Cloud.

MODULE III CONNECTED ECO-SYSTEM: M2M & OEM 06

Concept of Application Domains - Core Application Domains of Cloud and IoT - Use Cases in M2M - OEM Definition and Advantages - Value Chain - Challenges in Connected Eco System

MODULE IV ECONOMIC TRENDS AND SECURE NETWORKS 06

Identifying Macro Economic Trends in IoT - Economic Assessment of Social Networks - Metcalfe's Law - Wireless Network Platforms - Mobile Virtual Network Operators (MVNO) - Security Vitals in Network Connections

MODULE V NETWORK MANAGEMENT 06

Definition of Network Management - Network Management Concepts - Collusion Detection - Jam Code - Managing Ethernet Connections - Data Packet Transfers - Connected Devices Management.

Total Hours: 30

REFERENCES:

1. Michal Zalewski, “Silence on the Wire: A Field Guide to Passive Reconnaissance and Indirect Attacks”, No Starch Press; 1 edition (April 15, 2005)
2. Daniel Kellmereit and Daniel Obodovski, “The Silent Intelligence: The Internet of Things”, DnD Ventures; 1 edition (April, 2013)

OUTCOMES:

At the end of the course the student will be able to

- Gather business requirements for organizations looking to implement IT system
- Scrutinize administration and security protocols based on their optimality
- Quantify the value of a network such as social media and other network systems based on business and technical perspectives.
- Build basic projects in a web based ecosystem
- Correlate basic network knowledge and its relevance in web technologies.

MSCY 052 BIG DATA IN MANAGEMENT

L	T	P	C
3	0	0	2

OBJECTIVES:

The objectives of the course will be to enable the students to:

- Get fundamental information about big data and its components
- Learn the power of big data analytics framework in managing business corporations.
- Know about the components required in creating a Big Data Platform
- Identify the various phases involved in developing a Big Data strategy within an organization
- Examine the technological feasibility for selecting the big data wave

MODULE I INTRODUCTION TO BIG DATA 06

Evolution of Data management - Waves of Managing Data - Managing big data - Building a Successful Big Data Management Architecture - Traditional and advanced analytics - Defining Structured Data - Defining Unstructured Data - Integrating data types into a big data environment

MODULE II TECHNOLOGY COMPONENTS OF BIG DATA 06

Distributed Computing - Big Data Stack - Layers (0 - 4) - Big Data Analytics and Applications - Virtualization - Cloud Deployment

MODULE III BIG DATA MANAGEMENT 06

Operational Databases - Non-Linear Databases - Document Databases - Columnar Databases - Spatial Databases - Polyglot Persistence - MapReduce Fundamentals - Introduction to HadoopDistributedFileSystem(HDFS)

MODULE IV ANALYTICS AND BIG DATA - I 06

Big Data Analytics and Traditional Data Warehouses - Deployment Models - Appliance Model - Cloud Model - Modifying BI to Handle Big Data

MODULE V ANALYTICS AND BIG DATA - II 06

Text Analytics - Analysis and Extraction Taxonomies - Social Media Analytics - Text Analytics - Customized Approaches for Big Data Analysis - Big Data Analysis Framework

Total Hours: 30

REFERENCES:

1. Marr, Bernard. “Big Data: Using SMART big data, analytics and metrics to make better decisions and improve performance.” John Wiley & Sons, 2015.
2. Pries, Kim H., and Robert Dunnigan. “Big Data Analytics: A practical guide for managers.”, CRC Press, 2015.
3. Hurwitz, Judith, Alan Nugent, Fern Halper, and Marcia Kaufman. “Big data for dummies”, John Wiley & Sons, 2013.

OUTCOMES:

After studying the course, the students would:

- Be able to relate the concept of Big Data and its pertinent role in the corporate world
- Outline the components requited to set up a functional Big Data Platform
- Simplify the various phases of development involved in a Big Data strategy within an organization
- Analyse and perform calculations for requiring technology infrastructure to plan a big data wave.
- Enhance decision making with knowledge of data insights with big data analytics
- Possess in-depth understanding of the wide range of fundamental algorithms used for managing big data.

MSCY 053	APPLICATION OF ENTERPRISE RESOURCE PLANNING	L	T	P	C
		3	0	0	2

OBJECTIVES:

The objectives of the course would be to make the students

- Identify various concerns / issues during ERP implementation at different stages such as pre and post implementation.
- Appreciate the functionality of different ERP modules
- Gain knowledge the use of ERP in industries
- Get trained Live ERP
- Gain insight to ERP industrial needs

MODULE I ERP IMPLEMENTATION AND CONTROL 06

Project Scoping – Implementation of project plan – Managing requirements – Requirement gathering process – Business Process Reengineering – Introduction to Business Process Modeling - Gaps Identifications – Bridge of the gap

MODULE II LIVE ERP AND SUPPORT 06

Types of ERP security issues – Authorizations – Data Migration – Cutover planning and go live preparation – Training environment – Training delivery – Training evaluation – Success/Failure of ERP implementation – Application support – Vendor support strategies

MODULE III ERP FUNCTIONAL MODULES – I 06

Human Resource Management – Financial Management – Procurement – Inventory Management – Supplier Relationship Management – Production Planning

MODULE IV ERP FUNCTIONAL MODULES – II 06

Sales and Service – Supply Chain and Logistics Planning – Customer Relationship Management – Quality Management – Maintenance Management – Product Lifecycle Management

MODULE V ERP FOR INDUSTRIES 06

ERP for petroleum, oil and gas companies – auto industry – pharma industry – FMCG industry – Mining industry – retail industry – healthcare – educational institutions – telecom – banks insurance and utility companies.

Total Hours: 30

REFERENCES:

1. Ray, R. (2011). *Enterprise Resource Planning - Text & Cases*. New Delhi (India): Mcgraw-Hill Pub.
2. Leon, A. (2008). *ERP demystified*. New Delhi: Tata-McGraw-Hill.
3. Jaiswal, M., & Vanapalli, G. (2005). *Textbook of enterprise resource planning*. Delhi: Macmillan.
4. Monk, E. F., & Wagner, B. J. (2006). *Concepts in enterprise resource planning*. Boston, MA: Course Technology.
5. Garg, V. K., & Venkitakrishnan, N. K. (2004). *Enterprise resource planning: Concepts and practice* (2nd ed.). New Delhi: Prentice-Hall of India Private Limited.

OUTCOMES:

At the end of the course the student will be able to

- Recognize the various functionalities in Enterprise Resource Planning
- Create a robust method of requirements gathering during the process of ERP implementation
- Maintaining vendor relationship for successful implementation of the ERP system
- Identify the importance of different ERP functional modules and its relevance in present day businesses.
- Categorize ERP packages/modules/solutions customized across various manufacturing and service industries.

ELECTIVES -OPERATIONS MANAGEMENT

MSCY 061	SUPPLY CHAIN MANAGEMENT	L	T	P	C
		3	0	0	2

OBJECTIVES:

The objectives of the course would be to make the students

- Learn the various decision phases in supply chain management
- Aware of the supply chain drivers and design a distribution network
- Gain insight into aggregate plan and balancing demand and inventory in supply chain
- Get trained in sourcing and choice of transportation in supply chain
- Familiar with the information technology components in supply chain

MODULE I INTRODUCTION TO SUPPLY CHAIN 06

Understanding Supply Chain - Decision Phases - Supply Chain Performance - Competitive and Supply Chain Strategies - Achieving Strategic Fit - Expanding Strategic Scope.

MODULE II SUPPLY CHAIN DRIVERS AND DESIGN 06

Drivers of Supply Chain performance - Designing Distribution Network - Network Design in the Supply Chain - Network Design in an Uncertain Environment.

MODULE III AGGREGATE PLANNING AND MANAGING SUPPLY, DEMAND AND INVENTORY 06

Aggregate Planning in a Supply Chain: Role - Managing Supply - Managing Demand in Supply Chain - Cycle and Safety Inventory in Supply Chain - Level of Product Availability.

MODULE IV SOURCING AND TRANSPORTATION 06

Sourcing decision in Supply Chain - Third and Fourth Party Logistics Providers - Supplier Scoring and Assessment - Transportation in a Supply Chain - Risk and Trade-offs in Transportation Design.

MODULE V INFORMATION TECHNOLOGY IN A SUPPLY CHAIN 06

Information Technology in a Supply Chain - CRM, ISCM, SRM in Supply Chain - Over view of Recent Trends in Supply Chain: e-SRM, e-LRM, e-SCM.

Total Hours: 30

REFERENCES:

1. Sunil Chopra, Peter Meindl and D.V. Kalra. “Supply Chain Management: Strategy, Planning, and Operation”, Pearson Education, 5th Edition, New Delhi, 2013.
2. Janat Shah. “Supply Chain Management: Text and Cases”, Pearson Education, 1st Edition, New Delhi, 2009.
3. Vinod V. Sople. “Supply Chain Management: Text and Cases”, Pearson Education, 1st Edition, New Delhi, 2012.
4. Monczka, R. M., Handfield, R. B., Giunipero, L. C. and Patterson, J. L. “Purchasing and Supply Chain Management”, Cengage Learning, 5th Edition, 2012.
5. David Frederick Ross, “Introduction to e-Supply Chain Management: Engaging Technology to Build Market-Winning Business Partnerships”, CRC Press, 2002.

OUTCOMES:

On completion of the course, the student will be able to:

- Identify the phases for measuring the performance of supply chain
- Choose the appropriate distribution network designed for different products
- Estimate aggregate planning cost and find the right strategy for balancing demand and inventory
- Tap the best source and choose the best mode of transportation in supply chain
- Handle the appropriate information technology models for supply chain management

MSCY 062 TOTAL QUALITY MANAGEMENT

L	T	P	C
3	0	0	2

OBJECTIVES:

The objectives of the course would be to make the students

- Learn the framework of total quality management
- Aware of the various philosophies of quality management
- Gain insight into statistical process control
- Get trained in tools and techniques of quality management
- Familiar with various quality management systems

MODULE I INTRODUCTION 06

Defining Quality - Dimensions of Quality - TQM Framework - TQM Culture - Leadership - Quality Council - Customer Focus - Customer Perception of Quality - Translating Needs into Requirements - Employee Involvement.

MODULE II PRINCIPLES AND PHILOSOPHIES OF QUALITY MANAGEMENT 06

Overview of the contributions of Deming, Juran, Feiganbaum, Crosby, Ishikawa and Taguchi - Quality Circle - 5S Principles - 8D Methodology.

MODULE III STATISTICAL PROCESS CONTROL 06

Meaning and significance of Statistical Process Control (SPC) - Construction of Control Charts for Variables and Attributes - Process Capability - meaning, significance and measurement - Six Sigma.

MODULE IV TOOLS AND TECHNIQUES FOR QUALITY MANAGEMENT 06

Quality Function Deployment (QFD) - Voice of customer - Information Organization - House of quality (HOQ) - Failure Mode Effect Analysis (FMEA) - FMEA stages - Seven QC Tools - Benchmarking - POKA YOKE.

MODULE V QUALITY MANAGEMENT SYSTEMS 06

Quality Management Systems - Introduction to IS/ISO 9004:2008 - Documentation - Quality Audits - Environmental Management System - ISO 14000 series - Concepts of ISO 14001.

Total Hours: 30

REFERENCES:

1. Dale H.Besterfield, Carol Besterfield - Michna, Glen H. Besterfield, Mary Besterfield - Sacre, Hermant - Urdhwareshe and Rashmi Urdhwareshe. “Total Quality Management”, 3rd Edition, Pearson Education, New Delhi, 2011.
2. Shridhara Bhat, K. “Total Quality Management - Text and Cases”, Himalaya Publishing House, 1st Edition, New Delhi, 2002.

OUTCOMES:

On completion of the course, the student will be able to:

- Identify the culture and framework required for implementing total quality management
- Implement the appropriate quality management principles and philosophies
- Formulate the right strategy for applying statistical process control
- Tap the tools and techniques of quality management to improve quality
- Identity the quality management systems essential for industries

MSCY 063 INTEGRATED MATERIALS MANAGEMENT

L	T	P	C
3	0	0	2

OBJECTIVES:

The objectives of the course would be to make the students

- Know the importance of materials and integration of material management functions in an organization
- Learn the essentials and techniques of materials planning and inventory management
- Gain knowledge on purchasing procedure and related issues
- Familiar with store management activities and store keeping documents
- Learn the techniques of inventory control to reduce inventory cost

MODULE I INTRODUCTION 04

Materials - Importance - Need and Functions of Materials management - Integrated Materials Management: meaning - importance - benefits - Various types of organization structure for Materials Management - Associated costs in materials management.

MODULE II MATERIAL PLANNING AND INVENTORY MANAGEMENT 08

Material Requirement Planning - Bill of Materials - MRP-1 - Materials Budget: meaning, objectives- Meaning of Economic order quantity - Basic inventory models: Purchase and manufacturing models - Meaning of minimum, maximum, lead time, reorder point, safety stock - Quantity discount model - Meaning of Review systems: P and Q systems - MRP-II and ERP

MODULE III PURCHASING 06

Importance - Functions - Organization for purchasing - Centralized vs. Decentralized purchasing -Six Rs - Ethics in purchasing - Legal aspects in purchasing - Purchasing cycle - Source selection: Source of information - Single source and Multi source - Evaluation - Vendor rating - Selection Methods - Ordering Systems - e-SRM.

MODULE IV STORES MANAGEMENT 06

Storekeeping: Objectives - Responsibilities - Importance - Functions - Stores organization - Location of store house - Centralized and Decentralized stores - Layout - Types of stores - Methods of storing - Store room equipments - Principles of storing goods - Material Identification - Codification - Bar Code Technology -

RFID - - Safety in stores -Stores Ledger - Kardex System - Automation in material handling and storing.

MODULE V INVENTORY CONTROL 06

Purpose of inventory - Types of inventory - Need and objectives of scientific inventory control - 2 bin system - Visual control system - Stock verification procedure - Obsolete, surplus and scrap control - Selective inventory controls: ABC, XYZ, HML, VED, FSN, SOS, SDE, GOLF - Ratios used in Evaluation of materials management - Inventory turnover ratio - Role of IT in Materials Management

Total Hours: 30

REFERENCES:

1. Gopalakrishnan, P. and Abid Haleem. “Handbook of Materials Management”, Eastern Economy Edition, 2nd Edition, New Delhi, 2015.
2. Gopalakrishnan & Sundaresan, “Material management: An Integrated Approach”, Prentice- hall of India private limited, New Delhi, 2005.
3. A.K. Datta, “Materials Management: Procedures Text and Cases”, Prentice-Hall of India private limited, New Delhi, 2003.
4. Varma, M.M. “Materials Management”, Sultan Chand & Sons, 2004.
4. Gopalakrishnan, “Purchasing and Materials Management”, Tata McGraw Hill, New Delhi, 2010

OUTCOMES:

After completing the course, the students will be able to:

- Appreciate the significance of managing materials in an integrated manner
- Manage the inventory by prior planning and applying the appropriate inventory model
- Execute the purchasing of materials through proper sourcing, negotiation and evaluating vendors.
- Manage stores related activities and maintain the documents pertaining to stores
- Reduce the cost of inventory by applying various techniques for Inventory Control.

MSCY 064 LEAN SIX SIGMA

L	T	P	C
3	0	0	2

OBJECTIVES:

The objectives of the course would be to make the students

- Learn the basic concepts of Lean and Six Sigma.
- Identify and measure the critical aspects of an existing process
- Analyze the existing process with appropriate tools and techniques
- Improve and control the process quality applying various control techniques
- Evaluate the outcome of six sigma project implementation

MODULE I LEAN & SIX SIGMA BACKGROUND AND FUNDAMENTALS 06

Six Sigma - Lean Manufacturing and Six Sigma- Six Sigma and Process Tolerance - Six Sigma Capability - Six Sigma Need Assessments - Implications Of Quality Levels - Cost of Poor Quality (COPQ).

MODULE II SIX SIGMA IMPLEMENTATION - DEFINE AND MEASURE 06

Overview of DMAIC and DMADV - Tools for definition - IPO diagram, SIPOC diagram, Flow diagram, CTQ Tree, Project Charter - Tools for measurement - Check sheets, Histograms, Run Charts, Scatter Diagrams, Cause and effect diagram, Pareto charts, Control charts, Flow process charts, Process Capability Measurement.

MODULE III ANALYZE 06

Tools for analysis - Process Mapping, Regression analysis, RU/CS analysis, SWOT, PESTLE, Five Whys, interrelationship diagram, overall equipment effectiveness, TRIZ
innovative problem solving

MODULE III IMPROVE AND CONTROL 06

Tools for improvement - Affinity diagram, Normal group technique, SMED, 5S, mistake proofing, Value stream Mapping, forced field analysis - Tools for control - Gantt chart, Activity network diagram, Radar chart, PDCA cycle, Milestone tracker diagram, Earned value management

MODULE V EVALUATION AND CONTINUOUS IMPROVEMENT METHODS 06

Evaluation strategy - the economics of six sigma quality, Return on six Sigma (ROSS), ROI, poor project estimates - continuous improvement - lean manufacturing - value, customer focus, Perfection, focus on waste, overproduction - waiting, inventory in process (IIP), processing waste, transportation, motion, making defective products, underutilizing people - Kaizen

Total Hours: 30

REFERENCES:

1. Kastle, Bill; Rowlands, David and George, Michael. “What is Lean Six Sigma”, McGraw - Hill Education, 2005.
2. Keller, Paul and Pyzdek, Thomas. “The Six Sigma Handbook”, McGraw-Hill, 4th Edition, 2014.
3. Forrest W. Breyfogle, III, James M. Cupello and Becki Meadows. “Managing Six Sigma: A Practical Guide to Understanding, Assessing, and Implementing the Strategy That Yields Bottom-Line Success”, John Wiley & Sons, 2000.
4. James P. Womack and Daniel T. Jones. “Lean Thinking: Banish Waste And Create Wealth In Your Corporation”, Simon and Schuster, 2003.

OUTCOMES:

On completion of the course, the students would be able to:

- Learn the basic concepts of Lean and Six Sigma.
- Identify and measure the critical aspects of an existing process
- Analyze the existing process with appropriate tools and techniques
- Improve and control the process quality applying various control techniques
- Evaluate the outcome of six sigma project implementation

MSCY 065 LOGISTICS MANAGEMENT

L	T	P	C
3	0	0	2

OBJECTIVES:

The objectives of the course would be to make the students

- Identify of the role of logistics in adding value to the final product
- Gain knowledge on warehouse operations and materials handling
- Manage the functions of transportation and packaging
- Evaluate the performance of logistics functions
- Aware of the latest developments in the field of logistics

MODULE I INTRODUCTION 06

Definition and Scope of Logistics - Functions & Objectives - Customer Value Chain - Service Phases and attributes - Value added logistics services - Role of logistics in Competitive strategy - Customer Service.

MODULE II WAREHOUSING AND MATERIALS HANDLING 06

Warehousing Functions - Types - Site Selection - Decision Model - Layout Design - Costing - Virtual Warehouse - Material Handling Equipment and Systems - Role of Material Handling in Logistics - Automated Material Handling - Material Storage Systems - Principles - Benefits - Methods - ASRS.

MODULE III TRANSPORTATION AND PACKAGING 06

Transportation System - Evolution - Infrastructure and Networks - Freight Management - Vehicle Routing - Containerization - Forms for Inbound and out bound logistics-Modal Characteristics - Inter-Modal Operators and Transport Economies - Packaging - Design considerations - Material and Cost - Packaging as Unitization - Consumer and Industrial Packaging.

MODULE IV PERFORMANCE MEASUREMENT AND COSTS 06

Performance Measurement - Need - System - Levels and Dimensions - Internal and External Performance Measurement - Logistics Audit - Total Logistics Cost - Concept - Accounting Methods - Cost - Identification - Time Frame and Formatting.

MODULE V CURRENT TRENDS 06

Logistics Information Systems - Need - Characteristics and Design - E Logistics - Structure and Operation - Logistics Resource Management - e-LRM - Automatic Identification Technologies - Warehouse Simulation - Reverse Logistics - Scope -

Design and as a Competitive Tool - Global Logistics - Operational and Strategic Issues - Ocean and Air Transportation - Strategic Logistics Planning.

Total Hours: 30

REFERENCES:

1. Bowersox, D. and Closs, D. “Logistical Management: The Integrated Supply Chain Process”, Tata McGraw Hill, 1st Edition, New Delhi, 2010.
2. Vinod V. Sople. “Logistics Management”, Pearson Education, 3rd Edition, New Delhi, 2012.

OUTCOMES:

After completing this course, the students will be able to

- Appreciate the role of logistics in adding value to the final product
- Bring about changes in the material handling and warehousing practices of an organization
- Effectively manage the transportation and packaging related activities
- Evaluate the performance of logistic functions in an organization
- Execute logistics desires of a company from a global perspective

MSCY 066 SERVICES OPERATIONS MANAGEMENT

L	T	P	C
3	0	0	2

OBJECTIVES:

The objectives of the course would be to make the students

- Gain knowledge on the role of services in an economy
- Learn to design and develop new services based on market needs
- Recognize the dimensions of service quality and its implications
- Gain insight into various models applied in the management of service organizations
- Learn to apply tools and techniques in service operations management

MODULE I INTRODUCTION 06

Services - Importance and role in economy - Distinctive characteristics - Nature of services - Service classification - Service Package - Service Strategy - Internet strategies - Service Environment.

MODULE II SERVICE DESIGN 06

New Service Development - Designing the Service delivery system - Service Blue-printing - Managing Service Experience - Front-office and Back-office Interface - Servicescape - Implication for Service Design - Vehicle Routing and Scheduling

MODULE III SERVICE QUALITY 06

Service Quality - Dimensions - Gap Model - SERVQUAL instrument - Complaint management - Walk-through Audit - Service Recovery - Service Guarantees - Service Encounter - Service Feedback - Analysis and Enhancement.

MODULE IV OPERATING SERVICES 06

Service operational planning and control - Process Analysis - Process Simulation - Service Facility Location - Capacity Management in Services - Queuing models - Waiting Lines - Yield management.

MODULE V TOOLS AND TECHNIQUES 06

Inventory Management in Services - Retail Discounting Model - Newsvendor Model - Productivity and Performance measurement - Data Envelopment Analysis (DEA) - Scoring System - Technology in Services

Total Hours: 30

REFERENCES:

1. James A Fitzsimmons and Mona J Fitzsimmons. “Service Management: Operations, Strategy, Information Technology”, Tata McGraw Hill, 7th Edition, New Delhi, 2014.
2. Metters Richard D. “Successful Service Operations Management”, Cengage Learning, 2nd Edition, New Delhi, 2012.
3. Robert Johnston and Graham Clark. “Service Operations Management: Improving Service Delivery”, Pearson Education, 2nd Edition, New Delhi, 2008.
4. J. Nevan Wright, Peter Race. “The Management of Service Operations”, Thomson, 2nd Edition, 2005

OUTCOMES:

On completion of the course, the students would be:

- Appreciate the role of services in an economy
- Equipped with theoretical knowledge for designing a new service.
- Able to measure and improve the quality of service delivery.
- Able to manage the operations of a service organization with a strategic insight
- Able to choose the right tools and techniques to measure the efficiency and effectiveness of service delivery

MSCY 067 PRODUCT DESIGN

L	T	P	C
3	0	0	2

OBJECTIVES:

The objectives of the course would be to make the students

- Learn methods and tools used for product design
- Gain knowledge for planning the product development stages
- Aware of the role of multiple functions in designing and developing a new product
- Gain insight to various industrial design and robust design products
- Learn the about Intellectual Property Rights (IPR) and Patent Laws

MODULE I INTRODUCTION 06

Defining Product - Types of Products - Product Development - Characteristics - Duration and Cost - Challenges - Development Process - Generic Process - Adapting to Product Types - Evaluation - Decay Curve - Cost Expenditure Curve-

MODULE II PRODUCT PLANNING 06

Product Planning Process - Steps - Product Life Cycle - Technology Life Cycle - Understanding Customer Needs - Disruptive Technologies - Product Specification - Concept Generation - Activity - Steps - Brain Storming

MODULE III PRODUCT CONCEPT 06

Concept Selection - Importance - Methodology - Concept Screening - Concept Scoring - Concept Testing - Product Architecture - Definition - Modularity - Implication - Establishment - Delayed Differentiation - Platform Planning.

MODULE IV INDUSTRIAL DESIGN AND DESIGN TOOLS 06

Industrial Design - Design for Manufacturing - Value Engineering - Ergonomics - Prototyping - Robust Design - Collaborative Product Development- Product Development Economics.

MODULE V PATENTS 06

Defining Intellectual Property and Patents - Patent Searches and Application - Patent Ownership and Transfer - Patent Infringement - New Developments and International Patent Law.

Total Hours: 30

REFERENCES

1. Karl Ulrich, Steven Eppinger and Anita Goyal, “Product Design and Development”, Tata McGraw Hill, 4th Edition, New Delhi, 2009.
2. Chitale, A. K. and Gupta, R. C. “Product Design and Manufacturing”, Prentice Hall of India, 6th Edition, New Delhi, 2012.
3. Deborah E. Bouchoux, “Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets”, 4th Edition, Cengage Learning, New Delhi, 2013.
4. Randy J. Hunt. “Product Design for the Web: Principles of Designing and Releasing Web Products”, Pearson Education, 1st Edition, 2014.

OUTCOMES:

On completion of the course, the students would be:

- Appreciate and recognize the use of appropriate product development method
- Able to convert the identified concepts in to new product
- Equipped with the knowledge and confidence of designing a new product
- Able to identify the requirements of robust design for existing product
- Able to choose and implement Intellectual Property Rights (IPR) and Patent Laws

MSCY 068 SYSTEM SIMULATION AND MODELLING

L	T	P	C
3	0	0	2

OBJECTIVES:

The objectives of the course would be to make the students

- Learn the design manufacturing simulation models using common simulation software.
- Gain knowledge for evaluate and interpret alternative system designs
- Appreciate the technical reports documenting systems design alternatives and recommendations
- Gain insight for suggestions to implement new or improved manufacturing systems.
- Learn simulation modeling to an industrial problem, utilizing experimental design techniques.

MODULE I INTRODUCTION 06

Systems - Modeling - General Systems Theory - Concept of Simulation - Simulation as a Decision Making Tool - Types of Simulation.

MODULE II RANDOM NUMBERS 06

Pseudo Random Numbers - Methods of Generating Random Varieties - Discrete and Continuous Distributions - Testing of Random Numbers.

MODULE III DESIGN OF SIMULATION EXPERIMENTS 06

Problem Formulation - Data Collection and Reduction - Time Flow Mechanism - Key Variables - Logic Flow Chart - Starting Condition - Run Size - Experimental Design Consideration - Output Analysis and Interpretation Validation.

MODULE IV SIMULATION LANGUAGES 06

Simulation Languages - Study of GPSS and Applications.

MODULE V CASE STUDIES/MINI PROJECT 06

Development of Simulation Models using the Simulation Language studied for Systems - Queuing Systems - Production Systems - Inventory Systems - Maintenance and Replacement Systems - Investment Analysis and Network.

Total Hours: 30

REFERENCES:

1. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol, Saumil Shah and P. Shahabudeen. “Discrete Event System Simulation: (VTU)”, Pearson Education, 4th Edition, New Delhi, 2011.
2. Thomas J. Schriber, “An introduction to simulation using GPSS/H”, John Wiley & Sons, New York, 1991.
3. Deo, Narsingh and Millican Charles E., “System Simulation with Digital Computer”, Prentice Hall of India, 1979.
4. Subramanian KRV and Sundaresan R Kadayam, “System Simulation - An Introduction to GPSS”, CBS Publishers, New Delhi, 1993.
5. Zaven A. Karian and Edward J. Dudewicz, “Modern Statistical, Systems, and GPSS Simulation”, CRC Press, Washington D C, 1999.

OUTCOMES:

On completion of the course, the students would be able to:

- Present and demonstrate simulation results from a group project using appropriate visualization output.
- Design functions using modeling software and mathematical based toolboxes to simulate processes within a chosen model in a company.
- Develop high level block diagram designs of key technology physical systems using appropriate modeling environments which would be implemented in the industry.
- Demonstrate awareness of environmental issues in a selected model by incorporating appropriate input factors
- Equipped with converting any business problem in to a system format and find a solution

ELECTIVES - ISLAMIC BANKING AND FINANCE

MSCY 076	INTRODUCTION TO ISLAMIC ECONOMICS	L	T	P	C
		3	0	0	2

OBJECTIVES:

To make the students understand

- nature and basic features of Islamic economics
- Islamic critique of conventional economic thought and processes
- ethical character of Islamic Economics
- economic perspective of shariah prohibited business activities
- system of Islamic wealth distribution and its application

MODULE I INTRODUCTION 06

Islamic Economics: Definition, Nature, Essentials; Conventional Vs Islamic Economics; A Critical Review of Different Economic Systems; Capitalism Vs Socialism and Islamic Economic System.

MODULE II PRINCIPLES OF ISLAMIC ECONOMICS 06

Prohibition of Riba, Bank Interest and rationale of its prohibition; Prohibition of Gharar (ambiguity) and Maysir (Gambling); Competition, Cooperation and their relative scope; Risk sharing Verses Risk shifting; Economic Stability and the Role of abolition of interest.

MODULE III ISLAMIC CONSUMER/ PRODUCER BEHAVIOUR 06

Consumer Behaviour: Self interest with ethical constraints; Producer Behaviour: Theory of Firm; The possibility of taking Social goods into consideration; Public Sector Policy goals with Environmental Protection.

MODULE IV WEALTH DISTRIBUTION 06

Income and Wealth Distribution under Islamic System; Objectives; Sources of Public Revenue in Islam; Means of Distribution of Wealth: Zakah and Waqf institutions and their economics aspects.

MODULE V ISLAMIC COPERATION AND INSTITUTIONS 06

International Islamic Cooperation**;** Institutional Infrastructure supporting Islamic Finance**;** Role of Islamic Development Bank in Economic Cooperation and Development.

Total Hours: 30

REFERENCES:

1. Islamic Economics by Umar Chapra - CEPT Publications
2. An Introduction to Islamic Economics by Akram Khan
3. Fundamentals of Islamic Economic System By Dr. Muhammad Sharif Chaudhry

OUTCOMES:

After successful completion of the course, students will be able to:

- Differentiate between Islamic Economic System and other conventional economic systems;
- Explain the Prohibition of riba (interest) and its rationale from economics perspective;
- Appreciate and analyze various Islamic proscription/ prohibitions and their justification from economics points of view;
- Demonstrate an understanding of Islamic ethics of business, values and prescription;
- Demonstrate a comprehension of consumer and producer behaviour from Islamic perspective, ethical and moral dimensions, inclusiveness and sustainability.
- Assess the causes of inequitable distribution of wealth and measures to counter provided by Islamic system of wealth distribution

MSCY 077	FUNDAMENTALS OF ISLAMIC FINANCE	L	T	P	C
		3	0	0	2

OBJECTIVES:

To make the students understand

- basic concepts, *shari'ah* principles and guidelines on financial transaction
- foundation and characteristics of Islamic Finance
- major prohibition in Islamic finance
- Islamic law of contract and the prerequisite conditions for validity of contract
- various aspects of *'fiqh-al muamilat'* applied to resolve contemporary issues of finance and business transactions

MODULE I INTRODUCTION TO SOURCES OF ISLAMIC LAW (SHARI'AH) 06

Shariah & Fiqh : Definition and Concept; Sources of Shari'ah: Quran, Sunnah, Ijma, Qiyas; Objectives of Shariah; Concept of Ijtihad and the necessary conditions; Principles of Fiqh: Introduction and importance.

MODULE II MAJOR PROHIBITIONS IN ISLAMIC FINANCE 06

Riba(Interest): Definition and Classification; Gharar (Ambiguity/ Uncertainty): Definition and Classification; Maysir & Qimar (Gambling): Definition and Classification.

MODULE III ISLAMIC LAW OF CONTRACTS 06

Principles of Islamic Business; Contract: Definition and Classification; Aqd (contract), Wad (Promise), Muwa'adah/ Mu'ahida (Bilateral Promise); Elements of Contract and conditions for its Validity.

MODULE IV

CLASSIFICATION OF CONTRACTS (Unilateral & Bilateral) 06

Contract of Exchange (Sale Contracts); Contract of Partnership (Mudarabaha, Musharakah); Contract of Trust/ Safe Custody (Wadi'ah, Amanah) Contract of Security (Kafalah, Rahn, Hawalah), Contract of Usufruct utilization (Ijarah), Other Contracts: Wakalah, Jo'alah etc.

MODULE V PRINCIPLES OF ISLAMIC FINANCIAL SYSTEM 06

Islamic Finance: Definition, Concept, Foundation, Features, Objectives; Islamic Finance Vs Conventional Finance; A Breif introduction of Islamic Financial Instruments: Mudarabha, Musharakah, Murabaha, Salam, Istisna and Ijarah.

Total Hours: 30

REFERENCES:

1. An Introduction to Islamic Banking & Finance- Abdel Fattah M.Farah
2. Certified to Islamic banker (CeIB) program - Islamic-finance.com.
3. Meezan's Bank's Guide to Islamic Bank

OUTCOMES:

Students will be able to:

- Understand ethical underpinning of Islamic Finance
- Develop an appropriate level of understanding of the main principles of Islamic finance
- Develop a good understanding of sources of *shari'ah* (Islamic Laws)
- Demonstrate a broad understanding of major prohibitions in Islamic Finance like *Riba, Gharar, Maysir* and *Qimar* etc.
- Explain the basic legal principles of Islamic commercial contracts and know their applications in investment and financing;
- Assess the nature and characteristics of different types of contracts, their applications and implication in business transaction

MSCY 078 ISLAMIC INSURANCE (TAKAFUL)

L	T	P	C
3	0	0	2

OBJECTIVES:

To make the students understand

- *shari'ah* concern and reservation on conventional insurance
- basic concept of Takaful and its distinguishing features
- structure and development of Takaful products and market
- various models of Takaful used by Takaful companies worldwide
- technical aspects of Islamic Insurance (Takaful) and its application in global marketplace

MODULE I INTRODUCTION 06

Takaful (Islamic Insurance): Definition, Concept, Principles & Unique Characteristics**;** Major goals of the Takaful system**;** The origins of Takaful: Historical background; Takaful System in Islamic Era: Al-Aqilah, Diyah, Tabarru'/donation.

MODULE II TAKAFUL VS. CONVENTIONAL INSURANCE 06

Comparison of Takaful with Conventional Insurance; Issues of Riba, Gharar, Maysir & Qimar (interest, ambiguity & gambling elements) in Conventional Insurance; Risk sharing versus transfer; Takaful versus Mutual Insurance: similarities/differences.

MODULE III SHARIAH ELEMENTS/PRINCIPLES IN TAKAFUL 06

Shariah Mechanism of Takaful; Definitions & Concept of Waqf, Wakalah, Hiba & Tabarru', which are used in Takaful System; Shari'ah Ruling and Principles applied to Takaful, Prohibited Elements.

MODULE IV TAKAFUL MODELS, TYPE & STRUCTURES 06

Structure and operation of Takaful**;** Different Models of Takaful e.g. Wakalah Model, Waqf Model, Modaraba Model, Hybrid Model, and Surplus Distribution mechanism in all models**;** Type and Products of Takaful Business: General Takaful (General Insurance)**,** Family Takaful (Life Insurance).

MODULE V TAKAFUL PRODUCTS & RISK MANAGEMENT IN ISLAM 06

BancaTakaful, Re-Takaful, Micro Takaful etc.; Risk Management from an Islamic Perspective, Key Objectives of Risk Management Specific to Takaful; Risks associated with Takaful claims and their mitigation.

Total Hours: 30

REFERENCES:

1. Islamic Insurance: A Modern Approach to Islamic Banking by Aly Khorshid
2. "What's Takaful": A Guide To Islamic Insurance by Khaled Kassar
3. Islamic and Modern Insurance (Principles and Practices) by Ma'sum Billah
4. The Islamic Insurance: Theory and Practice by A S Mulhim & A Mohammed Sabbagh

OUTCOMES:

Students will be able to:

- Demonstrate an understanding of nature and principle of Islamic insurance, Shariah framework of Islamic insurance;
- Explain Takaful and its rationale as an alternative to conventional insurance
- Explain why traditional insurance is prohibited from the Shariah point of view;
- Discuss the main features of Islamic insurance vis-à-vis conventional insurance;
- Explain the operational framework of Islamic insurance including the different Takaful used for underwriting and managing the investments of the Takaful fund
- Explain the application of ethical considerations of Islamic insurance practice and their impact on underwriting policy and practice.

MSCY 079 ISLAMIC BONDS (SUKUK)

L	T	P	C
3	0	0	2

OBJECTIVES:

To make the students understand

- concept of securitization in accordance with Shariah principles
- shariah concern on process of conventional securitization
- nature of sukuk and how they differ from conventional bonds
- types of Sukuk (sovereign & corporate) and their investment features
- how to structure sukuk transactions and its application to raise fund for short and long term investment projects

MODULE I INTRODUCTION 06

Sukuk (Islamic Securities): Definition, Concept, Classification and Fundamentals; Origin of Sukuk and development in Islamic Finance; Features & Characteristics; Sukuk Vs Conventional Debt Securities (Bonds); Return (Profit) in Sukuk, Common Use & Benefits.

MODULE II ISLAMIC SECURITIZATION 06

Securitization Principle; Benefits of Securitization; Islamic securitization and overcollateralization; Limitations (Shariah Concern).

MODULE III SUKUK STRUCTURING - I 06

The Basic Sukuk Issuance Process; Application of Islamic and Conventional Financial Concept for issuance of sukuk; AAOIFI Standards: Range of Sukuk Structures Permitted by AAOIFI.

MODULE IV SUKUK STRUCTURING - II (Types) 06

Musharakah Sukuk, Mudarabah Sukuk, Ijarah Sukuk, Murabahah Sukuk, Salam Sukuk, Istisna Sukuk, Hybrid Sukuk, Others.

MODULE V CAPITAL MARKET CONSIDERATIONS RELATING TO SUKUK 06

Rating the Issue & Distribution; Sukuk trading and secondary markets; Sovereign and Corporate Sukuk: For Open Market Operation, liquidity management and balance sheet management.

Total Hours: 30

REFERENCES:

1. Islamic Bonds: Your Guide to Issuing, Structuring and Investing in Sukuk by Nathif J. Adam and Abdulkader Thomas
2. Sukuk and Islamic Capital Markets: A Practical Guide by Rahail Ali - Hogan Lovells
3. Sukuk by Abdulkader S. Thomas

OUTCOMES:

Students will be able to:

- Evaluate the differences between conventional and Islamic securities
- Apply various types of sukuk structure like Ijarah sukuk, Salam sukuk, Istisna sukuk etc.
- Know the differences between managing Sukuk and managing conventional securities
- Demonstrate an understanding of Securitization Principle and its benefits; Islamic securitization and overcollateralization, Limitations (Shariah Concern)
- Understand the basic processes involved in the issuance of Sukuk
- Know the AAOIFI Sukuk standards

MSCY 080 ISLAMIC ASSET & FUND MANAGEMENT

L	T	P	C
3	0	0	2

OBJECTIVES:

To make the students understand

- Critique of conventional capital market
- Islamic Financial Market Structure
- Nature and distinguishing features of Islamic Capital Market
- Concept of venture capital, investment funds, units trusts, REITs and its application in accordance with Islamic Finance principle

MODULE I INTRODUCTION 06

The Capital Market: Definition, Nature, Functions and Objectives; A Brief Overview of the Capital Market in India; Risk Return Principle in Islam: Cost of Capital, Choice between Capital and Debt Financing-Agency Problem; Shari'ah Principles for Capital Market.

MODULE II ISLAMIC STOCK AND WEALTH MANAGEMENT 06

Equity Shares and Equity Funds; Business and Structure of Islamic Enterprise: Indebtedness of the Enterprise, Earnings from Impermissible Activities, Cash and Receivables / Payables.

MODULE III NORMS FOR SHARI'AH SCREENING IN CAPITAL MKT 06

Business Screening and Sharia'h Screening; AAOIFI; Dow Jones Islamic Investment Criteria; Securities Exchange Commission (SEC) Malaysia Norms; FTSE; S & P and MSCI, NCB, DFM and TASIS India.

MODULE IV CRITICAL ASSESSMENT OF ISLAMIC SCREENING NORMS 06

Screening Norms Relating to Nature of Business; Screening Norms Relating to Financial Ratios; Suitability of Market Cap; Dividend Purification and Zakah.

MODULE IV ISLAMIC REAL ESTATE AND PROJECT FINANCING 06

Characteristics of Real Estate; Islamic REITS; Islamic Mutual Funds and Mudaraba Certificates.

Total Hours: 30

REFERENCES:

1. Islamic Capital Markets: Theory and Practice By Noureddine Krichene
2. Islamic Asset Management By Natalie Schoon
3. Contemporary Islamic Finance: Innovations, Applications and Best Practices by Karen Hunt-Ahmed (Chapter on Islamic Mutual Funds)

OUTCOMES:

Students will be able to:

- Examine the structure of capital market, shares/ bonds and the operations of investment funds from shariah perspective
- Critically reflect upon and assess the similarities and differences between Islamic and conventional capital market
- apply the Islamic stock selection process through the Industry and Financial Screens
- Critically assess various screening norms used by different shariah index providers and institutions;
- Know the functions of the various components of an Islamic mutual fund structure
- Evaluate both structural and stock-specific problem of shariah compliance in capital market

MSCY 081	ISLAMIC BANKING PRODUCTS AND SERVICES	L	T	P	C
		3	0	0	2

OBJECTIVES:

- To explain the concepts, theories, the origins and development of Islamic banking products
- To familiarize the students with basic functioning of Islamic banks
- To expose the students to a wider range of Islamic financing instruments used by Islamic Banks and get an advanced understanding of these financing techniques
- To introduce the students Islamic credit card structure based on various Islamic contracts
- To provide basic understanding of working of Islamic banks and financial institutions

MODULE I DEPOSIT PRODUCTS IN ISLAMIC BANKS 06

Islamic Banks Deposits: Current Account, Saving Account, Investment Deposit Account: General Investment Deposit Account, Special Investment Deposit Account; Deposit Management.

MODULE II CARD PRODUCTS IN ISLAMIC BANKS 06

Islamic Credit Cards in the market: Bai-al Ina Credit Card Structure, Tawarruq Credit Card Structure, Ijarah Credit Card Structure, Ujrah Credit Card Structure, Kafalah Credit Card Structure; Islamic Covered Card.

MODULE III ISLAMIC MODES OF FINANCING - I 06

Equity Based Products: Musharakah, Mudarabah; Deferred sale Financing - Bai Muajjal & Murabahah; Advance Sale Financing Product - Salam & Parallel Salam.

MODULE IV ISLAMIC MODES OF FINANCING - II 06

Financing Asset under Construction: Istisna & Parallel istisna; Lease Based Product - Ijarah & Ijarah Muntahiyah Bit-Tamleek; Services Based Products: Wakalah (Agency) & Kafalah (Guarantee); Bai- al ‘Inah & Twarruq : Financing for liquidity Management.

MODULE V OTHER MISCELLANEOUS SERVICES & ACTIVITIES 06

Letters of Credit; Cheque Payment System; Sarf (Foreign Exchange) & Hawalah (Remittance); Bai Istijrar (supply Contract) and Ujrah (fee); Bai- al Dain (Debt Trading); Qard-e Hasanah (Intrest- free Loan); Others.

Total Hours: 30

REFERENCES:

1. An introduction to Islamic finance By M. Taqi Usmani
2. Understanding Islamic Finance By Muhammad Ayub

OUTCOMES:

Students will be able to:

- Differentiate between conventional and Islamic finance products
- Demonstrate an understanding of resource mobilization and resource utilization of Islamic Banks
- Appreciate and apply various Islamic financing techniques used by modern Islamic banks like Mudarabah, Musharaka, Diminishing Musharaka, Murabaha, Ijara, Salam and Istisna etc.
- Know the operating structures and organisational forms adopted by Islamic financial institutions:
- Know the regulatory and standard setting bodies overseeing Islamic finance and banking:
- Grasp the functioning of debt-like and equity-like Islamic finance techniques

ELECTIVES – ENTREPRENEURSHIP

		L	T	P	C
MSCY 086	**ENTREPRENEURSHIP, FAMILY ENTERPRISES & SUCCESSFUL VENTURES**	**3**	**0**	**0**	**2**

OBJECTIVES:

- Small Business & Entrepreneurship students gain knowledge and skills to better prepare them to perform as an owner or manager in small business
- Graduates will possess a solid understanding of family business management and will be able to translate this knowledge into practice.
- Ability to appraise the Reasons for initial breakdown and steps to overcome crisis.
- Understanding of starting and building new firms, and how to manage ventures, and starting up.

MODULE I THE ENTREPRENEURIAL MIND 06

Crafting a Personal Entrepreneurial Strategy - Three Principles for Achieving entrepreneurial greatness, six dominant themes, core and Desirable Entrepreneurial Attributes. Women entrepreneurs and rural entrepreneurship.

MODULE II FAMILY BUSINESS 06

Importance of family business, Characteristics, Responsibility and the right of share holder in family business and strategies for improving the capability of family business.

MODULE III INSTITUTIONAL SUPPORT FOR ENTREPRENEURS 06

Need for institution support, Identifying institution support- MSME, NSIC, SIDO, SSID, SSICS, SISI, DICS, industrial estates and TCOS.

MODULE IV FACTOR AFFECTING ENTREPRENEURIAL GROWTH 06

Economic factor, Social factor factors, Psychological factors, Political factor and government actions.

MODULE V SUCCESS OF A NEW BUSINESS 06

Reasons for initial Failure & Visible Problems for Business, steps to overcome problem Strategic Management for Business enterprises.

Total Hours: 30

REFERENCES:

1. S S.Khanka, Entrepreneurial Development, Third Edition, S.Chand & company, NewDelhi 2001.
2. Jeffry A. Timmons and Stephen Spinelli, “New venture creation”, seventh Edition, Tata- McGraw-Hill education private limited, New Delhi 2009.
3. Hisrich, Robert D., Michael Peters and Dean Shepherded, Entrepreneurship, Tata McGraw Hill, 2004.
4. Lall, Madhurima, and Shikha Sahai, Entrepreneurship, Excel Book, New Delhi.2008.
5. Charantimath, Poornima, Entrepreneurship Development and Small Business Enterprises, Pearson Education, New Delhi. 2005.

OUTCOMES:

On completion of course the student will be able to

- Ability to recognize a business opportunity that fits the individual student:
- Demonstrate the ability to provide a self-analysis in the context of an entrepreneurial career
- Demonstrate the ability to find an attractive market that can be reached economically
- Awareness of institution and their formalities for entrepreneurial development.
- Articulate an effective elevator pitches to gain support for the venture.

MSCY 087	FINANCIAL INSTITUTIONS AND FUNDING FOR ENTREPRENEURS	L	T	P	C
		3	0	0	2

OBJECTIVES:

- This course is intended for Entrepreneurs to Recognize a financing options.
- Appreciate the difference between venture capital, private equity, early stage and traditional financing sources.
- Aware of Taxation Benefit and tax holidays for rural entrepreneurs
- Ability to understand the causes and consequences of industrial sickness.

MODULE I FINANCING OF ENTERPRISE 06

Need for financial Planning, Sources of finance- Commercial banks, NBFC, small business grants, venture capital, angel investor and PE funds.

MODULE II WORKING CAPITAL MANAGEMENT FOR ENTERPRISE 06

Working Capital-Meaning, Significance, assessment of working capital, factors determining the requirement of working capital, sources and management of working capital.

MODULE III INSTITUTIONAL FINANCE TO ENTREPRENEURS 06

IDBI, IFCI, ICICI, IRBI, LIC, SFC'S, SIDC, Small Industrial Bank of India, Export-Import Bank of India (EXIM Bank).

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MODULE IV TAXATION BENEFITS FOR ENTREPRENEURS 06

Need for tax benefits, tax holidays, tax concession for small-scale industry in rural areas and tax concession for small-scale industry in backward areas.

MODULE V INDUSTRIAL SICKNESS 06

Industrial Sickness- Concepts, Signal and Symptom of Industrial Sickness, Magnitude and Causes and Consequences of Industrial Sickness.

Total Hours: 30

REFERENCES:

1. Jeffry A. Timmons and Stephen Spinelli, "New venture creation", seventh Edition, Tata- McGraw-Hill education private limited, New Delhi 2009.
2. SS.KHANKA, Entrepreneurial Development, Third Edition, S.Chand & company, NewDelhi 2001.

3. Hisrich, Robert D., Michael Peters and Dean Shepherded, Entrepreneurship, Tata McGraw Hill, 2004.
4. Lall, Madhurima, and Shikha Sahai, Entrepreneurship, Excel Book, New Delhi.2008.
5. Charantimath, Poornima, Entrepreneurship Development and Small Business Enterprises, Pearson Education, New Delhi. 2005.

OUTCOMES:

On completion of course

- Student will able to identify the sources of funding for his enterprises
- Exhibit the ability to provide a self-analysis in the framework of an entrepreneurial career
- Display the ability to find an attractive market that can be reached economically
- Demonstrate the understanding of how to launch the individual's entrepreneurial career:
- Craft appropriate a business practices that suits the business to avail tax benefits.

MSCY 088 MARKETING FOR ENTREPRENEURS

L	T	P	C
3	0	0	2

OBJECTIVES:

- To better prepare them to perform about the marketing challenges in an entrepreneurial firm
- Understand the core concepts of Entrepreneurship and Marketing
- Apply creativity and innovation to generate new pricing tactics in marketing
- Ability to Design a marketing plan to incorporate artistic marketing tactics.

MODULE I INTRODUCTION TO ENTREPRENEURIAL MARKETING 06

Entrepreneurial Marketing- Introduction, analysis of definition, Entrepreneurial Marketing vs Traditional Marketing, Entrepreneurial Marketing competencies.

MODULE II DIMENSION OF ENTREPRENEURIAL MARKETING 06

Marketing task, Dimensions of entrepreneurial marketing, types of markets, Market segmentation, target market and positioning.

MODULE III ENTREPRENEURIAL PRICING STRATEGY 06

Setting the Price- steps in setting the price, The Three Cs Model for Price Setting, Different types of pricing techniques.

MODULE IV ENTREPRENEURIAL PROMOTION APPROACH 06

Advertising, sales promotion, Personal selling, Major Consumer-Promotion Tools, Major Trade-Promotion Tools and public relations, cause marketing.

MODULE V ENTREPRENEURIAL CHANNEL TACTIC 06

Channel management decisions, Types of Channel-Direct to customer, retailer, sales agent, own store, selling through Self Help Group

Total Hours: 30

REFERENCES:

1. Philip Kotler, Marketing Management, Millennium Edition, by Pearson Custom Publishing 2002.
2. SS.KHANKA, Entrepreneurial Development, Third Edition, S.Chand & company, NewDelhi 2001
3. Case Studies in Social Entrepreneurship: The Oikos Collection by Greenleaf Publishing, 2004.

4. Rashmi Bansal Poor Little Rich Slum published by Westland, India, 2012.
5. Srinivasan, Case Studies in marketing Indian context, sixth edition PHI learning private Limited 2014.

OUTCOMES:

On completion of course

- Build Entrepreneurial marketing competencies
- Develop a marketing plan for an entrepreneurial idea.
- Create appropriate a channel strategy to promote the product..
- Develop an attractive new or improved product or service idea into a product offering
- Ability to formulate sound marketing strategies to give the product or service offering the support it needs to succeed in the marketplace

MSCY 089	NEW VENTURE AND PROJECT PREPARATION	L	T	P	C
		3	0	0	2

OBJECTIVES:

- To examine how the entrepreneurial revolution in the United States is beginning to have a profound impact on the rest of world.
- Ability to differentiate between an idea and an opportunity.
- Capacity to screen the new venture opportunity by screening exercise.
- Apply innovation to generate new project identification and implementation.

MODULE I AMERICA'S ENTRPRENEURIAL REVOLUTION 06

Entrepreneurship-new venture formation, entrepreneurial revolution and Americas self made millionaires and building an entrepreneurial society.

MODULE II NEW VENTURE OPPURTUNITY 06

New venture opportunity, Creating, Shaping, Recognizing, To Think Big Enough, Opportunity through zoom lens. Transforming caterpillars into butterflies, When is an Idea an opportunity.

MODULE III NEW VENTURE OPPORTUNITIES AND SCREENING 06

New venture, Quick Screen, VOSE- Venture Opportunities Screening Exercises with twelve Exercises' and Case Newland Medical technologies.

MODULE IV PROJECT IDENTIFICATION & APPRAISAL 06

Project Identification, Project Selection, Project Formulation of Project Report, Content of project report and Project appraisal- concepts and methods and Project implementation

MODULE V GOVERNMENT OF INDIA INITIATIVE 06

Start up India and stand up India, digital India and make in India and skill India mission and a study on India's hot spot of startup – Koramangla.

Total Hours: 30

REFERENCES:

1. Jeffry A. Timmons and Stephen Spinelli, "New venture creation", seventh Edition, Tata- McGraw-Hill education private limited, New Delhi 2009.
2. SS.KHANKA, Entrepreneurial Development, Third Edition, S.Chand & company, New Delhi 2001.

3. Hisrich, Robert D., Michael Peters and Dean Shepherded, Entrepreneurship, Tata McGraw Hill, 2004.
4. Lall, Madhurima, and Shikha Sahai, Entrepreneurship, Excel Book, New Delhi.2008.
5. Charantimath, Poornima, Entrepreneurship Development and Small Business Enterprises, Pearson Education, New Delhi. 2005.

OUTCOMES:

On completion of course

- Ability to recognize a business opportunity that fits the individual learner:
- Demonstrate the ability to provide a self-analysis in the context of an entrepreneurial profession
- Demonstrate the ability to unearth an attractive market that can be reached cost-effectively
- Make obvious the understanding of how to identify the entrepreneurial Project:
- Ability to appraise the business projects with clarity.

CURRICULUM AND SYLLABI

REGULATIONS - 2016

(As approved by the 9th Academic Council)

MASTER OF COMPUTER APPLICATIONS (MCA)

B.S.ABDUR RAHMAN
UNIVERSITY
B.S. ABDUR RAHMAN INSTITUTE OF SCIENCE & TECHNOLOGY
(Estd. u/s 3 of the UGC Act, 1956)
(FORMERLY B.S. ABDUR RAHMAN CRESCENT ENGINEERING COLLEGE)
Rated with A Grade by National Assessment and Accreditation Council
Seethakathi Estate, G.S.T. Road, Vandalur, Chennai - 600 048
www.bsauniv.ac.in

REGULATIONS, CURRICULUM AND SYLLABI

MASTER OF COMPUTER APPLICATIONS (MCA)

(As approved by the 9th Academic Council)

JULY 2016

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VISION AND MISSION OF THE DEPARTMENT OF COMPUTER APPLICATIONS

VISION

Aspires to provide quality education in the field of computer applications with state of the art computational facilities and undertake quality research in collaboration with industries and universities to produce committed professionals and academicians to meet the needs of the industries and society.

MISSION

The Department of Computer Applications, endeavors

- To disseminate knowledge through education and training of graduates in the field of computer applications.
- To focus on teaching - learning, research and consultancy to promote excellence in computer applications.
- To foster graduates with opportunities required to explore, create and face challenges of IT related industries.
- To equip the graduates with the necessary skills in communication, team work and leadership qualities to meet the needs of the IT related sector globally.
- To disseminate the outcome of projects and research work undertaken by the department through appropriate measures for the benefit of society and industry.

PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES

MASTER OF COMPUTER APPLICATIONS

PROGRAMME EDUCATIONAL OBJECTIVES:

PEO-1: To provide students with a solid foundation in mathematics and computing fundamentals required to analyze and solve computing problems and also to pursue research and higher studies.

PEO-2: To provide technical knowledge in various programming languages and train them to comprehend, analyze, design and create innovative computing solutions for real time problems.

PEO-3: To prepare the students for a prolific career in IT and inculcate an urge for self learning by providing an ambient environment to improve personality , excellence, leadership and spiritual values in all activities throughout the career.

PEO-4: To foster and provide a social environment which moulds the students to become professionally enriched with communication, technical and innovative skills to meet the dynamic needs of industry and society.

PROGRAMME OUTCOMES:

On completion of the programme the graduates will be able to

PO1: Apply the knowledge of computing fundamentals and mathematical concepts in computer programming.

PO2: Identify, formulate, analyze and implement mathematics and technical skills to solve real time problems.

PO3: Design and develop the software to meet out the customer and industry needs.

PO4: Pursue Research based and industry oriented projects to provide valid conclusions for complex problems.

PO5: Use latest software and tools for solving problems and satisfy the dynamic needs of industry and society.

PO6: Become a software professional with social responsibilities and ethical values.

PO7: Solve societal and environmentally sensitive problems in professional manner.

PO8: Demonstrate knowledge of professional and ethical responsibilities.

PO9: Function as individual member or leader of team and able to manage projects in the software development process.

PO10: Comprehend, write effective reports and communicate their innovations and idea in an effective way.

PO11: Adapt self-learning using their learning abilities.

PO12: Develop as Entrepreneur in the software domain through innovative approach and excel in placement activities.

PO13: Understand and apply foundations of software engineering practice and process within production constraints.

PO14: The ability to employ modern computer languages, environments, and platforms in creating innovative career paths to be an entrepreneur, and a zest for higher studies.

CURRICULUM & SYLLABI FOR MASTER OF COMPUTER APPLICATIONS

(SIX SEMESTERS / FULL TIME)

CURRICULUM

Sl. No.	Course Code	Course Title	L	T	P	C
		SEMESTER I				
1	MAC6185	Discrete mathematics	**3**	**1**	**0**	**4**
2	CAC6101	Programming in C and C++	**3**	**0**	**0**	**3**
3	CAC6102	Computer Organization	**3**	**0**	**0**	**3**
4	CAC6103	Database Management Systems	**3**	**0**	**0**	**3**
5	CAC6104	Computer Networks	**3**	**0**	**0**	**3**
6	CAC6105	C and C++ Programming Lab	**0**	**0**	**4**	**2**
7	CAC6106	DBMS Lab	**0**	**0**	**4**	**2**
						20
		SEMESTER II				
1	CAC6201	Computer Graphics and Multimedia Systems	**3**	**0**	**1**	**4**
2	CAC6202	Software Engineering	**3**	**0**	**0**	**3**
3	CAC6203	Data Structures and Design and Analysis of Algorithms	**3**	**0**	**0**	**3**
4	CAC6204	Operating Systems	**3**	**0**	**0**	**3**
5		Elective – 1	**3**	**0**	**0**	**3**
6	CAC6205	Data Structures and Algorithms Lab	**0**	**0**	**4**	**2**
7	CAC6206	Communication Skills Laboratory	**0**	**0**	**2**	**2**
8	CAC6206	Seminar	**0**	**0**	**0**	**1**
						21

Sl. No.	Course Code	Course Title	L	T	P	C
		SEMESTER III				
1	CAC7101	Object Oriented Analysis and Design	**3**	**0**	**0**	**3**
2	CAC7102	Internet and Java Programming	**3**	**0**	**0**	**3**
3	MAC6186	Resource Management Techniques	**3**	**1**	**0**	**4**
4		Elective – 2	**3**	**0**	**0**	**3**
5		Elective – 3	**3**	**0**	**0**	**3**
6		Elective – 4	**3**	**0**	**0**	**3**
7	CAC7103	Case tools Lab/OOAD Lab	**0**	**0**	**4**	**2**
8	CAC7104	Programming in JAVA	**0**	**0**	**4**	**2**
9	CAC7105	Programming Languages				**1**
						24
		SEMESTER IV				
1	CAC7201	Advanced Web Design and Development	**3**	**0**	**0**	**3**
2	CAC7202	XML and Web Services	**3**	**0**	**0**	**3**
3	CAC7203	Mobile Computing	**3**	**0**	**0**	**3**
4		Elective – 5	**3**	**0**	**0**	**3**
5		Elective – 6	**3**	**0**	**0**	**3**
6		Elective – 7	**3**	**0**	**0**	**3**
7	CAC7204	Web design and development Lab	**0**	**0**	**4**	**2**
8	CAC7205	XML and Web Services Lab	**0**	**0**	**4**	**2**
9	CAC7206	Soft Skills and Personality Development	**0**	**0**	**2**	**2**
						24

Sl. No.	Course Code	Course Title	L	T	P	C
		SEMESTER V				
1	CAC8101	Mobile Application Development	**3**	**0**	**0**	**3**
2	MSC8181	Essentials of management for computer professionals	**3**	**0**	**0**	**3**
3	CAC8102	Internet of Things	**3**	**0**	**0**	**3**
4		Elective – 8	**3**	**0**	**0**	**3**
5		Elective – 9	**3**	**0**	**0**	**3**
6	CAC8103	Mobile Application Development Lab	**0**	**0**	**4**	**2**
7	CAC8104	Mini Project	**0**	**0**	**4**	**2**
						19
		SEMESTER VI				
1	CAC8201	Project				**12**

LIST OF ELECTIVES

Sl. No.	Course Code	Course Title	L	T	P	C
		Semester II				
1	CACY001	Management Information System	**3**	**0**	**0**	**3**
2	CACY002	Accounting and Financial Management	**3**	**1**	**0**	**4**
3	CACY003	E-commerce	**3**	**0**	**0**	**3**
4	CACY004	Business Processes	**3**	**0**	**0**	**3**
		Semester III				
5	CACY005	Grid Computing	**3**	**0**	**0**	**3**
6	CACY006	Cloud computing	**3**	**0**	**0**	**3**
7	CACY007	Unix and Network Programming	**3**	**0**	**0**	**3**
8	CACY008	Multimedia systems and Algorithms	**3**	**0**	**0**	**3**
9	CACY009	Network Security	**3**	**0**	**0**	**3**
10	CACY010	Microprocessor and its applications	**3**	**0**	**0**	**3**
11	CACY011	TCP/IP Protocol Suite	**3**	**0**	**0**	**3**
12	MSCY181	Management functional areas and information Systems	**3**	**0**	**0**	**3**
13	CACY012	Adhoc Networks	**3**	**0**	**0**	**3**
		Semester IV				
14	CACY013	Digital Image Processing	**3**	**0**	**0**	**3**
15	CACY014	Probability and Statistics	**3**	**1**	**0**	**4**
16	CACY015	Software Quality Management	**3**	**0**	**0**	**3**
17	CACY016	Embedded Systems	**3**	**0**	**0**	**3**
18	CACY017	Business Intelligence	**3**	**0**	**0**	**3**
19	CACY018	Software Testing	**3**	**0**	**0**	**3**
20	CACY019	Content Management System	**3**	**0**	**0**	**3**
21	CACY020	Advanced Programming Techniques	**3**	**0**	**0**	**3**
22	CACY021	Information Storage and Management	**3**	**0**	**0**	**3**
23	CACY022	Semantic Web	**3**	**0**	**0**	**3**

Sl. No.	Course Code	Course Title	L	T	P	C
24	CACY023	Healthcare Analytics	**3**	**0**	**0**	**3**
25	CACY024	Python Programming	**3**	**0**	**0**	**3**
26	CACY025	Enterprise Resource Planning	**3**	**0**	**0**	**3**
27	CACY026	Software Project Management	**3**	**0**	**0**	**3**
28	CACY027	Data Mining and Data warehousing	**3**	**1**	**0**	**3**
		Semester V				
29	CACY028	Unix Internals	**3**	**0**	**0**	**3**
30	CACY029	Advanced Databases	**3**	**0**	**0**	**3**
31	CACY030	Software Quality Assurance	**3**	**0**	**0**	**3**
32	CACY031	Service Oriented Architecture	**3**	**1**	**0**	**3**
33	CACY032	C# and .NET Framework	**3**	**0**	**0**	**3**
34	CACY033	PHP Programming	**3**	**0**	**0**	**3**
35	CACY034	Online Computer Advertising	**3**	**0**	**0**	**3**
36	CACY035	Web Mining	**3**	**0**	**0**	**3**
37	CACY036	Digital marketing	**3**	**0**	**0**	**3**
38	CACY037	Big data and its Analytics	**3**	**0**	**0**	**3**
39	CACY038	Information Retrieval	**3**	**0**	**0**	**3**
40	CACY039	Social Media Analysis	**3**	**0**	**0**	**3**
41	CACY040	Human Computer Interaction	**3**	**0**	**0**	**3**
42	CACY041	Bio-Informatics	**3**	**0**	**0**	**3**

SEMESTER I

MAC6185 DISCRETE MATHEMATICS

L	T	P	C
3	1	0	4

OBJECTIVES:

- Acquire knowledge on Set theory, Logical connectives and normal forms.
- To familiarize students with applications of Formal language and Algebraic Theory to Computer Science problems
- Compute problems on Permutations and Combinations, Algebraic structures, logical connectives, truth tables, normal forms.
- Analyze and derive conclusion on Proofs by contradiction, kernal of homomorphism, Cosets and Lagrange's theorem, Normal subgroups, Rings and Fields

MODULE I FUNDAMENTAL STRUCTURES 12

Set theory:- Relationships between sets - Operations on sets - Set identities - Principle of inclusion and exclusion - Minsets Relations – Binary relations - Partial orderings - Equivalence relations. Functions:– Properties of functions - Composition of functions – Inverse functions - Permutation functions.

MODULE II LOGIC 12

Prepositional, logic – Logical connectives – Truth tables – Normal forms (conjunctive and disjunctive) - Predicate logic - Universal and existential quantifiers - Proof techniques – direct and indirect – Proof by contradiction – Mathematical Induction.

MODULE III COMBINATORICS 12

Basics of counting – Counting arguments – Pigeonhole principle - Permutations and Combinations - Recursion and Recurrence relations – Generating functions.

MODULE IV ALGEBRAIC STRUCTURES 12

Introduction- Properties of an algebraic systems –Morphisms – Semigroups – Monoids – Sub semigroups and Submonoids –Groups-Order of a group – order of an element-permutation groups-subgroups –cyclic groups.

MODULE V MORPHISMS ON ALGEBRAIC STRUCTURES 12

Morphisms of groups – kernal of homomorphism - Cosets and Lagrange's theorem – Normal subgroups – Rings and Fields.

Total Hours: 60

REFERENCES:

1. Judith L. Gersting, "Mathematical Structures for Computer Science", 5th Edition, W.H. Freeman and Company, New York, 2003.
2. J.P. Tremblay and R. Manohar, "Discrete Mathematical Structures with Applications to Computer Science", Tata Mcgraw Hill, 1997.
3. Rosen K.H., "Discrete Mathematics and its Applications", Tata McGraw-Hill Publishing Company Limited, New Delhi, 5th Edition, 2003.
4. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, "Introduction to Automata Theory, Languages, and Computation", Pearson/Addison Wesley, 2007.
5. Michael Sipser, "Introduction to Theory of Computation", 3rd edition, Cengage Learning, 2012.

OUTCOMES:

On completion of this course, students will be able to

- model Physical Problems to Mathematical problems
- solve modeled problems using set theory, connectives and Permutation and combinations.
- critique solution derived using proofs by contradictions, homomorphisms and groups, Normal subgroups, Rings and Fields.
- construct, organize and conclude problems on algebraic structures, logical connectives, normal forms.
- apply the acquired knowledge to solve problems on Finite state machines, deterministic and Non- deterministic finite state, Formal Languages, Classes of Grammars

CAC6101 PROGRAMMING IN C AND C++

L	T	P	C
3	0	0	3

OBJECTIVES:

- To gain experience about structured programming
- To understand various features in C
- Teach the syntax and semantics of C language as well as data types offered by the language.
- Develop the programming ability in students using the programming constructs Loop, functions, arrays, structures and unions.
- Identify and practice the object-oriented programming concepts and techniques
- Practice the use of C++ classes and class libraries
- Develop applications using Object Oriented Programming concepts

MODULE I INTRODUCTION TO C LANGUAGE 09

Overview of C – Constants, Variables and Data Types – Operators and Expressions – Managing Input / Output Operations – Formatted I/O – Decision Making - Branching –- IF, Nested IF – Switch – goto - Looping- While, do, for statements.

MODULE II ARRAYS, FUNCTIONS, STRUCTURES AND UNIONS 09

Arrays – dynamic and multi-dimensional arrays - Character arrays and Strings – String handling Functions - User defined Functions – Categories of Functions – Recursion - Structures and Unions – Array of Structures – Structures and Functions.

MODULE III POINTERS AND FILE MANAGEMENT 09

Pointers – Declaration, Accessing a variable, character strings, pointers to functions and structures - File Management in C – Dynamic Memory allocation

MODULE IV OBJECT RIENTEDCONCEPTS 09

Overview of C++-Classes and Objects-Friend Functions-Friend Classes-Inline function-Static Members – Arrays – Pointers – References - Dynamic Allocation - Function Overloading-constructor Overloading - Copy Constructors - Default Argument

MODULE V INHERITANCE AND EXCEPTION HANDLING 09

Operator Overloading-Member Operator Overloading-Overloading new and delete-Inheritance-Base Class-Access Control-Virtual Functions-Pure Virtual Functions-Templates-Generic Functions-Applying Generic Functions-Generic Classes-Exception Handling-C++ I/O Streams-File I/O

Total Hours: 45

TEXT BOOKS:

1. R.G.Dromey “How to Solve it by Computer”, PHI, 1998
2. E.Balagurusamy “Programming in ANSI C”, Tata McGraw Hill, 2004.
3. Robert Lafore. “Waite Groups OOP in Turbo C++”, Galgotia Publications, 2001.
4. Stanley, B.Lippman,JoveLagrie, “C++Primer”, 3rd Edition, Addison Wesley,1998.

OUTCOMES:

On completion of this course, students will be able to

- design, implement, test and debug programs using different data types, arrays, decision making statement and loops.
- solve simple, moderate, mathematical, logical and business problems in ‘C’.
- differentiate structure and union in the aspect of memory management.
- list the features of object-oriented programming language
- apply various object oriented features like inheritance, data abstraction, encapsulation and polymorphism to solve various computing problems using C++ language.

CAC6102 COMPUTER ORAGANISATION

L	T	P	C
3	0	0	3

OBJECTIVES

- To impart the knowledge in the field of digital electronics
- To impart knowledge about the various components of a computer and its internals.
- To design and realize the functionality of the computer hardware with basic gates and other components using combinational and sequential logic.
- To understand the importance of the hardware-software interface

MODULE I LOGIC CIRCUITS 09

Logic functions – synthesis of logic functions – Minimizations of logic - Synthesis with NAND and NOR gates - Implementation of Logic gates - Flip-flops – Registers and shift registers – counters – decoders – Multiplexers – PLDs – sequential circuits. Basic Structure of Computers: Functional Units - Basic operational concepts – Bus structures – performance – Multi processors and Multi computers: Functional Units – Basic operational concepts – Bus structures – performance – Multiprocessors and Multi computers – Historical Perspective.

MODULE II MACHINE INSTRUCTIONS AND PROGRAMS 09

Numbers, Arithmetic operations and characters – Memory locations and address, operations – instructions and instruction, sequencing – addressing modes - assembly language – basic input/output operations – subroutines – encoding of Machine instructions. Instructions – Assembly language –O/I operations – Registers and addressing – Instructions language – program flow control – I/O operations - logic instructions of 6300 and Intel Pentium.

MODULE III INPUT / OUTPUT ORGANIZATION 09

Accessing I/O Devices – Interrupts – direct memory access – buses 240-interface circuits – Standard I/O Interfaces.

MODULE IV MEMORY SYSTEM 09

Concepts – semiconductor RAM memories – Readonly memories – cache memories – performance considerations – virtual memories management requirements – secondary storage Arithmetic: Addition and subtraction of signel members – design of fast adders – multiplication of positive members – signed operand multiplication – fast multiplication – integer division – floating point numbers and operations.

MODULE V BASIC PROCESSING UNIT 09

Concepts – execution of a complete instruction – Multiple – Bus organization – hardware control – microprogrammed control. Pipelining: Concepts – Data hazards – instruction hazards – influence on Instruction sets - data path and control constructions – supers cal operation- ultra SPARC II – Performance considerations.

Total Hours: 45

TEXT BOOKS:

1. Hamacher C, Vranesic Z, and Zaky S. Computer Organization, 5th edition, McGraw – Hill, 2002.

REFERENCE BOOKS:

1. Stallings W, Computer Organization and Architecture, 6th edition. Parson Education, 2003.
2. Mano M.M. Computer System Architecture, 3rd edition. PHI, 1993.
3. Yarbrough JM, Digital Logic – Applications and Design, Thomas Lernig, 1997.
4. Heuring VP, and Jordan HF, Computer Systems Design and Architecture, Pearson

OUTCOMES

On completion of this course, students will be able to

- solve basic binary math operations using the computer.
- demonstrate programming proficiency using the various addressing modes and data transfer instructions of the target computer.
- apply knowledge of the processor’s internal registers and operations by use of a PC based microprocessor simulator.
- write assembly language programs and run their program on the training boards.
- design electrical circuitry to the processor I/O ports in order to interface the processor to external devices.
- write assembly language programs and download the machine code that will provide solutions to the real - world control problems.

CAC6103 DATABASE MANAGEMENT SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- Provide an introduction to the management of database systems.
- Understand the fundamentals of relational systems including data models, database architectures and database manipulations.
- To teach how to construct simple and moderately advanced database queries using structured Query Language.
- To teach the concept of a database transaction, handling deadlocks, paging, concurrency control, backup and recovery systems.
- explore the origins of NoSQL databases and the characteristics that distinguish them from traditional relational database management systems.

MODULE I INTRODUCTION 09

Database Systems vs. File Systems - View of Data - Data Models-Database Languages -Transaction Management - Database Systems Structure - History of Database Systems - Database Systems Applications - Entity Relationship Model.

MODULE II RELATIONAL DATABASES 09

SQL - Basic Structure - Set Operations - Complex Queries - Joined Queries - DDL-Embedded SQL-Dynamic SQL-Other SQL Functions-Query by Example-Integrity and Security of searching-Relational Database Design.

MODULE III DATA STORAGE AND INDEXING 09

Storage & File Structure - Disks-RAID-File Organization - Indexing &Hashing- B+ TREE-B Tree-Static Hashing-Dynamic Hashing-Multiple Key Access.

MODULE IV QUERY EVALUATION & OPTIMIZATION 09

Query Processing-Selection Operation-Sorting-Join Operation-Evaluation of Expressions-Query Optimization.

MODULE V TRANSACTION MANAGEMENT 09

Transaction Concept-Static Implementation-Concurrency Control-Protocols-Deadlock Handling-Recovery Systems-Recovery with Concurrent Transactions - Shadow Paging-Buffer Management-Case Studies-Oracle-Microsoft SQL Server-NoSQL-Characteristics-major types of NoSQL databases-NoSQL Database-as-a-Service for Web and mobile applications

Total Hours: 45

TEXT BOOK:

1. Abraham Silberschatz, HentryF.Korth and S.Sudharssan, “Database System Concepts”, 4th Edition, Tata McGraw Hill, 2002.

REFERENCES:

2. Raghu Ramakrishnan & Johannes Gerhrke, “Data Base Management Systems”, McGraw Hill International Edition, 2000.

OUTCOMES:

On completion of this course, students will be able to

- describe the concepts of data storage and indexing, transaction management, query evaluations and optimization techniques.
- list the importance of DBMS and differentiate how DBMS is better than traditional File Processing Systems.
- analyze the basic structure of Database and recognize the different views of the database.
- formulate data retrieval queries in SQL for real time scenario.
- construct and normalize conceptual data models
- handle the deadlocks that occurs in the system.
- list the differences between a relational database and a non-relational (NoSQL) database

CAC6104 COMPUTER NETWORKS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide students with enough knowledge in networking, various types of networks and its applications.
- To describe the issues of data link protocols including encoding, framing, and error detection.
- To learn various switching and routing techniques
- To acquire essential knowledge about layer architecture of data communication.
- To learn the technologies of Software Defined Networking (SDN), Network Functions Virtualization (NFV)

MODULE I INTRODUCTION 09

Building a network – Requirements – Network Architecture – OSI – Internet – Direct Link Networks – Hardware building blocks – Framing – Error detection – Reliable transmission.

MODULE II NETWORK FUNDAMENTALS 09

LAN Technology – LAN Architecture – BUS/Tree – Ring – Star – Ethernet – Token Rings – Wireless.

MODULE III NETWORK LAYER 09

Packet Switching – Switching and Forwarding – Bridges and LAN switches – Internetworking – Simple Internetworking – Routing.

MODULE IV TRANSPORT LAYER 09

Reliable Byte Stream (TCP) – Simple Demultiplexer (UDP) – TCP Congestion Control – Congestion Avoidance Mechanisms.

MODULE V PRESENTATION LAYER and APPLICATIONS 09

Presentation formatting – Data compression – Cryptographic Algorithms: RSA - DES –– Applications – Domain Name Service – Email - SMTP – MIME – HTTP – SNMP-Introduction to Software Defined Networking(SDN) and Network Functions Virtualization(NFV)- SDN Fundamentals

Total Hours: 45

TEXT BOOK:

1. Larry L. Peterson & Bruce S. Davie, “Computer Networks - A systems Approach”, 2nd Edition, Harcourt Asia/Morgan Kaufmann, 2000.

REFERENCES:

1. James F. Kurose and Keith W. Ross, “Computer Networking - A Top Down Approach featuring the Internet”, 1st Edition, Addison Wesley Publishing Company, 2001.
2. William Stallings, “Data and Computer Communications”, 5th Edition, PHI, 1997.
3. Andrew S. Tanenbaum, “Computer Networks”, Tata Mcgraw Hill, 3rd Edition, 2001.

OUTCOMES:

At the end of the course, the students will be able to

- identify and describe the layers of the OSI and TCP/IP.
- list the applications of network
- make effective use of networking topologies
- illustrate how networks work in practice
- identify the requirements for different network architecture
- evaluate the performance of each of the protocols.
- Summarize the features of an emerging paradigm software defined networking(SDN) in computer networking.

CAC6105 C AND C++ PROGRAMMING LAB

L	T	P	C
0	0	4	2

OBJECTIVES:

- Brief on Data Types, Operators, Statements, Loops, Functions, Array, Pointers, Structures.
- Make the students write programs using various programming constructs.
- Understand and solve logical & mathematical problems through C++ language.
- Design and develop solutions to intermediate level problems.
- Develop their skills in software development using a procedural language.
- Get programming skill in object oriented technology with the usage of C++.

List of Programs

1. **Display the following:**
   i. Floyd's triangle
   ii. Pascal Triangle
2. **Generate the following series of numbers:**
   i. Armstrong numbers between 1 to 100
   ii. Prime numbers between 1 to 50
   iii. Fibonacci series up to N numbers
3. **Manipulate the strings with following operations.**
   i. Concatenating two strings
   ii. Reversing the string
   iii. Finding the substring
   iv. Replacing a string
   v. Finding length of the string
4. **Find the summation of the following series:**
   i. Sine
   ii. Cosine
   iii. Exponential
5. **Create the sales report for M sales person and N products using two dimensional array.**
6. **Simulate following Banking operations using functions.**
   i. Deposit
   ii. Withdrawal
   iii. Balance Enquiry

7. **Implement using recursion**
   i. Find the solution of Towers of Hanoi problem using recursion.
   ii. Fibonacci number generation.
   iii. Factorial
8. **Generate Student mark sheets using structures.**
9. **Create a collection of books using arrays of structures and do the following:**
   i. Search a book with title and author name
   ii. Sorts the books on title.
10. **Programs using Constructor and Destructor.**
11. **Creation of classes and use of different types of functions.**
12. **Count the number of objects created for a class using static member function.**
13. **Write programs using function overloading and operator overloading.**
14. **Programs using inheritance.**
15. **Program using friend functions.**
16. **Program using virtual function.**
17. **Write a program using exception handling mechanism.**
18. **Programs using files.**
19. **Programs using function templates.**

OUTCOMES:

On completion of this course, students will be able to

- design and debug programs involving different data types, decision structures and loops.
- apply the in-built functions and customized functions for solving the problems.
- handle the exceptions that raise in the program.
- write, read and manipulate the data stored in files to deal with various real time problems
- work in a team to analyze engineering problems and develop C++programs for solving these problems.
- reuse the code and write the classes which work like built-in types

CAC6106 DBMS LAB

L	T	P	C
0	0	4	2

OBJECTIVES:

- Learn how to create tables which are fundamental storage blocks of data.
- Learn how to place constraints on data that is entered on tables to ensure data integrity.
- Learn how to add, change and remove data from tables.
- Learn how to select a subset of the data you want to see from the collection of tables and data.
- Learn how to combine table and group multiple rows of data in table.

List of Exercises

1. Execute a single line and group functions for a table.
2. Execute DCL and TCL Commands.
3. Create and manipulate various DB objects for a table.
4. Create views, partitions and locks for a particular DB.
5. Write PL/SQL procedure for an application using exception handling.
6. Write PL/SQL procedure for an application using cursors.
7. Write a DBMS program to prepare reports for an application using functions.
8. Write a PL/SQL block for transaction operations of a typical application using triggers.
9. Write a PL/SQL block for transaction operations of a typical application using package.
10. Design and develop an application using any front end and back end tool (make use of ER diagram and DFD).

Typical Applications – Banking, Electricity Billing, Library Operation, Pay roll, Insurance, Inventory, etc

OUTCOMES:

On completion of this course, students will be able to

- apply iterative programming at database level.
- write programming blocks with conditional structure, assignment structure, loop structure, etc.
- use exception Handling, Transaction oriented programs, Stored procedures, functions, packages, etc.
- implement cursors which would allow row wise access of data.
- use triggers which would allow you define pre and post actions when something change in the database tables.

SEMESTER II

		L	T	P	C
CAC6201	**COMPUTER GRAPHICS AND MULTIMEDIA SYSTEMS**	**3**	**0**	**1**	**4**

OBJECTIVES:

- develop an understanding and awareness of how issues such as content, information architecture, motion, sound, design, and technology merge to form effective and compelling interactive experiences for a wide range of audiences and end users.
- be familiar with various software programs used in the creation and implementation of multi-media (interactive, motion/animation, presentation, etc.).
- enable students to be practically sound in area of 2D, 3D and animation.
- develop real time multimedia applications with user friendly environment.

MODULE I INTRODUCTION 09

Overview of Graphics System - Bresenham technique – Line Drawing and Circle Drawing Algorithms - DDA - Line Clipping - Text Clipping.

MODULE II 2D TRANSFORMATIONS 09

Two dimensional transformations – Scaling and Rotations - Interactive Input methods - Polygons - Splines – Bezier Curves - Window view port mapping transformation.

MODULE III 3D TRANSFORMATIONS 09

3D Concepts - Projections – Parallel Projection - Perspective Projection – Visible Surface Detection Methods - Visualization and polygon rendering – Color models – XYZ-RGB-YIQ-CMY-HSV Models - animation – Key Frame systems - General animation functions - morphing.

MODULE IV OVERVIEW OF MULTIMEDIA 09

Multimedia hardware & software - Components of multimedia – Text, Image – Graphics – Audio – Video – Animation – Authoring.

MODULE V MULTIMEDIA SYSTEMS AND APPLICATIONS 09

Multimedia communication systems – Data base systems – Synchronization Issues – Presentation requirements – Applications – Video conferencing – Virtual reality – Interactive video – video on demand.

Total Hours: 45

GRAPHICS AND MULTIMEDIA LAB:

1. Write a program for Line drawing using Bresenham Algorithm.
2. Write a program for Line drawing using DDA Line Drawing Algorithm.
3. Write a program for Circle Drawing using Bresenham Circle Drawing Algorithms.
4. Write a program for Line Clipping using Cohen-Sutherland Line clipping algorithm.
5. Write a program for 2D Transformations like Translations and Scaling and Rotations.
6. Write a program for 3D Transformations like Translations and Scaling and Rotations.
7. Write a program for 3D Projections like Parallel, Perspective
8. Create Frame by Frame Animations using multimedia authoring tools.
9. Develop a presentation for a product using techniques like Guide Layer, masking and onion Skin using authoring tools.
10. Create a JPEG image which demonstrates the various features of an image editing tool.

Use various software programs used in the creation and implementation of multi-media (interactive, motion/animation, presentation, etc.)

TEXT BOOKS:

1. Hearn D and Baker M.P, “Computer graphics – C Version”, 2nd Edition, Pearson Education, 2004 (unit 1, 2 &3)
2. Ralf Steinmetz, Klarasteinmetz, “Multimedia Computing, Communications and Applications”, Pearson education, 2004 (unit 4 & 5)

REFERENCES:

1. Siamon J. Gibbs and Dionysios C. Tsichritzis, “Multimedia programming”, Addison Wesley, 1995.
2. John Villamil, Casanova and LeonyFernanadez, Eliar, “Multimedia Graphics”, PHI, 1998.

OUTCOMES:

On completion of this course, students will be able to

- attain the complete knowledge in graphics & multimedia domain.
- show their proficiency while working with Graphics and multimedia software's and tools.
- create interactive graphics applications in C++ using one or more graphics application programming interfaces.
- design and develop a user friendly multimedia application.
- write programs that demonstrate 2D and 3D transformations

CAC6202 SOFTWARE ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- Assist the student in understanding the basic theory of software engineering
- Define software engineering and explain its importance
- Discuss the concepts of software products and software processes
- Solve problems in a team environment through effective use of written and oral communication skills.
- Practice the lifelong learning needed in order to keep current as new issues emerge.

MODULE I INTRODUCTION 09

Generic View of Process – Process Models-The Waterfall Model-Incremental Model-Evolutionary Model-Specialized Model-The Unified Process–Agile Process – Agile Models – Software Cost Estimation – Planning – Risk Analysis – Software Project Scheduling.

MODULE II REQUIREMENT ANALYSIS 09

System Engineering Hierarchy – System Modeling – Requirements Engineering: Tasks- Initiating The Process-Eliciting Requirements-Developing Use Cases-Negotiating Requirements-Validating Requirements – Building the Analysis Models: Concepts.

MODULE III SOFTWARE DESIGN 09

Design Concepts – Design Models – Pattern Based Design – Architectural Design – Component Level Design – Component – Class Based And Conventional Components Design – User Interface – Analysis And Design.

MODULE IV SOFTWARE TESTING 09

Software Testing – Strategies: Conventional - Object Oriented – Validation Testing – Criteria – Alpha – Beta Testing- System Testing – Recovery – Security – Stress – Performance - Testing Tactics – Testing Fundamentals-Black Box

MODULE V SCM AND QUALITY ASSURANCE 09

Software Configuration And Management-Features-SCM Process-Software Quality Concepts – Quality Assurance – Software Review–Technical Reviews –

Formal Approach To Software Quality Assurance – Reliability – Quality Standards – Software Quality Assurance Plan.

Total Hours: 45

TEXT BOOK :

1. Roger Pressman.S., “Software Engineering: A Practitioner's Approach”, 6th Edition, Mcgraw Hill, 2005.

REFERENCES :

1. P. Fleeger, “Software Engineering”, Prentice Hall, 1999.
2. Carlo Ghezzi, Mehdi Jazayari, Dino Mandrioli, “Fundamentals of Software Engineering”, Prentice Hall Of India 1991.
3. I. Sommerville, “Software Engineering”, 5th Edition: Addison Wesley, 1996.

OUTCOMES:

On completion of this course, students will be able to

- apply foundations of software engineering practice and process within production constraints.
- analyze, design, verify, validate, implement, apply, and maintain software systems
- justify the importance of cost estimation, scheduling and reviewing the progress of the software.
- apply different testing and debugging techniques and analyze their effectiveness.
- sketch the software project management concepts like cost estimation, scheduling and reviewing the progress.
- demonstrate different testing and debugging techniques and analyzing their effectiveness.

CAC6203	DATA STRUCTURES AND DESIGN AND ANALYSIS OF ALGORITHMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- to learn about different kinds of data structures that are suited to different kinds of applications
- to manage huge amounts of data efficiently,
- to understand the suitable applications of tree and graph data structure

MODULE I LINEAR STRUCTURES 09

Abstract Data Types(ADT) – List ADT–array-based implementation–linked list implementation–cursor-based linked lists–doubly-linked lists–applications of lists– Stack ADT–Queue ADT– circular queue implementation– Applications of stack sand queues

MODULE II TREE STRUCTURES 09

Tree ADT - tree traversals–left child right sibling data structures for general trees –Binary Tree ADT - expression trees– applications of trees–binary search tree ADT– AVL trees–binary heaps

MODULE III HASHING AND SETS 09

Hashing – Separate chaining –open addressing–rehashing –extendible hashing – Disjoint Set ADT–dynamic equivalence problem–smart union algorithms– path compression–applications of Sets

MODULE IV GRAPHS AND THEIR APPLICATIONS 09

Definitions – Topological sort–breadth-first traversal- shortest-path algorithms–minimum spanning tree– Prim's and Kruskal's algorithms–Depth-first traversal–biconnectivity–Euler circuits–applications of graphs.

MODULE V ALGORITHM DESIGN AND ANALYSIS 09

Introduction to algorithm design techniques: Greedy algorithms, Divide and conquer, Dynamic programming, backtracking, branch and bound, Randomized algorithms– Introduction to algorithm analysis: asymptotic notations, recurrences–Introduction to NP-complete problems

Total Hours: 45

TEXT BOOK:

1. Tanaenbaum A.S.,Langram Y. Augestein M.J “Data Structures using C” Pearson Education, 2004.

REFERENCES:

1. Robert Kruse & Clovis L. Tondo “Data Structures and Program Design in C”, Prentice Hall, 2nd edition, 1991.
2. Weiss “Data Structures and Algorithm Analysis in C”, Addison Wesley, 2nd Edition, 1997.
3. R.F.Gilberg, B.A.Forouzan, “Data Structures”, Second Edition, Thomson India Edition, 2005.
4. K.S.Easwarakumar, Object Oriented Data Structures using C++, Vikas
5. Publishing House pvt.Ltd., 2000.
6. SaraBaase and A.VanGelder, “Computer Algorithms”, Third Edition, Pearson Education, 2000.
7. T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, "Introduction to algorithms", Second Edition, Prentice Hall of India Ltd, 2001.

OUTCOMES:

At the completion of this course, the student will able to

- compare and contrast various sorting and searching techniques
- apply suitable shortest path algorithm in appropriate applications
- manage the storage by using proper storage management technique
- Identify the strengths and weaknesses of different data structures
- choose the appropriate data structure and algorithm design method for a specified application.
- determine which algorithm or data structure to use in different scenarios

CAC6204 OPERATING SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- Provide an overview of computer system and operating system
- Learn the scheduling mechanisms of operating systems
- Introduce the concepts of process management, memory management and storage management

MODULE I INTRODUCTION 07

Definition of OS-Mainframe System - Desktop Systems-Multi processor System-Distributed-Clustered-Real time Systems-Handheld Systems-Operating System Structure-System Components-Services-System Calls-System Programs-System Design and Implementation.

MODULE II PROCESS MANAGEMENT 08

Concepts-Process Scheduling-Operations on Processes-Co-operating Processes-Inter Process Communication-CPU Scheduling-Scheduling Concepts-Criteria-Scheduling Algorithms-Multiprocessor Scheduling-Real time Scheduling.

MODULE III PROCESS SYNCHRONIZATION 10

Critical Section-Synchronization Hardware-Semaphores-Problems of Synchronization-Critical Regions-Monitors-Deadlocks-Characterization-Handling Deadlocks-Deadlock Prevention-Avoidance-Detection-Deadlock Recovery.

MODULE IV MEMORY MANAGEMENT 10

Storage Hierarchy-Storage Management Strategies-Contiguous-Non Contigous Storage Allocation-Single User-Fixed Partition-Variable Partition - Swapping-Virtual Memory-Basic Concepts-Multilevel Organization-Block Mapping-Paging-Segmentation-Page Replacement Methods-Locality-Working Sets.

MODULE V I/O AND FILE SYSTEMS 10

Disk Scheduling-File Concepts-File System Structure-Access Methods- Directory Structure-Protection-Directory Implementation-Allocation Methods-Free Space Management-Case Study: Linux System.

Total Hours: 45

TEXT BOOK:

1. Silberschatz and Galvin, Operating System Concepts, 6th Edition, John Wiley & Sons, Inc., 2004.

REFERENCES:

1. Milankovic M., Operating System Concepts and Design, 2nd Edition, McGraw Hill, 1992.
2. P.C.Bhatt, An Introduction to Operating Systems-Concepts and Practice, Prentice Hall of India, 2004.
3. H.M.Deitel, An Introduction to Operating Systems, 2nd Edition, Pearson Education, 2002.

OUTCOMES:

On completion of this course, students will be able to

- summarize the functions and objectives of operating systems
- evaluate the design issues associated with operating systems.
- compare and contrast scheduling mechanisms
- analyze the memory management issues.
- comprehend synchronization, deadlocks and multithreading.
- illustrate the file system structure.

CAC6205 DATA STRUCTURES AND ALGORITHMS LAB

L	T	P	C
0	0	4	2

OBJECTIVES:

- Introduce various algorithmic techniques to solve the problems
- study run-time efficiency of an algorithm
- design and implement operations on stacks, queues, trees and graphs
- design and implement algorithms for searching and sorting
- determine the Big-O of an algorithm

ALGORITHMS:

1. Apply the divide and Conquer technique to arrange a set of numbers using merge sort method.
2. Perform Strassen's matrix multiplication using divide and conquer method.
3. Solve the knapsack problem using greedy method.
4. Construct a minimum spanning tree using greedy method.
5. Construct optimal binary search trees using dynamic programming method of problem solving.
6. Find the solution for traveling salesperson problem using dynamic programming approach.
7. Perform graph traversals.
8. Implement the 8 Queens Problem using backtracking.
9. Implement knapsack problem using backtracking.
10. Find the solution of traveling salesperson problem using branch and bound technique.

DATA STRUCTURES:

1. Represent the given sparse matrix using one dimensional array and linked list.
2. Create a Stack and do the following operations using arrays and linked lists
   (i) Push (ii) Pop (iii) Peep
3. Create a Queue and do the following operations using arrays and linked lists
   (i) Add (ii) Remove
4. Implement the operations on singly linked list, doubly linked list and circular linked list.
5. Create a binary search tree and do the following traversals
   (i) In-order (ii) Pre order (iii) Post order

6. Implement the following operations on a binary search tree.
   (i) Insert a node (ii) Delete a node
7. Sort the given list of numbers using heap and quick sort.
8. Perform the following operations in a given graph
   (i) Depth first search (ii) Breadth first search
9. Find the shortest path in a given graph using Dijkstra algorithm

OUTCOMES:

On completion of this course, students will be able to

- analyze the complexity of a given algorithm.
- apply various data structure such as stacks, queues, trees , linked list and graphs to solve various computing problems
- compare, contrast, and choose appropriate algorithmic design techniques to provide solution to the problem.
- develop program that implements kruskal's algorithm, prims, binary search, all types of sorting, greedy algorithm and backtracking technique.
- construct optimal binary search tree using dynamic programming technique.
- find the solution for the n-queens problem and implement traveling salesman problem using dynamic programming.

CAC6206 COMMUNICATION SKILLS LABORATORY

L	T	P	C
0	0	2	2

OBJECTIVES:

- Enable the students to speak English with correct accent and pronunciation.
- Interact effectively in real life situations and in workplace.
- Develop the writing ability of students by providing them the required practice.
- Improve the written communication skill so as to write reports, letters etc.

MODULE I LANGUAGE FUNDAMENTALS 03

Tenses, Subject – Verb Agreement, Correction of Errors.

MODULE II ORAL COMMUNICATION 10

Oral practice – Introducing oneself, Conversations, Role-play - Activities based on real life situations and professional situations such as marketing, advertising, etc. Debating on a topic, Group Discussion, Oral Presentation, Non-verbal communication, Mock Interviews, Conducting meetings, Participating in meetings- Phonetics- Correct Pronunciation.

MODULE III WRITTEN COMMUNICATION 06

Writing a letter of application with resume - practical training - calling for quotations – placing an order – letter of complaint, Memoranda, Writing an email, Minutes - Report Writing - Project report - Writing a proposal.

MODULE IV LANGUAGE LABORATORY 06

Language fundamental practices - Listening Comprehension, Reading Comprehension, Listening to correct pronunciation, Accent, Viewing models of Presentations, Interviews, Group Discussions in the language lab and practice in the class room.

Total Hours: 25

REFERENCES :

1. A.J.Thomson& A.V. Martinet, “A Practical English Grammar” Oxford University Press, 1999.
2. Andrea J. Rutherford, “Basic Communication Skills for Technology”, second edition, Pearson Education, 2007.
3. P.K.Dutt, G. Rajeevan and C.L.N. Prakash, “A Course in Communication Skills”, Cambridge University Press, India 2007.
4. Krishna Mohan and Meera Banerjee, “Developing Communication Skills”, Macmillan India Ltd. (reprinted 1994-2007).
5. Riordan, Pauley, “Report Writing Today”, AIT B.S. Publisher, New Delhi (2000).
6. Gerson, Sharon, Steve m. Gerson, “Technical Writing: Process and Product”, Pearson Education, New Delhi (2004).
7. R.K. Bansal, J.P. Harrison, “Spoken English”, Orient Longman, Mumbai (1999)
8. Grant Taylor, “English Conversation Practice” TataMCGraw Hill, New Delhi (1997).

OUTCOMES:

On completion of this course, students will be able to

- organise ideas relevantly and coherently.
- engage in debates.
- participate in group discussions and face interviews.
- write project and technical reports.
- write formal letters and deliver oral presentations
- take part in social and professional communication.

CAC6207 SEMINAR TOPICS

L	T	P	C
0	0	0	1

The student gives presentation on topics like:

- Social Networking
- Mobile Computing
- E-Business
- Human-Computer Interaction
- Cloud Computing
- Web of things
- Big Data
- xMax Technology
- Text mining
- Soft computing
- Plagiarism detection techniques.
- Ethical Hacking
- Surface Computer
- X-internet
- 4G broadband

SEMESTER III

CAC7101 OBJECT ORIENTED ANALYSIS AND DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- Describe basics of Object orientation and development methodologies
- Make the students to draw UML and other notations of object oriented paradigm and describe them
- to use UML and design patterns and framework in the processes
- Do object-oriented software testing and quality assurance

MODULE I INTRODUCTION 09

An overview – Object basics – Object state and properties – Behavior – Methods – Messages – Information hiding – Class hierarchy – Relationships – Associations – Aggregations- Identity – Dynamic binding – Persistence – Metaclasses – Object oriented system development life cycle.

MODULE II METHODOLOGY AND UML 09

Introduction – Survey – Rumbugh, Booch, Jacobson methods – Patterns – Frameworks – Unified approach – Unified modeling language – Static and Dynamic models – UML diagrams – Class diagram – Usecase diagrams – Dynamic modeling – Model organization – Extensibility.

MODULE III OBJECT ORIENTED ANALYSIS 09

Identifying Usecase – Business object analysis – Usecase driven object oriented analysis – Usecase model – Documentation – Classification – Identifying object, relationships, attributes, methods – Super-sub class – A part of relationships Identifying attributes and methods – Object responsibility.

MODULE IV OBJECT ORIENTED DESIGN 09

Design process – Axions – Colollaries – Designing classes – Class visibility – Refining attributes – Methods and protocols – Object storage and object interoperability – Databases – Object relational systems – Designing interface objects – Macro and Micro level processes – The purpose of a view layer interface.

MODULE V SOFTWARE QUALITY 09

Quality assurance – Testing strategies – Object orientation testing – Test cases– Test Plan – Debugging principles – Usability – Satisfaction – Usability testing – Satisfaction testing.

Total Hours: 45

TEXT BOOK :

1. Ali Bahrami, “Object Oriented System Development”, McGraw Hill International Edition, 1999.

REFERENCES:

1. Craig Larman, Applying UML and Patterns, 2nd Edition, Pearson, 2002.
2. Grady Booch, James Rumbaugh, Ivar Jacobson, “The Unified Modeling Language User Guide”, Addison Wesley Long man, 1999.
3. Bernd Bruegge, Allen H. Dutoit, Object Oriented Software Engineering using UML, Patterns and Java, Pearson 2004.

OUTCOMES:

On completion of this course, students will be able to

- describe basics of object orientation and development methodologies
- draw UML and other notations used in object oriented paradigm
- identify and apply object-oriented patterns and framework.
- test object oriented software and assure the quality.
- construct various UML models (including use case diagrams, class diagrams, interaction diagrams, state chart diagrams, activity diagrams, and implementation diagrams) using the appropriate notation.
- recognize the difference between various object relationships like inheritance, association, whole-part, and dependency relationships.

CAC7102 INTERNET AND JAVA PROGRAMMING

L	T	P	C
3	0	0	3

OBJECTIVES:

- learn basic internet concepts, fighting against spam, conferencing on the internet, planning and creating website.
- learn the fundamentals of Java and to introduce encapsulation, polymorphism, and the Java language mechanism (classes and objects) to implement it.
- develop Java computer programs that perform various problem-solving algorithms.
- develop the programming skills to use the object oriented programming methodology to produce quality computer based solutions to real problems.
- work with collection of API and develop fast programs.

MODULE I BASIC INTERNET CONCEPTS 08

Connecting to the Internet – Domain Name System - Exchanging E-mail – Sending and Receiving Files - Fighting Spam, Sorting Mail and avoiding e-mail viruses – Chatting and Conferencing on the Internet – Online Chatting - Messaging – Usenet Newsgroup – Internet Relay chat (IRC) – Instant Messaging - Voice and Video Conferencing.

MODULE II WORLD WIDE WEB 08

Overview – Web Security, Privacy, and site-blocking – Audio and Video on the web – Creating and Maintaining the Web – Web site creation concepts – Web Page Editors – Optimizing Web Graphics – Web Audio Files – Forms, Interactivity, and Database-Driven Web sites – File Transfer and downloading– FTP – Peer to Peer – Downloading and Installing software.

MODULE III JAVA FUNDAMENTALS 08

Java features – Java Platform – Java Fundamentals – Expressions, Operators, and Control Structures – Classes, Packages and Interfaces – Exception Handling.

MODULE IV PACKAGES 12

AWT package – Layouts – Containers – Event Package – Event Model – Painting – Garbage Collection - Multithreading – Language Packages.

MODULE V ADVANCED JAVA PROGRAMMING 09

Utility Packages – Input Output Packages – Inner Classes – Java Database Connectivity - Servlets - RMI – Java Beans.

Total Hours: 45

TEXT BOOKS:

1. Margaret Levine Young, “Internet and WWW”, 2nd Edition, Tata McGraw Hill, 2002. (Unit 1 & 2)
2. Herbert Schildt, The Complete Reference – Java 2 , 4th Edition, Tata McGraw Hill, 2001. (Unit 3, 4 & 5)

REFERENCES:

1. Keyur shah, “Gateway to Java Programmer Sun Certification”, Tata McGraw Hill 2002.
2. Deitel&Deitel, Java How to Program, Prentice Hall 1999.

OUTCOMES:

On completion of this course, students will be able to

- list the various applications of internet and able to create , maintain and block the website.
- identify classes, objects, members of a class and the relationships among them needed for a specific problem.
- compare and contrast the interfaces and abstract classes.
- handle the exceptions and illustrate the life cycle of thread.
- update and retrieve the data from the databases using SQL
- develop distributed applications using RMI
- develop programs using the AWT packages and collection framework

MAC6186 RESOURCE MANAGEMENT TECHNIQUES

L	T	P	C
3	1	0	4

OBJECTIVES

- Constructing a mathematical representation of the problem under study.
- Deriving a solution using any of the appropriate mathematical models namely linear programming models, transportation and assignment models, integer programming models, scheduling by pert and cpm, queuing models.
- Analyze the alternatives and produce an optimal solution for the existing problem.

MODULE I LINEAR PROGRAMMING MODELS 12

Mathematical Formulation - Graphical Solution of linear programming models – Simplex method – Artificial variable Techniques- Variants of Simplex method.

MODULE II TRANSPORTATION AND ASSIGNMENT MODELS 12

Mathematical formulation of transportation problem- Methods for finding initial basic feasible solution – optimum solution - degeneracy – Mathematical formulation of assignment models – Hungarian Algorithm – Variants of the Assignment problem.

MODULE III INTEGER PROGRAMMING MODELS 12

Formulation – Gomory's IPP method – Gomory's mixed integer method – Branch and bound technique.

MODULE IV SCHEDULING BY PERT AND CPM 12

Network Construction – Critical Path Method – Project Evaluation and Review Technique – Resource Analysis in Network Scheduling.

MODULE V QUEUEING MODELS 12

Characteristics of Queuing Models – Poisson Queues - (M / M / 1) : (FIFO / ∞ /∞), (M / M / 1) : (FIFO / N / ∞), (M / M / C) : (FIFO / ∞ / ∞), (M / M / C) : (FIFO / N / 8) models.

L : 45, T : 15 Total Hours: 60

TEXT BOOK:

1. Taha H.A., “Operations Research: An Introduction” 7th Edition, Pearson Education, 2004.

REFERENCES:

1. A.M.Natarajan, P.Balasubramani, A.Tamilarasi, “Operations Research”, Pearson Education, Asia, 2005.
2. Prem Kumar Gupta, D.S. Hira, “Operations Research”, S.Chand& Company Ltd, New Delhi, 3rd Edition, 2003.

OUTCOMES:

On completion of this course, students will be able to

- construct a real world problem into a mathematical problem.
- identify the appropriate model to solve the problem.
- explore the alternative models and justify on the selected model for representation.
- analyze and provide a optimal solution.
- construct the network and analyze the resources in network scheduling

CAC7103 CASE TOOLS LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

- learn the basics of OO analysis and design skills.
- be exposed to the UML design diagrams.
- learn to map design to code.
- be familiar with the various testing techniques

LIST OF EXERCISES

1. Design a UML diagram for Passport automation system.
2. Design a UML diagram for Stock Maintenance System.
3. Design a UML diagram for Online course reservation system.
4. Design a UML diagram for E-ticketing
5. Design a UML diagram for Library Management System
6. Design a UML diagram for Student Information System.
7. Design a UML diagram for Credit card processing.
8. Design a UML diagram for Exam Registration.
9. Design a UML diagram for e-book management system
10. Design a UML diagram for Recruitment system.

OUTCOMES*:*

At the end of the course, the student should be able to:

- design and implement projects using OO concepts.
- use the UML analysis and design diagrams.
- apply appropriate design patterns.
- create code from design.
- compare and contrast various testing techniques

CAC7104 PROGRAMMING IN JAVA

L	T	P	C
0	0	4	2

OBJECTIVES:

- to develop the programming skills using the object oriented programming
- methodology to produce quality computer based solutions to real problems.
- to utilize the advance features of Java technology.
- demonstrate the use of Application Programming Interface (API) and develop programs
- to develop good multithreaded programs

JAVA PROGRAMMING:

1. Program to illustrate the use of overloading and overriding.
2. Program to implement the concept of inheritance.
3. Program to illustrate the use of multi-threading.
4. Program to implement the concept of Interfaces and packages.
5. Generate the program using exceptions handling mechanism.
6. Implement the file operations.
7. Program using Applets.
8. Program to handle Mouse Events, Keyboard Events and work with GUI components.
9. Program using JDBC.

OUTCOMES:

On completion of this course, students will be able to

- apply basic control structures, arrays, looping statement and various class libraries in developing program.
- write Java programs using object-oriented programming techniques inheritance, polymorphism, interface, constructors and abstract class.
- create package for real time applications like bank transaction, employee processing etc.
- construct multithreaded programs and handle exceptions
- write programs using graphical user interface (GUI) components and various event handling methods.
- implement file operations and connect with database using JDBC.

CAC7105 PROGRAMMING LANGUAGES

L	T	P	C
0	0	0	1

OBJECTIVES:

- To gain experience about structured programming.
- To help students to understand the implementation of C language.
- To understand various features in C.
- To impart knowledge on object oriented features like inheritance, data abstraction, encapsulation and polymorphism to solve various computing problems.

MODULE I FUNDAMENTALS OF C LANGUAGE 03

Structures of 'C' Programming-Character set-C Tokens- Keywords- Identifiers-Variables- Constant- Data Types-Comments-Types of operators.

MODULE II CONTROL STRUCTURES 03

Decision making structures-If, If-else, Nested If-else, Switch; Loop Control structures: While, Do while, for, Nested for loop.

MODULE III ARRAYS, FUNCTIONS AND POINTERS 03

Arrays – dynamic and multi-dimensional arrays- Basic types of function – Recursion –- Pointers – Declaration, Accessing a variable, character strings.

MODULE IV OBJECT ORIENTED CONCEPTS 03

Overview of C++-Classes and Objects-Overloading-Constructor-Inheritance-Default argument

MODULE V EXCEPTION HANDLING AND TEMPLATES 03

Exception Handling, Virtual Function-Templates- C++ I/O Streams-File I/O

Total Hours: 15

TEXT BOOKS:

1. K R Venugopal, S R Prasad, Mastering in C. Tata McGraw Hill Publishing Company Limited, 2nd reprint 2007.

REFERENCES:

1. Yeshwantkanetkar, Let us C, Sixth Edition, BPB Publication 2005
2. Herbert Schildt, Turbo C: The Complete Reference, Mc Graw-Hill,1998,ISBN: 9780078813467
3. HM Deitel and PJ Deitel “C++ How to Program”, Seventh Edition, 2010, Prentice Hall
4. E Balagurusamy, “Object oriented Programming with C++”, Third edition, 2006, Tata McGraw Hill

OUTCOMES

On completion of this course, students will be able to

- solve the given problem using the syntactical structures of C language
- develop, execute and document computerized solution for various problems using the features of C language
- develop programs using single and multi-dimensional arrays.
- apply inheritance, data abstraction, encapsulation and polymorphism to solve various computing problems.
- handle the exception and work with files.

SEMESTER - IV

CAC7201	ADVANCED WEB DESIGN AND DEVELOPMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To make use of the Internet related technologies.
- To analyse advantages and use of different types of CSS.
- To design static and interactive web pages by embedding Java Script code in HTML and Use Java Script to validate user input.
- To teach the importance of functional programming to improve web applications
- To Know how to embed media—such as audio or video—into a web page
- To apply the basics of PHP and connect with MySQL database.

MODULE I INTRODUCTION TO WWW 09

Introduction to Network, Internet and Intranet, Application and Services, Internet Addressing – IP, DNS, URL. Elements of Web – Web Page, Web Site, Web Client & Server. Web Languages – HTML/DHTML, JavaScript, PHP, XML.

MODULE II BUILDING WEB BASED APPLICATION USING HTML 09

Html Document Structure, Various HTML Tags – Document Tag, Text Formatting Tag, Link Tag, List Tag, Image Tag, Table Tag, Line Breaks, Frame, Frameset, HTML Forms.

MODULE III CASCADING STYLE SHEET 09

Introduction to Style sheet, Types of Style sheet, concept of class & ID, Different CSS Property-.Background Property- Font property- Text -Dimensions-Combinators- Borders-Margins-Padding-Box Model.

MODULE IV CLIENT-SIDE SCRIPTING LANGUAGE 09

Concept and types of Scripting language, Introduction to Javascript, How to develop Javascript, Operators, Conditional Structure & Looping Structure, Dialog Boxes, Arrays, User Define Function, Javascript Function keyword, Function Expression, Constructor, Self Invoking Functions, Built-in Functions (String, Math, Date, Array), Built-in Object (window, screen ,location, history, Navigator),DOM, Forms, Objects and its events- Functional Programming.

MODULE V PHP COMPONENTS 09

Introduction to PHP, Basic PHP syntax: PHP tags, PHP statements and whitespace, comments, Operators, Conditional and Looping Structure, User Define Functions, Arrays. GET and POST Methods. GD Library, Cookies, Session, Server Variables, Database Connectivity with MySQL, PHP My Admin, Regular Expression, PHP with OOP (Class, constructor, inheritance), PHP with AJAX – Introduction-Sending Email using PHP.

Total Hours: 45

TEXT BOOKS:

1. Developing Web Application, Wiley India Publication, Ralph Moseley, Wiley India, 2007.

REFERENCE BOOKS:

1. Beginning PHP5, Apache, Mysql Web Development, Wrox, Elizabeth Naramore, Michael K. Glass, 2005.
2. PHP Bible, Wiley Publication, Tim Converse, Joyce Park, 2002.
3. Web Enabled Commercial Application Development Using HTML, DHTML, PERL, Java Script, BPB Publications, Ivan Bayross, 2005.
4. Beginning Ajax, Wrox, Chris Ullman, Lucinda Dykes, 2007.
5. Beginning JavaScript 2nd Edition, Wrox, Nicholas C. Zakas, 2004.

OUTCOMES:

On completion of this course, students will be able to

- differentiate web and website and summarize the importance of web languages in the development of website.
- apply JavaScript, HTML and CSS3 effectively to create interactive and dynamic websites
- build web applications using PHP and submit the form using GET or POST method.
- create layout in websites using Div tags and incorporate pre-designed elements into them.
- develop server side code using PHP and able to connect and manipulate the MySQL database.

CAC7202 XML AND WEB SERVICES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To describe the role of XML in enterprises.
- To teach the importance of various supporting technologies in XML.
- To describe the role of SOAP in building web services, the basics of the SOAP protocol, and the structure of a SOAP document.
- To impart knowledge on UDDI registries and WSDL in creating web-services clients.
- To cover the basics of XML, Schemas, WSDL, and Web Services concepts.

MODULE I INTRODUCTION 09

Role Of XML – XML and The Web – XML Language Basics – SOAP – Web Services – Revolutions Of XML – Service Oriented Architecture (SOA).

MODULE II XML TECHNOLOGY 09

XML – Name Spaces – Structuring With Schemas and DTD – Presentation Techniques – Transformation – XML Infrastructure.

MODULE III SOAP 09

Overview of SOAP – HTTP – XML-RPC – SOAP: Protocol – Message Structure– Intermediaries – Actors – Design Patterns and Faults – SOAP with Attachments.

MODULE IV WEB SERVICES 09

Overview – Architecture – Key Technologies - UDDI – WSDL – ebXML – SOAP And Web Services In E-Com – Overview of .NET and J2EE.

MODULE V XML SECURITY 09

Security Overview – Canonicalization – XML Security Framework – XML Encryption – XML Digital Signature – XKMS Structure – Guidelines for Signing XML Documents – XML In Practice.

Total Hours: 45

TEXT BOOK:

1. Frank. P. Coyle, XML, Web Services and The Data Revolution, Pearson Education, 2002.

REFERENCES:

1. Ramesh Nagappan, Robert Skoczylas and Rima Patel Sriganesh, “Developing Java Web Services”, Wiley Publishing Inc., 2004.
2. Sandeep Chatterjee, James Webber, “Developing Enterprise Web Services”, Pearson Education, 2004.
3. McGovern, et al., “Java Web Services Architecture”, Morgan Kaufmann Publishers, 2005.

OUTCOMES:

On completion of this course, students will be able to

- list the importance of XML
- differentiate the various technologies of XML and their working.
- assess the role played by SOAP and web services
- recognize the need for XML security.
- build effective XML documents.
- build DTD documents to validate XML.
- build Schema documents to validate XML.

CAC7203 MOBILE COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To describe the basics of wireless medium access, satellite system and broadcast systems.
- To explain the architectures and protocols of various wireless telecommunications systems (GSM, DECT, TETRA) and compare them.
- To outline the basics of satellite system
- To classify and discuss the various wireless LAN technologies like ieee 802.11, Bluetooth, etc., and identify the related research issues in wireless LAN.
- To illustrate the routing and transport issues in mobile networks and demonstrate the existing solutions
- To express wireless application layer protocol(WAP)

MODULE I INTRODUCTION 09

Medium Access Control : Motivation for Specialized MAC- SDMA- FDMA- TDMA- CDMA- Comparison of Access mechanisms – Tele communications : GSM- DECT- TETRA – UMTS- IMT-200 – Satellite Systems: Basics- Routing- Localization- Handover- Broadcast Systems: Overview – Cyclic Repetition of Data- Digital Audio Broadcasting – Digital Video Broadcasting.

MODULE II WIRELESS NETWORKS 09

Wireless LAN: Infrared Vs Radio Transmission – Infrastructure Networks- Ad hoc Networks- IEEE 802.11 – HIPERLAN – Bluetooth- Wireless ATM: Working Group- Services- Reference Model – Functions – Radio Access Layer – Handover- Location Management- Addressing Mobile Quality of Service- Access Point Control Protocol.

MODULE III MOBILE NETWORK LAYER 09

Mobile IP : Goals – Assumptions and Requirement – Entities – IP packet Delivery- Agent Advertisement and Discovery – Registration – Tunneling and Encapsulation – Optimization – Reverse Tunneling – IPv6 – DHCP- Ad hoc Networks.

MODULE IV MOBILE TRANSPORT LAYER 09

Traditional TCP- Indirect TCP- Snooping TCP- Mobile TCP- Fast retransmit/ Fast Recovery- Transmission/ Timeout Freezing – Selective Retransmission- Transaction Oriented TCP

MODULE V WAP 09

Architecture – Datagram Protocol- Transport Layer Security – Transaction Protocol- Session Protocol- Application Environment-Wireless Telephony Application

Total Hours: 45

TEXT BOOK :

1. J.Schiller, Mobile Communication, Addison Wesley, 2000.

REFERENCES :

1. William C.Y.Lee, Mobile Communication Design Fundamentals, John Wiley, 1993.
2. William Stallings, Wireless Communication and Networks, Pearson Education, 2003.
3. Singhal, WAP-Wireless Application Protocol, Pearson Education, 2003.

OUTCOMES:

On completion of this course, students will be able to

- express the issues in wireless medium access control and illustrate existing solutions
- Illustrate the fundamentals of satellite system and broadcast system
- discuss the architectures and working principles of wireless telecommunications systems(GSM, DECT,TETRA)
- classify and discuss the various wireless LAN technologies like IEEE 802.11, Bluetooth, etc., and identify the related research issues in wireless LAN.
- identify the issues in mobile routing, transport and application layers and demonstrate the existing solutions

CAC7204 WEB DESIGN AND DEVELOPMENT LAB

L	T	P	C
0	0	4	2

OBJECTIVES:

- To provide the student with the fundamental knowledge and skills to become a proficient web programmer
- Impart the knowledge of developing static and dynamic web page using HTML, CSS and JavaScript.
- To learn how to perform validation using JavaScript
- To impart designing online application and access database using MYSQL

LIST OF LAB EXERCISES

1. Design the static web page using frames, links and tables for any application.
2. Creation of HTML pages using ordered list, unordered list , definition list and hotspots
3. Create webpage to embed audio and video.
4. Usage of internal and external CSS along with HTML pages
5. Develop web pages using Background property, Font property, Dimensions, Box model, Combinators and Borders in CSS
6. Client side Programming
    i. Java script for displaying date and comparing two dates
    ii. Form Validation including text field, radio buttons, check boxes, list box and other controls
    iii. Design a digital clock
    iv. Develop Simple calculator
7. Developing online applications such as shopping, railway/air/bus, education using HTML, CSS, Javascript and PHP
8. Develop programs using control structures and arrays in PHP
9. Any online application using PHP and submit the form using GET or POST method.
10. Database connectivity in PHP

OUTCOMES:

On completion of this course, students will be able to

- build XML data file and validate using DTD and XML schema
- design and development applications using XML ,DOM and DSO
- design and implementation of Web forms and Web services.
- to design static and dynamic web pages
- to solve problem related to web based applications

CAC7205 XML AND WEB SERVICES LAB

L	T	P	C
0	0	4	2

OBJECTIVES:

- to provide the knowledge necessary to build and validate XML.
- to equip the students with XML, a core technology in Web Services.
- a background in the underlying technologies.
- to cover the basics of XML, Schemas, WSDL, and Web Services concepts

LAB EXCERCISES:

1. Create an XML document to store an address book.
2. Create an XML document to store information about books and create the DTD files.
3. Create an XML schema for the book's XML document from exercise.
4. Create an XML document to store resumes for a job web site and create the DTD file.
5. Present the book's XML document using cascading style sheets (CSS).
6. Write an XSLT program to extract book titles, authors, publications, book rating from the book's XML document and use formatting.
7. Use Microsoft DOM to navigate and extract information from the book's XML document.
8. Use Microsoft DSO to connect HTML form or VB form to the book's XML document and display the information.
9. Create a web service for temperature conversion with appropriate client program.
10. Create a web service for currency conversion (at five currencies) with appropriate client program.

OUTCOMES:

On completion of this course, students will be able to

- build effective XML documents.
- build DTD documents to validate XML.
- build Schema documents to validate XML.
- describe services using WSDL.
- build and consume Web services.
- Specify the role of web services in commercial applications.
- understand the principles of web service provision.
- understand the use of Java for implementing web services.

CAC7206	SOFT SKILLS AND PERSONALITY DEVELOPMENT	L	T	P	C
		0	0	2	1

OBJECTIVES:

- Attitude Control and Quick Personal Self Esteem Improvement
- Interview Motivation and Developing Personal Confidence using NLP
- Effective Answering and Maintaining Fluent Communication
- Positive Body Language
- Effective Resume Creation
- Leadership Skills, Team Player Skills and Career Plan to HR

MODULE I MOTIVATION 05

Awareness of Real World Industry and Situations - Conscious Self-Awareness - Practical Visualizations - Neuro- Linguistic Programming Basics - Developing Self Esteem and Self Motivation - Confident Goal Setting - Positive Attitude Development and Positive Thinking - Developing Inner Achievement Mindset.

MODULE II LEADERSHIP SKILLS 04

Types of Leadership - Leadership Process and Thinking - Innovative Thinking - Role of Competency, Discipline, Planning and Ethics - Creating Cooperation and Trust in Team Building Process – Mentoring.

MODULE III EFFECTIVE COMMUNICATION I 04

Eliminating Stage Fright - Increasing Fluency - Increasing Focus while Listening - How to communicate as a Follower - How to communicate as a Leader - Assertive and Polite Communication.

MODULE IV EFFECTIVE COMMUNICATION II 05

Fluency with increased vocabulary - Group Discussion Etiquette - Advanced Group Discussions - Giving a positive Body Language - Interviews: Clear Speaking - Interviews: Handling Pressure.

Total Hours: 18

REFERENCES :

1. Charles Faulkner and Steve Andreas, "NLP: The New Technology of Achievement", Harper Paperbacks publishers, 1996.
2. Sarvesh Gulati, "Corporate Soft Skills", Rupa and Co publishers.
3. P.K.Dutt, G.Rajeevan and C.L.N. Prakash, “A Course in Communication Skills”, Cambridge University Press, India 2007.

OUTCOMES:

On completion of this course, students will be able to

- understand the significance of soft skills in the working environment
- communicate effectively and present their concepts in a more confident manner.
- engage in debates and participate in group discussions.
- recognize the different leadership styles
- take part in social and professional communication.
- develop self-motivation, raised aspirations and belief in one's own abilities, defining and committing to achieving one's goals

SEMESTER V

CAC8101 MOBILE APPLICATION DEVELOPMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge on mobile app paradigm, IOS components and services.
- To impart knowledge on controls and gestures , creating universal applications run on iPhone and iPad
- To teach how to Install and use appropriate tools for Android development, including IDE, device emulator, and profiling tools.
- Design and develop mobile app using android

MODULE I INTRODUCTION TO IOS 08

Why IOS-The mobile App paradigm-Introduction to Xcode-main characteristics of mobile apps - Differences between mobile apps and desktop apps- How iOS is tailored to a mobile platform -IOS components and services- IPhone architecture-COCOA touch classes-interface builder.

MODULE II APPLICATION DEVELOPMENT IN iPHONE 09

Controls and Gestures-Advance controllers Programming-Navigation based Application development- create Universal applications that run on both iPhone and iPad-Core Animation- Core Graphics APIs to do simple drawing- Handle touch events- Create and present editable tables of data – using UI TableView-accessing user photos and camera within an application.

MODULE III INTRODUCTION TO ANDROID ARCHITECTURE 09

Introduction- History- Features- Android Architecture-setting up Android Application Environment-SDK- Application Environment and Tools, Android SDK. Programming paradigms and Application Components – Activity-Manifest File- Content providers, Broadcast receivers, Services-Interacting with UI-Persisting data using SQLite-packaging and deployment

MODULE IV USER INTERFACE DESIGN 10

Views &View Groups, Views : Button, Text Field, Radio Button, Toggle Button, Checkbox, Spinner, Image View, Image switcher, Event Handling, Listeners, Layouts : Linear, Relative- List View- Grid View-Table View- Web View- Adapters-Menus, Action Bars, Notifications : Status, Toasts and Dialogs, Styles and

Themes, Creating Custom Widgets, Focus, Touch Mode, Screen Orientation. Designing for Tablets – Working with tablets: Developing for the Honeycomb and Ice Cream Sandwich platforms, Manipulating objects with drag and drop-Localization, Localization Strategies, Testing Localized Applications, Publishing Localized Applications-Data Access and Storage- SQLite Databases

MODULE V NATIVE CAPABILITIES AND TESTING 09

Android Media API: Playing audio/video, Media recording. Sensors - how sensors work, listening to sensor readings. Bluetooth. Maps & Location: Android Communications: GPS, Working with Location Manager, Working with Google Maps extensions, Maps via intent and Map Activity, Location based Services. Location Updates, location-based services (LBS), Location Providers- Testing and Commercializing Applications - Basics of Testing- Debugging using DDMS-getting your app on the app store

Total Hours: 45

TEXT BOOKS:

1. Professional Android 4 Development by Reto Meier, John Wiley and Sons, 2012.
2. Android in Action, Third Edition, by W. Frank Ableson, RobiSen, Chris King, C. Enrique Ortiz, 2012.

REFERENCES:

1. Android Application Development Cookbook, by Wei-Meng Lee, John Wiley and Sons, 2013.
2. Beginning Android 4, by Grant Allen, Apress, 2011.

OUTCOMES:

On completion of this course, students will be able to

- List the differences between mobile apps and desktop apps
- create Universal applications that run on both iPhone and iPad
- Handle touch events, work with Table View and access user photos and camera through an application.
- use the development tools in the Android development environment
- apply the Java programming language to build Android apps
- develop UI-rich apps using all the major UI components
- Implement the design using Android SDK
- Deploy mobile applications in Android and iPone marketplace for distribution

CAC7206	ESSENTIALS OF MANAGEMENT FOR COMPUTER PROFESSIONALS NT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- learn various functions and principles of management
- apply planning techniques and decision making process in IT/ITES profession
- get acquainted with organizing and staffing activities applicable to computer profession
- know the art of directing and controlling in typical IT job environment
- derive inputs about individual and group behavior as well as organization dynamics
- learn the various functional areas of management
- get acquainted with information systems management

MODULE I BASICS OF MANAGEMENT: PLANNING AND ORGANIZING 07

Management: definition, functions, schools of thought/ contributions by experts, role of managers – Planning: definition, process, purpose, types – MBO – MBE – Decision making in IT environment: steps, types of decision – Organizing: meaning, organizational charts – Departmentation: objectives, bases, forming departments in IT enterprises – Centralization and decentralization – Delegation of authority

MODULE II STAFFING, DIRECTING AND CONTROLLING 08

Staffing: definition, sub-functions – Directing: leadership theories and styles – Motivation: concepts, types of motives, applications in software jobs – Communication: types, process, barriers to effective communication – Controlling: process, effective control, types, techniques

MODULE III INDIVIDUAL AND GROUP BEHAVIOUR 10

Personality types – Factors influencing personality – Perception: definition, process – Attitude: components, measurement in IT employees – Learning theories – Motivation theories, motivating software employees – Group behavior: reasons for group formation, types of group in IT organizations – Group decision making techniques – Power and Politics in Organization – Types of conflict and resolution methods in software organizations

MODULE IV ORGANIZATION SYSTEM AND DYNAMICS 05

Organizational culture, sub-culture, cross-culture/ international culture in software industry – Definition of QWL – Work stress: causes, effects & coping strategies – Organizational change in software environment: reasons, resistance & overcoming strategies

MODULE V FUNCTIONAL AREAS OF MANAGEMENT 09

Human resource management: functions - Roles of HR manager - Selection procedure – Types of production – Overview of production management functions – Broad functions of materials management - Purchasing procedure – Stock control methods – Concept of supply chain – Meaning of profit and loss account statement – Balance sheet – Types of costs – Break-even analysis – Marketing: concept, mix – Product life cycle - Stages of new product development – Pricing methods – Types of advertising media – Overview of personal selling process – Channel functions – Promotion methods – Enterprise Resource Planning

MODULE VI MANAGEMENT INFORMATION SYSTEM 06

Management Information System: definition, components – Information needs - Types of information – Systems concept – Elements of systems – Information gathering – Steps involved in system analysis and design – Tools – implementation

TOTAL: 45

REFERENCES

1. Harold Koontz & Heinz Weihrich “Essentials of Management”, Tata McGraw,Hill, 2008.
2. Stephen Robbins, "Organizational Behaviour", Prentice Hall of India, 2014
3. Prasad L.M, “ Principles of Management”, Sultan Chand & Sons , Edition 2006.
4. Tripathy P.C and Reddy P.N, “ Principles of Management”, Tata McGraw,Hill, 2010.
5. Aswathappa, "Organizational Behaviour", Himalya Publications, 2010
6. Fred Luthans, "Organizational Behaviour", McGrawHill, 2009.
7. Bhushan Y.K., “Fundamentals of Business Organization and Management”, Sultan Chand & Co., 2003

OUTCOMES:

After studying the course, the students would be able to:

- perform / adopt appropriate functions and principles of management in their jobs
- make decisions using suitable planning techniques in their activities
- organize the activities & carry out staffing functions in the job situations
- communicate effectively, motivate their subordinates and also exhibit right leadership style in their IT/ITES profession
- recognize individual, group and organization dynamics to demonstrate suitable behaviour in the job-routine
- use inputs on MIS to relate to functional areas of management

CAC8102 INTERNET OF THINGS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the fundamentals of Internet of Things.
- To build a small low cost embedded system using Arduino / Raspberry Pi or equivalent boards.
- To apply the concept of Internet of Things in the real world scenario

MODULE I FUNDAMENTALS OF IOT 09

Introduction-Characteristics-Physical design - Protocols – Logical design – Enabling technologies – IoT Levels – Domain Specific IoTs – IoTvs M2M.

MODULE II IOT DESIGN METHODOLOGY 09

IoT systems management – IoT Design Methodology – Specifications Integration and Application Development.

MODULE III BUILDING IOT WITH RASPBERRY PI 09

Physical device – Raspberry Pi Interfaces – Programming – APIs / Packages – Web services

MODULE IV BUILDING IOT WITH GALILEO/ARDUINO 09

Intel Galileo Gen2 with Arduino- Interfaces - Arduino IDE – Programming - APIs and Hacks

MODULE V CASE STUDIES and ADVANCED TOPICS 09

Various Real time applications of IoT- Connecting IoT to cloud – Cloud Storage for Iot – Data Analytics for IoT – Software & Management Tools for IoT

Total Hours:45

REFERENCES:

1. ArshdeepBahga, Vijay Madisetti, “Internet of Things – A hands-on approach”, Universities Press, 2015.
2. Manoel Carlos Ramon, “Intel® Galileo and Intel® Galileo Gen 2: API Features and Arduino Projects for Linux Programmers”, Apress, 2014.
3. Marco Schwartz, “Internet of Things with the Arduino Yun”, Packt Publishing, 2014.

OUTCOMES:

Upon the completion of the course the student should be able to

- Design a portable IoT using Arduino/ equivalent boards and relevant protocols.
- Develop web services to access/control IoT devices
- Deploy an IoT application and connect to the cloud
- Analyze applications of IoT in real time scenario
- Summarize the characteristics of IoT and differentiate physical and logical design.

CAC8103 MOBILE APPLICATION DEVELOPMENT LAB

L	T	P	C
0	0	4	2

OBJECTIVES:

- Understand the mobile programming aspects, design and implementation on android platforms.
- Develop mobile applications for the Android operating system using basic and advanced phone features.
- Deploy applications to the Android marketplace for distribution

List of Exercises: (Implementation using Android / IOS)

1. Display Hello World.
2. Add two Edit Text. When a number is entered in Edit Text 1, the square of that number should be displayed in Edit Text 2.
3. Add an Edit Text and a button. When the button is clicked, the text inputted in Edit Text should be retrieved and displayed back to the user.
4. Add two Edit Text and a button. When the button is clicked, the text inputted in Edit Text 1 should be retrieved and displayed in Edit Text 2.
5. Program a calculator.
6. Create a Module convertor for height.
7. Create a Module convertor for height and weight in the same application. Selection of height/weight can be done using a spinner.
8. Add a spinner. When the spinner is selected, there should be three options (e.g., android, java, testing). When you click on each option, it should go to another page containing some other components. Each of these pages should have a “back” button, which on pressing will take you back to the page with the spinner.
9. Create applications to include Action Bar, Menus, Dialogs and Notifications
10. Create a user login form and registration form. First time users have to register through the registration form and the details should be stored in the database. Then they can login using the login page.
11. Create a camera application, where you can click a picture and then save it as the wallpaper.
12. Create a media player which plays an mp3 song.
13. Create a media recorder which will record the sound.
14. Testing applications

OUTCOMES:

On completion of this course, students will be able to

- Describe the components and structure of a mobile development frameworks (Android SDK and Eclipse Android Development Tools (ADT)) and learn how and when to apply the different components to develop a working system.
- Design, implement and deploy mobile applications using an appropriate software development environment.

CAC8104 MINI PROJECT

L	T	P	C
0	0	4	2

Develop the applications like:

1. Online railway reservation system
2. Payroll processing application
3. Hospital management system
4. Automating the banking process
5. Hotel Reservation system
6. Library management system
7. Attendance Management system
8. Text editor
9. Grocery Shopping
10. Create an E-Book of your choice

Software required:

Languages: C/C++/Java/JSDK/Web browser.

- Any front end tool (like VB, VC++, Developer 2000, Android SDK) etc
- Any backend tool (Oracle, MS-Access, SQL) etc.
- Open source software
- Framework (.Net)
- Any CASE tool

ELECTIVES

CACY001 MANAGEMENT INFORMATION SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the basic principles of Computer based Information System support the management in the various arena in the business units.
- To get an insight into the various organizational structures, culture and power.
- To provide an understanding of the Information Systems (IS) management framework of E-business. To focus on best practices, tools and models to implement an effective management system.
- To provide insights on how to develop and implement enterprise-wide IT strategies, initiatives and programs.
- To explore MIS subsystems and technologies including hardware, software and networking.

MODULE I SYSTEM CONCEPTS 07

Definition – Computer based user machine system – Integrated system – Need for a database – Utilization of models – Evolution – Subsystems – Organizational subsystems – Activities subsystems.

MODULE II ORGANIZATIONAL STRUCTURE 09

Basic model – Hierarchical – Specialization – Formalization – Centralization – Modifications of basic organizational structure – Project organization – Lateral relations – Matrix organization – Organizational culture and power organizational change.

MODULE III STRUCTURE OF MIS 10

Operating elements – Physical components – Processing functions – outputs– MIS support for decision making – Structured programmable decisions – Unstructured non-programmable decisions – MIS structure based on management activity and organizational functions – Synthesis of MIS structure

MODULE IV SYSTEM SUPPORT 10

Data representation – Communication network – Distributed systems – Logical data concepts – Physical storage devices – File organizations – Data base

organization – Transaction processing.

MODULE V DEVELOPMENT AND MANAGEMENT 09

A contingency approach to choosing an application – Developing strategy – Lifecycle definition stage – Lifecycle development stage – Lifecycle installation and operation stage – Project management.

Total Hours: 45

TEXT BOOK:

1. Gordon B. Davis, Margrethe H. Olson, Management Information Systems: Conceptual foundations, Structure and development –2nd Edition – Tata-McGraw hill International book company, 2000.

REFERENCES :

1. E.Wainright Martin, Carol V. Brown, Danial W. DeHayes, Jeffrey A. Hoffer, William C. Perkins, “Managing Information Technology” 3rd Edition, Prentice Hall International edition 1999.
2. Harold Koontz, Heinz Weihrich, “Essentials of Management”, 5th Edition, Tata McGraw Hill 1998.

OUTCOMES:

On completion of this course, students will be able to

- describe the various components of Computer based Information system suitable for the business organization.
- compare, contrast, and choose appropriate hardware, software, database and networking suitable for the organizational Information system.
- Distinguish and analyze ethical problems that occur in business and society
- Apply leadership skills and competencies in business situations
- Illustrate how current technologies and decision-support tools can be utilized to the advantage of business operations.
- develop various types of Information system suitable for organizational levels and various functional units in the organization.

CACY002 ACCOUNTING AND FINANCIAL MANAGEMENT

L	T	P	C
3	1	0	4

OBJECTIVES:

- finance has rightly been termed as the “Master Key” providing access to all resources required for running business activities. Hence efficient management of business enterprises is closely linked with the efficient management of their finances. In view of the growing importance of the finance function, Financial Management and Accounting plays an important role in any organization.

MODULE I FINANCIAL ACCOUNTING 12

Meaning and Scope of Accounting - Principles - Concepts-Conventions-accounting Standards - Final Accounts-Trial Balance-Trading Account-Profit and Loss Account-Balance Sheet.

MODULE II COST ACCOUNTING 12

Meaning-Objectives-Elements of Cost-Cost Sheet-Marginal Costing and Cost Volume Profit Analysis- Break Even Analysis-Applications-Limitations.

MODULE III MANAGEMENT ACCOUNTING 12

Budgets and Budgetary Control-Meaning-Types-Sales Budget-Production Budget- Budget-Flexible Budgeting-Cash Budget- Computerized Accounting - Accounting Ratios Analysis-Funds Flow Analysis-Cash Flow Analysis.

MODULE IV INVESTMENT DECISION 12

Objectives and Functions of Financial Management - Foreign exchange (Forex) - Risk - Return Relationship -Time Value of Money Concepts-Capital Budgeting-Methods of Appraisal.

MODULE V FINANCING DECISION AND WORKING CAPITAL MANAGEMENT 12

Capital Structure-Factors Affecting Capital Structure-Dividend Policy-Types of Dividend Policy- Concepts of Working Capital-Working Capital Policies-Factors affecting Working Capital-Estimation of Working Capital Requirements

Total Hours: 60

TEXTBOOKS:

1. S.N.Maheswari, “Financial and Management Accounting”, Sultan Chand & Sons, 2003.
2. I.M.Pandey, “Financial Management”, Vikas Publications, 4th Reprint, 2002.

REFERENCES:

1. S.P.Iyengar, “Cost and Management Accounting”, Sultan Chand & Co.
2. I.M.Pandey, “Elements of Management Accounting” Vikas Publishing House, 1999.

OUTCOMES:

On completion of this course, students will be able to

- prepare final accounts of a concern to find out the profit or loss
- List the objectives and functions of Financial Management
- analyze the firm by applying various ratios.
- Perform Computerized Accounting, Accounting Ratios Analysis, Funds Flow Analysis and Cash Flow Analysis
- analyze the factors affecting a capital structure, working capital and dividends.

CACY003 E - COMMERCE

L	T	P	C
3	0	0	3

OBJECTIVES:

The aim of this course is to make the students understand

- the scope of E-Commerce in the realm of modern business.
- the technologies used to develop and deliver E-Commerce applications.
- the marketing methods used in E-Commerce
- the legal and regulatory framework in which e-commerce must operate.

MODULE I INTRODUCTION 06

Networks and Commercial Transactions - Internet and Other Novelties - Electronic Transactions Today - Commercial Transactions - Establishing Trust - Internet Environment - Internet Advantage - World Wide Web.

MODULE II SECURITY TECHNOLOGIES 09

Why Internet Is Unsecure - Internet Security Holes - Cryptography : Objective Codes and Ciphers - Breaking Encryption Schemes - Data Encryption Standard - Trusted Key Distribution and Verification - Cryptographic Applications Encryption - Digital Signature – Nonrepudiation and Message Integrity.

MODULE III ELECTRONIC PAYMENT METHODS 09

Traditional Transactions : Updating - Offline and Online Transactions - Secure Web Servers - Required Facilities - Digital Currencies and Payment Systems - Protocols for the Public Transport - Security Protocols - SET - Credit Card Business Basics.

MODULE IV ELECTRONIC COMMERCE PROVIDERS 09

Online Commerce Options - Functions and Features - Payment Systems : Electronic, Digital and Virtual Internet Payment System - Account Setup and Costs - Virtual Transaction Process - InfoHaus - Security Considerations – CyberCash: Model - Security - Customer Protection - Client Application - Selling through CyberCash.

MODULE V ONLINE COMMERCE ENVIRONMENTS 12

Servers and Commercial Environments - Payment Methods - Server Market Orientation - Netscape Commerce Server - Microsoft Internet Servers - Digital Currencies -DigiCash-Using Ecash-Ecash Client Software and Implementation -

Smart Cards - The Chip - Electronic Data Interchange - Internet Strategies, Techniques and Tools.

Total Hours: 45

TEXT BOOK:

1. Pete Loshin, “Electronic Commerce”, 4th Edition, Firewall media, An imprint of laxmi publications Pvt. Ltd., New Delhi, 2004.

REFERENCES :

1. Jeffrey F.Rayport and Bernard J. Jaworski, “Introduction to E-Commerce”, 2nd Edition, Tata Mc-Graw Hill Pvt., Ltd., 2003.
2. Greenstein, “Electronic Commerce”, Tata Mc-Graw Hill Pvt., Ltd., 2000.

OUTCOMES:

On completion of this course, students will be able to

- understand E-Commerce concepts and terminology
- process management decisions that are involved in launching, operating and managing business activity on the World Wide Web.
- use critical thinking, problem-solving, and decision-making skills in evaluating e-commerce technologies;
- design (plan) a simple e-commerce web site;
- distinguish various electronics payment methods.

CACY004 BUSINESS PROCESSES

L	T	P	C
3	0	0	3

OBJECTIVES:

To develop a business process strategy to meet stakeholder needs.

- to analyse, improve, design and develop processes to meet stakeholder needs.
- to align technology, organisation, and facilities with the business process strategy and design
- to apply their knowledge to manage process projects effectively.
- to identify, clarify and manage business benefits arising from process change

MODULE I ORGANIZATIONAL STRUCTURE 09

Introduction – Nature of Organizations – Types of Business Organizations – Organizational Structures – Formalization – Departmentation – Span of Management – Organizational Relationships – Centralization – Organizational Culture – Forms and Outcomes – IT industry and Organizational Structures – Case Studies: Organizational Improvement - Case Studies.

MODULE II ORGANIZATIONAL OUTCOMES 09

Introduction – Nature of Power in Organizations – Outcomes of Power Relationships – Leadership – Decision Making – Communication – Organizations and Change- Structure and Management of Change in Indian Organizations – Organizational Environments – Inter-Organizational Relationships - Case Studies

MODULE III BUSINESS PROCESS RE-ENGINEERING (BPR) 09

Introduction – Emergence of BPR – What is BPR – Framework for Reengineering – Reengineering Methodology – Advantages – Success Factors – Failure Factors – Justifying Path to Reengineering – Planning Reengineering Projects – Setting Up for Reengineering – Information Analysis – Futuristic State Design and Validation - Case Studies

MODULE IV BPR AND IT INDUSTRY 09

Introduction – Integration of Business with Computers – Management Perceptions – Empowering People through IT – Managing Change – BPR Rediscovering Indian Paradigm – Case Studies.

MODULE V E-BUSINESS PROCESS 09

Introduction – Linking Business with Modern Technology – Trends driving E-Business – E-Business Patterns – New Era of Cross-functional Integrated Apps – Knowledge Management and Information Technology – Case studies.

Total Hours: 45

TEXTBOOKS :

1. Richard H.Hall, Organizations-Structures, Processes and Outcomes", Pearson Education, 2004.
2. M.S.Jayaramanet. Al, "Business Process Reengineering", Tata McGraw Hill Publications, 2001.
3. Ravi Kalakota and Marcia Robinson, "E-Business; Roadmap for Success; Pearson Education, 2000.

REFERENCES :

1. Gareth Jones, "Organizational Theory, Design and Change", Pearson Education, 4th Edition, 2004.
2. Dave Chaffey, "E-business and E-Commerce" Pearson Education, 2nd Edition, 2003.

OUTCOMES:

On completion of this course, students will be able to

- form the organizational structure
- improve leadership quality
- analyze, improve, design and develop processes to meet stakeholder needs
- align technology, organization, and facilities with the business process strategy and design
- apply their knowledge to manage projects effectively.
- identify, clarify and manage business benefits arising from process change.

CACY005 GRID COMPUTING

L	T	P	C
3	0	0	3

Objective:

- to provide insight into the architectural implications of Grid Computing
- to provide students with awareness of current issues in skills utilizing current grid tools and technologies.
- identifying the weakness of existing tools and technologies and proposing potential areas for improvement.
- Justify the applicability, non-applicability of Grid technologies for a specific Application

MODULE I INTRODUCTION 09

Grid Computing values and risks – History of Grid computing – Grid computing model and protocols – overview of types of Grids.

MODULE II TYPES OF GRIDS 09

Desktop Grids : Background – Definition – Challenges – Technology – Suitability– Grid server and practical uses; Clusters and Cluster Grids; HPC Grids; Scientific in sight – application and Architecture – HPC application development environment and HPC Grids; Data Grids; Alternatives to Data Grid – Data Grid architecture.

MODULE III ARCHITECTURE AND MANAGEMENT 09

The open Grid services Architecture – Analogy – Evolution – Overview – Building on the OGSA platform – implementing OGSA based Grids – Creating and Managing services – Services and the Grid – Service Discovery – Tools and Toolkits – Universal Description Discovery and Integration (UDDI)

MODULE IV NATIVE PROGRAMMING AND SOFTWARE APPLICATIONS 09

Desktop supercomputing – parallel computing – parallel programming paradigms – problems of current parallel programming paradigms – Desktop supercomputing programming paradigms – parallelizing existing applications -– Grid enabling software applications – Needs of the Grid users – methods of Grid deployment – Requirements for Grid enabling software – Grid enabling software applications.

MODULE V APPLICATIONS,SERVICES AND ENVIRONMENTS 09

Application integration – application classification – Grid requirements – Integrating Applications with Middleware platforms – Grid enabling Network services – managing Grid environments – Managing Grids – Management reporting – Monitoring – Data catalogs and replica management – portals – Different application areas of Grid computing.

Total Hours: 45

TEXT BOOK:

1. Ahmar Abbas, “Grid Computing, A Practical Guide to Technology and Applications”, Firewall media , 2004.

REFERENCES :

1. Joshy Joseph, Craig Fellenstein, “Grid Computing”, Pearson Education, 2004. Foster, “Grid Blue print foe new computing”.

OUTCOMES:

On completion of this course, students will be able to

- summarize the key concepts of Grid computing.
- sketch the architecture of open grid services.
- list the needs of grid users and build computer grids.
- gain a basic knowledge of Data management and transfer in Grid environments and Resource management.
- prepare for any upcoming Grid deployments and be able to get started with a potentially available Grid setup.
- list the applications of grid computing

CACY006 CLOUD COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES

- To understand the current trend and basics of cloud computing.
- To learn cloud services from different providers.
- To understand the collaboration of cloud services.
- To expose various ways to collaborate the cloud service online.

MODULE I UNDERSTANDING CLOUD COMPUTING 09

Cloud Computing – History of Cloud Computing – Cloud Architecture – Cloud Storage – Why Cloud Computing Matters – Advantages of Cloud Computing – Disadvantages of Cloud Computing – Companies in the Cloud Today – Cloud Services.

MODULE II DEVELOPING CLOUD SERVICES 09

Web-Based Application – Pros and Cons of Cloud Service Development – Types of Cloud Service Development – Software as a Service – Platform as a Service – Web Services – On-Demand Computing – Discovering Cloud Services Development Services and Tools – Amazon Ec2 – Google App Engine – IBM Clouds.

MODULE III CLOUD COMPUTING FOR EVERYONE 09

Centralizing Email Communications – Collaborating on Schedules – Collaborating on To-Do Lists – Collaborating Contact Lists – Cloud Computing for the Community – Collaborating on Group Projects and Events – Cloud Computing for the Corporation.

MODULE IV USING CLOUD SERVICES 09

Collaborating on Calendars, Schedules and Task Management – Exploring Online Scheduling - Applications – Exploring Online Planning and Task Management – Collaborating on Event Management – Collaborating on Contact Management – Collaborating on Project Management – Collaborating on Word Processing - Collaborating on Databases – Storing and Sharing Files.

MODULE V OTHER WAYS TO COLLABORATE ONLINE 09

Collaborating via Web-Based Communication Tools – Evaluating Web Mail Services – Evaluating Web Conference Tools – Collaborating via Social

Networks and Groupware – Collaborating via Blogs and Wikis.

Total Hours: 45

REFERENCES:

1. Michael Miller, Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online, Que Publishing, August 2008.
2. Kumar Saurabh, “Cloud Computing – Insights into New Era Infrastructure”, Wiley Indian Edition, 2011.
3. Haley Beard, Cloud Computing Best Practices for Managing and Measuring Processes for On- demand Computing, Applications and Data Centers in the Cloud with SLAs, Emereo Pty Limited, July 2008.

OUTCOMES:

On completion of this course, students will be able to

- Understand the systems, protocols to support cloud computing.
- Identify the architecture and infrastructure of cloud computing.
- Design applications by integrating cloud services.

CACY007 UNIX AND NETWORK PROGRAMMING

L	T	P	C
3	0	0	3

OBJECTIVES:

- Learn and get familiar with the UNIX operating system and UNIX process environment. The creation, communication and execution of process are studied with well defined examples through this course.
- Infer the inter-process communication between similar and different process through standard mechanisms such as pipes, message queue etc.,
- Provide a broad knowledge on client server communication using socket across a network for reliable network programming.

MODULE I INTRODUCTION & FILE SYSTEM 09

Overview of UNIX OS - File I/O – File Descriptors – File sharing - Files and directories – File types - File access permissions – File systems – Symbolic links - Standard I/O library – Streams and file objects – Buffering - System data files and information - Password file – Group file – Login accounting – system identification.

MODULE II PROCESSES 09

Environment of a UNIX process – Process termination – command line arguments - Process control – Process identifiers - Process relationships terminal logins – Signals -threads.

MODULE III INTERPROCESS COMMUNICATION 09

Introduction - Message passing (SVR4)- pipes – FIFO – message queues - Synchronization (SVR4) – Mutexes – condition variables – read – write locks– file locking – record locking – semaphores –Shared memory (SVR4).

MODULE IV SOCKETS 09

Introduction – transport layer – socket introduction - TCP sockets – UDP sockets - raw sockets – Socket options - I/O multiplexing - Name and address conversions.

MODULE V APPLICATIONS 09

Debugging techniques - TCP echo client server - UDP echo client server - Ping - Trace route - Client server applications like file transfer and chat.

Total Hours: 45

TEXT BOOKS :

1. W.Richard Stevens, Advanced programming in the UNIX environment, Addison Wesley, 1999. (Unit 1,2 & 3)
2. W. Stevens, Bill Fenner, Andrew Rudoff, “Unix Network Programming”, Volume 1, The Sockets Networking API, 3rd Edition, Pearson education, Nov 2003. (unit 4 & 5)

REFERENCES :

1. MeetaGandhi,TilakShetty and Rajiv Shah – The ‘C’ Odyssey Unix –The open Boundless C ,1st Edition, BPB Publications 1992.

OUTCOMES:

On completion of this course, students will be able to

- attain the complete knowledge in network communication in UNIX platform.
- list the different types of networking and their functionality
- summarize the broad knowledge on network details of a system which is configured as UNIX supported components.
- develop a socket programming for effective client-server communication across a network.

CACY008 MULTIMEDIA SYSTEMS AND ALGORITHMS

L	T	P	C
3	0	0	3

OBJECTIVES

- learn the basic definitions of algorithmic complexity, and how to analyze the complexity of algorithms.
- learn basic algorithmic tools used to design efficient algorithms.
- learn how to design efficient algorithms and to recognize situations where this is not possible.
- understand the linear and non linear data structures available in solving problems
- know about the sorting and searching techniques and its efficiencies
- get a clear idea about the various algorithm design techniques
- Use the data structures and algorithms in real time applications
- analyze the efficiency of algorithm•

MODULE I INTRODUCTION 09

Definition - CD-ROM and multimedia-Multimedia applications: business - schools - homes - public places and virtual reality. Introduction to making of multimedia: hardware - software - creativity - and organization.

MODULE II MULTIMEDIA TOOLS 09

Macintosh and windows production platforms - 3-d modeling and animation - image-editing tools - sound editing tools - animation - video - and digital movie tools - linking multimedia objects - office suites - word processors - spread sheets - databases - presentation tools. Authoring tools - Card and Page-based authoring tools - Icon Based authoring tools - time based authoring tools - object oriented authoring tools - cross platform-authoring tools

MODULE III MULTIMEDIA AND THE INTERNET 09

Internet fundamentals: Internetworking – Connections – Internet services – The World Wide Web – Tools for the World Wide Web: Web serves – Web browsers – Web page makers and Site builders – Plug-ins and Delivery vehicles – Beyond HTML

MODULE IV ALGORITHM OVERVIEW 09

Introduction Overview of Graphics System – Bresenham technique – Line Drawing and Circle Drawing Algorithms – DDA – Line Clipping – Text Clipping.

MODULE V 2D AND 3D TRANSFORMATIONS 09

Two dimensional transformations – Scaling and Rotations – Interactive Input methods – Polygons – Splines – Bezier Curves Window view port mapping transformation – 3D Concepts – Projections.

Total Hours: 45

TEXTBOOKS:

1. Multimedia: Making It Work – Tay Vaughan (Unit 1, Unit 2 and Unit 3)
2. Hearn D and Baker M.P, “Computer graphics – C Version”, 2nd Edition, Pearson Education, 2004 (Unit 4 and 5)

REFERENCE BOOKS:

1. Multimedia System Design – K. Andleigh and K. Thakkrar
2. Multimedia: Computing, Communication & Application – Ralf stein Metz and Klara Nahrstsedt
3. Advanced multimedia programming – Steve Rimmer
4. Multimedia Literacy – Fred T. Hofstetter MGHill

OUTCOMES:

On completion of this course, students will be able to

- Possess the knowledges of creativity skills with support of multimedia tools
- Gain hands – on experience in image, sound and video editing and in some aspects of multimedia authoring tools
- Design an interactive website for information services
- Analyze and evaluate various algorithms to draw geometrical shapes
- Attain the complete knowledge in graphics & multimedia domain
- Show their proficiency while working with Graphics and multimedia software and tools.

CACY009 NETWORK SECURITY

L	T	P	C
3	0	0	3

OBJECTIVE:

- to impart knowledge on building networks, network layer and software defined networking
- to understand how network security is conceptualized and carried out
- to analyze both early and contemporary threats to network security
- to articulate informed opinion about issues related to network security
- to appreciate the challenges of network security

MODULE I INTRODUCTION 09

Building a network-Network Architecture-Network fundamentals-Network layer Overview on Software Defined Networking.

MODULE II ATTACKS AND PUBLIC KEY ENCRYPTION 09

Attacks- Services-Mechanisms-Conventional Encryption , Classical And RSA - Elliptic Curve Cryptography - Number Theory Concepts

MODULE III MESSAGE AUTHENTICATION 09

Hash Functions - Digest Functions - Digital Signatures – Authentication Protocols.

MODULE IV NETWORK SECURITY PRACTICE 09

Authentication, Applications - Electronic Mail Security - IP Security – Web Security.

MODULE V SYSTEM SECURITY 09

Intruders – Viruses – Worms – Firewalls Design Principles – Trusted Systems.

Total Hours: 45

TEXT BOOK :

1. Stallings, Cryptography & Network Security - Principles & Practice, Prentice Hall, 3rd Edition 2002.

REFERENCES:

1. Bruce, Schneier, Applied Cryptography, 2nd Edition, Toha Wiley & Sons, 1996.

2. Man Young Rhee, “Internet Security”, Wiley, 2003.
3. Pfleeger&Pfleeger, “Security in Computing”, Pearson Education, 3rd Edition, 2003.

OUTCOMES:

On completion of this course, students will be able to

- master information security governance, and related legal and regulatory issues,
- master understanding external and internal threats to an organization
- summarize the basics of network security and attacks.
- compare various public and private key encryption algorithms.
- illustrate Message Authentication functions and protocols
- identify the virus and worms
- list the firewalls design principles

CACY010 MICROPROCESSORS AND APPLICATIONS

L	T	P	C
3	0	0	3

OBJECTIVES:

- Introduce features and technology of microprocessor based systems
- gain assembly language programming, interfacing of memory and peripheral devices
- gain knowledge about the architecture, instruction set, programming, addressing mode interfacing and applications of INTEL 8085, INTEL 8086 and INTEL 80386.

MODULE I INTRODUCTION TO 8085 MICRO PROCESSOR 09

Evolution of the Microprocessor - INTEL 8085- Introduction- Register Architecture - Memory Addressing - 8085 Addressing Modes -8085 Instruction Set -Timing Methods 8085 Pins and Signals -8085 Instruction Timing and Execution – Interrupts-DMA- Serial port-8085 Based System Design.

MODULE II INTRODUCTION TO 8086 MICROPROCESSOR 09

Introduction -8086 Architecture -8086 Addressing Modes -8086 Instruction Set – Data Movement Instructions Arithmetic and Logic Instructions – Program Control Instructions.

MODULE III 8086 MICROPROCESSOR INTERFACING 09

System Design Using 8086- Basic System concepts-Bus Cycle - Address and data bus concepts- interfacing with memories-RAM - EPROM - DRAMs - Programmed I/O : 8086-Based Microcomputer.

MODULE IV 80386 AND PENTIUM MICRO PROCESSORS 09

Introduction to Intel 80386- Basic Programming model - Memory Organisation - I/O Space - 80386 pins and signals- Bus transfer techniques - 80386 Modes – Introduction to Intel Pentium Microprocessor: Block diagram and Registers.

MODULE V PERIPHERAL INTERFACING 09

Keyboard Display Interface-Hex key and display interface to 8085, 8279 Keyboard display controller chip- Printer Interface: LR 7040 Printer interface using 8295 printer controller-CRT controller interface: CRT Fundamentals, 8275 CRT Controller- Coprocessors.

Total Hours: 45

TEXT BOOK :

1. Mohamed Rafiquzzaman “Introduction to Microprocessors and Microcomputer- Based System Design” 2nd edition, CRC Press,1995.

REFERENCES:

1. Walter A.Triebel, AvtarSingh,“the 8088and8086 Microprocessors Programming, Interfacing, Software, Hardware and Applications”, Prentice Hall of India Pvt. Ltd., 2002.
2. Barry B.Brey, ”The INTEL microprocessors 8086/8088, 80186, 80286, 80386 and 80486 Architecture, Programming and Interfacing,” Prentice Hall of India, 2001.

OUTCOMES:

On completion of this course, students will be able to

- identify different types of memory and describe how each is used
- list microprocessor instruction groups and classify machine instructions accordingly
- develop a program in assembly language for the INTEL 8085 and INTEL 8086.
- analyze (trace) the execution of assembly code programs
- design interfacing logic to connect external devices to microprocessor.
- design and develop a microprocessor based system for specific applications.

CACY011 TCP/IP PROTOCOL SUITE

L	T	P	C
3	0	0	3

OBJECTIVES:

- to design, build and test a small TCP/IP Network, comprising of three sub networks and two routers.
- to trace and rectify faults on the network.

MODULE I INTRODUCTION 10

Standards – Internet – History- OSI model – Protocol suite – Addressing – Transmission media – Local Area and Wide Area Networks – Switching – Connecting devices – IP addressing.

MODULE II INTERNET PROTOCOL 10

Sub netting – Super netting – IP packets – Delivery – Routing – Routing model– Routing table – Datagram – Fragmentation – Checksum – IP Design – ARP – RARP – Internet control message protocol – Internet group management protocol.

MODULE III TRANSMISSION CONTROL PROTOCOL 08

User Datagram protocol – UDP operation – Use – UDP design – TCP services– Flow control – Error control – TCP operation and design – connection – Transition diagram – Congestion control.

MODULE IV APPLICATION LAYER AND CLIENT SERVER MODEL 08

Concurrency – BOOTP – DHCP – Domain name system – Name space – Distribution – Resolution – Messages – Telnet – Rlogin – Network Virtual Terminal – Character Set – Controlling the server – Remote login.

MODULE V APPLICATION PROTOCOLS 09

File Transfer Protocol – Connections – Communication – Simple Mail Transfer Protocol – Simple Network Management Protocol – Hyper Text Transfer Protocol – Transaction – Request and Response messages.

Total Hours: 45

TEXT BOOK :

1. Behrouz A. Forouzan, “TCP/IP Protocol Suite”, Tata McGraw Hill Edition 2000.

REFERENCE :

1. Douglas E. Comer, David L. Stevens, “Internetworking with TCP/IP – Volume I, II and III”, Prentice - Hall of India Pvt. Ltd., 2nd Edition 1994.

OUTCOMES:

At the end of the course the student will be able to:

- identify the needs and the purpose of each of the protocols at each layer
- use and configure each of the common applications used with TCP/IP
- configure a router using static routing and RIP
- Control the server and place request to the server with the support of protocols
- examine a TCP/IP trace at all levels, and diagnose network problems

CACY012 ADHOC NETWORKS

L	T	P	C
3	0	0	3

OBJECTIVES:

- Understand the fundamental concepts of infrastructureless wireless network
- Learn and analyze the different types of ad hoc routing protocols.
- Impart knowledge on Providing QoS in Ad Hoc Wireless Networks

MODULE I INTRODUCTION 09

Introduction-Fundamentals of Wireless Communication Technology - The Electromagnetic Spectrum - Radio Propagation Mechanisms - Characteristics of the Wireless Channel - IEEE 802.11a,b Standard – Origin Of Ad hoc: Packet Radio Networks - Technical Challenges - Architecture of PRNETs - Components of Packet Radios – Ad hoc Wireless Networks -What Is an Ad Hoc Network? Heterogeneity in Mobile Devices - Wireless Sensor Networks - Traffic Profiles - Types of Ad hoc Mobile Communications - Types of Mobile Host Movements - Challenges Facing Ad Hoc Mobile Networks-Ad hoc wireless Internet.

MODULE II ADHOC ROUTING PROTOCOLS 09

Introduction - Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks - Classifications of Routing Protocols -Table-Driven Routing Protocols - Destination Sequenced Distance Vector (DSDV) - Wireless Routing Protocol (WRP) - Cluster Switch Gateway Routing (CSGR) - Source-Initiated On-Demand Approaches - Ad Hoc On-Demand Distance Vector Routing (AODV) - Dynamic Source Routing (DSR) -Temporally Ordered Routing Algorithm (TORA) - Signal Stability Routing (SSR) -Location-Aided Routing (LAR) - Power-Aware Routing (PAR) - Zone Routing Protocol (ZRP)

MODULE III MULTICASTROUTING IN ADHOC NETWORKS 09

Introduction - Issues in Designing a Multicast Routing Protocol - Operation of Multicast Routing Protocols - An Architecture Reference Model for Multicast Routing Protocols -Classifications of Multicast Routing Protocols - Tree-Based Multicast Routing Protocols- Mesh-Based Multicast Routing Protocols Summary of Tree-and Mesh-Based Protocols - Energy-Efficient Multicasting - Multicasting with Quality of Service Guarantees - Application-Dependent Multicast Routing - Comparisons of Multicast Routing Protocols

MODULE IV TRANSPORT LAYER, SECURITY PROTOCOLS 09

Introduction - Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks - Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks -Classification of Transport Layer Solutions - TCP Over Ad Hoc Wireless Networks -Other Transport Layer Protocols for Ad Hoc Wireless Networks - Security in Ad Hoc Wireless Networks - Network Security Requirements - Issues and Challenges in Security Provisioning - Network Security Attacks - Key Management - Secure Routing in Ad Hoc Wireless Networks.

MODULE V QoS AND ENERGY MANAGEMENT 09

Introduction - Issues and Challenges in Providing QoS in Ad Hoc Wireless Networks -Classifications of QoS Solutions - MAC Layer Solutions - Network Layer Solutions - QoS Frameworks for Ad Hoc Wireless Networks Energy Management in Ad Hoc Wireless Networks –Introduction - Need for Energy Management in Ad Hoc Wireless Networks - Classification of Energy Management Schemes - Battery Management Schemes - Transmission Power Management Schemes - System Power Management Schemes.

Total Hours: 45

TEXT BOOK :

1. C. Siva Ram Murthy and B.S. Manoj “Ad Hoc Wireless Networks: Architectures and Protocols”, Prentice Hall PTR, 2004.

REFERENCES:

1. C.K. Toh, Ad Hoc Mobile Wireless Networks: Protocols and Systems, Prentice Hall PTR, 2001.
2. Charles E. Perkins, Ad Hoc Networking, Addison Wesley, 2000.

OUTCOMES:

At the end of this course students will be able to

- evaluate the performance of different ad hoc routing protocols
- analyze the issues in designing routing and transport protocols
- compare and contrast various routing, transport and security protocols.
- list the issues and challenges in Providing QoS in Ad Hoc Wireless network.
- classify the QoS solutions and energy management schemes

CACY013 DIGITAL IMAGE PROCESSING

L	T	P	C
3	0	0	3

OBJECTIVES:

- to cover the basic theory and algorithms that are widely used in digital image processing.
- to expose students with current technologies and issues that are specific to image processing systems.
- to develop hands-on experience in using computers to process images
- to develop critical thinking about shortcomings of the state of the art in image processing.

MODULE I DIGITAL IMAGE FUNDAMENTALS 09

Image formation, Image transforms – fourier transforms, Walsh, Hadamard, Discrete cosine, Hotelling transforms.

MODULE II IMAGE ENHANCEMENT & RESTORATION 09

Histogram modification techniques - Image smoothening - Image Sharpening - Image Restoration - Degradation Model – Noise models - Spatial filtering – Frequency domain filtering.

MODULE III IMAGE COMPRESSION & SEGMENTATION 09

Compression Models - Elements of information theory - Error free Compression -Image segmentation –Detection of discontinuities - Edge linking and boundary detection - Thresholding – Region based segmentation - Morphology.

MODULE IV REPRESENTATION AND DESCRIPTION 09

Representation schemes- Boundary descriptors- Regional descriptors - Relational Descriptors.

MODULE V OBJECT RECOGNITION AND INTERPRETATION 09

Patterns and pattern classes - Decision-Theoretic methods - Structural methods.

Total Hours: 45

TEXT BOOK:

1. Gonzalez.R.C& Woods. R.E., Digital Image Processing, II Ed., Pearson Education, 2002.

REFERENCES:

1. Anil Jain.K, Fundamentals of Digital image Processing, Prentice Hall of India, 1989.
2. Sid Ahmed, Image Processing, McGraw Hill, New York, 1995.

OUTCOMES:

On completion of this course, students will be able to

- describe how digital images are represented,
- manipulate, encode and process, with emphasis on algorithm design, implementation and performance evaluation.
- analyze various techniques and mention the strength and weakness.
- develop small programs to perform image processing tasks.
- understand the design & specification of multi-dimensional digital filters for image processing applications
- gain proficiency in using simulation and design software tools, such as those found in Matlab

CACY014 PROBABILITY AND STATISTICS

L	T	P	C
3	1	0	4

OBJECTIVES:

- Knowledge about the basic concepts of one dimensional and two dimensional Random Variables.
- Knowledge on various probability axioms and theorems, probability distributions.
- To apply Estimation theory, Correlation, Regression and testing of hypothesis for real life problems.
- To enable the students to apply the concepts of multivariate normal distribution and principle components analysis and evaluate on the results

MODULE I ONE DIMENSIONAL RANDOM VARIABLES 12

Random variables - Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Functions of a Random Variable.

MODULE II TWO DIMENSIONAL RANDOM VARIABLES 12

Joint distributions – Marginal and Conditional distributions – Functions of two dimensional random variables – Regression Curve – Correlation.

MODULE III ESTIMATION THEORY 12

Unbiased Estimators – Method of Moments – Maximum Likelihood Estimation - Curve fitting by Principle of least squares – Regression Lines.

MODULE IV TESTING OF HYPOTHESES 12

Sampling distributions - Type I and Type II errors - Testsbased on Normal, t, Chi-Square and F distributions for testing of mean, variance and proportions – Tests for Independence of attributes and Goodness of fit.

MODULE V MULTIVARIATE ANALYSIS 12

Random Vectors and Matrices - Mean vectors and Covariance matrices - Multivariate Normal density and its properties - Principal components Population principal components - Principal components from standardized variables.

Total Hours: 60

REFERENCES:

1. Jay L. Devore, “Probability and Statistics for Engineering and the Sciences”, Thomson and Duxbury, 2002.
2. Richard Johnson. “Miller & Freund’s Probability and Statistics for Engineer”, Prentice – Hall, Seventh Edition, 2007.
3. Richard A. Johnson and Dean W. Wichern, “Applied Multivariate Statistical Analysis”, Pearson Education, Asia, Fifth Edition, 2002.
4. Gupta S.C. and Kapoor V.K. “Fundamentals of Mathematical Statistics”, Sultan and Sons, 2001.
5. Dallas E Johnson, “Applied Multivariate Methods for Data Analysis”, Thomson and Duxbury press, 1998.

OUTCOMES:

On completion of this course, students will be able to

- apply fundamental concepts in Exploratory data analysis
- demonstrate an understanding of the basic concepts of probability and random variables
- analyze and choose among the probability distributions for application to a specific real life problem
- apply inferential methods relating to the means of Normal Distributions.
- demonstrate an appreciation of one—way analysis of variance (ANOVA)
- interpret and analyze data that may be displayed in a two—way table

CACY015 SOFTWARE QUALITY MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the fundamental concepts of software quality management.
- To acquire the knowledge in quality analysis tools and techniques.
- To have the exposure on software quality assurance, quality measures and quality control.
- To introduce philosophies and strategies to quality related issues

MODULE I INTRODUCTION 09

Software Process assessment overview - Assessment phases - Assessment principles - Assessment conduct -Implementation consideration - Quality management - Quality assurance plan - Considerations – Verification and Validation.

MODULE II CONFIGURATION MANAGEMENT 09

Need for configuration Management - Software product nomenclature - configuration management functions - Baselines - Responsibilities - Need for automated tools - plan – SCM support functions - The requirement phase Design control - The implementation phase - Test phase - SCM Tools - Configuration accounting and audit.

MODULE III SOFTWARE STANDARDS AND INSPECTION 09

Definitions - Reason for software standards - Benefits - Establishing standards - Guidelines - Types of reviews - Inspection of objectives - Basic inspection principles - The conduct of inspection - Inspection training.

MODULE IV TESTING AND MANAGING SOFTWARE QUALITY 09

Testing: principles - Types - Planning - Development - Execution and reporting– Tools and methods - Real Time testing - quality management paradigm - Quality motivation – Measurement criteria - Establishing a software quality program - Estimating software quality.

MODULE V DEFECT PREVENTION 09

Principles of software defect prevention - Process changes for defect prevention - Defect prevention considerations - Managements role - Framework for software

process change - Managing resistance to software process change - Case studies.

Total Hours: 45

TEXT BOOK :

1. Watts S. Humphrey, Managing the software process, Addison Wesley, 1999.

REFERENCES :

1. TsumS.Chow, Software Quality Assurance a Practical Approach, IEEE Computer Society press, 1985.
2. Richard E. Fairley, Software Engineering - A Practitioner's approach, McGraw Hill, 1982.

OUTCOMES:

At the end of this course, the students will be able to

- describe the various practices available to manage a software system.
- understand software quality management problems, general solutions, technologies and standards.
- compare and contrast product quality and process quality.
- apply product and process quality control techniques.
- define, implement, and apply software (process) metrics apply software quality management to software and software development processes

CACY016 EMBEDDED SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide a clear understanding on the basic concepts, building blocks for Embedded System
- To teach the fundamentals of processes and scheduling policies.
- To teach how to program embedded systems in assembly language and C
- To introduce on Embedded Process development Environment

MODULE I EMBEDDED COMPUTING 09

Challenges of Embedded Systems – Embedded system design process. Embedded processors – 8051 Microcontroller, ARM processor – Architecture, Instruction sets and programming.

MODULE II MEMORY AND INPUT / OUTPUT MANAGEMENT 09

Programming Input and Output – Memory system mechanisms – Memory and I/O devices and interfacing – Interrupts handling.

MODULE III PROCESSES AND OPERATING SYSTEMS 09

Multiple tasks and processes – Context switching – Scheduling policies – Inter process communication mechanisms – Performance issues.

MODULE IV EMBEDDED SOFTWARE 09

Programming embedded systems in assembly and C – Meeting real time constraints –Multi-state systems and function sequences. Embedded software development tools –Emulators and debuggers.

MODULE V EMBEDDED SYSTEM DEVELOPMENT 09

Design issues and techniques – Case studies – Complete design of example embedded systems.

Total Hours: 45

TEXT BOOKS

1. Wayne Wolf, “Computers as Components: Principles of Embedded Computer System Design”, Elsevier, 2006.
2. Michael J. Pont, “Embedded C”, Pearson Education , 2007.

REFERENCES:

1. Steve Heath, “Embedded System Design”, Elsevier, 2005.
2. Muhammed Ali Mazidi, Janice GillispieMazidi and Rolin D. McKinlay, “The 8051Microcontroller and Embedded Systems”, Pearson Education, Second edition, 2007.

OUTCOMES:

On completion of this course, students will be able to

- get exposure with different families and architectures of Embedded System tools such as Microcontrollers, DSPs, FPGAs etc.
- analyze real-time scheduling algorithms and identify design flaws
- design any embedded system (h/ w or s/w or both) based on any of the above tools
- become highly proficient in Embedded Software particularly in real-time programming with Industry standard RTOS such as VxWorks and RT Linux.

CACY017 BUSINESS INTELLIGENCE

L	T	P	C
3	0	0	3

OBJECTIVES:

- To give an overview of business and project planning.
- To introduce and explain the complexity of business intelligence decision support projects
- To present a step-by-step guide for the entire Business Intelligence project life cycle
- To impart knowledge of a complete development lifecycle including activities, deliverables, roles, risks, responsibilities, Do's and Don'ts, entry and exit criteria for a successful Business Intelligence (BI) decision support implementation.

MODULE I STAGES AND STEPS 09

Stages and Steps: Guide to the development steps- Business Intelligence (BI) Definition – BI Decision Support Initiatives – Development Approaches – Engineering Stages and Development Steps – Parallel Development Tracks – BI Project Team Structure – Business Case Assessment: Business Justification – Business Drivers – Business Analyst Issues – Cost-Benefit Analysis – Risk Assessment – Business Case Assessment Activities.

MODULE II ENTERPRISE INFRASTRUCTURE EVALUATION 09

Enterprise Infrastructure Evaluation: Technical Infrastructure Evaluation – The Hardware Platform – The Middleware Platform – The DBMS Platform – Technical Infrastructure Evaluation Activities – Deliverables Resulting from these Activities - Roles and Risks involved in these activities. Nontechnical Infrastructure Evaluation – The Effects of Stovepipe Development – The need for Nontechnical Infrastructure Evaluation -Enterprise architecture and Enterprise Standards - Nontechnical Infrastructure Evaluation Activities – Deliverables Resulting from these Activities - Roles and Risks involved in these activities.

MODULE III PROJECT PLANNING 09

Project Planning – Managing, Defining, Planning the BI Project - Project Planning Activities – Deliverables Roles and Risks - Project Requirements Definition – General Business and Project-Specific Requirements – TheInterviewing Process – Project Requirements and Deliverables – Roles and Risks involved - Data Analysis – Business-Focused Data Analysis – Top-Down Logical Data Modeling – Bottom-Up Source Data Analysis - Data Cleansing, Activities, Deliverables,

Roles and Risks - Application Prototyping– Purposes, Best Practices, Types – Building Successful Prototypes – Applications, Deliverables, Roles and Risks – Meta Data Repository Analysis.

MODULE IV DATABASE DESIGN 09

Database Design – Differences, Logical and Physical Database Design and Activities – Deliverables, Roles and Risks - Extract/Transform/Load (ETL) Design – Implementation Strategies – Preparing for the ETL Process – Designing the Extract, Transformation, Load Programs and ETL Process Flow – Evaluating ETL Tools - ETL Design Activities – Deliverables, Roles and Risks – Meta Data Repository Design – Extract/Transform/Load Development.

MODULE V APPLICATION DEVELOPMENT 09

Application Development – Online analytical Processing Tools – Multidimensional Analysis Factors – Online Analytical Processing Architecture – Development Environments – Application Development Activities – Deliverables, Roles and Risks - Data Mining – Meta Data Repository Development.

Total Hours: 45

TEXT BOOK:

1. Business Intelligence Roadmap: The Complete Project Lifecycle for Decision Support Applications, Larissa T. Moss, ShakuAtre, Addison Wesley Publications, 2003.

REFERENCE:

1. Business Intelligence Strategy – A practical Guide for Achieving BI Excellence, John Boyer, Bill Frank, Brian Green Tracy Harris and Kay Van De Vanter, First Edition, IBM Corporation, 2010.

OUTCOMES:

On completion of this course, students will be able to

- describe the infrastructure components of BI decision support system.
- build prototype for developing a successful project
- evaluate enterprise infrastructure
- define, compare and implement physical and logical database design
- determine number of resources required, type of resources in terms of both technical and human and could be able to recognize the components that impairs the success of BI decision support application.

CACY018 SOFTWARE TESTING

L	T	P	C
3	0	0	3

OBJECTIVES

- Fundamentals of testing
- Role of Testing in Software Development Lifecycle
- Various techniques of testing
- Tools for testing.

MODULE I FUNDAMENTALS OF TESTING 09

Human and errors, Testing and Debugging, Software Quality, Requirement Behavior and Correctness, Fundamentals of Test Process, Psychology of Testing, General Principles of Testing, Test Metrics.

MODULE II ROLE OF TESTING IN SDLC 09

Review of software development models (Waterfall Models, Spiral Model, W Model, V Model) Agile Methodology and Its Impact on testing, Test Levels (Unit, Component, Module, Integration, System, Acceptance, Generic)

MODULE III APPROACHES TO TESTING 09

Black Box Testing- Equivalence Class Partitioning, Boundary Value Analysis, State Transition Test, Cause Effect Graphing and Decision Table Technique and Used Case Testing and Advanced black box techniques: White Box Testing- Statement Coverage, Branch Coverage, Test of Conditions, Path Coverage, Advanced White Box Techniques, Instrumentation and Tool Support Gray Box Testing, Intuitive and Experience Based Testing.

MODULE IV TEST ORGANIZATION 09

Test Organization: Test teams, tasks and Qualifications: Test Planning : Quality Assurance Plan, Test Plan, Prioritization Plan, Test Exit Criteria: Cost and economy Aspects: Test Strategies: Preventive versus Reactive Approach, Analytical versus heuristic Approach Test Activity Management, Incident Management, Configuration Management Test Progress Monitoring and Control: Specialized Testing: Performance, Load, Stress & Security Testing.

MODULE V TESTING TOOLS 09

Automation of Test Execution, Requirement tracker, High Level Review Types of test Tools: Tools for test management and Control, Test Specification, Static

Testing, Dynamic Testing, Non functional testing.

Total Hours: 45

REFERENCES:

1. Software Testing Foundations, Andreas Spillner, Tilo Linz, Hans Schaefer, Shoff Publishers and Distributors.
2. Software Testing: Principles and Practices by Srinivasan D and Gopalswamy R, Pearson Ed, 2006.
3. Foundations of Software Testing by Aditya P. Mathur – Pearson Education custom edition 2000.
4. Testing Object Oriented Systems: models, patterns and tools, Robert V Binder, Addison Wesley, 1996.
5. Software Engineering – A practitioner's approach by Roger S. Pressman, 5th Edition, McGraw Hill.
6. The art of software testing by GJ Myers, Wiley.

OUTCOMES

On completion of this course, students will be able to

- recognize the need for testing
- review various software development models like Waterfall Models, Spiral Model, W Model and V Model
- perform various testing like black box testing, white box testing, gray box testing and Experience Based Testing
- describe the various testing techniques
- work with various test tools
- apply the testing techniques in commercial environment

CACY019 CONTENT MANAGEMENT SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES

- To impart knowledge in installing CMS and how CMS differ from website builder
- Provide knowledge on the core modules, using Smarty to build templates with own functionality
- To train the students in using an open source content management (CMS) tool – Joomla!, A powerful and robust tool.

MODULE I **09**

Content Management System (CMS) – Introduction - Getting Started - CMS versus website builder – Creating Pages and Navigation.

MODULE II **09**

Design and Layout - Using Core modules – Users and Permissions – Using Third-party Modules – Creating Own Functionality.

MODULE III **09**

E-commerce workshop - Advanced Use of CMS - Administration and Trouble Shooting.

MODULE IV **09**

Introduction to dynamic web pages and development tools for dynamic content– Downloading tools for dynamic content – Downloading and Installing a content Management System (Joomla!) – Administration elements of a Content Management System – Organizing Content.

MODULE V **09**

Basic elements: pages, menus and navigation – incorporate components, modules, plug-ins and languages – Case Studies: Marketing strategies and planning for websites – Design and create a school website, restaurant website, blog site, Securing Content Management System.

Total Hours: 45

TEXT BOOKS:

1. CMS Made simple 1.5, Sofia Hauschildt, 2010
2. Joomla! 1.5: A User's Guide – Barrie M. North Second Edition, Prentice Hall.

OUTCOMES:

On completion of this course, students will be able to

- install CMS made simple (CMSMS), Converting other website templates to work with CMSMS
- add a e-commerce functionality and a discussion of users and permissions.
- develop a successful website powered by Joomla
- list the advanced use of CMS
- incorporate components , modules, plug-ins and languages.

CACY020 ADVANCED PROGRAMMING TECHNIQUES

L	T	P	C
3	0	0	3

OBJECTIVES:

- Comprehend the concepts of C and C++
- Obtain the knowledge on advanced Java programming concepts like interface, threads, Swings etc.
- Apply java programming concepts in writing network programs
- Apply and analyze issues in enterprise applications development.

MODULE I **9**

Fundamentals of C Programming – Control Statements – String - Arrays - Functions - Pointers - Structures - File Structures - File Handling.

MODULE II **09**

C++ Overview - Functions and Variables - Classes in C++ - Operator Overloading - Storage Management - Inheritance - Polymorphism - Exceptions- Templates.

MODULE III **09**

JAVA FUNDAMENTALS : Java I/O streaming – filter and pipe streams – Byte Code interpretation - Threading –Swing - Remote method Invocation – activation models – RMI custom sockets – Object Serialization – RMI – IIOP implementation – CORBA – IDL technology – Naming Services – CORBA programming Models - JAR file creation.

MODULE IV MULTI-TIER APPLICATION DEVELOPMENT **09**

Server side programming – servlets – Java Server Pages - Applet to Applet communication – applet to Servlet communication - JDBC – Applications on databases – Multimedia streaming applications – Java Media Framework.

MODULE V ENTERPRISE APPLICATIONS **09**

Server Side Component Architecture – Introduction to J2EE – Session Beans– Entity Beans – Persistent Entity Beans .

Total Hours: 45

TEXT BOOKS:

1. Elliotte Rusty Harold, “ Java Network Programming”, O’Reilly publishers, 2000.

2. Ed Roman, “Mastering Enterprise Java Beans”, John Wiley & Sons Inc., 1999.
3. Hortsmann& Cornell, “CORE JAVA 2 ADVANCED FEATURES, VOL II”, Pearson Education, 2002.

REFERENCES:

1. Web reference: http://java.sun.com.
2. Patrick Naughton, “COMPLETE REFERENCE: JAVA2”, Tata McGraw-Hill, 2003.

OUTCOMES:

On completion of this course, students will be able to

- apply the basic and advanced concepts of programming languages such as C, C++ and Java in developing application.
- connect the java application with backend database and manipulate the data stored in the database.
- invoke and execute the methods of the remote object using RMI
- summarize various Enterprise JavaBean (EJB) concepts including entity beans, session beans, bean managed persistence (BMP), and container managed persistence (CMP)
- perform database queries and updates using JDBC.

CACY021 INFORMATION AND STORAGE MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES

- Describe and apply storage technologies
- Identify leading storage technologies that provide cost-effective IT solutions for medium to large scale businesses and data centers
- Describe important storage technologies' features such as availability, replication, scalability and performance
- Discuss the types of storage virtualization
- Understand logical and physical components of a storage infrastructure

MODULE I INTRODUCTION TO STORAGE TECHNOLOGY 09

Data creation and The value of data to a business, Information Life cycle, Challenges in data storage and data management, Solutions available for data storage, Core elements of a Data Center infrastructure, role of each element in supporting business activities.

MODULE II STORAGE SYSTEMS ARCHITECTURE 09

Hardware and software components of the host environment, Key protocols **-** Physical --logical components of a connectivity environment -Major physical components- logical constructs of a physical disk- access characteristics- performance Implications- Concept of RAID and its components, Different RAID levels -high-level architecture and working of an intelligent storage system

MODULE III INTRODUCTION TO NETWORKED STORAGE 09

Evolution of networked storage, Architecture, components, and topologies of FC-SAN, NAS, and IP-SAN, Benefits of the different networked storage options, Understand the need for long-term archiving solutions and describe how CAS fulfill the need, Understand the appropriateness of the different networked storage options for different application environments.

MODULE IV MONITORING & MANAGING DATA CENTER 09

Differentiate between business continuity (BC) and disaster recovery (DR), RTO and RPO, Identification of single points of failure in a storage infrastructure - solutions to mitigate these failures-Architecture of backup/recovery -recovery topologies-replication technologies-ensuring information availability and business continuity-Remote replication technologies-providing disaster recovery-

business continuity capabilities-Key areas to monitor in a data center -Key metrics to monitor storage infrastructure.

MODULE V SECURING STORAGE AND STORAGE VIRTUALIZATION 09

Information Security, Critical security attributes for information systems, Storage security domains, Analyze the common threats in each domain. Storage Virtualization: Forms, Configurations and Challenges. Types of Storage Virtualization: Block-level and File-Level.

Total Hours: 45

REFERENCES

1. G.Somasundaram, AlokShrivastava, EMC Education Series, " Information Storage and Management", Wiley, Publishing Inc., 2011.
2. Robert Spalding, "Storage Networks: The Complete Reference",TataMcGrawHill,Osborne, 2003.
3. Marc Farley, "Building Storage Networks",TataMcGraw Hill, Osborne. 2001.
4. MeetaGupta, Storage Area Network Fundamentals, Pearson Education Limited, 2002

OUTCOMES

After completion of this course, the students would be able to

- have a general knowledge of the different types of storage media for digital data.
- understand computer terminology as it applies to data storage.
- differentiate between different types of data storage systems.
- select different data storage types appropriate for various GIS system data.
- recognize the differences between the data in a GIS system and the real world it represents.
- recognize the importance of data design in a GIS system.

CACY022 SEMANTIC WEB

L	T	P	C
3	0	0	3

OBJECTIVES

- understand the need of semantic web in web services
- know the methods to discover, classify and build ontology for more reasonable results in searching
- build and implement a small ontology that is semantically descriptive of chosen problem domain
- implement applications that can access, use and manipulate the ontology

MODULE I INTRODUCTION 09

Introduction to the Syntactic web and Semantic Web – Evolution of the Web – The visual and syntactic web – Levels of Semantics – Metadata for web information - The semantic web architecture and technologies –Contrasting Semantic with Conventional Technologies –Semantic Modeling - Potential of semantic web solutions and challenges of adoption

MODULE II ONTOLOGICAL ENGINEERING 09

Ontologies – Taxonomies –Topic Maps – Classifying Ontologies – Terminological aspects: concepts, terms, relations between them – Complex Objects – Subclasses and Sub-properties definitions – Upper Ontologies – Quality – Uses - Types of terminological resources for ontology building – Methods and methodologies for building ontologies – Multilingual Ontologies -Ontology Development process and Life cycle – Methods for Ontology Learning – Ontology Evolution – Versioning

MODULE III STRUCTURING AND DESCRIBING WEB RESOURCES 09

Structured Web Documents - XML – Structuring – Namespaces – Addressing – Querying – Processing - RDF – RDF Data Model – Serialization Formats- RDF Vocabulary –Inferencing - RDFS – basic Idea – Classes – Properties- Utility Properties – RDFS Modeling for Combinations and Patterns- Transitivity

MODULE IV WEB ONTOLOGY LANGUAGE 09

OWL – Sub-Languages – Basic Notions -Classes- Defining and Using Properties – Domain and Range – Describing Properties - Data Types – Counting and Sets- Negative Property Assertions – Advanced Class Description – Equivalence – Owl Logic.

MODULE V SEMANTIC WEB TOOLS AND APPLICATIONS 09

Development Tools for Semantic Web – Jena Framework – SPARL –Querying semantic web - Semantic Wikis - Semantic Web Services – Modeling and aggregating social network data - Ontological representation of social relationships, Aggregating and reasoning with social network data

Total Hours: 45

REFERENCE BOOKS:

1. Michael C.Daconta, Leo J. Obart and Kevin J Smith, “Semantic Web – A guide to the future of XML, Web Services and Knowledge Management”,Wiley Publishers, 2003. Liyang Yu, “A Developer's Guide to the Semantic Web”, Springer, First Edition, 2011
2. John Hebeler, Matthew Fisher, Ryan Blace and Andrew Perez-Lopez, “Semantic Web Programming”,Wiley, First Edition, 2009.
3. Grigoris Antoniou, Frank van Harmelen, “A Semantic Web Primer”, Second Edition (Cooperative Information Systems) (Hardcover), MIT Press, 2008
4. Robert M. Colomb, “Ontology and the Semantic Web”, Volume 156 Frontiers in Artificial Intelligence and Applications (Frontier in Artificial Intelligence and Applications), IOS Press, 2007.
5. Dean Allemang and James Hendler, “Semantic Web for the Working Ontologist: Effective Modeling in RDFS and OWL, Morgan Kaufmann”, Second Edition, 2011.
6. Michael C. Daconta, Leo J. Obrst and Kevin T. Smith, “The Semantic Web: A Guide to the Future of XML,Web Services, and Knowledge Management”,Wiley, First Edition 2003

OUTCOMES:

On completion of this course, students will be able to

- comprehend the semantic web basics and sketch the architecture diagram of semantic web.
- identify the component technologies of the Semantic Web and explain their roles.
- represent data from a chosen problem in XML with appropriate semantic tags obtained or derived from the ontology
- illustrate the semantic relationships among these data elements using Resource Description Framework (RDF)

- List the limitations of semantic web technologies and aware of the services it can and cannot deliver
- discover the capabilities and limitations of semantic web technology for social networks

CACY023 HEALTHCARE ANALYTICS

L	T	P	C
3	0	0	3

OBJECTIVES

- to know about creating and maintaining health care information systems
- to understand the basic concepts of health care system.
- to understand IT governance and assessment of health care information system

MODULE I INTRODUCTION 09

Introduction to health care information – Health care data quality – Health care information regulations, laws and standards.

MODULE II HEALTH CARE INFORMATION SYSTEMS 09

History and evolution of health care information systems – Current and emerging use of clinical information systems – system acquisition – System implementation and support.

MODULE III INFORMATION TECHNOLOGY 09

Information architecture and technologies that support health care information systems – Health care information system standards – Security of health care information systems.

MODULE IV MANAGEMENT OF IT CHALLENGES 09

Organizing information technology services – IT alignment and strategic planning – IT governance and management.

MODULE V IT INITIATIVES 09

Management's role in major IT initiatives – Assessing and achieving value in health care information systems. Case study

Total Hours: 45

TEXT BOOKS:

1. Karen A Wager, Frances Wickham Lee, John P Glaser, " Managing Health Care Information Systems: A Practical Approach for Health Care Executives", John Wiley, 2 nd edition 2009.

2. Marion J. Ball, Charlotte Weaver, Joan Kiel ,"Healthcare Information Management Systems: Cases, Strategies, and Solutions", Springer, 2010, 3 rd edition
3. Rudi Van De Velde and Patrice Degoulet, "Clinical Information Sytems: A Componenet based approach", Springer 2005.

REFERENCE BOOKS

1. Kevin Beaver, Healthcare Information Systems, Second edition Best Practices, CRC Press, 2002
2. Marion J. Ball Healthcare Information Management Systems: A Practical Guide Springer-Verlag GmbH, 1995

OUTCOMES:

On completion of this course, students will be able to

- Identify, Analyze the computing requirements of a problem and Solve them using computing principles.
- Design and Evaluate a computer based system, components and process to meet the specific needs of applications.
- Use current techniques and tools necessary for complex computing practices.
- Use suitable architecture or platform on design and implementation with respect to performance
- Develop and integrate effectively system based components into user environment.
- Apply the understanding of management principles with computing knowledge to manage the projects in multidisciplinary environments.

CACY024 PYTHON PROGRAMMING

L	T	P	C
3	0	0	3

OBJECTIVES

- establish proficiency in fundamentals of writing Python scripts
- learn the concepts of file I/O and handling of errors and exceptions
- discover the features of python structures and flow control
- use and manipulate several core data structures: Lists, Dictionaries, Tuples, and Strings.

MODULE I INTRODUCTION TO PYTHON 09

Python Overview- Environment Setup- Basic Syntax- Python Identifiers- Reserved Words- Lines and Indentation- Comments- Variable Types- Basic Operators- Decision Making-Loops.

MODULE II BUILT IN FUNCTIONS 09

Python - Numbers – Math Functions-Strings - Special Operators- Formatting Operator- Built-in String Methods- Lists –List operations and Functions- Tuples – Basic Tuple operations and Functions -Dictionary –Adding-updating-Deleting-Built in Functions and Methods.

MODULE III DATE AND TIME FUNCTIONS 09

Date & Time – Getting current Time-Formatted Time-Time Tuple-Time Module-Calendar Module- Functions –Defining Functions-Calling Functions-Types of Function Arguments- Anonymous Functions-Modules - import Statement-Namespaces and Scoping.

MODULE IV FILES AND EXCEPTIONS 09

Files I/O -Printing to the Screen- Reading Keyboard Input- Opening and Closing Files- Reading and Writing Files- Renaming and Deleting Files- Directories in Python- Exceptions-Except Clause.

MODULE V ADVANCED PHYTHON 09

Advanced Python - Classes/Objects - Creating Classes and Instance Objects - Built-In Class Attributes- Class Inheritance- Overloading Methods- -Reg Expressions - Regular Expression Modifiers and Patterns- Database Access - Sending Email .

Total Hours: 45

TEXTBOOKS

1. Vernon L. Ceder ," The Quick Python Book “, 2nd Edition, Manning Publications, Jan 2010.
2. Python In A Day: Learn The Basics, Learn It Quick, Start Coding Fast (In A Day Books) (Volume 1) by Richard Wagstaff
3. Python Programming: An Introduction to Computer Science– December, 2003 by John Zelle

OUTCOMES

On Completion of the course the students will be able to

- List the string and math built in functions.
- Handle the file-system with python scripts
- Classify and Design functions, modules and classes.
- Demonstrate the use of the built-in data structures 'list' and 'dictionary'.
- Perform file operations like open, create ,read, write and close the file.
- Create class, inherit the class, overload the methods and handle regular expressions.

CACY025 ENTERPRISE RESOURCE PLANNING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To describe the concept of ERP and the ERP model
- To explain how ERP is used to integrate business processes and analyze a process
- To impart the key technological considerations and infrastructure concerns in ERP implementation
- To describe project organizational considerations define the project management tools and resources needed to implement an ERP system

MODULE I INTRODUCTION TO ERP 09

Integrated Management Information Seamless Integration – Supply Chain Management – Integrated Data Model – Benefits of ERP – Business Engineering and ERP – Definition of Business Engineering – Principle of Business Engineering – Business Engineering with Information Technology.

MODULE II BUSINESS MODELLING FOR ERP 09

Building the Business Model – ERP Implementation – An Overview – Role of Consultant, Vendors and Users, Customisation – Precautions – ERP Post Implementation Options-ERP Implementation Technology –Guidelines for ERP Implementation.

MODULE III ERP AND THE COMPETITIVE ADVANTAGE 09

ERP domain MPGPRO – IFS/Avalon – Industrial and Financial Systems – Baan IV SAP-Market Dynamics and Dynamic Strategy.

MODULE IV COMMERCIAL ERP PACKAGE 09

Description – Multi-Client Server Solution – Open Technology – User Interface-Application Integration.

MODULE V ARCHITECTURE 09

Basic Architectural Concepts – The System Control Interfaces – Services – Presentation Interface – Database Interface.

Total Hours: 45

TEXT BOOK:

1. Vinod Kumar Garg and N.K.Venkita Krishnan, “Enterprise Resource Planning – Concepts and Practice”, PHI, 1998.

REFERENCE:

1. Jose Antonio Fernandz, The SAP R/3 Handbook, TMH, 1998.

OUTCOMES:

On completion of this course, students will be able to

- List the steps and activities in the ERP life cycle;
- articulate the challenges associated with post-implementation and management of ERP systems.
- evaluate the progress of an ongoing ERP implementation project.
- apply modern software including Oracle ERP system to plan and manage resources in organizations.
- examine systematically the planning mechanisms in an enterprise
- identify all components in an ERP system and the relationships among the components;

CACY026 SOFTWARE PROJECT MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the concepts of Software project management.
- To know the techniques in developing Quality Software Products
- To manage the Software Product Development

MODULE I INTRODUCTION 09

Introduction to Competencies - Product Development Techniques - Management Skills - Product Development Life Cycle - Software Development Process and models-The SEI CMM - International Organization for Standardization.

MODULE II DOMAIN PROCESSES 09

Managing Domain Processes - Project Selection Models - Project Portfolio Management - Financial Processes - Selecting a Project Team - Goal and Scope of the Software Project - Project Planning -Creating the Work Breakdown Structure - Approaches to Building a WBS -Project Milestones - Work Packages - Building a WBS for Software.

MODULE III SOFTWARE DEVELOPMENT 09

Tasks and Activities - Software Size and Reuse Estimating - The SEI CMM - Problems and Risks - Cost Estimation - Effort Measures - COCOMO: A Regression Model - COCOMO II - SLIM: A Mathematical Model - Organizational Planning - Project Roles and Skills Needed.

MODULE IV SCHEDULING ACTIVITIES 09

Project Management Resource Activities - Organizational Form and Structure - Software Development Dependencies - Brainstorming - Scheduling Fundamentals - PERT and CPM - Leveling Resource Assignments - Map the Schedule to a Real Calendar - Critical Chain Scheduling.

MODULE V QUALITY ASSURANCE 09

Quality: Requirements – The SEI CMM - Guidelines - Challenges - Quality Function Deployment - Building the Software Quality Assurance - Plan - Software Configuration Management: Principles - Requirements - Planning and Organizing - Tools - Benefits - Legal Issues in Software - Case Study.

Total Hours: 45

TEXT BOOK :

1. Robert T. Futrell, Donald F. Shafer, Linda I. Safer, “Quality Software Project Management”, Pearson Education, Asia, 2002.

REFERENCES :

1. PankajJalote, “Software Project Management in Practice”, Addison Wesley, 2002.
2. Hughes, “Software Project Management, 3/E”, Tata McGraw-Hill, 2004.

OUTCOMES:

On completion of this course, students will be able to

- gain Knowledge to develop Quality Software Products.
- plan, organize and manage the various resources effectively to achieve.
- specific target in a software organization.
- list the tasks and activities involved in the software development.
- differentiate PERT and CPM in project management.
- handle Software projects effectively

CACY027 DATA MINING AND DATA WAREHOUSING

L	T	P	C
3	01	0	3

OBJECTIVES:

- Provide an overview of data mining and warehousing.
- Introduce data mining techniques
- Offer adequate knowledge to work with data warehouse
- Learn the techniques that can be applied to numerous applications

MODULE I: INTRODUCTION **09**

Databases - Data Mining Functionalities - Steps In Data Mining Process - Architecture of a Typical Data Mining Systems – Classification of Data Mining Systems - Overview of Data Mining Techniques. Data Preprocessing: Data Cleaning – Integration – Reduction – Transformation and Discretization.

MODULE II: ASSOCIATION RULES **09**

Mining Frequent Patterns, Associations and Correlations: Basic Concepts – Frequent Itemset Mining Methods. Classification and Prediction: Issues Regarding Classification and Prediction-Classification by Decision Tree Induction-Bayesian Classification-Other Classification Methods-Prediction

MODULE III: CLUSTERING **09**

Clusters Analysis: Types of Data In Cluster Analysis- Categorization of Major Clustering Methods: Partitioning Methods: k-Means, k-Medoids – Hierarchical Methods: BIRCH, Chameleon – Density based Methods: DBSCAN, OPTICS, Grid based Methods: STING and CLIQUE

MODULE IV: DATA WAREHOUSING **09**

Data Warehouse: Basic Concepts – Data Warehouse Modeling – Data Warehouse Design and Usage – Data Warehouse Implementation.

MODULE V: APPLICATIONS **09**

Social Impacts of Data Mining - Data Mining for Financial Data, Retail and Telecommunications, Science and Engineering, Mining WWW, Mining Text Database – Mining Spatial Databases – Tools - An Introduction to DB Miner - Case Studies

Total Hours: 45

TEXT BOOK :

1. Jiawei Han, MichelineKamber, "Data Mining: Concepts and Techniques", Morgan Kaufmann Publishers, 2002.

REFERENCES :

1. Alex Berson,Stephen J. Smith, “Data Warehousing, Data Mining,& OLAP”, Tata McGraw- Hill, 2004.
2. UsamaM.Fayyad, Gregory Piatetsky - Shapiro, Padhrai Smyth and RamasamyUthurusamy, "Advances In Knowledge Discovery and Data Mining", The M.I.T Press, 1996.
3. Ralph Kimball, "The Data Warehouse Life Cycle Toolkit", John Wiley & Sons Inc., 1998.
4. Sean Kelly, "Data Warehousing In Action", John Wiley & Sons Inc., 1997.

OUTCOMES:

On completion of this course students will be able to:

- recognize the key areas and issues in data mining
- make more effective use of data stored in databases.
- apply association rules, clustering and classification techniques to the dataset to demonstrate some interesting rules or predict interesting pattern from that.
- compare database and data warehouse.
- manage the data mining development process in an individual or team context
- plan, design and deploy the necessary data mining technologies to support a software system

CACY028 UNIX INTERNALS

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OBJECTIVES:

- Provide an in-depth knowledge of the UNIX operating system's internal features and their operation.
- describes the data structures, their relationships and the major algorithms used to manage System, processes, system calls, interrupts and exceptions, virtual memory and file systems.

MODULE I INTRODUCTION TO UNIX 09

Unix operating system - History - System structure –Users Perspective- OS Services- Hardware-Architecture- System Concepts- Kernel data structures– System Administration – Buffer Cache- Heaters – Structure of the Buffer Pool- Scenarios-Reading and writing Disk Blocks.

MODULE II FILE SYSTEMS 09

INODES - Structure of a regular file- Directories – Conversion of a path name to an INODE - Super Block- INODE assignment – Disk Blocks- System calls for the file system.

MODULE III PROCESSES 09

Process States and Transitions – Layout of System Memory – Context of a Process – Manipulation of the process address space – Sleep – Process Control – Creation – Signals – Awaiting process termination – The Shell – System Boot and Init Process – Process Scheduling and Time – System calls for time – Clock.

MODULE IV MEMORY MANAGEMENT 09

Swapping – Segmentation - Demand Paging – Driver Interfaces – Disk Drivers – Terminal Drivers - Streams.

MODULE V INTERPROCESS COMMUNICATION 09

Process Tracing – System V IPC – Network Communications - Sockets – Problem of Multiprocessor Systems – Solution with Master and Slave Processors – Semaphores – Distributed Unix Systems – Satellite Processors-– Newcastle connection – Transparent distributed file systems – System Calls.

Total Hours: 45

TEXT BOOK :

1. Bach M.J., The Design of the Unix Operating System, Prentice Hall India, 1986.

REFERENCES :

1. Goodheart B., Cox.J., The Magic Garden Explained, Prentice Hall India, 1994.
2. Leffler S.J., Mckusick M.K., Karels M.J and Quarterman J.S., The Design and Implementation of the 4.3 BSD Unix Operating System. Addison Wesley, 1998.

OUTCOMES:

On completion of this course, students will be able to

- work with the basic functioning of UNIX operating systems.
- write shell programming and convert path name to an INODE.
- analyze the buffers and kernel representation, to understand the UNIX system structure and system calls .
- compare the various memory management techniques like Swapping , Segmentation and Demand Paging.

CACY029 ADVANCED DATABASES

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OBJECTIVES:

- use concepts and DBMS features learned previously
- be familiar with data modeling and able to apply the techniques to medium complexity problems
- be proficient with basic SQL and familiar with advanced usage
- be exposed to database administration
- be familiar with OBDC and Web site use of databases

MODULE I RELATIONAL DATABASES 09

Relational Model - Querying - Storage Structures - Query Processing - Normalization.

MODULE II OBJECT ORIENTED DATABASES 09

Introduction to Object Oriented Data Bases - Approaches - Modeling and Design - Persistence - Transaction - Concurrency - Recovery - Database Administration.

MODULE III EMERGING SYSTEMS 09

Enhanced Data Models - Client/Server Model - Data Warehousing and Data Mining - Web Databases – Mobile Databases.

MODULE IV CURRENT ISSUES 09

Rules - Knowledge Bases - Active and Deductive Databases - Distributed Databases and Parallel databases.

MODULE V DATABASE DESIGN ISSUES 09

Security - Integrity - Consistency - Database Tuning - Optimization and Research Issues.

Total Hours: 45

TEXT BOOK :

1. R. Elmasri and S.B. Navathe, Fundamentals of Database Systems, Addison Wesley, 2000.

REFERENCES :

1. Gary W. Hanson and James V. Hanson, Database Management and Design, Prentice Hall of India Pvt Ltd, 1999.
2. Alex Benson, Stephen Smith and Kurt Thearling, Building Data Mining Applications for CRM, Tata McGraw-Hill, 2000.

OUTCOMES:

On completion of this course, students will be able to

- discuss the concepts of transaction management.
- design high-quality relational databases and database applications.
- develop skills in advanced visual & conceptual modeling and database design.
- translate complex conceptual data models into logical and physical database designs.

CACY030 SOFTWARE QUALITY ASSURANCE

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OBJECTIVES:

- To understand the fundamental concepts of quality assurance, SQA activities and SQA metrics.
- To get an insight into the various quality control tools.
- To explore the guidelines prescribed by the various quality standards like CMMI.
- To investigate the techniques and tools for Software testing.

MODULE I CONCEPTS 09

Concepts of Quality Control, Quality Assurance, Quality Management - Total Quality Management; Cost of Quality; QC tools - 7 QC Tools and Modern Tools; Other related topics - Business Process Re-engineering –Zero Defect, Six Sigma, Quality Function Deployment, Benchmarking, Statistical process control.

MODULE II SOFTWARE ENGINEERING CONCEPTS 09

Software Engineering Principles, Software Project Management, Software Process, Project and Product Metrics, Risk Management, Software Quality Assurance; Statistical Quality Assurance - Software Reliability, Muse Model; Software Configuration Management; Software Testing; CASE (Computer Aided Software Engineering).

MODULE III QUALITY ASSURANCE MODELS 09

Models for Quality Assurance-ISO-9000 - Series, CMM, SPICE, Malcolm Baldrige Award.

MODULE IV SOFTWARE QUALITY ASSURANCE RELATED TOPICS 09

Software Process - Definition and implementation; internal Auditing and Assessments; Software testing -Concepts, Tools, Reviews, Inspections & Walk thoughts; P-CMM.

MODULE V FUTURE TRENDS 09

PSP and TSP, CMMI, OO Methodology, Clean-room software engineering, Defect injection and prevention.

Total Hours: 45

TEXT BOOK :

1. Watts Humphery, “Managing Software Process", Addison - Wesley, 1998.

REFERENCES:

1. Philip B Crosby, "Quality is Free: The Art of Making Quality Certain", Mass Market, 1992.
2. Roger Pressman, “Software Engineering ", Sixth Edition, McGraw Hill, 2005.

OUTCOMES:

At the end of this course, the students will be able to

- apply software quality control tools.
- identify the software quality attributes and explore the quality standards.
- apply software testing techniques and identify the inputs and deliverables of testing.
- evaluate how new technologies impact software quality assurance and the system’s development life cycle.

CACY031 SERVICE ORIENTED ARCHITECTURE

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OBJECTIVES:

- To gain understanding of the basic principles of service orientation
- To learn service oriented analysis techniques
- To interpret technology underlying the service design
- To learn advanced concepts such as service composition, orchestration and Choreography
- To know about various WS specification standards
- To introduce the fundamentals and issues relating to Service Oriented Architecture
- To bring out the importance of service orientation and web services.

MODULE I INTRODUCTION 09

Roots of SOA – Characteristics of SOA - Comparing SOA to client-server and distributed internet architectures – Anatomy of SOA- How components in an SOA interrelate - Principles of service orientation.

MODULE II SERVICE LAYER 09

Web services – Service descriptions – Messaging with SOAP –Message exchange Patterns – Coordination –Atomic Transactions – Business activities – Orchestration –Choreography - Service layer abstraction – Application Service Layer – Business Service Layer – Orchestration Service Layer.

MODULE III SERVICE ORIENTED ANALYSIS AND DESIGN 09

Service oriented analysis – Business-centric SOA – Deriving business services-service modeling - Service Oriented Design – WSDL basics – SOAP basics – SOA composition guidelines – Entity-centric business service design – Application service design – Task centric business service design.

MODULE IV TECHNOLOGIES AND DESIGN FOR SOA 09

SOA platform basics – SOA support in J2EE – Java API for XML-based web services (JAX-WS) - Java architecture for XML binding (JAXB) – Java API for XML Registries (JAXR) - Java API for XML based RPC (JAX-RPC)- Web Services Interoperability Technologies (WSIT) - SOA support in .NET – Common Language Runtime - ASP.NET web forms – ASP.NET web services – Web Services Enhancements (WSE).

MODULE V SERVICE DESIGN AND SECURITY 09

Service design-guidelines- WS-BPEL language basics – WS-Coordination overview – WS -Choreography, WS-Policy, WS Security-WSOA platform-SOA support in J2EEand .NET.

Total Hours: 45

TEXT BOOK:

1. Thomas Erl, “Service-Oriented Architecture: Concepts, Technology, and Design”, Pearson Education, 2005.

REFERENCES:

1. Thomas Erl, “SOA Principles of Service Design “(The Prentice Hall Service-Oriented Computing Series from Thomas Erl), 2005.
2. Newcomer, Lomow, “Understanding SOA with Web Services”, Pearson Education, 2005.
3. SandeepChatterjee, James Webber, “Developing Enterprise Web Services, An Architect’s Guide”, Pearson Education, 2005.
4. Dan Woods and Thomas Mattern, “ Enterprise SOA Designing IT for Business Innovation” O’REILLY, First Edition, 2006.

OUTCOMES:

On completion of this course, students will be able to

- recall the principles of service orientation.
- differentiate service composition, orchestration and Choreography.
- develop ASP.NET web services.
- apply the tools and technique for Service Oriented Architecture.
- build an SOA platform supported by J2EE and .NET

CACY032 C# AND .NET FRAMEWORKS

L	T	P	C
3	0	0	3

LEARNING OBJECTIVES:

- Teach the fundamental skills that are required to design and develop object-oriented applications
- Train the students to program in C# and develop .NET applications using C#.
- Access data using ADO.NET
- Utilize XML in the .NET environment to create Web Service-based applications and components

MODULE I INTRODUCTION TO C# 09

Introducing C#, Understanding .NET, overview of C#, Literals, Variables, Data Types, Operators, checked and unchecked operators, Expressions, Branching, Looping, Methods, implicit and explicit casting, Constant, Arrays, Array Class, Array List, String, String Builder, Structure, Enumerations, boxing and unboxing.

MODULE II OBJECT ORIENTED ASPECTS OF C# 09

Class, Objects, Constructors and its types, inheritance, properties, indexers, index overloading, polymorphism, sealed class and methods, interface, abstract class, abstract and interface, operator overloading, delegates, events, errors and exception, Threading.

MODULE III APPLICATION DEVELOPMENT ON .NET 09

Building windows application, Creating our own window forms with events and controls, menu creation, inheriting window forms, SDI and MDI application, Dialog Box(Modal and Modeless), accessing data with ADO.NET, DataSet, typed dataset, Data Adapter, updating database using stored procedures, SQL Server with ADO.NET, handling exceptions, validating controls, windows application configuration.

MODULE IV WEB BASED APPLICATION DEVELOPMENT ON .NET 09

Programming web application with web forms, ASP.NET introduction, working with XML and .NET, Creating Virtual Directory and Web Application, session management techniques, web.config, web services, passing datasets, returning datasets from web services, handling transaction, handling exceptions, returning exceptions from SQL Server.

MODULE V CLR AND .NET FRAMEWORK 09

Assemblies, Versoning, Attributes, reflection, viewing meta data, type discovery, reflection on type, marshalling, remoting, security in .NET

Total Hours: 45

TEXT BOOKS:

1. S. ThamaraiSelvi and R. Murugesan “A Textbook on C# “, Pearson Education, 2003.
2. Stephen C. Perry “ Core C# and .NET”, Pearson Education, 2006.

REFERENCES:

1. Jesse Liberty, “Programming C#”, Second Edition, O’Reilly Press, 2002.
2. Robinson et al, “Professional C#”, Fifth Edition, Wrox Press, 2002.
3. Herbert Schildt, “The Complete Reference: C#”, Tata McGraw Hill, 2004.
4. Andrew Troelsen, “C# and the .NET Platform”, A! Press, 2003.
5. Thuan Thai and Hoang Q. Lam, “.NET Framework Essentials”, Second Edition, O’Reilly, 2002.

OUTCOMES:

On completion of this course, students will be able to

- List the major elements of the .NET frame work
- Analyze the basic structure of a C# application
- design, run and debug simple C# console applications
- implement methods, classes, encapsulation, constructors, overloading, inheritance and polymorphism to develop C# programs
- Design and develop windows and web based applications on .NET
- Access data from database with ADO.NET

CACY033 PHP PROGRAMMING

L	T	P	C
3	0	0	3

OBJECTIVES:

- to learn how to build good web applications using PHP language.
- to install PHP and work with arrays and regular experiment.
- to handle the exceptions and file operations.

MODULE I INTRODUCTION TO PHP 09

PHP installation and Introduction, Syntax, Variables-Data types- Operators and expressions-Decisions and Loops-Function- Arrays with attributes-Creating and String- String related Library functions- Regular Expression.

MODULE II ADVANCED PHP 09

Introduction to OOPS- Class- methods- Constructors and Destructors, Access Modifiers-Inheritance-Abstract class-Interface-Error and Exceptional Handling-File Handling-PHP date and time.

MODULE III PHP FORMS AND IMAGES 09

Form Handling –PHP Interactive Forms-PHP GET & POST-Form Validation-PHP Form sanitization-PHP Form URL/E-mail –Basics of Computer Graphics-Creating Image-Manipulating Image-Using Text in Image-Watermarks to Image

MODULE IV PHP WITH MYSQL AND CMS 09

Database Basics-My SQL Create-database operation-Executing Query-Joins-Order By-Group By-Advantages of a CMS, Different types of CMS, Examples , Drupal -- Installation – Content Management, Structure – Site Building – Modules – Theming.

MODULE V PHP APPLICATION FRAMEWORKS 09

Web Development Frameworks – Introduction – Yii – Model View Controller –Yii PHP framework– PHP XML Parsers-PHP XML Expat-PHP XML DOM-PHP Mail.

Total Hours: 45

TEXT BOOK:

1. Kevin Tatroe, Peter MacIntyre,RasmusLerdorf, “Programming PHP”, Creating Dynamic Web Pages, O'Reilly Media, 3rd Edition, 2013.

REFERENCES:

1. http://php.net
2. http://www.tutorialspoint.com/php/index.html

OUTCOMES:

On completion of this course, students will be able to

- Design a web project to use real-time processing capabilities to interact with a database.
- test and debug a php application
- apply the Model View controller pattern for web applications
- pass information from client browser to web server for transaction processing
- able to send email directly from a script
- work with Yii , a high-performance PHP framework for developing Web 2.0 applications.

CACY034 ONLINE COMPUTER ADVERTISING

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OBJECTIVES

- provide an understanding of the Internet as an advertising and the process of selling an online ad program
- know the trends and issues concerning the current and evolving forms of Internet-based advertising and brand communication media;
- provide an overview of the processes and elements considered in the Conceptualizing and production of integrated brand communication campaigns
- Learn how online ads are priced and delivered, along with key measurement metrics

MODULE I ONLINE ADVERTISING 09

Internet advertising- Definition-Advantage-Players in the Internet advertising Industry-Online A d models-Advertising via email-web-testing-buttons-text links-sponsorships-push technology-Interstitials-screensavers-bookmarks-cursors-Undervalued web space

MODULE II TARGETING APPROACHES 09

A Unique Element in Online Advertising-Demographic Targeting -Contextual Targeting-Behavioral Targeting-Geographic Targeting -Affinity Targeting -Purchase-Based Category Targeting-Key Considerations in Online Targeting -Direct Email-Banner advertising-Mini-page-Direct response piece-Loyalty programs-coupons-free samples-trials-contests and games

MODULE III DISPLAY ADVERTISEMENT ONLINE 09

Standard Online Advertising Formats-Creative Factors That Influence Display Advertising -Effectiveness-Rich Media Advertising on Broadband-Online Video AdvertisingOnline Advertising Reach and Frequency Concepts-Strategies for Managing Online Reach and Frequency- Frequency of Online Advertising-Reach and Site Visiting-Winning Strategies in Online Advertising -Generate Leads and Acquire Customers-Generate Brand Preference to Stimulate Sales -Brand Growth, Rewards, and Loyalty

MODULE IV WEB MEASUREMENT 09

Terminology –Log Analysis-Web measurement Tools-Problems with Web measurement -Ad Management-Ad Management for Publishers –Advertisers –

Targeting –Content and context-Registration Information-Database Mining-Profiling and Personalization-Pricing Online Ads-Pricing Models-Trends in pricing

MODULE V BUYING AND SELLING ONLINE ADS 09

Buying Online Ads-Determine campaign goals-Site selection process –Paying for Media buys-Pricing for buys-Allocating campaign budget -Selling Online Advertising-Preparing site's infrastructure-Monitoring and measuring traffic-Ad modelsAd management-Auditing-Media kit- selling strategies-Sales Staff

Total Hours: 45

Text Books

1. Joe Plummer, Steve Rappaport, Taddy Hall, and Robert Barocci, The Online Advertising Playbook, John Wiley & Sons, Inc. (Hoboken, New Jersey), 2007
2. RobbinZeff and Brad Aronson (ZA book from here on), *Advertising on the Internet,* 2nd edition, John Wiley & Sons, Inc. (New York, NY), 1999.

OUTCOMES

Students who complete this course will be able to

- explore and discuss the important issues in the Internet brand communications in general and advertising.
- develop, promote, and manage Internet-based integrated communication campaigns
- list the problems with web measurement
- Identify the steps involved in digital campaign planning

CACY035 WEB MINING

L	T	P	C
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OBJECTIVES:

- To provide students with a sound basis in Web data mining tasks and techniques.
- To ensure that students are able to implement and to use some of the important Web mining algorithms.
- To evaluate Web Mining techniques in their workplace.

MODULE I INTRODUCTION TO WEB INTELLIGENCE 09

Historical Perspective - Towards Intelligent Web - Knowledge Web Mining- Building Better Web sites using Intelligent Technologies - Benefits of Intelligent Web

MODULEII WEB USAGE MINING 09

Introduction to Web Mining- Web usage Mining - Web Log Processing -Analyzing Web Logs- Web Usage Mining Applications

MODULE III WEB CONTENT MINING 09

Introduction- Data Collections - Search Engines - Robot Exclusion - - Personalization of Web Content - Multimedia Information Retrieval

MODULE IV WEB STRUCTURE MINING 09

Introduction - Modeling Web Topology - Other Approaches to Studying the Web-Link Structure

MODULE V WEB MINING APPLICATIONS 09

Data integration for e-commerce - Web personalization - Web content and structure mining- Web data warehousing - Review of tools, applications, and systems

Total Hours: 45

TEXTBOOKS:

1. Data Mining Techniques for Marketing, Sales, and Customer Relationship Management, Third Edition, by Michael Berry and Gordon Linoff, John Wiley, 2011

2. Data Mining: Practical Machine Learning Tools and Techniques, by Ian Witten and Eibe Frank, 3rd Ed., Morgan Kaufmann, 2011
3. Web Data Mining: Exploring Hyperlinks, Content, and Usage Data, by Bing Liu, 2nd Edition, , Springer, 2011
4. Building an Intelligent Web: Theory & Practice, R. Akerkar& P. Lingras; Jones & Bartlett, 2007.
5. Mining the Web, Discovering Knowledge from Hypertext Data, Soumen Chakrabarti, Morgan Kaufmann Publishers, 2003

OUTCOMES:

Students who complete this course will be able to

- index search engines and rank web documents.
- Identify the different components of a page that can be used for mining.
- conduct business intelligence from online resources.
- apply Web Mining strategies and algorithms in their workplace or research careers.
- analyze social media data using appropriate web mining techniques
- modify an existing search engine to make it personalized.

CACY036 DIGITAL MARKETING

L	T	P	C
3	0	0	3

OBJECTIVES

- to learn how to take a systematic approach to develop a Digital Marketing strategies
- to designing an online marketing strategy integrated with overall marketing objectives
- to learn to use email marketing as an effective marketing channel
- to learn all the essentials of mobile marketing

MODULE 1 DIGITAL MARKETING BASICS 08

introduction to marketing-digital marketing and its principles-digital marketing wins over traditional marketing- CPR, CPM, PPC, CPC, SEO, SEM-UNDERSTANDING various Social channels- Digital Marketing Process-Increasing Visibility- Visitors Engagement-- Bringing Targeted Traffic- Converting Traffic into Leads- Retention -Performance Evaluation.

MODULE II BUILDING WEBSITE AND SEARCH ENGINE OPTIMIZATION 10

Internet- web – websites-domain names-web server- web hosting- Planning and conceptualizing a website- Building website using CMS in class-SEO-SERP-Google Keyword Planner tool- Google Operator- Content optimization & planning- On page Optimization- Off page Optimization-Local SEO- Google Webmaster Tools

MODULE III ONLINE DISPLAY ADVERTISING AND ECOMMERCE MARKETING 09

Online advertising-display advertising**-** Banner ads- Rich Media ads- Pop ups and Pop under ads- Contextual advertising- Payment Modules- Online advertising platforms- Ecommerce- Top Ecommerce websites- Ecommerce scenario in India- marketing strategy- Mobile Marketing and Social Media- Using tools to create mobile websites- Content Marketing on mobile- SMS marketing-Uploading mobile app in Android and iOS

MODULE IV CONTENT MARKETING 09

Content Marketing- steps in strategy building process- Optimizing content for search engines- authority blog- monetizing authority blog- unique ways to write magnetic headlines- Case study on content marketing.

MODULE V ONLINE REPUTATION MANAGEMENT 09

Online reputation management- ORM scenario- Online reputation management Commandments- positive brand image online- tools for monitoring online reputation- overcome negative online reputation-Case Study

Total Hours : 45

REFERENCES:

1. Wayne L.Winston, Marketing Analytics: Data driven techniques and Microsoft Excel
2. Calvin Jones : The best digital marketing campaigns in the world , Mastering The Art of Customer Engagement
3. Jan Zimmerman – Social media marketing all in one for dummies
4. Leon G.Schiffman –Consumer Behavior
5. Chaffey Et Al E marketing Excellence: Planning and Optimizing your digital marketing , 4Ed
6. Alan CharlesworthDigital Marketing: A Practical Approach

OUTCOMES:

At the end of this course the students will be able to

- List the advantages of digital marketing over traditional marketing.
- Summarize how they can use digital marketing is used to increase sales and grow their business
- Work with digital marketing tool kit
- Become familiar with the elements of the digital marketing plan
- reach online target market and develop basic digital marketing objectives
- collect, process, and analyze consumer data to make informed marketing decisions
- develop marketing strategies based on product, price, place and promotion objectives.

CACY037 BIG DATA AND ITS ANALYTICS

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OBJECTIVES

- bring together several key technologies used in manipulating, storing, and analyzing big data.
- Make the student understand details of Hadoop.
- introduce tools that provide SQL-like access to unstructured data.

MODULE I INTRODUCTION TO BIG DATA 09

Big Data and its Importance – Four V's of Big Data – Drivers for Big Data – Introduction to Big Data Analytics – Big Data Analytics applications.

MODULE II BIG DATA TECHNOLOGIES 09

Hadoop's Parallel World – Data discovery – Open source technology for Big Data Analytics – cloud and Big Data –Predictive Analytics – Mobile Business Intelligence and Big Data – Crowd Sourcing Analytics – Inter- and Trans-Firewall Analytics - Information Management.

MODULE III PROCESSING BIG DATA 09

Integrating disparate data stores - Mapping data to the programming framework - Connecting and extracting data from storage - Transforming data for processing - Subdividing data in preparation for Hadoop Map Reduce.

MODULE IV HADOOP MAP REDUCE 08

Employing Hadoop Map Reduce - Creating the components of Hadoop Map Reduce jobs - Distributing data processing across server farms –Executing Hadoop Map Reduce jobs - Monitoring the progress of job flows - The Building Blocks of Hadoop Map Reduce - Distinguishing Hadoop daemons - Investigating the Hadoop Distributed File System Selecting appropriate execution modes: local, pseudo-distributed, fully distributed.

MODULE V ADVANCED ANALYTICS PLATFORM 10

Real-Time Architecture – Orchestration and Synthesis Using Analytics Engines – Discovery using Data at Rest – Implementation of Big Data Analytics – Big Data Convergence – Analytics Business Maturity Model- Installing and Running Pig – Comparison with Databases – Pig Latin – User- Define Functions – Data Processing Operators – Installing and Running Hive – Hive QL – Tables.

Total Hours : 45

REFERENCES:

1. Michael Minelli, Michehe Chambers, “Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today’s Business”, 1st Edition, AmbigaDhiraj, Wiely CIO Series, 2013.
2. ArvindSathi, “Big Data Analytics: Disruptive Technologies for Changing the Game”, 1st Edition, IBM Corporation, 2012.
3. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, 1st Edition, Wiley and SAS Business Series, 2012.
4. Tom White, “Hadoop: The Definitive Guide”, 3rd Edition, O’reilly, 2012.

OUTCOMES:

On Completion of the course the students will be able to

- categorize and Summarize Big Data and its importance.
- manage Big Data and analyze Big Data.
- apply tools and techniques to analyze Big Data.
- Analyze the big data analytic techniques for useful business applications.
- Work with big data platform

CACY038 INFORMATION RETRIEVAL

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OBJECTIVES:

- Learn the information retrieval models.
- Be familiar with Web Search Engine.
- expose to Link Analysis.
- Understand Hadoop and Map Reduce.
- Learn document text mining techniques. .

MODULE I INTRODUCTION 09

Introduction -History of IR- Components of IR – Issues –Open source Search engine Frameworks – The impact of the web on IR – The role of artificial intelligence (AI) in IR – IR Versus Web Search – Components of a Search engine-Characterizing the web.

MODULE II INFORMATION RETRIEVAL 09

Boolean and vector-space retrieval models- Term weighting – TF-IDF weighting-cosine similarity – Preprocessing – Inverted indices – efficient processing with sparse vectors – Language Model based IR – Probabilistic IR –Latent Semantic Indexing – Relevance feedback and query expansion.

MODULE III WEB SEARCH ENGINE – INTRODUCTION AND CRAWLING 09

Web search overview, web structure, the user, paid placement, search engine optimization/ spam. Web size measurement – search engine optimization/spam – Web Search Architectures – crawling – meta-crawlers- Focused Crawling – web indexes –- Near-duplicate detection – Index Compression – XML retrieval.

MODULE IV WEB SEARCH – LINK ANALYSIS AND SPECIALIZED SEARCH 09

Link Analysis –hubs and authorities – Page Rank and HITS algorithms - Searching and Ranking – Relevance Scoring and ranking for Web – Similarity – Hadoop& Map Reduce – Evaluation – Personalized search – Collaborative filtering and content-based recommendation of documents and products – handling “invisible” Web – Snippet generation, Summarization, Question Answering, Cross- Lingual Retrieval.

MODULE V DOCUMENT TEXT MINING 09

Information filtering; organization and relevance feedback – Text Mining -Text classification and clustering – Categorization algorithms: naive Bayes; decision trees; and nearest neighbor – Clustering algorithms: agglomerative clustering; k-means; expectation maximization (EM).

Total Hours: 45

TEXT BOOKS:

1. C. Manning, P. Raghavan, and H. Schütze, Introduction to Information Retrieval , Cambridge University Press, 2008.
2. Ricardo Baeza -Yates and BerthierRibeiro – Neto, Modern Information Retrieval: The Concepts and Technology behind Search 2nd Edition, ACM Press Books 2011.
3. Bruce Croft, Donald Metzler and Trevor Strohman, Search Engines: Information Retrieval in Practice, 1st Edition Addison Wesley, 2009.
4. Mark Levene, An Introduction to Search Engines and Web Navigation, 2nd Edition Wiley, 2010.

REFERENCES:

1. Stefan Buettcher, Charles L. A. Clarke, Gordon V. Cormack, Information Retrieval: Implementing and Evaluating Search Engines, The MIT Press, 2010.
2. OphirFrieder “Information Retrieval: Algorithms and Heuristics: The Information Retrieval Series “, 2nd Edition, Springer, 2004.
3. Manu Konchady, “Building Search Applications: Lucene, Ling Pipe”, and First Edition, Gate Mustru Publishing, 2008

OUTCOMES:

On Completion of the course the students will be able to

- Apply information retrieval models.
- Design Web Search Engine.
- Use Link Analysis.
- Use Hadoop and Map Reduce.
- Apply document text mining techniques.

CACY039 SOCIAL MEDIA ANALYSI

L	T	P	C
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OBJECTIVES:

- give an overview of social networks and its importance.
- understand the social network concepts and various methods of analysis.
- expose and train on various tools and techniques for analyzing and visualizing social media networks.

MODULE I INTRODUCTION TO SOCIAL NETWORKS and SNA 08

Connected World – Networks: Actors, Relations and Attributes - Networks as Information Maps - Networks as Conduits – Leaders and Followers – Psychological foundations of social networks – Basic building Blocks – Brief history of Social Network Analysis.

MODULE II NETWORK CONCEPTS 08

Individual Members of the Network – Sociological Questions about Relationships – Whole Social Networks- Distributions – Multiplexity – Roles and Positions – Network Segmentation – Graph Theory – Notations for Social Network Data

MODULE III SOCIAL NETWORK ANALYSIS FUNDAMENTALS 09

Points, Lines and Density – Centrality and Centralization – Components, Cores and Cliques – Positions, Roles and Clusters – Dimensions and Displays.

MODULE IV METHODS OF SOCIAL NETWORK ANALYSIS 10

Graphs – Matrices – Relationship Measures – Centrality and Prestiges – Cliques – Structural Equivalence – Visual Displays – Book models – Network Position Measures – Logit Models – Affiliation networks – Lattices- Levels of Analysis

MODULE V TOOLS AND TECHNOLOGIES 10

Twitter Analytics – Facebook Analytics – Google+ Analytics – Google+ Ripples – R for Social Network Analysis – Pajek – Network Visualization Tools – Analyzing Social Media Networks with NodeXL.

Total Hours: 45

REFERENCES:

1. Charles Kadushin, “Understanding Social Networks: Theories, Concepts, and Findings”, Oxford University Press, USA, 2011.

2. David Knoke, Song Yang, “Social Network Analysis”, 2nd Edition, SAGE Publications, 2007.
3. Christina Prell , “Social Network Analysis: History, Theory and Methodology”, 1st Edition, SAGE Publications Ltd, 2012.

OUTCOMES:

On Completion of the course the students will be able to

- understand the theories and concepts of social networks.
- analyze the social networks by applying various methods of analysis, tools and techniques.
- Use advanced network analysis software to generate visualizations and perform empirical investigations of network data.
- Plan and execute network analytical computations

CACY040 HUMAN COMPUTER INTERACTION

L	T	P	C
3	0	0	3

OBJECTIVES

- Determine the need for computers and evaluate the use of computers,
- identify the stages in software engineering that need to be modified for effectiveness of interacting with computers,
- discover the various models that can be used for designing systems, evaluate the design techniques by applying the apt statistical approach, and design dialogue for representation to computers

MODULE I DESIGN PROCESS 09

Introduction : Importance of user Interface – definition, importance of good design. Benefits of good design. Need for Interaction – Models –– Paradigms – Designing of Interactive systems – Usability –– Interaction design basics – Complexity of design Human interaction with computers, importance of human characteristics human consideration, Human interaction speeds

MODULE II DESIGN AND EVALUATION OF INTERACTIVE SYSTEMS 09

The graphical user interface – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, - Principles of user interface. Design rules – maximum usability – Principles – Standards and guidelines – design patterns –

MODULE III Software tools AND Components 09

Programming Tools – Windowing systems – Interaction tool kit –Evaluation techniques – evaluation design – Evaluating implementations – Observational Methods ,text and messages, Icons– Multimedia, colors, uses problems, choosing colors.

MODULE IV MODELS 09

Universal design principles – Multimodal systems – User Support – Presentation and Implementation Issues – types – requirements – approaches – Cognitive model – Hierarchical model – Linguistic model – physical and device models – Socio-technical models – Communication and Collaboration models – Task models – Task analysis and design

MODULE V EXPERIMENTAL DESIGN AND STATISTICAL ANALYSIS OF HCI 09

Basic Design structure – Single independent variable – multiple independent variable – factorial design – split-plot design – random errors – experimental procedure – Statistical analysis – T tests – Analysis of Variance test – Regression – Chi-Square test – Survey – Probabilistic sampling – Non-probabilistic sampling – developing survey questions

Total Hours: 45

TEXT BOOKS:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale Human Computer Interaction, 3rd Edition Prentice Hall, 2004.
2. Jonathan Lazar Jinjuan Heidi Feng, Harry Hochheiser, Research Methods in Human Computer Interaction, Wiley, 2010. REFERENCE:.
3. The essential guide to user interface design, Wilbert O Galitz, Wiley DreamaTech.

REFERENCES

1. Human – Computer Interaction. ALAN DIX, JANET FINCAY, GRE GORYD, ABOWD, RUSSELL EALG, PEARSON.
2. Interaction Design PRECE, ROGERS, SHARPS. Wiley Dreamtech, 3. User Interface Design, SorenLauesen , Pearson Education.

OUTCOMES

On completion of this course, students will be able to

- Explain Computer components functions regarding interaction with human
- Demonstrate Understanding of Interaction between the human and computer components.
- Implement Interaction design basics
- Use HCI in the software process
- Apply Design rules
- Use Evaluation techniques

CACY041 BIO-INFORMATICS

L	T	P	C
3	0	0	3

OBJECTIVES:

The aim of the course is to

- improve the programming skills of the student
- let the students know the recent evolution in biological science.

MODULE I INTRODUCTION 09

Introduction to molecular biology – the genetic material – gene structure – protein structure – chemical bonds – molecular biology tools – genomic information content

MODULE II ALIGNMENTS 09

Data searches – simple alignments – gaps – scoring matrices – dynamic programming – global and local alignments – database searches – multiple sequence alignments Patterns for substitutions – estimating substitution numbers – evolutionary rates – molecular clocks – evolution in organelles

MODULE III PHYLOGENETICS 09

Phylogenetics – history and advantages – phylogenetic trees – distance matrix methods – maximum likelihood approaches – multiple sequence alignments – Parsimony – ancestral sequences – strategies for faster searches – consensus trees – tree confidence – comparison of phylogenetic methods – molecular phylogenies

MODULE IV GENR STRUCTURE 09

Genomics – prokaryotic genomes: prokaryotic gene structure – GC content – genedensity – eukaryotic genomes: gene structure – open reading frames – GC content – gene expression – transposition – repeated elements – gene density

MODULE V PROTIENS AND PREDICTION 09

Amino acids – polypeptide composition – secondary structure – tertiary and quaternary structure – algorithms for modeling protein folding – structure prediction – predicting RNA secondary structures Proteomics – protein classification – experimental techniques – inhibitors and drug designing and screening – NMR structures – empirical methods and prediction techniques – post-translational modification prediction

Total Hours : 45

TEXT BOOK:

1. D. E. Krane and M. L. Raymer, “Fundamental concepts of Bioinformatics”, Pearson Education, 2003.

REFERENCES:

1. Arthur M. Lesk, “Introduction to Bioinformatics”, Second Edition, Oxford University Press, 2005.
2. T. K. Attwood, D. J. Parry-Smith, and S. Phukan, “Introduction to Bioinformatics”, Pearson Education, 1999.
3. Vittal R. Srinivas, “Bioinformatics – A Modern Approach”, Prentice-Hall of India Pvt.Ltd., 2005.

OUTCOMES:

On completion of this course, students will be able to

- develop bioinformatics tools with programming skills.
- apply computational based solutions for biological perspectives.
- pursue higher education in this field.
- practice life-long learning of applied biological science.

CURRICULUM AND SYLLABI

REGULATIONS - 2016

(As approved by the 9th Academic Council)

M. Tech.

CAD - CAM

B.S.ABDUR RAHMAN UNIVERSITY

B.S. ABDUR RAHMAN INSTITUTE OF SCIENCE & TECHNOLOGY
(Estd. u/s 3 of the UGC Act, 1956)

(FORMERLY B.S. ABDUR RAHMAN CRESCENT ENGINEERING COLLEGE)
Rated with A Grade by National Assessment and Accreditation Council
Seethakathi Estate, G.S.T. Road, Vandalur, Chennai - 600 048
www.bsauniv.ac.in

REGULATIONS, CURRICULUM AND SYLLABI

M. Tech.

CAD – CAM

(As approved by the 9th Academic Council)

JULY 2016

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VISION AND MISSION OF THE DEPARTMENT OF MECHANICAL ENGINEERING

VISION

To excel in providing quality education and training through Undergraduate and Postgraduate programmes and carryout quality research in the field of Mechanical Engineering.

MISSION

- To provide a good learning experience through appropriate design of curriculum and syllabi that facilitates students to gain thorough understanding of the fundamental concepts and applications in Mechanical Engineering
- To equip students to solve challenging problems in Mechanical Engineering and related areas taking in to account their impact on the society
- To facilitate students to develop good communication, leadership and managerial skills through team approach in conducting experiments and projects
- To pursue academic and collaborative research activities with industry and other research institutions ensuring high quality in publications and other research outputs

PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES

M. Tech. (CAD – CAM)

PROGRAMME EDUCATIONAL OBJECTIVES

- To provide a holistic approach in learning through well designed courses involving fundamental concepts and state-of-the-art techniques in the field of CAD – CAM
- To equip the graduates, with knowledge and skill to undertake design, analysis, evaluation of systems, processes and components
- To supplement course work through seminars, workshops, case studies and through paper presentation
- To inculcate research culture by way of solving typical problems, Project works from real life situation and innovative assignments
- To develop team spirit, problem solving skill and appreciation for ethical and social relevance of the technologies used

PROGRAMME OUTCOMES

On completion of programme, the graduates will

- have sound conceptual knowledge and skill in the area of design and manufacturing
- be able to design, analyse and manufacture real life systems and components
- have capability to use latest software in the area of computer aided engineering for modelling, analysis and manufacture
- be able to undertake academic and applied research and address open ended problems
- have the ability to discharge professional, social & economic responsibilities ethically

CURRICULUM & SYLLABI FOR
M. Tech. (CAD – CAM)
(FOUR SEMESTERS / FULL TIME)

Sl. No.	Course Code	Course Title	L	T	P	C
		SEMESTER I				
1	MAC6182	Differential Equations and Numerical Methods	**3**	**1**	**0**	**4**
2	MEC6101	Applied Materials Engineering	**3**	**0**	**0**	**3**
3	MEC6102	Computer Graphics and Geometric Modeling (Integrated Lab)	**3**	**0**	**2**	**4**
4	MEC6103	Advanced Finite Element Analysis (Integrated Lab)	**2**	**1**	**2**	**4**
5	MEC6104	Rapid Prototyping	**2**	**0**	**0**	**2**
6		Professional Electives #				**3**
						20
		SEMESTER II				
1	GEC6201	Research Methodology For Engineers	3	0	0	3
2	MEC6201	Integrated Product Design	3	0	0	3
3	MEC6202	Advanced Metrology and NDT (Integrated Lab)	3	0	2	4
4	MEC6203	Flexible Manufacturing Systems	3	0	0	3
5		Professional Electives ##				6
6	MEC6204	Design Project	0	0	2	1
						20
		SEMESTER III				
1		General Elective*	3	0	0	3
2	MEC7102	Non Linear Finite Element Analysis	1	0	0	1
3		Professional Electives ###				9
4	MEC7103	Industry Internship	0	0	0	1
5	MEC7101	Project Work - Phase I	0	0	12	6**
						14

Sl. No.	Course Code	Course Title	L	T	P	C
		SEMESTER IV				
	MEC7101	Project Work - Phase II	0	0	36	18**
		Total credit (Semester IV)				**18 + 6 = 24**
		GRAND TOTAL CREDIT				**78**

\# Professional Electives can be chosen from the list, provided that the cumulative credits should not be less than 3.

\## Professional Electives can be chosen from the list, provided that the cumulative credits should not be less than 6.

\### Professional Electives can be chosen from the list, provided that the cumulative credits should not be less than 9.

* General Electives can be chosen from the list, provided that the cumulative credits should not be less than 3.

** Credits for project work phase I to be accounted along with project work phase II in IV semester

LIST OF PROFESSIONAL ELECTIVES

Sl. No.	Course Code	Course Title	L	T	P	C
		PROFESSIONAL ELECTIVES ON CAD				
1	MECY001	Advanced Mechanisms Design and Simulation	**3**	**0**	**0**	**3**
2	MECY002	Advanced Strength of Materials	**3**	**0**	**0**	**3**
3	MECY003	Advanced Tool Design	**3**	**0**	**0**	**3**
4	MECY004	Computational Fluid Dynamics	**3**	**0**	**0**	**3**
5	MECY005	Computer Aided Process Planning	**3**	**0**	**0**	**3**
6	MECY006	Design of Hydraulic and Pneumatic Systems	**3**	**0**	**0**	**3**
7	MECY007	Design of Material Handling Equipment	**3**	**0**	**0**	**3**
8	MECY008	Industrial Robotics and Flexible Automation	**3**	**0**	**0**	**3**
9	MECY009	Mechanical Vibrations	**3**	**0**	**0**	**3**
10	MECY010	Optimization Techniques in Design	**3**	**0**	**0**	**3**
11	MECY011	Tribology	**3**	**0**	**0**	**3**
12	MECY012	Mechanics of Composite Materials	**2**	**0**	**0**	**2**
13	MECY013	Geometric Dimensioning and Tolerancing	**1**	**0**	**0**	**1**
		PROFESSIONAL ELECTIVES ON CAM				
14	MECY014	Advances in Manufacturing Technology	**3**	**0**	**0**	**3**
15	MECY015	CNC Machines and Computer Aided Manufacturing	**3**	**0**	**0**	**3**
16	MECY016	Polymers and Composites	**3**	**0**	**0**	**3**
17	MECY017	Precision Engineering and Nano Technology	**3**	**0**	**0**	**3**
18	MECY018	Mechatronics for Manufacturing Systems	**2**	**0**	**0**	**2**
19	MECY019	Newer Materials	**2**	**0**	**0**	**2**
20	MECY020	Automotive Manufacturing	**1**	**0**	**0**	**1**
21	MECY021	Virtual Manufacturing	**1**	**0**	**0**	**1**
		PROFESSIONAL ELECTIVES ON CAD / CAM MANAGEMENT				
22	MECY022	Data Communication in CAD/CAM	**3**	**0**	**0**	**3**
23	MECY023	Industrial Safety Management	**3**	**0**	**0**	**3**
24	MECY024	Integrated Manufacturing Systems and Management	**3**	**0**	**0**	**3**

Sl. No.	Course Code	Course Title	L	T	P	C
25	MECY025	Manufacturing Information Systems	**3**	**0**	**0**	**3**
26	MECY026	Reliability and Total Productive Maintenance	**3**	**0**	**0**	**3**
27	MECY027	Product Life Cycle Management	**1**	**0**	**0**	**1**

GENERAL ELECTIVES FOR M.TECH PROGRAMMES

Sl. No.	Course Code	Course Title	L	T	P	C
1	GECY101	Project Management	**3**	**0**	**0**	**3**
2	GECY102	Society, Technology & Sustainability	**3**	**0**	**0**	**3**
3	GECY103	Artificial Intelligence	**3**	**0**	**0**	**3**
4	GECY104	Green Computing	**3**	**0**	**0**	**3**
5	GECY105	Gaming Design	**3**	**0**	**0**	**3**
6	GECY106	Social Computing	**3**	**0**	**0**	**3**
7	GECY107	Soft Computing	**3**	**0**	**0**	**3**
8	GECY108	Embedded System Programming	**3**	**0**	**0**	**3**
9	GECY109	Principles of Sustainable Development	**3**	**0**	**0**	**3**
10	GECY110	Quantitative Techniques in Management	**3**	**0**	**0**	**3**
11	GECY111	Programming using MATLAB & SIMULINK	**1**	**0**	**2**	**2**
12	GECY112	JAVA Programming	**1**	**0**	**2**	**2**
13	GECY113	PYTHON Programming	**1**	**0**	**2**	**2**
14	GECY114	Intellectual Property Rights	**1**	**0**	**0**	**1**

SEMESTER I

MAC6182	DIFFERENTIAL EQUATIONS AND NUMERICAL METHODS	L	T	P	C
		3	1	0	4

COURSE EDUCATIONAL OBJECTIVES:

The aim of this course is to

- Familiarize the students with boundary value problems of partial differential equations in engineering.
- Expose the students to variational problems, numerical integration techniques and conformal mapping.

MODULE I ONE DIMENSIONAL WAVE AND HEAT EQUATIONS 10+03

Laplace transformation for one dimensional wave equation – displacements in a line string – longitudinal vibration of an elastic bar – Fourier transformation for one dimensional heat conduction problems in infinite and semi-infinite rods.

MODULE II CALCULUS OF VARIATIONS 10+03

Variation and its properties – Euler's equation – functional dependant on first and higher order derivatives – functional dependant on functions of several independent variables – variational problems with moving boundaries – Isoperimetric Problems – Ritz and Kantorovich methods.

ODULE III NUMERICAL INTEGRATION 07+03)

Newton - Cotes formula - Trapezoidal, Simpson's one third and three eighth rules - Gauss Quadrature formulae.

MODULE IV NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS 09+03

Solution of Laplace and Poisson equations on a region by Liebmann's method - diffusion equation by the explicit and Crank Nicolson - implicit methods - stability and convergence criterion - solution of wave equation by explicit scheme.

MODULE V CONFORMAL MAPPING AND APPLICATIONS 09+03

The Schwarz – Christoffel transformation – transformation of boundaries in parametric form – physical applications – fluid flow and heat flow problems.

L – 45; T – 15; Total Hours: 60

TEXT BOOKS:

1. Curtis F. Gerald and Patrick O. Wheatley, Applied Numerical Analysis, 7th edition, Pearson Publications, USA, 2004.
2. S.K. Gupta, Numerical methods for Engineers, New Age Intl. Publishers (Earlier: Wiley Eastern, New Delhi), 1995,Second Edition, 2010 (from IITB).
3. Sankar Rao, Introduction to Partial Differential Equations, PHI Learning Pvt. Ltd., 2010.

REFERENCES:

1. Sneddon, I.N., “Elements of Partial Differential Equations”, Mc Graw-Hill, 1986.
2. Gupta, A.S., “Calculus of Variations with Applications”, Prentice Hall of India Pvt. Ltd, New Delhi, 1997.
3. Kreyszig, E., “Advanced Engineering Mathematics”, 8th Edition, John Wiley & Sons, Inc., Singapore, 2002.
4. L.E. Elsgolts, “Differential equations and calculus of variations”, University Press of the Pacific, 2003.

COURSE OUTCOMES:

At the end of the course students will be able to solve

- Problems using the concepts of Laplace transform
- Problems using the concepts of Fourier transform.
- Problems on calculus of variation.
- Problems on Conformal mapping.
- Heat flow problems of one and two dimensional conditions using numerical methods.

MEC6101 APPLIED MATERIALS ENGINERING

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To study the elastic and plastic behaviour of engineering materials
- To understand the fracture behaviour of engineering materials
- To gain the knowledge on selection of materials for specific applications
- To select the modern materials and identify their applications
- To suggest suitable non-metallic materials for various engineering applications

MODULE I ELASTIC AND PLASTIC BEHAVIOUR 12

Elasticity in metals and polymers - Anelastic and visco-elastic behaviour – Mechanism of plastic deformation and non metallic shear strength of perfect and real crystals – Strengthening mechanisms - work hardening, solid solutioning, grain boundary strengthening, poly phase mixture, precipitation, particle, fiber and dispersion strengthening - Effect of temperature, strain and strain rate on plastic behaviour – Super plasticity – Deformation of non crystalline materials.

MODULE II FRACTURE BEHAVIOUR 15

Griffith's theory, stress intensity factor and fracture toughness – Toughening mechanisms – Ductile, brittle transition in steel – High temperature fracture, creep – Larson Miller parameter – Deformation and fracture mechanism maps – Fatigue, low and high cycle fatigue test, crack initiation and propagation mechanisms and Paris law - Effect of surface and metallurgical parameters on fatigue – Fracture of non metallic materials – Failure analysis, sources of failure, procedure of failure analysis.

MODULE III SELECTION OF MATERIALS 08

Motivation for selection, cost basis and service requirements – Selection for mechanical properties, strength, toughness, fatigue and creep – Selection for surface durability corrosion and wear resistance – Relationship between materials selection and processing – Case studies in materials selection with relevance to aero, auto, marine, machinery and nuclear applications – Computer aided materials selection.

MODULE IV MODERN METALLIC MATERIALS 05

Dual phase steels, High strength low alloy (HSLA) steel, Transformation induced

plasticity (TRIP) Steel, Maraging steel, Nitrogen steel – Intermetallics, Ni and Ti aluminides – Smart materials, Shape memory alloys – Metallic glass and Nano crystalline materials.

MODULE V NON METALLIC MATERIALS 05

Polymeric materials – Formation of polymer structure – Production techniques of fibers, foams, adhesives and coating – structure, properties and applications of engineering polymers – Advanced structural ceramics, WC, TiC, TaC, Al_2O_3, SiC, Si_3N_4 CBN and Diamond – properties, processing and applications.

Total Hours: 45

REFERENCES:

1. George E. Dieter, Mechanical Metallurgy, McGraw Hill, 1988.
2. Thomas H. Courtney, Mechanical Behaviour of Materials, (2nd edition), McGraw Hill, 2000.
3. Charles, J.A., Crane, F.A.A. and Fumess, J.A.G., Selection and use of engineering materials, (3rd edition), Butterworth-Heiremann, 2001.
4. Flinn, R.A., and Trojan, P.K., Engineering Materials and their Applications, (4th Edition) Jaico, 1999.
5. ASM Hand book, Vol.11, Failure Analysis and Prevention, (10th Edition), ASM, 2002.
6. Ashby M.F., Material Selection in Mechanical Design, 3rd Edition, Butter Worth 2005.

COURSE OUTCOMES:

Students should be able to

- Describe the elastic and plastic behaviour of engineering materials
- Interpret the fracture behavior of engineering materials
- Use the suitable materials for specific applications
- Choose the modern materials for appropriate applications
- Employ the non- metallic materials for various engineering applications

MEC6102	COMPUTER GRAPHICS AND GEOMETRIC MODELLING	L	T	P	C
		3	0	2	4

COURSE EDUCATIONAL OBJECTIVES:

- To acquire knowledge for generating high quality images of massive geometric models in a short time.
- To learn about the concepts of complex curves and surface models
- To learn the concepts of solid modelling and current trends in modelling
- To understand the surface visualization, models presentation and communication techniques.
- To acquire knowledge on the applications of CAD

MODULE I IMAGE GENERATION AND MANIPULATION 09+06

Overview of display devices and systems – generation of primitives; line, circle, ellipse generation algorithms – 2D & 3D transformation –viewing transformation – projections.

Practice on Develop 3D models to realizing the transformation and projections.

MODULE I I MODELLING OF CURVES AND SURFACES 09+06

Curves: Parametric representation – Analytic curves; synthetic curves – Bicubic, Bezier, B-spline, NURBS; Surfaces: surface patches – Bicubic – Bezier – B-spline – Coons patch, Sweep surfaces; continuity conditions; manipulation of curves & surfaces.

Practice on Models with free form curves and surfaces (bike petrol tank, car body).

MODULE II MODELLING OF SOLIDS 09+06

Constructive Solid Geometry (CSG) – Boundary Models – Sweeping; Other methods of solid modeling; Constraint based modeling – parametric – variational; Feature based modeling; Data associativity; features of Solid modeling packages – current trends in modeling.

Practice on

1. Simple constrain based models to appreciate their advantages.
2. Realization of Data associativity principles (Edit part model and realize the change in drawing).
3. Parametric modeling of Bolt – Nut assembly, Flange, Gears.

MODULE IV IMAGE ENHANCEMENT AND GRAPHICS STANDARDS 09+06

Clipping-Hidden line/surface removal- shading and rendering; Graphic standards – Computing shades – Data exchange standards – Data Communication Standards

Practice on

1. Shading and rendering of real life products.
2. Hidden line/Surface removal of machine components.
3. Data exchange between CAD and CAE software.

MODULE V COLLABORATIVE ENGINEERING AND APPLICATIONS 09+06

Collaborative design – Product Lifecycle Management; Mass property calculation - Assembly modeling – Mesh generation techniques - Animation Techniques – Tool path generation

Practice on

1. Mass property calculation for complex models.
2. Assembly modeling.

L: 45, P: 30, Total Hours: 75

REFERENCES:

1. Ibrahim Zeid, CAD / CAM- Theory and Practice, Mc Graw Hill International Edition, 1998.
2. Chris Mc Mahon and Jimmie Browne, CAD CAM – Principles, Practice and Manufacturing Management, 2nd edition, Pearson Education Asia LN, 2005.
3. Donald Hearn and Pauline Baker, Computer Graphics Printice Hall Inc.

COURSE OUTCOMES:

Students would be able to

- Generate high quality images of massive geometric models in a short time.
- Realize the concepts of analytic and synthetic curve/surface generation, and develop physical models to represent them.
- Acquire knowledge on the development of solid models including the current techniques in the industry.
- Prepare the components for visual presentation and exchange the models between CAD/CAE software.
- Realize the applications of CAD

MEC6103 ADVANCED FINITE ELEMENT ANALYSIS

L	T	P	C
2	1	1	4

COURSE EDUCATIONAL OBJECTIVES:

- To introduce the mathematical and physical principles underlying the Finite Element Method (FEM).
- To uncover iso-parametric formulation and its importance
- Top describe the elementary concepts of plate bending behaviour and theory.
- To introduce time dependent finite element procedure
- To introduce error norms and convergence rates

MODULE I REVIEW OF 1D FEM 12

Historical background - Concept of finite element method - Finite element formulation based on weighted residual method and stationary of a functional - Review of static analysis using 1D element – Bar, truss, Beam element.

Practice on FEA analysis of Machine elements under static loads

MODULE II 2D & 3D FEM 12

Triangular, quadrilateral, tetrahedral element, Lower order and higher order element, Iso-parametric formulation, Static structural and thermal analysis applications.

Practice on FEA analysis of Heat transfer – steady state and transient

MODULE III BENDING OF PLATES & SHELLS 12

Bending of plate and shells - Thin (Kirchoff) and Thick (Mindlin) plate elements – Finite Element Formulation of Plate and Shell Elements – Applications and Examples.

Practice on FEA analysis of Modal analysis, Harmonic analysis

MODULE IV STRUCTURAL DYNAMICS 12

Dynamical equations of motion, Consistent and Lumped Mass Matrices, Damping matrices, Vibration Analysis, Eigenvalue problems and solution techniques, Transient dynamical and structural dynamical problems, Explicit and implicit schemes of integrations, Stability issues.

Practice on FEA analysis of Plate bending analysis

MODULE V ERROR ESTIMATES AND ADAPTIVE REFINEMENT 12

Classification of errors – Error tests - Convergence rates- Mesh revision and Gradient Recovery – Adaptive meshing - h refinement with adaptivity – adaptive refinement.

Practice on FEA analysis of Error estimation and convergence tests

Total Hours: 60

REFERENCES:

1. Reddy J.N. An Introduction to the Finite Element Method, McGraw Hill, International Edition, 1993.
2. Cook, Robert Davis et al “Concepts and Applications of Finite Element Analysis”, Wiley, John & Sons, 1999.
3. Nitin S. Gokhale , Sanjay S. Deshpande and Sanjeev V. Bedekar, “Practical Finite Element Analysis”, Amazon India, 2008.
4. Chandrupatla & Belagundu, “Finite Elements in Engineering”, Prentice Hall of India Private Ltd., 1997.
5. Zienkiewicz. O.C, Taylor. R.L “The Finite Element Method” McGraw Hill International Editions, Fourth Edition, 1991, Volume 2.
6. Bathe, K.J., “Finite Element Procedures in Engineering Analysis, 1990.
7. S.S. Rao, Finite Element Analysis, 2002 Edition.
8. David V Hutton “Fundamentals of Finite Element Analysis”. McGraw-Hill International Edition, 2004.

COURSE OUTCOMES:

Students will be able to

- Solve static structural problem by functional approximation and finite element method.
- Solve structural and thermal problems involving complex geometries.
- Model and analyse structures such as pressure vessel, automobile parts and chimney stacks.
- Perform Modal analysis, Harmonic analysis and transient analysis.
- Enhance the skills of interpreting results

MEC6104 RAPID PROTOTYPING

L	T	P	C
2	0	0	2

COURSE EDUCATIONAL OBJECTIVES:

- To learn the fundamentals of rapid prototyping and automated fabrication.
- To acquire knowledge on the generation of suitable CAD models.
- To study the current rapid prototyping fabrication technologies, the use of secondary processing and the impact of these technologies.
- To understand the various rapid prototyping fabrication technologies, their underlying material science and the application of this technology on society.

MODULE I INTRODUCTION 05

Introduction to RP –Technology- Description -Definition to RP -Overview of RP - Benefits and Application.

MODULE II RPT FILE GENERATION 08

RP Processes: Process overviews, STL file Generation, File Verification & Repair, Build File Creation, Part Construction, Part Cleaning and finishing, Process Strength & limitations.

MODULE III LIQUID BASED AND SOLID BASED RAPID PROTOTYPING SYSTEMS 08

Classes of RP systems: 3D Printers, Enterprise Prototyping centers, Direct digital tooling, Direct digital manufacturing, system classification, Stereo lithography, SL with photo polymerization, Selective Laser Sintering, Fused deposition modeling, Laminated object manufacturing, Laser powder forming. Prototype properties: Material, color, dimensional accuracy, stability, surface finish, machine-ability, environmental resistance, operational properties

MODULE IV RAPID PROTOTYPING APPLICATIONS 09

RP Applications: Design, Concept Models, Form & fit checking, Ergonomic Studies, Functional testing, Requesting Price quotes, CAD data verification, Rapid Tooling, rapid manufacturing, Science & Medicine, Archeology, Paleontology & forensic Science, miniaturization

Total Hours: 30

REFERENCES:

1. Chua C.K., Leong K.F., and Lim C.S., Rapid prototyping: Principles and applications, second edition, World Scientific Publishers, 2003.
2. Andreas Gebhardt, Hanser Gardener, Rapid prototyping, Publications, 2003.
3. Liou W. Liou, Frank W. Liou, Rapid Prototyping and Engineering applications: A tool box for prototype development, CRC Press, 2007.
4. Ali K. Kamrani, Emad Abouel Nasr, Rapid Prototyping: Theory and practice, Springer, 2006.
5. Peter D. Hilton, Hilton / Jacobs, Paul F. Jacobs, Rapid Tooling: Technologies and Industrial Applications, CRC press, 2000.

COURSE OUTCOMES:

The students will

- Identify the currently available rapid prototyping systems, their fundamental operating principles and their characteristics
- Demonstrate complementary, secondary fabrication processes commonly used with the above rapid prototyping systems
- Select the appropriate fabrication technology or technologies for a given prototyping task

SEMESTER II

GEC6201	RESEARCH METHODOLOGY FOR ENGINEERS	L	T	P	C
		3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To provide a perspective on research to the scholars
- To educate on the research conceptions for designing the research
- To impart knowledge on statistical techniques for hypothesis construction
- To gain knowledge on methods of data analysis and interpretation
- To learn about the effective communication of research finding

MODULE I RESEARCH PROBLEM FORMULATION 07

Research – objectives – types, Research process, Solving engineering problems, Identification of research topic, Formulation of research problem, Literature survey and review.

MODULE II HYPOTHESIS FORMULATION 08

Research design – meaning and need – basic concepts, Different research designs, Experimental design – principle – important experimental designs, Design of experimental setup, Mathematical modeling, Simulation – validation and experimentation, Dimensional analysis and similitude.

MODULE III STATISTICAL TECHNIQUES 12

Statistics in research – concept of probability – popular distributions –Hypothesis testing- sample design- Design of experiments – factorial designs -– orthogonal arrays- ANOM - ANOVA - Multivariate analysis - Use of optimization techniques – traditional methods – evolutionary optimization techniques –Transportation model.

MODULE IV STATISTICAL ANALYSIS OF DATA 10

Research Data analysis – interpretation of results – correlation with scientific facts- Accuracy and precision – error analysis, limitations - Curve fitting, Correlation and regression.

MODULE V RESEARCH REPORT 08

Purpose of written report – audience, synopsis writing, preparing papers for International journals, Thesis writing – organization of contents – style of writing – graphs and charts – referencing, Oral presentation and defense, Ethics in

research, Patenting, Intellectual Property Rights.

Total Hours: 45

REFERENCES:

1. Ganesan R., Research Methodology for Engineers, MJP Publishers, Chennai, 2011.
2. Ernest O., Doebelin, Engineering Experimentation: planning, execution, reporting, McGraw Hill International edition, 1995.
3. George E. Dieter., Engineering Design, McGraw Hill – International edition, 2000.
4. Madhav S. Phadke, Quality Engineering using Robust Design, Printice Hall, Englewood Cliffs, New Jersey, 1989.
5. Kothari C.R., Research Methodology – Methods and Techniques, New Age International (P) Ltd, New Delhi, 2003.
6. Kalyanmoy Deb., “Genetic Algorithms for optimization”, KanGAL report, No.2001002.
7. Holeman, J.P., Experimental methods for Engineers, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 2007.
8. Govt. of India, Intellectual Property Laws; Acts, Rules & Regulations, Universal Law Publishing Co. Pvt. Ltd., New Delhi 2010.
9. University of New South Wales, “How to write a Ph.D. Thesis” Sydney, Australia, Science @ Unsw.
10. Shannon. R.E., System Simulation: the art and science, Printice Hall Inc, Englewood Cliffs, N.J.1995.
11. Scheffer. R.L. and James T. Mc Clave, Probability and Statistics for Engineers, PWS – Kent Publishers Co., Boston, USA, 1990.

COURSE OUTCOMES:

Students should be able to

- Formulate the research problem
- Design and Analyse the research methodology
- Construct and optimize the research hypothesis
- Analyse and interpret the data
- Report the research findings

MEC6201 INTEGRATED PRODUCT DESIGN

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To provide and learn the scientific approach to product design that integrates technical, human and business concerns
- To understand the tools and methods of concept development with focus on the front end processes of new product development
- To learn and enable the student to architecture the geometrical layout of product
- To create awareness and role of industrial design, integration of computerized tools and quality design
- To gain knowledge on multiple functional areas like design for manufacturing and assembly, product development economics, prototyping and intellectual property that makes confidence and capability to create an own new product

MODULE I INTRODUCTION 08

Strategic importance of integrated product design - product life cycle - characteristics and challenges of product development - a generic product development process - the front end processes - the variants of generic product development process - concept of concurrent engineering - integration of customer, designer, material supplier, process planner and competitor - plan for products - understanding the market opportunity - understanding and identifying customer needs - establishing product specifications - competitive benchmarking analysis - house of quality.

MODULE II CONCEPT GENERATION, SELECTION AND TESTING 10

Need for creative thinking and innovation - creativity and problem solving - activities of concept generation - clarify the problem - search externally and internally - explore systematically - reflect on the solutions and process - concept selection - concept screening - concept scoring - concept testing - protocol of concept testing.

MODULE III PRODUCT ARCHITECTURE 08

Concept embodiment design - product architecture - types of modular architecture - implications of the architecture - product change - variety - component standardization - product performance - manufacturability - product development management - establishing the product architecture - related system level design issues - portfolio architecture

MODULE IV INDUSTRIAL DESIGN 08

Integrated process design - integrating CAE, CAD and CAM tools - need for industrial design - impact - industrial design process - management of design process - technology driven and user driven products - assessing the quality of industrial design - robust design.

MODULE V ECONOMICS AND IMPLEMENTATION OF DESIGN 11

Design for 'X' (DFX) - environment - strength - manufacturing and assembly - estimation of manufacturing cost - reducing the cost of components, assembly and supporting production - prototyping - principles of prototyping - planning for prototypes - rapid prototyping - 3D printers - toy design - product development economics - introduction to patents and intellectual property

Total Hours: 45

REFERENCES:

1. Karl T.Ulrich, Steven D.Eppinger, Anita Goyal, "Product Design and Development ", 4th Edition, 2009, Tata McGraw-Hill Education, ISBN-10-007-14679-9
2. Kevin Otto, Kristin Wood, "Product Design", Indian Reprint 2013, Pearson Education, New Delhi, ISBN 9788177588217
3. George E.Dieter, Linda C.Schmidt, "Engineering Design", McGraw-Hill International Edition, 4th Edition, 2009, ISBN 978-007-127189-9
4. Yousef Haik, T. M. M. Shahin, "Engineering Design Process", (2nd Edition – 2010 reprint), Cengage Learning, ISBN 0495668141
5. G.Pahl, and W. Beitz, "Engineering Design – A Systematic Approach", Springer- Verlag, 1996

COURSE OUTCOMES:

Upon satisfactory completion of the course, the student will be able to:

- Identify the role and integration of customer, marketing, finance, design and production in creating a new product
- Apply structured approach to generate the concepts, selection and testing
- Construct the geometrical layout of product in architecture way
- Describe the industrial design and quality of product design
- Demonstrate the physical model preparation and analyze the cost reduction techniques
- Effectively communicate the solutions of engineering or societal context

MEC6202 ADVANCED METROLOGY AND NDT

L	T	P	C
3	0	2	4

COURSE EDUCATIONAL OBJECTIVES:

- To train the students in recent measurement systems
- To educate the students on laser based measuring instruments usage
- To gain knowledge in liquid penetrant and magnetic particle test
- To impart knowledge in radiography and its applications
- To perceive ultrasonic and acoustic emission techniques

MODULE I MEASURING MACHINES 15

Tool Maker's microscope - Coordinate measuring machine (CMM)- Universal measuring machine - Machine vision technology -Microprocessors in metrology- Nano-metrology -Measurement system analysis.

Practices on Tool Makers Microscope- - Machine vision technology and surface roughness measurement- CMM

MODULE II LASER METROLOGY 12

Precision instruments based on laser-Principles- laser interferometer-application in linear, angular measurements and machine tool metrology- need, constructional features – types, applications – computer aided inspection.

Practices on measuring the quality using linear measuring Instruments

MODULE III LIQUID PENETRANT AND MAGNETIC PARTICLE TESTS 12

Characteristics of liquid penetrates - Different washable systems – Developers - Applications - Methods of production of magnetic fields - Principles of operation of magnetic particle test - Applications - Advantages and limitations.

Practices on Liquid Penetrant and Magnetic Particle Tests

MODULE IV RADIOGRAPHY 12

Sources of ray-x-ray production - Properties of gamma and x rays – Film characteristics - Exposure charts - Contrasts - Operational characteristics of x ray equipment - Applications.

MODULE V ULTRASONIC AND ACOUSTIC EMISSION TECHNIQUES 09

Production of ultrasonic waves - Different types of waves – General characteristics of waves - Pulse echo method - A, B, C scans - Principles of acoustic emission

techniques - Advantages and limitations – Instrumentation and applications.

Total Hours: 60

REFERENCES:

1. Jain, R.K. Engineering Metrology, Khanna Publishers, 1997.
2. Barry Hull and Vernon John, Non Destructive Testing, MacMillan, 1988.
3. American Society for Metals, Metals Hand Book, Vol. II, 1976.
4. I. G. Scott, Basic Acoustic Emission, CRC Press, 1991.

COURSE OUTCOMES:

Students should be able to

- Measure various engineering specifications using recent measurement system
- Use advanced measurement tools such as CMM
- Adopt liquid penetrant and magnetic particle test for engineering applications
- Execute radiography techniques
- Perform ultrasonic and acoustic emission techniques

MEC6203 FLEXIBLE MANUFACTURING SYSTEMS

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To understand the swiftness and flexibility of changes in the manufacturing technology.
- To learn the FMS components and its layouts.
- To understand the tool magazines in FMS
- To acquire knowledge on suitable material handling systems used in FM cell.
- To acquire knowledge about the software used in FMS.

MODULE I INTRODUCTION TO FMS 09

Evolution of Manufacturing systems, Definition, Objective and Need, Components, Merits, Demerits and Applications Flexibility in Pull and Push type.

MODULE II LAYOUTS OF FMS 09

Layouts and their Salient features, Single line, dual line, loop, ladder, robot centre type etc. Group Technology.

MODULE III PROCESSING STATIONS 09

Salient features Machining Centers, Turning Centre, Coordinate measuring machine (CMM), Washing/Deburring station.

MODULE IV MATERIAL HANDLING SYSTEM 09

An introduction, Conveyor, Robots, Automated Guided Vehicle (AGV), Automated Storage Retrieval System (ASRS)s.

MODULE V COMPUTER SOFTWARE, SIMULATION AND DATABASE OF FMS 09

System issues, Types of software, specification and selection, Trends, Application of simulation, Software, Manufacturing data systems, data flow, CAD/CAM considerations, Planning FMS database; Typical case studies-future prospects.

.

Total Hours: 45

REFERENCES:

1. William W Luggen, “Flexible Manufacturing Cells and System” Prentice Hall of Inc New Jersey, 1991.
2. Reza A Maleki “Flexible Manufacturing System” Prentice Hall of Inc New Jersey, 1991.
3. John E Lenz “Flexible Manufacturing” marcel Dekker Inc Newyork, 1989.
4. Groover, M.P “Automation, Production Systems and Computer Integrated Manufacturing”, Prentice Hall of India Pvt Ltd. New Delhi 2009.

COURSE OUTCOMES:

The students will be able to

- Classify and differentiate FMS with other manufacturing systems including job-shop and mass production systems.
- Comprehend the FMS components and layouts and plan the FMS layouts.
- Illustrate the tool management in FMS.
- Explain processing stations and material handling systems used in FMS environments.
- Analyze FMS using simulation and analytical techniques

MEC6204 DESIGN PROJECT

L	T	P	C
0	0	2	1

The main objective is to inculcate problem based learning and to promote team spirit. Students will be asked to take a real world problem in CAD / CAM and solve it by designing a system or/ and simulate in the CAM software. Students will work in groups.

SEMESTER III

MEC7102	NON LINEAR FINITE ELEMENT ANALYSIS	L	T	P	C
		1	0	0	1

COURSE EDUCATIONAL OBJECTIVES:

- To introduce nonlinear FEA analysis procedures considering geometric, material nonlinearity.
- Designed to broaden the class of physical problems such as beam, plates, shells, contact and impact nonlinearity solved by FEA method.

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MODULE I NON LINEAR FININTE ELEMENT BASICS 07

Basic Nonlinear Continuum Mechanics of Solids, Total and Updated Lagrangian Approaches – Non linear bending of beams - Nonlinear Plates and Shells, Time-dependent Deformation of Shells.

MODULE II NON LINEAR FINITE ELEMENTS OF SOLIDS 08

Material Nonlinearities, Geometric Nonlinearities, Nonlinear Elasticity, Plasticity, Viscoplasticity, Viscoelasticity, Stability, bifurcation and nonlinear buckling, Contact and impact nonlinearity.

Total Hours: 15

REFERENCES:

1. Cook R. D., Finite Element Modelling for Stress Analysis, John Wiley and
2. Sons Inc, 1995
3. Reddy, J. N., An Introduction to Nonlinear Finite Element Analysis, Oxford
4. University Press, Oxford, UK, 2004.
5. E.A. de Souza Neto, D. Peric and D.R.J. Owen: Computational Methods for Plasticity: Theory and Applications, Wiley, 2008

COURSE OUTCOMES:

The students will be able to

- Decide whether or not a nonlinear analysis is necessary.
- Explain the different steps of a nonlinear finite element analysis.
- Perform nonlinear FEA of real engineering problems such that a drop test or sheet metal forming.
- Interpret the results of a nonlinear analysis.

MEC7103 INDUSTRY INTERNSHIP

L	T	P	C
0	0	0	1

Students must undergo two weeks industrial training preferably in the industries relevant to CAD/ CAM to gain practical experience.

MEC7101 PROJECT WORK - PHASE I

L	T	P	C
0	0	12	6

The main objective is to promote project based learning.

(Refer to clause 3.15 of B.S. Abdur Rahman University regulations)

SEMESTER IV

		L	T	P	C
MEC7101	**PROJECT WORK - PHASE II**	**0**	**0**	**36**	**18**

This is in continuation with Phase I. The main objective is to promote project based learning.

(Refer to clause 3.15 of B.S. Abdur Rahman University regulations)

PROFESSIONAL ELECTIVES ON CAD

MECY001	ADVANCED MECHANISMS DESIGN AND SIMULATION	L	T	P	C
		3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To familiarize basics concepts of mechanism design.
- To provide knowledge in the kinematic analysis of simpler mechanisms.
- To introduce concepts and theories for complex mechanism design.
- To learn the art of synthesis of mechanism.
- To realize the importance of special purpose mechanism.

MODULE I INTRODUCTION 09

Review of fundamentals of kinematics-classifications of mechanisms-components of mechanisms – mobility analysis – formation of one D.O.F. multi loop kinematic chains, Network formula – Gross motion concepts-Basic kinematic structures of serial and parallel robot manipulators-Compliant mechanisms-Equivalent mechanisms.

MODULE II KINEMATIC ANALYSIS 09

Position Analysis – Vector loop equations for four bar, slider crank, inverted slider crank, geared five bar and six bar linkages. Analytical methods for velocity and acceleration Analysis– four bar linkage jerk analysis. Plane complex mechanisms-auxiliary point method. Spatial RSSR mechanism-Denavit-Hardenberg Parameters – Forward and inverse kinematics of robot manipulators.

MODULE III PATH CURVATURE THEORY, COUPLER CURVE 09

Fixed and moving centrodes, inflection points and inflection circle. Euler Savary equation, graphical constructions – cubic of stationary curvature. Four bar coupler curve-cusp-crunode-coupler driven six-bar mechanisms-straight line mechanisms.

MODULE IV SYNTHESIS OF FOUR BAR MECHANISMS 09

Type synthesis – Number synthesis – Associated Linkage Concept. Dimensional synthesis – function generation, path generation, motion generation. Graphical methods-Pole technique-inversion technique-point position reduction-two, three and four position synthesis of four- bar mechanisms. Analytical methods-Freudenstein’s Equation-Bloch’s Synthesis.

MODULE V SYNTHESIS OF COUPLER CURVE BASED MECHANISMS & CAM MECHANISMS 09

Cognate Linkages-parallel motion Linkages. Design of six bar mechanisms-single dwell-double dwell-double stroke. Geared five bar mechanism-multi-dwell. Cam Mechanisms- determination of optimum size of cams. Mechanism defects. Study and use of Mechanism using Simulation Soft-ware packages. Students should design and fabricate a mechanism model as term project.

Total Hours: 45

REFERENCES:

1. Robert L.Norton., “Design of Machinery”,Tata McGraw Hill, 2005.
2. Sandor G.N., and Erdman A.G., “Advanced Mechanism Design Analysis and Synthesis”, Prentice Hall, 1984.
3. Uicker, J.J., Pennock, G. R. and Shigley, J.E., “Theory of Machines and Mechanisms”, Oxford University Press, 2005.
4. Amitabha Ghosh and Asok Kumar Mallik, “Theory of Mechanism and Machines”, EWLP, Delhi, 1999.
5. Kenneth J, Waldron, Gary L. Kinzel, “Kinematics, Dynamics and Design of Machinery”, John Wiley-sons, 1999.
6. Ramamurti, V., “Mechanics of Machines”, Narosa, 2005.

COURSE OUTCOMES:

Students will be able to

- Understand the fundamentals of kinematics and network formula.
- Perform displacement analysis, velocity and acceleration for planar mechanisms
- Apply path curvature theory to design complex mechanism.
- Synthesize a mechanism for a motion and function generation
- Design and fabricate simple mechanisms for single dwell , double dwell period

MECY002 ADVANCED STRENGTH OF MATERIALS

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To understand the stress strain relations and location of shear centers.
- To study and analyze stress and deflections in curved beams.
- To understand the stresses in flat plates.
- To study and analyze torsional stresses in thin walled tubes and non-circular sections.
- To understand the stresses in rotary sections and contacts.

MODULE I ELASTICITY 09

Stress-Strain relations and general equations of elasticity in Cartesian, Polar and curvilinear coordinates, differential equations of equilibrium-compatibility-boundary conditions-representation of three-dimensional stress of a tension generalized Hooke's law - St. Venant's principle - plane stress - Airy's stress function. Energy methods.

MODULE II SHEAR CENTER AND UNSYMMETRICAL BENDING 10

Location of shear center for various thin sections - shear flows. Stresses and deflections in beams subjected to unsymmetrical loading-kern of a section.

MODULE III CURVED FLEXIBLE MEMBERS AND STRESSES IN FLAT PLATES 10

Circumference and radial stresses – deflections - curved beam with restrained ends - closed ring subjected to concentrated load and uniform load - chain links and crane hooks. Solution of rectangular plates – pure bending of plates – deflection – uniformly distributed load – various end conditions.

MODULE IV TORSION OF NON-CIRCULAR SECTIONS 07

Torsion of rectangular cross section - St. Venants theory - elastic membrane analogy - Prandtl's stress function - torsional stress in hollow thin walled Stress

MODULE V STRESSES IN ROTARY SECTIONS AND CONTACT STRESSES 09

Radial and tangential stresses in solid disc and ring of uniform thickness and varying thickness allowable speeds. Methods of computing contact stress-deflection of bodies in point and line contact applications.

Total Hours: 45

REFERENCES:

1. Arthur P Boresi, Richard J. Schmidt, “Advanced mechanics of materials”, John Wiley, 2002.
2. Timoshenko and Goodier, "Theory of Elasticity", McGraw Hill.
3. Robert D. Cook, Warren C. Young, "Advanced Mechanics of Materials", Mc millan pub. Co., 1985.
4. Srinath. L.S., “Advanced Mechanics of solids”, Tata McGraw Hill, 1992.
5. Ryder G H ,Strength of Materials Macmillan, India Ltd, 2007

COURSE OUTCOMES:

Students will be able to

- Analyze two and three dimensional complex stress problems.
- Compute stresses and deflections in beams subjected to unsymmetrical loading.
- Critique stresses in curved beams and flat plates.
- Analyze and solve torsion of non-circular sections.
- Evaluate problems arising from stresses in rotary sections and contact applications

MECY003 ADVANCED TOOL DESIGN

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To learn tool design methods and techniques of manufacturing dies and its accessories.
- To acquire knowledge on different materials available for cutting tools and necessary heat treatment procedures to get the required properties.
- To acquire knowledge in selecting suitable materials for calibrating and inspecting gauges.
- To learn to design fixtures for various machining and metal forming operations.
- To acquire knowledge on designing fixtures and cutting tools for NC machine tools.

MODULE I TOOL DESIGN METHODS 05

Introduction – The Design Procedure – Statement of the problem – The Needs Analysis –Research and Ideation – Tentative Design Solutions – The Finished Design – Drafting and Design Techniques in Tooling drawings – Screws and Dowels – Hole location – Jig-boring practice –Installation of Drill Bushings – Punch and Die Manufacture – Electro-discharge machining –Electro-discharge machining for cavity.

MODULE II TOOLING MATERIALS AND HEAT TREATMENT 09

Introduction – Properties of Materials – Ferrous Tooling Materials – Tool steels – Cast Iron – Mild, or low-carbon Steel – Nonmetallic Tooling Materials – Nonferrous Tooling Materials – Metal cutting Tools – Single-point cutting tools – Milling cutters – Drills and Drilling – Reamer classification –Taps – Tap classification- the selection of carbide cutting tools – Determining the insert thickness for carbide tools.

MODULE III DESIGN OF DRILL JIGS 09

Introduction – Fixed Gages – Gage Tolerances – The selection of material for Gages – Indicating Gages – Automatic gages – Principles of location – Locating methods and devices – Principles of clamping – Drill jigs – Chip formation in drilling – General considerations in the design of drill jigs – Drill bushings – Methods of construction – Drill jigs and modern manufacturing.

MODULE IV DESIGN OF FIXTURES AND DIES 14

Introduction – Fixtures and economics – Types of Fixtures – Vise Fixtures – Milling Fixtures –Boring Fixtures – Broaching Fixtures – Lathe Fixtures – Grinding Fixtures – Types of Die construction – Die-design fundamentals – Blanking and Piercing die construction – Pilots – Strippers and pressure pads Presswork materials – Strip layout – Short-run tooling for Piercing – Bending dies – Forming dies – Drawing operations.

MODULE V TOOL DESIGN FOR NUMERICALLY CONTROLLED MACHINE TOOLS 08

Introduction – The need for numerical control – A basic explanation of numeric control – Numerical control systems in use today – Fixture design for numerically controlled machine tools – Cutting tools for numerical control – Tool holding methods for numerical control – Automatic tool changers and tool positioners – Tool presetting – Introduction – General explanation of the Brown and sharp machine – tooling for Automatic screw machines.

Total Hours: 45

REFERENCES:

1. Cyrll Donaldson, George H.LeCain, V.C. Goold, “Tool Design”, Tata McGraw Hill Publishing Company Ltd., 2000.
2. Prakash Hiralal Joshi, “Tooling data”, Wheeler Publishing, 2000.

COURSE OUTCOMES:

Students will be able to

- Summarize tool design methods and punch and die manufacturing techniques
- Judge in selecting materials for cutting tools and identify their nomenclature.
- Identify the materials for gauges and to make them with the available technology
- Design fixtures for milling, boring, lathe, grinding and welding
- Design and analyse fixtures and cutting tools for NC machine tools

MECY004 COMPUTATIONAL FLUID DYNAMICS

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To understand the equations describing fluid flow and numerical solutions to these equation.
- To teach the concepts of conduction of heat through solids in steady and transient state.
- To learn the methods to solve the governing equations of an incompressible fluid flow.
- To apply computational method to solve convection heat transfer.
- To introduce different turbulence models for accurate prediction of fluid flow.

MODULE I GOVERNING DIFFERENTIAL EQUATION AND FINITE DIFFERENCE METHOD 10

Classification, Initial and Boundary conditions – Initial and Boundary Value problems – Finite difference method, Central, Forward, Backward difference, Uniform and non-uniform Grids, Numerical Errors, Grid Independence Test.

MODULE II CONDUCTION HEAT TRANSFER 10

Steady one dimensional conduction, two and three dimensional steady state problems, Transient one dimensional problem, Two-dimensional Transient Problems.

MODULE III INCOMPRESSIBLE FLUID FLOW 10

Governing Equations, Stream Function – Verticity method, Determination of pressure for viscous flow, SIMPLE Procedure of Patankar and Spalding, Computation of Boundary layer flow, finite difference approach.

MODULE IV CONVECTION HEAT TRANSFER AND FEM 10

Steady One-Dimensional and Two-Dimensional Convection – diffusion, unsteady one-dimensional convection – diffusion, Unsteady two-dimensional convection – Diffusion – Introduction to finite element method – solution of steady heat conduction by FEM – Incompressible flow – simulation by FEM.

MODULE V TURBULENCE MODELS 05

Algebraic Models – One equation model, K – ε Models, Standard and High and Low Reynolds number models, Prediction of fluid flow and heat transfer using

standard codes.

Total Hours: 45

REFERENCES:

1. Muralidhar, K., and Sundararajan, T., “Computational Fluid Flow and Heat Transfer”, Narosa Publishing House, New Delhi, 1995.
2. Ghoshdasdidar, P.S., “Computer Simulation of flow and heat transfer” Tata McGraw-Hill Publishing Company Ltd., 1998.
3. Subas, V.Patankar “Numerical heat transfer fluid flow”, Hemisphere Publishing Corporation, 1980.
4. Taylor, C and Hughes, J.B. “Finite Element Programming of the Navier-Stokes Equation”, Pineridge Press Limited, U.K., 1981.
5. Anderson, D.A., Tannehill, J.I., and Pletcher, R.H., “Computational fluid Mechanics and Heat Transfer “ Hemisphere Publishing Corporation, New York, USA,1984.
6. Fletcher, C.A.J. “Computational Techniques for Fluid Dynamics 1” Fundamental and General Techniques, Springer – Verlag, 1987.
7. Fletcher, C.A.J. “Computational Techniques for fluid Dynamics 2” Specific Techniques for Different Flow Categories, Springer – Verlag, 1987.Bose, T.X., “Numerical Fluid Dynamics” Narosa Publishing House, 1997.

COURSE OUTCOMES:

Students will be able to

- solve heat conduction problems numerically.
- describe the methods of discretize a partial differential equation
- understand standard algorithms applied for solving incompressible fluid flow
- apply FEM to solve a convection heat transfer problem
- choose the best turbulence model for the flow analysis encounters turbulence.

MECY005 COMPUTER AIDED PROCESS PLANNING

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To provide basic knowledge on process planning in a manufacturing cycle
- To impart knowledge on geometrical representation of part design
- To provide knowledge on process planning methodology
- To inculcate systematic process planning using computers
- To provide knowledge on integration of various process planning systems

MODULE I INTRODUCTION 09

The Place of Process Planning in the Manufacturing cycle - Process Planning and Production Planning – Process Planning and Concurrent Engineering, CAPP, Group Technology.

MODULE II PART DESIGN REPRESENTATION 09

Design Drafting - Dimensioning - Conventional tolerance - Geometric tolerance - CAD - input / output devices - topology - Geometric transformation - Perspective transformation - Data structure - Geometric modelling for process planning - GT coding - The optiz system - The MICLASS system.

MODULE III PROCESS ENGINEERING AND PROCESS PLANNING 09

Experienced, based planning - Decision table and decision trees - Process capability analysis - Process Planning - Variant process planning - Generative approach - Forward and Backward planning, Input format, Al.

MODULE IV COMPUTER AIDED PROCESS PLANNING SYSTEMS 09

Logical Design of a Process Planning - Implementation considerations - manufacturing system components, production Volume, No. of production families - CAM-I, CAPP, MIPLAN, APPAS, AUTOPLAN and PRO, CPPP.

MODULE V AN INTERGRADED PROCESS PLANNING SYSTEMS 09

Totally integrated process planning systems - An Overview - Modulus structure - Data Structure, operation - Report Generation, Expert process planning.

Total Hours: 45

REFERENCES:

1. Gideon Halevi and Roland D. Weill, “Principles of Process Planning ", A logical approach, Chapman & Hall, 1995.
2. Tien-Chien Chang, Richard A.Wysk, "An Introduction to automated process planning systems ", Prentice Hall, 1985.
3. Chang, T.C., “An Expert Process Planning System ", Prentice Hall, 1985.
4. Nanua Singh, “Systems Approach to Computer Integrated Design and Manufacturing ", John Wiley & Sons, 1996.
5. Rao, “Computer Aided Manufacturing ", Tata McGraw Hill Publishing Co., 2000.

COURSE OUTCOMES:

At the end of the course students will be able to

- Analyse process planning in a manufacturing cycle
- Analyse and model the geometrical representation of parts
- Analyse the methodology on processes and their planning
- Designing the process planning systems
- Analyse and design the advanced process planning systems

MECY006	DESIGN OF HYDRAULIC & PNEUMATIC SYSTEMS	L	T	P	C
		3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To learn the various hydraulic power system and their components.
- To understand the various components of fluid power system.
- To understand the designing of various hydraulic power circuits for a particular application.
- To acquire knowledge on the similarities between hydraulic and pneumatic power and to design various pneumatic circuits for industrial application.
- To understand the electro-hydraulic and electro-pneumatic circuits and their maintenance.

MODULE I OIL HYDRAULIC SYSTEMS AND ACTUATORS 05

Hydraulic Power Generators - Selection and specification of pumps, pump characteristics. Hydraulic actuators - Linear and Rotary Actuators - selection, specification and characteristics.

MODULE II CONTROL AND REGULATION ELEMENTS 10

Pressure, direction and flow control valves - relief valves, non return and safety valves – actuation systems.

MODULE III HYDRAULIC CIRCUITS 08

Reciprocation, quick return, sequencing, synchronizing circuits - accumulator circuits – industrial circuits –Hydraulic press circuits - milling machine, grinding, planning, copying, forklift, and earth mover circuits - design and selection of components - safety and emergency manuals.

MODULE IV PNEUMATIC SYSTEMS AND CIRCUITS 15

Pneumatic fundamentals - control elements, position and pressure sensing - logic circuits - switching circuits - fringe conditions modules and their integration - sequential circuits – cascade methods - mapping methods – step counter method - compound circuit design – combination circuit design.

MODULE V INSTALLATION, MAINTENANCE AND SPECIAL CIRCUITS 07

Pneumatic equipments - selection of components - design calculations - application - fault finding –hydro pneumatic circuits - use of microprocessors for

sequencing - PLC, Low cost automation - Robotic circuits.

Total Hours: 45

REFERENCES:

1. Antony Espossito, “Fluid power with Applications”, Prentice Hall, 1980.
2. Dudleyt, A.Pease and John J.Pippenger, “Basic Fluid Power”, Prentice Hall, 1987.
3. Andrew Parr, “Hydraulic and Pneumatics”, (HB), Jaico Publishing House, 1999.
4. Bolton. W. “Pneumatic and Hydraulic Systems”, Butterworth - Heineman, 1997.
5. Majumdar, “Oil Hydraulics Systems: Principles and Maintenance” Tata McGraw Hill, 2004
6. Majumdar, “Pneumatic system : Principles and Maintenance” Tata McGrawHill, 2004.

COURSE OUTCOMES:

- Students will be able to classify the various fluid power system and their applications.
- Students will be able to illustrate important components of fluid power used in power packs.
- Students will be able to design and analyze fluid power circuits for a specific application.
- Students will be able to summarize the modern controls for fluid power system and their maintenance.

MECY007 DESIGN OF MATERIAL HANDLING EQUIPMENT

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To acquire knowledge of different material handling equipment and its selection.
- To learn the different types of hoist and its accessories.
- To understand the various drives of hoisting gear.
- To gain knowledge on variety of conveyors for specific applications.
- To obtain a basic understanding of vertical transportation.

MODULE I MATERIALS HANDLING EQUIPMENT 05

Types, selection and applications

MODULE II DESIGN OF HOISTS 10

Design of hoisting elements: Welded and roller chains - Hemp and wire ropes - Design of ropes, pulleys, pulley systems, sprockets and drums, Load handling attachments. Design of forged hooks and eye hooks – crane grabs - lifting magnets - Grabbing attachments - Design of arresting gear - Brakes: shoe, band and cone types.

MODULE III DRIVES OF HOISTING GEAR 10

Hand and power drives - Traveling gear - Rail traveling mechanism - cantilever and monorail cranes - slewing, jib and luffing gear - cogwheel drive - selecting the motor ratings.

MODULE IV CONVEYORS 10

Types - description - design and applications of Belt conveyors, apron conveyors and escalators Pneumatic conveyors, Screw conveyors and vibratory conveyors.

MODULE V ELEVATORS 10

Bucket elevators: design - loading and bucket arrangements - Cage elevators - shaft way, guides, counter weights, hoisting machine, safety devices - Design of fork lift trucks.

Total Hours: 45

REFERENCES:

1. Rudenko, N., Materials handling equipment, ELnvee Publishers, 1970.
2. Spivakovsy, A.O. and Dyachkov, V.K., Conveying Machines, Volumes I and II, MIR Publishers, 1985.
3. Alexandrov, M., Materials Handling Equipments, MIR Publishers, 1981.
4. Boltzharol, A., Materials Handling Handbook, The Ronald Press Company, 1958.
5. P.S.G. Tech., “Design Data Book”, Kalaikathir Achchagam, Coimbatore, 2003.
6. Lingaiah. K. and Narayana Iyengar, “Machine Design Data Hand Book”, Vol.1 & 2, Suma Publishers, Bangalore, 1983

COURSE OUTCOMES:

At the end of the course students will be able to

- Analyse various material handling equipment
- Designing of hoists for material handling
- Analyse and design typical drives and gears for hoists
- Analyse and select various conveyor systems for material transfer
- Analyse the components and accessories of elevators for material handling

MECY008	INDUSTRIAL ROBOTICS AND FLEXIBLE AUTOMATION	L	T	P	C
		3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To provide basic knowledge on kinematics of robots
- To impart knowledge on various drives and controls for robotics
- To provide in knowledge on typical sensors and their applications in robotics
- To impart detailed knowledge on various automation systems in robotics
- To provide knowledge on robot programming

MODULE I INTRODUCTION AND ROBOT KINEMATICS 10

Definition need and scope of Industrial robots – Robot anatomy – Work volume – Precision movement – End effectors – Sensors. Robot Kinematics – Direct and inverse kinematics – Robot trajectories – Control of robot manipulators – Robot dynamics – Methods for orientation and location of objects.

MODULE II ROBOT DRIVES AND CONTROL 09

Controlling the Robot motion – Position and velocity sensing devices – Design of drive systems – Hydraulic and Pneumatic drives – Linear and rotary actuators and control valves – Electro hydraulic servo valves, electric drives – Motors – Designing of end effectors – Vacuum, magnetic and air operated grippers.

MODULE III ROBOT SENSORS 09

Transducers and Sensors – Sensors in Robot – Tactile sensor – Proximity and range sensors – Sensing joint forces – Robotic vision system – Image Grabbing – Image processing and analysis – Image segmentation – Pattern recognition – Training of vision system.

MODULE IV ROBOT FOR FLEXIBLE AUTOMATION 09

Robot work cell design and control – Safety in Robotics – Robot cell layouts – Multiple Robots and machine interference – Robot cycle time analysis. Industrial application of robots.

MODULE V ROBOT PROGRAMMING, AI & EXPERT SYSTEMS 08

Methods of Robot Programming – Characteristics of task level languages lead through programming methods – Motion interpolation. Artificial intelligence – Basics – Goals of artificial intelligence – AI techniques – problem representation in

AI – Problem reduction and solution techniques - Application of AI and KBES in Robots.

Total Hours: 45

REFERENCES:

1. Fu .K.S., R.C. Gonzalez and C.S.G. Lee, “Robotics Control, Sensing, Vision and Intelligence”, Mc Graw Hill, 1987.
2. Yoram Koren, “Robotics for Engineers”, Mc Graw-Hill, 1987.
3. Kozyrey, Yu. “Industrial Robots”, MIR Publishers Moscow, 1985.
4. Richard. D, Klafter, Thomas, A, Chmielewski, Michael Negin, “Robotics Engineering – An Integrated Approach”, Prentice-Hall of India Pvt. Ltd., 1984.
5. Deb, S.R. “Robotics Technology and Flexible Automation”, Tata Mc Graw-Hill, 1994.
6. Mikell, P. Groover, Mitchell Weis, Roger, N. Nagel, Nicholas G. Odrey, “Industrial Robotics Technology, Programming and Applications”, Mc Graw-Hill, Int. 1986.
7. Timothy Jordanides et al, “Expert Systems and Robotics”, Springer –Verlag, New York, May 1991.

COURSE OUTCOMES:

At the end of the course students will be able to

- Analyse kinematically the operation of robots
- Analyse and design various drives and controls for robotics
- Analyse and identify typical sensors in robotics as per their applications
- Analyse and identify suitable automation systems in robotics
- Analyse and Programming for intelligent robots

MECY009 MECHANICAL VIBRATIONS

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To understand how to apply theory of vibration to engineering problems and appreciate the importance of vibrations in mechanical design of machine parts that operates in vibratory conditions.
- To obtain linear vibratory models of dynamic systems with changing complexities (SDOF, MDOF)
- To familiarize the methods of controlling vibrations.
- To understand the methods of obtaining solution for a vibratory continuous systems.
- To learn the techniques for vibration isolation and balancing of masses.

MODULE I FUNDAMENTALS OF VIBRATION 08

Review of Single degree system - Response to arbitrary periodic exicitations - Duhamel's Integral – Impulse Response function - Virtual work - Lagrange's equation - Single degree freedom forced vibration with elastically coupled viscous dampers - System Identification from frequency response - Transient Vibration – Laplace transformation formulation.

MODULE II TWO - DEGREE FREEDOM SYSTEMS 08

Free vibration of spring - coupled system - mass coupled system - Bending vibration of two degree of freedom system - forced vibration - Vibration Absorber - Vibration isolation.

MODULE III MULTI-DEGREE FREEDOM SYSTEM 12

Normal mode of vibration - Flexibility Matrix and Stiffness matrix - Eigen values and Eigen vectors – orthogonal properties - Modal matrix-Modal Analysis - Forced Vibration by matrix inversion - Modal damping in forced vibration - Numerical methods for fundamental frequencies

MODULE IV VIBRATION OF CONTINUOUS SYSTEMS 08

Systems governed by wave equations - Vibration of strings - vibration of rods - Euler Equation for Beams -Effect of Rotary inertia and shear deformation - Vibration of plates.

MODULE V VIBRATION MEASURMENT AND CONTROL 09

Measurement of vibration, free and forced tests, FFT analyzer, Modal analysis, methods of vibration control, excitation reduction at source, balancing of rigid rotors, field balancing, detuning and decoupling,

Total Hours: 45

REFERENCES:

1. Thomson W T, "Theory of Vibration with Applications", Prentice Hall of India, 1997.
2. Singiresu S Rao "Mechanical Vibrations", Prentice Hall, 2010
3. Ashok Kumar Mallik, "Principles of Vibration Control", Affiliated East-West Press Pvt. Ltd, 1990.

COURSE OUTCOMES:

At the end of the course students will be able to

- To write the basic equations of motion of vibratory systems.
- To predict Eigen values and Eigen vectors of two -degrees of freedom systems.
- To apply numerical methods to solve a multi degree freedom subjected to different types of excitation.
- To obtain solution for a continuous system.
- To measure and process vibration signals and employ methods of vibration control.

MECY010 OPTIMIZATION TECHNIQUES IN DESIGN

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To provide basic knowledge on optimization requirements
- To impart knowledge on various types optimization techniques
- To provide in knowledge on multi objective optimization
- To impart detailed knowledge on various static applications of optimization
- To provide knowledge on dynamic applications of optimization

MODULE I INTRODUCTION 05

General Characteristics of mechanical elements, adequate and optimum design, principles of optimization, formulation of objective function, design constraints – Classification of optimization problem.

MODULE II OPTIMIZATION TECHNIQUES 10

Single variable and multivariable optimization, Techniques of unconstrained minimization – Golden section, Random, pattern and gradient search methods – Interpolation methods; Optimization with equality and inequality constraints.

MODULE III MULTI OBJECTIVE OPTIMIZATION 10

Direct methods – Indirect methods using penalty functions, Lagrange multipliers; Geometric programming and stochastic programming; Multi objective optimization, Genetic algorithms and Simulated Annealing techniques.

MODULE IV STATIC APPLICATIONS 10

Structural applications – Design of simple truss members. Design applications – Design of simple axial, transverse loaded members for minimum cost, maximum weight – Design of shafts and torsionall loaded members – Design of springs.

MODULE V DYNAMIC APPLICATIONS 10

Dynamic Applications – Optimum design of single, two degree of freedom systems, vibration absorbers. Application in Mechanisms – Optimum design of simple linkage mechanisms.

Total Hours: 45

REFERENCES:

1. Johnson Ray, C., “Optimum design of mechanical elements”, Wiley, John & Sons, 1990.
2. Goldberg, D.E., “Genetic algorithms in search, optimization and machine”, Barnen, Addison-Wesley, New York, 1989.
3. Kalyanamoy Deb, “Optimization for Engineering design algorithms and Examples”, Prentice Hall of India Pvt. 1995.

COURSE OUTCOMES:

At the end of the course students will be able to

- Analyse the need of optimization
- Analyse and identify suitable optimization technique
- Analyse multi objective optimization
- Analyse the various static applications of optimization
- Analyse the various dynamic applications of optimization

MECY011 TRIBOLOGY

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To understand the basic theories of tribology in industrial systems that experience friction and wear.
- To acquire knowledge on the methods to reduce the friction for engineering surface by the use of lubricants.
- To learn the basics of hydrodynamic theory of lubrication.
- To understand Hertz contact and rough surface contact and design methods of rolling bearings.
- To familiarize with the methods of testing friction and wear.

MODULE I SURFACES, FRICTION AND WEAR 08

Topography of Surfaces – Surface features – Surface interaction – Theory of Friction – Sliding and Rolling Friction, Friction properties of metallic and non-metallic materials – friction in extreme conditions – wear, types of wear – mechanism of wear – wear resistance materials – surface treatment – Surface modifications – surface coatings.

MODULE II LUBRICATION THEORY 08

Lubricants and their physical properties lubricants standards – Lubrication Regimes Hydrodynamic lubrication – Reynolds Equation, Thermal, inertia and turbulent effects – Elasto hydrodynamic and plasto hydrodynamic and magneto hydrodynamic lubrication – Hydro static lubrication – Gas lubrication.

MODULE III DESIGN OF FLUID FILM BEARINGS 12

Design and performance analysis of thrust and journal bearings – Full, partial, fixed and pivoted journal bearings design – lubricant flow and delivery – power loss, Heat and temperature rotating loads and dynamic loads in journal bearings – special bearings – Hydrostatic Bearing design.

MODULE IV ROLLING ELEMENT BEARINGS 10

Geometry and kinematics – Materials and manufacturing processes – contact stresses – Hertzian stress equation – Load divisions – Stresses and deflection – Axial loads and rotational effects, Bearing life capacity and variable loads – ISO standards – Oil films and their effects – Rolling Bearings Failures

MODULE V TRIBO MEASUREMENT IN INSTRUMENTATION 07

Surface Topography measurements – Electron microscope and friction and wear measurements – Laser method – instrumentation - International standards – bearings performance measurements – bearing vibration measurement.

Total Hours: 45

REFERENCES:

1. Cameron, A. “Basic Lubrication Theory”, Ellis Herward Ltd., OK, 1981
2. Hulling, J. (Editor) – “Principles of Tribology “, Macmillian – 1984.
3. Williams J.A. “Engineering Tribology”, Oxford Univ. Press, 1994.
4. Neale, M.J. “Tribology Hand Book”, Butterworth Heinemann, 1995.

COURSE OUTCOMES:

At the end of the course students will be able to

- Have a comprehensive, systematic and integrated knowledge of the principles of friction and wear.
- Have a clear picture about lubrication mechanism and how to apply them to the practical engineering problem.
- Design an efficient and robust tribological system such as hydrodynamic bearing and dry sliding bearings for the needs of a specific application.
- Explain Hertz contact and rough surface contact and design methods of rolling bearing.
- Asses and select suitable methods to measure friction and wear under different sliding conditions.

MECY012 MECHANICS OF COMPOSITE MATERIALS

L	T	P	C
2	0	0	2

COURSE EDUCATIONAL OBJECTIVES:

- To understand the constitutive equations of composite materials and learn mechanical behavior at micro and macro level.
- To learn the mechanical behavior of layered composites compared to isotropic materials.
- To calculate stresses and strains in composites.
- To understand mechanical behavior of composites due to variation in temperature and moisture.

MODULE I INTRODUCTION, LAMINA CONSTITUTIVE EQUATIONS 10

Lamina Constitutive Equations: Lamina Assumptions–Macroscopic Viewpoint. Generalized Hooke's Law. Reduction to Homogeneous Orthotropic Lamina–Isotropic limit case, Orthotropic Stiffness matrix (Qij), Definition of stress and Moment Resultants. Strain Displacement relations. Basic Assumptions of Laminated anisotropic plates. Laminate Constitutive Equations–Coupling Interactions, Balanced Laminates, Symmetric Laminates, Angle Ply Laminates, Cross Ply Laminates. Laminate Structural Moduli. Evaluation of Lamina Properties from Laminate Tests. Quasi-Isotropic Laminates. Determination of Lamina stresses within Laminates.

MODULE II LAMINA STRENGTH ANALYSIS AND ANALYSIS OF LAMINATED FLAT PLATES 10

Introduction- Maximum Stress and Strain Criteria. Von- Misses Yield criterion for Isotropic Materials. Generalized Hill's Criterion for Anisotropic materials. Tsai-Hill's Failure Criterion for Composites. Tensor Polynomial (Tsai-Wu) Failure criterion. Prediction of laminate Failure Equilibrium Equations of Motion. Energy Formulations. Static Bending Analysis. Buckling Analysis. Free Vibrations– Natural Frequencies

MODULE III THERMAL ANALYSIS 10

Assumption of Constant Co-efficient of Thermal Expansion (C.T.E.)-Modification of Hooke's Law. Modification of Laminate Constitutive Equations. Orthotropic Lamina C.T.E's. C.T.E's for special Laminate Configurations – Unidirectional, Off-axis, Symmetric Balanced Laminates, Zero C.T.E laminates, Thermally Quasi - Isotropic Laminates

Total Hours: 30

REFERENCES:

1. Gibson, R.F., Principles of Composite Material Mechanics, McGraw-Hill, 1994,
2. Second Edition-CRC press in progress.
3. Hyer, M.W., “Stress Analysis of Fiber–Reinforced Composite Materials”, McGraw-Hill, 1998
4. Issac M. Daniel and Ori Ishai, “Engineering Mechanics of Composite Materials”, Oxford University Press-2006, First Indian Edition-2007
5. Mallick, P.K., Fiber–”Reinforced Composites: Materials, Manufacturing and Design”, Maneel Dekker Inc, 1993.5.Halpin, J.C., “Primer on Composite Materials, Analysis”, Techomic Publishing Co., 1984.
6. Agarwal, B.D., and Broutman L.J., “Analysis and Performance of Fiber composites”, John Wiley and Sons, New York, 1990.
7. Mallick, P.K. and Newman, S., (edition), “Composite Materials Technology: Processes and Properties”, Hansen Publisher, Munish, 1990.
8. Madhujit Mukhopadhyay, “Mechanics of Composite Materials and Structures”, University Press (India) Pvt. Ltd., Hyderabad, 2004 (Reprinted 2008)
9. Chung, Deborah D.L., “Composite Materials: Science and Applications”, Ane Books Pvt. Ltd./Springer, New Delhi, 1st Indian Reprint, 2009

COURSE OUTCOMES:

At the end of this course, the students will be able to

- Apply constitutive equations of composite materials and understand mechanical behavior at micro and macro level.
- Explain the specifics of mechanical behavior of layered composites compared to isotropic materials.
- Determine stresses and strains in composites.
- Analyze mechanical behavior of composites due to variation in temperature and moisture.

MECY013	GEOMETRIC DIMENSIONING AND TOLERANCING	L	T	P	C
		1	0	0	1

COURSE EDUCATIONAL OBJECTIVES:

- To teach the principles of geometric product definition
- To educate the students on types of tolerances.

MODULE I INTRODUCTION 05

Introduction to limits fits and tolerances – GDNT definitions and importance -Datum reference frame – Feature control frame - MMC & LMC – General Rules – Datum System.

MODULE II PRINCIPLES OF MEASUREMENT FOR GEOMETRIC CHARACTERISTICS 10

Geometric characteristic symbols and meanings – Form tolerances – Profile tolerances – Location tolerances – Runout tolerances – Orientation tolerances – True position theory – Dimensional and tolerance schemes

Total Hours: 15

REFERENCES

1. ASME Y – 14.5
2. Rao Ming, Harry Peck, “Designing for Manufacture” , Pitman Publications, London, 1983.
3. Krulikowski. A, “Fundamentals of Geomtric Dimensioning and Tolerancing”, Delmar Publishers – New York, 1997
4. Spotts. M.F, “Dimensioning and Tolerance for Quality Production”, Prentice Hall Inc., New Jersey, 1983.
5. Oliver R Wade, “Tolerance Control in Design and Manufacturing”, Industrial Press Inc., New York, 2008.

COURSE OUTCOMES:

Students should be able to

- Analyze situations and proceed to the logical end to solve product’s geometric definitions in order to function and be cost effective.
- Totally consider function, manufacturing process and inspection methods in order to guarantee function with reduction in manufacturing and inspection cost.

PROFESSIONAL ELECTIVES ON CAM

		L	T	P	C
MECY014	**ADVANCES IN MANUFACTURING TECHNOLOGY**	**3**	**0**	**0**	**3**

COURSE EDUCATIONAL OBJECTIVES:

- To understand the wear mechanism in cutting tools and to predict its life.
- To learn the special machining process in creating holes and finishing it.
- To assess the principle and mechanism of metal removal of various unconventional machining processes.
- To understand the concept of various micro fabrication technology
- To explore the current scope, potential, limitations and implications of intelligent systems.

MODULE I METAL CUTTING AND TOOL MATERIALS 12

Orthogonal and oblique cutting - Types of tool wear, Abrasion, Diffusion, Oxidation, Fatigue and Adhesive wear - Prediction of tool life - Monitoring of tool wear, Cutting forces and vibration – Tool materials, Cemented carbide, Coated carbide, Cermets, Ceramic, CBN and PCD - Selection of machining parameters and Tools.

MODULE II SPECIAL MACHINING 09

Deep hole drilling - Gun drills - Gun boring - Trepanning - Honing - Lapping - Super finishing - Burnishing - Broaching - High speed machining.

MODULE III UNCONVENTIONAL MACHINING 09

Principles, processes, Various influencing parameters and Applications of Ultrasonic machining, Electro Discharge Machining, Electro Chemical Machining, Electron and Laser Beam Machining, Plasma Arc Machining and Water Jet Machining.

MODULE IV MICROFABRICATION 06

Wafer preparation – monolithic processing – moulding – Printed circuit board hybrid and multi-chip module technology –electronic material and processing– stereolithographic surface acoustic wave (SAW) devices, Surface Mount Technology.

MODULE V ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS 09

Introduction - Pattern recognition - Control strategies - Heuristic search, Forward and Backward reasoning - Search algorithms - Game playing - Knowledge

representation - structural representation of knowledge – Expert systems in manufacturing.

Total Hours: 45

REFERENCES:

1. Armarego E.J.A. and Brown R.H., “The machining of metals ", Prentice Hall, 1982.
2. Battacharya," Theory of metal cutting ", NCB Agency, 1984.
3. HMT Manual, “Non-traditional machining methods ", 1975.
4. More Madon, Fundamentals of Microfabrication, CRC Press, 1997.
5. Rich E. and Knight K., “Artificial Intelligence ", McGraw Hill Inc, 1991.
6. Pham D.T., “Expert Systems in Engineering ", IFS Publishers, Springer-Verlag, 1988.
7. Durvent W.R., “The Lithographic hand book ", Narosa Publishers, 1995.
8. Pandey P.S. and Shah N. “Modern Manufacturing Processes ", 1980.
9. Sadasivan T.A. and Sarathy D. “Cutting tools for Productive Machining ", Widia (India) Limited, 1999.

COURSE OUTCOMES:

Students will be able

- To distinguish different materials used for cutting tools and to select the machining parameters for improving the tool life.
- To demonstrate various types of machining that can be carried out in special purpose machines.
- To identify the process parameters, their effect and applications of different processes.
- To realize the applications of Micro fabrication technology.
- To apply basic principles of AI in solutions that require problem solving, knowledge representation and learning

MECY015	CNC MACHINES AND COMPUTER AIDED MANUFACTURING	L	T	P	C
		3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To provide knowledge on basic concepts of computer aided manufacturing
- To impart knowledge on various components and structures of CNC machine tool
- To provide knowledge on various accessories of CNC machines
- To impart knowledge on programming involved in Computer Aided Manufacturing system
- To expose on various tools needed for CNC machines and maintenance of CNC machines

MODULE I INTRODUCTION TO CNC MACHINE TOOLS 07

Development of CNC Technology, principles, features, advantages, economic benefits, applications, CNC, DNC concept, classification of CNC Machine, types of control, CNC controllers, characteristics, interpolators.

MODULE II STRUCTURE OF CNC MACHINE TOOL 09

CNC Machine building, structural details, configuration and design, guideways - friction and anti friction and other types of guide ways, elements used to convert the rotary motion to a linear motion - Screw and nut, recirculating ball screw, planetary roller screw, recirculating roller screw, rack and pinion, torque transmission elements - gears, timing belts, flexible couplings, Bearings.

MODULE III DRIVES AND CONTROLS 09

Spindle drives - DC shunt motor, 3 phase AC induction motor, feed drives - stepper motor, servo principle, DC & AC servomotors. Open loop and closed loop control, Axis measuring system - synchro, synchro-resolver, gratings, moire fringe gratings, encoders, inductosyn, laser interferometer.

MODULE IV CNC PROGRAMMING 10

Coordinate system, structure of a part program, G & M Codes, Manual part programming for Fanuc, Heidenhain, Sinumeric control system, CAPP, APT part programming using CAD/CAM, Parametric Programming.

MODULE V TOOLING AND MAINTENANCE OF CNC 10

Cutting tool materials, carbide insets classification, qualified, semi qualified and preset tooling, tooling system for Machining centre and Turning centre, work

holding devices, maintenance of CNC Machines.

Total Hours: 45

REFERENCES:

1. HMT, Mechatronics, Tata McGraw-Hill Publishing Company Limited, New Delhi, 1998.
2. James Madison, “CNC Machining Hand Book ", Industrial Press Inc., 1996.
3. Steve Krar, Arthur Gill, “CNC Technology and Programming ", McGraw-Hill International Editions, 1990.
4. Berry Leathan - Jones, “Introduction to Computer Numerical Control ", Pitman, London, 1987.
5. Hans B.Kief, T.Fredericx Waters, “Computer Numerical Control ", MacMillan / McGraw-Hill, 1992.
6. Bernard Hodgers, “CNC Part Programming Work Book ", city and Guids / Macmillan, 1994.
7. David Gribbs, “An Introduction to CNC Machining ", Cassell, 1987.
8. Sadasivan, T.A. and Sarathy, D, “Cutting Tools for Productive Machining ", Widia (India) Ltd., August 1999.
9. Radhakrishnan, P. “Computer Numerical Control Machines ", New Central Book Agency, 1992.
10. Peter Smid, “CNC Programming Hand Book ", Industrial Press Inc., 2000.

COURSE OUTCOMES:

At the end of the course students will be able to

- Analyse CNC machines
- Design and analyse the structure of CNC machine tools
- Identify appropriate accessories for CNC machines based on requirements
- Part Programming for CNC machining
- Identify tools and maintenance methods of CNC machines

MECY016 POLYMERS AND COMPOSITES

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To learn various polymers and their applications
- To know about the various processing techniques of plastics used in industries.
- To understand the machining and joining of plastics.
- To learn the important fibers used in the composite materials and various commercial procedures used for manufacturing PMCs.
- To acquire knowledge on the manufacturing methods of MMCs.

MODULE I INTRODUCTION 05

Chemistry and Classification of Polymers - Properties of Thermo Plastics - Properties of Thermosetting Plastics - Applications - Merits and Demerits.

MODULE II PROCESSING OF PLASTICS 12

Extrusion - Injection Moulding - Blow Moulding - Compression and Transfer Moulding - Casting –Thermo Forming.

MODULE III MACHINING AND JOINING OF PLASTICS 07

General Machining properties of Plastics - Machining Parameters and Their effect - Joining of Plastics - Mechanical Fastners - Thermal bonding - Press Fitting.

MODULE IV COMPOSITE MATERIALS AND PROCESSING 12

Fibres - Glass, Boron, Carbon, Organic, Ceramic and Metallic Fibers - Matrix Materials - Polymers,Metals and Ceramics – Composites Processing- Open Mould Processes, Bag Moulding,Compression Moulding with BMC and SMC - Filament winding - Pultrusion - Centrifugal Casting -Injection Moulding - Application of PMC's.

MODULE V PROCESSING OF METAL MATRIX COMPOSITES 09

Solid State Fabrication Techniques - Diffusion Bonding - Powder Metallurgy Techniques – Plasma Spray, Chemical and Physical Vapour Deposition of Matrix on Fibres - Liquid State Fabrication Methods - Infiltration - Squeeze Casting - Rheo Casting –Application of MMCS.

Total Hours: 45

REFERENCES:

1. Harold Belofsky, Plastics: “Product Design and Process Engineering”, Hanser Publishers, 1995.
2. Bera, E and Moet, A, “High Performance Polymers ", Hanser Publishers, 1991.
3. Hensen, F, “Plastics Extrusion technology ", Hanser Publishers, 1988.
4. Johannaber F, “Injection Moulding Machines ", Hanser Publishers, 1983.
5. Rauwendaal, C, “Polymer extrusion ", Hanser Publishers, 1990.
6. Rosatao, D.V., “Blow Moulding Handbook, Hanser Publisher, 1989.
7. Seamour,E.B., " Modern Plastics Moulding ", John Wiley.
8. John Dalmonte, “Plastics Moulding ", John Wiley.
9. Akira Kobyashi, “Machining of Plastics ", Mc-Graw Hill.
10. Krishan K.Chawla, “Composite Materials science and Engineering ", springer-Verlag, 1987.
11. Agarwal. D. and Broutman L.J., “Analysis and Performance of Fiber Composites ", Wiley, 1990.
12. Mallick, P.K. and Newman, S. “Composite Materials Technology ", Hanser Publishers, 1990.

COURSE OUTCOMES:

At the end of the course students will be able to

- Explain different polymers and select a polymer for specific applications.
- Demonstrate different processing techniques of plastics.
- Evaluate the various techniques for shaping and joining of plastics.
- Compare variety of fibers used in PMCs and their fabrication techniques.
- Outline the techniques for manufacturing MMCs and identify their applications.

MECY017	PRECISION ENGINEERING AND NANO TECHNOLOGY	L	T	P	C
		3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To provide basic knowledge on Precision engineering materials
- To impart knowledge on various types of Precision machining techniques
- To provide in knowledge on precision machining tools
- To impart detailed knowledge on characterization of nano materials
- To provide knowledge on various applications of Nano materials

MODULE I MATERIALS FOR PRECISION ENGINEERING 08

Introduction – Accuracy and Precision– Need for high precision – concept of accuracy – tolerance an fits: system – Hole and shaft system – expects accuracy of a Manufacturing process – types of fits – Selective assembly. Materials-Diamond – types-single crystal- PCD – Natural-synthetic CBN - Ceramics – coated metals and non-metals–High– performance polymer – alloys – refractory metals: cutting tools – performance – components of instruments – Jewels – self Lubrication – smart materials – properties – testing – applications.

MODULE II PRECISION MACHINING AND ERRORS 12

Precision grinding: IC chip manufacturing- ELID process – aspherical surface generation Grinding wheel- Designer and selection of grinding wheel-High-speed grinding-High-speed milling-Micro machining – Diamond turning-MEMS – micro finishing process – surface roughness measures – concept and non-concept method – comparison of features with machining process. Static stiffness - influence on machining accuracy. Introduction – over all stiffness in a machine/instrument – errors due to variation of cutting forces – clamping forces – errors due to compliance while machining. Inaccuracy due to thermal effects: Heat sources –war dissipation – Geometry of thermal deformation-influence of forced iso-static dimensional wear of elements – instruments; Machining tools their influence an accuracy- error due to clamping and setting location.

MODULE III PRECISION MACHINE ELEMENTS 06

Introduction- guide ways- Drive systems; rolling element bearings-Principles, construction, classification, application etc., -Lubricated sliding bearings-construction – Principles etc.,- Hydrostatics bearings-types – aerostatic bearings – linear drive motors – magnetic bearings- applications-limitations - advantages.

MODULE IV NANOMATERIALS SYNTHESIS AND CHARACTERIZATION 10

Amorphous, crystalline, microcrystalline, quasi-crystalline and nano-crystalline materials. Historical development of nanomaterials – Issues in fabrication and characterization of nanomaterials Methods of production of Nanoparticles, Sol-gel synthesis, Inert gas condensation, High energy Ball milling, Plasma synthesis, Electro deposition and other techniques. Synthesis of Carbon Nanotubes – Solid carbon source based production techniques, Gaseous carbon source based production techniques - Growth mechanisms-Nano wires. Scanning Probe Microscopy (SPM), Transmission electron microscope, Scanning transmission electron microscope, Atomic force microscope, Scanning thermal microscopy Nano indentation.

MODULE V APPLICATIONS OF NANOMATERIALS 09

Applications in Mechanical, Electronics engineering industries – Use of nanomaterials in automobiles, aerospace, defense and medical applications – Metallic, polymeric, organic and ceramic nanomaterials. LIGA, Ion beam etching, Molecular manufacturing techniques – Nano machining techniques, Top/Bottom up Nano fabrication techniques - Sub micron lithographic technique, conventional film growth technique, Chemical etching, Quantum materials.

Total Hours: 45

REFERENCES:

1. Murthy R.L., Precision Engineering in Manufacturing, New age Instruction Publishes 2005. New Delhi.
2. Venkatesh V.C. and Sudin, Izwan, Precision engineering: - Tata McGraw Hill Co., New Delhi, 2007.
3. Bandyopadhyay A.K., “Nano Materials”, New Age International Publishers, New Delhi, 2007
4. Bharat Bhushan, “Handbook of Nanotechnology”, Springer, Germany, 2004.
5. JAMESD, MEADOWS, - “Geometric Dimensioning and tolerancing”, Marcel Dekker Inc.1995
6. Mark Ratner and Daniel Ratner, “Nano Technology”, Pearson Education, New Delhi, 2003.
7. Gregory Timp, “Nanotechnology”, Springer, India, 2005
8. Ahmed Busnaina, “Nanomanufacturing Handbook”, CRC Press, London, 2006.

COURSE OUTCOMES:

At the end of the course students will be able to

- Analyse and identify precision engineering materials
- Analyse various types of Precision machining techniques
- Analyse and identify precision machining tools for requirement
- Analyse the characterization of nano materials
- Analyse various applications of Nano materials

MECY018	MECHATRONICS FOR MANUFACTURING SYSTEMS	L	T	P	C
		2	0	0	2

COURSE EDUCATIONAL OBJECTIVES:

- To study the definition and application of mechatronics systems
- To choose appropriate sensors to be used in manufacturing technology
- To select the required actuator for an application

MODULE I MECHATRONICS AND ITS APPLICATION 08

Mechatronics definition - Systems- Measurement Systems - Control Systems - Traditional and Mechatronics design concepts - Case studies of Mechatronics systems - Pick and place Robot -Conveyor based material handling system - PC based CNC drilling machine – Mechatronic control in automated manufacturing

MODULE II SENSORS AND TRANSDUCERS 12

Introduction - Performance Terminology – Potentiometers - LVDT-Capacitance sensors – Strain gauges – Eddy current sensor – Hall effect sensor - Temperature sensors – Light sensors - Selection of sensors - Signal processing .

MODULE III ACTUATORS 10

Actuators – Mechanicsl – Electrical – Fluid Power – Piezoelectric –magnetostrictive – Shape memory alloy – applications – selection of actuators

Total Hours: 30

REFERENCES:

1. Bolton.W, “Mechatronics” , Pearson education, second edition, fifth Indian Reprint, 2003.
2. Smaili.A and Mrad.F , "Mechatronics integrated technologies for intelligent machines", Oxford university press, 2008.
3. Devadas Shetty and Richard A.Kolk, “Mechatronics systems design”, PWS Publishing Company, 2007.
4. Godfrey C. Onwubolu, "Mechatronics Principles and Applications", Elsevier, 2006.
5. Nitaigour Premchand Mahalik, “Mechatronics Principles, Concepts and Applicatlions” Tata McGraw-Hill Publishing company Limited, 2003.
6. Michael B.Histand and Davis G.Alciatore,” Introduction to Mechatronics and Measurement systems”. McGraw Hill International edition, 1999.
7. Bradley D.A, Dawson.D, Buru N.C and Loader A.J, “Mechatronics” Nelson

Thornes ltd, Eswar press, Indian print, 2004.

COURSE OUTCOMES:

At the end of the course, the student will be able to

- Explain the importance of mechatronics and its application in manufacturing systems
- Select suitable sensor and corresponding signal conditioning that is required
- Choose appropriate actuators for given manufacturing system

MECY019 NEWER MATERIALS

L	T	P	C
2	0	0	2

COURSE EDUCATIONAL OBJECTIVES:

- To learn the Physical Properties of various Smart Materials
- To acquire knowledge on synthesis of newer materials.
- To learn the techniques of characterization of newer materials.
- To acquire knowledge on applications of smart sensor, actuator and transducer technologies.

MODULE I SMART BEHAVIOURS AND MATERIALS 12

Piezoelectric, electrostrictive, magnetostrictive, pyroelectric, electrooptic, Piezomagnetism, Pyromagnetism, Piezoresitivity, Thermoelectricity, photon striction, Thermally and Magnetically activated Shape memory alloy, Superelastic, Viscoelastic, Thermochromic materials. Magneto rheological fluid: constitutive behaviour and its applications as damper, Behaviour of Electro active polymer and its use as artificial muscles.

MODULE II MATERIAL SYNTHESIS 06

Solid state reaction, sol-gel process.

MODULE III APPLICCATIONS 12

Impact Design and fabrication of devices and structures and their integration with system, Biomorphs / Moonies, Chip capacitor, Memory devices (FRAM), Sensor, actuator and transducers, Accelerometer, Gyroscopes, Ultrasonic Motor, Liquid Crystal display, Photonics, Structural Health Monitoring

Total Hours: 30

REFERENCES:

1. Volti Rudi, “Society and Technology Change”, 6th Edition, Worth publishers Inc, USA, 2009.
2. Ferroelectric devices- Kenji Uchino, Marcell Decker Inc., 2000.
3. Smart Materials and Structures- M.V. Gandhi, B.S. Thompson, Chapman and Hall, London1992.
4. Electromechanical Sensors and Actuators, Ilene J. Busch-Vishniac, Springer-Verlag NY,1999.
5. Fundamentals of Piezoelectricity- Takuro Ikeda, Oxford University Press, 1990.

6. Actuators: Basics and Applications H.armut Janocha (Ed), Springer-Verlag Berlin Heidelberg, 2004.
7. Smart Material Systems: Model Developments, Ralph C. Smith, Cambridge University Press, Series: Frontiers in Applied Mathematics (No. 32), 2005.
8. T. Yoneyama & S. Mayazaki, Shape memory alloys for biomedical applications, CRC Press, 2009
9. Kwang J. Kim & S. Tadokoro, Electroactive polymers for robotics applications, artificial muscles and sensors, Springer, 2007.

COURSE OUTCOMES:

At the end of this course, the students will be able to

- Summarize the properties of newer materials, their synthesis and characterization.
- Explain the development of actuators and sensors and their integration into a smart structure
- Demonstrate about application areas of smart materials

MECY020 AUTOMOTIVE MANUFACTURING

L	T	P	C
1	0	0	1

COURSE EDUCATIONAL OBJECTIVES:

- To impart knowledge on various machining processes of automotive components
- To gain knowledge on different forming processes

MODULE I MACHINING PROCESS 08

Machining of connecting rods - crank shafts - cam shafts - pistons - piston pins – piston rings – valves - front and rear axle housings - fly wheel - Honing of cylinder bores - Copy turning and profile grinding machines

MODULE II FORMING PROCESS 07

Powder injection molding - Production of aluminum MMC liners for engine blocks - Plasma spray coated engine blocks and valves - Recent developments in auto body panel forming –Squeeze Casting of pistons - aluminum composite brake rotors - Sinter diffusion bonded idler sprocket – gas injection molding of window channel – cast con process for auto parts

Total Hours: 15

TEXT BOOK

1. Heldt. P.M., “High Speed Combustion Engines”, Oxford Publishing Co., New York, 1990

REFERENCES

1. Haslehurst.S.E., “Manufacturing Technology”, ELBS, London, 1990
2. Rusinoff, “Forging and Forming of metals”, D.B. Taraporevala Son & Co. Pvt Ltd., Mumbai, 1995.
3. Sabroff.A.M. & Others, “Forging Materials & Processes”, Reinhold Book Corporation, New York, 1988.
4. Upton, “Pressure Die Casting”, Pergamon Press, 1985.
5. High Velocity “Forming of Metals”, ASTME, prentice Hall of India (P) Ltd., New Delhi, 1990

COURSE OUTCOMES:

Students should be able to

- Execute various machining processes
- Apply suitable forming process for various automotive components

MECY021 VIRTUAL MANUFACTURING

L	T	P	C
1	0	0	1

COURSE EDUCATIONAL OBJECTIVES:

- To understand the fundamentals of virtual manufacturing
- To introduce different facets of virtual manufacturing

MODULE I FUNDAMENTALS OF VIRTUAL MANUFACTURING 08

Paradigms of VM: Design-centered VM, Production-centered VM and Control-centered VM. Generic VM Issues - relationships between VM, Virtual Prototyping, the Virtual Enterprise. Role of object oriented technology in VM - Integrated Simulation Method to Support Virtual Factory Engineering Application of Virtual Reality

MODULE II FACETS OF VIRTUAL MANUFCATURING 07

Dispersed Network Manufacturing - Virtual factory, enterprise collaborative modeling system - virtual manufacturing (VM) system - Web-based work flow management, collaborative product commerce - applications of multi-agent technology - e-supply chain management and tele-manufacturing

Total Hours: 15

TEXT BOOKS

1. Warim Ahmed Khan Abdul Raouz, Kari Chens, Virutal Manufacturing, Springer Series in Advanced Manufacturing.

REFERENCES

1. Crabb, C. H., The Virtual Engineer-21st Century Product Development, Society of Manufacturing Engineers, 1998.
2. Rao Ming, Qun Wang, Jianzhong Cha, Integrated Distributed Intelligent Systems in Manufacturing (Intelligent Manufacturing), Chapman & Hall 1993.
3. Prasant Banerjee, Virtual manufacturing a willey, I addition 2001.

COURSE OUTCOMES:

Students should be able to

- Describe the fundamentals of virtual manufacturing
- Explain different facets of virtual manufacturing

PROFESSIONAL ELECTIVES ON CAD / CAM MANAGEMENT

MECY022 DATA COMMUNICATION IN CAD/CAM

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To provide basic knowledge on various digital computers and microprocessors
- To impart knowledge on typical components of operating systems and environments
- To provide in depth knowledge on data communication systems
- To impart detailed knowledge on networking systems
- To provide knowledge on internet services and tools for communication

MODULE I DIGITAL COMPUTERS & MICRO PROCESSORS 09

Block diagram - register transfer language - arithmetic, logic and shift micro operations - instruction code - training and control instruction cycle - I/O and interrupt design of basic computer. Machine language - assembly language - assembler.

Registers ALU and Bus Systems - timing and control signals - machine cycle and timing diagram - functional block diagrams of 80 x 86 and modes of operation. Features of Pentium Processors.

MODULE II OPERATING SYSTEM & ENVIRONMENTS 09

Types - functions - UNIX & WINDOWS - Architecture - Graphical User Interfaces- Compilers - Analysis of the Source program - the phases of a compiler - cousins of the compiler, the grouping of phases - compiler construction tools.

MODULE III COMMUNICATION MODEL 09

Data communication and networking - protocols and architecture - data transmission concepts and terminology - guided transmission media - wireless transmission - data encoding - asynchronous and synchronous communication - base band interface standards RS232C, RS449 interface.

MODULE IV COMPUTER NETWORKS 09

Network structure - network architecture - the OSI reference model services network standardization – example - Managing remote systems in network – cloud computing- on demand computing- high performance computing- network file systems.

MODULE V INTERNET 09

Internet services - Protocols - intranet information services - mail based service - system and network requirements - Internet tools - Usenet - e-mail - IRC - www - FTP - Telnet.

Total Hours: 45

REFERENCES:

1. Morris Mano. M., “Computer System Architecture”, Prentice Hall of India, 1996.
2. Gaonkar R.S., “Microprocessor Architecture, Programming and Applications of 8085”, Penram International, 1997
3. Peterson J.L., Galvin P. and Silberschaz, A., “Operating Systems Concepts”, Addison Wesley, 1997.
4. Alfred V. Aho, Ravi Setjhi, Jeffrey D Ullman, “Compilers Principles Techniques and Tools”, Addison Wesley, 1986.
5. William Stallings, “Data of Computer Communications”, Prentice Hall of India, 1997.
6. Andrew S. Tanenbanum “Computer Networks”, Prentice Hall of India 3rd Edition, 1996.
7. Christian Crumlish, “The ABC's of the Internet”, BPB Publication, 1996.

COURSE OUTCOMES:

At the end of the course students will be able to

- Analyse various digital computers and microprocessors
- Describe and identify typical components of operating systems and environments
- Analyse and design necessary data communication system
- Incorporate various networking systems and remote computing
- Identify and select suitable internet services and tools for communication

MECY023 INDUSTRIAL SAFETY MANAGEMENT

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To understand the fundamentals of safety management.
- To acquire knowledge on the occupational hazards in extreme cases.
- To learn the safety measures followed in the Industry.
- To acquire knowledge on the safety standards that must be maintained with regulatory requirements.
- To learn the various safety laws in the work place.

MODULE I SAFETY MANAGEMENT 09

Evaluation of modern safety concepts - Safety management functions - safety organization, safety department - safety committee, safety audit - performance measurements and motivation - employee participation in safety - safety and productivity.

MODULE II OPERATIONAL SAFETY 09

Hot metal Operation - Boiler, pressure vessels - heat treatment shop - gas furnace operation - electroplating-hot bending pipes - Safety in welding and cutting. Cold-metal Operation - Safety in Machine shop - Cold bending and chamfering of pipes - metal cutting - shot blasting, grinding, painting - power press and other machines.

MODULE III SAFETY MEASURES 09

Layout design and material handling - Use of electricity - Management of toxic gases and chemicals - Industrial fires and prevention - Road safety - highway and urban safety - Safety of sewage disposal and cleaning - Control of environmental pollution - Managing emergencies in Industries - planning, security and risk assessments, on- site and off site. Control of major industrial hazards.

MODULE IV ACCIDENT PREVENTION 09

Human side of safety - personal protective equipment - Causes and cost of accidents. Accident prevention programmes - Specific hazard control strategies - HAZOP - Training and development of employees - First Aid- Fire fighting devices - Accident reporting, investigation.

MODULE V SAFETY, HEALTH, WELFARE & LAWS 09

Safety and health standards - Industrial hygiene - occupational diseases prevention - Welfare facilities - History of legislations related to Safety-pressure

vessel act-Indian boiler act - The environmental protection act - Electricity act - Explosive act.

Total Hours: 45

REFERENCES:

1. John V. Grimaldi and Rollin H. Simonds, “Safety Management”, All India Travelers bookseller, New Delhi-1989.
2. Krishnan N.V., “Safety in Industry”, Jaico Publisher House, 1996.
3. Occupational Safety Manual BHEL.
4. Industrial safety and the law by P.M.C. Nair Publisher's, Trivandrum.
5. Managing emergencies in industries, Loss Prevention of India Ltd., Proceedings, 1999.
6. Singh, U.K. and Dewan, J.M., “Safety, Security and risk management”, APH Publishing Company, New Delhi, 1996.

COURSE OUTCOMES:

Students will be able to

- Demonstrate safety concepts practiced in Industry.
- Analyze the required safety precautions under worst operating conditions.
- Evaluate the possible safety prevention measures while handling hazardous substances.
- Demonstrate an understanding of work place injury prevention and incident investigations.
- Students are expected to have knowledge in the safety laws to be followed at various places of the workplace.

MECY024	INTEGRATED MANUFACTURING SYSTEMS AND MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To understand the various manufacturing strategies and the role of CIM in management.
- To acquire knowledge to select a suitable process in order to minimize waiting time in a system.
- To understand the importance of location of plant and facilities.
- To gain knowledge on Inventory systems, MRP and information control systems.
- To learn to use computers to increase the productivity.

MODULE I FIELD OF MANUFACTURING MANAGEMENT 09

Introduction – Manufacturing Strategies and competitiveness-Meeting the competitive Project management-Product Life Cycle – Role of CIM in Modern Manufacturing Management.

MODULE II DESIGNING OF PRODUCTION PROCESSES 09

Process selection-Process flow Design – Operations Technology -Waiting line management-Computer simulation of waiting lines – Quality management.

MODULE III DESIGN OF FACILITIES AND JOBS 09

Capacity and Requirement planning – Strategies – Planning service capacity-JIT –Facility location and layout-Job Design and Work measurement. – Lean Manufacturing.

MODULE IV INVENTORY SYSTEMS AND MRP 09

Definition-Purposes of Inventory-Inventory models-Fixed order Quantity models and Fixed-time period models - MRP Systems-MRP system structures-Improvements in the MRP system-Advanced MRP-type systems.

MODULE V INFORMATION SYSTEM FOR MANUFACTURING 09

Parts oriented production information system - concepts and structure - computerized production scheduling, online production control systems, Computer based production management system, computerized manufacturing information system - case study.

Total Hours: 45

REFERENCES:

1. Chase, Aquilano and Jacobs, Production and Operations Management, , Tata McGraw Hill, eighth Edition.
2. Robert A. Olsen, Manufacturing management: a quantitative approach,International Textbook Co, 1968.
3. Chary S.N., Production and Operations Management, Tata McGraw-Hill, 3rd Edition 2006.
4. Jay Heizer, Barry Render Production and Operations Management: Strategic and Tactical Decisions, Business & Economics – 1996.
5. Jae K. Shim, Joel G. Siegel, Operations Management,- Business & Economics – 1999.

COURSE OUTCOMES:

Students will be able to

- Analyze the various strategies adopted in a Management.
- Simulate various queuing techniques to select a suitable process.
- Evaluate the importance of location of plant layout.
- Predict the importance of Inventory systems.
- Apply the use of computers in creating data base for production scheduling.

MECY025 MANUFACTURING INFORMATION SYSTEMS

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To provide basic knowledge on MRP and production organization
- To impart knowledge on various types and components of data
- To provide in knowledge on various approach of database design
- To impart detailed knowledge on various components of manufacturing organization
- To provide knowledge on Information management for manufacturing

MODULE I INTRODUCTION 05

The evolution of order policies, from MRP to MRP II, the role of Production organization, Operations control.

MODULE II DATABASE 07

Terminologies - Entities and attributes - Data models, schema and subschema - Data Independence – ER Diagram - Trends in database.

MODULE III DESIGNING DATABASE 13

Hierarchical model - Network approach - Relational Data model -concepts, principles, keys, relational operations - functional dependence -Normalisation, types - Query languages.

MODULE IV MANUFACTURING CONSIDERATION 10

The product and its structure, Inventory and process flow - Shop floor control - Data structure and procedure -various model - the order scheduling module, input / output analysis module the stock status database – the complete IOM database.

MODULE V INFORMATION SYSTEM FOR MANUFACTURING 10

Parts oriented production information system - concepts and structure - computerised production scheduling, online production control systems, Computer based production management system, computerised manufacturing information system - case study.

Total Hours: 45

REFERENCES:

1. Luca G. Sartori, “Manufacturing Information Systems”, Addison-Wesley Publishing Company, 1988.
2. Date. C.J., “An Introduction to Database systems”, Narosa Publishing House, 1997.
3. Orlicky. G., “Material Requirements Planning”, McGraw-Hill Publishing Co., 1975.
4. Kerr. R, “Knowledge based Manufacturing Management”, Addison-wesley, 1991.

COURSE OUTCOMES:

At the end of the course students will be able to

- Analyse on MRP and production organization
- Analyse various types and components of database
- Analyse various approaches and Design the database
- Analyse various components of manufacturing database organization
- Analyse the Information management for manufacturing

MECY026	RELIABILITY AND TOTAL PRODUCTIVE MAINTENANCE	L	T	P	C
		3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To provide knowledge on basic concepts of reliability and failure analysis
- To impart knowledge on various reliability assessment and monitoring techniques
- To provide in knowledge on approach to reliability improvement
- To impart detailed knowledge on basics and types of maintainability
- To provide knowledge on various maintainability issues and remedies

MODULE I RELIABILITY CONCEPT AND FAILURE DATA ANALYSIS 11

Reliability definition – Quality and Reliability– Reliability mathematics – Reliability functions – Hazard rate – Measures of Reliability – Design life –A priori and posteriori probabilities – Mortality of a component –Bath tub curve – Useful life. Failure Data Analysis-Data collection –Empirical methods: Ungrouped/Grouped, Complete/Censored data – Time to failure distributions: Exponential, Weibull – Hazard plotting – Goodness of fit tests.

MODULE II RELIABILITY ASSESSMENT AND MONITORING 09

Different configurations – Redundancy – m/n system – Complex systems: RBD – Baye's method – Cut and tie sets – Fault Tree Analysis – Standby system. Reliability Monitoring-Life testing methods: Failure terminated – Time terminated – Sequential Testing –Reliability growth monitoring – Reliability allocation – Software reliability.

MODULE III RELIABILITY IMPROVEMENT 06

Analysis of downtime – Repair time distribution – System MTTR – Maintainability prediction – Measures of maintainability – System Availability – Replacement theory.

MODULE IV MAINTENANCE MODELS 10

Maintenance definition – Maintenance objectives – Maintenance management – Functions of maintenance department – Tero technology – Maintenance costs. Maintenance policies – Imperfect maintenance – PM versus b/d maintenance – Optimal PM schedule and product characteristics – Inspection decisions: Maximizing profit – Minimizing downtime – Replacement models.

MODULE V MAINTENANCE LOGISTICS, QUALITY AND TPM 09

Maintenance staffing – Human factors –Resource requirements: Optimal size of service facility – Optimal repair effort – Maintenance planning and scheduling – Spares planning – Capital spare. Five Zero concept –FMECA – Maintainability prediction– Design for maintainability – Maintainability allocation – Reliability Centered Maintenance. TPM fundamentals – Chronic and sporadic losses – Six big losses – OEE as a measure – TPM pillars– Autonomous maintenance –TPM implementation.

Total Hours: 45

REFERENCES:

1. Charles E. Ebeling, “An introduction to Reliability and Maintainability engineering”, TMH, 2000.
2. Roy Billington and Ronald N. Allan, “Reliability Evaluation of Engineering Systems”, Springer, 2007.
3. Andrew K.S.Jardine & Albert H.C.Tsang, “Maintenance, Replacement and Reliability”, Taylor and Francis, 2006.
4. Bikas Badhury & S.K.Basu, “Tero Technology: Reliability Engineering and Maintenance Management”, Asian Books, 2003.
5. Seichi Nakajima, “Total Productive Maintenance”, Productivity Press, 1993.

COURSE OUTCOMES:

At the end of the course students will be able to

- Analyse reliability and failure in mechanical systems
- Assess reliability
- Analyse various monitoring and reliability improvement techniques
- Analyse the maintainability of equipment
- Analyse various maintainability issues and remedies

MECY027 PRODUCT LIFE CYCLE MANAGEMENT

L	T	P	C
1	0	0	1

COURSE EDUCATIONAL OBJECTIVES:

- To provide basic knowledge Product Life Cycle Management
- To provide in knowledge on PLM concepts
- To understand PLM strategy and assessment

MODULE I INTRODUCTION TO PRODUCT LIFE CYCLE MANAGEMENT (PLM) 05

Definition- PLM Lifecycle model-Threads of PLM-Need for PLM- Opportunities and benefits of PLM- Views, Components and Phases of PLM- PLM feasibility study-PLM visioning.

MODULE II PLM CONCEPTS AND PROCESSES 05

Characteristics of PLM- Environment driving PLM- PLM Elements- Drivers of PLM-Conceptualization- Design- Development-Validation- Production-, Support of PLM

MODULE III PLM STRATEGY AND ASSESSMENT 05

Strategy, Impact of strategy, implementing a PLM strategy, PLM initiatives to support corporate objectives. Infrastructure assessment, assessment of current systems and applications.

Total Hours: 15

REFERENCES:

1. Grieves, Michael. Product Lifecycle Management, McGraw-Hill, 2006.
2. Product Life Cycle Management - by Antti Saaksvuori, Anselmi Immonen, Springer, 1st Edition, 2003
3. Stark, John. Product Lifecycle Management: Paradigm for 21st Century Product Realisation, Springer-Verlag, 2004.
4. Team Center Engineering and Product Lifecycle Management Basics, by Stephen M. Samuel; Eric D. Weeks and Mark A. Kelley

COURSE OUTCOMES:

At the end of the course students will be able to

- Realize the importance of PLM in CAD/CAM
- Analyse and identify PLM processes
- Design and assess PLM strategy

GENERAL ELECTIVES

GECY101	PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

The objectives of the course would be to make the students

- Learn to e valuate and choose an optimal project and build a project profile.
- Attain knowledge on risk identification and risk analysis
- Gain insight into a project plan and components
- Familiar with various gamut of technical analysis for effective project implementation
- Learn to apply project management techniques to manage resources.

MODULE I INTRODUCTION & PROJECT INITIATION 09

Introduction to project and project management - projects in contemporary organization – The project life cycle - project initiation - project evaluation methods & techniques - project selection criteria - project profile.

MODULE II RISK ANALYSIS 09

Sources of risk: project specific - competitive - industry specific - market and international risk – perspectives of risk – risk analysis: sensitivity analysis - scenario analysis - breakeven analysis - simulation analysis - decision tree analysis – managing/mitigating risk – project selection under risk.

MODULE III PROJECT PLANNING & IMPLEMENTATION 09

Project planning – importance – functions - areas of planning - project objectives and policies - steps in planning process - WBS – capital requirements - budgeting and cost estimation - feasibility analysis - creation of project plan – project implementation: pre-requisites - forms of project organization

MODULE IV TECHNICAL ANALYSIS 09

Technical analysis for manufacturing/construction/infrastructure projects – process/technology - materials and inputs - product mix - plant capacity – plant location and site selection – plant layout - machinery and equipment – structures and civil works – schedule of project implementation – technical analysis for software projects.

MODULE V PROJECT MANAGEMENT TECHNIQUES 09

Project scheduling - network construction – estimation of project completion time – identification of critical path - PERT & CPM – crashing of project network - complexity of project scheduling with limited resources - resource allocation - resource leveling – resource smoothing – overview of project management software.

Total Hours: 45

REFERENCES:

1. Projects: Planning, Analysis, Financing, Implementation and Review, Prasanna Chandra, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2004.
2. Project Management and Control, Narendra Singh, Himalaya Publishing, New Delhi, 2015.
3. A Management Guide to PERT/CPM, Jerome, D. Weist and Ferdinand K. Levy, Prentice Hall of India, New Delhi, 1994.

OUTCOMES:

On successfully completing this course, the student will be able to:

- Evaluate & select a project as well as develop a project profile.
- Identify various risks associated with the project and manage it effectively.
- Prepare a detailed project plan addressing its components.
- Perform technical analysis for effective project implementation
- Apply project management techniques for maximizing resource utilization.

GECY102 SOCIETY, TECHNOLGY & SUSTAINABILITY

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To aware of new technologies through advances in Science and Engineering.
- To make them realise the profound impact on society.
- To understand the ethical issues raised by technological changes and its effect on society.
- To introduce students a broad range of perspectives on the adoption and use of technologies.
- To make them realize the need of sustainability in the context of emerging technologies.

MODULE I TECHNOLOGY AND ITS IMPACTS 09

Origin and evolution of technologies – Nature of technology- Innovation – Historical Perspective of technology – Sources of technological change - Co-evolution of technology and economy – Scientific knowledge and technological advance – Science and Engineering aspects of Technology – Impact on the Society – Social and Ethical Issues associated with technological change – Social and environmental consequences - Impact of technological change on human life – Technology and responsibility – Technology and social justice.

MODULE II TECHNOLOGY AND ITS ADVANCEMENT 09

Sociological aspects of technology – Ethics and technology – Technology and responsibility – International Economics, Globalisation and Human Rights – Sustainability and Technology – Population and environment - Technology, Energy and Environment – Organisations and technological change.

MODULE III SOCIETY AND TECHNOLOGY 09

Impact of technologies on contemporary society – Role of society in fostering the development of technology – Response to the adaption and use of technology – Impact of technology on developer and consumers – Technological change and globalisation.

MODULE IV IMPACT OF A SPECIFIC TECHNOLOGY ON HUMAN WELFARE 09

Impact of the following technologies on Human life – Medical and Biomedical – Genetics Technology – Electronics and Communications – Electronic media

Technology – Information Systems Technology – Nanotechnology – Space Technology and Energy Technology.

MODULE V THE IMPORTANCE OF SUSTAINABILITY 09

Sustainability – A brief history – Concepts and contexts for sustainability – Ecological imbalance and biodiversity loss – Climate change – Population explosion. Industrial ecology – systems approach to sustainability – Green engineering and technology- sustainable design- sustainable manufacturing- Green consumer movements – Environmental ethics – Sustainability of the planet Earth – Future planning for sustainability.

Total Hours: 45

REFERENCES:

1. Volti Rudi, “Society and Technology Change”, 6th Edition, Worth publishers Inc, USA, 2009.
2. Arthur W.A, “The nature of Technology: What it is and how it evolves”, Free Press, NY, USA, 2009.
3. Winston M and Edelbach R, “Society, Ethics and Technology”, 3rd Edition, San Francisco, USA, 2005.
4. Martin A.A Abraham, “Sustainability Science and Engineering: Defining Principles”, Elsevier Inc, USA, 2006.
5. R.V.G.Menon, “Technology and Society”, Pearson Education, India, 2011.

COURSE OUTCOMES:

At the end of this course, the students will be able to

- Understand the benefits of modern technology for the well-being of human life.
- Connect sustainability concepts and technology to the real world challenges.
- Find pathway for sustainable society.

GECY103 ARTIFICIAL INTELLIGENCE

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- Expose the history and foundations of artificial intelligence.
- Showcase the complexity of working on real time problems underlying the need for intelligent approaches.
- Illustrate how heuristic approaches provide a good solution mechanism.
- Provide the mechanisms for simple knowledge representation and reasoning.
- Highlight the complexity in working with uncertain knowledge.
- Discuss the current and future applications of artificial intelligence.

MODULE I HISTORY AND FOUNDATIONS 08

History – Scope – Influence from life – Impact of computing domains - Agents in environments - Knowledge representation – Dimensions of Complexity – Sample application domains – Agent structure.

MODULE II SEARCH 10

Problem solving as search – State spaces – Uninformed Search – Heuristic search – Advanced search – Constraint satisfaction - Applications.

MODULE III KNOWLEDGE REPRESENTATION AND REASONING 10

Foundations of knowledge representation and reasoning, representing and reasoning about objects, relations, events, actions, time, and space predicate logic, situation calculus, description logics, reasoning with defaults, reasoning about knowledge, sample applications.

MODULE IV REPRESENTING AND REASONING WITH UNCERTAIN KNOWLEDGE 08

Probability, connection to logic, independence, Bayes rule, Bayesian networks, probabilistic inference, sample applications.

MODULE V CASE STUDY AND FUTURE APPLICATIONS 09

Design of a game / Solution for problem in student's domain. Natural Language processing, Robotics, Vehicular automation – Scale, Complexity, Behaviour – Controversies.

Total Hours: 45

TEXT BOOK:

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall, Third Edition, 2010.
2. David Poole, Alan Mackworth, Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010.
3. Nils J. Nilsson, The Quest for Artificial Intelligence, Cambridge University Press, Online edition, 2013.
4. Keith Frankish, William M. Ramsey (eds) The Cambridge Handbook of Artificial Intelligence, Cambridge University Press, 2014.

COURSE OUTCOMES:

Students who complete this course will be able to

- Discuss the history, current applications, future challenges and the controversies in artificial intelligence.
- Apply principle of AI in the design of an agent and model its actions.
- Design a heuristic algorithm for search problems.
- Analyze and represent the fact using logic for a given scenario
- Represent uncertainty using probabilistic models
- Develop a simple game or solution using artificial intelligence techniques.

GECY104 GREEN COMPUTING

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To focus on the necessity of green computing technology.
- To expose to various issues with information technology and sustainability.
- To attain knowledge on the technologies for enabling green cloud computing.
- To elaborate on the energy consumption issues
- To illustrate a Green and Virtual Data Center
- To develop into a Green IT Technologist.

MODULE I INTRODUCTION 08

Trends and Reasons to Go Green - IT Data Center Economic and Ecological Sustainment - The Growing Green Gap: Misdirected Messaging, Opportunities for Action - IT Data Center “Green” Myths and Realities - PCFE Trends, Issues, Drivers, and Related Factors - Green Computing and Your Reputation- Green Computing and Saving Money- Green Computing and the Environment

MODULE II CONSUMPTION ISSUES 10

Minimizing power usage – Cooling - Electric Power and Cooling Challenges - Electrical – Power -Supply and Demand Distribution - Determining Energy Usage - From Energy Avoidance to Efficiency - Energy Efficiency Incentives, Rebates, and Alternative Energy Sources - PCFE and Environmental Health and Safety Standards- Energy-exposed instruction sets- Power management in power-aware real-time systems.

MODULE III NEXT-GENERATION VIRTUAL DATA CENTERS 09

Data Center Virtualization - Virtualization beyond Consolidation - Enabling Transparency - Components of a Virtual Data Center - Datacenter Design and Redesign - Greening the Information Systems - Staying Green- Building a Green Device Portfolio- Green Servers and Data Centers- Saving Energy

MODULE IV TECHNOLOGIES FOR ENABLING GREEN AND VIRTUAL DATA CENTERS 08

Highly Effective Data Center Facilities and Habitats for Technology - Data Center Electrical Power and Energy Management - HVAC, Smoke and Fire Suppression

- Data Center Location - Virtual Data Centers Today and Tomorrow - Cloud Computing, Out-Sourced, and Managed Services.

MODULE V SERVERS AND FUTURE TRENDS OF GREEN COMPUTING 10

Server Issues and Challenges - Fundamentals of Physical Servers - Types, Categories, and Tiers of Servers - Clusters and Grids - Implementing a Green and Virtual Data Center - PCFE and Green Areas of Opportunity- 12 Green Computer Companies- What's in Green computer science-Green off the Grid aimed for data center energy evolution-Green Grid Consortium- Green Applications- Green Computing Making Great Impact On Research

Total Hours: 45

REFERENCES:

1. Bud E. Smith,"Green Computing Tools and Techniques for Saving Energy, Money, and Resources", Taylor & Francis Group, CRC Press, ISBN-13: 978-1-4665-0340-3, 2014.
2. Jason Harris, "Green Computing and Green IT Best Practices, On Regulations and Industry Initiatives, Virtualization and power management, materials recycling and Tele commuting, Emereo Publishing .ISBN-13: 978-1-9215-2344-1,2014.
3. Ishfaq Ahmed & Sanjay Ranka, "Handbook of Energy Aware and Green Computing", CRC Press, ISBN: 978-1-4665-0116-4, 2013.
4. Kawahara, Takayuki, Mizuno, "Green Computing with Emerging Memory", Springer Publications, ISBN:978-1-4614-0811-6, 2012
5. Greg Schulz, "The Green and Virtual Data Center", CRC Press, ISBN-13:978-1-4200-8666-9, 2009.
6. Marty Poniatowski, "Foundation of Green IT: Consolidation, Virtualization, Efficiency, and ROI in the Data Center", Printice Hall, ISBN: 9780-1-3704-375-0, 2009.

COURSE OUTCOMES:

Students who complete this course will be able to

- Demonstrate issues relating to a range of available technologies, systems and practices to support green computing.
- Select appropriate technologies that are aimed to reduce energy consumption.
- Address design issues needed to achieve an organizations' green

computing objectives.

- Analyze the functionality of Data Centers.
- Critically evaluate technologies and the environmental impact of computing resources for a given scenario.
- Compare the impact of Green Computing with other computing techniques.

GECY105 GAMING DESIGN

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To master event-based programming
- To learn resource management as it relates to rendering time, including level-of-detail and culling.
- To become familiar with the various components in a game or game engine.
- To explore leading open source game engine components.
- To become familiar of game physics.
- To be compatible with game animation.

MODULE I INTRODUCTION 09

Magic Words – What Skills Does a Game Designer Need? – The Most Important Skill -The Five Kinds of Listening-The Secret of the Gifted.

MODULE II THE DESIGNER CREATES AN EXPERIENCE 09

The Game Is Not the Experience -Is This Unique to Games? -Three Practical Approaches to Chasing Rainbows -Introspection: Powers, Perils, and Practice -Dissect Your Feelings -Defeating Heisenberg -Essential Experience.

MODULE III THE EXPERIENCE IN THE PLAYER MIND AND GAME MECHANICS 08

Modeling – Focus -Empathy – Imagination – Motivation – Space – Objects, Attributes, and States – Actions – Rules.

MODULE IV GAMES THROUGH AN INTERFACE 09

Breaking it Down – The Loop of Interaction – Channels of Information – Other Interface.

MODULE V BALANCED GAME MECHANICS 10

Balance – The Twelve Most Common Types of Game Balance – Game Balancing Methodologies - Balancing Game Economies.

Total Hours: 45

REFERENCES:

1. Jesse Schell, "The Art of Game Design: A Book of Lenses", 2nd Edition

ISBN-10: 1466598646, 2014.

2. Ashok Kumar, Jim Etheredge, Aaron Boudreaux, “Algorithmic and Architectural Gaming Design: Implementation and Development", 1st edition, Idea Group, U.S ISBN-10: 1466616342, 2012.
3. Katie Salen Tekinba, Melissa Gresalfi, Kylie Peppler, Rafi Santo, "Gaming the System - Designing with Gamestar Mechanic" MIT Press , ISBN-10: 026202781X, 2014.
4. James M. Van Verth, Lars M. Bishop "Essential Mathematics for Games and Interactive Applications", Third Edition, A K Peters / CRC Press, ISBN-10: 1482250926, 2015.

COURSE OUTCOMES:

Students who complete this course will be able to

- Realize the basic history and genres of games
- Demonstrate an understanding of the overall game design process
- Explain the design tradeoffs inherent in game design
- Design and implement basic levels, models, and scripts for games
- Describe the mathematics and algorithms needed for game programming
- Design and implement a complete three-dimensional video game

GECY106 SOCIAL COMPUTING

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To create original social applications, critically applying appropriate theories and effective practices in a reflective and creative manner.
- To critically analyze social software in terms of its technical, social, legal, ethical, and functional features or affordances.
- To encourage the development of effective communities through the design, use, and management of social software.
- To give students with a base of knowledge and advances for them to critically examine existing social computing services.
- To plan and execute a small-scale research project in social computing in a systematic fashion.
- To become familiar with the concept of computational thinking.

MODULE I BASIC CONCEPTS 09

Networks and Relations: Relations and Attributes, Analysis of Network Data, Interpretation of network data -New Social Learning – Four Changes that Shift Work - Development of Social Network Analysis: Sociometric analysis and graph theory, Interpersonal Configurations and Cliques – Analysing Relational Data.

MODULE II SOCIAL LINK 09

Individual Actors, Social Exchange Theory, Social Forces, Graph Structure, Agent Optimization Strategies in Networks – Hierarchy of Social Link Motivation- Social Context.

MODULE III SOCIAL MEDIA 08

Trends in Computing – Motivations for Social Computing – Social Media: Social relationships, Mobility and Social context – Human Computation – Computational Models- Business use of social Media.

MODULE IV SOCIAL INFORMATION FILTERING 09

Mobile Location Sharing – Location based social media analysis – Social Sharing and Social Filtering – Automated recommender Systems – Traditional and Social Recommender Systems.

MODULE V SOCIAL NETWORK STRATEGY 10

Application of Topic Models – Opinions and Sentiments – Recommendation Systems – Language Dynamics and influence in online communities – Psychometric analysis – Case Study: Social Network Strategies for surviving the zombie apocalypse.

Total Hours: 45

REFERENCES:

1. Tony Bingham, Marcia Conner, “The New Social Learning, Connect. Collaborate. Work”, 2nd Edition, ATD Press, ISBN-10:1-56286-996-5, 2015.
2. Nick Crossley, Elisa Bellotti, Gemma Edwards, Martin G Everett, Johan Koskinen, Mark Tranmer, “Social Network Analysis for Ego-Nets”, SAGE Publication, 2015.
3. Zafarani, Abbasi and Liu, Social Media Mining: An Introduction, Cambridge University Press, 2014.
4. Christina Prell, “Social Network Analysis: History, Theory and Methodology”, 1st Edition, SAGE Publications Ltd, 2012.
5. John Scott, “Social Network Analysis”, Third Edition, SAGE Publication, 2013.
6. Jennifer Golbeck, “Analyzing the Social Web”, Elsevier Publication, 2013.
7. Huan Liu, John Salerno, Michael J. Young, “Social computing and Behavioral Modeling”, Springer Publication, 2009.

COURSE OUTCOMES:

Students who complete this course will be able to

- Realize the range of social computing applications and concepts.
- Analyze data left after in social media.
- Recognize and apply the concepts of computational models underlying social computing.
- Take out simple forms of social diagnostics, involving network and language models, applying existing analytic tools on social information.
- Evaluate emerging social computing applications, concepts, and techniques in terms of key principles.
- Design and prototype new social computing systems.

GECY107 SOFT COMPUTING

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

The aim of the course is to

- Enumerate the strengths and weakness of soft computing
- Illustrate soft computing methods with other logic driven and statistical method driven approaches
- Focus on the basics of neural networks, fuzzy systems, and evolutionary computing
- Emphasize the role of euro-fuzzy and hybrid modeling methods
- Trace the basis and need for evolutionary computing and relate it with other soft computing approaches

MODULE I SOFT COMPUTING - BASICS 06

Soft computing – Hard Computing – Artificial Intelligence as the basis of soft computing – Relation with logic driven and statistical method driven approaches- Expert systems – Types of problems: Classification, Functional approximation, Optimizations – Modeling the problem – Machine Learning – Hazards of Soft Computing – Current and future areas of research

MODULE II ARTIFICIAL NEURAL NETWORK 12

Artificial Neuron – Multilayer perceptron – Supervised learning – Back propagation network –Types of Artificial Neural Network: Supervised Vs Un Supervised Network – Radial basis function Network – Self Organizing Maps – Recurrent Network – Hopfield Neural Network – Adaptive Resonance Theory – Issues in Artificial Neural Network – Applications

MODULE III FUZZY SYSTEMS 09

Fuzzy Logic – Membership functions – Operators – Fuzzy Inference systems – Other sets: Rough sets, Vague Sets – Fuzzy controllers - Applications

MODULE IV NEURO FUZZY SYSTEMS 09

Cooperative Neuro fuzzy systems – Neural network driven fuzzy reasoning – Hybrid Neuro fuzzy systems – Construction of Neuro Fuzzy systems: Structure Identification phase, Parameter learning phase – Applications

MODULE V EVOLUTIONARY COMPUTING 09

Overview of evolutionary computing – Genetic Algorithms and optimization –

Genetic Algorithm operators – Genetic algorithms with Neural/Fuzzy systems – Variants of Genetic Algorithms– Population based incremental learning – Evolutionary strategies and applications

Total Hours: 45

TEXTBOOKS:

1. Samir Roy, “Introduction to Soft Computing: Neuro-Fuzzy and Genetic Algorithms”, Pearson, 2013
2. Anupam Shukla, Ritu Tiwari and Rahul Kala, “Real life applications of Soft Computing”, CRC press, 2010.
3. Fakhreddine O. Karray, “Soft Computing and Intelligent Systems Design: Theory, Tools and Applications”, Pearson, 2009

COURSE OUTCOMES:

At the end of the course the students will be able to

- Enumerate the theoretical basis of soft computing
- Explain the fuzzy set theory
- Discuss the neural networks and supervised and unsupervised learning networks
- Demonstrate some applications of computational intelligence
- Apply the most appropriate soft computing algorithm for a given situation

GECY108 EMBEDDED SYSTEM PROGRAMMING

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To introduce the design of embedded computing systems with its hardware and software architectures.
- To describe entire software development lifecycle and examine the various issues involved in developing software for embedded systems.
- To analyze the I/O programming and Embedded C coding techniques
- To equip students with the software development skills necessary for practitioners in the field of embedded systems.

MODULE I INTRODUCTION OF EMBEDDED SYSTEM 09

Embedded computing – characteristics and challenges – embedded system design process – Overview of Processors and hardware units in an embedded system – Compiling, Linking and locating – downloading and debugging – Emulators and simulators processor – External peripherals – Memory testing – Flash Memory.

MODULE II SOFTWARE TECHNOLOGY 09

Software Architectures, Software development Tools, Software Development Process Life Cycle and its Model, Software Analysis, Design and Maintenance.

MODULE III INPUT/OUTPUT PROGRAMMING 09

I/O Instructions, Synchronization, Transfer Rate & Latency, Polled Waiting Loops, Interrupt – Driven I/O, Writing ISR in Assembly and C, Non Maskable and Software Interrupts

MODULE IV DATA REPRESENTATION IN EMBEDDED SYSTEMS 09

Data representation, Twos complement, Fixed point and Floating Point Number Formats, Manipulating Bits in -Memory, I/O Ports, Low level programming in C, Primitive data types, Arrays, Functions, Recursive Functions, Pointers, Structures & Unions, Dynamic Memory Allocation, File handling, Linked lists, Queues, Stacks.

MODULE V EMBEDDED C 09

Embedded Systems programming in C – Binding & Running Embedded C program in Keil IDE – Dissecting the program - Building the hardware. Basic techniques for

reading & writing from I/O port pins – switch bounce - LED Interfacing using Embedded C.

Total Hours: 45

REFERENCES:

1. Marilyn Wolf, "Computers as components ", Elsevier, 2012.
2. Qing Li and Carolyn Yao, "Real-Time Concepts for Embedded Systems", CMP Books, 2003.
3. Daniel W. Lewis, "Fundamentals of embedded software where C and assembly meet", Pearson Education
4. Michael Bass, "Programming Embedded Systems in C and C++", Oreilly, 2003.

COURSE OUTCOMES:

On completion of this course the student will be able to

- Design the software and hardware components in embedded system
- Describe the software technology
- Use interrupt in effective manner
- Use keil IDE for programming
- Program using embedded C for specific microcontroller
- Design the embedded projects

GECY109 PRINCIPLES OF SUSTAINABLE DEVELOPMENT

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To impart knowledge in the concepts and dimensions of sustainable development.
- To gain knowledge on the framework for achieving sustainability.

MODULE I CONCEPT OF SUSTAINABLE DEVELOPMENT 09

Environment and Development - Population poverty and Pollution – Global and Local environmental issues – Resource Degradation- Greenhouse gases – Desertification-industrialization – Social insecurity, Globalization and environment. History and emergence of the concept of sustainable development-Objectives of Sustainable Development.

MODULE II COMPONENTS AND DIMENSIONS OF SUSTAINABLE DEVELOPMENT 09

Components of Sustainability – Complexity of growth and equity – Social economic and environmental dimensions of sustainable development – Environment – Biodiversity – Natural – Resources – Ecosystem integrity – Clean air and water – Carrying capacity – Equity, Quality of Life, Prevention, Precaution – Preservation and Public Participation Structural and functional linking of developmental dimensions.

MODULE III FRAMEWORK FOR ACHIEVING SUSTAINABILITY 09

Operational guidelines – interconnected prerequisites for sustainable development Empowerment of Women, children, Youth, Indigenous People, Non-Governmental Organizations Local Authorities, Business and industry – Science and Technology for sustainable development – performance indicators of sustainability and assessment mechanism – Constraints and barriers for sustainable development.

MODULE IV SUSTAINABLE DEVELOPMENT OF SOCIO ECONOMIC SYSTEMS 09

Demographic dynamics of sustainability – Policies for socio-economic development – Strategies for implementing eco-development programmes Sustainable development through trade – Economic growth – Action plan for implementing sustainable development – Urbanization and sustainable Cities – Sustainable Energy and Agriculture – sustainable livelihoods.

MODULE V SUSTAINABLE DEVELOPMENT AND INTERNATIONAL RESPONSE 09

Role of developed countries in the development of developing countries – international summits – Stockholm to Johannesburg – Rio principles – Agenda-Conventions – Agreements – Tokyo Declaration – Doubling statement – Tran boundary issues integrated approach for resources protection and management

Total Hours: 45

REFERENCES:

1. Sayer J. and Campbell, B., The Science of Sustainable Development: Local Livelihoods and the Global environment - Biological conservation restoration & Sustainability, Cambridge university Press, London, 2003.
2. M.K. Ghosh Roy. and Timberlake, Sustainable Development, Ane Books Pvt. Ltd, 2011.
3. Mackenthun K.M., Concepts in Environmental Management, Lewis Publications London, 1999.
4. APJ Abdul Kalam and Srijan Pal Singh, Target 3 Billion: Innovative Solutions Towards Sustainable Development, Penguin India, 2011

COURSE OUTCOMES:

At the end of the course the student will be able to

- Describe the concepts of sustainable development
- Define the components and dimensions of sustainable development
- Outline the Frame work for achieving sustainability.
- State the policies and strategies for implementing sustainable development for Socio economic programmes.
- Examine the role of developed countries in sustainable development.

GECY110	QUANTITATIVE TECHNIQUES IN MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVE:

To impart knowledge on

- Concepts of operations research
- Inventory control in production management
- Financial management of projects
- Decision theory and managerial economics

MODULE I OPERATIONS RESEARCH 09

Introduction to Operations research – Linear programming – Graphical and Simplex Methods, Duality and Post-Optimality Analysis – Transportation and Assignment Problems

MODULE II PRODUCTION MANAGEMENT 09

Inventory control, EOQ, Quantity Discounts, Safety Stock – Replacement Theory – PERT and CPM – Simulation Models – Quality Control.

MODULE III FINANCIAL MANAGEMENT 09

Working Capital Management – Compound Interest and Present Value methods – Discounted Cash Flow Techniques – Capital Budgeting.

MODULE IV DECISION THEORY 09

Decision Theory – Decision Rules – Decision making under conditions of certainty, risk and uncertainty – Decision trees – Utility Theory.

MODULE V MANAGERIAL ECONOMICS 09

Cost concepts – Break even Analysis – Pricing techniques – Game Theory applications.

Total Hours: 45

REFERENCES:

1. Vohra, N.D. , Quantitative Techniques in Management, Tata McGraw Hill Co., Ltd, New Delhi, 2009.
2. Seehroeder, R.G., Operations Management, McGraw Hill, USA, 2002.
3. Levin, R.I, Rubin, D.S., and Stinsonm J., Quantitative Approaches to Management, McGraw Hill Book Co., 2008.

4. Frank Harrison, E., The Managerial Decision Making Process, Houghton Miffin Co. Boston, 2005.
5. Hamdy A. Taha, Operations Research- An Introduction, Prentice Hall, 2002.

OUTCOME:

At the end of the course, the students will be able to

- Apply the concepts of operations research for various applications
- Create models for inventory control in production management
- Compute the cash flow for a project
- Choose a project using decision theory based on the risk criterion.
- Apply the concepts of managerial economics in construction management

GECY111 PROGRAMMING USING MATLAB & SIMULINK

L	T	P	C
1	0	2	2

COURSE EDUCATIONAL OBJECTIVES:

The aim of this course is to:

- Teach students how to mathematically model engineering systems
- Teach students how to use computer tools to solve the resulting mathematical models. The computer tool used is MATLAB and the focus will be on developing and solving models of problems encountered in engineering fields

MODULE I INTRODUCTION TO MATLAB AND DATA PRESENTATION 10

Introduction to MATLAB-Vectors, Matrices -Vector/Matrix Operations & Manipulation- Functions vs scripts- Making clear and compelling plots-Solving systems of linear equations numerically and symbolically.

Lab Experiments

1. Study of basic matrix operations and manipulations.
2. Numerical and symbolical solution of linear equations.

MODULE II ROOT FINDING AND MATLAB PLOT FUNCTION 10

Linearization and solving non-linear systems of equations- The Newton-Raphson method- Integers and rational numbers in different bases- Least squares regression -Curve fitting-Polynomial fitting and exponential fitting.

Lab Experiments

1. Solution of non linear equations using Newton-Raphson method.
2. Determination of polynomial fit and exponential fit for the given data.

MODULE III LINEAR AND NON-LINEAR DIFFERENTIAL EQUATIONS 13

Numerical integration and solving first order, ordinary differential equations (Euler's method and Runge-Kutta) - Use of ODE function in MATLAB- Converting second order and higher ODEs to systems of first order ODEs- Solving systems of higher order ODEs via Euler's method and Runge-Kutta) - Solving single and systems of non-linear differential equations by linearization-Use of the function ODE in MATLAB to solve differential equations - Plot Function –Saving & Painting Plots.

Lab Experiments

1. Solution of fourth order linear differential equations using
    a. Trapezoidal Rule

b. Euler method

2. Solution of fourth order non-linear differential equations using
   a. Modified Euler method
   b. Runge – Kutta method

MODULE IV INTRODUCTION OF SIMULINK 12

Simulink & its relations to MATLAB – Modeling a Electrical Circuit- Modeling a fourth order differential equations- - Representing a model as a subsystem- Programme specific Simulink demos.

Lab Experiments

1. Solution of fourth order non-linear differential equations using simulink.
2. Programme specific experiment based on simulink.

Total Hours (Including Practicals): 45

REFERENCE:

1. Griffiths D V and Smith I M, “Numerical Methods for Engineers”, Blackwell, 1991.
2. Laurene Fausett, “Applied Numerical Analysis Using MATLAB”, Pearson 2008.
3. Moin P, “Fundamentals of Engineering Numerical Analysis”, Cambridge University Press, 2001.
4. Wilson HB, Turcotte LH, Advanced mathematics and mechanics applications using MATLAB”, CRC Press, 1997
5. Ke Chen, Peter Giblin and Alan Irving, “Mathematical Exploration with MATLAB”, Cambridge University Press, 1999.

COURSE OUTCOMES:

At the end of this unit students will be able to:

- Use Matlab as a convenient tool for solving a broad range of practical problems in engineering from simple models to real examples.
- Write programs using first principles without automatic use of built-in ones.
- Write programs for solving linear and nonlinear systems, including those arising from boundary value problems and integral equations, and for root-finding and interpolation, including piecewise approximations.
- Be fluent in exploring Matlab’s capabilities, such as using matrices as the fundamental data-storage unit, array manipulation, control flow, script and function m-files, function handles, graphical output.
- Make use of Maltab visual capabilities for all engineering applications.

- An ability to identify, formulate, and solve engineering problems. This will be accomplished by using MATLAB to simulate the solution to various problems in engineering fields

GECY112 JAVA PROGRAMMING

L	T	P	C
1	0	2	2

COURSE EDUCATIONAL OBJECTIVES:

- To learn the fundamentals of Java programming such as data types, variables and arrays.
- To study the syntax and necessity of decision making and iterative statements.
- To create a class and invoke the methods.
- To instigate programming in overloading of methods.
- To emphasize the concept of packages.
- To learn the exception handling routines.

MODULE I INTRODUCTION TO JAVA PROGRAMMING 08

History and Evolution of Java – Overview of Java – Data types, variables and arrays – Operators – Control statements.

MODULE II METHODS AND CLASSES 07

Class fundamentals – Declaring objects – Methods – Constructors – Garbage collection – Overloading methods – Constructor overloading – Access control – Inheritance – Packages - Exception handling.

L: 15, P: 30, Total Hours: 15

REFERENCES:

1. Herbert Schildt, “Java The Complete Reference”, 9th Edition, Oracle Press, 2014, ISBN: 978007180855-2.
2. Nicholas S. Williams, **“**Professional Java for Web Applications: Featuring WebSockets, Spring Framework, JPA Hibernate and Spring Security (WROX)”, John Wiley & Sons, 2014, ISBN: 978111865651-8.
3. E Balagurusamy, “Programming with Java”, 5th Edition, Tata Mcgraw Hill, 2014.
4. Yashavant Kanetka**, “**Let Us Java”, 2nd Edition, BPB Publications, 2012**.**

COURSE OUTCOMES:

Students who complete this course will be able to

- Implement basic Java programming.
- Create a class and invoke methods for real world problems.

- Construct simple overloading of methods programs.
- Implement various types of inheritance concepts.
- Describe the access control mechanism.
- Handle exception thrown while implementing programming.

GECY113 PYTHON PROGRAMMING

L	T	P	C
1	0	2	2

COURSE EDUCATIONAL OBJECTIVES:

- To learn the list and records of python programming.
- To study the control statements and string functions of python.
- To instigate the fundamental python programming.
- To emphasize GUI in python.
- To integrate python with embedded systems.
- To implement programs in python.

MODULE I INTRODUCTION TO PYTHON PROGRAMMING 08

Installation and environment set up – syntax used in python – variable types – operators – Loops – decision making – string functions - formatted files - GUI basics.

MODULE II EMBEDDED PROGRAMMING USING PYTHON 07

Web interface – system tools – script execution context - Motion-triggered LEDs – Python - Arduino prototyping-storing and plotting Arduino data-Remote home monitoring system.

L: 15, P: 30, Total Hours: 15

REFERENCES:

1. Nick Goddard, “Python Programming”, 2nd edition, ISBN: 1533337772, 2016.
2. Pratik Desai, “Python Programming for Arduino”, 1st edition, Packt publishing, 2015, ISBN: 9781783285938.
3. Mark Lutz, Learning Python: Powerful Object-Oriented Programming, 5th Edition, O'Reilly Media, 2013.
4. Richard H. Barnett, Sarah Cox, Larry O'Cull, “Embedded C Programming and the Atmel AVR”, 2nd edition, 2006.
5. Michael Barr, Anthony Massa, “Programming Embedded Systems”, 2nd Edition, O'Reilly Media, 2006.

COURSE OUTCOMES:

Students who complete this course will be able to

- Implement date and time function programming using python.

- Write formatted file programming.
- Construct simple python programs.
- Create web interface using python programming
- Develop embedded system with python programming.
- Build Arduino prototype using python programming.

GECY114 INTELLECTUAL PROPERTY RIGHTS (IPR)

L	T	P	C
1	0	0	1

COURSE EDUCATIONAL OBJECTIVES:

- To study about Intellectual property rights and its need
- To explore the patent procedure and related issues

MODULE I INTRODUCTION 07

Introduction and the need for intellectual property right (IPR) – IPR in India – Genesis and Development – IPR in abroad – Important examples of IPR – Copyrights, Trademarks, Patents, Designs, Utility Models, Trade Secrets and Geographical Indications – Industrial Designs

MODULE II PATENT 08

Concept of Patent – Product / Process Patents & Terminology – Duration of Patents – Law and Policy Consideration Elements of Patentability –- Patentable Subject Matter – Procedure for Filing of Patent Application and types of Applications – Procedure for Opposition – Revocation of Patents – Working of Patents- Patent Agent – Qualification and Registration Procedure – Patent databases and information system – Preparation of patent documents – Process for examination of patent application- Patent infringement – Recent developments in patent system

Total Hours: 15

REFERENCES

1. B.L.Wadehra; Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India 2000
2. Ajit Parulekar and Sarita D' Souza, Indian Patents Law – Legal & Business Implications; Macmillan India ltd , 2006
3. P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi, 2010.
4. E. T. Lokganathan, Intellectual Property Rights (IPRs): TRIPS Agreement & Indian Laws Hardcover, 2012
5. Alka Chawla, P N Bhagwati , Law of Copyright Comparative Perspectives 1st Edition, LexisNexis, 2013
6. V. K. Ahuja, Law Relating to Intellectual Property Rights 2nd Edition, LexisNexis, 2nd Edition, 2013

7. Deborah E. Bouchoux, Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets, 2015
8. Jatindra Kumar Das, Law of Copyright, PHI Learning, 2015

COURSE OUTCOMES:

Students should be able to

- Identify the various types of intellectual property and their value
- Apply the procedure to file a patent and to deal the related issues
- Search and extract relevant information from various intellectual database

CURRICULUM AND SYLLABI

REGULATIONS - 2016

(As approved by the 9th Academic Council)

M. Tech.

COMPUTER SCIENCE AND ENGINEERING

B.S.ABDUR RAHMAN UNIVERSITY

B.S. ABDUR RAHMAN INSTITUTE OF SCIENCE & TECHNOLOGY
(Estd. u/s 3 of the UGC Act, 1956)

(FORMERLY B.S. ABDUR RAHMAN CRESCENT ENGINEERING COLLEGE)
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REGULATIONS, CURRICULUM AND SYLLABI

M. Tech.
COMPUTER SCIENCE AND ENGINEERING

(As approved by the 9th Academic Council)

JULY 2016

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VISION AND MISSION OF THE DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

VISION

The vision of the Department of Computer Science and engineering is to impart quality education, inculcate professionalism and enhance the problem solving skills of the students in the domain of Computer Science and Engineering with a focus to make them industry ready, involve in possible areas of research, to pursue and have continual professional growth.

MISSION

- To equip the students with strong fundamental concepts, analytical capability, programming and problem solving skills.
- To create an academic environment conducive for higher learning through faculty training, self learning, sound academic practices and research endeavors.
- To provide opportunities in order to promote organizational and leadership skills in students through various co-curricular and extra – curricular activities
- To make the students industry ready and to enhance their employability through training and internships.
- To improve department industry collaboration through interaction including participation in professional society activities, guest lecturers and industrial visit.

PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES

M. Tech. (Computer Science and Engineering)

PROGRAMME EDUCATIONAL OBJECTIVES

- To provide advanced knowledge and skills in the field of Computer Science and Engineering.
- To provide essential skill sets needed for Software Development as per the Industry requirements.
- To instill confidence and provide necessary ambience to take up fundamental as well as applied Research in Computer related domains with social relevance.
- To impart required analytical skills and tools for solving problems with varied complexity.
- To hone necessary skills to effectively communicate, work as a team for a successful professional career.

PROGRAMME OUTCOMES

On completion of the programme the graduates will

- have the capability to design and develop computer based systems for different domains.
- be able to apply the knowledge of computing tools and techniques for solving real life problems encountered in Software Industries.
- be able to pursue quality research in areas of social relevance.
- be able to work as a team exhibiting effective managerial skills.

CURRICULUM & SYLLABI FOR
M. Tech. (Computer Science and Engineering)

CURRICULUM

Sl. No.	Course Code	Course Title	L	T	P	C
		SEMESTER I				
1	MAC6181	Applied Algebra and Discrete Algorithms	**3**	**1**	**0**	**4**
2	CSC6101	Advanced Computer Architecture	**3**	**1**	**0**	**4**
3	CSC6102	Algorithm Design and Implementation	**3**	**0**	**2**	**4**
4	CSC6103	Computer Networks and Management	**2**	**0**	**2**	**3**
5	CSC6104	Distributed Operating System	**3**	**0**	**0**	**3**
6	CSC6105	Advanced Software Engineering	**3**	**0**	**0**	**3**
7	CSC6106	Case Study 1	**0**	**0**	**2**	**1**
						22
		SEMESTER II				
1	GEC6201	Research Methodology For Engineers	**3**	**0**	**0**	**3**
2	CSC6201	Machine Learning Techniques	**2**	**0**	**2**	**3**
3	CSC6202	Applied Cryptography & Network Security	**3**	**0**	**2**	**4**
4		Professional Electives #				**9**
						19
		SEMESTER III				
1	CSC7102	Internship* / Term paper	**0**	**0**	**2**	**1**
2		Professional Electives ##				**9**
3		General Elective	**3**	**0**	**0**	**3**

Sl. No.	Course Code	Course Title	L	T	P	C
4	CSC7101	Project – Phase I	**0**	**0**	**12**	**6**
						13
		SEMESTER IV				
1	CSC7101	Project – Phase II	**0**	**0**	**36**	**18**
						6+18=24
		TOTAL CREDITS				**78**

- Student has to take a minimum of 9 credits from the list of Electives.

* - Internship must be taken after the completion of II semester examinations.

- Student has to take a minimum of 9 credits from the list of Electives.

PROFESSIONAL ELECTIVES

Sl. No.	Course Code	Course Title	L	T	P	C
		LIST OF ODD SEMESTER ELECTIVES				
1	CSCY101	Data warehousing and Data mining	**3**	**0**	**0**	**3**
2	CSCY102	Agent Based Intelligent Systems	**1**	**0**	**2**	**2**
3	CSCY103	Human Computer Interaction	**3**	**0**	**0**	**3**
4	CSCY104	Cognitive Science	**3**	**0**	**0**	**3**
5	CSCY105	Deep Learning	**3**	**0**	**0**	**3**
6	CSCY106	Computer Vision	**3**	**0**	**0**	**3**
7	CSCY107	Statistical Natural Language Processing	**2**	**0**	**2**	**3**
8	CSCY108	Component Based Technology	**2**	**0**	**2**	**3**
9	CSCY109	Mobile Computing	**1**	**0**	**2**	**2**
10	CSCY110	Digital Image Processing	**3**	**0**	**0**	**3**
11	CSCY111	Bio Inspired Algorithms	**3**	**0**	**0**	**3**
12	ECCY009	Internet of Things	**3**	**0**	**0**	**3**
13	ECC6121	Advanced Embedded Systems	**3**	**0**	**0**	**3**
		LIST OF EVEN SEMESTER ELECTIVES				
1	CSCY201	Software Testing and Quality Assurance	**3**	**0**	**0**	**3**
2	CSCY202	Mobile Adhoc Networks	**3**	**0**	**0**	**3**
3	CSCY203	Performance Evaluation of Computer Systems and Networks	**3**	**0**	**0**	**3**
4	CSCY204	Advanced Databases	**3**	**0**	**0**	**3**
5	CSCY205	Real Time Systems	**3**	**0**	**0**	**3**
6	CSCY206	Multicore Programming	**3**	**0**	**0**	**3**

7	CSCY207	Software Project Management	**3**	**0**	**0**	**3**
8	CSCY208	Dependable Computing	**3**	**0**	**0**	**3**
9	CSCY209	Advanced Graphics Programming	**3**	**0**	**0**	**3**
10	CSCY210	Pervasive Computing	**3**	**0**	**0**	**3**
11	CSCY211	Web Technology	**1**	**0**	**2**	**2**
12	CSCY212	XML and Web Services	**1**	**0**	**2**	**2**
13	CSCY213	Multimedia Systems	**1**	**0**	**2**	**2**
14	ITC6201	Cloud Computing Technologies	**3**	**0**	**0**	**3**

LIST OF SINGLE CREDIT ELECTIVE COURSES

Sl. No.	Course Code	Course Title	L	T	P	C
1	CSCY071	Wireless Network Programming	**0.5**	**0**	**1**	**1**
2	CSCY072	Cloud Computing Programming	**0.5**	**0**	**1**	**1**
3	CSCY073	Big Data Programming	**0.5**	**0**	**1**	**1**
4	CSCY074	Visual Systems Programming	**0.5**	**0**	**1**	**1**
5	CSCY075	Open Source Tools	**0.5**	**0**	**1**	**1**

GENERAL ELECTIVES FOR M.TECH PROGRAMMES

Sl. No.	Course Code	Course Title	L	T	P	C
1	GECY101	Project Management	**3**	**0**	**0**	**3**
2	GECY102	Society, Technology & Sustainability	**3**	**0**	**0**	**3**
3	GECY103	Artificial Intelligence	**3**	**0**	**0**	**3**
4	GECY104	Green Computing	**3**	**0**	**0**	**3**
5	GECY105	Gaming Design	**3**	**0**	**0**	**3**
6	GECY106	Social Computing	**3**	**0**	**0**	**3**
7	GECY107	Soft Computing	**3**	**0**	**0**	**3**
8	GECY108	Embedded System Programming	**3**	**0**	**0**	**3**
9	GECY109	Principles of Sustainable Development	**3**	**0**	**0**	**3**
10	GECY110	Quantitative Techniques in Management	**3**	**0**	**0**	**3**
11	GECY111	Programming using MATLAB & SIMULINK	**1**	**0**	**2**	**2**
12	GECY112	JAVA Programming	**1**	**0**	**2**	**2**
13	GECY113	PYTHON Programming	**1**	**0**	**2**	**2**
14	GECY114	Intellectual Property Rights	**1**	**0**	**0**	**1**

SEMESTER I

MAC6181	APPLIED ALGEBRA AND DISCRETE ALGORITHMS	L	T	P	C
		3	1	0	4

OBJECTIVES :

The aim of this course is to

- Make the students familiarize on the concepts of mathematical induction and codes.
- Motivate the students to solve problems applying techniques of logic.
- To have a knowledge on the concepts of Formal languages and Automata theory.
- Familiarize students with basics of graph theory.
- Train the students in applying the basic concepts of Cryptography.

MODULE I INTEGERS, COMPUTER ALGEBRA AND CODES 09+03

Integers – computer algebra versus numerical analysis – sums and products – mathematical induction – Binary, Hexadecimal, ASCII, Morse, Braille, Two out of Five and Hollerith Codes.

MODULE II LOGIC 09+03

Propositional logic – logical connectives – truth tables – normal forms (conjunctive and disjunctive) – solving word problems - predicate logic - universal and existential quantifiers - proof techniques – direct and indirect – proof by contradiction – applications.

MODULE III MODELING, COMPUTATION AND LANGUAGES 09+03

Finite state machines - deterministic and non-deterministic finite state machines - classes of grammars - phrase structure grammar - context sensitive - context-free - regular grammars - formal languages - ambiguity - Turing machines.

MODULE IV GRAPH THEORY 09+03

Multigraphs - applications of graph theory - classes of graphs - subgraphs and morphisms - Hamilton circuits – planar graphs – shortest paths and spanning.

MODULE V CIPHERS 09+03

Cryptography - cryptanalysis - substitution and permutation ciphers – block cipher – the playfair cipher – unbreakable ciphers – applications.

L – 45; T – 15

TEXT BOOKS:

1. Hopcraft, J. E, R. Motwani and Ullman, J. D, 'Introduction to Automata theory, Languages and Computation', Narosa publishing House, 4th edition 2006.
2. Kenneth H. Rosen, "Discrete Mathematics and its Applications", 7th edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2015.
3. J.P. Tremblay and R. Manohar, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill, 1997.

REFERENCES:

1. Juraj Hromkovic, Theoretical Computer Science: Introduction to Automata, Computability, Complexity, Algorithmics, Randomization, Communication and Cryptography, Springer, 2003.
2. Darel W. Hardy, Fred Richman, Carol L. Walker, Applied Algebra: Codes, Ciphers and Discrete Algorithms, Second Edition (Discrete Mathematics and Its Applications), CRC Press, Newyork, 2009.
3. David Gries and Fred B. Schneider, A Logical Approach to Discrete Math, Springer, 3rdEdition, 1993.

OUTCOMES:

At the end of the course students will be able to

- Authenticate the correctness of the given statement using mathematical induction.
- Test and analyze the logic of a program.
- Apply the concept of finite state machines and to generate languages.
- Analyze the types of graphs solve problems using the concepts of graph theory.
- Apply encryption and decryption techniques to send messages securely.

CSC6101 ADVANCED COMPUTER ARCHITECTURE

L	T	P	C
3	1	0	4

OBJECTIVES :

- To understand the functional requirements and their role in the system design
- To understand the various parameters that contribute to the performance of a computer system and the technology of achieving the best performance through these parameters
- To acquire essential knowledge to measure or predict system performance
- To understand how the memory hierarchy and optimization contribute to the performance of the system
- To understand the approaches in designing a new system through Instruction level parallel processing and to improve the Performance overcoming the hazards-meeting the functionality.
- To understand the data level parallel processing and Vector Processing for performance

MODULE I FUNDAMENTALS OF COMPUTER DESIGN 09+04

Functional Requirements and architecture - Measuring and reporting performance - Quantitative principles of computer design - Classifying instruction set architecture - Operands and operations for media and signal processing –Graphic processing - Encoding an instruction set - Example architecture - MIPS and TM32.

MODULE II MEMORY HIERARCHY DESIGN 09+03

Memory Hierarchy - Cache performance - Reducing cache miss penalty and miss rate - Reducing hit time - Main memory and performance - Memory technology and optimization-Virtual memory and Virtual Machine and protection.

MODULE III INSTRUCTION LEVEL PARALLELISM 09+03

Concepts of ILP - Pipelining and hazards –Compiler techniques for exposing ILP- Dynamic scheduling - Dynamic hardware prediction - Multiple issues - Hardware based speculation - Limitations of ILP - Case studies: lP6 Micro architecture. Compiler techniques for exposing ILP - Static branch prediction - Static multiple issues: VLIW - Advanced compiler support –Hardware VS software speculation.– Case study: Intel core i7 and ARM Cortex-A8

MODULE IV DATA-LEVEL PARALLELISM 09+02

Vector Architecture - SIMD Instruction Set Extensions for Multimedia - Graphic Processing Units- Detecting and Enhancing Loop Level Parallelism - Mobile verses Server GPUs - Case Studies

MODULE V THREAD LEVEL PARALLELISM 09+03

Centralized Symmetric and shared memory Multiprocessor architectures - Performance issues - Distributed Shared Memory architecture- Directory based architecture-Synchronization - Cache Coherence and memory consistency - Trends in processor design- Need for multi-core processor – difference between multiprocessor and multicore processor- Thread level processing – Simultaneous multi-threading.

L – 45; T – 15

REFERENCES :

1. John L. Hennessey and David A. Patterson," Computer Architecture: A Quantitative Approach", Morgan Kaufmann / Elsevier, 5th Edition, 2012.
2. David A. Patterson and John L. Hennessy, Computer Organization and Design – The Hardware / Software Interface, 4th Edition, Morgan Kaufmann, Elsevier, 2009.
3. D.Sima, T. Fountain and P. Kacsuk, "Advanced Computer Architectures: A Design Space Approach", Addison Wesley, 2000.
4. Vincent P. Heuring and Harry F. Jordan, "Computer System Design and Architecture", Addison Wesley, 2nd Edition, 2004.
5. B.Govindarajalu, “Computer Architecture and Organization”, Tata McGraw Hill Education Pvt. Ltd., 2010.

OUTCOMES :

Students who complete this course will be able to

- Suggest the requirements for a new instruction set, to meet the functional requirement and to contribute to performance.
- Test the performance of a computer system
- Analyze changes in performance with various configurations and Memory Hierarchy
- Analyze code for instruction level Parallel Processing and modify the code for out of order execution for better performance
- Modify the code to exploit SIMD architecture and improve the performance of the system.
- Analyze how multi-threading in multiple processors and multi-core processors will share the resources for performance.

CSC6102 ALGORITHM DESIGN AND IMPLEMENTATION

L	T	P	C
3	0	2	4

OBJECTIVES :

- To discuss various algorithm design techniques for developing algorithms.
- To study the basic techniques for designing algorithms, including the techniques of recursion, divide-and-conquer, and greedy.
- To provide the basic knowledge of computational complexity, approximation and randomized algorithms.
- To learn the advanced techniques for designing algorithms, including dynamic programming, network flow and problem reduction
- To illustrate the NP completeness and identify different NP complete problems.
- To determine the time and space complexity of simple algorithms and recursively defined algorithms.

MODULE I INTRODUCTION 09

Introduction and Motivation-Lower Bound-Asymptotic Notations-Mathematical Induction-Mathematical models-Formulating the Equations-Solving the equations-Homogeneous Linear Recurrence with Constant Coefficients-Non-homogeneous Equations-Transformations.

MODULE II GRAPH ALGORITHMS 09

Elementary Graph Algorithms Breadth-first search- Depth-first search - Topological sort- Minimum Spanning Trees -The algorithms of Kruskal and Prim - Single-Source Shortest Paths - The Bellman-Ford algorithm - Single-source shortest paths in directed acyclic graphs -Dijkstra's algorithm -All-Pairs Shortest Paths -The Floyd-Warshall algorithm -Johnson's algorithm for sparse graphs- Maximum Flow- Flow network- The Ford-Fulkerson method- Maximum bipartite matching-Push-relabel algorithms-The relabel-to-front algorithm.

MODULE III DIVIDE-AND-CONQUERANDRANDOMIZED ALGORITHMS 09

The maximum-sub array problem- Strassen's algorithm for matrix multiplication-The substitution method for solving recurrences-The recursion-tree method for solving recurrences-The master method for solving recurrences-Proof of the master theorem-The hiring problem- Indicator random variables-Randomized algorithms-Probabilistic analysis and further uses of indicator random variables.

MODULE IV MULTITHREADED AND NUMBER-THEORETIC ALGORITHMS 09

The basics of dynamic multithreading-Multithreaded matrix multiplication Multithreaded merge sort-Elementary number-theoretic notions- Greatest common divisor - Modular arithmetic -Solving modular linear equations - The Chinese remainder theorem - Powers of an element- The RSA public-key cryptosystem- Primality testing-Integer factorization .

MODULE V NP-COMPLETENESS AND APPROXIMATION ALGORITHMS 09

Polynomial time-Polynomial-time verification-NP-completeness and reducibility-NP-completeness proofs-NP-complete problems- Approximation Algorithms-The vertex-cover problem-The traveling-salesman problem-The set-covering problem-Randomization and linear programming-The subset-sum problem.

L – 45; P – 30

REFERENCES :

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, “Introduction to Algorithms”, 3rd Edition MIT Press, ISBN:978-0262033848,2009.
2. Alfred V Aho, John E Hopcrof,” The Design and Analysis of Computer Algorithms”, Pearon Education, 4th Edition, ISBN:978813170205,2009.
3. Mark Allen Weiss,” Data Structures and Algorithm Analysis in C++”, Addison-Wesley,3rd edition, ISBN: 978-0132847377,2013.

OUTCOMES :

Students who complete this course will be able to

- Prove the correctness of algorithms using inductive proofs and invariants.
- Analyze randomized algorithms with respect to expected running time, probability of error using tail inequalities
- Classify problems into different complexity classes corresponding to both deterministic and randomized algorithms
- Analyze approximation algorithms including algorithms that are PTAS and FPTAS.
- Implement both a greedy and a divide-and-conquer algorithm to solve problems.

- Design the techniques of proof by contradiction, mathematical induction and recurrence relation, and apply them to prove the correctness and to analyze the running time of algorithms.

CSC6103 COMPUTER NETWORKS AND MANAGEMENT

L	T	P	C
2	0	2	3

OBJECTIVES :

- To outline the basic concepts of computer networks
- To illustrate the operations of network traffic, congestion, controlling and Queuing delay models
- To compare different mechanism for quality of service and Internet protocols
- To describe the concept and architecture of network management
- To showcase the different network management protocols like SNMP and RMON
- To identify various network tools to simulate the working of connection oriented and connectionless networks.

MODULE I INTRODUCTION TO COMPUTER NETWORKS 09

Introduction – Reliable Transmission via Redundancy – Reliable transmission by retransmission - Routing and addressing – Link Layer Protocols and Technologies – Quality of Service overview

MODULE II TRANSMISSION CONTROL PROTOCOL (TCP) AND SWITCHING AND QUEUING DELAY MODELS 09

Introduction to UDP and TCP – User Datagram Protocol (UDP) – TCP and Reliable Byte Stream Service – Congestion Control – Fairness – Recent TCP Versions – TCP Wireless Links - Packet Switching in Routers - Queuing Model – Networks of Queues

MODULE III MECHANISMS FOR QUALITY OF SERVICE AND INTERNET PROTOCOLS 09

Queue Scheduling – Policing – Active Queue Management – MPLS - Internet Protocol Version (IPV6) – Routing Protocols – Address Translation Protocols – Domain Name System (DNS) – Network Management Protocols – Network Tools

MODULE IV NETWORK MANAGEMENT AND SNMP 09

Network Management : goals , Organization and Functions – Network Management Architecture and organization – Network Management perspective – NMS platform – Current Status & future of Network Management – SNMP V1 Network Management- Basic Foundation standards, Models and languages –

Organization and information Models - Communication and functional Models – SNMP V2 – SNPV3

MODULE V RMON, NETWORK MANAGEMENT TOOLS AND APPLICATIONS 09

Remote Monitoring – RMON SMI & MIB – RMON1-RMON2-ATM Remote Monitoring – A Case Study of Internet Traffic using RMON – Network Management Tools, Systems and Engineering – System utilities for Management – Network Statistics Measurement Systems – MIB Engineering – NMS Design – Network Management Applications

L-30; P-30

REFERENCES :

1. Ivan Marsic, “Computer Networks Performance and Quality of Service” , Rutgers University, New Brunswick, New Jersey, 1st edition, FREE PDF, ISBN-10: N/A, http://www.ece.rutgers.edu/~marsic/books/CN, 2013.
2. Mani Subramanian “Network Management: Principles and Practice “,2nd edition, Pearson Edition, ISBN-13: 978-8131734049, 2010.
3. Olivier Bonaventure, “Computer Networking: Principles, Protocols and Practice”, Creative Commons Attribution, ISBN: 978-1-365-18583-0, 2011.
4. Larry Peterson and Bruce S Davis “Computer Networks: A System Approach” 5th Edition, Elsevier, ISBN-13: 978-0123850591, 2014.
5. Douglas E Comer, “Internetworking with TCP/IP, Principles, Protocols and Architecture” 6th Edition, PHI, ISBN-13: 978-0136085300, 2014.

OUTCOMES :

Students who complete this course will be able to

- Describe the network services, protocols and architectures
- Identify the different congestion control techniques
- Develop effective communication mechanisms using techniques like connection establishment, queuing theory, recovery Etc.
- Apply SNMP and RMON for Managing Network.
- Access MIBS from devices using SNMP on a workstation
- Analyze and interpret the data provided by an NMS and take suitable actions

CSC6104 DISTRIBUTED OPERATING SYSTEM

L	T	P	C
3	0	0	3

OBJECTIVES :

- To obtain an in depth knowledge of the aspects of operating systems such as process management, scheduling, synchronization.
- To give an insight into remote procedure calls and distributed systems.
- To outline the distributed scheduling and shared memory concepts.
- To provide a concise overview of distributed resource management.
- To outline the approaches of fault recovery and the issues.
- To give an emphasis on the resource security and protection.

MODULE I PROCESS SYNCHRONISATION 09

Overview – synchronization mechanism-Critical Section Problems-Language mechanism for Synchronization -Process Deadlocks-Models of Deadlock and Resources-Graph Theoretic Model of a system state- Systems with single unit requests-consumable –reusable resources .

MODULE II DISTRIBUTED SYSTEMS 09

System architecture types-Distributed architecture systems -issues in distributed operating systems-communication networks-primitives-Theoretical Foundations-inherent limitation of distributed systems-Lamport's Logical clocks- distributed mutual exclusion: classification of mutual exclusion algorithms, Lamport's ,token based algorithm, Suzuki-Kasami's Broadcast algorithm, Raymond's Tree based algorithm, Distributed deadlock detection.

MODULE III DISTRIBUTED RESOURCE MANAGEMENT 09

Distributed File Systems – Architecture – Mechanisms – Design Issues - Distributed Shared Memory – Distributed Scheduling – Case Studies.

MODULE IV FAULT TOLERANCE AND RECOVERY 09

Classification of failures-Backward and forward error recovery – Basic approaches – Recovery in concurrent systems – Synchronous and Asynchronous check point and recovery – Fault tolerance- Issues-Atomic actions and committing-Commit protocols-voting protocols.

MODULE V SECURITY 09

Security Environment - Operating System Security - Controlling Access to Resources – Formal Models of Secure Systems - Cryptography as a Security Tool – Authentication-Exploiting Software – Attacks-Malware – Defenses.

Theory : 45

REFERENCES :

1. MukeshSinghal and Niranjan. G. Shivaratri, “Advanced Concepts in Operating Systems”, McGrawHill, 2011.
2. Andrew S.Tanenbaum and Herbert Bos, “Modern Operating Systems”, 4th Edition, Pearson, ISBN 978-0-13-359162-0, 2015.
3. Abraham Silberschatz, Peter B. Galvin, G. Gagne, “Operating System Concepts”, 9th Edition, Addison Wesley Publishing Co., ISBN –978-1-11-809375-7, 2012.
4. William Stallings, Moumita Mitra Manna. “Operating Systems – Internal and Design Principles”, 8th Edition, Pearson Education, ISBN978-0-13-380591-8, 2014.

OUTCOMES :

Students who complete this course will be able to

- Demonstrate operating system concepts such as scheduling and synchronization.
- Identify the design and implementation issues with distributed systems.
- Evaluate the scheduling requirements of distributed systems and find their solutions
- Identify the different approaches to fault recovery and the fault tolerance issues.
- Apply methods and tools for resource protection and security.
- Investigate different operating system principles, abstractions, algorithms and techniques.

CSC6105 ADVANCED SOFTWARE ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES :

- To expose students to social, legal and ethical issues for Software Engineers.
- To provide experience using an agile like process.
- To expose development of software systems of high quality.
- To demonstrate the necessary understanding of methods and techniques for software management.
- To accumulate knowledge of the analysis, design and management of large and complex software systems.
- To develop the ability to understand, design and implement such systems in the global market.

MODULE I INTRODUCTION 09

Professional Software Development – Software Engineering Ethics – Case Study – Software Process Models – Process Activities – Agile Process Development – Requirement Engineering – System Modeling – Architectural Design – Implementation – Testing.

MODULE II SYSTEM DEPENDABILITY AND SECURITY 09

Dependable Systems Dependability Properties – Sociotechnical Systems – Dependable Process – Formal Methods and Dependability – Reliability Engineering Reliability Requirements – Fault tolerant Architectures – Reliability Measurement – Safety Engineering – Security Engineering.

MODULE III ADVANCED SOFTWARE ENGINEERING 09

Software Reuse – Reuse Landscape – Application Framework Application System reuse – Component Based Software Engineering Componenets and Components models – CBSE Processes – Component composition – Distributed Software Management.

MODULE IV SOFTWARE ORIENTED SOFTWARE ENGINEERING 09

Service Oriented Architecture – RESTful services – Service Engineering – Service Composition – Systems Engineering – Systems of Systems – Real Time Software Engineering – Embedded System Design – Architectural Patterns for real-time Software – Time Analysis – Real-Time Operating Systems.

MODULE V SOFTWARE MANAGEMENT 09

Project Management – Project Planning – Software Pricing – Plan Driven development – Projevct Scheduling – Agile planning – Estimation Techniques – COCOMO Testing Modeling – Quality Management – Configuration management.

Theory : 45

REFERENCES :

1. Ian Sommerville, Software engineering, Pearson education Limited, 6th edition, ISBN : 978-1-292-09613-1,2016.
2. Roger S.Pressman, Software engineering- A practitioner's Approach, McGraw- Hill International Edition, 8th edition, ISBN-13: 978-0-0780-2212-8, 2014.
3. Dogru, Ali H., Modern Software Engineering Concepts and Practices: Advanced Approaches: Advanced Approaches, IGI Global, ISBN: 978-1-60960-215-4, 2011.

OUTCOMES :

Students who complete this course will be able to

- Expose technical issues through a software development project.
- Analyze the impact of computing on individuals, organizations and society, including ethical, legal, security and global policy issues;
- Design models to reflect abstract architectures of software systems.
- Create and understand descriptions of SOA using high level UML models
- Apply the Software Engineering concepts to Software Projects in a real business environment.
- Evaluate research articles and thus be aware of the research front in software development.

SEMESTER II

GEC6201 RESEARCH METHODOLOGY FOR ENGINEERS

L	T	P	C
3	0	0	3

OBJECTIVES :

- To provide a perspective on research to the scholars
- To educate on the research conceptions for designing the research
- To impart knowledge on statistical techniques for hypothesis construction
- To gain knowledge on methods of data analysis and interpretation
- To learn about the effective communication of research finding

MODULE I RESEARCH PROBLEM FORMULATION 07

Research – objectives – types, Research process, Solving engineering problems, Identification of research topic, Formulation of research problem, Literature survey and review.

MODULE II HYPOTHESIS FORMULATION 08

Research design – meaning and need – basic concepts, Different research designs, Experimental design – principle – important experimental designs, Design of experimental setup, Mathematical modeling, Simulation – validation and experimentation, Dimensional analysis and similitude.

MODULE III STATISTICAL TECHNIQUES 12

Statistics in research – concept of probability – popular distributions –Hypothesis testing- sample design- Design of experiments – factorial designs -– orthogonal arrays- ANOM - ANOVA - Multivariate analysis - Use of optimization techniques – traditional methods – evolutionary optimization techniques –Transportation model.

MODULE IV STATISTICAL ANALYSIS OF DATA 10

Research Data analysis – interpretation of results – correlation with scientific facts- Accuracy and precision – error analysis, limitations - Curve fitting, Correlation and regression.

MODULE V RESEARCH REPORT 08

Purpose of written report – audience, synopsis writing, preparing papers for International journals, Thesis writing – organization of contents – style of writing –

graphs and charts – referencing, Oral presentation and defence, Ethics in research, Patenting, Intellectual Property Rights.

Theory : 45

REFERENCES :

1. Ganesan R., Research Methodology for Engineers, MJP Publishers, Chennai, 2011.
2. Ernest O., Doebelin, Engineering Experimentation: planning, execution, reporting, McGraw Hill International edition, 1995.
3. George E. Dieter., Engineering Design, McGraw Hill – International edition, 2000.
4. Madhav S. Phadke, Quality Engineering using Robust Design, Printice Hall, Englewood Cliffs, New Jersey, 1989.
5. Kothari C.R., Research Methodology – Methods and Techniques, New Age International (P) Ltd, New Delhi, 2003.
6. Kalyanmoy Deb., “Genetic Algorithms for optimization”, KanGAL report, No.2001002.
7. Holeman, J.P., Experimental methods for Engineers, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 2007.
8. Govt. of India, Intellectual Property Laws; Acts, Rules & Regulations, Universal Law Publishing Co. Pvt. Ltd., New Delhi 2010.
9. University of New South Wales, “How to write a Ph.D. Thesis” Sydney, Australia, Science @ Unsw.
10. Shannon. R.E., System Simulation: the art and science, Printice Hall Inc, Englewood Cliffs, N.J.1995.
11. Scheffer. R.L. and James T. Mc Clave, Probability and Statistics for Engineers, PWS – Kent Publishers Co., Boston, USA, 1990.

OUTCOMES :

Students who complete this course will be able to

- Formulate the research problem
- Design and Analyse the research methodology
- Construct and optimize the research hypothesis
- Analyse and interpret the data
- Report the research findings

CSC6201 MACHINE LEARNING TECHNIQUES

L	T	P	C
2	0	2	3

OBJECTIVES :

- To expose the applications of machine learning.
- To study the various algorithms related to supervised and unsupervised learning.
- To recognize the different types of machine learning models and how to use them.
- To learn the theoretical and practical aspects of probabilistic graphical models.
- To acquire the knowledge of various classification techniques.
- To learn the various neural network algorithms.

MODULE I INTRODUCTION TO MACHINE LEARNING 09

Introduction - examples of machine learning applications - Types of machine learning- Mathematical foundations of machine learning– Introduction to Parametric Models – Non-Parametric Models –Probability Basics.

MODULE II SUPERVISED LEARNING 09

Linear Models for Regression –Linear Basis Function Models - The Bias-Variance Decomposition - Bayesian Linear Regression - Bayesian Model Comparison - Limitations of Fixed Basis Functions - Linear Models for Classification – Discriminant Functions -Probabilistic Generative Models -Probabilistic Discriminative Models - Bayesian Logistic Regression. Neural Networks –Network Training - Feed-forward Network Functions – Back Propagation Network – Bayesian Neural Network.

MODULE III UNSUPERVISED LEARNING 09

Clustering- K-means - EM Algorithm- Mixtures of Gaussians - Dimensionality Reduction - Factor analysis - Principal Component Analysis - Probabilistic PCA - Independent components analysis - Singular Value Decomposition.

MODULE IV PROBABILISTIC GRAPHICAL MODELS 09

Graphical Models - Undirected graphical models - Markov Random Fields - Directed Graphical Models -Bayesian Networks - Conditional independence properties - Inference – Learning - Generalization - Hidden Markov Models - Conditional random fields.

MODULE V APPLICATIONS 09

Ranking: Priority Inbox - Ordering Email Messages by Priority - Writing a Priority Inbox - Spam Filtering - Analyzing Social Graphs - Social Network Analysis - Hacking Twitter Social Graph Data - Analyzing Twitter Networks – Case Study.

L-30; P-30

REFERENCES :

1. Christopher Bishop, “Pattern Recognition and Machine Learning” Springer, 1st edition, ISBN-13: 978-0387-31073-2, 2006.
2. Ethem Alpaydin, “Introduction to Machine Learning”, 3rd Edition, MIT Press, ISBN: 9780262028189, 2014.
3. Kevin Patrick Murphy, “Machine Learning: a Probabilistic Perspective”, 4th edition, MIT Press, ISBN:9780262018029, 2013.
4. Drew Conway, John Myles White, “Machine Learning for Hackers”, 1st Edition, O'Reilly Media, 2012.
5. Ian H. Witten, Eibe Frank, Mark A. Hall, “Data Mining: Practical Machine Learning Tools and Techniques”, 3rd Edition, Morgan Kaufmann, 2011.

OUTCOMES :

Students who complete this course will be able to

- Describe the concepts and models of machine learning.
- Design and implement algorithms for supervised and unsupervised learning.
- Develop skills of using recent machine learning software for solving practical problems.
- Analyze the efficient clustering techniques for solving real world problems.
- Implement probabilistic discriminative and generative algorithms for an application and analyze the results.
- Apply the appropriate techniques in social network analysis and Web Security.

CSC6202	APPLIED CRYPTOGRAPHY AND NETWORK SECURITY	L	T	P	C
		3	0	2	4

OBJECTIVES :

The Student should

- Have a theoretical understanding of the principles underlying cryptography and cryptanalysis.
- Have a fundamental understanding of symmetric and asymmetric encryption, hashing, and digital signatures.
- Learn the basic concepts in networking and wireless security, applied cryptography, as well as ethical, legal, social and economic facets of security.
- Become familiar with the cryptographic techniques that provide information and network security.
- Be able to evaluate the security of communication systems, networks and protocols based on a multitude of security metrics.
- Provide an awareness of network security issues in emerging technologies.

MODULE I CRYPTOGRAPHY AND ENCRYPTION TECHNIQUES 09

Overview – Principles-Concepts –Symmetric and Asymmetric Encryption–AES – Block Cipher Operations– RSA Algorithm – Diffie Hellman Key Exchange

MODULE II DATA INTEGRITY ALGORITHMS AND MUTUAL TRUST 10

Hash Functions – SHA – Message Authentication Codes – Digital Signatures- Key Management and Distribution – X.509 Certificates – Kerberos

MODULE III NETWORK SECURITY 08

Vulnerabilities - Security Assessment, Analysis, and Assurance-Disaster Management – Access Control and Authentication – Authorization

MODULE IV WIRELESS NETWORK SECURITY 08

Wireless Security – Wireless LAN - Smart Phones – PDA – Bluetooth- Broadband Security

MODULE V SECURITY IN EMERGING TECHNOLOGIES 09

Next Generation Mobile Networks – Wireless Sensor Networks – Adhoc Networks – IP based Mobile Networks

L- 45; P-30

REFERENCES :

1. William Stallings, “Cryptography and Network Security – Principles and Practice” 7th Edition, Pearson Education, ISBN No. 978- 0134444284, 2016.
2. Joseph MiggaKizza, “Guide to Computer Network Security” 3rd Edition, Springer Publishers, ISBN No 978-1447166535, 2015.
3. Wolfgang Osterhage, “Wireless Security”, CRC Press, ISBN No. 978-1578087686, 2011.
4. William Stallings, “Network Security Essentials, Applications and Standards”, 5th Edition, Pearson Education, ISBN No.978-0133370430,2013.
5. John R.Vacca , “Network and System Security”,2nd Edition, Elsevier Publishers, ISBN No.978-0124166899,2014.

OUTCOMES :

Students who complete this course should

- Have a technical understanding of the main cryptographic concepts and technologies available today.
- Explain the requirements and techniques for security management, including security policies, risk analysis, and physical threats and controls.
- Illustrate how cryptography and its application can maintain privacy and security in electronic communications and computer networks.
- Describe the vulnerabilities brought about by modern web-based application and services, and discuss countermeasures.
- Identify the appropriate procedures required to secure networks.
- Innovate techniques for enforcing computer and network security and developing secure e-commerce protocols.

PROFESSIONAL ELECTIVES
LIST OF ODD SEMESTER ELECTIVES

CSCY101 DATA WAREHOUSING AND DATA MINING

L	T	P	C
3	0	0	3

OBJECTIVES :

- To provide students with basic knowledge of tools used for data ware housing.
- To explore the technologies for storing and mining large databases.
- To assess the concepts and methods used for mining the data.
- To explore the strength and weakness of data mining algorithms.
- To expose the use of classification in data mining.
- To explain the application of data warehousing and data mining in real time scenario.

MODULE I INTRODUCTION 09

Data warehousing Components –Building a Data warehouse – Mapping the Data Warehouse to a Multiprocessor Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools – Metadata – reporting – Query tools and Applications – Online Analytical Processing (OLAP) – OLAP and Multidimensional Data Analysis.

MODULE II DATA WAREHOUSING AND BUSINESS ANALYSIS 09

Data warehouse –Basic concept-Modeling-Data cube and OLAP, Design and Usage-Frame work, information Processing, Online Analytical Processing-Implementation-Data Generalization.

MODULE III MINING CONCEPTS AND METHODS 09

Mining Basic concepts- Market Basket Analysis-Frequent Itemset - Closed Itemset - Association rules-Mining Methods - Apriori Algorithm-Generating Association rules for Frequent item set-Pattern Mining – Pattern Evaluation Methods

MODULE IV CLASSIFICATION AND CLUSTER ANALYSIS 09

Basic concepts-Decision Tree Induction-Bayes Classification Methods Rule Based Classification-Model Evaluation and selection-Improving classification Accuracy-Cluster Analysis: - Types and Categorization - Partitioning , Hierarchical , Density, Grid, Constraint - and Model-Based Clustering Methods

MODULE V APPLICATION 09

Case study of the application of data mining in the following field: Financial Data Analysis, Retail Industry, Telecommunication Industry, Biological Data Analysis, Social Network, Scientific Applications, Intrusion Detection

Theory : 45

REFERENCES :

1. Jiawei Han & Micheline Kamber, “Data Mining – Concepts and Techniques”, 3rd Edition, ISBN 978-0-12-381479- Morgan Kaufmann Publishers, Elsevier, 2012.
2. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, “Introduction to Data Mining”, 1st Edition, ISBN: 1-892095-02-5, Pearson education, 2006.

OUTCOMES :

Students who complete this course will be able to

- Distinguish between database and data warehouse.
- Design appropriate data warehouse multi-dimensional model.
- Perform basic data mining operations and apply standard data mining algorithms to solve real time problems
- Correlate data mining techniques to current scenarios in various fields and inculcate the ability to apply tools for mining and analysis.
- Review the various latest research activities going on in the field of Data Mining, thereby creating an interest for research.
- Able to mine the data and perform predictive analysis.

CSCY102 AGENT BASED INTELLIGENT SYSTEMS

L	T	P	C
1	0	2	2

OBJECTIVES :

- To provide basic knowledge of employing intelligent agents in solving complex problems.
- To give the awareness of the building blocks of agents and working of different types of agents.
- To analyze the reasons for uncertainty and ability to design agents to handle them.
- To study the employment of artificial intelligence in recent technologies.
- To represent knowledge in first order and predicate logic.
- To learn about machine learning and planning agent.

MODULE I INTRODUCTION 15

Introduction to Artificial Intelligence – Problem solving with AI – CSP - Representation of knowledge using Logic and Rules - Uncertain knowledge and reasoning – Probabilistic reasoning - Types of Agent - Multi Agent Planning - Multi Agent Based Learning - Architecture of expert system - Natural Language Processing – Fuzzy and hybrid Intelligence system –Cloud Computing and Intelligent Agents – Business Intelligence and Analytics – Big Data and Sensory Processing.

MODULE II INTELLIGENT AGENT 15

Problem Solving: Travelling Salesperson problem, Tower of Hanoi, Tic-Tac-Toe, Water Jug Problem. Creation of agents -Defining their behavior – Observe behavior. Visualization of agent based models - Creating Interface for Robots and Sensors.

L-15; P-30

REFERENCES :

1. Parag Kulkarni, Prachi Joshi, “Artificial Intelligence: Building Intelligent Systems, 1st Edition, PHI, ISBN: 978-81-203-5046-5, 2015.
2. Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach”, 3rd Edition, Prentice Hall, ISBN-13: 978-0136042594, 2010.
3. Ngooc Thanh Nguyaaen, Lakhmi C. Jain, “Intelligent Agents in the Evolution of Web and Applications”, 4th Edition, Springer, 2009.

4. ZiliZhang, Chengqi Zhang, “Agent-Based Hybrid Intelligent Systems: An Agent-Based Framework for Complex Problem Solving”, 1st Edition, Springer-Verlag New York, LLC , 2004.

COURSE OUTCOMES :

Students who complete this course will be able to

- Differentiate the types of agents and learn how to apply them in different problem based on requirements.
- Explore the scenarios of uncertainty and design planning agents to handle them.
- Ability to apply the tools in knowledge representation and reasoning for real-world problems.
- Apply Artificial Intelligence techniques in the cutting edge technologies such as cloud computing and Big data.
- Design knowledge based agents for challenging environment.
- Explain the basic knowledge representation, problem solving, and learning methods of Artificial Intelligence.

CSCY103 HUMAN COMPUTER INTERACTION

L	T	P	C
3	0	0	3

OBJECTIVES :

- To analyze an interface or device in terms of its usability.
- To define common terms in HCI (e.g. direct manipulation).
- To describe different interaction techniques, including their strengths and weaknesses.
- To use HCI software process.
- To explain Computer components functions regarding interaction with human
- To demonstrate Understanding of Interaction between the human and computer components.

MODULE I FOUNDATIONS 09

Human: Human memory – Emotion – Individual differences – Psychology and the design of interactive systems – Computer: Devices used for Text entry, display, virtual reality and 3D interactions – Positioning & pointing – physical controls, sensors and special devises – memory – processing and networks. Interactions: Models of interactions - Framework – interaction styles – context of interactions - elements of WIMP interface.

MODULE II INTERACTION DESIGN BASICS 09

Paradigms of interactions – process of design – HCI in software process - software life cycle – usability engineering – interactive design and prototyping – design rules: principles to support usability – standards – guidelines and rules for heuristics – HCI patterns – implantation support – evaluation technique – user support.

MODULE III IMPLEMENTATION AND EVALUATION 09

Elements of windowing systems – Toolkits – User interface systems – Goals of evaluation – evaluation through expert system, user participation – choosing evaluation method – universal design principles – multi-modal interaction – design focus – user support.

MODULE IV MODELS AND THEORIES-1 09

Cognitive models : Goals and task hierarchies – linguistic models – challenge of display based systems- physical and device models – cognitive architecture –

socio organizational issues and stakeholder requirements: organizational issues – capturing requirements.

MODULE V MODELS AND THEORIES-2 09

Communication and collaboration models: face to face communication – conversion – text based communication – group working – task analysis: task decomposition – knowledge based analysis – dialog notations and design - models of systems – models of rich interactions.

Theory : 45

REFERENCES :

1. Julie A. Jacko, “Human Computer Interaction Handbook: Fundamentals, Evolving Technologies, and Emerging Applications”, 3rd edition, CRC Press, ISBN 9781439829431, 2012.
2. Yvonne Rogers, Helen Sharp, Jenny Preece, “Interaction Design: Beyond Human computer Interaction”, 3rd edition, Wiley, ISBN-10: 0470665769, 2011.
3. Dix A, Human – Computer Interaction. Harlow, England: Prentice Hall, ISBN- 10:0130461091, 2004.

OUTCOMES :

Students who complete this course will be able to

- Prepare the basics of human and computational abilities and limitations.
- Formulate the basic theories, tools and techniques in HCI.
- Propose fundamental aspects of designing and evaluating interfaces.
- Practice a variety of simple methods for evaluating the quality of a user interface.
- Apply appropriate HCI techniques to design systems that are usable by people.
- Review various models used for HCI.

CSCY104 COGNITIVE SCIENCE

L	T	P	C
3	0	0	3

OBJECTIVES :

- To observe the beginning of cognitive science in the areas of linguistics and artificial intelligence.
- To identify the cognitive science as an interdisciplinary field.
- To develop the fundamental skills required for understanding theories, evidence and methods in cognitive science.
- To learn various approaches to artificial intelligence, and the computational modelling of cognitive processes.
- To study the functioning of artificial neurons.
- To gain knowledge in neuroscience and linguistics.

MODULE I INTRODUCTION TO COGNITIVE SCIENCE 09

The prehistory of cognitive science–Extending computational modeling to the brain -Language and micro worlds - Cognitive science and the integration challenge - Tackling the integration challenge–Information Processing Models of The Mind - The Organization of The Mind - Strategies for brain mapping.

MODULE II ARTIFICIAL NEURAL NETWORK AND MACHINE LEARNING 09

Applying the symbolic paradigm - Expert systems, machine learning, and the heuristic search hypothesis - machine learning algorithm - Neural networks and distributed information processing - Neural network models of cognitive processes - Architectures for intelligent agents.

MODULE III LINGUISTIC APPROACH 09

Linguistic Approach - Language and Cognitive Science - The Nature of Language - Language Use in Primates - Language Acquisition - Language Deprivation - Philosophy and Linguistics - Cognition and Linguistics - Neuroscience and Linguistics - Artificial Intelligence and Linguistics.

MODULE IV ARTIFICIAL INTELLIGENCE OPERATIONAL PERSPECTIVE 09

The Practical World of Artificial Intelligence - Approaches to the Design of Intelligent Agents - Machine Intelligence, Knowledge, and Machine Reasoning - Logical Reasoning - Inductive Reasoning – Robotics.

MODULE V APPLICATIONS 09

Cognitive neuroscience – Evolutionary psychology – Embodied, Embedded and Extended Cognition – Animal Cognition - Case Study.

Theory : 45

REFERENCES :

1. Jose Luis Bermudez, Cognitive Science: An Introduction to the Science of the Mind, 2nd Edition, Cambridge University Press, ISBN: 9781107653351, 2014.
2. Keith Frankish, William Ramsey, Cognitive Science, 2nd Edition, Cambridge University Press, ISBN: 9780521691901, 2012.
3. Jay Friedenberg and Gordon Silverman, “Cognitive Science: An Introduction to the Study of Mind, 1stEdition, SAGE Publications, 2006.
4. Mark F. Bear, Barry W. Connors, Michael A. Paradiso, “Neuroscience: Exploring the brain”, 4th Edition, Lippincott Williams and Wilkins Publication, 2016.

OUTCOMES :

Students who complete this course will be able to

- Define what is cognitive science and information processing of mind.
- Apply neural network algorithm for cognitive processes.
- Describe the relationship between cognitive science and linguistic approach.
- Design and implement intelligent agent.
- Apply the cognitive neuroscience to solve research problems.
- Relate cognitive science with artificial intelligence.

CSCY105 DEEP LEARNING

L	T	P	C
3	0	0	3

OBJECTIVES :

- To introduce the basic architecture and statistical approaches for spoken language processing.
- To illustrate how these models are applied to speech recognition and speaker verification.
- To provide knowledge on training the networks constructed based on the mathematical models.
- To introduce Deep Neural Network for modelling complex patterns of speech.
- To learn the fundamental issues in speech recognition.
- To provide an overview on advanced deep models for speech recognition.

MODULE I SPEECH TECHNOLGY 09

Introduction - Recognizing Speech – Reproducing Speech - Scope of Speech Technology – Human Factors - Automatic speech Recognition – Basic Architecture.

MODULE II TRANING NETWORK 09

Deep Neural Networks – Architecture – Parameter Estimation – Practical Considerations – Restricted Boltzman Techniques – Deep Belief Network – Discriminative Pretraining – Hybrid and Dropout Pretraining.

MODULE III NETWORK MODEL 09

DNN-HMM Hybrid System – Key components – Training and Decoding Speedup – Sequence Discriminative Training Criteria – Practical Considerations – Noise Estimation.

MODULE IV REPRESENTATION OF LEARNING NETWORK 09

Feature Representation Learning in Deep Neural Network – Fuse Deep Neural Network – Guassian Mixture Model systems – Adaptation of Deep Neural Networks.

MODULE V ADVANCED DEEP MODELS 09

Representation Sharing and Transfer – Multilingual and Cross Lingual Speech Recognition – Multiobjective Training of Neural Network for Speech Recognition –

Robust Speech Recognition Exploiting – Recurrent Neural Network – Related Models – Computational Network.

Theory : 45

REFERENCES :

1. Dong Yu, Li Deng, “Automatic Speech Recognition: A Deep Learning Approach”, Springer, ISBN:978-1-4471-5778-6, 2015.
2. Jack Hollingum, Graham Cassford, “Speech Technology at Work”, Springer, ISBN: 978-3-662-13012-4, 2013.
3. Tuomas Virtanen, Rita Singh, Bhiksha Raj, “Techniques for Noise Robustness in Automatic Speech Recognition”, Wiley, ISBN: 978-1-119-97088-0, 2013.

OUTCOMES :

Students who complete this course will be able to

- Apply appropriate mathematical model for the processing the speech.
- Perform various decompositions and modifications of speech signals.
- Build a complete speech recognition system using the various techniques.
- Apply speech recognition system in areas like military, healthcare, etc.
- Resolve the issues in speech recognition using the various methods.
- Authenticate the identity of the speaker using deep neural network models.

CSCY106 COMPUTER VISION

L	T	P	C
3	0	0	3

OBJECTIVES :

- To give introduction on image data and analysis.
- To have knowledge on modern mathematics background.
- To provide information about cameras , coordinates and calibration.
- To learn about 3D shape reconstruction method.
- To know about stereo matching and feature detection.
- To gain knowledge on application areas.

MODULE I IMAGE DATA AND ANALYSIS 08

Introduction –Computer vision –Image Data - Images in Spatial domain-Images in frequency domain- Color and Color images – Image Analysis - Basic image topology-Geometric 2D Shape Analysis - Image value analysis

MODULE II IMAGE SEGMENTATION 09

Basic Example of Segmentation – Mean Shift Segmentation – Image segmentation as an optimization problem – Video segmentation and segment tracking – Camera – coordinates – camera calibration

MODULE III 3-D SHAPE RECONSTRUCTION 09

Cameras – Coordinates – Calibration – 3D shape Reconstruction – Surfaces – Structured Lighting

MODULE IV STEREO MATCHING AND FEATURE DETECTION 09

Stereo matching – Matching, Data cost and confidence – Dynamic programming matching – Third Eye technique – Feature Detection – Invariance, Features and Sets of features – Examples of features.

MODULE V USEFUL METHODS AND APPLICATIONS 09

Color spaces and segmentation – Binary morphology – 3D perception - Perspective analysis of images – Application scenarios – Industrial quality inspection – Safe Human Robot interaction – Lunar Remote sensing.

Theory : 45

REFERENCES :

1. Reinhard Klette,"Concise Computer Vision: An Introduction into Theory and Algorithms", Springer Science & Business Media, ISBN 978-1-4471-6320-6, 2014.
2. Fosyth and Ponce, "Computer Vision: A modern Approach" , 2nd Edition, Prence Hall, ISBN – 10:013608502X, 2011.
3. Richard Szeliski, "Computer Vision: Algorithms and Applications" , Springer, http://szeliski.org/Book, ISBN 978-1-84882-935-0, 2010.
4. Hongyu Guo, "Modern Mathematics and Applications in Computer Graphics and Vision", World Scientific Publishing Co. Pte. Ltd., ISBN 978-9814449328, 2014.
5. Christian Wohler,"3D Computer Vision: Efficient Methods and Applications", 2nd edition, Springer Science & Business Media, ISBN-13: 978-1447141495, 2012.

OUTCOMES :

Students who complete this course will be able to

- Analyze the image data.
- Classify the different image segmentation
- Identify the cameras, coordinates and calibration in computer vision.
- Construct 3D shape stereo images.
- Illustrate stereo matching methods and feature detection.
- Apply concepts of computer vision in various fields.

CSCY107 STATISTICAL NATURAL LANGUAGE PROCESSING

L	T	P	C
2	0	2	3

OBJECTIVES :

- To learn the concepts of speech processing and synthesis
- To gain knowledge on syntax and semantics in NLP
- To explain various statistical methods for language processing.
- To describe the Machine translation approaches.
- To explore the language processing in real world application.
- To trace the statistical approaches used in natural language processing.

MODULE I WORD AND SPEECH 09

Regular Expressions and Automata - Words and Transducers - N-grams - Part-of-Speech Tagging - Hidden Markov and Maximum Entropy Models. Phonetics-Speech Synthesis - Automatic Speech Recognition - Speech Recognition: Advanced Topics - Computational Phonology

MODULE II SYNTAX, SEMANTICS AND PRAGMATICS 09

Formal Grammars of English - Syntactic Parsing - Statistical Parsing - Features and Unification - Language and Complexity - The Representation of Meaning - Computational Semantics - Lexical Semantics- Computational Lexical Semantics - Computational Discourse.

MODULE III N-GRAMS 09

N-grams Models of Syntax - Counting Words - Unsmoothed N-grams – Smoothing-Backoff - Deleted Interpolation – Entropy - English Word Classes - Tagsets for English - Part of Speech Tagging - Rule-Based Part of Speech Tagging - Stochastic Part of Speech Tagging - Transformation-Based Tagging.

MODULE IV STATISTICAL MACHINE TRANSLATION 09

Machine translation approaches – Statistical machine translation – Machine translation evaluation metrics – Semitic languages – Building phrase-based SMT systems.

MODULE V APPLICATION AND TECHNIQUES 09

Statistical Alignment and Machine Translation – Clustering – Information Retrieval – Text Categorization

L-30; P-30

REFERENCES :

1. NitinIndurkhya, Fred J. Damerau, “Handbook of Natural Language Processing”, 2nd Edition”, CRC Press, ISBN: 9781420085921, 2010.
2. Daniel Jurafsky and James H.Martin, “Speech and Language Processing”, 2nd Edition, Prentice Hall, ISBN: 100131873210, ISBN: 9780262133609, 2009.
3. Christopher D. Manning and Hinrich Schütze, “Foundations of Statistical Natural Language Processing”, MIT Press. Cambridge, 1999.
4. Imed Zitouni, “Natural language processing of semantic language “, Springer, ISBN :97836424535588, 2014.

OUTCOMES :

Students who complete this course will be able to

- Identify the different linguistics components of given sentences.
- Build a tagger to semantically tag words using word tag.
- Implement a parser by providing suitable grammar and words.
- Analyse the statistical machine translation techniques.
- List the various applications of language processing.
- Gather knowledge on various statistical techniques in NLP.

CSCY108 COMPONENT BASED TECHNOLOGY

L	T	P	C
2	0	2	3

OBJECTIVES :

- To learn the basics of software components design.
- To provide knowledge on how a component is converted by the web service into a service.
- To portray the semantically relation between data and functions inside each component.
- To provide insight knowledge about the various fundamental properties of the components, technology, architecture and middleware.
- To recognize the use of various components based framework for a distributed environment.
- To give an idea that software should be componentized - built from prefabricate components

MODULE I INTRODUCTION 09

Introduction to Software Components - Software Language Engineering - Software Components - Initial Design Considerations - RPC – RMI- MOM - JNI – JAVA BEAN – EJB composing software components : Stateless Component Composition – Tools for Stateless components - CBSD Support - Tools – Debugging Components.

MODULE II BUILDING INFORMATION MODEL 09

CORBA: Exploring CORBA alternatives - Architecture overview - IDL - ORB - Building an application with CORBA - BIM 2.0 – SOA Pattern for Complex Models – IoT Software Platforms – Advanced SOA for BIM.

MODULE III COMPONENT REALIZATION CONCEPT 09

Big Picture MoCo Template - MoCo Execution Environment - MoCo Service Library - ExplorativePrototyping- MoCo Core API - ISA Architecture

MODULE IV WEB COMPONENTS 09

Web Component –Challenges – Web Component Architecture - UI Core Concepts –Basics – Z-Index – Building UI –Building Web Components – Widgets - Shadow DOM- Deploying Components with Polymer – Testing Web Components

MODULE V NET ENTITY FRAMEWORK 09

COM: Object Creation and Destruction Using .NET - Introduction to .NET - Overview of .NET Architecture - Marshalling – Remoting. Introduction - Entity Data Models-Operations - Querying EDMS with Entity SQL - Mapping Stored Procedures- Data Access with ADO.Net.

L-30; P-30

REFERENCES :

1. Mahdi Derakhshanmanesh, Model – Integrating Software Components, Engineering Flexible Software Systems, Springer. ISBN : 978-3-658-09645-8, 2015.Top of Form Bottom of Form
2. Sandeep Kumar Patel, Learning Web Component Development", Packt Publishing 1st Edition, ISBN: 978-1-78439-364-9, 2015.
3. Y Jarrod Overson, Jason Strimpe, "Developing Web Components: UI from JQuery to Polymer", O'Reilly Publications 1st Edition, ISBN:978-1-491-94902, 2015.
4. Alessandro Del Sole, Top of Form Bottom of Form "Visual Basic 2015" Unleashed, SAMS
5. Dick Hamlet, Top of Form Bottom of Form Composing Software Components: A Software-testing Perspective", Springer, 2010.
6. Thomas J. Mowbray, William A. Ruh, "Inside CORBA", Pearson Education, ISBN: 81-7758-247-6, 2006.
7. Jason Pritchard, "COM and CORBA Side by Side", Pearson Education 5th Edition, ISBN: 978-81-317-0913-9, 2009.

OUTCOMES :

Students who complete this course will be able to

- Apply the principles for building software systems from component based techniques.
- Create reusable widgets or components in web documents and web applications.
- Implement .Net components for the applications
- Develop or construct software by gluing together prefabricated components.
- Summarize the importance of component information model.
- Use the appropriate testing tools for testing the applications.

CSCY109 MOBILE COMPUTING

L	T	P	C
1	0	2	2

OBJECTIVES :

- To discuss about advanced learning in the field of wireless communication.
- To elaborate upon the basic concepts and principles in mobile computing.
- To expose the students to the concepts of wireless devices.
- To explain the structure and components for Mobile IP and Mobility Management
- To create awareness about various operating systems available for mobile computing
- To discuss various issues related to security of mobile computing environment

MODULE I INTRODUCTION 15

Mobile Computing- Networks- Application and Services supporting - Developing Mobile Computing Applications-Security in Mobile Computing Mobile Computing Architecture-GSM-Wireless Internet- Wireless Vehicular Networks-Architecture-Vehicular Applications-Standards-Challenges

MODULE II APPLICATION DEVELOPMENT 15

Three tier architecture -Model View Controller Architecture -Memory Management –Information Access Devices –PDAs and Smart Phones –Smart Cards and Embedded Controls –J2ME – Programming for CLDC –GUI in MIDP –Application Development ON Android and iPhone .

L-15; P-30

REFERENCES :

1. Asoke K Talukder, Nuno M. Garcia, Jayateertha G. M, “Convergence Through All-IP Networks”, Pan Stanford, ISBN: 978-9814364638, 2013.
2. Asoke K Talukder, HasanHasan Ahmed and Roopa R Yavagal, “Mobile Computing Technology, Applications and Service Creation”, 2nd Edition, Tata McGraw-Hill Education Private Limited, ISBN: 978-0070707313, 2011.

OUTCOMES :

Students who complete this course will be able to

- Acquire capability to work with heterogeneous networks.

- Apply the knowledge of various mobile operating systems like Android to develop mobile computing applications.
- Develop mobile computing applications by analyzing their requirements.
- Identify the security algorithms to be used for mobile computing environment.
- Analyze business practices in mobile computing applications and their technical feasibility.
- Comparatively evaluate deployment platforms for mobile computing applications.

CSCY110 DIGITAL IMAGE PROCESSING

L	T	P	C
3	0	0	3

OBJECTIVES :

- To describe digital image processing with respect to computer vision.
- To analyze digital images through programming tools.
- To theorize the background of image processing techniques.
- To gain knowledge on filters, edges and contours.
- To program with Image J software.
- To implement image processing techniques using java.

MODULE I IMAGE ANALYSIS 09

Digital image processing – Image formation and Sensing -Image representation-Digital image analysis-Segmentation-Line detection – Feature analysis and Pattern classification.

MODULE II PROGRAMMING WITH TOOLS 09

CVIP Software – Image data and file structures- Algorithm test and analysis tool-Application development- CVIP Feature Extraction and pattern classification tool.

MODULE III IMAGING SOFTWARE 09

Digital images - Programming with images-Types of digital images -Image acquisition- Image file formats - ImageJ software - Image J Overview.

MODULE IV FILTERS, EDGES AND CONTOURS 09

Linear filters-Non linear filters-Implementing filters-Gradient based edge detector-Simple edge detector-Canny Edge detector -Edge sharpening.

MODULE V PROGRAMMING IMAGEJ SOFTWARE 09

Point operations in ImageJ-Filter operations in Image J-Edge operations in Image J-Java implementation of Hough transform, filters- Advanced programming.

Theory : 45

REFERENCES :

1. Scott E Umbaugh, “Digital Image Processing and Analysis: Human and Computer Vision Applications with CVIP tools”, CRC Press, 2nd Edition, ISBN 1439802068, 2016.

2. Wilhelm Burger and Mark. J. Burge, "Digital image processing: An Algorithmic introduction using Java", 2nd Edition, Springer, ISBN: 978-1-4471-6683-2, 2016.

OUTCOMES :

Students who complete this course will be able to

- Describe various digital image formats.
- Write program through tools for analyzing images.
- Use of point and regional processing techniques.
- Apply filters in digital image processing.
- Illustrate the concepts of edges and contours.
- Implement image processing methodologies using the environment image software and java.

CSCY111 BIO INSPIRED ALGORITHMS

L	T	P	C
3	0	0	3

OBJECTIVES :

- To showcase the various Bio Inspired Models for Semantic Web.
- To comprehend the Evolutionary Learning and its Applications.
- To illustrate the concept of Evolutionary Algorithms.
- To explicate the Developmental and Artificial Immune Systems.
- To expose to Collective Systems such as Particle Swarm Optimization (PSO),Ant Colony Optimization (ACO) and Swarm Robotics.
- To explicate the Optimization Algorithms with application.

MODULE I BIO INSPIRED MODELS 09

Introduction - Semantic Web - Constituent Models - Artificial Neural Networks-Swarm Intelligence - Applications of Semantic Web - Neuro-Fuzzy systems for the Web Content Filtering – Applications.

MODULE II EVOLUTIONARY LEARNING 09

Hybrid Neural Systems – Genetic Algorithms - Introduction to Fuzzy Concepts – Fuzzy Inference Systems – Neural Fuzzy Approach – Hybrid Neural Network – Genetic Algorithm Approach - Applications.

MODULE III EVOLUTIONARY ALGORITHMS 09

Particle swarm optimization (PSO)– Ant Colony Optimization (ACO)–Swarm Robotics – Lion Optimization Algorithm - Ant Lion Optimization-Cockroach Swarm Optimization – Comparison of Firefly and Cockroach - Cuckoo Search - BColony Optimization - Bees Algorithm.

MODULE IV IMMUNE ALGORITHMS 09

Overview-Clonal Selection Algorithm - Negative Selection Algorithm - Artificial Immune Recognition System - Immune Network Algorithm –Dendritic Cell Algorithm.

MODULE V DNA COMPUTING 09

Need for DNA Computing-Structure of DNA- Operations on DNA Molecules-Adleman’s Experiment-Basics of Formal Language Theory.

Theory : 45

REFERENCES :

1. Xin-She Yang, Zhihua Cui, Renbin Xiao, Amir Hossein Gandomi, Mehmet Karamanoglu,"Swarm Intelligence and Bio-Inspired Computation: Theory and Applications", First Edition ,Elsevier,ISBN:978-0-12-405163-8, 2013
2. Management Association, Information Resources, "Nature-Inspired Computing: Concepts, Methodologies, Tools, and Applications", IGI Global,ISBN:978-1-5225-0788-8, 2016
3. Jason Brownlee, "Clever Algorithms: Nature-inspired Programming Recipes", First Edition Lu Lu, ISBN:978-1-4467-8506-5, 2011.
4. Gheorghe Paun, Grzegorz Rozenberg, Arto Salomaa ,"DNA Computing: New Computing Paradigms",Springer, Second Edition,ISBN:978-3-642-08388-4,2005
5. Grady Hanrahan, "Artificial Neural Networks in Biological and Environmental Analysis", CRC Press,ISBN-3:978-1-4378-1259-4, 2011.

OUTCOMES :

Students who complete this course will be able to

- Apply the Bio Inspired Models in Semantic Web.
- Familiarize with the concepts of Fuzzy Networks and Genetic Algorithm with Applications.
- Design and Implement simple Bio-Inspired Algorithms.
- Acquire adequate knowledge in various Immune Algorithms.
- Get insight into biologically inspired as well as Traditional Machine Learning Methods for Search,Optimization and Classification.
- Acquire knowledge of using the Bio Inspired Models for Real World Applications.

ECCY009 INTERNET OF THINGS

L	T	P	C
3	0	0	3

OBJECTIVES :

- To introduce emerging technological options and platforms
- To explain the architecture of IoT
- To explore application development for mobile Platforms
- To Provide the appropriate IoT solutions and recommendations according to the applications used.

MODULE I THE IOT NETWORKING CORE 10

History of IoT, Review of Technologies involved in IoT Development, Internet/Web and Networking Basics -OSI Model, Data transfer referred with OSI Model, IP Addressing, Point to Point Data transfer, Point to Multi Point Data transfer & Network Topologies, Sub-netting, Network Topologies referred with Web, Introduction to Web Servers, Introduction to Cloud Computing. Basics of Big Data, Data Science.

MODULE II IOT ARCHITECTURE AND APPLICATIONS 09

Architecture: M2M – Machine to Machine, Web of Things, IoT protocol, Introduction to wireless and mobile networks, ZigBee, BLE mesh, WiFi, MQTT, LoRa-Machine Applications: Remote Monitoring & Sensing, Remote Controlling, Performance Analysis

MODULE III IOT PLATFORM OVERVIEW 09

Overview of IoT supported Hardware platforms such as: Raspberry pi, ARM Cortex Processors, Arduino and Intel Galileo boards. Network Fundamentals: Overview and working principle of Wired Networking equipment's – Router, Switches, Overview and working principle of Wireless Networking equipment's – Access Points, Hubs etc. Linux Network configuration Concepts: Networking configurations in Linux Accessing Hardware & Device Files interactions.

MODULE IV IOT APPLICATION DEVELOPMENT 09

Application Protocols-MQTT, REST/HTTP, CoAP, MySQL -Back-end Application -Design Apache for handling HTTP Requests, PHP & MySQL for data processing, MongoDB Object type Database, HTML, CSS &jQuery for UI Designing, JSON lib for data processing, Security & Privacy during development, Application Development for mobile Platforms: Overview of Android / IOS 10 25 47 /97 App Development tools

MODULE V CASE STUDY & ADVANCED IOT APPLICATIONS 08

IoT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IoT electronic equipments. Use of Big Data and Visualization in IoT, Industry 4.0 concepts. Sensors and sensor Node and interfacing using any Embedded target boards

Theory : 45

REFERENCES :

1. Interconnecting Smart Objects with IP: The Next Internet, Jean-Philippe Vasseur, Adam Dunkels, Morgan Kuffmann-2010.
2. Internet of Things (A Hands-on-Approach), Vijay Madisetti , Arshdeep Bahga-2014.
3. Designing the Internet of Things, Adrian McEwen (Author), Hakim Cassimally-2013.
4. Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, Dr. Ovidiu Vermesan, Dr. Peter Friess, River Publishers -2013.
5. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010 10. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010.
6. Asoke K Talukder and Roopa R Yavagal, “Mobile Computing,” Tata McGraw Hill, 2010.
7. Adelstein and S.K.S. Gupta, “Fundamentals of Mobile and Pervasive Computing,” McGraw Hill, 2009.

OUTCOMES :

Students who complete this course will be able to

- Articulate the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art Internet of things
- Identify the architecture and infrastructure of IoT.
- Explain the core issues of IoT such as security, privacy, and interoperability
- Choose the appropriate technologies, algorithms, and approaches for the related issues.
- Identify problems, and explain, analyze, and evaluate various IoT solutions
- Attempt to generate new ideas and innovations in IoT.

ECC6121 ADVANCED EMBEDDED SYSTEMS

L	T	P	C
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OBJECTIVES :

- To explore Embedded system lifecycle
- To Introduce the occurrence of shared data problem in embedded systems
- To describe need for power management techniques in embedded systems
- To familiarize the debugging in embedded systems.

MODULE I EMBEDDED DESIGN LIFE CYCLE 09

Product specification – Hardware / Software partitioning – Detailed hardware and software design – Integration – Product testing – Selection Processes – Microprocessor Vs Micro Controller – Performance tools – Bench marking –RTOS Micro Controller – RTOS availability – Tool chain availability – Other issues in selection processes.

MODULE II EMBEDDED HARDWARE AND SOFTWARE 09

Review of basics in embedded hardware and software– Hardware software co design- Interrupts – Built interrupts – Interrupts basis – Shared data problems – Interrupt latency – Interrupt routines in an RTOS environment –Hard Real Time scheduling considerations - Embedded platform boot sequence.

MODULE III MEMORY AND INTERFACING 09

Memory: Memory write ability and storage performance – Memory types – composing memory – Advance RAM interfacing - communication basic – Microprocessor interfacing I/O addressing – Interrupts – Direct memory access– Arbitration -Multilevel bus architecture – Serial protocol – Parallel protocols – Wireless protocols

MODULE IV INTEGRATION AND TESTING OF EMBEDDED HARDWARE AND FIRMWARE 09

Integration of Hardware and Firmware-In system programming-The Integrated development environment-Debugging techniques- Host based debugging – Remote debugging – ROM emulators – Logic analyzer- Real time trace – Hardware break points – Overlay memory- Testing embedded software.

MODULE V POWER OPTIMIZATION TECHNIQUES IN EMBEDDED SYSTEMS 09

The power profile of an Embedded Computing Systems – Constant versus Dynamic power – A simple model of power efficiency –Advanced Configuration and Power Interface –ACPI system states- Case Study- power optimization techniques in wireless sensor networks.

Theory : 45

REFERENCES :

1. Arnold S. Berger – “Embedded System Design: An introduction to processor, tools and techniques”, CMP books, USA, 2002.
2. David. E. Simon, “An Embedded Software Primer”, Pearson Education, 2001.
3. Frank Vahid and Tony Givargis ‘Embedded Systems Design: A Unified Hardware / Software Introduction’, John & Wiley Publications, 2002.
4. Peter Barry, Patrick Crowley, “Modern Embedded Computing” Morgan Kaufmann Publishers, 2012.

OUTCOMES :

Students who complete this course will be able to

- Analyze the quality principles and tools in embedded system during product development process
- Analyze the division of hardware/software in embedded systems.
- Develop the interrupt routines in RTOS environment
- Design energy efficient embedded systems
- Design interface circuit with processor and peripheral devices
- Test and debug the coding in embedded systems

LIST OF EVEN SEMESTER ELECTIVES

CSCY201	SOFTWARE TESTING AND QUALITY ASSURANCE	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To elucidate the theoretical aspects of software testing.
- To demonstrate the testing design methods.
- To expose to various industrial practices on software testing and quality assurance strategies
- To explain the fundamental concepts of defect analysis
- To introduce the software quality metrics
- To develop into a software tester and quality controller

MODULE I FOUNDATIONS OF SOFTWARE TESTING 09

Software Testing Lifecycle - Software Quality Attributes - Software Specifications- Program Correctness and Verification- - Software Testing Taxonomy

MODULE II TEST DATA GENERATION 08

Testing Plan and Design -Test Generation Concepts - Functional Criteria- Structural Criteria- Failures, Errors, and Faults

MODULE III TEST DEPLOYMENT AND ANALYSIS 09

Test Oracle Design - Test Driver Design - Test Outcome Analysis - Metrics for Software Testing - Software Testing Tools - Test execution and reporting.

MODULE IV SOFTWARE QUALITY MANAGEMENT 10

Software Quality Concept-Defect Management- Risk Vulnerability and Threat Management- Software Quality Expectation- Software Quality Characteristics- Information Audit- Security Policy Document -Software Reliability and Process Improvement

MODULE V SOFTWARE QUALITY ENGINEERING APPLICATIONS 09

Software Quality Engineering- System and Software Quality Engineering Applications- Trustworthiness of IT Systems and Services- Case Studies

Theory : 45

REFERENCES :

1. Ali Mili, FairouzTchier, “Software Testing: Concepts and Operations”, Jon Wiley & Sons Publications, ISBN: 978-1-118-66287-8,2015.
2. Abu SayedMahfuz, “Software Quality Assurance: Integrating Testing, Security, and Audit”, CRC Press, Taylor and Francis Group, Auerbach Publications, ISBN 978-1-498-73553-7, 2016.
3. WitoldSuryn, “Software Quality Engineering: A Practitioner's Approach”, IEEE Computer Society Press, Jon Wiley & Sons Publications, ISBN: 978-1-118-83018-5, 2014.

OUTCOMES :

Students who complete this course will be able to

- Comprehend the types of Software Testing plans.
- Compare the different Software Testing design for the given data.
- Apply the various software testing strategies in industrial practices.
- Explore and use an appropriate testing tool for real time case studies.
- Analyze software quality attributes and ensure quality in IT Systems.
- Design and implement software quality engineering applications and take up a career as a professional software tester

CSCY202 MOBILE ADHOC NETWORKS

L	T	P	C
3	0	0	3

OBJECTIVES :

- To provide a broad overview of the state of wireless and mobile ad hoc networking.
- To discuss physical, networking and architectural issues of mobile ad hoc networks.
- To elaborate the functions of various routing protocols under unicast, multicast and transport layer protocols.
- To give a knowledge about issues in QoS, energy management of mobile ad hoc networks
- To learn the various security mechanism used in mobile adhoc networks.
- To study the current technology trends for the implementation and deployment of mobile ad hoc networks.

MODULE I INTRODUCTION 09

Introduction – Fundamentals of wireless communication technology – The Electromagnetic spectrum – Radio propagation mechanisms – Characteristics of the wireless channel – IEEE 802.11a,b standard – Origin of Ad hoc: Packet radio networks – Technical challenges – Architecture of PRNETs – Components of packet radios – Adhoc wireless networks – Heterogeneity in mobile devices– Wireless sensor networks – Traffic profiles – Types of Ad hoc mobile communications – Types of mobile host movements – Challenges facing Ad hoc mobile networks – Ad hoc wireless internet.

MODULE II ROUTING PROTOCOLS 09

Introduction – Issues in designing a routing protocol for Ad hoc wireless networks – Classifications of routing protocols – Table-Driven routing protocols– Destination Sequenced Distance Vector (DSDV) – Source-Initiated On-Demand approaches – Ad hoc On-Demand Distance Vector Routing (AODV)– Dynamic Source Routing (DSR) –Temporally Ordered Routing Algorithm (TORA) –Location–Aided Routing (LAR) – Power-Aware Routing (PAR) – Zone Routing Protocol (ZRP).

MODULE III MULTICASTING AND SECURITY PROTOCOLS 09

Introduction – Issues in designing a multicast routing protocol – Operation of multicast routing protocols –Classifications of multicast routing protocols – Tree-Based multicast routing protocols – Mesh-based multicast routing protocols. Security in Ad hoc wireless networks – Network security requirements – Issues

and challenges in security provisioning – Network security attacks – Key management – Secure routing in Ad hoc wireless networks.

MODULE IV TRANSPORT LAYER PROTOCOLS 09

Introduction – Issues in designing a transport layer protocol for Ad hoc wireless networks – Design goals of a transport layer protocol for Ad hoc wireless networks –Classification of transport layer solutions – TCP over Ad hoc wireless networks – Other transport layer protocols for Ad Hoc wireless networks.

MODULE V QOS AND ENERGY MANAGEMENT 09

Introduction – Issues and challenges in providing QoS in Ad hoc wireless networks –Classifications of QoS solutions – MAC layer solutions – Network layer solutions– Introduction – Need for energy management in Ad hoc wireless networks – Classification of energy management schemes – Battery management schemes – Transmission power management schemes – System power management schemes.

Theory : 45

REFERENCES :

1. C.Siva Ram Murthy and B.S.Manoj, “Ad hoc Wireless Networks Architectures and Protocols”, 2nd Edition, Pearson Education, ISBN-13: 9780133007060, 2012.
2. Stefano Basagni, Marco Conti, Silvia Giordano and Ivan Stojmenovic “Mobile Ad Hoc Networking: The Cutting Edge Directions”, 2nd Edition, Wiley-IEEE Press, ISBN: 978-1-118-08728-2,2013.
3. Jonathan Loo, Jaime Lloret Mauri, Jesús Hamilton Ortiz, “Mobile Ad Hoc Networks: Current Status and Future Trends” CRC Press, ISBN 9781439856505 ,2012.

OUTCOMES :

Students who complete this course will be able to

- Assess the platform architectures that are suitable for Mobile Adhoc networks.
- Identify the issues in wireless networks and how they can be addressed.
- Examine the various security threats to ad hoc networks and propose the solutions.
- Analyze the issues in designing the multicasting and security protocols for Mobile Adhoc networks.

- Analyze the challenges in designing the routing and transport protocols for Mobile Adhoc networks.
- Implement the various schemes to improve the quality of service in mobile Adhoc networks

CSCY203	PERFORMANCE EVALUATION OF COMPUTER SYSTEMS AND NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To explain the different metric for measuring the performance of the system.
- To familiarize with the importance of workloads and to predict the nature of future loads.
- To expose the students the importance of queuing theory.
- To design a petri net model for the given scenario.
- To describe the tools and techniques for test bed.
- To train the students on the basics of simulation modelling.

MODULE I INTRODUCTION 09

Need for performance evaluation - Role of performance evaluation - Performance evaluation methods - Performance metrics and evaluation criteria - CPU and I/O architectures - Distributed and network architectures-Secondary storage - Topologies - Computer architecture - Fundamental concepts and performance measures.

MODULE II PROBABILITY AND STOCHASTIC PROCESSES 09

Scheduling algorithms - Workloads - Random variables - Probability distributions - Densities - Expectation - Stochastic processes - Poisson process - Birth-Death process - Markov process.

MODULE III QUEUING THEORY 09

Queuing systems - Networks of queues - Estimating parameters and distributions - Computational methods - Simulation process - Time control - Systems and modelling.

MODULE IV PETRINETS AND SYSTEM PERFORMANCE 09

Petri nets - Classical Petri nets - Timed Petri nets - Priority-based Petri nets - Colored Petri nets - Generalized Petri nets - Tool selection - Validation of results - Performance metrics -Evaluation - Multiple server computer system analysis.

MODULE V ANALYSIS AND SIMULATION 09

OS components - System architecture - Workloads - Design - Simulation - Analysis - Database system performance - Computer networks components - Simulation

modelling of LAN-Stochastic Simulations - Monte Carlo Simulation Random Number Generators .

Theory : 45

REFERENCES :

1. Jean-Yves Le Boudec, “Performance Evaluation of Computer and Communication Systems”, 1st Edition, EPFL press, Lausanne, Switzerland, ISBN 978-2-940222-40-7, 2010.
2. Paul J. Fortier and Howard E. Michael, “Computer Systems Performance Evaluation and Prediction", 1st Edition, Elsevier Science, USA, ISBN 1-55558-260-5, 2013.

OUTCOMES :

Students who complete this course will be able to

- Carry out the performance analysis of their computer systems.
- Categorize the different queuing models
- Identify the algorithm for analysis of networks.
- Design a test bed for a given scenario
- Suggest a simulator for a particular problem.
- Design simulation model for the real time problem.

CSCY204 ADVANCED DATABASES

L	T	P	C
3	0	0	3

OBJECTIVES :

- To comprehend the different issues involved in the design and implementation of a database system
- To analyse the physical and logical database designs.
- To explore the database modelling, relational and object oriented models.
- To describe the techniques involved in the design of distributed databases.
- To recognize the various database techniques used in cloud and big data applications.

To develop an understanding of emerging DBMS for various applications

MODULE I ADVANCED SQL QUERIES AND DATABASE TUNING 08

Relational model conformity and Integrity- Advanced SQL programming- Query optimization- Concurrency control and Transaction management- Database performance tuning-Distributed relational systems -Security issues in Databases.

MODULE II THE EXTENDED ENTITY RELATIONSHIP MODEL AND OBJECT MODEL 09

The ER model-Motivation for complex data types-User defined abstract data types and structured types- Subclasses- Super classes- Inheritance-Specialization and Generalization-Constraints and characteristics of specialization and Generalization-Relationship types of degree higher than two.

MODULE III DISTRIBUTED DATABASES 10

Distributed Systems- Parallel Databases: I/O Parallelism -Inter and Intra Query Parallelism -Inter and Intra operation Parallelism- Design of Parallel Systems. Distributed Database Concepts- Distributed Data Storage -Distributed Transactions -Commit Protocols - Concurrency Control -Distributed Query Processing - Case Studies.

MODULE IV INTRODUCTION TO CLOUD DATABASES AND BIG DATA 09

Cloud Based Databases: Data Storage Systems on the Cloud- Cloud Storage Architectures-Cloud Data Models- Query Languages- Introduction to Big Data-Storage-Analysis. Batch computing models for Big Data computing- Key-value storage systems -- Scalable prediction models - Distributed file systems - Scalable data analytics-- Data models – Real time data stream analytics.

MODULE V EMERGING DATABASE MANAGEMENT SYSTEM TECHNOLOGIES 09

Object Oriented database concepts-Object Relational database concepts-Active database concepts; Temporal database concepts-Spatial database concepts and architecture- Deductive databases and Query processing- Mobile Databases-Geographic Information Systems. Multimedia Databases; Multidatabases - Native XML databases (NXD)-Genome Data management.

Theory : 45

REFERENCES :

1. Henry F Korth, Abraham Silberschatz, S. Sudharshan, “Database System Concepts”, Fifth Edition, McGraw Hill, 2011.
2. Jeff Hoffer, Ramesh Venkataraman, Heikki Topi, “Modern Database Management Systems”, Pearson Education Limited, 12th edition, ISBN:9781292101866, 2016.
3. Thomas Cannolly and Carolyn Begg, “Database Systems, A Practical Approach to Design, Implementation and Management”, 6th edition, Pearson Education, ISBN-13: 978-0132943260, 2014.
4. Carlos Coronel and Steven Morris, “Database Systems: Design, Implementation, & Management”, Cengage Learning, 12th edition, ISBN-13: 9781305627482, 2016.

OUTCOMES :

Students who complete this course will be able to

- Define the terminology, features, classifications, and characteristics in database systems.
- Illustrate the design strategies, query processing techniques and algorithms for advanced databases.
- Analyze an information storage problem and derive at an appropriate data model for the problem.
- Assess the Database techniques for designing intelligent information retrieval system for any application.
- Describe the database techniques used in Cloud and Big data environment.
- Appraise the emerging technologies in Databases and propose suitable model for any given application

CSCY205 REAL TIME SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES :

- To focus on the basic concepts and architecture of Real Time Systems (RTS).
- To provide an overview on memory management issues in real time operating systems.
- To explain the software requirement specification for RTS
- To discuss programming languages for Real Time Systems.
- To elaborate on the issues and challenges involved in RTS design and development.
- To throw a light on future visions of RTS.

MODULE I REAL TIME SYSTEMS 08

Fundamentals – Hardware – Basic Processor Architecture – Memory technologies – Architectural Advancements – Peripheral Interfacing – Microprocessor Vs Microcontrollers – Distributed Real Time Architectures.

MODULE II REAL TIME OPERATING SYSTEMS 10

Pseudo kernels to operating systems – Theoretical Foundations of scheduling – system services for Application programs – Memory management issues – selecting Real Time Operating Systems – Coding of Real Time Software – Overview of programming languages for Real Time Systems – Automatic Code Generation – Compiler Optimizations of code.

MODULE III REQUIREMENTS ENGINEERING METHODOLOGIES 10

Requirements Engineering for Real Time Systems – Formal and Semi Formal Methods in System Specifications – Requirement Document – Case study in Software Requirements Specification

MODULE IV SOFTWARE DESIGN APPROACHES 10

Qualities of Real time systems – Software Engineering principles – Procedural Design Approach – Object Oriented Design Approach – Life Cycle Models – Case study in Designing Real Time Systems.

MODULE V PERFORMANCE ANALYSIS TECHNIQUES 07

Real Time Performance Analysis – Applications of Queuing Theory – Input/ Output Performance – Analysis of Memory Requirements – Future visions of on Real Time Systems.

Theory : 45

REFERENCES :

1. Phillip A. Laplante and Seppo J. Ovaska, Real-Time Systems Design and Analysis: Tools for the Practitioner (Wse),ISBN: 978-8126541935, 2013.
2. Giorgio C. Buttazzo, “Hard Real Time Computing Systems Predictable Scheduling Algorithms and applications”, 3rd Edition, Springer, ISBN: 978-1-4614-0675-4, 2011.

OUTCOMES :

Students who complete this course will be able to

- Analyze the various challenges associated with real time system and the techniques to manage them.
- Provide solutions for memory management issue in real time systems.
- Relate qualities of RTS for procedural design and object oriented design approach.
- Apply Formal and Semi Formal Methods in System Specifications.
- Compare and choose suitable software engineering approach for designing a Real Time System.
- Demonstrate Real Time Systems and its performance.

CSCY206 MULTICORE PROGRAMMING

L	T	P	C
3	0	0	3

OBJECTIVES :

- To expose the basic concepts of multi-core and parallel programming.
- To study about performance of various parallel programming models.
- To elucidate the importance of parallel programming in shared memory architecture
- To elaborate on memory hierarchy organization in Multicore Architecture.
- To focus on challenges in parallel and multi-threaded programming.
- To have knowledge on various parallel programming paradigms and solutions.

MODULE I PARALLEL PROGRAMMING 08

Introduction - Parallel Computing – Parallel Hardware – Parallel Software – Input and Output – Performance – Parallel program design example – writing and running parallel programs.

MODULE II MULTICORE ARCHITECTURE 10

Limits on Parallel Program Performance - Parallel Programming Models - Motivation for Memory Hierarchy - Basic Architectures of a Cache - Cache Performance - Prefetching - Cache Design in Multicore Architecture - Physical Cache Organization - Logical Cache Organization - Case Studies - Shared Memory Multiprocessors - The Cache Coherence Problem - Memory Consistency Problem - Synchronization Problem.

MODULE III DISTRIBUTED MEMORY PROGRAMMING WITH MPI 09

Compilation and execution - MPI programs - SPMD programs - Communication - Message matching - Trapezoidal Rule in MPI - Dealing with I/O – Collective Communication - Tree-structured communication - Collective Vs. Point-to-Point communications - MPI Derived Datatypes - Performance Evaluation of MPI Programs - Parallel Sorting Algorithm.

MODULE IV SHARED-MEMORY PROGRAMMING WITH PTHREADS 09

Starting, Running and Stopping the threads - Error checking - Matrix-Vector Multiplication - Critical Sections –Busy Waiting - Mutexes - Producer-Consumer Synchronization and Semaphores - Barriers and Condition Variables - Read-Write Locks - Caches, Cache Coherence, and False Sharing - Thread-Safety -Exercises - Programming Assignments.

MODULE V SHARED MEMORY PROGRAMMING WITH **OPENMP 09**

Compiling and running OpenMP programs - program and Error checking - The Trapezoidal Rule - Scope of Variables - The Reduction Clause -The parallel for Directive - More About Loops in OpenMP - Scheduling Loops -Producers and Consumers - Caches, Cache Coherence, and False Sharing - Thread-Safety - Exercises - Programming Assignments.

Theory : 45

REFERENCES :

1. Peter S. Pacheco, “An Introduction to Parallel Programming”, Morgan-Kauffman/ Elsevier, ISBN 978-0-12-374260-5, 2011.
2. Yan Sohilin, Fundamentals of Parallel Multicore Architecture, Chapman and Hall/CRC Computational Science November 24, 2015, ISBN 9781482211184, 2015 (MODULE II)
3. Darryl Gove, “Multicore Application Programming for Windows, Linux, and Oracle Solaris”, Pearson, ISBN-13: 978-0-321-71137-3, 2011.

OUTCOMES :

Students who complete this course will be able to

- Summarize the limitations in various parallel programming models.
- Compare and contrast programming for serial processors and parallel processors.
- Implement parallel programming system for Distributed Memory programming with MPI
- Implement parallel programming system for Shared Memory architecture using threads and open MP libraries.
- Analyze different problems in shared memory multiprocessors.
- Illustrate the design and performance issues in multicore architecture.

CSCY207 SOFTWARE PROJECT MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES :

- To provide tools and techniques for project monitoring.
- To evaluate and assess the projects in Software Project Management.
- To find the cost of the project using cost benefit evaluation techniques
- To produce an activity plan for a project
- To identify the factors that influence people's behaviour in a project environment.
- To improve group working and to select appropriate leadership styles.

MODULE I INTRODUCTION TO SOFTWARE PROJECT MANAGEMENT09

Project Definition – Contract Management – Activities covered By Software Project Management – Overview of Project Planning – Stepwise Project Planning

MODULE II PROJECT EVALUATION 09

Strategic Assessment – Technical Assessment – Cost Benefit Analysis –Cash Flow Forecasting – Cost Benefit Evaluation Techniques – Risk Evaluation.

MODULE III ACTIVITY PLANNING 09

Objectives – Project Schedule – Sequencing and Scheduling Activities –Network Planning Models – Forward Pass – Backward Pass – Activity Float – Shortening Project Duration – Activity on Arrow Networks – Risk Management – Nature Of Risk – Types Of Risk – Managing Risk – Hazard Identification – Hazard Analysis – Risk Planning And Control.

MODULE IV MONITORING AND CONTROL 09

Creating Framework – Collecting The Data – Visualizing Progress – Cost Monitoring – Earned Value – Prioritizing Monitoring – Getting Project Back To Target – Change Control – Managing Contracts – Introduction – Types Of Contract – Stages In Contract Placement – Typical Terms Of A Contract – Contract Management – Acceptance.

MODULE V MANAGING PEOPLE AND ORGANIZING TEAMS 09

Introduction – Understanding Behaviour – Organizational Behaviour: A Background – Selecting The Right Person For The Job – Instruction In The Best Methods – Motivation – The Oldham – Hackman Job Characteristics Model –

Working In Groups – Becoming A Team –Decision Making – Leadership – Organizational Structures – Stress –Health And Safety – Case Studies.

Theory : 45

REFERENCES :

1. Bob Hughes, “Mike Cotterell, Rajib Mall, Software Project Management”, 5th Edition, The McGraw-Hill Higher Education, ISBN :13:978-0-07-10724-8 , 2011.
2. Robert K. Wysocki, “Effective Project Management – Traditional, Agile, Extreme”, 6th Edition, Wiley Publication, ISBN: 1118080653, 2011.
3. Robert K. Wysocki, “Effective Software Project Management”, 3rd Edition, Wiley Publication, ISBN: 9780764596360, 2010.
4. MuraliChemuturi, Thomas M. Cagley , “Mastering Software Project Management: Best Practices, Tools and Techniques”, J.Ross publishing, ISBN:9781604270341, 2010
5. S. A. Kelkar, “Software Project Management: A Concise Study”, 3rd edition, PHI learning pvt Ltd ,ISBN: 9788120347021, 2013.

OUTCOMES :

Students who complete this course will be able to

- Practice the process of project management and its application in delivering successful IT projects
- Evaluate a project to develop the scope of work, provide accurate cost estimates and to plan the various activities
- Use risk management analysis techniques that identify the factors that put a project at risk and to quantify the likely effect of risk on project timescales
- Identify the resources required for a project and to produce a work plan and resource Schedule
- Monitor the progress of a project and to assess the risk of slippage, revising targets or counteract drift
- Distinguish between the different types of project and follow the stages needed to negotiate an appropriate contract.

CSCY208 DEPENDABLE COMPUTING

L	T	P	C
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OBJECTIVES :

- To expose the basic concept of dependable computing
- To explore the various error coding techniques used in dependable computing.
- To discuss the modelling tools used in dependable computing.
- To illustrate the countermeasure taken to deal with the impairment to dependability at the physical level.
- To showcase the importance of redundancy method to handle the fault.
- To discuss the issues at the architectural level when the subsystems interact.

MODULE I DEPENDABLE SYSTEMS 09

Dependable systems-Back ground and Motivation-Dependability attributes-combinational modelling –state space modelling.

MODULE II PHYSICAL IMPERFECTIONS 09

Physical imperfections-Defect Avoidance-Defeat Circumvention-Shielding and Hardening –Yield Enhancement.

MODULE III LOGICAL DEVIATIONS 09

Logical Deviations-Fault Testing-Fault Masking –Design for Testability-Replication and Voting.

MODULE IV ERRORS 09

Information Distortions-Error Detection-Error Correction-Self Checking Modules-Redundant Disk Array

MODULE V MALFUNCTIONS 09

Architectural Anomalies-Malfunction Diagnosis-Malfunction Tolerance –Standby Redundancy-Resilient Algorithms.

Theory : 45

REFERENCES :

1. Behrooz Parhami,”Dependable Computing, A Multilevel Approach”, TBD Publishers, 2015.

2. John Knight, “Fundamentals of Dependable Computing for Software Engineers”, ISBN 978143986255, 2012.

OUTCOMES :

Students who complete this course will be able to

- Identify the assessment component of dependability in computing systems.
- Suggest countermeasures to deal with impairments due to dependability at the physical level.
- Identify the logical level problem due to dependability and suggest solutions to solve them.
- Develop methods for detecting and correcting data path and control errors.
- Solve the technical problems that arise when the system interacts in a distributed system.
- Apply the redundancy algorithms for real time issues.

CSCY209 ADVANCED GRAPHICS PROGRAMMING

L	T	P	C
3	0	0	3

OBJECTIVES :

- To provide basics of computer graphics for advanced programming.
- To gain knowledge on motion and depth of graphics.
- To insight on features in advanced graphical effects.
- To focus on current, practical rendering methods used in games and other applications.
- To design program using Open GL tool box.
- To implement advanced animation through Open GL programming.

MODULE I MOTION AND DEPTH 09

Computer graphics –Display- Graphic file formats – Layering with depth - nimation – Camera and tilting - Illusion of depth- User interface.

MODULE II ADVANCED GRAPHICS 09

Particle systems- Creating effects – An Effect system – Optimization –GPU Programming – Pixel modification – Shader languages – Polish.

MODULE III 3D REAL TIME RENDERING 09

Graphics rendering pipeline – Transforms – Texturing – Advanced Shading – Global illumination – Non-photo realistic rendering - Graphics hardware.

MODULE IV 3D COMPUTER GRAPHICS PROGRAMMING 09

Open GL – Open GL Geometric primitives – Three Dimensions, Depth Buffer and Perspective projection – Drawing projects- Open GL tool box- Animation and Viewing.

MODULE V RENDERING PIPE LINE 09

Programming with Open GL - Advanced animation – Modeling in 3D space – Fixed functionality pipeline - Shaders and the programmable pipeline: Lift Off – Shaders and the programmable pipeline: Escape Velocity- Examples.

Total Hours : 45

REFERENCES :

1. John Pile,Jr., “ 2D Graphics Programming for Games” , CRC Press, ISBN 1466501901, 2016.

2. Tomas Akenine-Möller, Eric Haines, Naty Hoffman, “Real-Time Rendering”, 3rd Edition, CRC Press, ISBN 1498785638, 2016.
3. Sumanta Guha,” Computer Graphics Through OpenGL: From Theory to Experiments”, 2nd Edition, CRC Press, ISBN 1498760597, 2015.

OUTCOMES :

Students who complete this course will be able to

- Explain the basics of computer graphics.
- Analyze the motion and depth of graphical design.
- Design advanced graphical effects and program it.
- Illustrate real time rendering methods for games and other applications.
- Use of the openGL Application Programming Interface (API) to code 3D scenes and animation, including games and movies
- Implement advanced animation and graphical effects for any application.

CSCY210 PERVASIVE COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES :

- To learn the basics of pervasive computing and systems
- To explain the role of pervasive networks and communications
- To provide exposure to latest technologies such as wearable computing and smart identification which relate to pervasive computing
- To illustrate architecture and protocols in pervasive computing and to identify the trends and latest development of the technologies in the area
- To design successful mobile and pervasive computing applications and services
- To give practical experience in the area through the design and execution of a modest research project

MODULE I INTRODUCTION 09

Prototyping – The Internet of Things: an Overview - Design Principles for Connected Devices- Internet Principles-Calm and Ambient Technology-Web Thinking for Connected Devices- Internet Principles- -DNS-Static IP address Assignment-Dynamic IP address Assignment-IPv6-MAC addresses-TCP and UDP Ports-An Example: HTTP Ports-Other Common Ports-Application Layer Protocols-HTTP-HTTPS-Encrypted HTTP-Other Application Layer Protocols.

MODULE II TOOLS AND TECHNOLOGIES 09

Pervasive Learning – Emerging Technologies and Systems for Pervasive Learning- Integration of Real-World Practice and Experience with Pervasive Learning- Nature of Pervasive Learning and Provision of Well-Being in Education-Service Management in Pervasive Computing Environments- Service Management in Pervasive Computing Environments- Techniques for Service Management in PvCE- Service Composition-Standards and Implementation of Pervasive Computing Applications.

MODULE III SECURITY AND PRIVACY 09

Security and Privacy in Pervasive Networks – Security Classics- Hardening Pervasive Networks- Privacy in Pervasive Networks- Understanding Wormhole Attacks in Pervasive Networks- A Wormhole Attack- Severity of a Wormhole Attack- Classification of Wormholes- Wormhole Attack Modes- Mitigating Wormhole Attacks- Discussion of Some Mitigating Solutions to Avoid Wormhole Attacks.

MODULE IV NETWORKING AND COMMUNICATION 09

Autonomic and Pervasive Networking – Ubiquitous/Pervasive Networks- Applying Autonomic Techniques to Ubiquitous/Pervasive Networks- Self-* (star) In Autonomic and Pervasive Networks- Autonomic and Pervasive Networking Challenges- An Adaptive Architecture of Service Component for Pervasive Computing- Motivation- An Overview of the Delaying Adaptation Tool- Case Study.

MODULE V QUALITY OF SERVICE 09

The Coverage Problem - Stochastic k-Coverage Protocol- Performance Evaluation of Pervasive Networks Based on WiMAX Networks- IEEE 802.16 Architecture and QoS Requirements- Proposed QoS Framework- Implementation Frameworks for Mobile and Pervasive Networks- Correlating Design to Implementations- Challenges for Implementation Frameworks- State of the Art in Implementation Frameworks

Theory : 45

REFERENCES :

1. Adrian McEwen, Hakim Cassimally, “Designing the Internet of Things”,1st , Wiley, ISBN: 9781118430620, 2014.
2. Mohammad S. Obaidat, Mieso Denko And Isaac Woungang, “Pervasive Computing and Networking”, Wiley, ISBN: 9780470747728, 2011.
3. Asoke K Talukder, HasanHasan Ahmed and Roopa R Yavagal, “Mobile Computing Technology, Applications and Service Creation”, 2nd Edition, Tata McGraw-Hill Education Private Limited, 9780070707313, 2011.

OUTCOMES :

Students who complete this course will be able to

- Describe the concept of pervasive computing
- Design a basic architecture for a pervasive computing environment
- Analyze the role of sensors in Wireless networks
- Relate to current trends in pervasive computing and develop a sense of their practicality.
- Evaluate important issues and concerns on security and privacy
- Deploy the location and context information for application development

CSCY211 WEB TECHNOLOGY

L	T	P	C
1	0	2	2

OBJECTIVES :

- To provide an overview about the web related essential elements.
- To expose the construction and manipulation of web databases.
- To depict the technologies in building the web.
- To explicate the various scripting languages.
- To be familiar with markup languages used in web.
- To practice the programming aspects in building a web.

MODULE I INTRODUCTION TO WEB TECHNOLOGIES 15

Web Technology Architecture - Markup Languages – Inter Process Communication- Scripting languages- Database Connectivity – Client Side and Server Side programming - Web Security.

MODULE II DEVELOPING WEB APPLICATIONS 15

Client-Side Programming - Server-Side Programming - Creating Layout -Dynamic visuals to web application: building JSON Servlet and JQuery AJAX method - Integrating social website - Linking Dynamic Content from External Websites- Integrating E-commerce applications-Debugging and testing.

L-15; P-30

REFERENCES :

1. Achyut Godbole, Atul Kahate, “Web Technologies: TCP/IP, Web/Java Programming, and Cloud Computing”, Third edition, McGraw Hill Education Pvt Ltd, ISBN: 978-1-2-906268-1, 2013.
2. Jhon k, “Web technology: html, php, css, jquary, ajax, javascript”, Dreamtech press, 2014.
3. Sandeep Kumar Patel, “Developing Responsive Web Applications with AJAX and jQuery”, 1st edition, Packt publishing, ISBN: 978-1-78328-637-9, 2014.

OUTCOMES :

Students who complete this course will be able to

- Analyze a web page and identify its elements and attributes.
- Develop XML applications with DTD and style sheets for use with legacy browsers.

- Apply inter-process communication in web.
- Construct and manipulate web databases.
- Create a website and link it to social media.
- Build interactive web applications.

CSCY212 XML AND WEB SERVICES

L	T	P	C
1	0	2	2

OBJECTIVES :

- To edify evolution of web services and their architecture.
- To describe, discover &develop web services.
- To inculcate in-built programming skill needed to provide a web service.
- To incorporate comprehensive introduction to the programming tools required to build and maintain websites
- To facilitate how to build XML applications with DTD and style sheets.
- To practice the technologies in building the web services.

MODULE I INTRODUCTION 15

Introduction to XML-Name spaces –Schema - Web Services- Web Service Technologies- Web Services Architecture – SOAP – WSDL – UDDI – Standards - Service Coordination Protocols – Infrastructure- WS-Coordination – WS-Transaction – RosettaNet – xCBL – ebXML – WSCI-Service Composition-Exception Handling-Business Process Execution Language for Web Services.

MODULE II BUILDING WEB SERVICES 15

Introduction to ASP.NET Web API- Managing a Web API- Connecting Applications-Creating a Web API using Mobile Services- Creating Hybrid Services-Data services in Cloud: Data and Access Technologies- Creating Data Source for Web Application.

L-15; P-30

REFERENCES :

1. Gustavo Alonso, Fabio Casati, Harumi Kuno, Vijay Machiraju, “Web Services: Concepts, Architectures and Applications”,Springer, ISBN: 3662108763, 2013.
2. Olaf Zimmermann, Mark Tomlinson, Stefan Peuser,“Perspectives on Web Services: Applying SOAP, WSDL and UDDI to Real-World”, Springer, ISBN:978-3-642-62468-1, 2012.
3. Alex Belotserkovskiy, Stephen Kaufman, Nikhil Sachdeva, “Building Web Services with Microsoft Azure”, first edition, Packt publishing, ISBN: 978-1-78439-8, 2015.

OUTCOMES :

Students who complete this course will be able to

- Create web based application with the suitable markup languages like XML or HTML
- Develop database driven web applications using various web designing tools.
- Build and consume web services.
- Develop web service enabled applications.
- Use SOAP, WSDL & UDDI.
- Construct, deploy and call web services using the existing web technologies.

CSCY213 MULTIMEDIA SYSTEMS

L	T	P	C
1	0	2	2

OBJECTIVES :

- To provide the basics of multimedia systems and processing of multimedia signals.
- To gain knowledge on multimedia tools and processes.
- To design multimedia systems in systematic approach.
- To produce information on user interface design.
- To identify the major applications of multimedia systems.
- To insight the research areas of multimedia systems.

MODULE I MULTIMEDIA DESIGN 15

Mathematical Transforms used for multimedia signal processing- Digital Audio, image and video formats- Storing and Transmission of Digital audio signals – Visual Communication – Page layout – User interface design – Web design.

MODULE II PROGRAMMING AND APPLICATIONS 15

Static Media - Text- Graphics-Photography-Time Based Media – Recording formats and Device settings – Audio production – Video production – Time based Editing- Interactive Multimedia- Digital Video Stabilization – Development of Architecture Information Archive and Multimedia formats for Digital E-libraries.

L-15; P-30

REFERENCES :

1. Srdjan Stankovic, Irena Orovic, Ervin Sejdic, “Multimedia Signals and Systems: Basic and Advanced Algorithm for Signal processing”, 2nd Edition, Springer , ISBN 978-3-319-23950-7, 2015 .
2. Vic Costello, “Multimedia Foundations: Core Concepts for Digital Design”, 2nd Edition, CRC Press, ISBN 1317808908, 2016.
3. George A. Tsihrintzis, Maria Virvou, Lakhmi C. Jain, Robert J. Howlett, Toyohide Watanabe, ”Intelligent Interactive Multimedia Systems and Services in Practice”, Springer, ISBN 3319177443, 2015.

OUTCOMES :

Students who complete this course will be able to

- Construct mathematical transformations for multimedia signals.
- Analyse and process the multimedia signals such as images, audio, video.

- Acquire the basic concepts of multimedia tools and process in design.
- Illustrate design process of implementing multimedia systems.
- Use static and time based media in Multimedia system.
- Apply multimedia technology in various scenarios.

ITC6201 CLOUD COMPUTING TECHNOLOGIES

L	T	P	C
3	0	0	3

OBJECTIVES :

- To gain understanding of the basic concepts of cloud computing.
- To learn various types of cloud services, technologies and service providers.
- To know the design challenges of cloud infrastructure.
- To have knowledge about different programming models and cloud software.
- To understand the privacy and security issues in cloud environments.

MODULE I CLOUD COMPUTING BASICS 09

Introduction to Cloud Computing – Cloud computing reference model- Essential Characteristics - Benefits and challenges of cloud computing- Cloud Delivery Models - Deployment models -Cloud computing vendors .

MODULE II CLOUD COMPUTING TECHNOLOGY 08

Virtualization-Types of virtualization-Virtualization and cloud computing- Client-thin, thick, mobile clients- Cloud Providers and Consumers-Various Cloud Services- Accessing the Cloud- Frameworks- AJAX, Python- Web Hosting Services- Web Applications- Web API’s and Web Browsers.

MODULE III CLOUD INFRASTRUCTURE 10

Architectural Design of Compute and Storage Clouds – Layered Cloud Architecture Development– Design Challenges - Inter Cloud Resource Management – Resource Provisioning and Platform Deployment – Global Exchange of Cloud Resources.

MODULE IV PROGRAMMING MODEL 10

Map Reduce programming model - Map reduce and extensions - Relational operations – Parallel Efficiency of Map Reduce- Cloud File Systems - GFS and HDFS –Cloud platforms in Industry – Google App Engine, Amazon AWS- Cloud Software Environments -Eucalyptus, Open Nebula.

MODULE V SECURITY IN CLOUD 08

Cloud security fundamentals- Privacy and Security in cloud - Software-as-a-Service Security Risk Management – Security Monitoring – Security Architecture Design – Data Security – Application Security – Virtual Machine Security.

Theory : 45

REFERENCES :

1. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, “Cloud Computing: A Practical Approach“ ,McGraw-Hill,2010.
2. John W.Rittinghouse and James F.Ransome, “Cloud Computing: Implementation, Management, and Security”, CRC Press, 2010.
3. George Reese, “Cloud Application Architectures: Building Applications and Infrastructure in the Cloud” O'Reilly, 2009.
4. Rajkumar Buyya, James Broberg, Andrzej Goscinski, “Cloud Computing Principles and Paradigms” John Wiley & Sons, Inc Publications,2011
5. Rajkumar Buyya, Christian Vecchiola, S.ThamaraiSelvi, “Mastering Cloud Computing”, McGraw-Hill Education Private Ltd.,2013
6. Tim Malhar, S.Kumaraswammy, Shahed Latif ,”Cloud Security & Privacy”, O’Reilly media , 2009.

OUTCOMES :

On completion of the programme students will be able to:

- Articulate the main concepts, key technologies, strengths and limitations of cloud computing
- Identify the architecture, infrastructure and delivery models of cloud computing
- Discuss the cloud technologies including virtualization and web based technologies.
- Explain the cloud file systems and their applications in industry.
- Explain the core issues of cloud computing such as security, privacy and interoperability

LIST OF SINGLE CREDIT ELECTIVE COURSES

CSCY071 WIRELESS NETWORK PROGRAMMING

L	T	P	C
0.5	0	1	1

OBJECTIVES :

- To gain knowledge on the programming structure
- To learn the graph concepts
- To have an exposure on the implementation of sensor networks
- To address the programming models
- To gather knowledge on the link layer protocols
- To acquire information on the issues related to flooding

TOPICS

Data structures for sensor computing – general structure of programming – Importance of graph concepts in sensor programming-Programming challenges in sensor networks - structural characteristics and properties – sensor network stack – Synchronization-Programming with link layer protocols - ARQ protocol – transmitter role – naming and addressing – algorithms – flooding – tracking.

L – 8; P – 15

REFERENCES :

1. S. Sitharama Iyengar, Nandan Parameshwaran, Vir V. Phoha, N. Balakrishnan, Chuka D. Okoye, “Fundamentals of sensor network programming: applications and technology”, John Wiley & sons, ISBN 9780470890158, 2011.

OUTCOMES :

Students who complete this course will be able to

- Know the programming fundamentals of sensor computing
- Get familiarized with sensor network characteristics and stack
- Identify the programming models of sensor networks and issues related to it
- Implement the algorithms related to sensor concepts
- Know the issues related to flooding
- Explore the importance of graph concepts in network programming

CSCY072 CLOUD COMPUTING PROGRAMMING

L	T	P	C
0.5	0	1	1

OBJECTIVES :

- To explore the basic cloud architecture.
- To analyze the application need and design an infrastructure.
- To extend the cloud capacity understanding the different loop holes.
- To learn the implementation of cloud services
- To comprehend the Google web services
- To get expose to cloud security

TOPICS

Design a cloud environment in stimulator-resource management-energy management in stimulated environment-Abstraction and virtualization-capacity planning-Google web service-Amazon web service-Microsoft cloud service-Manage cloud-cloud security. Moving applications to cloud-cloud-based storage.

L – 8; P – 15

REFERENCES :

1. Barrie Sosinsky” Cloud Computing Bible”, Wiley India Pvt. Limited, ISBN: 978-0-470-90356-8, 2011.
2. Mark Chu-Carroll “Code in the Cloud: Programming Google App Engine” Pragmatic Bookshelf, ISBN: 1934356638,2011.

OUTCOMES :

Students who complete this course will be able to

- Design a cloud infrastructure based on different platforms.
- Compare the different cloud services provided by different cloud provider.
- Constitute the basic necessities when building an infrastructure for dynamic applications
- Illustrate the importance of energy management in stimulated environment
- Develop real time applications using cloud services
- Explore the issues in cloud security

CSCY073 BIG DATA PROGRAMMING

L	T	P	C
0.5	0	1	1

OBJECTIVES :

- To illustrate the fundamentals of programming in classes functions and invoking methods.
- To learn how to create a package and interfaces using programming tools.
- To solve the problem using Big Data programming tools.
- To gain the knowledge of designing Big data environment
- To explore the concepts of Map reduce.
- To learn the configuration of other tools supported for Big data

TOPICS

Meet hadoop – MapReduce – Hadoop File System-Configuration API – Configuring the Development Environment – Writing a unit test – Running on a cluster – tuning a job – Mapreduce work flows – how MapReduce Works

L – 8; P – 15

REFERENCES :

1. Tom White, "Hadoop: The Definitive Guide", 3rd Edition, O'Reilly, ISBN: 978-1-449-31152-0, 2012.

OUTCOMES :

Students who complete this course will be able to

- Design and analyze the real time problems using Hadoop.
- Create an environment to interact with users
- Configure the big data infrastructure.
- Demonstrate the concepts with processing tools.
- Develop a simple program for solving the problems using big data tools
- Apply Big data concepts into real world applications.

CSCY074 VISUAL SYSTEMS PROGRAMMING

L	T	P	C
0.5	0	1	1

OBJECTIVES :

- To introduce the concepts of visual programming.
- To explore the Visual Basic's Integrated Development Environment (IDE)
- To enable the students to develop programs and simple application using Visual C++
- To learn the basics of .NET Framework
- To become familiar with Windows Programming
- To get expose to Structured Query Language

TOPICS

Programming with Visual C++ 2008: The .NET Framework – Writing C++ Applications – Learning Windows Programming - Using the IDE-Windows Programming Basics –Using Windows Forms-The Document/View Concept in MFC – Creating MFC Applications. Working with Menus and Toolbars– Elements of a Menu –Drawing in a Window:– The Drawing Mechanism in Visual C++-Database Management with Microsoft ODBC – Structured Query Language – MFC ODBC classes – sample database applications – filter and sort strings – DAO concepts – displaying database records in scrolling view – Threading – VC++ Networking issues – Winsock – building a web client – Internet Information Server – ISAPI server extension.

L – 8; P – 15

REFERENCES :

1. Julian Templeman, "Microsoft Visual C++/CLI Step by Step", 1st Edition, Microsoft Press, ISBN: 978-0735675179, 2013.
2. Ivor Horton, "Beginning Visual C++", 1st Edition, Wroz, ISBN:978-0470500880, 2010.

OUTCOMES :

Students who complete this course will be able to

- Apply visual programming to software development by designing projects with menus and submenus
- Implement SDI and MDI applications using forms, dialogs, and other types of GUI components.

- Design and deploy applications using visual C++ programming
- Develop real time applications using Windows Programming
- Comprehend the issues relating to VC++ Networking
- Develop applications in the .NET Framework

CSCY075 OPEN SOURCE TOOLS

L	T	P	C
0.5	0	1	1

OBJECTIVES :

- To introduce to Open Source Ecosystem
- To create awareness on IPR issues, Licensing considerations
- To discuss concepts of Open Web and its role in Open Source Development
- To introduce varied open source tools for productivity and development
- To become familiar with data analytics
- To study about the significance of FOSS tools for personal use.

TOPICS

Open Source Eco-system-IPR and Open Source-Licensing: GNU GPL, LGPL, BSD, CPL, Creative Commons-Open Web-GitHub-FOSS Tools for Personal (Individual Use)-FOSS Tools for Small Teams (Limited Users)-FOSS Tools for Corporate Usage-Open Source Productivity and Development Tools in Vogue-Domain Specific Open Source Tools (Networking, Data Analytics, Software Engineering, Database Management etc)

L – 8; P – 15

REFERENCES :

1. Sandeep Koranne, “Handbook of Open Source Tools”, 1st Edition, Springer, 2011.

OUTCOMES :

Students who complete this course will be able to,

- Appreciate the significance of Open Source tools
- Comprehend the process, issues and considerations related to IPR, Licensing etc.
- Work with Open Web concepts, Github Environments etc
- Use varied Open Source tools for different productivity and development tasks
- Analyze domain specific Open Source tools
- Develop applications using FOSS tools

GENERAL ELECTIVES

GECY101	PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The objectives of the course would be to make the students

- Learn to e valuate and choose an optimal project and build a project profile.
- Attain knowledge on risk identification and risk analysis
- Gain insight into a project plan and components
- Familiar with various gamut of technical analysis for effective project implementation
- Learn to apply project management techniques to manage resources.

MODULE I INTRODUCTION & PROJECT INITIATION 09

Introduction to project and project management - projects in contemporary organization – The project life cycle - project initiation - project evaluation methods & techniques - project selection criteria - project profile.

MODULE II RISK ANALYSIS 09

Sources of risk: project specific - competitive - industry specific - market and international risk – perspectives of risk – risk analysis: sensitivity analysis - scenario analysis - breakeven analysis - simulation analysis - decision tree analysis – managing/mitigating risk – project selection under risk.

MODULE III PROJECT PLANNING & IMPLEMENTATION 09

Project planning – importance – functions - areas of planning - project objectives and policies - steps in planning process - WBS – capital requirements - budgeting and cost estimation - feasibility analysis - creation of project plan – project implementation: pre-requisites - forms of project organization

MODULE IV TECHNICAL ANALYSIS 09

Technical analysis for manufacturing/construction/infrastructure projects – process/technology - materials and inputs - product mix - plant capacity – plant location and site selection – plant layout - machinery and equipment – structures and civil works – schedule of project implementation – technical analysis for software projects.

MODULE V PROJECT MANAGEMENT TECHNIQUES 09

Project scheduling - network construction – estimation of project completion time – identification of critical path - PERT & CPM – crashing of project network - complexity of project scheduling with limited resources - resource allocation - resource leveling – resource smoothing – overview of project management software.

Total Hours: 45

REFERENCES:

1. Projects: Planning, Analysis, Financing, Implementation and Review, Prasanna Chandra, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2004.
2. Project Management and Control, Narendra Singh, Himalaya Publishing, New Delhi, 2015.
3. A Management Guide to PERT/CPM, Jerome, D. Weist and Ferdinand K. Levy, Prentice Hall of India, New Delhi, 1994.

OUTCOMES:

On successfully completing this course, the student will be able to:

- Evaluate & select a project as well as develop a project profile.
- Identify various risks associated with the project and manage it effectively.
- Prepare a detailed project plan addressing its components.
- Perform technical analysis for effective project implementation
- Apply project management techniques for maximizing resource utilization.

GECY102 SOCIETY, TECHNOLGY & SUSTAINABILITY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To aware of new technologies through advances in Science and Engineering.
- To make them realise the profound impact on society.
- To understand the ethical issues raised by technological changes and its effect on society.
- To introduce students a broad range of perspectives on the adoption and use of technologies.
- To make them realize the need of sustainability in the context of emerging technologies.

MODULE I TECHNOLOGY AND ITS IMPACTS 09

Origin and evolution of technologies – Nature of technology- Innovation – Historical Perspective of technology – Sources of technological change - Co-evolution of technology and economy – Scientific knowledge and technological advance – Science and Engineering aspects of Technology – Impact on the Society – Social and Ethical Issues associated with technological change – Social and environmental consequences - Impact of technological change on human life – Technology and responsibility – Technology and social justice.

MODULE II TECHNOLOGY AND ITS ADVANCEMENT 09

Sociological aspects of technology – Ethics and technology – Technology and responsibility – International Economics, Globalisation and Human Rights – Sustainability and Technology – Population and environment - Technology, Energy and Environment – Organisations and technological change.

MODULE III SOCIETY AND TECHNOLOGY 09

Impact of technologies on contemporary society – Role of society in fostering the development of technology – Response to the adaption and use of technology – Impact of technology on developer and consumers – Technological change and globalisation.

MODULE IV IMPACT OF A SPECIFIC TECHNOLOGY ON HUMAN WELFARE 09

Impact of the following technologies on Human life – Medical and Biomedical – Genetics Technology – Electronics and Communications – Electronic media

Technology – Information Systems Technology – Nanotechnology – Space Technology and Energy Technology.

MODULE V THE IMPORTANCE OF SUSTAINABILITY 09

Sustainability – A brief history – Concepts and contexts for sustainability – Ecological imbalance and biodiversity loss – Climate change – Population explosion. Industrial ecology – systems approach to sustainability – Green engineering and technology- sustainable design- sustainable manufacturing- Green consumer movements – Environmental ethics – Sustainability of the planet Earth – Future planning for sustainability.

Total Hours: 45

REFERENCES:

1. Volti Rudi, “Society and Technology Change”, 6th Edition, Worth publishers Inc, USA, 2009.
2. Arthur W.A, “The nature of Technology: What it is and how it evolves”, Free Press, NY, USA, 2009.
3. Winston M and Edelbach R, “Society, Ethics and Technology”, 3rd Edition, San Francisco, USA, 2005.
4. Martin A.A Abraham, “Sustainability Science and Engineering: Defining Principles”, Elsevier Inc, USA, 2006.
5. R.V.G.Menon, “Technology and Society”, Pearson Education, India, 2011.

OUTCOMES:

At the end of this course, the students will be able to

- Understand the benefits of modern technology for the well-being of human life.
- Connect sustainability concepts and technology to the real world challenges.
- Find pathway for sustainable society.

GECY103 ARTIFICIAL INTELLIGENCE

L	T	P	C
3	0	0	3

OBJECTIVES:

- Expose the history and foundations of artificial intelligence.
- Showcase the complexity of working on real time problems underlying the need for intelligent approaches.
- Illustrate how heuristic approaches provide a good solution mechanism.
- Provide the mechanisms for simple knowledge representation and reasoning.
- Highlight the complexity in working with uncertain knowledge.
- Discuss the current and future applications of artificial intelligence.

MODULE I HISTORY AND FOUNDATIONS 08

History – Scope – Influence from life – Impact of computing domains - Agents in environments - Knowledge representation – Dimensions of Complexity – Sample application domains – Agent structure.

MODULE II SEARCH 10

Problem solving as search – State spaces – Uninformed Search – Heuristic search – Advanced search – Constraint satisfaction - Applications.

MODULE III KNOWLEDGE REPRESENTATION AND REASONING 10

Foundations of knowledge representation and reasoning, representing and reasoning about objects, relations, events, actions, time, and space predicate logic, situation calculus, description logics, reasoning with defaults, reasoning about knowledge, sample applications.

MODULE IV REPRESENTING AND REASONING WITH UNCERTAIN KNOWLEDGE 08

Probability, connection to logic, independence, Bayes rule, Bayesian networks, probabilistic inference, sample applications.

MODULE V CASE STUDY AND FUTURE APPLICATIONS 09

Design of a game / Solution for problem in student's domain. Natural Language processing, Robotics, Vehicular automation – Scale, Complexity, Behaviour – Controversies.

Total Hours: 45

TEXT BOOK:

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall, Third Edition, 2010.
2. David Poole, Alan Mackworth, Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010.
3. Nils J. Nilsson, The Quest for Artificial Intelligence, Cambridge University Press, Online edition, 2013.
4. Keith Frankish, William M. Ramsey (eds) The Cambridge Handbook of Artificial Intelligence, Cambridge University Press, 2014.

OUTCOMES:

Students who complete this course will be able to

- Discuss the history, current applications, future challenges and the controversies in artificial intelligence.
- Apply principle of AI in the design of an agent and model its actions.
- Design a heuristic algorithm for search problems.
- Analyze and represent the fact using logic for a given scenario
- Represent uncertainty using probabilistic models
- Develop a simple game or solution using artificial intelligence techniques.

GECY104 GREEN COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To focus on the necessity of green computing technology.
- To expose to various issues with information technology and sustainability.
- To attain knowledge on the technologies for enabling green cloud computing.
- To elaborate on the energy consumption issues
- To illustrate a Green and Virtual Data Center
- To develop into a Green IT Technologist.

MODULE I INTRODUCTION 08

Trends and Reasons to Go Green - IT Data Center Economic and Ecological Sustainment - The Growing Green Gap: Misdirected Messaging, Opportunities for Action - IT Data Center “Green” Myths and Realities - PCFE Trends, Issues, Drivers, and Related Factors - Green Computing and Your Reputation- Green Computing and Saving Money- Green Computing and the Environment

MODULE II CONSUMPTION ISSUES 10

Minimizing power usage – Cooling - Electric Power and Cooling Challenges - Electrical – Power -Supply and Demand Distribution - Determining Energy Usage - From Energy Avoidance to Efficiency - Energy Efficiency Incentives, Rebates, and Alternative Energy Sources - PCFE and Environmental Health and Safety Standards- Energy-exposed instruction sets- Power management in power-aware real-time systems.

MODULE III NEXT-GENERATION VIRTUAL DATA CENTERS 09

Data Center Virtualization - Virtualization beyond Consolidation - Enabling Transparency - Components of a Virtual Data Center - Datacenter Design and Redesign - Greening the Information Systems - Staying Green- Building a Green Device Portfolio- Green Servers and Data Centers- Saving Energy

MODULE IV TECHNOLOGIES FOR ENABLING GREEN AND VIRTUAL DATA CENTERS 08

Highly Effective Data Center Facilities and Habitats for Technology - Data Center Electrical Power and Energy Management - HVAC, Smoke and Fire Suppression

- Data Center Location - Virtual Data Centers Today and Tomorrow - Cloud Computing, Out-Sourced, and Managed Services.

MODULE V SERVERS AND FUTURE TRENDS OF GREEN COMPUTING 10

Server Issues and Challenges - Fundamentals of Physical Servers - Types, Categories, and Tiers of Servers - Clusters and Grids - Implementing a Green and Virtual Data Center - PCFE and Green Areas of Opportunity- 12 Green Computer Companies- What's in Green computer science-Green off the Grid aimed for data center energy evolution-Green Grid Consortium- Green Applications- Green Computing Making Great Impact On Research

Total Hours: 45

REFERENCES:

1. Bud E. Smith,"Green Computing Tools and Techniques for Saving Energy, Money, and Resources", Taylor & Francis Group, CRC Press, ISBN-13: 978-1-4665-0340-3, 2014.
2. Jason Harris, "Green Computing and Green IT Best Practices, On Regulations and Industry Initiatives, Virtualization and power management, materials recycling and Tele commuting, Emereo Publishing .ISBN-13: 978-1-9215-2344-1,2014.
3. Ishfaq Ahmed & Sanjay Ranka, "Handbook of Energy Aware and Green Computing", CRC Press, ISBN: 978-1-4665-0116-4, 2013.
4. Kawahara, Takayuki, Mizuno, "Green Computing with Emerging Memory", Springer Publications, ISBN:978-1-4614-0811-6, 2012
5. Greg Schulz, "The Green and Virtual Data Center", CRC Press, ISBN-13:978-1-4200-8666-9, 2009.
6. Marty Poniatowski, "Foundation of Green IT: Consolidation, Virtualization, Efficiency, and ROI in the Data Center", Printice Hall, ISBN: 9780-1-3704-375-0, 2009.

OUTCOMES:

Students who complete this course will be able to

- Demonstrate issues relating to a range of available technologies, systems and practices to support green computing.
- Select appropriate technologies that are aimed to reduce energy consumption.
- Address design issues needed to achieve an organizations' green

computing objectives.

- Analyze the functionality of Data Centers.
- Critically evaluate technologies and the environmental impact of computing resources for a given scenario.
- Compare the impact of Green Computing with other computing techniques.

GECY105 GAMING DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To master event-based programming
- To learn resource management as it relates to rendering time, including level-of-detail and culling.
- To become familiar with the various components in a game or game engine.
- To explore leading open source game engine components.
- To become familiar of game physics.
- To be compatible with game animation.

MODULE I INTRODUCTION 09

Magic Words – What Skills Does a Game Designer Need? – The Most Important Skill -The Five Kinds of Listening-The Secret of the Gifted.

MODULE II THE DESIGNER CREATES AN EXPERIENCE 09

The Game Is Not the Experience -Is This Unique to Games? -Three Practical Approaches to Chasing Rainbows -Introspection: Powers, Perils, and Practice -Dissect Your Feelings -Defeating Heisenberg -Essential Experience.

MODULE III THE EXPERIENCE IN THE PLAYER MIND AND GAME MECHANICS 08

Modeling – Focus -Empathy – Imagination – Motivation – Space – Objects, Attributes, and States – Actions – Rules.

MODULE IV GAMES THROUGH AN INTERFACE 09

Breaking it Down – The Loop of Interaction – Channels of Information – Other Interface.

MODULE V BALANCED GAME MECHANICS 10

Balance – The Twelve Most Common Types of Game Balance – Game Balancing Methodologies - Balancing Game Economies.

Total Hours: 45

REFERENCES:

1. Jesse Schell, "The Art of Game Design: A Book of Lenses", 2nd Edition

ISBN-10: 1466598646, 2014.

2. Ashok Kumar, Jim Etheredge, Aaron Boudreaux, “Algorithmic and Architectural Gaming Design: Implementation and Development", 1st edition, Idea Group, U.S ISBN-10: 1466616342, 2012.
3. Katie Salen Tekinba, Melissa Gresalfi, Kylie Peppler, Rafi Santo, "Gaming the System - Designing with Gamestar Mechanic" MIT Press , ISBN-10: 026202781X, 2014.
4. James M. Van Verth, Lars M. Bishop "Essential Mathematics for Games and Interactive Applications", Third Edition, A K Peters / CRC Press, ISBN-10: 1482250926, 2015.

OUTCOMES:

Students who complete this course will be able to

- Realize the basic history and genres of games
- Demonstrate an understanding of the overall game design process
- Explain the design tradeoffs inherent in game design
- Design and implement basic levels, models, and scripts for games
- Describe the mathematics and algorithms needed for game programming
- Design and implement a complete three-dimensional video game

GECY106 SOCIAL COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To create original social applications, critically applying appropriate theories and effective practices in a reflective and creative manner.
- To critically analyze social software in terms of its technical, social, legal, ethical, and functional features or affordances.
- To encourage the development of effective communities through the design, use, and management of social software.
- To give students with a base of knowledge and advances for them to critically examine existing social computing services.
- To plan and execute a small-scale research project in social computing in a systematic fashion.
- To become familiar with the concept of computational thinking.

MODULE I BASIC CONCEPTS 09

Networks and Relations: Relations and Attributes, Analysis of Network Data, Interpretation of network data -New Social Learning – Four Changes that Shift Work - Development of Social Network Analysis: Sociometric analysis and graph theory, Interpersonal Configurations and Cliques – Analysing Relational Data.

MODULE II SOCIAL LINK 09

Individual Actors, Social Exchange Theory, Social Forces, Graph Structure, Agent Optimization Strategies in Networks – Hierarchy of Social Link Motivation- Social Context.

MODULE III SOCIAL MEDIA 08

Trends in Computing – Motivations for Social Computing – Social Media: Social relationships, Mobility and Social context – Human Computation – Computational Models- Business use of social Media.

MODULE IV SOCIAL INFORMATION FILTERING 09

Mobile Location Sharing – Location based social media analysis – Social Sharing and Social Filtering – Automated recommender Systems – Traditional and Social Recommender Systems.

MODULE V SOCIAL NETWORK STRATEGY 10

Application of Topic Models – Opinions and Sentiments – Recommendation Systems – Language Dynamics and influence in online communities – Psychometric analysis – Case Study: Social Network Strategies for surviving the zombie apocalypse.

Total Hours: 45

REFERENCES:

1. Tony Bingham, Marcia Conner, “The New Social Learning, Connect. Collaborate. Work”, 2nd Edition, ATD Press, ISBN-10:1-56286-996-5, 2015.
2. Nick Crossley, Elisa Bellotti, Gemma Edwards, Martin G Everett, Johan Koskinen, Mark Tranmer, “Social Network Analysis for Ego-Nets”, SAGE Publication, 2015.
3. Zafarani, Abbasi and Liu, Social Media Mining: An Introduction, Cambridge University Press, 2014.
4. Christina Prell, “Social Network Analysis: History, Theory and Methodology”, 1st Edition, SAGE Publications Ltd, 2012.
5. John Scott, “Social Network Analysis”, Third Edition, SAGE Publication, 2013.
6. Jennifer Golbeck, “Analyzing the Social Web”, Elsevier Publication, 2013.
7. Huan Liu, John Salerno, Michael J. Young, “Social computing and Behavioral Modeling”, Springer Publication, 2009.

OUTCOMES:

Students who complete this course will be able to

- Realize the range of social computing applications and concepts.
- Analyze data left after in social media.
- Recognize and apply the concepts of computational models underlying social computing.
- Take out simple forms of social diagnostics, involving network and language models, applying existing analytic tools on social information.
- Evaluate emerging social computing applications, concepts, and techniques in terms of key principles.
- Design and prototype new social computing systems.

GECY107 SOFT COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

The aim of the course is to

- Enumerate the strengths and weakness of soft computing
- Illustrate soft computing methods with other logic driven and statistical method driven approaches
- Focus on the basics of neural networks, fuzzy systems, and evolutionary computing
- Emphasize the role of euro-fuzzy and hybrid modeling methods
- Trace the basis and need for evolutionary computing and relate it with other soft computing approaches

MODULE I SOFT COMPUTING - BASICS 06

Soft computing – Hard Computing – Artificial Intelligence as the basis of soft computing – Relation with logic driven and statistical method driven approaches- Expert systems – Types of problems: Classification, Functional approximation, Optimizations – Modeling the problem – Machine Learning – Hazards of Soft Computing – Current and future areas of research

MODULE II ARTIFICIAL NEURAL NETWORK 12

Artificial Neuron – Multilayer perceptron – Supervised learning – Back propagation network –Types of Artificial Neural Network: Supervised Vs Un Supervised Network – Radial basis function Network – Self Organizing Maps – Recurrent Network – Hopfield Neural Network – Adaptive Resonance Theory – Issues in Artificial Neural Network – Applications

MODULE III FUZZY SYSTEMS 09

Fuzzy Logic – Membership functions – Operators – Fuzzy Inference systems – Other sets: Rough sets, Vague Sets – Fuzzy controllers - Applications

MODULE IV NEURO FUZZY SYSTEMS 09

Cooperative Neuro fuzzy systems – Neural network driven fuzzy reasoning – Hybrid Neuro fuzzy systems – Construction of Neuro Fuzzy systems: Structure Identification phase, Parameter learning phase – Applications

MODULE V EVOLUTIONARY COMPUTING 09

Overview of evolutionary computing – Genetic Algorithms and optimization – Genetic Algorithm operators – Genetic algorithms with Neural/Fuzzy systems – Variants of Genetic Algorithms– Population based incremental learning – Evolutionary strategies and applications

Total Hours: 45

TEXTBOOKS:

1. Samir Roy, “Introduction to Soft Computing: Neuro-Fuzzy and Genetic Algorithms”, Pearson, 2013
2. Anupam Shukla, Ritu Tiwari and Rahul Kala, “Real life applications of Soft Computing”, CRC press, 2010.
3. Fakhreddine O. Karray, “Soft Computing and Intelligent Systems Design: Theory, Tools and Applications”, Pearson, 2009

OUTCOMES:

At the end of the course the students will be able to

- Enumerate the theoretical basis of soft computing
- Explain the fuzzy set theory
- Discuss the neural networks and supervised and unsupervised learning networks
- Demonstrate some applications of computational intelligence
- Apply the most appropriate soft computing algorithm for a given situation

GECY108 EMBEDDED SYSTEM PROGRAMMING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the design of embedded computing systems with its hardware and software architectures.
- To describe entire software development lifecycle and examine the various issues involved in developing software for embedded systems.
- To analyze the I/O programming and Embedded C coding techniques
- To equip students with the software development skills necessary for practitioners in the field of embedded systems.

MODULE I INTRODUCTION OF EMBEDDED SYSTEM 09

Embedded computing – characteristics and challenges – embedded system design process – Overview of Processors and hardware units in an embedded system – Compiling, Linking and locating – downloading and debugging – Emulators and simulators processor – External peripherals – Memory testing – Flash Memory.

MODULE II SOFTWARE TECHNOLOGY 09

Software Architectures, Software development Tools, Software Development Process Life Cycle and its Model, Software Analysis, Design and Maintenance.

MODULE III INPUT/OUTPUT PROGRAMMING 09

I/O Instructions, Synchronization, Transfer Rate & Latency, Polled Waiting Loops, Interrupt – Driven I/O, Writing ISR in Assembly and C, Non Maskable and Software Interrupts

MODULE IV DATA REPRESENTATION IN EMBEDDED SYSTEMS 09

Data representation, Twos complement, Fixed point and Floating Point Number Formats, Manipulating Bits in -Memory, I/O Ports, Low level programming in C, Primitive data types, Arrays, Functions, Recursive Functions, Pointers, Structures & Unions, Dynamic Memory Allocation, File handling, Linked lists, Queues, Stacks.

MODULE V EMBEDDED C 09

Embedded Systems programming in C – Binding & Running Embedded C program in Keil IDE – Dissecting the program - Building the hardware. Basic techniques for

reading & writing from I/O port pins – switch bounce - LED Interfacing using Embedded C.

Total Hours: 45

REFERENCES:

1. Marilyn Wolf, "Computers as components ", Elsevier, 2012.
2. Qing Li and Carolyn Yao, "Real-Time Concepts for Embedded Systems", CMP Books, 2003.
3. Daniel W. Lewis, "Fundamentals of embedded software where C and assembly meet", Pearson Education
4. Michael Bass, "Programming Embedded Systems in C and C++", Oreilly, 2003.

OUTCOMES:

On completion of this course the student will be able to

- Design the software and hardware components in embedded system
- Describe the software technology
- Use interrupt in effective manner
- Use keil IDE for programming
- Program using embedded C for specific microcontroller
- Design the embedded projects

GECY109 PRINCIPLES OF SUSTAINABLE DEVELOPMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge in the concepts and dimensions of sustainable development.
- To gain knowledge on the framework for achieving sustainability.

MODULE I CONCEPT OF SUSTAINABLE DEVELOPMENT 09

Environment and Development - Population poverty and Pollution – Global and Local environmental issues – Resource Degradation- Greenhouse gases – Desertification-industrialization – Social insecurity, Globalization and environment. History and emergence of the concept of sustainable development-Objectives of Sustainable Development.

MODULE II COMPONENTS AND DIMENSIONS OF SUSTAINABLE DEVELOPMENT 09

Components of Sustainability – Complexity of growth and equity – Social economic and environmental dimensions of sustainable development – Environment – Biodiversity – Natural – Resources – Ecosystem integrity – Clean air and water – Carrying capacity – Equity, Quality of Life, Prevention, Precaution – Preservation and Public Participation Structural and functional linking of developmental dimensions.

MODULE III FRAMEWORK FOR ACHIEVING SUSTAINABILITY 09

Operational guidelines – interconnected prerequisites for sustainable development Empowerment of Women, children, Youth, Indigenous People, Non-Governmental Organizations Local Authorities, Business and industry – Science and Technology for sustainable development – performance indicators of sustainability and assessment mechanism – Constraints and barriers for sustainable development.

MODULE IV SUSTAINABLE DEVELOPMENT OF SOCIO ECONOMIC SYSTEMS 09

Demographic dynamics of sustainability – Policies for socio-economic development – Strategies for implementing eco-development programmes Sustainable development through trade – Economic growth – Action plan for implementing sustainable development – Urbanization and sustainable Cities – Sustainable Energy and Agriculture – sustainable livelihoods.

MODULE V SUSTAINABLE DEVELOPMENT AND INTERNATIONAL RESPONSE 09

Role of developed countries in the development of developing countries – international summits – Stockholm to Johannesburg – Rio principles – Agenda-Conventions – Agreements – Tokyo Declaration – Doubling statement – Tran boundary issues integrated approach for resources protection and management

Total Hours: 45

REFERENCES:

1. Sayer J. and Campbell, B., The Science of Sustainable Development: Local Livelihoods and the Global environment - Biological conservation restoration & Sustainability, Cambridge university Press, London, 2003.
2. M.K. Ghosh Roy. and Timberlake, Sustainable Development, Ane Books Pvt. Ltd, 2011.
3. Mackenthun K.M., Concepts in Environmental Management, Lewis Publications London, 1999.
4. APJ Abdul Kalam and Srijan Pal Singh, Target 3 Billion: Innovative Solutions Towards Sustainable Development, Penguin India, 2011

OUTCOMES:

At the end of the course the student will be able to

- Describe the concepts of sustainable development
- Define the components and dimensions of sustainable development
- Outline the Frame work for achieving sustainability.
- State the policies and strategies for implementing sustainable development for Socio economic programmes.
- Examine the role of developed countries in sustainable development.

GECY110	QUANTITATIVE TECHNIQUES IN MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVE:

To impart knowledge on

- Concepts of operations research
- Inventory control in production management
- Financial management of projects
- Decision theory and managerial economics

MODULE I OPERATIONS RESEARCH 09

Introduction to Operations research – Linear programming – Graphical and Simplex Methods, Duality and Post-Optimality Analysis – Transportation and Assignment Problems

MODULE II PRODUCTION MANAGEMENT 09

Inventory control, EOQ, Quantity Discounts, Safety Stock – Replacement Theory – PERT and CPM – Simulation Models – Quality Control.

MODULE III FINANCIAL MANAGEMENT 09

Working Capital Management – Compound Interest and Present Value methods – Discounted Cash Flow Techniques – Capital Budgeting.

MODULE IV DECISION THEORY 09

Decision Theory – Decision Rules – Decision making under conditions of certainty, risk and uncertainty – Decision trees – Utility Theory.

MODULE V MANAGERIAL ECONOMICS 09

Cost concepts – Break even Analysis – Pricing techniques – Game Theory applications.

Total Hours: 45

REFERENCES:

1. Vohra, N.D. , Quantitative Techniques in Management, Tata McGraw Hill Co., Ltd, New Delhi, 2009.
2. Seehroeder, R.G., Operations Management, McGraw Hill, USA, 2002.
3. Levin, R.I, Rubin, D.S., and Stinsonm J., Quantitative Approaches to Management, McGraw Hill Book Co., 2008.

4. Frank Harrison, E., The Managerial Decision Making Process, Houghton Miffin Co. Boston, 2005.
5. Hamdy A. Taha, Operations Research- An Introduction, Prentice Hall, 2002.

OUTCOME:

At the end of the course, the students will be able to

- Apply the concepts of operations research for various applications
- Create models for inventory control in production management
- Compute the cash flow for a project
- Choose a project using decision theory based on the risk criterion.
- Apply the concepts of managerial economics in construction management

GECY111 PROGRAMMING USING MATLAB & SIMULINK

L	T	P	C
1	0	2	2

OBJECTIVES:

The aim of this course is to:

- Teach students how to mathematically model engineering systems
- Teach students how to use computer tools to solve the resulting mathematical models. The computer tool used is MATLAB and the focus will be on developing and solving models of problems encountered in engineering fields

MODULE I INTRODUCTION TO MATLAB AND DATA PRESENTATION 10

Introduction to MATLAB-Vectors, Matrices -Vector/Matrix Operations & Manipulation- Functions vs scripts- Making clear and compelling plots-Solving systems of linear equations numerically and symbolically.

Lab Experiments

1. Study of basic matrix operations and manipulations.
2. Numerical and symbolical solution of linear equations.

MODULE II ROOT FINDING AND MATLAB PLOT FUNCTION 10

Linearization and solving non-linear systems of equations- The Newton-Raphson method- Integers and rational numbers in different bases- Least squares regression -Curve fitting-Polynomial fitting and exponential fitting.

Lab Experiments

1. Solution of non linear equations using Newton-Raphson method.
2. Determination of polynomial fit and exponential fit for the given data.

MODULE III LINEAR AND NON-LINEAR DIFFERENTIAL EQUATIONS 13

Numerical integration and solving first order, ordinary differential equations (Euler's method and Runge-Kutta) - Use of ODE function in MATLAB- Converting second order and higher ODEs to systems of first order ODEs- Solving systems of higher order ODEs via Euler's method and Runge-Kutta) - Solving single and systems of non-linear differential equations by linearization-Use of the function ODE in MATLAB to solve differential equations - Plot Function –Saving & Painting Plots.

Lab Experiments

1. Solution of fourth order linear differential equations using
    a. Trapezoidal Rule

b. Euler method

2. Solution of fourth order non-linear differential equations using
    a. Modified Euler method
    b. Runge – Kutta method

MODULE IV INTRODUCTION OF SIMULINK 12

Simulink & its relations to MATLAB – Modeling a Electrical Circuit- Modeling a fourth order differential equations- - Representing a model as a subsystem- Programme specific Simulink demos.

Lab Experiments

1. Solution of fourth order non-linear differential equations using simulink.
2. Programme specific experiment based on simulink.

Total Hours (Including Practicals): 45

REFERENCE:

1. Griffiths D V and Smith I M, “Numerical Methods for Engineers”, Blackwell, 1991.
2. Laurene Fausett, “Applied Numerical Analysis Using MATLAB”, Pearson 2008.
3. Moin P, “Fundamentals of Engineering Numerical Analysis”, Cambridge University Press, 2001.
4. Wilson HB, Turcotte LH, Advanced mathematics and mechanics applications using MATLAB”, CRC Press, 1997
5. Ke Chen, Peter Giblin and Alan Irving, “Mathematical Exploration with MATLAB”, Cambridge University Press, 1999.

OUTCOMES:

At the end of this unit students will be able to:

- Use Matlab as a convenient tool for solving a broad range of practical problems in engineering from simple models to real examples.
- Write programs using first principles without automatic use of built-in ones.
- Write programs for solving linear and nonlinear systems, including those arising from boundary value problems and integral equations, and for root-finding and interpolation, including piecewise approximations.
- Be fluent in exploring Matlab’s capabilities, such as using matrices as the fundamental data-storage unit, array manipulation, control flow, script and function m-files, function handles, graphical output.
- Make use of Maltab visual capabilities for all engineering applications.

- An ability to identify, formulate, and solve engineering problems. This will be accomplished by using MATLAB to simulate the solution to various problems in engineering fields

GECY112 JAVA PROGRAMMING

L	T	P	C
1	0	2	2

OBJECTIVES:

- To learn the fundamentals of Java programming such as data types, variables and arrays.
- To study the syntax and necessity of decision making and iterative statements.
- To create a class and invoke the methods.
- To instigate programming in overloading of methods.
- To emphasize the concept of packages.
- To learn the exception handling routines.

MODULE I INTRODUCTION TO JAVA PROGRAMMING 08

History and Evolution of Java – Overview of Java – Data types, variables and arrays – Operators – Control statements.

MODULE II METHODS AND CLASSES 07

Class fundamentals – Declaring objects – Methods – Constructors – Garbage collection – Overloading methods – Constructor overloading – Access control – Inheritance – Packages - Exception handling.

L: 15, P: 30, Total Hours: 15

REFERENCES:

1. Herbert Schildt, “Java The Complete Reference”, 9th Edition, Oracle Press, 2014, ISBN: 978007180855-2.
2. Nicholas S. Williams, **“**Professional Java for Web Applications: Featuring WebSockets, Spring Framework, JPA Hibernate and Spring Security (WROX)”, John Wiley & Sons, 2014, ISBN: 978111865651-8.
3. E Balagurusamy, “Programming with Java”, 5th Edition, Tata Mcgraw Hill, 2014.
4. Yashavant Kanetka**, “**Let Us Java”, 2nd Edition, BPB Publications, 2012**.**

OUTCOMES:

Students who complete this course will be able to

- Implement basic Java programming.
- Create a class and invoke methods for real world problems.

- Construct simple overloading of methods programs.
- Implement various types of inheritance concepts.
- Describe the access control mechanism.
- Handle exception thrown while implementing programming.

GECY113 PYTHON PROGRAMMING

L	T	P	C
1	0	2	2

OBJECTIVES:

- To learn the list and records of python programming.
- To study the control statements and string functions of python.
- To instigate the fundamental python programming.
- To emphasize GUI in python.
- To integrate python with embedded systems.
- To implement programs in python.

MODULE I INTRODUCTION TO PYTHON PROGRAMMING 08

Installation and environment set up – syntax used in python – variable types – operators – Loops – decision making – string functions - formatted files - GUI basics.

MODULE II EMBEDDED PROGRAMMING USING PYTHON 07

Web interface – system tools – script execution context - Motion-triggered LEDs – Python - Arduino prototyping-storing and plotting Arduino data-Remote home monitoring system.

L: 15, P: 30, Total Hours: 15

REFERENCES:

1. Nick Goddard, “Python Programming”, 2nd edition, ISBN: 1533337772, 2016.
2. Pratik Desai, “Python Programming for Arduino”, 1st edition, Packt publishing, 2015, ISBN: 9781783285938.
3. Mark Lutz, Learning Python: Powerful Object-Oriented Programming, 5th Edition, O'Reilly Media, 2013.
4. Richard H. Barnett, Sarah Cox, Larry O'Cull, “Embedded C Programming and the Atmel AVR”, 2nd edition, 2006.
5. Michael Barr, Anthony Massa, “Programming Embedded Systems”, 2nd Edition, O'Reilly Media, 2006.

OUTCOMES:

Students who complete this course will be able to

- Implement date and time function programming using python.

- Write formatted file programming.
- Construct simple python programs.
- Create web interface using python programming
- Develop embedded system with python programming.
- Build Arduino prototype using python programming.

GECY114 INTELLECTUAL PROPERTY RIGHTS (IPR)

L	T	P	C
1	0	0	1

OBJECTIVES:

- To study about Intellectual property rights and its need
- To explore the patent procedure and related issues

MODULE I INTRODUCTION 07

Introduction and the need for intellectual property right (IPR) – IPR in India – Genesis and Development – IPR in abroad – Important examples of IPR – Copyrights, Trademarks, Patents, Designs, Utility Models, Trade Secrets and Geographical Indications – Industrial Designs

MODULE II PATENT 08

Concept of Patent – Product / Process Patents & Terminology – Duration of Patents – Law and Policy Consideration Elements of Patentability –- Patentable Subject Matter – Procedure for Filing of Patent Application and types of Applications – Procedure for Opposition – Revocation of Patents – Working of Patents- Patent Agent – Qualification and Registration Procedure – Patent databases and information system – Preparation of patent documents – Process for examination of patent application- Patent infringement – Recent developments in patent system

Total Hours: 15

REFERENCES

1. B.L.Wadehra; Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India 2000
2. Ajit Parulekar and Sarita D' Souza, Indian Patents Law – Legal & Business Implications; Macmillan India ltd , 2006
3. P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi, 2010.
4. E. T. Lokganathan, Intellectual Property Rights (IPRs): TRIPS Agreement & Indian Laws Hardcover, 2012
5. Alka Chawla, P N Bhagwati , Law of Copyright Comparative Perspectives 1st Edition, LexisNexis, 2013
6. V. K. Ahuja, Law Relating to Intellectual Property Rights 2nd Edition, LexisNexis, 2nd Edition, 2013

7. Deborah E. Bouchoux, Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets, 2015
8. Jatindra Kumar Das, Law of Copyright, PHI Learning, 2015

COURSE OUTCOMES:

Students should be able to

- Identify the various types of intellectual property and their value
- Apply the procedure to file a patent and to deal the related issues
- Search and extract relevant information from various intellectual database

REGULATIONS, CURRICULAM AND SYLLABUS

M. TECH.
POWER SYSTEMS ENGINEERING

(As approved by the 9th Academic Council)

JULY 2016

B.S.ABDUR RAHMAN UNIVERSITY
B.S.ABDUR RAHMAN INSTITUTE OF SCIENCE & TECHNOLOGY
(Estd.u/s 3 of the UGC Act, 1956)
(FORMERLY B.S.ABDUR RAHMAN CRESCENT ENGINEERING COLLEGE)
Seethakathi Estate, G.S.T. Road, Vandalur, Chennai - 600 048.

VISION AND MISSION OF THE DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

VISION

To achieve excellence in the programs offered by the Department of Electrical and Electronics Engineering through quality teaching, holistic learning and innovative research

MISSION

- To offer Under Graduate, Post Graduate & Research programs of industrial and societal relevance
- To provide knowledge and skill in the Design and realization of Electrical and Electronic circuits and systems
- To impart necessary managerial and soft skills to face the industrial challenges
- To pursue academic and collaborative research with industry and research institutions in India and abroad
- To disseminate the outcome of research and projects through publications, seminars and workshops

PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES

PROGRAMME EDUCATIONAL OBJECTIVES

1. **Engineering knowledge**:
   Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**:
   Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**:
   Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**:
   Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**:
   Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**:
   Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**:
   Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**:
   Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work**:
   Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**:
    Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**:
    Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**:
    Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME OUTCOMES

(i) Ability to provide solutions for power system problems to meet global requirements
(ii) Have ability to apply various industrial power system software packages in the areas of planning and operation of power systems.
(iii) To have a substantial knowledge, in emerging areas such as deregulation of power system, smart grid and clean energy

CURRICULUM & SYLLABI FOR
M. Tech (Power Systems Engineering)

CURRICULUM
FOUR SEMESTERS / FULL TIME)

Sl. No.	Course Code	Course Title	L	T	P	C
		Semester I				
1	MAC6184	Probability, Matrix Theory and Linear Programming	**3**	**1**	**0**	**4**
2	EEC6101	System Theory	**3**	**0**	**0**	**3**
3	EEC6102	Advanced Power System Analysis	**3**	**1**	**0**	**4**
4	EEC6103	Power Distribution System	**3**	**0**	**0**	**3**
5	EEC6104	Power System Protection	**3**	**0**	**0**	**3**
6		Professional Elective#				**3#**
7	EEC6105	Power System Analysis & Protection Lab	**0**	**0**	**2**	**1**
8	EEC6106	Design / Simulation Project	**0**	**0**	**2**	**1**
		Total Credit (semester I)				**22**

Minimum of 3 credits

		Semester II				
1	EEC6211	Advanced Power system Operation and Control	**3**	**0**	**0**	**3**
2	EEC6212	Restructured Power Systems	**3**	**0**	**0**	**3**
3	CSB6101	Research Methodology	**3**	**1**	**0**	**4**
4		Professional Elective##				**9##**
5	EEC6213	Power System Dynamics Control & Operation Laboratory	**0**	**0**	**2**	**1**
6	EEC6214	Self Learning	**0**	**2**	**0**	**2**
7	EEC6215	Industrial Internship	**0**	**0**	*****	******
		Total Credit (semester II)				**22**

Minimum of 9 credits

* Minimum of 30 days Industrial Internship

** Industrial internship will be undertaken during first year summer vacation. The credit will be awarded in the 3rd semester.

Sl. No.	Course Code	Course Title	L	T	P	C
		Semester III				
1		General Elective	**3**	**0**	**0**	**3**
2		Professional Elective				**3#**
2	EEC6215	Industrial Internship	**0**	**0**	*****	**2**
3	EEC7101	Project Phase I ####	**0**	**0**	**12**	**6####**
		Total Credit (semester III)				**8**
	* Minimum of 30 days Industrial Internship					
	# Minimum of 3 credits					
		Semester IV				
1	EEC7101	Project Phase II####	**0**	**0**	**36**	**18####**
		Total Credit (semester IV)	**18+6 = 24**			
	#### Credits for Project Work Phase I to be accounted along with Project Work Phase II in IV Semester.					
		Grand Total of credits				**76**

PROFESSIONAL ELECTIVE

Sl. No.	Course Code	Course Title	L	T	P	C
1	EECY001	Electro Magnetic Field Computation and Modelling	**3**	**0**	**0**	**3**
2	EECY002	Power System Dynamics	**3**	**0**	**0**	**3**
3	EECY003	EHV Power Transmission	**3**	**0**	**0**	**3**
4	EECY047	Special Electrical Machines and Controllers	**3**	**0**	**0**	**3**
5	EECY004	Power Quality	**3**	**0**	**0**	**3**
6	EECY005	Power system Planning and Reliability	**3**	**0**	**0**	**3**
7	EECY006	Advanced Digital Signal Processing	**3**	**0**	**0**	**3**
8	EECY007	Control System Design	**3**	**0**	**0**	**3**
9	EECY008	High Voltage Switch Gear	**3**	**0**	**0**	**3**
10	EECY009	Optimal Control and Filtering	**3**	**0**	**0**	**3**
11	EECY010	Industrial Power System Analysis and Design	**3**	**0**	**0**	**3**
12	EECY011	High Voltage Direct Current Transmission	**3**	**0**	**0**	**3**
13	EECY012	Wind energy Conversion Systems	**3**	**0**	**0**	**3**
14	EECY013	Application of MEMS Technology	**3**	**0**	**0**	**3**
15	EECY014	Outdoor Insulators	**3**	**0**	**0**	**3**
16	EECY015	Flexible AC Transmission Systems	**3**	**0**	**0**	**3**
17	EECY016	Electrical Transients in Power Systems	**3**	**0**	**0**	**3**
18	EECY017	High voltage Pulse Generation, Measurement and Testing for Life Sciences	**3**	**0**	**0**	**3**
19	EECY018	Smart Power Grid	**3**	**0**	**0**	**3**
20	EECY019	Distributed Generation and Micro-grid	**3**	**0**	**0**	**3**
21	EECY020	Reactive Power Management in Power Systems	**3**	**0**	**0**	**3**
22	EECY021	State estimation and contingency analysis in smart grid	**3**	**0**	**0**	**3**
23	EECY049	Solar and Energy storage system	**3**	**0**	**0**	**3**
24	EECY050	Fundamentals of grid connected photo voltaic power electronic converter design	**3**	**0**	**0**	**3**
25	EECY051	Solar power system design	**3**	**0**	**0**	**3**
26	EECY022	Power Electronics Applications to Power Systems	**3**	**0**	**0**	**3**
27	EECY043	SCADA and DCS	**3**	**0**	**0**	**3**

Sl. No.	Course Code	Course Title	L	T	P	C
28	EEC6125	Modeling and Analysis of Electrical Machines	**3**	**0**	**0**	**3**
29	EEC6126	Advanced Power Semiconductor Devices	**3**	**0**	**0**	**3**
30	EEC6127	Analysis of Power converters	**3**	**0**	**0**	**3**
31	EEC6235	Solid State AC & DC Drives	**3**	**0**	**0**	**3**
32	EECY023	Electrical Insulation in Power Apparatus and Systems	**2**	**0**	**0**	**2**
33	EECY024	Energy Auditing	**2**	**0**	**0**	**2**
34	EECY025	Wide Area Measurement Systems	**2**	**0**	**0**	**2**
35	EECY026	Power System Simulation Software	**0**	**0**	**2**	**1**
36	EECY027	Simulation of Power Electronic Circuits	**0**	**0**	**2**	**1**
37	EECY028	Electric Vehicles	**1**	**0**	**0**	**1**

GENERAL ELECTIVES FOR M.TECH PROGRAMMES

Sl. No.	Course Code	Course Title	L	T	P	C
1	GECY101	Project management	**3**	**0**	**0**	**3**
2	GECY102	Society, Technology & Sustainability	**3**	**0**	**0**	**3**
3	GECY103	Artificial Intelligence	**3**	**0**	**0**	**3**
4	GECY104	Green Computing	**3**	**0**	**0**	**3**
5	GECY105	Gaming Design	**3**	**0**	**0**	**3**
6	GECY106	Social Computing	**3**	**0**	**0**	**3**
7	GECY107	Soft Computing	**3**	**0**	**0**	**3**
8	GECY108	Embedded System Programming	**3**	**0**	**0**	**3**
9	GECY109	Principles of Sustainable Development	**3**	**0**	**0**	**3**
10	GECY110	Quantitative Techniques in Management	**3**	**0**	**0**	**3**
11	GECY111	Programming using MATLAB & SIMULINK	**1**	**0**	**2**	**2**
12	GECY112	JAVA Programming	**2**	**0**	**0**	**2**
13	GECY113	PYTHON Programming	**2**	**0**	**0**	**2**
14	GECY114	Intellectual Property Rights	**1**	**0**	**0**	**1**

SEMESTER I

MAC6184	PROBABILITY, MATRIX THEORY AND LINEAR PROGRAMMING	L	T	P	C
		3	1	0	4

(M.Tech. PSE, PED, VLSI, Communication, EIE & Structural)

OBJECTIVE:

The aim of this course is to

- provide a comprehensive introduction to the probability distributions used in engineering.
- familiarize students with advanced matrix theory and variation problems.
- expose the students to Operations Research using concepts of linear programming.

MODULE I PROBABILITY DISTRIBUTIONS 10+03

Axioms of probability – addition and multiplication theorem – conditional probability – total probability – random variables - moments – moments generating functions and their properties- Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

MODULE II TWO DIMENSIONAL RANDOM VARIABLES 08+03

Joint distributions - marginal and conditional distributions - functions of random variables - covariance - correlation and regression - Central limit theorem.

MODULE III ADVANCED MATRIX THEORY 09+03

Matrix norms - singular value decomposition - QR algorithm - pseudo inverse - least square approximations.

MODULE IV LINEAR PROGRAMMING 10+03

Formation - graphical method - simplex method - Big-M method - Two Phase method - transportation and assignment problems.

MODULE V CALCULUS OF VARIATIONS 08+03

Variation and its properties – Euler's equation – functional dependant on first and higher order derivatives – functional dependant on functions of several independent variables – variational problems with moving boundaries – isoperimetric problems – Ritz and Kantorovich methods.

L – 45; T – 15; Total – 60

TEXT BOOKS:

1. S.M.Ross, “A First Course in Probability”, 9th edition, Pearson Education, 2013.
2. Lewis.D.W., “Matrix Theory”, Allied Publishers, Chennai, 1995.
3. Taha, H.A., “Operations Research - An Introduction '', 10th edition, Pearson Prentice Hall, 2016.
4. A.S. Gupta, “Calculus of variations with applications”, PHI Pvt. Ltd, New Delhi, 2011.

REFERENCES:

1. H. Cramer., “Random Variables and Probability Distributions”, Cambridge University Press (2004).
2. Roger A. Horn, Charles R. Johnson, “Matrix Analysis”, Cambridge University Press; 2nd edition (2012).
3. Robert.J.Vanderbei., “Linear Programming: Foundations and Extensions”, Springer US(2014).
4. David. J. Rader., “Deterministic Operations Research”, Wiley (2010).
5. Elsgolts, “Differential Equations and Calculus of Variations", University Press of the Pacific (2003).

OUTCOME:

At the end of the course students will be able to

- Solve problems using concept of standard, discrete and continuous distributions.
- Solve problems using one dimensional and two dimensional random variables.
- Find Eigen values and Eigen vectors of a higher order matrix.
- Solve problems of linear programming.
- Solve problems of calculus of variations by direct methods and using Euler’s formulae.

EEC6101 SYSTEM THEORY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide knowledge on state space approach, state feedback controllers and observers for different processes.
- To enhance knowledge on stability analysis of multivariable processes.
- To introduce nonlinear systems and its linearization methods.
- To evaluate Stability of Linear and Non Linear Systems.

MODULE I STATE SPACE APPROACH 08

Introduction to State Space Approach - System representation in state variable form – State transition equation – Methods of computing the state transition matrix.

MODULE II STATE FEEDBACK CONTROL AND STATE ESTIMATOR 08

Stability analysis - Controllability and Observability of linear time invariant systems - State Feedback – Output Feedback – Pole placement technique – Full order and Reduced Order Observers.

MODULE III STABILITY FOR LINEAR SYSTEMS 08

Introduction – Equilibrium points – Stability in the sense of Lyapunov - BIBO Stability – Stability of LTI systems – The direct method of Lyapunov and the Linear continuous time autonomous systems – Popov Stability Criterion.

MODULE IV NON-LINEAR SYSTEMS 06

Types of Non-Linearity – Typical Examples – Phase plane analysis (analytical and graphical methods) – Limit cycles – Equivalent Linearization.

MODULE V STABILITY FOR NON-LINEAR SYSTEMS 08

Equilibrium stability of non linear continuous time autonomous systems – Finding Lyapunov functions for nonlinear continuous time autonomous systems – Krasovskii and variable gradient method.

MODULE VI STABILITY FOR NON-LINEAR SYSTEMS USING DESCRIBING 07

Describing Function Analysis for Non Linear Systems, Describing Functions for different non-linear elements- backlash, deadzone, saturation and hysteresis.

Total Hours: 45

REFERENCES:

1. M.Gopal, “Modern Control System Theory”, New Age International, 2005.
2. K.Ogata, “Modern Control Engineering”, Prentice Hall of India, 2002.
3. John .S.Bay, “Fundamentals of Linear State Space Systems”, Tata McGraw– Hill, 1999.
4. Z.Bubnicki, “Modern Control Theory”, Springer, 2005.

OUTCOMES:

At the end of the course, the students will have knowledge and achieve skills on the following:

- Implement state space approach for the process and obtain the solution.
- Design state feedback controller and observers.
- Perform stability analyses of the system using conventional mathematical approach
- Ability to analyze complex systems using mathematical models.
- Ability to analyze the stability of Linear Systems using Lyapnov and Popov Stability Criterions
- Ability to analyze the stability of Non-Linear Systems using novel techniques.

EEC6102 ADVANCED POWER SYSTEM ANALYSIS

L	T	P	C
3	1	0	4

OBJECTIVES:

- To provide the student the knowledge to use efficient numerical techniques suitable for computer application which are required for planning and operation of power system.
- To provide the student the knowledge and computational skills required to model and analyze large-scale power system under normal and abnormal operating conditions.

MODULE I SPARSE MATRICES IN POWER SYSTEMS 08

Sparse Matrix techniques for large scale power systems: Optimal ordering schemes for preserving sparsity. Flexible packed storage scheme for storing matrix as compact arrays - Factorization by Bifactorization and Gauss elimination methods; Repeat solution using Left and Right factors and L and U matrices.

MODULE II POWER FLOW ANALYSIS 08

Power flow equation in real and polar forms; Review of Newton's method for solution; Adjustment of P-V buses; Review of Fast Decoupled Power Flow method; Sensitivity factors for P-V bus adjustment; DC Power Flow,; Net Interchange power control in Multi-area power flow analysis.

MODULE III OPTIMAL POWER FLOW 07

Problem statement; Solution of Optimal Power Flow (OPF) - The gradient method, Newton's method, Linear Sensitivity Analysis; LP methods - With real power variables only - LP method with AC power flow variables and detailed cost functions; Security constrained Optimal Power Flow; Interior point algorithm; Bus Incremental costs. DC Optimal Power Flow (DCOPF)

MODULE IV SHORT CIRCUIT ANALYSIS 08

Fault calculations using sequence networks for different types of faults. Bus impedance matrix (ZBUS) construction using Building Algorithm for lines with mutual coupling; Simple numerical problems. Computer method for fault analysis using ZBUS and sequence components. Derivation of equations for bus voltages, fault current and line currents, both in sequence and phase domain using Thevenin's equivalent and ZBUS matrix for different faults.

MODULE V CONTINGENCY ANALYSIS 07

Introduction and concept of linear sensitivity factors– Generation outage and line outage Sensitivity factors - Analysis of multiple contingencies - Contingency ranking methods – Numerical examples

MODULE VI STABILITY ANALYSIS 07

Introduction, Numerical Integration Methods: Euler and Fourth Order Runge-Kutta methods, Algorithm for simulation with classical synchronous machine model; Factors influencing transient stability, implicit Integration methods and numerical stability. Small Signal Stability – Eigen value and participation factors for SMIB systems

Total Hours: 60

REFERENCES:

1. G W Stagg, A.H El. Abiad, “Computer Methods in Power System Analysis”, McGraw Hill, 1968.
2. P.Kundur, “Power System Stability and Control”, McGraw Hill, 1994.
3. A.J.Wood and B.F.Wollenberg, “Power Generation Operation and Control”, John Wiley and sons, New York, 1996.
4. W.F.Tinney and W.S.Meyer, “Solution of Large Sparse System by Ordered Triangular Factorization”, IEEE Trans. on Automatic Control, Vol:18, pp:333-346, Aug 1973.
5. K.Zollenkopf, “Bi-Factorization: Basic Computational Algorithm and Programming Techniques; pp: 75-96; Book on “Large Sparse Set of Linear Systems” Editor: J.K.Rerd, Academic Press, 1971.
6. Mariesa L. Crow, “Computational Methods for Electric Power Systems’, Second Edition CRC Press, 2009.
7. John Grainger, William Stevenson Jr., ‘’Power System Analysis’’ First Edition, McGraw-Hill, 1994
8. L.P. Singh, “Advanced Power System: Analysis and Dynamics”, Sixth Revised Edition, New Age International Pvt. Ltd., 2014.

OUTCOMES:

At the end of the course, the student will be able to:

- Use the right solution technique to handle the solution technique while encountering sparse matrices in power system analysis.
- Perform load flow study and interpret the result effectively for power system

operational problems.

- Suggest optimal settings for power system operation by performing optimal power flow analysis.
- Perform short circuit studies and interpret the result for designing the circuit breaker and protection system in long term planning problem.
- Assess the steady state security of the power system for different contingencies.
- Perform transient stability study and interpret the result effectively for long term planning problem.

EEC6103 POWER DISTRIBUTION SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide knowledge about basics of distribution systems
- To provide knowledge about distribution feeders and substations
- To provide knowledge about analysis of distribution system
- To understand the protection devices and practices followed in distribution system
- To understand the concepts of reactive power compensation and voltage control in distribution system.

MODULE I INTRODUCTION TO DISTRIBUTION SYSTEMS 08

General, an overview of the role of computers in distribution system planning Load modeling and characteristics: definition of basic terms like demand factor, utilization factor, load factor, plant factor, diversity factor, coincidence factor, contribution factor and loss factor-Relationship between the load factor and loss factor - Classification of loads (Residential, Commercial, Agricultural and Industrial) and their characteristics.

MODULE II DISTRIBUTION FEEDERS AND SUBSTATIONS 08

Design consideration of Distribution feeders: Radial and loop types of primary feeders- voltage levels- feeder loading. Design practice of the secondary distribution system-Location of Substations: Rating of a Distribution Substation service area with primary feeder - benefits derived through optimal location of substations.

MODULE III SYSTEM ANALYSIS 08

Voltage drop and power loss calculations : Derivation forvolt-drop and power loss in lines- manual methods of solution for radial networks - three-phase balanced primary lines- non-three-phase primary lines.

MODULE IV PROTECTIVE DEVICES AND COORDINATION 08

Objectives of distribution system protection - types of common faults and procedure for fault calculation. Protective Devices: Principle of operation of fuses, circuit reclosers, line sectionalizer and circuit breakers-Coordination of protective devices : General coordination procedure.

MODULE V CAPACITIVE COMPENSATION FOR POWER FACTOR CONTROL 08

Different types of power capacitors, shunt and series capacitors, effect of shunt capacitors (Fixed and switched) - power factor correction, capacitor location. Economic justification - Procedure to determine the best capacitor location.

MODULE VI VOLTAGE CONTROL 05

Equipment for voltage control - effect of series capacitors - effect of AVR- line drop compensation.

Total Hours: 45

REFERENCES:

1. Turan Gonen, “Electric Power Distribution System Engineering”, Mc.GrawHill Book Company, 1986.
2. A.S.Pabla, “Electric Power Distribution”, Tata Mc Graw-Hill Publishing Company, 4th edition,1997.
3. V.Kamaraju, “Electrical Power Distribution Systems”, Tata Mc Graw Hill publication, 2009

OUTCOMES:

At the end of the course, the student is expected to achieve the following:

- Better understanding of basics of power distribution system
- Ability to design distribution feeders and substations
- Ability to perform voltage drop and power loss calculations
- Ability to do distribution system planning
- Ability to carry out reactive power compensation and voltage control in distribution system.
- Ability to perform fault calculations.

EEC6104	POWER SYSTEM PROTECTION	L	T	P	C
		3	0	0	3

OBJECTIVES:

A protection scheme for Power System is designed to continuously monitor the Power System to ensure maximum continuity of Electrical Supply, with minimum damage to Life, Equipment and Property. Hence, the course on Power System Protection aims at the following:

- Fault Characteristics of individual Power System elements
- Tripping characteristics of various protective relays and matching them
- Various schemes of protection employed in Generator and Transformer protection
- Significance of Over Current Protective Schemes
- Relays used for protection of Transmission lines.
- Protection of bus bars.

MODULE I GENERATOR PROTECTION 05

Introduction to Equipment Protection - Electrical circuit of the generator -Various faults and abnormal operating conditions - Rotor faults -Abnormal operating conditions; Numerical examples for typical generator protection schemes

MODULE II TRANSFORMER PROTECTION 08

Types of transformers - Phasor diagram for a three Phase transformer -Equivalent circuit of transformer - Types of faults in transformers - Over current protection - Percentage Differential Protection of Transformers - Inrush phenomenon - High resistance Ground Faults in Transformers – Inter turn faults in transformers - Incipient faults in transformers - Phenomenon of overfluxing in transformers - Transformer protection application chart - Numerical examples for typical transformer protection schemes

MODULE III BUSBAR PROTECTION 08

Introduction – Differential protection of busbars - External and internal fault - Actual behaviors of a protective CT - Circuit model of a saturated CT - External fault with one CT saturated :need for high impedance Busbar protection – Minimum internal fault that can be detected – Stability ratio of high impedance busbar differential scheme - Supervisory relay - Protection of three Phase busbars - Numerical example on design of high impedance bus bar differential scheme.

MODULE IV OVER CURRENT PROTECTION 08

Time - Current characteristics - Current setting - Time setting - Over current protective schemes - Reverse power or directional relay - Protection of parallel feeders - Protection of ring feeders - Earth fault and phase fault protection - Combined Earth fault and phase fault protection scheme - Phase fault protective scheme - Directional earth fault relays.

MODULE V DISTANCE PROTECTION OF TRANSMISSION LINES 08

Drawbacks of over Current protection – Introduction to distance Protection – Simple impedance relay – Reactance relay – Mho relay - comparison between distances relays.

Need for carrier aided protection – Various options for a carrier – Coupling and trapping the carrier into the desired line section – Unit type carrier aided directional comparison relaying – Carrier aided distance schemes – Phase comparison relaying.

MODULE VI NUMERICAL PROTECTION 08

Introduction – Block diagram of numerical relay - Sampling theorem - Correlation with a reference wave - Digital filtering - Numerical over Current protection – Numerical transformer differential protection. Numerical distance protection of transmission line.

Case study of a simulation software for solving a protection problem.

Total Hours: 45

REFERENCES:

1. Y.G. Paithankar and S.R Bhide, “Fundamentals of Power System Protection”, Prentice-Hall of India, 2010
2. Badri Ram and D.N. Vishwakarma, “Power System Protection and Switchgear”, Tata McGraw- Hill Publishing Company, 2011
3. Bhavesh Bhalja, R. P. Maheswari and Nilesh Ghothani, “Protection and Switchgear,” Oxford University press, 2011
4. J. Lewis Blackburn and Thomas J. Domin “Protection Relaying: Principles and Applications”, CRC press, 2014

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Fault Characteristics of Individual Power System elements.
- Various schemes employed in Generator and Transformer protection.
- Design of Busbar differential Scheme.
- Significance of Over Current Protective Schemes.
- Distance and Carrier Protection of Transmission lines.
- Numerical Protection.

EEC6105	POWER SYSTEM ANALYSIS & PROTECTION LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES

- To study and develop programs for steady state analysis of Power systems.
- To study and develop programs for transient analysis of SMIB systems.
- To understand the operation of power system protection relays through simulation.
- To understand the effects of energization of transmission lines and starting of induction motor on power systems.
- To get familiarized with both proprietary and open source power system simulation software such as MATLAB, Octave, Scilab, ETAP, PSCAD, CYME and OpenDSS.

LIST OF EXERCISES

1. Sparse matrix techniques and optimal ordering schemes using C.
2. Development of load flow analysis program by Newton-Raphson method using MATLAB
3. Development of transient stability program for single machine-infinite bus system using classical machine model using MATLAB.
4. Contingency analysis: Calculation of Generator shift factors and line outage distribution factors using MATLAB.
5. Development of Load flow analysis program by FDPF method using GNU OCTAVE.
6. Development of small signal stability program for single machine infinite bus system using classical machine model using Scilab.
7. Co-ordination of over-current and distance relays for radial line protection using ETAP.
8. Simulation of digital differential relay protection using MATLAB Simulink.
9. Analysis of switching surge using PSCAD/EMTDC: Energization of a long distributed parameter line.
10. Induction motor starting analysis using CYME.
11. Modeling of smart distribution networks using OpenDSS.

Total Hours: 30

COURSE OUTCOMES

At the end of the course, the student will be able to

- Handle sparse matrices effectively, while they are encountered in power system programming.
- Develop programs for power system steady state analysis using MATLAB / Octave / Scilab.
- Develop programs for transient simulation of SMIB systems.
- Model over-current, distance and differential relays in simulation software ETAP/Simulink.
- Simulate energization of transmission lines and perform induction motor starting analysis using power system simulation software PSCAD/CYME.
- Model distribution networks using the open source software Open DSS.

EEC6106	DESIGN / SIMULATION PROJECT	L	T	P	C
		0	0	2	1

OBJECTIVE:

- To identify the problems existing in power sector expose the students to the available tools and methodologies for solving a power system problem.

COURSE DESCRIPTION:

Design / Simulation project shall be carried out by each and every individual student under the supervision of a faculty of this department. The student shall meet the faculty periodically and attend the periodic reviews for evaluating the progress. There will be two reviews for continuous assessment and one final review and viva voce at the end of the semester. A report prepared according to approved guidelines and duly signed by the supervisor(s) and the Head of the Department shall be submitted to the course teacher.

Design / Simulation project may be chosen from, but not limited to, the following areas:

1) Distribution system optimization, planning and reliability
2) Flexible AC Transmission Systems
3) Forecasting and Management
4) Generation systems
5) Modeling and simulation
6) Power quality
7) Power system restructuring
8) Power systems protection
9) Smart grid technologies and applications
10) Renewable energy sources and technology
11) Distributed generation and micro grid
12) Power system dynamics and control
13) High voltage engineering
14) HVAC/DC and EHV transmission
15) Reactive power management
16) Micrigrid

Total Hours: 30

OUTCOMES:

At the end of the course, the student will be able to

- Identify a problem existing in the power industry.
- Obtain the mathematical model a power system or components of a power system under study.
- Analyze a problem analytically & practically and to suggest a viable solution.
- Use appropriate software tools for simulation and analysis.
- Critically evaluate and improve a published work.
- Effectively communicate the findings.

SEMESTER II

		L	T	P	C
EEC6211	**ADVANCED POWER SYSTEM OPERATION AND CONTROL**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To get an overview of system operation and control
- To become familiar with the preparatory work necessary for meeting the next day's operation such as load forecasting, unit commitment and generation scheduling.
- To review the basics of AGC and also study about the security of power systems.
- To understand the concepts of hydro thermal scheduling, SCADA and state estimation

MODULE I LOAD FORECASTING 08

Introduction – Estimation of Average and trend terms – Estimation of periodic components – Estimation of Stochastic components: Time series approach – Auto-Regressive Model, Auto-Regressive Moving – Average Models – Kalman Filtering Approach – On-line techniques for non stationary load prediction.

MODULE II UNIT COMMITMENT 07

Constraints in unit commitment – Spinning reserve – Thermal unit constraints – Other constraints – Solution using Priority List method, Dynamic programming method - Forward DP approach Lagrangian relaxation method – adjusting.

MODULE III GENERATION SCHEDULING 08

The Economic dispatch problem – Thermal system dispatching with network losses considered – The Lambda – iteration method – Gradient method of economic dispatch – Economic dispatch with Piecewise Linear cost functions – Transmission system effects – A two generator system – coordination equations – Incremental losses and penalty factors.

MODULE IV HYDROTHERMAL CO-ORDINATION 08

Introduction- Hydro electric plant models-Scheduling Problems-Short term hydro thermal scheduling problem-Gradient approach-Hydro units in series(Hydraulically coupled)-Pumped storage hydro scheduling with a iteration method – Pumped

storage hydro scheduling by a gradient method-Dynamic programming solution to hydro thermal scheduling problem.

MODULE V CONTROL OF POWER SYSTEMS 07

Review of AGC and reactive power control -System operating states by security control functions – Monitoring, evaluation of system state by contingency analysis – Corrective controls (Preventive, emergency and restorative) - Energy control center – SCADA system – Functions – monitoring, Data acquisition and controls – EMS system.

MODULE VI STATE ESTIMATION 07

Maximum likelihood Weighted Least Squares Estimation: - Concepts - Matrix formulation - Example for Weighted Least Squares state estimation; State estimation of an AC network: development of method – Typical results of state estimation on an AC network – State Estimation by Orthogonal Decomposition algorithm.

Total Hours: 45

REFERENCES:

1. O.I.Elgerd, “Electric Energy System Theory - an Introduction”, - Tata McGraw Hill, New Delhi, 2002.
2. P.Kundur; “Power System Stability and Control”, EPRI Publications, California, 1994.
3. Allen J.Wood and Bruce. F.Wollenberg, “Power Generation Operation and Control’, John Wiley & Sons, New York, 1996.
4. A.K.Mahalanabis, D.P.Kothari. and S.I.Ahson., “Computer Aided Power System Analysis and Control”, Tata McGraw Hill publishing Ltd, 1984.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Ability to do optimal generation scheduling with and without transmission loss
- Ability to carry out real time unit commitment problem.
- Ability to carry out load forecasting using different techniques
- Better understanding of Automatic Generation Control and security of power systems
- Ability to carry out Hydro thermal co-ordination and state estimation.
- Better understanding of SCADA and Energy Management System

EEC6212 RESTRUCTURED POWER SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide the student a background on restructuring of power system which has taken place in many countries in the world including our country
- To provide insight on new trends in operation and control in deregulated power systems
- To highlight electric energy trading in the electricity market.

MODULE I OVERVIEW OF POWER SYSTEM RESTRUCTURING 08

Restructuring Models: PoolCo Model, Bilateral Contracts Model, Hybrid Model - Independent System Operator (ISO): The Role of ISO - Power Exchange(PX): Market Clearing Price (MCP) - Market operations: Day-ahead and Hour-Ahead Markets, Elastic and Inelastic Markets - Market Power - Stranded costs - Transmission Pricing: Contract Path Method, The MW-Mile Method - Congestion Pricing: Congestion Pricing Methods, Transmission Rights - Management of Inter-Zonal/Intra Zonal Congestion: Solution procedure, Formulation of Inter-Zonal Congestion Sub problem, Formulation of Intra- Zonal Congestion Sub problem.

MODULE II ELECTRIC UTILITY MARKETS IN THE UNITED STATES 08

California Markets: ISO, Generation, Power Exchange, Scheduling Coordinator, UDCs, Retailers and Customers, Day-ahead and Hour-Ahead Markets, Block forwards Market, Transmission Congestion Contracts(TCCs) - New York Market: Market operations - PJM interconnection - Ercot ISO - New England ISO - Midwest ISO: MISO's Functions, Transmission

Management, Transmission System Security, Congestion Management, Ancillary Services Coordination, Maintenance Schedule Coordination - Summary of functions of U.S. ISOs.

MODULE III OASIS: OPEN ACCESS SAME-TIME INFORMATION SYSTEM 08

FERC order 889 - Structure of OASIS: Functionality and Architecture of OASIS Types of information available on OASIS, Information requirement of OASIS, Users of OASIS - Transfer Capability on OASIS: Definitions, Transfer Capability Issues, ATC Calculation, TTC Calculation, TRM Calculation, CBM Calculation - Transmission Services - Methodologies to Calculate ATC - Experiences with OASIS in some Restructuring Models: PJM OASIS, ERCOT OASIS

MODULE IV ELECTRIC ENERGY TRADING 08

Essence of Electric Energy Trading - Energy Trading Framework: The Qualifying factors - Derivative Instruments of Energy Trading: Forward Contracts, Futures Contracts, Options, Swaps, Applications of Derivatives in Electric Energy Trading - Port Folio Management: Effect of Positions on Risk Management - Energy Trading Hubs - Brokers in Electricity Trading – Green Power Trading.

MODULE V SPECIAL COMPUTATIONAL TECHNIQUES 08

Formulation of D.C. Optimal Power Flow (DCOPF) model for- Assessment of Available Transfer Capability (ATC)- Assessment of Simultaneous ATC (SATC)- Congestion Management.-Solution of the above problems using the LP technique- Numerical examples for the above problems.

MODULE VI FREQUENCY RELATED ANCILLARY SERVICES AND ITS MARKET MODELS 05

General Configuration of AGC in a Deregulated Environment - Disco Participation Matrix- State Space Characterization of the Two-Area System in Deregulation - Market Models for Frequency related Ancillary Services - Regulation - Load following - frequency based pricing - Unsheduled Interchange - ABT .

Total Hours: 45

REFERENCES:

1. Mohammad Shahidehpour and Muwaffaq Almoush, “Restructured Electrical Power systems: Operation, Trading and Volatility”, Marcel Dekkar, Inc., 2001.
2. G.Zaccour, “Deregulation of Electric Utilities”, Kluwer Academic Publishers, 1998.
3. M.Ilic, F. Galiana and L.Fink, "Power Systems Restructuring : Engineering and Economics", Kluwer Academic Publishers, 2000.
4. Editor: Loi Lei Lai, "Power System Restructuring and Deregulation: Trading, Performance and Information Technology", John Wiley and sons Ltd, 2001.
5. K.Bhattacharya, M.H.J.Bollen and J.E.Daader, "Operation of Restructured Power Systems", Kluwer Academic Publishers, 2001.\
6. J.H.Chow,F.F.Wu and J.A.Momoh, "Applied Mathematics for restructured electric power systems: Optimization, Control and Computation Intelligence", Springer 2004.
7. F.C.Schweppe, M.C.Caramanis, R.D.Tabors and R.E.Bohn, "Spot Pricing

of Electricity", Kluwer Academic Publishers, 2002.

8. Rajesh Joseph Abraham, Automatic Generation Control : Traditional and Deregulated Environments", LAP Lambert Academic Publishing (1 September 2010).

OUTCOMES:

At the end of the course, the student is expected to:

- Perform the various steps of electricity trading operation such as market clearing and settlement for an exchange.
- Explain the operation of different electricity markets in United States.
- Compute transmission pricing and perform congestion Use and interpret the real time information available in an OASIS.
- Perform the various steps of trading such as forecasting of energy requirement and billing of supply offers / demand bids for GENCOS / DISCOS
- Compute the ATC and perform congestion management in restructured power systems.
- Carry out the various transformation process required for converting our present Indian power system into a restructured power system with competitive energy trading.

CSB6101	RESEARCH METHODOLOGY FOR ENGINEERS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To make the students well versed in statistical methods used in engineering.
- To describe the steps involved in research process.
- To explain how to formalize research problems.
- To discuss clearly the approaches for research through some case studies.

MODULE I RESEARCH PROBLEM 08

The research problem – Sources of research problem – Information, how to deal with it – Criteria / characteristics of a good research problem – Errors in selecting a good research problem – Types of research – Nature and use of arguments.

MODULE II ANALYSIS OF VARIANCE 07

Anova – one way – two way classification – Collection of Secondary Latin square design – 2^2 factorial design.

MODULE III DESIGN OF EXPERIMENTS 08

Experimental factors – interaction of factors, Types of experimental design – blocking design – factorial – fractional factorial, Taguchi's orthogonal approach.

MODULE IV REGRESSION, CORRELETION AND CURVE FITTING 10

Regression analysis – simple linear regression – regression coefficient, multiple regression – multiple & partial correlation coefficient, curve fitting – graphical – least square – method testing of goodness of fit.

MODULE V TRANSPORTATION AND ASSIGMENT MODELS 06

Transportation Problem – Assignment Problem – Travelling Sales man. Problem.

MODULE VI CASE STUDIES 06

Presentation by students on their area of research.

Total Hours: 60

REFERENCES:

1. Kothari, C.R., “Research Methodology: Methods and Techniques”, 2nd Edition, New Age International, New Delhi, 2012.
2. Nicholas Walliman, “Your Research Project”, 2nd Edition, Vistaar Publication, New Delhi, 2005.
3. Taha H.A., “Operations Research: An Introduction”, 7th Edition, Pearson Education Edition, Asia, New Delhi, 2002.
4. Richard A. Johnson, “Miller and Freund’s Probability and Statistics for Engineers”, 8th Edition, Pearson Education, Asia, 2011.

OUTCOMES:

Students who complete this course will be able to

- Identify the research problem.
- Become capable of analyzing the data using mathematical techniques.
- Learn to apply the statistical concepts in research.
- Demonstrate the different research methods applicable to a specific problem.

EEC6213	POWER SYSTEM DYNAMICS, CONTROL AND OPERATION LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES

- To model and analyze multi-machine power systems for small signal and transient stability.
- To incorporate models of FACTS devices in the steady state and dynamic analysis of power systems and understand their effects.
- To understand effects of wind energy conversion system in the transient stability of power systems.
- To understand the operation of Automatic Generation Control (AGC) in deregulated environment.
- To study and develop programmes for economic operation of the power systems.
- To develop programs for computation ATC and congestion management in deregulated environment
- To expose the students to simulation software such as Xcos, PSPICE, EUROSTAG and PSAT.

LIST OF EXERCISES

1. Economic Dispatch with line flow constraints using MATLAB.
2. Unit commitment: Dynamic programming using MATLAB.
3. Development of small signal stability program for multi machine power system using classical machine model using MATLAB.
4. Load flow analysis of two-bus system with STATCOM using MATLAB.
5. Small signal stability enhancement with TCSC in a SMIB system using MATLAB.
6. Simulation of Automatic Generation Control (AGC) in a multi-area deregulated power system using Scilab / Xcos.
7. Available Transfer Capability (ATC) calculation and congestion management by DCOPF method using GNU OCTAVE.
8. Transient stability analysis of power system with doubly fed induction generator using EUROSTAG.
9. Computation of harmonic indices generated by a rectifier feeding an R-L load using PSPICE
10. Transient analysis of single machine infinite bus system with STATCOM using MATLAB SIMULINK.
11. Transient stability analysis of multi-machine power system using PSAT.

Total Hours: 30

OUTCOMES

At the end of the course, the student will be able to

- Develop programs for small signal stability analysis of multi-machine systems.
- Prepare data and simulate multi-machines systems for transient stability.
- Incorporate models of FACTS devices in the dynamic simulations and steady state analysis of power systems.
- Use the software EUROSTAG for transient simulation of power systems with induction generators.
- Develop programs for unit commitment, economic dispatch for the economic operation of power systems, congestion management and automatic generation control in deregulated environment
- Simulate power electronic circuits using PSPICE and measure the harmonics generated by non-linear loads.

EEC6214	SELF LEARNING	L	T	P	C
		0	2	0	2

OBJECTIVE:

- To provide fundamental and advanced knowledge in the area of final year project work the student intends to do.
-

COURSE DESCRIPTION:

A student is expected to do the self learning course on his own, relating to the area of Project work. For discussion and interaction with the project supervisor, two hours per week is allocated. The course content and the materials for self learning course shall be decided by the student and the respective supervisor and the same will be approved by the Head of the Department. A broader choice will be given to the student so that a student is permitted to choose a course in the areas of his/her interest.

OUTCOMES:

At the end of the course, the student will be able to

- Narrow down the area of project work to focus on specific topic.
- Acquire sufficient fundamental and advanced knowledge to carry out the project work.

EEC 6125 INDUSTRIAL INTERNSHIP

L	T	P	C
0	0	*	**

* Minimum of 30 days Industrial Internship.

** Industrial internship will be undertaken during first year summer vacation. Two credits will be awarded in the 3rd semester.

OBJECTIVE:

- To provide fundamental and advanced knowledge in the area of final year project work the student intends to do.

COURSE DESCRIPTION:

1. To earn credits for this course, a minimum 30 days of industrial training, in a single slot, is mandatory. The course has to be undertaken during the first year summer vacation and the credits will be awarded in the third semester.
2. If the student is not able to complete the internship during the first year summer vacation, he/she can complete the course in a single slot between 2th and 4th semester vacation.
3. For effective implementation of the course Industry Internship, a teaching faculty is appointed as the coordinator by the Head of the department.
4. The students of EEE will be allowed to undergo training only in reputed companies/research labs/design centres. The co-ordinator identifies the companies related to core engineering for internship during second semester. He/she assists the students in every process of getting into the companies as an intern.
5. To enable the students to focus on the internship, no two students are allowed to be in the same site.
6. Interacting with the respective industries, where the students do their internship, the Coordinator continuously monitors the performance of the students during the internship.
7. After completion of the internship, the students are required to submit a detailed report and present what they had learned through the internship, in the form of posters. The students should submit the industry certificate at the time of giving the presentation.
8. The performance of the student will be evaluated by the industry as well as the University. Both the evaluations will be considered and aggregated to award the final grade. 50% weightage is given to the evaluation by the industry and remaining 50% weightage to the evaluation by the committee appointed by the Head of the Department.

9. The 50 % weightage of evaluation done at the department comprises of (a) 20/50 for viva-voce, (b) 20/50 for the Intern report and (c) 10 /50 for poster presentation.

OUTCOMES:

At the end of the course, the student will be able to

- Solve problems typically encountered by engineers in industry.
- Identify and address social, economic, and safety issues in an engineering problem and develop a solution that addresses this.
- Learn new concepts and apply them to the solution of engineering problems.
- Function effectively on a multidisciplinary team and interface effectively with other areas of the organization.
- Clearly communicate their ideas orally and in writing.
- Prepare for a lifelong productive career as an engineer.

SEMESTER III

EEC 6125	**PROJECT WORK**	**L**	**T**	**P**	**C**
	PHASE – I (SEMESTER III)	**0**	**0**	**12**	**6***
	PHASE – II (SEMESTER IV)	**0**	**0**	**36**	**18+6***

* Credits for Project work (Phase-I) of third semester will be accounted along with Project work (Phase-II) of fourth semester

OBJECTIVES:

- To enable a student to do an individual project work which may involve design, modelling, simulation and/or fabrication.
- To analyze a problem both theoretically and practically.
- To motivate the students to involve in research activities leading to innovative solutions for industrial and societal problems.

COURSE DESCRIPTION:

Project work shall be carried out by each and every individual student under the supervision of a faculty of this department. A student may however, in certain cases, be permitted to work for the project in association with other departments or in an Industrial/Research Organization, on the recommendation of the Head of the Department. In such cases, the project work shall be jointly supervised by a faculty of the Department and the faculty of the other department of the University or an Engineer / Scientist from the organization. The student shall meet the faculty periodically and attend the periodic reviews for evaluating the progress.

Project work will be carried out in two phases, Phase-I during the pre-final semester and Phase-2 during the final semester. Phase-I shall be pursued for a minimum of 12 periods per week and Phase – II in 36 periods per week. Credits for Phase I will be accounted along with Phase II in the final semester.

In each phase, there will be three reviews for continuous assessment and one final review and viva voce at the end of the semesters. The Project Report prepared according to approved guidelines and duly signed by the supervisor(s) and the Head of the Department shall be submitted to the concerned department.

OUTCOMES:

At the end of the course, the student will be able to

- Comprehend a problem thoroughly and provide an appropriate solution.
- Do a systematic literature survey.

- Derive a mathematical model for the system under study.
- Get proficiency over the software used for simulation and analysis.
- Present the findings of a research work in conferences and publish in journals.
- Identify and provide solution for the industrial and societal problems.

PROFESSIONAL ELECTIVES

		L	T	P	C
EECY001	**ELECTROMAGNETIC FIELD COMPUTATION AND MODELING**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To impart knowledge on Finite Element Analysis (FEA) of Electric machines and systems.
- To impart knowledge on mathematics of FEA.
- To impart knowledge on FEA software package.

MODULE I INTRODUCTION 06

Review of basic field theory – electric and magnetic fields – Maxwell's equations – Laplace, Poisson and Helmoltz equations – principle of energy conversion – force/torque calculation – Electro thermal formulation.

MODULE II SOLUTION OF FIELD EQUATIONS I 09

Limitations of the conventional design procedure, need for the field analysis based design, problem definition, solution by analytical methods-direct integration method – variable separable method – method of images, solution by numerical methods-Finite Difference Method.

MODULE III SOLUTION OF FIELD EQUATIONS II 09

Finite element method (FEM) – Differential/ integral functions – Variational method – Energy minimization – Discretisation – Shape functions –Stiffness matrix –1D and 2D planar and axial symmetry problem.

MODULE IV FIELD COMPUTATION FOR BASIC CONFIGURATIONS 07

Computation of electric and magnetic field intensities– Capacitance and Inductance – Force, Torque, Energy for basic configurations.

MODULE V BASIC EXERCISES IN FEA PACKAGES 06

Modeling – Pre-processing – A vector and flux plot calculations – deriving Other quantities in Post-processing.

MODULE VI DESIGN APPLICATIONS 08

Insulators- Bushings – Cylindrical magnetic actuators – Transformers – Rotating machines.

Total Hours: 45

REFERENCES:

1. Silvester and Ferrari, “Finite Elements for Electrical Engineers”,Cambridge University press, 1983.
2. K.J.Binns, P.J.Lawrenson, C.W Trowbridge, “The analytical and numerical solution of Electric and magnetic fields”, John Wiley & Sons, 1993.
3. Nathan Ida, Joao P.A.Bastos , “Electromagnetics and calculation of fields”, Springer-Verlage, 1992.
4. Nicola Biyanchi , “Electrical Machine analysis using Finite Elements”, Taylor and Francis Group, CRC Publishers, 2005.
5. S.J Salon, “Finite Element Analysis of Electrical Machines.” ,Kluwer Academic Publishers, London, distributed by TBH Publishers & Distributors, Chennai, India, 1995.
6. User manuals of MAGNET, MAXWELL & ANSYS software.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Ability to find solutions for field equations
- Ability to perform field computation for basic configurations
- Ability to model and analyze electrical system through Finite Element techniques.
- Ability to analyze pre-processing and post processing in FEA packages
- Ability to design applications.

EECY002 POWER SYSTEM DYNAMICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To model and analyze the dynamics of power system with its synchronous machines, turbines and various controllers when subjected to small signal and large signal disturbances.
- To model and analyze SMIB for small-signal stability and transient stability with controllers.
- To assess power system stability in large-signal, small-signal sense and to design the system with enhanced stability.

MODULE I INTRODUCTION TO POWER SYSTEM STABILITY 03

Power system stability: Basic Concepts and Definitions - Classification of Power system Stability –Rotor angle stability-Voltage stability and Voltage collapse- Mid term and long term stability-Historical review of stability problem.

MODULE II SYNCHRONOUS MACHINE MODELLING 09

Schematic Diagram, Physical Description: armature and field structure, machines with multiple pole pairs, mmf waveforms, direct and quadrature axes, Mathematical Description of a Synchronous Machine: Basic equations of a synchronous machine: stator circuit equations, stator self, stator mutual and stator to rotor mutual inductances, dq0 Transformation: flux linkage and voltage equations for stator and rotor in dq0 coordinates, electrical power and torque, physical interpretation of dq0 transformation, Per Unit Representations: Lad-reciprocal per unit system and that from power-invariant form of Park's transformation; Equivalent Circuits for direct and quadrature axes, Steady state Analysis: Voltage, current and flux-linkage relationships, Phasor representation, Rotor angle, Steady-state equivalent circuit, Computation of steady-state values, Equations of Motion: Swing Equation, calculation of inertia constant, Representation in system studies, Synchronous Machine Representation in Stability Studies: Simplifications for large-scale studies : Neglect of stator terms and speed variations, Simplified model with amortisseurs neglected: two-axis model with amortisseur windings neglected, classical model.

MODULE III MODELLING OF EXCITATION AND SPEED GOVERNING SYSTEMS 09

Excitation System Requirements; Elements of an Excitation System; Types of Excitation System; Control and protective functions; IEEE (1992) block diagram for simulation of excitation systems. Turbine and Governing System Modeling: Functional Block Diagram of Power Generation and Control, Schematic of a hydroelectric plant, classical transfer function of a hydraulic turbine (no derivation), special characteristic of hydraulic turbine, electrical analogue of hydraulic turbine, Governor for Hydraulic Turbine: Requirement for a transient droop, Block diagram of governor with transient droop compensation, Steam turbine modeling: Single reheat tandem compounded type only and IEEE block diagram for dynamic simulation; generic speed governing system model for normal speed/load control function.

MODULE IV SMALL-SIGNAL STABILITY ANALYSIS WITHOUT CONTROLLERS 08

Rotor angle stability, The Stability Phenomena. Fundamental Concepts of Stability of Dynamic Systems: State-space representation, stability of dynamic system, Linearization, Eigen properties of the state matrix: Eigen values and eigenvectors, modal matrices, Eigen value and stability, mode shape and participation factor. Single-Machine Infinite Bus (SMIB) Configuration: Classical Machine Model stability analysis with numerical example, Effects of Field Circuit Dynamics: synchronous machine, network and linearised system equations, block diagram representation with K-constants; expression for K-constants (no derivation), effect of field flux variation on system stability: analysis with numerical example - Enhancement Of Small Signal Stability and its countermeasures.

MODULE V TRANSIENT STABILITY ANALYSIS 08

Review of numerical integration methods: Euler and Fourth Order Runge Kutta methods, Numerical stability and implicit methods, Simulation of Power System Dynamic response: Structure of Power system Model, Synchronous machine representation: equations of motion, rotor circuit equations, stator voltage equations, Thevenin's and Norton's equivalent circuits, Excitation system representation, Transmission network and load representation, Overall system equations and their solution: Partitioned - Explicit and Simultaneous implicit approaches, treatment of discontinuities, Simplified Transient Stability Simulation using implicit integration method.

MODULE VI VOLTAGE STABILITY ANALYSIS 08

Voltage and frequency controllers - Limiting devices affecting voltage stability - Voltage-reactive power characteristics of synchronous generators - Capability curves - Effect of machine limitation on deliverable power - Load Aspects - Voltage dependence of loads - Load restoration dynamics.

Total Hours: 45

REFERENCES:

1. P. Kundur, “Power System Stability and Control”, McGraw-Hill, 1993.
2. P.M Anderson and A.A Fouad, “Power System Control and Stability”, Iowa State University Press, Ames, Iowa, 1978.
3. IEEE Committee Report, “Dynamic Models for Steam and Hydro Turbines in Power System Studies”, IEEE Trans., Vol.PAS-92, pp:1904-1915, November/ December, 1973. on Turbine- Governor Model.
4. R.Ramanujam, “Power system dynamics, Analysis and Simulation”, Prentice Hall India Learning Pvt. Ltd., New Delhi, 2009.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- detailed model of the electrical and mechanical parts of a three phase synchronous machine, excitation system and turbine for dynamics studies.
- perform simple power system stability study on a small multi-machine power system model using commercial software AU POWER LAB, ETAP, CYME. Report and critically assess the results of the study.
- familiarize with different type of numerical integration algorithms used for transient stability analysis of power systems.
- mathematically model the electromechanical dynamics of a power system, to determine the transient stability limits under fault conditions.
- determine how the voltage profile across a large power network can be controlled to maintain voltage within stipulated limits throughout the network.
- assess power system stability and to design the system with enhanced stability.

EECY003 EHV POWER TRANSMISSION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the need for long EHV & UHV transmission lines.
- To study calculation procedures to obtain line parameters, conductor voltage gradients and electric field produced in the vicinity of the line
- To study about the audible noise and radio interference caused by corona and methods to regulate them.

MODULE I INTRODUCTION 08

Indian Power Scenario - Power Scenario in Tamil Nadu - Conventional and non conventional methods of power generation details in India - Choice of economic voltage - standard transmission voltages - problems with long EHVAC lines - need for compensation - FACTS devices - HVDC transmission.

MODULE II LINE PARAMETERS 08

Types of conductors - bundled conductors - various line configurations of EHVAC lines - line resistance - Maxwell's potential coefficient matrix - Inductance and capacitance matrices of multi conductor untransposed / transposed lines - sequence inductances and capacitances - line parameters for modes of propagation in case of travelling wave propagation.

MODULE III LINE LOADINGS 08

Temperature rise of line conductors and current carrying capacity of lines - surge impedance loading - Power handling capacity of long lines - EHVAC and HVDC alternatives - Line loss - mechanical vibrations / oscillations of line conductors and their reduction.

MODULE IV VOLTAGE GRADIENT ON CONDUCTORS 06

Charge - potential relations for multi conductor lines - surface voltage gradients of bundled conductors - gradients factors and their use - distribution of voltage gradient on sub conductors of bundle - voltage gradients on conductors in the presence of ground wires on towers.

MODULE V EFFECTS OF CORONA 08

Corona Power loss and its comparison with leakage loss and line I^2R Loss - Audible noise generation and its characteristics - limits for audible noise - Day - Night

equivalent noise level - Radio Interference (RI) due to corona pulse generation and its properties - limits on RI fields.

MODULE VI EFFECT OF ELECTRIC FIELD PRODUCED BY EHV LINES 07

Effects of EHV lines on heavy vehicles - calculation of electric field of EHVAC lines - Effect of high fields on humans, animals and plants - measurement of electric fields - Induced voltages in unenergised circuit of a double circuit line - induced voltages in insulated ground wires - electromagnetic interference.

Total Hours: 45

REFERENCES:

1. Rakosh Das Begamudre, “Extra High Voltage AC Transmission engineering”, Second Edition, New Age International Pvt. Ltd, 2011.
2. Power engineer’s Hand book, Revised and Enlarged 6th Edition, TNEB Engineer’s Association, October 2002.
3. Microtran Power system Analysis Corporation, Microtran Reference Manual Vancouver Canada, (Website: www.microtran.com)

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Possess data about power scenario of India and major countries of the world, history of growth of electrical industry and its latest development.
- Ability to obtain line parameters for analysis with symmetrical and unsymmetrical power frequency operation and modes of operation with travelling wave propagation.
- Ability to obtain power carrying capacity of EHVAC and HVDC lines of various lengths.
- Work out voltage gradients od EHVAC and HVDC lines with bundled conductors analytically and by using pre-calculated charts.
- Ability to recognize the occurrence of corona and regulate its effects in the form of audible and radio noises.
- Calculate the voltage induced in neighboring lines and the electric fields produced by the EHVAC / HVDC lines and its effects on human beings , animals and plants.

EECY047	SPECIAL ELECTRICAL MACHINES AND CONTROLLERS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To impart knowledge on Construction, principle of operation and performance of switched reluctance motors.
- To understand the Construction, principle of operation and performance of SM.
- To impart knowledge on Construction, principle of operation and performance of AC commutator motors.
- To study about the Construction, principle of operation and performance of permanent magnet brushless D.C. motors and PMSM.
- To impart knowledge on Construction, principle of operation and performance of linear motors.
- To learn the softwares Magnet AND ANSYS for performance analysis of motor.

MODULE I SWITCHED RELUCTANCE MOTORS 07

Constructional features - principle of operation - Torque equation - Power controllers Characteristics and control - Microprocessor based controller.

MODULE II STEPPING MOTORS 07

Constructional features, principle of operation-modes of excitation torque, production in Variable Reluctance (VR) stepping motor- dynamic characteristics, Drive systems - circuit for open loop control- closed loop control of stepping motor.

MODULE III AC COMMUTATOR MOTORS 07

Principle of operation – Equivalent circuit – Phasor diagram – Performance of Repulsion motor and Universal motor

MODULE IV PERMANENT MAGNET MOTORS 07

Principle of operation – types – magnetic circuit analysis – EMF and Torque equations – Power Controllers – Motor characteristics and control of PMSM and BLDC motors.

MODULE V LINEAR MOTORS 07

Linear Induction motor (LIM) classification – construction – Principle of operation – Concept of current sheet – goodness factor – DC Linear motor (DCLM) types –

circuit equation , DCLM control applications ,Linear Synchronous motor(LSM) – Types - Performance equations – Applications.

MODULE VI CASE STUDY 10

Modeling and simulation – Switched Reluctance Machines – Permanent magnet BLDC Motor – PMSM – MAGNET 6.0, ANSYS software.

Total Hours: 45

REFERENCES:

1. Taylor E O, “The performance and design of AC Commutator motors”, Sir Issac Pitman & Sons, London, 1998.
2. Kenjo T, “Stepping Motors and their Microprocessor Controls”, Clarendon Press London, 1984.
3. Miller T J E, “Brushless Permanent Magnet and Reluctance Motor Drives”, Clarendon Press, Oxford, 1989.
4. Naser A and Boldea L,”Linear Electric Motors: Theory Design and Practical Applications”, Prentice Hall Inc., New Jersey 1987.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Talent in selection of motor for various application
- A thorough understanding of various special electric machines and their applications.
- Able to analyse any electric machine.
- Ability to model small power rating of motor for real time application
- Software knowledge in Magnet, ANSYS for electrical application.
- Able to present the rudiments of linear machines.

EECY0045 POWER QUALITY

L	T	P	C
3	0	0	3

OBJECTIVES:

- The main objective of the course is to enhance the knowledge of the participants in the emerging area of power quality and several key issues related to its modeling, assessment and mitigation.
- The course will provide a platform to an in-depth discussion on the various challenges and their possible remedies with respect to maintaining power quality in electricity sector, which will benefit participants from academic and R & D institutions, professional engineers from utilities, industries and policy makers

MODULE I INTRODUCTION 06

Power Quality – Significance of power quality, Terms and Definitions (IEC Standards) – Transients, Voltage Imbalance, Waveform distortion, Power frequency variations, DC offset, Electric Noise, Voltage Fluctuation and Flicker Sources of Sags and Interruptions, Estimating Voltage Sag Performance - Solutions at the End-User Level.

MODULE II DISCRETE FREQUENCY DOMAIN ANALYSIS 08

Harmonics versus Transients -Harmonic Indexes -Harmonic Sources from Commercial Loads -Harmonic Sources from Industrial Loads - Time domain methods and Frequency domain methods: Laplace's, Fourier and Hartley transform – The Walsh Transform – Wavelet Transform- Harmonic Distortion - Voltage versus Current Distortion - Locating Harmonic Sources -System Response Characteristics -Effects of Harmonic

MODULE III FUNDAMENTALS OF HARMONICS 07

Harmonic Distortion Evaluations – End users, utility -Principles for Controlling Harmonics- Where to Control Harmonics - Harmonic Studies – Computer tools for harmonic analysis- Harmonic analyzer - Devices for Controlling Harmonic Distortion -Harmonic Filter Design

MODULE IV DISTRIBUTED GENERATION AND POWER QUALITY 08

Resurgence of DG-DG Technologies – Interfacing DG to the Utility System -Power Quality Issues - Operating Conflicts - DG on Distribution Networks - Sitting DG Distributed Generation - Interconnection Standards (IEC)

MODULE V POWER QUALITY MONITORING AND ANALYSIS 08

Monitoring considerations: Power line disturbance analyzer, power quality measurement equipment, harmonic / spectrum analyzer, flicker meters, disturbance analyzer. Analysis of power outages, Analysis of unbalance: Symmetrical components of phasor quantities, Instantaneous symmetrical components, Instantaneous real and reactive powers, Analysis of distortion: On–line extraction of fundamental sequence components from measured samples

MODULE VI GROUNDING 08

Impact of grounding on power quality- Terms and definitions, Reasons for grounding, problems associated with grounding- Problems with conductors and Connectors, Missing safety ground, Multiple neutral-to-ground connections, additional ground rods, ground loops - Solutions to wiring and grounding- Proper grounding practices, Ground electrode (rod), Service entrance connections, Panel board, Isolated ground, Separately derived systems, Grounding techniques for signal Reference, grounding for sensitive equipment

Total Hours: 45

REFERENCES:

1. G.T.Heydt, "Electric Power Quality", Stars in a Circle Publications, (2nd edition) 1994.
2. Arindam Ghosh, “Power Quality Enhancement Using Custom Power Devices”, Kluwer Academic Publishers, 2002.
3. R.C. Duggan,” Power Quality “McGraw-Hill, 2003.
4. Arrillaga, j.. Bradley. D.a.. And bodger, P.S.,“Power system harmonics”, Wiley, 1985.
5. Derek A. Paice, “Power electronic converter harmonics : Calculations and multipulse methods”, Paice and Associates -1994.
6. Andreas Eberhard, “Power Quality”, Published by InTech, March 2011.
7. Surajit Chattopadhyay, Madhuchhanda Mitra,Samarjit Sengupta, “Electric Power Quality”, Springer, 2010.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Understand the power quality issues and its importance
- Evaluate the characteristics of power quality disturbances
- Know the power quality issues caused due to the insertion of DG

- Able to monitor the power quality parameters
- Identify the techniques to mitigate power quality disturbances
- Know the importance of grounding to improve power quality

EECY005	POWER SYSTEM PLANNING AND RELIABILITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

To impart knowledge on:

- Load forecasting in power systems.
- Basic probability theory and concepts of reliability analysis.
- Factors influencing the reliability of generation systems, transmission systems and distribution systems.
- Expansion planning.

MODULE I INTRODUCTION TO POWER SYSTEMS AND LOAD FORECASTING 08

A perspective: brief introduction to structure of power systems, growth of power system in India, present Indian power industry, GRID formation, concept of National GRID.Objectives of forecasting - Load growth patterns and their importance in planning - Load forecasting based on discounted multiple regression technique - Weather sensitive load forecasting - Determination of annual forecasting – Use of AI in load forecasting.

MODULE II INTRODUCTION TO RELIABILITY ANALYSIS 07

Review of probability distribution, binomial distribution and exponential distribution – Network modeling and evaluation of simple and complex systems – System reliability evaluation using probability distributions – Frequency and duration techniques. Reliability concepts: Meantime to failure – Series and parallel systems – MARKOV process – Recursive technique.

MODULE III GENERATION SYSTEM RELIABILITY ANALYSIS 08

Probabilistic generation and load models - Determination of reliability of isolated and interconnected generation systems – Energy transfer and off peak loading.

MODULE IV TRANSMISSION SYSTEM RELIABILITY ANALYSIS 07

Deterministic contingency analysis - Probabilistic load flow - Fuzzy load flow - Probabilistic transmission system reliability analysis - Determination of reliability indices like LOLP and expected value of demand not served.

MODULE V EXPANSION PLANNING 07

Basic concepts on expansion planning - Procedure followed to integrate transmission system planning, current practice in India - Capacitor placement problems in transmission systems and radial distribution systems.

MODULE VI DISTRIBUTION SYSTEM PLANNING AND RELIABILITY 08

Introduction, sub transmission lines and distribution substations - Design primary and secondary systems - Distribution system protection and coordination of protective devices. Distribution system reliability evaluation: Reliability analysis of radial systems with perfect and imperfect switching.

Total Hours : 45

REFERENCES:

1. R.L .Sullivan, "Power System Planning", Heber Hill, 1987.
2. Roy Billington, “Power System Reliability Evaluation”, Gordan & Breach Scain Publishers, 1990.
3. A.S.Pabla, “Electric Power Distribution”, Tata Mc Graw-Hill Publishing Company, 5th edition, 2003.
4. Turen Gonen, “Electric Power Distribution System Engineering”, McGraw Hill, 1986.
5. Turen Gonen, “Electric Power Transmission System Engineering Analysis and Design”, McGraw Hill, 2nd Edition, 2010.
6. Eodrenyi, J., “Reliability Modelling in Electric Power System”, John Wiley, 1980.
7. B.R. Gupta, “Power Sytem Analysis and Design”, S.Chand, New Delhi, 2003.

OUTCOMES:

At the end of the course, the Students will be

- Able to carry out contingency analysis in transmission systems.
- Capable of applying the probabilistic methods for evaluating the reliability of generation and transmission system
- Able to design different model of system components in reliability studies
- Able to analyze advanced concepts of power system planning
- Able to design the expansion planning of power system
- Able to forecast the load using different regression models

EECY006	ADVANCED DIGITAL SIGNAL PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Provide the student with a broad, yet strong background in the traditional topics associated with processing of deterministic digital signals, e.g., discrete time transforms, linear filtering, spectrum estimation and linear prediction.
- Introduce the student to some of the more recent developments that promise to have a broad impact on digital signal processing, e.g., nonlinear filtering and adaptive filtering.
- To provide basics of multi rate DSP, Wavelets, multi resolution analysis and their interpretation and use
- To expose the students with basic DSP programming

MODULE I PARAMETRIC METHODS FOR POWER SPECTRUM ESTIMATION 08

Relationship between the auto correlation and the model parameters – The Yule – Walker method for the AR Model Parameters – The Burg Method for the AR Model parameters – unconstrained least-squares method for the AR Model parameters – sequential estimation methods for the AR Model parameters – selection of AR Model order.

MODULE II ADAPTIVE SIGNAL PROCESSING 08

FIR adaptive filters – steepest descent adaptive filter – LMS algorithm – convergence of LMS algorithms – Application: noise cancellation – channel equalization – adaptive recursive filters – recursive least squares.

MODULE III MULTIRATE SIGNAL PROCESSING 08

Decimation by a factor D – Interpolation by a factor I – Filter Design and implementation for sampling rate conversion: Direct form FIR filter structures – Polyphase filter structure.

MODULE IV SPEECH SIGNAL PROCESSING 08

Digital models for speech signal : Mechanism of speech production – model for vocal tract, radiation and excitation – complete model – time domain processing of speech signal:- Pitch period estimation – using autocorrelation function – Linear predictive Coding: Basic Principles – autocorrelation method – Durbin recursive solution.

MODULE V WAVELET TRANSFORMS 05

Fourier Transform : Its power and Limitations – Short Time Fourier Transform – The Gabor Transform - Discrete Time Fourier Transform and filter banks – Continuous Wavelet Transform – Wavelet Transform Ideal Case – Perfect Reconstruction Filter Banks and wavelets – Recursive multi-resolution decomposition – Haar Wavelet – Daubechies Wavelet.

MODULE VI DSP PROCESSORS 08

General and special purpose DSP Processors – Computer Architecture for signal processing – Havard Architecture – Pipelining – Hardware Multiply and Accumulate – Special Instructions – Replication – On-chip Memory Cache – Extended Parallelism – SIMD – VLIW and static super-scalar Processing – Brief study of TMS320C4X and ADSP 2106 processors.

Total Hours: 45

REFERENCES:

1. John G Proakis and Manolakis, “Digital Signal Processing Principles, Algorithms and Applications”, Pearson, Fourth Edition, 2007.
2. Sanjit K.Mitra, “Digital Signal Processing: A computer based approach”, Tata McGraw Hill, second edition, 2004.
3. A.V.Oppenheim and R.W Schafer, Englewood, “ Digital Signal Processing”, Prentice Hall, Inc. 2006.
4. B. Venkatramani & M.Bhaskar, “Digital Signal Procesors architecture, Programming and applications”, Tata McGraw Hill, 2002.
5. Andreas Antoniou, “Digital signal Processing Processing”, Tata McGraw Hill,second edition, 2008.
6. Stewen W. Smith, “Digital signal Processing Processing – A practical guide for Engineers and scientist”, Elsevier Science, 2003.

OUTCOMES:

- Have a more thorough understanding of the relationship between time and frequency domain interpretations and implementations of signal processing algorithms;
- Understand and be able to implement adaptive signal processing algorithms based on second order statistics;
- Students will have the ability to solve various types of practical problems in DSP
- Be familiar with some of the most important advanced signal processing

techniques,

- understand the multi-rate processing wavelet transform and time-frequency analysis techniques to solve real time process.
- Apply the above tools to real-world problems including spectral analysis, filter design, noise cancellation, signal compression, rate conversion, feature extraction, inverse problems.

EECY007 CONTROL SYSTEM DESIGN

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To have an exhaustive exposure to various methods of control system design.
- To study the basic control system design approaches.
- To study the Design in Discrete Domain and effect of sampling.
- To have good knowledge on State variable feedback.
- To study the Non - linear control system design with emphasis to sliding mode control.
- To impart knowledge in control system design through case studies.

MODULE I INTRODUCTION TO CONTROL SYSTEMS 08

Concept of control - Control system terminology, classification of Control Systems. Mathematical Models of Systems - Differential equations of electrical and mechanical system, transfer function of linear systems, block diagram models, signal flow graph.

MODULE II DESIGN OF FEEDBACK CONTROL SYSTEM 08

Approaches to system design - P, PI and PID Controllers - Compensators - Root Locus method - Phase lead, phase lag design using Bode diagram - Design Problems.

MODULE III DESIGN IN DISCRETE DOMAIN 08

Sample and Hold - Digital equivalents - Impulse and step invariant transformations - Methods of discretisation - Effect of sampling - Direct discrete design, Design Problems.

MODULE IV DESIGN USING STATE VARIABLE FEEDBACK 08

Controllability - Observability - Pole placement using state feedback - Ackerman's formula, Limitations of state variable feedback - Observers - Design Problems.

MODULE V NON - LINEAR CONTROL SYSTEM DESIGN 07

Concept of variable structure controller and sliding control - Implementation of switching control laws - Cascade designs - Partial state feedback design - Feedback linearization - Design Problems.

MODULE VI CASE STUDIES 06

Cruise control - Robotic arm - Process control application – Aircraft control- Ball and beam arrangement.

Total Hours: 45

REFERENCES:

1. Gene F Franklin. J David Powell, Michael Workman, “Digital Control of Dynamic Systems”, Pearson Education, Asia, 2000.
2. Graham C. Goodwin, Stefan F. Graebe and Mario E. Salgado, "Control system Design", PHI (Pearson), 2003.
3. Loan D. Landau, GianlucaZito," Digital Control Systems, Design, Identification and Implementation", Springer, 2006
4. M. Gopal, "Modern control system Theory", New Age International, 2005
5. Benjamin C. Kuo, "Digital control systems", Oxford University Press, 2006.
6. Seborg D, Edgar T, Mellichamp, D and Doyle F, Process Dynamics and Control, 3rd Edition, Wiley, 2011.

OUTCOMES:

At the end of the course, the student will have knowledge on:

- The different phases that constitute the process of designing control system using the enumerate methods available.
- The feedback techniques and the choice of selecting the appropriate method for design of feedback control system.
- Establishing a quantitative foundation to the design and analysis of sampled data systems.
- The basis for applying the methods of state space in multivariable systems design.
- Non - linear control system design with emphasis to sliding mode control.
- The working tools and design the system given using the appropriate tools identified.

EECY008 HIGH VOLTAGE SWITCH GEAR

L	T	P	C
3	0	0	3

OBJECTIVES:

As Switch Gear is an important link in any Power System network, including Transmission and Distribution systems, this course aims to provide a holistic view of all the aspects of Switch Gear, including the following:

- Insulation clearance in the medium like Air, Oil, SF6, Vacuum etc.
- Various characteristics and phenomena of “Arc”
- Various types of Circuit Breakers and their applications
- The testing technique, short circuit calculation and rating of Circuit Breaker

MODULE I INSULATION OF SWITCHGEAR 08

Rated and tested voltage - co-ordination between inner and external insulation - Insulation clearances in air, oil SF6 and vacuum - bushing insulation - solid insulating materials – dielectric and mechanical strength consideration.

MODULE II CIRCUIT INTERRUPTION 08

Switchgear terminology – Arc characteristics – direct and alternating current interruption – arc quenching phenomena – computer simulation of arc models – transient re-striking voltage – RRRV – recovery voltage – current chopping – capacitive current breaking – auto re-closing.

MODULE III SHORT CIRCUIT CALCULATIONS AND RATING OF CIRCUIT BREAKERS 05

Types of faults in Power systems - short circuit current and short circuit MVA calculations for different types of faults-ratings of circuit breakers – symmetrical and asymmetrical ratings.

MODULE IV CIRCUIT BREAKERS 08

Classifications of circuit breakers-design, construction and operating principles of bulk oil, minimum oil, airblast, SF6 and vacuum circuit breakers – comparison of different types of circuit breakers.

MODULE V TESTING OF CIRCUIT BREAKERS 08

Type tests and routine tests – short circuit testing – synthetic testing of circuit breakers – recent advancements in high voltage circuit breakers – diagnosis.

MODULE VI DESIGN OF CIRCUIT BREAKERS 08

Basic data and specifications – Design of Arc extinguishing chamber – insulation design – Design of current carrying system – Thermal calculation.

Total Hours: 45

REFERENCES:

1. Chunikhin A and Zhavoronkov M., “High Voltage Switchgear analysis and Design”, Mir Publishers, MOSCOW, 1989.
2. Kuffel E., Zaengl, W.S., and Kuffel J., “High Voltage Enginering Fundamentals, Newness”, Second edition , Butterworth – Heinemann publishers, New Delhi, 2000
3. B. Ravindranath and M. Chander “Power System Protection and Switchgear”, New Age international (P) Ltd., 2011.
4. B.H.E.L., “Handbook of Switchgear” Tata McGraw Hill, 2007.

OUTCOMES:

At the successful completion of the course, the student is expected to possess knowledge and skill on the following:

- Various insulation medium and their characteristics
- Arc characteristics and arc extinction methods
- Rating of Circuit Breakers.
- Circuit breaks – their types, and applications
- Testing of Circuit Breakers.
- Design of Circuit Breakers

EECY009 OPTIMAL CONTROL AND FILTERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To give students a background in the historical trends in dynamicoptimization.
- To study the optimality problems persisting in control system.
- To impart knowledge in numerical methods for optimal control problems.
- To have a detail understanding on Dynamic programming including LQ control problems.
- To study the filters and estimation methods.

MODULE I OPTIMALITY PROBLEMS IN CONTROL THEORY 08

Concept of optimal control-Statement of optimal control problem - Problem formulation and forms of optimal Control - Selection of performance measures-Necessary conditions of optimal control.

MODULE II PONTRYAGIN'S MINIMUM PRINCIPLE 08

Minimum Time problem - Minimum Fuel problem - Minimum Energy problem - Singular intervals.

MODULE III NUMERICAL TECHNIQUES FOR OPTIMAL CONTROL PROBLEMS 08

Linear optimal regulator problem - Matrix Riccatti equation and solution method - Choiceof weighting matrices - Steady state properties of optimal regulator - Solution of Ricatti equation by negative exponential and interactive Methods - Numerical solution of 2-pointboundary value problem by Steepest Descent and Fletcher Powell Method.

MODULE IV DYNAMIC PROGRAMING AND LQ CONTROL PROBLEMS 08

Linear tracking problem – LQ, LQG and LQR problem - Computational procedureforsolving optimal control problems - Characteristics of dynamic programming solution -Dynamic programming application to discrete and continuous systems - Hamilton Jacobi Bellman equation.

MODULE V FILTERING & ESTIMATION 05

Filtering of Linear system – System noise smoothing and prediction -Gauss Markovdiscrete time model - Estimation criteria – Minimum variance estimation - Least square estimation - Recursive estimation.

MODULE VI KALMAN FILTER 08

Kalman Filter- Linear estimator property of Kalman Filter - Time invariance and asymptotic stability of Kalman filters - Discrete-time Kalman Filter- Implementation-sub-optimal steady-state Kalman Filter - Extended Kalman Filter-practical applications Optimal smoothing.

Total Hours: 45

REFERENCES:

1. Donald E Kirk, "Optimal Control Theory - An Introduction", Prentice-Hall Inc, Englewood Cliffs, New Jersey,1970.
2. Athans M and P L Falb, "Optimal Control - An Introduction to the Theory and its Applications", McGraw Hill Inc, New York,1966.
3. Dimitri P. Bertsekas, "Dynamic Programming and Optimal Control", Athena Scientific Publisher, 2007.
4. Frank L. Lewis, DragunaVrabie, Vassilis L. Syrmos, "Optimal Control", Wiley & Sons; IncHobkoken New Jersey, 2012.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- • Understand the basic background of dynamic optimization.
- • Understand the problems persisting in optimal control system.
- • Study numerical methods for optimal control problems.
- • Detail understanding on Dynamic programming including LQ control problems.
- • Understand the various filters and estimation methods.

EECY010	INDUSTRIAL POWER SYSTEM ANALYSIS AND DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study and understand the calculations used with induction motor starting studies.
- To study and calculate the rating of capacitors for power factor correction studies.
- To study and understand and calculate harmonics indices in power quality studies
- To study and understand the phenomenon of Flicker
- To study the grounding grid calculations and to introduce computer analysis methods for ground grid calculations
- To study and understand the operation of recent power systems and smart grids.

MODULE I INDUCTION MOTOR STARTING STUDIES 05

Induction motor classification based on NEMA standards and enclosure – Starting methods – Voltage drop calculations - Calculation of Acceleration time - Evaluation Criteria- Motor starting with limited – capacity generators-Computer Aided Analysis.

MODULE II POWER FACTOR CORRECTION 08

System description and modeling-Acceptance Criteria-Frequency Scan analysis-Voltage Magnification-Sustained Overvoltage-Switching surge analysis-Back-to back switching – Capacitor for EHV applications – Capacitors for motor starting.

MODULE III HARMONICS ANALYSIS 08

Harmonics sources-system response to harmonics-System model for computer Aided analysis-Acceptance criteria-Harmonic Filters-Harmonic evaluation-Case study.

MODULE IV FLICKER ANALYSIS 08

Sources of flicker –Flicker analysis-Flicker Criteria-Data for flicker –Case study Arc Furnace Load-Minimizing the flicker effects.

MODULE V GROUND GRID ANALYSIS 08

Introduction-Acceptance criteria-Ground grid calculations-computer aided analysis –Improving the performance of the grounding grids.

MODULE VI RECENT TRENDS IN INDUSTRIAL POWER SYSTEMS 08

Overview of power system-Layout of power system-Generation, Transmission and Distribution- Comparison between utility & industrial power systems - Introduction to deregulated power system — introduction of smart grid.

Total Hours: 45

REFERENCES:

1. Ramaswamy Natrajan,"Computer –Adided Power system analysis",Marcel Dekker Inc.,2002.
2. Shoiab Khan, Sheeba Khan,"Industrial Power Systems,"CRC press,Taylor & Francis Group,2007
3. Loi Lei Lai, "Power System Resstructuring and Regulation: Trading,Performance and Information Technology", John Wiley &Sons,2001.
4. NPTEL material for deregulation of power system
5. Tony Flick and Justin Morehouse, "Securing the smart Grid-Next Generation Power Grid Security", Elsevier Publications, 2011.

OUTCOMES:

At the end of the course, the student is expected to possess the following.

- Ability to select an induction motor for a particular industrial application
- Capable of designing the rating of capacitor for power factor correction.
- To calculate the harmonics indices in power quality study.
- To be familiar with Flicker analysis
- To be familiar with grounding grids and calculations
- .Able to understand the operation of deregulated power system and smart grids

EECY011	HIGH VOLTAGE DIRECT CURRENT TRANSMISSION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To identify situations where HVDC is a better alternative
- To acquire knowledge of HVDC converters, system control and development of MTDC systems
- To perform power flow analysis in an integrated EHVAC - HVDC system.

MODULE I COMPARISON OF EHVAC AND HVDC SYSTEMS 07

Technical and economic problems in bulk power transmission over long distances using EHV / UHV AC lines - HVDC alternatives for transmission - Description of HVDC systems - its application - comparison of EHVAC and HVDC systems.

MODULE II ANALYSIS OF HVDC CONVERTERS 08

Planning of HVDC transmission - modern trends in HVDC transmission - DC breakers - U/G cable transmission - VSC based HVDC - pulse number - choice of converter configuration - simplified analysis of Graetz circuit - 6 pulse converter bridge characteristics - generation of harmonics and filtering.

MODULE III ANALYSIS AND CONTROL OF HVDC SYSTEMS 08

Twelve pulse converter characteristics - its advantages - detailed analysis of Converters - Principles of DC link control - converter / inverter control characteristics - system control hierarchy - firing angle control - current and extinction angle control - power control - higher level controllers.

MODULE IV MULTI TERMINAL HVDC SYSTEMS 07

Introduction to MTDC systems – potential applications of MTDC systems – Types of MTDC systems – Control and protection of MTDC systems – Detailed study about developments of MTDC systems.

MODULE V POWER FLOW ANALYSIS 08

Per unit system for DC quantities – modeling of DC links – solution of DC power flow – solution of AC – DC power flow – case studies

MODULE VI SIMULATION 07

System simulation – philosophy and tools – HVDC systems simulation: modeling of HVDC systems for digital simulation – dynamic interaction between DC and AC systems. Application in Wind Power generation.

Total Hours: 45

REFERENCES:

1. K.R. Padiyar, “HVDC Power Transmission Systems”, New Age International (P) Ltd., New Delhi, 2002.
2. J. Arrillaga, “High Voltage Direct Current Transmission”, Peter Pregrinus, London, 1983.
3. P. Kundur, “Power System stability and Control”, Tata McGraw Hill, 1993.
4. Erich Uhlmann, “Power Transmission by Direct Current”, BS Publications, 2004.
5. V.K. Sood, “HVDC and FACTS Controllers - Applications of Static Converters in power system”, Kluwer Academic Publishers, April 2004.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Identification of situations where HVDC transmission is a better alternative to EHVAC transmission
- The operation and control of converter/Inverter for power control
- The development and applications of MTDC systems
- Power flow analysis used for Integrated EHVAC-HVDC system
- Steady state performance simulation and analysis
- Analysis of HVDC controllers.

EECY012 WIND ENERGY CONVERSION SYSTEM

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the demand for electrical power generation from the renewable wind and fundamentals of wind power.
- To study and understand about the wind turbine components, power generation machinery, and its control systems.
- To simulate the wind turbine dynamic behavior when integrated to grid and in standalone operation.

MODULE I INTRODUCTION 08

Introduction-Historical Development and current status of Wind power-Generators and Power Electronics for wind turbines - Power System Impacts of Wind turbines-Wind speed estimation-wind speed measurements-Rayleigh distribution-Maximum Power obtainable-Bertz limit-Power coefficient –aerodynamics of Wind rotor-Blade element theory-aerodynamic efficiency-Wind energy Conversion System Components.

MODULE II WIND TURBINE 08

Types of Wind Turbine-Rotor design consideration-Tip speed ratio-blade profile-Power regulation-Yaw control –Pitch angle control-stall control-schemes for maximum power extraction.

MODULE III FIXED SPEED AND VARIABLE SPEED SYSTEMS 08

Fixed speed and variable speed wind turbine- Need of variable speed systems-Power-wind speed characteristics-Generation schemes with fixed and variable speed turbines-Comparison of different schemes.

MODULE IV MODELING AND SIMULATION OF FIXED SPEED AND VARIABLE SPEED WIND GENERATORS 08

Modeling of Fixed speed Induction generator-axes transformation-flux linkage equations-voltage equations-state equations-modeling of variable speed DFIG for Wind Energy Conversion Systems-Converter Control System- transient stability simulation of fixed speed induction generator using EUROSTAG 4.3-Doubly Fed Induction Generator(DFIG) modeling - controller modelling -modelling of DFIG in EUROSTAG - transient stability simulation of powersystems with induction generators using EUROSTAG 4.3.

MODULE V POWER ELECTRONICS IN WIND ENERGY CONVERSION SYSTEM 08

Induction generator-Controlled firing angle scheme with AC and DC side Capacitor-Scalar method-flux vector scheme-Control scheme for Synchronous generator with variable speed drive-Variable speed synchronous generator control with boost converter

MODULE VI GRID CONNECTED SYSTEMS 05

Stand alone and Grid Connected WECS system-Grid connection Issues- Impacts of wind power on Power System Stability-wind plant reactive power capability and its requirements-voltage Control and active power control -Storage technologies.

TotalHours: 45

REFERENCES:

1. S.N.Bhadra, D.Kasthra,S.Banerjee, “Wind Electrical Systems”,OxfordHigherEduction, 2005.
2. Thomas Ackermann,”Wind Power in Power system”,Wiley 2012.
3. L.L.Freris ,"Wind Energy conversion Systems", Prentice Hall, 1990.
4. Jian Zhang, Adam Dysko, John O'Reilly, William E. Leithead," Modeling andperformance of fixed-speed induction generators in power system oscillationstability studies", Electric Power System Research Vol. 78,pp: 1416-1424,2008.
5. Andre´s Feijoo, Jose Cidras, Camilo Carrillo, "A third order model for thedoubly-fed induction machine", Electric Power Systems Research 56 (2000)121-127.
6. Eurostag 4.3 Theory Manual Part I.
7. Ion Boldea, "Variable speed generators", Taylor & Francis group, 2006.
8. E.W.Golding, "The generation of Electricity by wind power", Redwood burn
9. Ltd., Trowbridge, 1976.
10. S.Heir, "Grid Integration of WECS", Wiley 1998.

OUTCOMES:

At the end of the course, the student will be able to:

- recognize the need of renewable energy technologies and their role in the world energy demand.
- identify and mathematically model the wind turbine components, calculate the available wind power, predict mechanical loads based on design, and discuss the generation of electrical power.

- to numerically simulate the wind turbine dynamic system behavior with integration of component, and control for given real time application.
- mathematically model and simulate the transient and steady state performance of the stand-alone and grid connected wind generators using EUROSTAG, MATLAB, CYME packages.
- analyze the wind power integration issues and their mitigation techniques.
- indentify the present and the future energy storage technologies used for standalone operation and grid connected operation .

EECY013 APPLICATION OF MEMS TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To develop skills in the area of Micro fabrication and Micromachining techniques.
- To study about different types of micro sensors and their applications in various areas.

MODULE I MEMS: MICRO-FABRICATION, MATERIALS AND ELECTROMECHANICALCONCEPTS 08

Introduction to micro fabrication – Silicon and other material based fabrication processes – Concepts: Conductivity of semiconductors - Crystal planes and orientation-stress and strain- flexural beam bending analysis- Torsional deflections- Intrinsic stress - resonant frequency and quality factor.

MODULE II ELECTROSTATIC SENSORS AND ACTUATION 08

Principle, material, design and fabrication of parallel plate capacitors as electrostatic sensors and actuators - Applications.

MODULE III THERMAL SENSING AND ACTUATION 07

Principle, material, design and fabrication of thermal couples, thermal bimorph sensors, thermal resistor sensors-Applications.

MODULE IV PIEZOELECTRIC SENSING AND ACTUATION 07

Piezoelectric effect-cantilever piezo-electric actuator model-properties of piezoelectric materials-Applications.

MODULE V RF APPLICATIONS OF MEMS 09

Introduction – RF based communication system and RF Modules: Tuners, Resonators, Switch, Phase shifter – RF MEMS: Application Areas, Advantages of RF MEMS technology – RF MEMS Design scenarios: MEMS Inductors, Varactors, Tuner/Filter, Resonators, MEMS Switches, Phase Shifters.

MODULE VI CASE STUDIES 06

Piezoresistive sensors, Magnetic actuation, Micro fluidics applications, Medical applications, Optical MEMS.

Total Hours: 45

REFERENCES:

1. Chang Liu, “Foundations of MEMS”, Pearson International Edition, 2006.
2. Marc Madou , “Fundamentals of microfabrication”, CRC Press, 1997.
3. Boston , “Micromachined Transducers Sourcebook”, WCB McGraw Hill, 1998.
4. M.H.Bao “Micromechanical transducers :Pressure sensors, accelerometers and gyroscopes”, Elsevier, Newyork, 2000.
5. N.P. Mahalik, “MEMS”,Tata McGraw Hill, 2007.
6. Julian W.Gardner, Vijay.K.Varadhan, Osama O. Awadelkarim, “Microsensors, MEMS and Smart Devices”, John Wiley and Sons Ltd, 2001.
7. Vijay.K. Varadhan, K.J.Vinoy, K.A.Jose, “RF MEMS and their Applications”, John Wiley and Sons Ltd, 2003.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Ability to understand the operation of micro devices, micro systems and their applications.
- Ability to design the micro devices, micro systems using the MEMS fabrication process.
- Working principles of different micro sensors and applications.
- Execute a vibrant analysis on sensing and actuation mechanisms.
- Perform different case studies on various micro sensors.

EECY014 OUTDOOR INSULATORS

L	T	P	C
3	0	0	3

OBJECTIVES:

The course aims at giving a comprehensive knowledge on Outdoor Insulators, which are mainly used for Transmission and Distribution systems, including the following:

- Become familiar with different stresses encountered in the service of the insulator as well as the types and performance of Insulators.
- Able to connect the current area of Research in insulators including non-ceramic insulators
- Design and Manufacturing process of insulators can be understood
- The testing standards, selection and maintenance of insulators will also be made aware.

MODULE I INTRODUCTION 07

Overview – Important Definitions – Types of Outdoor Insulators – Uses of Outdoor Insulators – Stresses Encountered in Service – Electrical Performance – Mechanical Performance – Role of Insulators on Overall Power System Reliability – Shapes of Outdoor Insulators – Mechanical and Electrical Ratings of Insulators – Comparison of Porcelain, Glass and Composite Insulators – Life Expectancy.

MODULE II NONCERAMIC INSULATOR TECHNOLOGY 07

Introduction - Materials for Weathersheds / Housings – Shed Design – Insulator Core – Hardware – Establishing Equivalency to Porcelain/Glass – Manufacturing Changes and Quality Control (QC) – Un-standardization/ Propagation - Live-line Maintenance Handling, Cleaning and Packaging - Brittle Fracture – Water Drop Corona – Aging and Longevity – Grading Control Rings.

MODULE III DESIGN AND MANUFACTURE OF INSULATORS 08

Porcelain Insulators – Manufacture of Porcelain Insulators – The Porcelain Suspension Insulator – Porcelain Pin-type Insulators – Porcelain Multicone Insulators – Porcelain Long-rod and Post Insulators – Porcelain Insulators Glazes - Porcelain Insulator Hardware – Porcelain Insulator Cement – The Porcelain Dielectric.

Glass Insulators – The Glass Suspension Insulator – Glass Pin-type Insulators – Glass Multicone Post Insulators – Manufacture of Glass Insulators – Glass Insulator Hardware – Glass Insulator Cement – The Glass Dielectric.

Nonceramic Insulators - Nonceramic Suspension Insulator – Line Post Insulator –

Hollow Core Insulator – Manufacture of Nonceramic Insulators – The Composite Dielectric – Voltage Stress Control.

MODULE IV TESTING STANDARDS FOR INSULATORS 08

Need for Standards – Standards Producing Organizations – Insulator Standards – Classification of Porcelain / Glass Insulator Tests – Brief Description and Philosophy of Various Tests for Cap and Pin Porcelain/Glass Insulators – Summary of Standards for Porcelain/Glass Insulators – Standards of Nonceramic (Composite) Insulators – Classification of Tests, Philosophy and Brief Description – Standards for Nonceramic Insulators.

MODULE V DETECTING DEFECTIVE INSULATORS 07

Detecting defective porcelain insulators – principles involved – electrical methods – thermography. Detecting defective non ceramic insulators – detection prior to installation – detecting degraded insulator during service

MODULE VI SELECTION AND MAINTENANCE OF INSULATORS 08

Introduction – Cost and Weight – National Electricity Safety Code (NESC) – Basic Lightning Impulse Insulation Level (BIL) – Contamination Performance– Experience with Silicone Rubber Insulators in Salt Areas – Compaction – Grading Rings for Nonceramic Insulators.Maintenance of Insulators-Maintenance Inspection – Hotline washing – equivalent salt deposit

Total Hours: 45

REFERENCES:

1. Ravi S. Gorur, Edward A. Cherney and Jeffrey T. Burnham, “Outdoor Insulators”, Ravi S. Gorur. Inc., Phoenix, Arizona 85044, USA,1999.
2. J.S.T. Looms, “Insulators for High Voltages”, Peter Peregrinus Ltd., 1988.
3. A.O. Austin, “Porcelain Insulators”, Ohio Brass Company, 1980.
4. IEC 1109, “Composite Insulators for AC overhead lines with a Nominal Voltage Greater than 1000V,
5. Definition, Test Methods and Acceptance Criteria”, 1992
6. EPRI, “Transmission Lines Reference Book – 345kV and above”, 1982
7. ANSI C 29.1, “Electrical Power Insulator – Test Methods”, 1992

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Various types of outdoor insulators and their characteristics
- Design, testing and maintenance of different types of insulators
- Selection and detection of defective Insulators
- Various standards used in Insulators testing
- Manufacturing Process of Insulators
- Maintenance and selection of Insulators.

EECY015 FLEXIBLE AC TRANSMISSION SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce students to the transmission challenges of modern electrical power systems
- To present the basic concepts, principles and operation of fast high power electronic controllers known as Flexible AC Transmission Systems (FACTS)
- To provide advanced knowledge and understanding of power electronics applications in power transmission systems
- To introduce the operating principles, control systems and modeling of different FACTS devices (SVC, SSSC, SR, TCSC, STATCOM, UPFC, IPFC, etc.)
- To understand the influence of measurement systems, network resonances and harmonic interactions on the performance of FACTS control systems
- To provide the techniques of FACTS controller design for enhancing power transfer, stability and damping, mitigating sub-synchronous resonances, preventing voltage instability, etc.
- To understand the interactions amongst various FACTS Controllers and techniques for their coordination and placement

MODULE I INTRODUCTION 08

Reactive power - uncompensated transmission lines - load compensation - system compensation - lossless distributed parameter lines -symmetrical lines - midpoint conditions of a symmetrical line case study passive compensation - shunt compensation -series compensation - effect on power-transfer capacity.

MODULE II STATIC VAR COMPENSATOR (SVC) 08

Voltage control by SVC - advantages of slope in dynamic characteristics - influence of svc on system voltage - design of SVC voltage regulator - modelling of SVC for power flow and transient stability.

MODULE III THYRISTOR CONTROLLED SERIES CAPACITOR (TCSC) 07

Operation of the TCSC - different modes of operation - modelling of TCSC - variable reactance model - modeling for power flow and stability studies. sub synchronous resonance- torsional interaction,- torsional torque - NGH damping schemes.

MODULE IV VOLTAGE SOURCE CONVERTER BASED FACTS CONTROLLERS 07

Static synchronous compensator (STATCOM) - principle of operation - V-I characteristics. SSSC-operation of SSSC and the control of power flow - modeling of SSSC in load flow and transient stability studies -UPFC and IPFC.

MODULE V CO-ORDINATION OF FACTS CONTROLLERS 07

Controller interactions - SVC - SVC interaction - co-ordination of multiple controllers using linear control techniques - control coordination using genetic algorithms.

MODULE VI APPLICATIONS OF FACTS CONTROLLERS 08

Applications of SVC - enhancement of transient stability - steady state power transfer - enhancement of power system damping - prevention of voltage instability. -applications of TCSC- improvement of the system stability limit - enhancement of system damping. applications of STATCOM- steady state power transfer- enhancement of transient stability - prevention of voltage instability - applications of SSSC – SSR mitigation.

Total Hours: 45

REFERENCES:

1. R.Mohan Mathur, Rajiv K.Varma, “Thyristor - Based FACTS Controllers for Electrical Transmission Systems”, IEEE press and John Wiley & Sons, Inc., 2002.
2. Narain G. Hingorani, “Understanding FACTS -Concepts and Technology of Flexible AC Transmission Systems”, Standard Publishers Distributors, Delhi- 110 006,1999.
3. K.R.Padiyar, “FACTS Controllers in Power Transmission and Distribution”, New Age International (P) Limited, Publishers, New Delhi, 2008 .
4. A.T.John, “Flexible A.C. Transmission Systems”, Institution of Electrical and Electronic Engineers (IEEE)”, Wiley IEEE Press,1999.
5. V.K.Sood, “HVDC and FACTS controllers - Applications of Static Converters in Power System”, Kluwer Academic Publishers, 2004.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Identify the needs of power systems and utility networks where installation of FACTS Controllers/Devices becomes essential

- Compute power transmission capability of a transmission system and apply reactive compensation methods for its improvement
- Comprehend the operating principles, control systems and modeling of different FACTS Controllers
- Understand the influence of measurement systems, network resonances and harmonic interactions on the performance of FACTS control systems
- Apply the techniques of FACTS controller design for enhancing power transfer, increasing stability, augmenting system damping, mitigating sub-synchronous resonances, preventing voltage instability, performing load compensation, etc.
- Analyze the interactions amongst various FACTS Controllers and Utilize techniques for the coordination of FACTS Devices within power systems

EECY016	ELECTRICAL TRANSIENTS IN POWER SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To model the transmission lines for transient analysis
- To study about the generation of switching and lightning transients, their propagation on the grid.
- To protect the station equipments against over voltages with proper insulation co-ordination

MODULE I LINE MODELLING 08

Line parameters - Bundled Conductors - Maxwell potential coefficient matrices for various line configurations - L and C calculations for lines - resistance and inductance of ground return using Carson's formulae - Line modeling for Power frequency and surge over voltages.

MODULE II POWER FREQUENCY OVER VOLTAGES 07

Symmetrical components for O/H lines and computation of sequence impedance - a, ß, O and Karrenbaur's transformations - over voltages caused by unsymmetrical line faults - over voltages due to Ferranti effect and load rejection.

MODULE III PROPAGATION OF TRAVELLING WAVES 07

Wave equation and its solution - Relation between voltage and current waves - velocity of travelling waves-reflection and refraction - behavior at line terminations - multiple reflections - lattice diagram - attenuation and distortion

MODULE IV MODAL ANALYSIS FOR MULTI CONDUCTOR LINES 07

Wave equation for multi conductor lines - general solution using modal analysis - significance of modal analysis - simple example of modal analysis – modes of propagation for a three conductor system.

MODULE V LIGHTNING AND SWITCHING OVER VOLTAGES 08

Lightning and switching over voltages - their influence on line transients -switching surges in capacitive circuits - switching surges in distributed parameter systems.

MODULE VI PROTECTION AND INSULATOR CO-ORDINATION 08

Protection against over voltages - shielding and non - shielding methods - back flashover - characteristics of surge arrestors - Location of surge arrestors –

substation earthing - Basic Insulation levels - insulation co-ordination in 220kV and 400kV systems - Specific examples - insulation co-ordination in HVDC systems.

Total Hours: 45

REFERENCES:

1. Pritindra Chowdhari, “Electromagnetic transients in Power system”, PHILearning. Age International (P) Ltd., Publishers New Delhi, 2008.
2. Allan Greenwood, “Electrical Transients in Power System”, Wiley & Sons Inc., New York, 1991.
3. H.W. Dommel, “EMTP Theory Book”, Microtran Power System Analysis Corporation, Vancouver B.C.,1992.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Ability to distinguish between power frequency and surge over-voltages and Model the transmission lines accordingly.
- Analyse the propagation characteristics of voltage and current surges in
- Transmission lines and their terminations.
- Design insulation co-ordination schemes for 220kV and 400kV systems.
- Analyse and control power frequency over voltages due to unsymmetrical faults , Ferranti effect and load rectification.
- Analyse propagation in multi-conductor lines using modal analysis.

EECY017	HIGH VOLTAGE PULSE GENERATION, MEASUREMENT AND TESTING FOR LIFE SCIENCES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- As the application of High voltage electric Pulse in Life Science is getting increased attention among the researchers, this course aims to provide a comprehensive idea.
- By the end of the semester, a student will be able to as certain methods of High Voltage generated measures.
- Appreciate the significance NDT testing techniques.
- Role of Bioelectrics in life science
- Appreciate the significance Electro pulsed and electromagnetic in cancer treatment

MODULE I HIGH VOLTAGE GENERATION & MEASUREMENT 08

Generation of High Alternating Voltages – High Frequency A.C. High Voltages - Generation of Rectangular & Square Current Pulses - Measurements of High Alternating Voltages – Currents – High Power Frequency.

MODULE II NON DESTRUCTIVE TESTING TECHNIQUE 08

Measurement of Direct Current Resistivity – Dielectric constant and Loss Factor – Partial Discharge Measurement – Balance Detection Method – Calibration of Discharge Detectors – Discharge Detection in Power Cables.

MODULE III BIO ELECTRICS 08

Window effect of pulsed Electric field on Biological Cells – Biological Matter due to the Application of Ultra short High Voltage Pulses – Bio response to sub Nano second ultra high voltage pulsing – Effects of Steep pulsed Electric fields on human liver cancer cells – cortical anchoring on the stability of transmembrane Electropores.

MODULE IV CANCER TREATMENT 07

Preliminary procedures – partial – mastectomy and auxiliary dissection – Total mastectomy – Reconstruction and Prosthesis – Radiation Therapy – Systemic Therapy – Complementary and Alternative Treatments.

MODULE V ELECTROPORATION 07

Introduction – Effect of Electroporation – Frequency Response of Cells – Nano electroporation – Nano Second – Electroporation effects – Caspases – Calcium Bursts – Nano pulses – Nano Second pulse Generator.

MODULE VI ELECTROPORATORS 07

Introduction – Design of electroporator including Booster circuit and converter circuit – Design of clinical electroporator.

Total Hours: 45

REFERENCES:

1. E. Kuffl, W.S. Zaengl, “High Voltage Engineering, Fundamentls”, first Edition, PERGAMON Press, OXFORD, New York,1984.
2. M.S. Naidu, V. Kamaraju, “High Voltage Engineering”, Third Edition, Tata Mc Graw Hill Publishing Company Ltd., New Delhi, 2001.
3. Chenguo Yao, Xiaoqian Hu, Yan Mi, Chengxiang Li and Caixin Sun, “Window effect of pulsed electric field on biological cells”, IEEE Trans. Dielectrics and electrical insulation Vol. 16, No: 5,pp 1259-1266, October 2009.
4. UweF.Pliquett and Karl. H. Schoenbach, “Changes in Electrical Impedance of Biological Matter Due to the Application of Ultrashort High Voltage Pulses”, IEEE Trans. Dielectrics and electrical insulation Vol. 16, No. 5,pp1273-1279, October 2009.
5. R. P. Joshi, J. Song, K. H. Schoenbach and V. Sridhara, “Aspects of Lipid Membrance Bio-responses to Subnanosecond, Ultrahigh Voltage pulsing”, IEEE Trans. Dielectrics and electrical insulation Vol. 16, No. 5,pp1243-1250, October 2009.
6. Yan Mi, Chengxiang Li, Caixin Sun, Liling Tang and Huan Liu, “Apoptosis Induction Effects of Steep Pulsed Electric Fields (SPEF) on Human Liver Cancer Cell SMMC-7721 in vitro”, IEEE Trans. Dielectrics and electrical insulation Vol. 16, No. 5,pp1302-1310, October 2009.
7. S. M. Kennedy, Z. Ji, N. B. Rockweiler, A. R. Hahn, J. H. Booske and S. C.Hagness, “The Role of Plasmalemmal-Cortical Anchoring on the Stability of Transmembrane Electropores”, IEEE Trans. Dielectrics and electrical insulation Vol. 16, No. 5; pp1251-1258., October 2009.
8. RajiSundararajan, “Nano Second Electroporation Another look Mol Biotechnol”, Vol No:41, pp :69-82, 2009.
9. Susan M. Love, Karen Lindsey, “Dr. Susan Love’s Breast Book”, 4th Edition,

First Da Ca Po Press Edition, 2005.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge on the following:

- Ability to impart knowledge on generation and measurement of high frequency AC voltages and currents.
- Ability to select an appropriate testing technique for high voltage apparatus.
- Ability to relate bioelectrics with high voltage applications.
- Ability to gain fundamental knowledge on various cancer treatments techniques.
- Application of Electroporation and Electroporators in Cancer Treatment

EECY018 SMART POWER GRID

L	T	P	C
3	0	0	3

OBJECTIVES :

- Introduce the fundamentals of smart grids.
- Introduce modeling of devices associated with smart grids.
- Introduce the different automation and networking standards.
- Introduce the concept of Wide area measuring systems and Phasor measurement units.(PMU)

MODULE I SMART GRID FUNDAMENTALS 09

Smart grid structure – Interactive grid – Micro grid – Distributed Resources modeling – communication infrastructure – sensing and Control devices – smart grid characteristics.

MODULE II COMPONENTS AND STANDARDS 09

Smart grid components – Metering – Virtual power plants- Benefits and cost elements – Pricing regulations – Networking Standards and integration – Analytics.

MODULE III AUTOMATION TECHNOLOGIES 09

Control centre systems – Data management principles – Smart Grid implementation standards and procedure – Advanced Metering Infrastructure – Outage management – Distribution and Substation automation .

MODULE IV WIDE AREA MEASUREMENT SYSTEMS AND PMU 06

Wide area measurement systems –Phasor Measurement Units- Optimal placement algorithm for PMUs. Smart grid experimentation plan for load forecasting.

MODULE V CASE STUDY I 06

Smart meters – Cloud computing and security issues - Forecasting – Coordination between cloud computing and Smart power grids – Development of power system models and control and communication software.

MODULE VI RECENT TRENDS IN SMART POWER GRIDS 06

Demand Response – concepts and models.Real time pricing models for practical applications-SCADA in smart grids.

Total Hours: 45

REFERENCES :

1. Ali Keyhani :" Design of Smart Power Grid Renewable Energy Systems ", First Edition , John Wiley Inc., 2011
2. Tony Flick and Justin Morehouse : "Securing the Smart Grid – Next generation Power Grid security ", Elsevier Publications,2011.
3. Krzysztof Iniewski:Smart Grid Infrastructure and Networking , 1st Edition , 2012.
4. Stephen F Bush :Smart Grid Communication – Enabled Intelligence for Electric Power Grid, Wiley IEEE .,2014
5. James Momoh : Smart Grids , Fundamentals of Design and Analysis .,2014.
6. Mini . S. Thomas :Power System SCADA and Smart Grids.
7. Kenneth . C.Budka , Jayant G.Deshpande :Communication Networks for Smart Grids:Making Smart Grid Real , 2014

OUTCOMES:

At the end of the course the student is expected to possess knowledge and skills on the following :

- Ability to design and implement Smart Power Grid Power Systems
- Ability to apply the concept of demand response in Smart grids.
- Ability to apply Smart grid concepts to real applications.
- Ability to co ordinate between cloud computing and smart grids
- Ability to apply SCADA in smart power grids
- Ability to use PMUs for optimal placement in smart grids.

EECY019	DISTRIBUTED GENERATION AND MICROGRID	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart the importance of renewable based generation system to meet the growing demands
- To locate distributed generation system optimally in the distribution system network and to study its impacts

MODULE I INTRODUCTION 08

Microgrid basic concepts – architecture - operational conditions, Microgrid : merits and demerits - functionalities and variables in microgrid - issues in microgrid. Types of microgrid (LV microgrid, MV microgrid - DC microgrid, AC microgrid, hybrid) - Microgrid as part of smarter grid Modes of operation : grid connected mode - islanded mode - transition between grid connected mode and islanded mode.primary control strategy - secondary control strategy - Control of distribution generation - demand side management - Opportunities and risk of different market players

MODULE II DISTRIBUTED ENERGY RESOURCES AND STORAGE DEVICES 08

Distributed Energy Resources: solar – wind – CHP – MCHP – Microturbine - Diesel generators –geo thermal –working, characteristics and mathematical modeling, Storage devices-Batteries - fuel cells - super capacitors.

MODULE III DISTRIBUTED SYSTEM EXPANSION 08

Power flow, Short circuit and loss calculations- with and without distributed generation- Distribution system reliability analysis –Distribution system expansion planning – load characteristics – load forecasting – design concepts – optimal location of distributed generation – solution technique.

MODULE IV CONTROLLERS 08

Three phase converter - Three phase Voltage source Inverter (VSI) – Boost Converter – PWM Techniques - P-Q Control - Structure of the VSI PQ Controller - Power-Voltage (PV) Control Scheme - Frequency (Vf) Control Scheme - generation Control Based on Droop Concept - adaptive droop control, Phase locked loop for synchronization.

MODULE V PROTECTION ISSUES 07

Requirements of protection - issues in protection (LOM, Blinding of protection, unwanted islanding, lack of selectivity, failure of co-ordination between fuse and recloser) - challenges in protection scheme – Solutions for microgrid protection - digital relays- Adaptive protection scheme : centralized, decentralized–Multiagent based protection scheme – protection scheme based on variables

MODULE VI MICROGRID COMPONENTS 06

PMU basic concepts - International Electrotechnical Commission (IEC) 61850, 61850-7-420, 61850-8. Renewable Microgrid controller RMC 600. Microgrid pilots : KERI – CERTS - Intelligent Electronic Device (IED) - Microgrid Management system (MMS) - Static Transfer switch (STS) - RTU/ gateway - Smart metering – Sensing Devices.

Total Hours: 45

References:

1. Jukka Ihamäki, “Integration of microgrids into electricity distribution networks” Master’s Thesis in Lappeenranta University of Technology, 2012, pages-105
2. Amirhossein Hajimiragha, “Generation Control in Small Isolated Power Systems” Master of Science Thesis -Royal Institute of Technology, Department of Electrical Engineering Stockholm 2005.
3. Juan Carlos V´asquez Quintero, “Decentralized Control Techniques Applied to Electric Power Distributed Generation in Microgrids dissertation submitted for the degree of European Doctor of Philosophy, June 10, 2009.
4. Stanley H.Horowitz and Arun G. Phadke, “ Power System Relaying third edition, John Wiley & sons
5. Renewable Microgrid controller RMC 600 – ABB Brochure
6. Taha Selim Ustun, Cagil Ozansoy and Aladin Zayegh, “ Fault current coefficient and time delay assignment for microgrid protection system with central protection unit” IEEE Transaction (accepted for publication in future issue of the journal-DOI-10.1109/TPWRS.2012.2214489
7. Taha Selim Ustun, Cagil Ozansoy and Aladin Zayegh, “ Modelling of a centralized Microgrid Protection system and Distributed Energy Resources according to IEC 61850-7-420” IEEE Transaction on power systems, vol 27, No.3, pp 1560-1567, 2012.
8. M. Amin Zamani, Amirnaser Yazdani, and Tarlochan S. , “A Communication-Assisted Protection Strategy for Inverter-Based Medium-

Voltage Microgrids", IEEE Transactions on Smart Grid, Vol. 3, No. 4,pp.2088-2099, 2012

9. Eric Sorotomme, S.S. Venkata, Joydeep Mitra, " Microgrid protection using communication assisted digital relays" IEEE transaction on power delivery, vol.25, No.4, pp.2789-2796, 2010

Course Outcomes:

At the end of the course, the student will be able to

- Know the basic concepts with respect to microgrid
- Model the distributed generator for distribution network
- Optimally locate the distributed generator in the distribution system
- Address the Issues involved in microgrid protection
- Model controllers for distributed generator to interface it to the distribution system network

EECY020	REACTIVE POWER MANAGEMENT IN POWER SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To analyze the operation of AC voltage controllers and AC-DC converters.
- To understand the operating principles of power semiconductor devices.
- To understand the fundamental concepts of compensation.
- To understand the concepts of Demand side management.

MODULE I SINGLE-PHASE AND THREE PHASE AC-DC CONVERTERS 08

Single phase Half controlled and Fully controlled Converters with RL load– Evaluation of input power factor and harmonic factor-Continuous and Discontinuous load current- Three Phase ac-dc Converters- Half controlled and fully controlled Converters with RL load-Continuous and Discontinuous load current -three phase PWM-twelve pulse converters- numerical problems.

MODULE II MULTI LEVEL INVERTERS 08

Introduction, Multilevel Concept - Types of Multilevel Inverters- Diode-Clamped Multilevel Inverter- Principle of Operation, Features of Diode-Clamped Inverter- Flying-Capacitors Multilevel Inverter- Principle of Operation, Features of Flying-Capacitors Inverter- Features of Multilevel Inverters.

MODULE III LOAD COMPENSATION AND DEMAND SIDE MANAGEMENT 07

Objectives and specifications – reactive power characteristics – inductive and capacitive approximate biasing – Load compensator as a voltage regulator – phase balancing and power factor correction of unsymmetrical loads- Reactive power planning – objectives – Economics Planning capacitor placement – retrofitting of capacitor banks.

MODULE IV REACTIVE POWER COMPENSATION IN TRANSMISSION SYSTEM 07

Uncompensated line – types of compensation – Passive shunt and series and dynamic shunt compensation – examples-Characteristic time periods – passive shunt compensation – static compensations- series capacitor compensation – compensation using synchronous condensers – examples- Mathematical modelling.

MODULE V SERIES AND SHUNT COMPENSATION TECHNIQUE 08

Modeling and control of Thyristorised controlled series compensators. Static VAR Compensation - Basic concepts, Thyristor controlled reactor (TCR), Thyristors switched reactor (TSR), Thyristor switched capacitor (TSC)- Variable structure FACTS controllers for Power system transient stability, Non-linear variable structure control, Unified power flow, Unified Power Flow Control - Basics of STATCOM, its applications.

MODULE VI CASE STUDY 07

Reactive power compensation capability of a matrix converter-based FACTS device- Reactive Power Compensation in Single-Phase Operation of Microgrid- Practices of reactive power management and compensation- Transmission system reactive power compensation.

Total Hours: 45

Reference Books:

1. Reactive power control in Electric power systems by T.J.E.Miller, John Wiley and sons, 1982.
2. Power Electronics-Md.H.Rashid –Pearson Education Third Edition- First Indian Reprint- 2008
3. Power Electronics- Ned Mohan, Tore M.Undelan and William P.Robbins – John Wiley & Sons -2nd Edition.
4. R.Mohan Mathur, Rajiv K.Varma, “Thyristor – Based Facts Controllers for Electrical Transmission Systems”, IEEE press and John Wiley & Sons, Inc.
5. A.T.John, “Flexible A.C. Transmission Systems”, Institution of Electrical and Electronic Engineers (IEEE), 1999.
6. Reactive power Management by D.M.Tagare,Tata McGraw Hill, 2004.

OUTCOMES:

After Completion of this course students will be able to

- Analyze the operation of AC voltage controllers and AC-DC converters.
- Design the power factor correction converters.
- Analyze the load compensation in transmission systems.
- Analyze suitable compensation for AC transmission systems.
- To understand the concept of reactive power management and various method of control employed in power systems.
- To understand its performance under static and dynamic conditions.

EECY021	STATE ESTIMATION AND CONTINGENCY ANALYSIS IN SMART GRID	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the model, management and protection of smart grid systems.
- To understand the information systems used in smart grid.
- To grasp the limits of the power system operating states.
- To grasp the contingency analysis made in a transmission grid.
- To model the states in power system for state estimation.
- To analyse the states for observability.

MODULE I SMART GRID SYSTEMS 05

Smart Grid introduction, Major systems in Smart Grid a technical perspective: Smart infrastructure system, Smart management system, Smart protection system, benefits and requirements of smart grid, Microgrid, Grid to vehicle and vehicle to grid.

MODULE II SMART INFORMATION SYSTEMS 08

Smart Metering, Smart Monitoring and Measurement, Information Management, Smart Communication Subsystem, An Overview, Wireless Technologies, wired technologies

MODULE III CONTINGENCY ANALYSIS FOR POWER SYSTEMS 05

Contingency Analysis of Power System, Types of Violations, Low Voltage Violations, Line MVA Limits Violation, Instability Prediction.

MODULE IV CONTINGENCIES STUDY OF NIGERIAN TRANSMISSION GRID 09

Case Study of Nigeria's 330kV Transmission Grid, Power System Security, Algorithm of a typical Contingency Analysis, Line Loadability, Simulation, Phasor and PMU Functions, Phasor Measurement Unit, Typical PMU Applications.

MODULE V STATIC STATE ESTIMATION MODELS 09

Power System Static- State Estimation, Exact Model, Nature of problem, Modeling, General Theory, State Estimation, Detection, Identification, Initial Tests, Approximate Model: State Estimation using P- Delta, Contingency Evaluation: P-Delta, Reactive Power and Voltage Magnitude.

MODULE VI EQUATION FORMULATIONS AND OBSERVABILITY ANALYSIS 09

Use of Loop Equations in Power System Analysis, Loop and Nodal Formulations, Pre- compensation, Post-compensation. Mid-compensation, Load Flow Computation, Network Observability Problem, Conventional Observability Analysis, Linearized Measurement Model, Classification of Measurements, Observability Algorithm.

Total Hours: 45

REFERENCES:

1. Nonyelu, Chibuzo Joseph, Prof. Theophilus C. Madueme, “Power System Contingency Analysis: A Study of Nigeria’s 330kV Transmission Grid”, Conference of Energy Source for Power Generation, University of Nigeri, Nsukka, Volume: 4, February 2016.
2. Xinyu Tony Jiang, Joe H Chow, Bruce Fardanesh, Deepak Maragal, George Stefopoulos, Michael Raxanousky, “ Power System State Estimation using Direct Non-Iterative method”, Electrical Power and Energy Systems, Volume 73, Pages 361-368, 2015.
3. Mrs. Veenavati Jagadishprasad Mishra, Prof. Manisha D. Khardenvis, “Contingency Analysis of Power System”, IEEE Students’ Conference on Electrical, Electronics and Computer Science, 2012.
4. Feng Ding, C.D. Booth, “Protection and Stability Assessment in Future Distribution Networks Using PMUs”, 11th International Conference on Developments in Power Systems Protection, 2012.
5. Xi Fand, Satyajayant Misre, Guoliang Xue, Dejun Yang, “Smart Grid - The New and Improved Power Grid: A Survey”, Volume: 14, Issue 4, Pages: 944 – 980, 2012.
6. Antonio Gomez ExpBsito and Ali Abur, “Generalized Observability Analysis and Measurement Classification”, IEEE Transactions on Power Systems, Volume 13, No3, August 1998.
7. Antonio Gomez ExpBsito and Ali Abur and Esther Rineri Ramos, “On the use of LOOP Equations in Power System Analysis”, IEEE International Symposium on Circuits and Systems, ISCAS’ 95, 15 Volume 2, 1995.
8. Fred C. Scheweppe, and J.Wildes, “Power System Static-State Estimation, Part 1: Exact Model”, Transactions on Power Apparatus and Systems, Volume: PAS-8, No1, January 1970.
9. Fred C. Schweppe, and Douglas B.Rom, “Power System Static-State Estimation, Part 2: Approximate Model”, IEEE Transactions on Power

Apparatus and Systems, Volume: PAS-89, Issue 1, 1970.

OUTCOMES:

- The model, management and protection of smart grid systems were understood.
- The information systems used in smart grid was gathered.
- The limits of the power system operating states were understood.
- The contingency analysis made in a transmission grid was understood.
- The state estimation modeling was understood.
- The analysis and observability of the states was done.

EECY049	SOLAR AND ENERGY STORAGE SYSTEM	L	T	P	C
		3	0	0	3

OBJECTIVES

- To Study about solar modules and PV system design and their applications
- To Deal with grid connected PV systems
- To Discuss about different energy storage systems

MODULE I INTRODUCTION 09

Characteristics of sunlight – semiconductors and P-N junctions –behavior of solar cells – cell properties – PV cell interconnection

MODULE II STAND ALONE PV SYSTEM 09

Solar modules – storage systems – power conditioning and regulation - protection – stand alone PV systems design – sizing

MODULE III GRID CONNECTED PV SYSTEMS 09

PV systems in buildings – design issues for central power stations – safety – Economic aspect – Efficiency and performance - International PV programs

MODULE IV POWER CONDITIONING SCHEMES 08

DC Power conditioning Converters - Maximum Power point tracking algorithms - AC Power conditioners Synchronized operation with grid supply - Harmonic problem – building integrated PV systems.

MODULE IV ENERGY STORAGE SYSTEMS 09

Impact of intermittent generation – Battery energy storage – solar thermal energy storage – pumped hydroelectric energy storage

MODULE V APPLICATIONS 09

Water pumping – battery chargers – solar car – direct-drive applications –Space – Telecommunications.

Total Hours : 45

TEXT BOOKS

1. Eduardo Lorenzo G. Araujo, Solar electricity engineering of photovoltaic systems, Progensa,1994. 2. Stuart R.Wenham, Martin A.Green, Muriel E. Watt and Richard Corkish, Applied Photovoltaics, 2007,Earthscan, UK.

REFERENCES

1. Frank S. Barnes & Jonah G. Levine, Large Energy storage Systems Handbook , CRC Press, 2011.
2. Solar & Wind energy Technologies – McNeils, Frenkel, Desai, Wiley Eastern, 1990
3. Solar Energy – S.P. Sukhatme, Tata McGraw Hill,1987.

OUTCOMES:

Students will develop more understanding on solar energy storage systems:

- Students will develop basic knowledge on standalone PV system
- Students will understand the issues in grid connected PV systems
- Able to develop various power conditioning schemes for solar systems.
- Able to explain the Grid connected PV systems.
- Students will study about the modelling of different energy storage systems and their performances
- Students will attain more on different applications of solar energy

EECY050	FUNDAMENTALS OF GRID CONNECTED PHOTO-VOLTAIC POWER ELECTRONIC CONVERTER DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart knowledge on constructional details and characteristics of solar panel.
- To familiarize theoretical concepts and control strategies, for extraction of maximum power from the solar power and its synchronization with the grid.

MODULE I INTRODUCTION 04

Characteristics of sunlight – semiconductors and P-N junctions –behaviour of solar cells – cell properties – PV cell interconnection

MODULE II OVERVIEW OF PHOTO VOLTAIC SYSTEMS AND CONVERTERS 08

Grid connection standards, Solar Cell Characteristics, Solar panel and converter configurations, Converter topologies, Grid filter topologies, Temporary storage

MODULE III CONTROL OF PHOTO-VOLTAIC CONVERTERS 09

Maximum power utilization of photo voltaic power sources, DC-DC Converter Control, DC-AC Converter control, Harmonic compensation, Grid synchronization, Anti Islanding

MODULE IV POWER CONDITIONING SCHEMES 09

DC Power conditioning Converters - Maximum Power point tracking algorithms - AC Power conditioners Synchronized operation with grid supply - Harmonic problem – building integrated PV systems.

MODULE V SYSTEM DESCRIPTION, MODELLING AND OPTIMIZATION 09

Converter topology and control description, P&O Maximum Power Point Tracker optimization, Phase Locked Loop PI Regulator, Current Regulator, Voltage Controller , Complete control system model.

MODULE VI SIMULATIONS 06

DC-DC Converter, DC-AC Converter- PLL, Current control, Voltage control, The LCL filter.

Total Hours: 45

TEXT BOOK

1. Svein Erik Evju,Fundamentals of Grid Connected Photo-Voltaic Power Electronic Converter Design', Norwegian University of Science and Technology.

REFERENCES

1. Eduardo Lorenzo G. Araujo, Solar electricity engineering of photovoltaic systems, Progensa,1994.
2. Stuart R.Wenham, Martin A.Green, Muriel E. Watt and Richard Corkish, Applied Photovoltaics, 2007,Earthscan, UK.
3. Frank S. Barnes & Jonah G. Levine, Large Energy storage Systems Handbook , CRC Press, 2011.
4. Solar & Wind energy Technologies – McNeils, Frenkel, Desai, Wiley Eastern, 1990
5. Solar Energy – S.P. Sukhatme, Tata McGraw Hill,1987.

OUTCOMES:

- Will become familiar with the operation of the components of PV systems, including solar modules, power control components, and the balance of system components.
- Able to carry out a credible design of a grid-connected PV system.
- Able to model and design MPPT and controllers of grid tied inverters.
- Use of simulation software for energy yield estimation

EECY051 SOLAR POWER SYSTEM DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge, analyze and to design the modern semi-conductor devices and their applications in power Electronic controller for rectification, inversion, frequency conversion with improved performance.

MODULE I SOLAR POWER SYSTEM PHYSICS 07

Solar Cell Physics - Solar Cell Electronics - Types of Solar Cells Technologies - Concentrators - Solar Panel Arrays - Solar Power System Components.

MODULE II SOLAR POWER TECHNOLOGIES 08

Solar Power System Components - Crystalline Solar Photovoltaic Module Production - Amonix Megaconcentrators - Film Technologies - Solar Photovoltaic System Power Research and Development.

MODULE III SOLAR POWER SYSTEM DESIGN 09

Solar Power System Components and Materials - - Storage Battery Technologies - Solar Power System Wiring - Considerations for - Lightning Protection - Central Monitoring and Logging System Requirements - Ground-Mount and Roof-Mount Photovoltaic Module Installations - Shading Analysis and Solar Energy Performance Multiplier - Site Evaluation - Solar Power Design.

MODULE IV SOLAR POWER GENERATION PROJECT IMPLEMENTATION 07

Designing a Typical Residential Solar Power System - Example of Typical Solar Power System Design and Installation Plans for a Single Residential Unit - Commercial Applications -Small-Scale Solar Power Pumping Systems -Large-Capacity Solar Power Pumping Systems - Pump Operation Characteristics - Semitropic Open Field Single-Axis Tracking System PV Array

MODULE V ECONOMICS OF SOLAR POWER SYSTEMS 06

Current Preliminary Engineering Design - Meteorological Data - Energy Cost Factor - Project Cost Analysis - Feasibility Study Report.

MODULE VI PASSIVE SOLAR HEATING TECHNOLOGIES 08

Passive Solar Water Heating - Pool Heating - Concentrator Solar Technologies - Solar Cooling and Air Conditioning - Direct Solar Power Generation - Innovations

in Passive Solar Power Technology.

Total Hours: 45

REFERENCES:

1. Mukund R. Patel, "Wind and Solar Power Systems Design, Analysis, and Operation", Published in 2006 by CRC Press, Taylor & Francis Group
2. Ned Mohan, Tore M. Undeland. "Power Electronics- Converters, Applications and Design", John Wiley & Sons (Asia) Private Ltd., 2003.
3. M.D.Singh , " Power Electronics"Tata McGraw-Hill Education, 07-Jul-2008
4. R W Erickson and D Makgimovic,"Fundamental of Power Electronics" Springer, 2001 2nd Edition.
5. Vedam Subrahmanyam, "Power Electronics", New Age International (P) Limited, New Delhi, 1997.
6. D.M.Mitchell, DC-DC Switching Regulator Analysis McGraw-Hill Ryerson, Limited, 1988

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following

- Understand the characteristics of solar cell.
- Understand the constructional details of solar panel.
- Know about the monitoring and commissioning of solar panel
- Know about the solar pumping and mechanical tracking of solar power generation system.
- Cost analysis of solar power generation system.

EEC0Y22	POWER ELECTRONIC APPLICATIONS TO POWER SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To have a thorough understanding of the construction, theory and characteristics of the Devices like MOSFET, BJT's, IGBT's and SCR.
- To analysis and modeling of Inverters and converters.
- To study in detail about the Reactive power compensation and FACTS devices.
- To study about the definition and issues in power quality.

MODULE I INTRODUCTION 07

Basic Concept of Power Electronics, Different types of Power Electronic Devices - Diodes, Transistors, SCR, MOSFET, IGBT and GTO's.

MODULE II AC TO DC CONVERTERS 09

Single Phase and three phase bridge rectifiers, half controlled and Fully Controlled Converters With R, RL, AND RLE loads. Free Wheeling Diodes, Dual Converter, Sequence Control of Converters - inverter operation, Input Harmonics and Output Ripple, Smoothing Inductance - Power Factor Improvement effect of source impedance, Overlap, Inverter limit.

MODULE III DC TO AC CONVERTERS 09

General Topology of single Phase and three phase voltage source and current source inverters- Need for feedback diodes in anti parallel with switches - Multi Quadrant Chopper viewed as a Single phase inverter- Configuration of Single phase voltage source inverter: Half and Full bridge, Selection of Switching Frequency and Switching Device. Voltage Control and PWM strategies.

MODULE IV STATIC REACTIVE POWER COMPENSATION 08

Shunt Reactive Power Compensation - Fixed Capacitor Banks, Switched Capacitors, Static Reactor Compensator, Thyristor Controlled Shunt Reactors (TCR) - Thyristor Controlled Transformer- FACTS Technology-Applications of static thyristor Controlled Shunt Compensators for load compensation ,Static Var Systems for Voltage Control, Power Factor Control and Harmonic Control of Converter Fed Systems.

MODULE V POWER QUALITY 06

Power Quality - Terms and Definitions - Transients - Impulsive and Oscillatory Transients - Harmonic Distortion - Harmonic Indices - Total Harmonic Distortion - Total Demand Distortion- Locating Harmonic Sources Harmonic s from commercial and industrial Loads -Devices for Controlling Harmonics Passive and Active Filters -Harmonic Filter Design.

MODULE VI VOLTAGE SAGS AND HARMONICS 06

Sources of over voltages - Capacitor switching – lightning- Mitigation of voltage swells - surge arrester. Sources of sags and interruptions, estimating voltage sag performance, motor starting sags mitigation of voltage sags harmonics.

Total Hours: 45

REFERENCES:

1. N.Mohan,T.M.Undeland and W.P.Robbins, Power Electronics : Converter, Applications and Design , John Wiley and Sons , 2000.
2. M.H.Rashid, Power Electronics, Prentice Hall of India,2006.
3. B.K.Bose, Power Electronics and A.C. Drives , Prentice Hall ,2004.
4. Roger C.Dugan , Mark .F. Mc Granaghan, Surya Santaso, H.Wayne Beaty, “Electrical Power Systems Quality”, Second Edition, Mc Graw Hill, 2002.
5. T.J.E. Miller, Static Reactive Power Compensation, John Wiley and Sons, Newyork,1982.
6. Mohan Mathur.R., Rajiv.K.Varma, “Thyristor Based FACTS controllers for Electrical Transmission Systems”, IEEE press .1999.
7. Tripathy, S.C., 'Electric Energy Utilisation and Conservation', Tata McGraw Hill Publishing Company Ltd. New Delhi, 1991.
8. Soni, M.L., P.V. Gupta and Bhatnagar, 'A Course in Electrical Power', Dhanpat Rai Sons, New Delhi, 1983.
9. Roger.C.Dugan, Mark.F.McGranagham, Surya Santoso, H.Wayne Beaty, ‘Electrical Power Systems Quality’ McGraw Hill, 2003.
10. M.H.J Bollen, ‘Understanding Power Quality Problems: Voltage Sags and Interruptions’, (New York: IEEE Press, 1999). (For Chapters 1, 2, 3 and 5)

OUTCOMES:

At the end of the course, the Students are expected to possess knowledge and achieve skills on the following:

- Ability to model and analyze Inverters & Converters.
- Ability to analyze custom power electronic devices.

- Basic understanding of the semiconductor devices like rectifiers, Thyristors and transistors.
- Understanding the principle of operation of FACTS devices.
- Knowing the issues like sag and harmonics in power quality.

EECY043 SCADA AND DCS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To give an in depth study of SCADA and PLC.
- To acquire knowledge of application of software automation blocks and DCS.
- To expose the students to the Micro SCADA techniques

MODULE I INTRODUCTION 06

Introduction to automation tools PLC, DCS, SCADA, Hybrid DCS/PLC.

MODULE II DCS PROJECT 08

Development of User Requirement Specifications - Functional Design Specifications for automation tool - GAMP, FDA.

MODULE III PROGRAMMABLE LOGIC CONTROLLERS 08

Introduction of Advanced PLC programming, Selection of processor, Input/ output MODULEs - Interfacing of Input/output devices, Operator Interface - OPC- study of SCADA software - Interfacing of PLC with SCADA software.

MODULE IV DCS 09

Introduction to architecture of different makes - DCS Specifications, configuration of DCS blocks for different applications - Interfacing of protocol based sensors - Actuators and PLC systems, Plant wide database management- Security and user access management - MES, ERP Interface.

MODULE V STUDY OF ADVANCE PROCESS CONTROL BLOCKS 09

Statistical Process Control - Model Predictive Control - Fuzzy Logic Based Control - Neural-Network Based Control Higher Level Operations: Control & Instrumentation for process optimization - Applications of the above techniques to the same standard units/processes.

MODULE VI MICRO SCADA FOR POWER ELECTRONICSYSTEMS 05

System concept –Hardware: Base computer - Workstations-Front ends-Peripherals Software Programming-Process Objects – Command Procedures – RTU Integration –Communication to Third Party Systems –Functional description:

process pictures- operation-Alarm handling-Event Handling- reports- Trends

Total Hours: 45

REFERENCES:

- Gary Dunning, “Introduction to Programmable logic Controllers”, Delmar Thomson learning, 2001.
- Webb & Reis, “Programmable logic Controllers”, (Prentice Hall), 2003.
- Jose A. Romagnoli, Ahmet Palazoglu, 'Introduction to process Control' (CRC Taylor and Francis group), 2013.
- “Statistical Process Control” -ISA Handbook.
- B.G. Liptak “Handbook of Instrumentation- Process Control”.
- Installation and user manuals of different DCS, PLC Vendors, 2004.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Basics of SCADA & DCS.
- Appropriate knowledge and skills in Industrial automation systems with the use of DCS, PLCs, and SCADA.
- An ability to apply creativity in design of systems, components or processes appropriate to power electronic circuits.
- Ability to get a grip on micro SCADA for power electronics applications
- Ability to perform programming in SCADA and DCS.

EEC 6125	MODELING AND ANALYSIS OF ELECTRIC MACHINES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To give an in-depth input on generalized theory of electric machines.
- To impart knowledge on the Modeling aspects of reference frame theory and transformational variables of electrical machines using reference frame theory.
- To impart knowledge on Analysis of electric machines using the reference frame theory model.
- Prediction of torque and other related variables for static and dynamic analysis of electric machines.

MODULE I PRICIPLE OF ELECTOMAGNETIC ENERGY CONVERSION 07

Stored magnetic energy – Co-energy – flux-linkage vs current curves – Singly excited and Doubly excited systems – Force and Torque predictions.

MODULE II BASIC CONCEPTS OF ELECTRIC MACHINES 07

Generalized theory of electric machines – Concept of d-q model – Kron's Primitive Model – Airgap MMF, Per phase machine inductance, Voltage and Torque equations for DC machine and AC machines.

MODULE III MODELING AND ANALYSIS OF DC MACHINES 09

Static and Rotating reference frames and Transformation Relationships – R, L, M, V, I and T equations using direct and quadrature axes in: Modeling of separately excited DC machines – Modeling of DC series machines – Influence of brush shift.

MODULE IV REFERENCE FRAME THEORY FOR 3-PHASE INDUCTION MACHINES 09

Modeling of 3-phase symmetrical induction machines – V, I, L and T equations in actual variables and hypothetical variables – Rotor transformation – V, I, L and T equations in transformed machine.

MODULE V REFERENCE FRAME THEORY FOR 3-PHASE SYNCHRONOUS MACHINES 08

Modeling of Synchronous Machines – Determination of self inductances and mutual inductances – Transformation of self inductances and mutual inductances – Dynamic Modeling of AC machines.

MODULE VI MODELING OF SPECIAL ELECTRIC MACHINES 05

Modeling aspects of Magnetic Systems – Modeling Switched Reluctance Machines – Case Study (Modeling of DC and AC machines.)

Total Hours: 45

REFERENCES:

1. C.V. Jones, 'The Unified Theory of Electric Machines', Butterworth, London, 1967
2. R. Krishnan, 'Switched Reluctance Motor Drives', CRC Press.
3. MAGNET software rule book for Case study purpose.

OUTCOMES:

- Ability to understand the rudiments of electric machines for modeling and analysis.
- Ability to apply generalized machine theory for DC and AC machine modeling.
- Ability to apply Reference Frame theory for DC and AC machine modeling and analysis.
- Ability to model and analyze any new electric machine.
- Ability to use modeling software tools for machine modeling and analysis.

EEC 6126	ADVANCED POWER SEMICONDUCTOR DEVICES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basics of devices selection.
- To understand the static and dynamic characteristics of power semiconductor devices
- To enable the students for the selection of devices for different power electronics applications
- To get the knowledge about the datasheet of power semiconductor Devices.
- To understand the control and firing circuit for different devices.
- Study about the thermal protection of the Devices

MODULE I INTRODUCTION 06

Power switching devices overview; Attributes of an ideal switch, application requirements, and circuit symbols. Power handling capability, Device selection strategy – On-state and switching losses -Power diodes - Types, forward and reverse characteristics, switching characteristics – rating.

MODULE II SILICON POWER ELECTRONIC SEMICONDUCTORS DEVICES and DRIVER CIRCUITS 10

Construction, static characteristics, switching characteristics and Gate characteristics of Thyristor – GTO – MOSFET- IGBTs – SIC – GAN – FCT – RCT. Converter grade and inverter grade SCR. High Speed Opto-Couplers – Zero Crossing Detectors - Optically Isolated High Voltage and High Current sensing circuits, Driver ICs**:** MOC series SCR , IR2XXX Series Full Bridge and Half Bridge MOSFET / IGBT Driver ICs.

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MODULE III DATASHEET RATINGS FOR SEMICONDUCTOR DEVICES 09

Standards, Symbols and terms-Maximum ratings – Thermal Impedance and resistance-Component (type) designation system - Mechanical data –Safe Operating Area during switching and short circuit.

MODULE IV PROTECTION AND NOISE 07

Over voltage, Over current and gate protections and Design of snubber circuits - Noise generated due to switching-Common noise sources in SMPS-Noises Due to High frequency transformer-Measurement of Noise.

MODULE V THERMAL PROTECTION 07

Heat transfer – conduction, convection and radiation, Cooling – liquid cooling, vapour – phase cooling, Guidance for heat sink selection- heat sink types and design-Electrical analogy of thermal components– Mounting types.

MODULE VI CASE STUDY 06

Switching characteristics and VI characteristics of Thyristor – GTO – MOSFET-IGBTs – SIC – GAN. Design of drivers and Snubber Circuit.

Total Hours: 45

REFERENCES:

1. Rashid M.H., “Power Electronics circuits, Devices and Applications”, Prentice Hall India, Third Edition, New Delhi, 2008.
2. M.D. Singh and K.B.Khanchandani, “Power Electronics”, Tata McGraw Hill, 2006.
3. Vedam Subramanian, "Power Electronics", New Age International (P) Limited, New Delhi, 1997.
4. Ned Mohan, Undcland and Robins, “Power Electronics – Concepts, applications and Design, John Wiley and Sons, Singapore, 2000.
5. B.W. Williams, “Power Electronics – Devices, Drivers, Applications and Passive Components”, Macmillan, 1992.
6. Dr.-Ing. Arendt Wintrich,Dr.-Ing. Ulrich Nicolai,Dr. techn. Werner Tursky,Univ.-Prof. Dr.-Ing. Tobias Reimann,Application Manual Power Semiconductors ,published by SEMIKRON International GmbH

OUTCOMES:

At the end of the course, the student will

- Understand the operation and characteristics of the semiconductor devices
- Understand the gate drive circuits and its necessity.
- Select suitable component for the particular application with the help of data sheet.
- Design protection circuit for the semiconductor devices.
- Design heat sinks for semiconductor devices

EEC6127 ANALYSIS OF POWER CONVERTERS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge, analyze and to design the power Electronic converters.
- To discuss in depth the main families of PWM strategies.
- To enable the students to design Power Factor Correction(PFC) controller.

MODULE I AC – DC CONVERTER 08

Circuits and operating principles: Analysis of Single phase and three phase controlled rectifiers with RLE loads - Input line current harmonics and power factor – Fourier Analysis of controlled rectifiers - Dual converters.

MODULE II PERFORMANCE CHARACTERISTICS OF PHASE CONTROLLED CONVERTERS 08

Performance parameters: Dc voltage ratio – input displacement angle – displacement factor - power factor – current distortion factor- Harmonic content of DC terminal voltage and input current - THD of Two quadrant converters and one quadrant converters - reduction of reactive loading of the supply by the Two quadrant converter by means of consecutive firing angle control.

MODULE III PHASE CONTROLLED CYCLOCONVERTER 08

Symmetrical - open delta - Ring connected cycloconverter circuits - Harmonic distortion in the output voltage – General Expression for Three pulse waveform for an arbitrary firing angle control method - Harmonic series of three and six pulse cycloconverters – cosine wave control method – Firing pulse generation: Functional schemes – End stop control : reverence voltage - clamp method – pulse isolating output stage.

MODULE IV AC – AC 08

Analysis of Single-phase and Three phase AC Voltage Controllers- Matrix converter - Bi-directional switch topologies, Modulation techniques for matrix converters, Concept of Direct AC-AC frequency Converter.

MODULE V ACTIVE FRONT END RECTIFIERS 08

Overview of Power Factor Correction Approaches - Unity power factor rectifiers - Resistor emulation principle –mathematical modeling – control schemes- Design of feedback compensators -front end rectifiers with real and reactive power control

– Phase shifter.

MODULE VI DUAL ACTIVE BRIDGE CONVERTER 07

Dual active bridge converter – circuit configuration – steady state analysis – steady state model of DC-DC DAB Converters - Steady-State Model for AC-AC DAB Converters - soft switching analysis – DAB for Solid state transformer.

REFERENCES:

1. M. H. Rashid, "Power Electronics - Circuits, Devices and Applications", Pearson Education India, 2003
2. Ned Mohan, Tore M. Undeland. "Power Electronics- Converters, Applications and Design", John Wiley & Sons (Asia) Private Ltd., 2003.
3. M.D.Singh, " Power Electronics"Tata McGraw-Hill Education, 07-Jul-2008.
4. Eric Monmasson, Power Electronic Converters PWM Strategies and Current Control Techniques, John Wiley & Sons, Inc, © ISTE Ltd 2011.
5. ON Semiconductor "Power Factor Correction (PFC) Handbook", HBD853/D Rev. 5, Apr−2014.
6. D.M.Mitchell, DC-DC Switching Regulator Analysis McGraw-Hill Ryerson, Limited, 1988.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following

- Understand the concept of Converters, choppers, and AC voltage controllers.
- Select the suitable devices for the required applications in power Electronic controller for rectification, inversion, frequency conversion.
- Use these devices to Design controllers for the AC and DC drive systems.
- Provides a comprehensive overview of PFC circuits and details of operation and design considerations for commonly used PFC circuits.
- Able to learn more about advanced power electronics converters.

EEC 6235 SOLID STATE AC & DC DRIVES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the stable steady-state operation and transient dynamics of a motor-load system.
- To study and analyze the operation of the converter / chopper fed dc drive and to solve simple Problems.
- To study and understand the operation of both classical and modern induction motor drives.
- To understand the differences between synchronous motor drive and induction motor drive and
- to learn the basics of permanent magnet synchronous motor drives with converter.
- To analyze and design the current and speed controllers for a closed loop solid-state DC and AC motor drive and simulation using a software package

MODULE I FUNDAMENTAL OF DC AND AC MOTOR 06

Components of electrical Drives-electric machines, power converter, controllers-dynamics of electric drive - torque equation - equivalent values of drive parameters - components of load torques types of load - four quadrant operation of a motor– steady state stability– load equalization – classes of motor duty - determination of motor rating

MODULE II SENSORS FOR DRIVES 06

Hall Effect Sensors – Mechanical Sensors for speed and angular positions – Absolute Encoders – Incremental Encoders – Resolvers –

MODULE III CLOSED LOOP CONTROL POD DC AND AC DRIVES 09

Transient analysis of separately excited motor – converter control of dc motors – analysis of separately excited & series motor with 1 - phase and 3 - phase converters – dual converter – analysis of chopper controlled dc drives – converter ratings and closed loop control – transfer function of self, separately excited DC motors – linear transfer function model of power converters – sensing and feeds back elements – current and speed loops, P, PI and PID controllers – response comparison – simulation of converter and chopper fed DC drive.

MODULE IV SCALAR METHODS FOR IM DRIVES FROM STATOR SIDE 09

Stator voltage control of induction motor–torque-slip characteristics-operation with different types of loads – operation with unbalanced source voltages and single phasing – analysis of induction motor fed from non - sinusoidal voltage supply – stator frequency control - variable frequency operation – V/F control, controlled current and controlled slip operation – effect of harmonics and control of harmonics

MODULE V SCALAR METHODS FOR IM DRIVES FROM ROTOR SIDE 08

PWM inverter drives – multiquadrant drives – rotor resistance control – slip torque characteristic – torque equations, constant torque operation – slip power recovery scheme – torque equation – torque slip characteristics – power factor – methods of improving power factor – limited sub synchronous speed operation – super synchronous speed operation

MODULE VI SYNCHRONOUS MOTOR DRIVES 07

Principle of synchronous motor control – Introduction to CSI Single phase and three phase CSI – CSI fed synchronous machines – adjustable frequency operation of synchronous motors –voltage source inverter drive with open loop control – self controlled synchronous motor with electronic commutation – self controlled synchronous motor drive using load commutated thyristor inverter.

Total Hours: 45

REFERENCES:

1. R. Krishnan, Electrical Motor Drives, PHI 2003.
2. G.K.Dubey, Powersemiconductor controlled drives, Prentice Hall- 2000.
3. G.K.Dubey, Fundamentals of Electrical Drives, Narosa-1999.
4. A. Nasar, Boldea , Electrical Drives, Second Edition, CRCPress-2006.
5. M. A. ElSharkawi , Fundamentals of Electrical Drives , Thomson Learning - 2000. 49
6. W. Leohnard, Control of Electric Drives,-Springer-2001.
7. Murphy and Turnbull, Power Electronic Control of AC motors, Pergamon Press, 1973.
8. Vedam Subrahmaniam, Electric Drives, TMH-2000.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Analyze the system considering the steady state and dynamic characteristics.
- Ability to design a closed loop control of AC and DC drives.
- Talent in selection of motor for various applications.
- Software knowledge in Matlab for drive application.
- Modeling AC,DC machines with appropriate loads
- Design a system with suitable parameters to control a drive system.

EECY23	ELECTRICAL INSULATION IN POWER APPARATUS AND SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To expose the students to different insulating materials that could be used in high voltage technologies.
- To understand the breakdown mechanisms in various types of insulating materials.
- To understand the high voltage testing procedure for insulators.

MODULE I INSULATING MATERIALS IN HIGH VOLTAGE TECHNOLOGY 07

Requirement for insulating material - Properties and testing of insulating materials: Electrical properties, Thermal properties, Chemical Properties - Natural inorganic insulation materials, Synthetic inorganic insulation materials, Natural inorganic insulation materials, Synthetic organic insulating materials

MODULE II ELECTRIC FIELD AND BREAKDOWN VOLTAGE 06

Determination of electric fields, Maximum field strengths in geometrically similar configurations, Formulation for the calculation of the breakdown voltage, Fields in multi-dielectric, isotropic materials.

MODULE III BREAKDOWN MECHANISM IN GASES, SOLIDS AND LIQUIDS 09

Breakdown theory of gases: Charge carriers in gases, Classical gas laws, self sustaining discharges, Breakdown mechanism in strong inhomogeneous fields, Breakdown characteristics under transient voltages - Breakdown theory in solid insulating materials: Charge carriers at low field strengths, Intrinsic breakdown, Thermal breakdown, Partial discharge breakdown, Mechanism of failure in nanocomposite materials - Breakdown theory in Liquid insulation: Electric strength of technical configurations with insulating liquids, Theory of breakdown in liquid insulation

MODULE IV TESTING OF INSULATORS 08

High voltage testing procedures - statistical treatment of results - dynamic properties of dielectrics - Dielectric loss and capacitance measurements - Partial discharge measurements.

Total Hours: 30

REFERENCES

1. N.H. Malik, A.A. Al-Arainy, M.I. Qureshi, Electrical insulation in power system, Marcell&Dekker Inc, 1998.
2. Paul Gill, Electrical power equipment maintenance and testing, Second Edition, CRC Press, 2008.
3. A. Bradwell (ed.), Electrical insulation, Peter Peregrinus Ltd., London, England, 1983.
4. E. Kuffel, W.S. Zaengl, J. Kuffel, High voltage Engineering fundamentals, Newnes (an imprint of Elsevier),2005.
5. Dieter Kind, Hermann Karner, High voltage insulation technology, Translated from the German by Y. Narayana Rao, Friedr. Vieweg&Sohn, Braunschweig, 1985.

OUTCOMES

At the end of the course, the students will be able to

- Choose appropriate insulating material depending upon the application.
- Determine the electric fields and breakdown voltages in electric insulators.
- Explain the breakdown phenomena in gaseous, solid and liquid insulating materials.
- Use appropriate testing procedure to test the high voltage insulators.

EECY024 ENERGY AUDITING

L	T	P	C
2	0	0	2

OBJECTIVES:

- To introduce the general concepts and methodologies of energy auditing.
- To understand the procedures and techniques involved in energy auditing
- To systematically explore the possibilities of energy saving.
- To expose the students to different instruments involved in energy auditing.

MOUDULE I GENERAL ASPECTS, METHODOLOGY AND APPROACH 09

General Philosophy and need of Energy Audit and Management. Definition and Objective of Energy Management, General Principles of Energy Management - Energy Audit: Need, Types - Understanding Energy Costs, Bench marking, Energy performance, Matching energy usage to requirements, Maximizing system efficiency, Optimizing the input energy requirements, Fuel and Energy substitution.

MODULE II PROCEDURES AND TECHNIQUES 08

Data gathering : Level of responsibilities, energy sources, control of energy and uses of energy get Facts, figures and impression about energy /fuel and system operations, Past and Present operating data, Special tests, Questionnaire for data gathering. Analytical Techniques: Incremental cost concept, mass and energy balancing techniques, inventory of Energy inputs and rejections, Heat transfer calculations, Evaluation of Electric load characteristics, process and energy system simulation.

MODULE III EVALUATION OF SAVING OPPORTUNITIES 07

Determining the savings in Rs, Noneconomic factors, Conservation opportunities, estimating cost of implementation. Energy Audit Reporting: The plant energy study report- Importance, contents, effective organization, report writing and presentation - Identification of losses, Improvements. Energy Balance sheet

MODULE IV ENERGY AUDIT INSTRUMENTS 06

Basic measurements – Electrical measurements, Light, Pressure, Temperature and heat flux, Velocity and Flow rate, Vibrations, etc. Instruments Used in Energy systems: Load and power factor measuring equipments, Wattmeter, flue gas analysis, Temperature and thermal loss measurements, air quality analysis.

Total Hours: 30

REFERENCES

1. W.R.Murphy, G.Mckay ‘Energy Management’ Butterworths
2. C.B.Smith ‘Energy Management Principles’, Pergamon Press
3. I.G.C.Dryden ‘Efficient Use of Energy’, Butterworth Scientific
4. A.V.Desai ‘Energy Economics’, Wieley Eastern
5. D.A. Reay ‘Industrial Energy Conservation’, Pergammon Press
6. W.C. Turner ‘Energy Management Handbook, John Wiley and Sons, A Wiley Interscience Publication
7. L.C. Witte, P.S. Schmidt, D.R. Brown ‘Industrial Energy Management and Utilization’, Hemisphere Publication, Washington
8. ‘Industrial Energy Conservation Manuals’, MIT Press, Mass, 1982
9. Patrick/Patrick/Fardo ‘Energy Conservation guide book’, Prentice Hall
10. Handbook on Energy efficiency
11. ASHRAEE Energy Use (4 Volumes)
12. CIBSI Guide –Users Manual (U.K.)
13. CRC Handbook of Energy Efficiency – CRC Press.

OUTCOMES:

At the end of the course, the students will be able to

- Demonstrate the importance of energy auditing.
- Use the right technique and procedure for energy auditing
- Explore the possibilities of reducing the losses and saving the energy systematically.
- Use appropriate instruments in the process of energy auditing.

EECY025 WIDE AREA MEASUREMENT SYSTEMS

L	T	P	C
2	0	0	2

OBJECTIVE:

- To understand the operating principle of wide area measurement systems and performance of phasor measurement units.

MODULE I MATHEMATICAL BACKGROUND 08

Phasor representation of sinusoids - Fourier series and Fourier transform and DFT Phasor representation - Phasor Estimation of Nominal Frequency Signals - Formulas for updating phasors - Nonrecursive updates - Recursive updates - Frequency Estimation

MODULE II SYNCHRO PAHSOR MEASUREMENTS 10

Need of Synchro phasor Measurements, Phasor Measurement Unit : Architecture, Functions, Optimal Placement of PMUs, phasor data concentrators and associated communication system. Visualization tools to enhance visibility and control within transmission system, PMU measurements and sampling rates State Estimation & observability by using PMU, phasor data use for real time operation, frequency stability monitoring and trending, power oscillation, voltage monitoring and trending. Alarming and setting system operating limits. Dynamic line rating and congestion management, outage restoration. Application of PMU for wide area monitoring and control.

MODULE III WIDE AREA MEASUREMENT SYSTEM 06

Architecture, Components of WAMS, GUI (Graphical User Interface), Applications: Voltage Stability Assessment, Frequency stability Assessment, Power Oscillation Assessment, Communication needs of WAMS, WAMPAC (Wide Area Monitoring Protection & Control), RAS (Remedial Action Scheme). Standards: IEEE 1344, IEEE C37.118 (2005), IEEE Standard C37.111-1999 (COMTRADE), IEC61850 GOOSE.

MODULE IV PERFORMANCE OF A GENERIC PMU 06

The global positioning system - Hierarchy for phasor measurement systems, - Functional requirements of PMUs - Transient Response of Phasor Measurement Units - of instrument transformers, filters, during electromagnetic transients - Transient response during power swings

Total Hours: 30

REFERENCES

1. A.G. Phadke, J.S. Thorp, 'Synchronized Phasor Measurements and Their Applications', Springer Publications, 2008
2. Joseph Euzebe Tate "Event detection and visualization based on phasor measurement units for improved situational awareness", UMI Dissertation Publishing.
3. Fahd Hashiesh, M. M. Mansour , Hossam E. Mostafa Fahd Hashiesh , M. M. Mansour , Hossam E. Mostafa ,"Wide Area Monitoring, Protection and Control: The Gateway to Smart Grids",
4. Dr. Arun G. Phadke, Dr. James S. Thorp,. "Computer Relaying for Power Systems", Wiley Publication, Second Edition.
5. Krzysztof Iniewski "SMART GRID Infrastructure & Networking", Tata McGraw Hill.

OUTCOMES:

Upon finishing the course, students are expected to,

- Model the phasor measurement system mathematically.
- Define and demonstrate the concept of Wide area measurement systems
- Use the wide area measurement systems for assessing power system oscillations and stability.
- Analyze the performance of a generic phasor measurement unit.

EECY026	POWER SYSTEM SIMULATION SOFTWARE	L	T	P	C
		0	0	2	1

OBJECTIVE:

- To expose the students to various proprietary and open source software for simulation of power systems.

COURSE DESCRIPTION:

Study of both proprietary and open source software for simulation of power systems:

PROPRIETARY SOFTWARE

- ETAP
- CYME
- PSCAD
- EUROSTAG

OPEN SOURCE SOFTWARE

- UWPFLOW
- PSAT
- InterPSS
- DCOPFJ
- OpenDSS
- MatDyn
- minpower
- Dome
- GridLAB-D
- OpenPMU

Assessment I: A presentation on the proprietary software available in the department and the latest open source software.

Assessment II: Comparative study by simulating the same problem over multiple software.

Semester End: Solving a given power system problem using any one of the software.

EECY027	SIMULATION OF POWER ELECTRONIC CIRCUITS	L	T	P	C
		0	0	2	1

OBJECTIVE:

- To expose the students to various proprietary and open source software for simulation of power electronic circuits.

COURSE DESCRIPTION:

Study of both proprietary and open source software for simulation of power electronic circuits:

PROPRIETARY SOFTWARE

- PSIM
- PSPICE
- FEADMOS
- VISSIM

OPEN SOURCE SOFTWARE

- PYTHON POWER ELECTRONICS
- ZenitPCB
- NgSpice
- LTSpice

Assessment I: A presentation on the proprietary software available in the department and the latest open source software.

Assessment II: Comparative study by simulating the same problem over multiple software.

Semester End: Solving a given power electronic circuit using any one of the software.

EECY028 ELECTRIC VEHICLES

L	T	P	C
1	0	0	1

History and development of on-road Electric Vehicles (EV). Different configurations of hybrid EVs with block diagram representation, merits & demerits of different configurations in view of vehicle efficiency and energy storage system. - Energy storage systems – Basics of EV batteries, specifications, power density, Energy density, Charging & Discharging cycle and recommended methodologies for charging. Recommended drives for EV and converter topology used in EVs.

Total Hours: 15

REFERENCES

1. Ron Hodkinson & John Fenton, Light Weight Electric/ Hybrid Vehicle design, Butterworth Publications, Heinemann
2. H. A. Kiehne, Battery Technology Handbook, MARCEDLE KKEIRN,C
3. Sandeep Dhameja , Electric vehicle battery systems , Butterworth–Heinemann

References:

- A.G. Phadke, J.S. Thorp, ‘Computer Relaying for Power Systems’, John Wiley and Sons Ltd., Research Studies Press Limited, 2 nd Edition, 2009
- A.G. Phadke, J.S. Thorp, ‘Synchronized Phasor Measurements and Their Applications’, Springer Publications, 2008

GENERAL ELECTIVES

GECY101 PROJECT MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

The objectives of the course would be to make the students

- Learn to evaluate and choose an optimal project and build a project profile.
- Attain knowledge on risk identification and risk analysis
- Gain insight into a project plan and components
- Familiar with various gamut of technical analysis for effective project implementation
- Learn to apply project management techniques to manage resources.

MODULE I INTRODUCTION & PROJECT INITIATION 09

Introduction to project and project management - projects in contemporary organization – The project life cycle - project initiation - project evaluation methods & techniques - project selection criteria - project profile.

MODULE II RISK ANALYSIS 09

Sources of risk: project specific - competitive - industry specific - market and international risk – perspectives of risk – risk analysis: sensitivity analysis - scenario analysis - breakeven analysis - simulation analysis - decision tree analysis – managing/mitigating risk – project selection under risk.

MODULE III PROJECT PLANNING & IMPLEMENTATION 09

Project planning – importance – functions - areas of planning - project objectives and policies - steps in planning process - WBS – capital requirements - budgeting and cost estimation - feasibility analysis - creation of project plan – project implementation: pre-requisites - forms of project organization

MODULE IV TECHNICAL ANALYSIS 09

Technical analysis for manufacturing/construction/infrastructure projects – process/technology - materials and inputs - product mix - plant capacity – plant location and site selection – plant layout - machinery and equipment – structures

and civil works – schedule of project implementation – technical analysis for software projects.

MODULE V PROJECT MANAGEMENT TECHNIQUES 09

Project scheduling - network construction – estimation of project completion time – identification of critical path - PERT & CPM – crashing of project network - complexity of project scheduling with limited resources - resource allocation - resource leveling – resource smoothing – overview of project management software.

Total Hours: 45

REFERENCES:

1. Projects: Planning, Analysis, Financing, Implementation and Review, Prasanna Chandra, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2004.
2. Project Management and Control, Narendra Singh, Himalaya Publishing, New Delhi, 2015.
3. A Management Guide to PERT/CPM, Jerome, D. Weist and Ferdinand K. Levy, Prentice Hall of India, New Delhi, 1994.

OUTCOMES:

On successfully completing this course, the student will be able to:

- Evaluate & select a project as well as develop a project profile.
- Identify various risks associated with the project and manage it effectively.
- Prepare a detailed project plan addressing its components.
- Perform technical analysis for effective project implementation
- Apply project management techniques for maximizing resource utilization.

GECY102 SOCIETY, TECHNOLGY & SUSTAINABILITY

L	T	P	C
3	0	0	3

OBJECTIVES:

- Aware of new technologies through advances in Science and Engineering.
- To make them realise the profound impact on society.
- Understand the ethical issues raised by technological changes and its effect on society.
- To introduce students a broad range of perspectives on the adoption and use of technologies.
- To make them realize the need of sustainability in the context of emerging technologies.

MODULE I TECHNOLOGY AND ITS IMPACTS 09

Origin and evolution of technologies – Nature of technology- Innovation – Historical Perspective of technology – Sources of technological change - Co-evolution of technology and economy – Scientific knowledge and technological advance – Science and Engineering aspects of Technology – Impact on the Society – Social and Ethical Issues associated with technological change – Social and environmental consequences - Impact of technological change on human life – Technology and responsibility – Technology and social justice.

MODULE II TECHNOLOGY AND ITS ADVANCEMENT 09

Sociological aspects of technology – Ethics and technology – Technology and responsibility – International Economics, Globalisation and Human Rights – Sustainability and Technology – Population and environment - Technology, Energy and Environment – Organisations and technological change.

MODULE III SOCIETY AND TECHNOLOGY 09

Impact of technologies on contemporary society – Role of society in fostering the development of technology – Response to the adaption and use of technology – Impact of technology on developer and consumers – Technological change and globalisation.

MODULE IV IMPACT OF A SPECIFIC TECHNOLOGY ON HUMAN WELFARE 09

Impact of the following technologies on Human life – Medical and Biomedical – Genetics Technology – Electronics and Communications – Electronic media Technology – Information Systems Technology – Nanotechnology – Space Technology and Energy Technology.

MODULE V THE IMPORTANCE OF SUSTAINABILITY 09

Sustainability – A brief history – Concepts and contexts for sustainability – Ecological imbalance and biodiversity loss – Climate change – Population explosion. Industrial ecology – systems approach to sustainability – Green engineering and technology- sustainable design- sustainable manufacturing- Green consumer movements – Environmental ethics – Sustainability of the planet Earth – Future planning for sustainability.

Total Hours: 45

REFERENCES:

1. Volti Rudi, “Society and Technology Change”, 6th Edition, Worth publishers Inc, USA, 2009.
2. Arthur W.A, “The nature of Technology: What it is and how it evolves”, Free Press, NY, USA, 2009.
3. Winston M and Edelbach R, “Society, Ethics and Technology”, 3rd Edition, San Francisco, USA, 2005.
4. Martin A.A Abraham, “Sustainability Science and Engineering: Defining Principles”, Elsevier Inc, USA, 2006.
5. R.V.G.Menon, “Technology and Society”, Pearson Education, India, 2011.

OUTCOMES:

At the end of this course, the students will be able to

- Understand the benefits of modern technology for the well-being of human life.
- Connect sustainability concepts and technology to the real world challenges.
- Find pathway for sustainable society.

GECY103 ARTIFICIAL INTELLIGENCE

L	T	P	C
3	0	0	3

OBJECTIVES:

- Expose the history and foundations of artificial intelligence.
- Showcase the complexity of working on real time problems underlying the need for intelligent approaches.
- Illustrate how heuristic approaches provide a good solution mechanism.
- Provide the mechanisms for simple knowledge representation and reasoning.
- Highlight the complexity in working with uncertain knowledge.
- Discuss the current and future applications of artificial intelligence.

MODULE I HISTORY AND FOUNDATIONS 08

History – Scope – Influence from life – Impact of computing domains - Agents in environments - Knowledge representation – Dimensions of Complexity – Sample application domains – Agent structure.

MODULE II SEARCH 10

Problem solving as search – State spaces – Uninformed Search – Heuristic search – Advanced search – Constraint satisfaction - Applications.

MODULE III KNOWLEDGE REPRESENTATION AND REASONING 10

Foundations of knowledge representation and reasoning, representing and reasoning about objects, relations, events, actions, time, and space predicate logic, situation calculus, description logics, reasoning with defaults, reasoning about knowledge, sample applications.

MODULE IV REPRESENTING AND REASONING WITH UNCERTAIN KNOWLEDGE 08

Probability, connection to logic, independence, Bayes rule, Bayesian networks, probabilistic inference, sample applications.

MODULE V CASE STUDY AND FUTURE APPLICATIONS 09

Design of a game/Solution for problem in student's domain. Natural Language processing, Robotics, Vehicular automation – Scale, Complexity, Behaviour – Controversies.

Theory: 45

TEXT BOOK:

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall, Third Edition, 2010.
2. David Poole, Alan Mackworth, Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010.
3. Nils J. Nilsson, The Quest for Artificial Intelligence, Cambridge University Press, Online edition, 2013.
4. Keith Frankish, William M. Ramsey (eds) The Cambridge Handbook of Artificial Intelligence, Cambridge University Press, 2014.

OUTCOMES:

Students who complete this course will be able to

- Discuss the history, current applications, future challenges and the controversies in artificial intelligence.
- Apply principle of AI in the design of an agent and model its actions.
- Design a heuristic algorithm for search problems.
- Analyze and represent the fact using logic for a given scenario
- Represent uncertainty using probabilistic models
- Develop a simple game or solution using artificial intelligence techniques.

GECY104 GREEN COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To focus on the necessity of green computing technology.
- To expose to various issues with information technology and sustainability.
- To attain knowledge on the technologies for enabling green cloud computing.
- To elaborate on the energy consumption issues
- To illustrate a Green and Virtual Data Center
- To develop into a Green IT Technologist.

MODULE I INTRODUCTION 08

Trends and Reasons to Go Green - IT Data Center Economic and Ecological Sustainment - The Growing Green Gap: Misdirected Messaging, Opportunities for Action - IT Data Center “Green” Myths and Realities - PCFE Trends, Issues, Drivers, and Related Factors - Green Computing and Your Reputation- Green Computing and Saving Money- Green Computing and the Environment

MODULE II CONSUMPTION ISSUES 10

Minimizing power usage – Cooling - Electric Power and Cooling Challenges - Electrical – Power -Supply and Demand Distribution - Determining Energy Usage - From Energy Avoidance to Efficiency - Energy Efficiency Incentives, Rebates, and Alternative Energy Sources - PCFE and Environmental Health and Safety Standards- Energy-exposed instruction sets- Power management in power-aware real-time systems.

MODULE III NEXT-GENERATION VIRTUAL DATA CENTERS 09

Data Center Virtualization - Virtualization beyond Consolidation - Enabling Transparency - Components of a Virtual Data Center - Datacenter Design and Redesign - Greening the Information Systems - Staying Green- Building a Green Device Portfolio- Green Servers and Data Centers- Saving Energy

MODULE IV TECHNOLOGIES FOR ENABLING GREEN AND VIRTUAL DATA CENTERS 08

Highly Effective Data Center Facilities and Habitats for Technology - Data Center Electrical Power and Energy Management - HVAC, Smoke and Fire Suppression - Data Center Location - Virtual Data Centers Today and Tomorrow - Cloud Computing, Out-Sourced, and Managed Services.

MODULE V SERVERS AND FUTURE TRENDS OF GREEN COMPUTING 10

Server Issues and Challenges - Fundamentals of Physical Servers - Types, Categories, and Tiers of Servers - Clusters and Grids - Implementing a Green and Virtual Data Center - PCFE and Green Areas of Opportunity- 12 Green Computer Companies- What's in Green computer science-Green off the Grid aimed for data center energy evolution-Green Grid Consortium- Green Applications- Green Computing Making Great Impact On Research

Theory: 45

REFERENCES:

1. Bud E. Smith,"Green Computing Tools and Techniques for Saving Energy, Money, and Resources", Taylor & Francis Group, CRC Press, ISBN-13: 978-1-4665-0340-3, 2014.
2. Jason Harris, "Green Computing and Green IT Best Practices, On Regulations and Industry Initiatives, Virtualization and power management, materials recycling and Tele commuting, Emereo Publishing .ISBN-13: 978-1-9215-2344-1,2014.
3. Ishfaq Ahmed & Sanjay Ranka, "Handbook of Energy Aware and Green Computing", CRC Press, ISBN: 978-1-4665-0116-4, 2013.
4. Kawahara, Takayuki, Mizuno, "Green Computing with Emerging Memory", Springer Publications, ISBN:978-1-4614-0811-6, 2012
5. Greg Schulz, "The Green and Virtual Data Center", CRC Press, ISBN-13:978-1-4200-8666-9, 2009.
6. Marty Poniatowski, "Foundation of Green IT: Consolidation, Virtualization, Efficiency, and ROI in the Data Center", Printice Hall, ISBN: 9780-1-3704-375-0, 2009.

OUTCOMES:

Students who complete this course will be able to

- Demonstrate issues relating to a range of available technologies, systems and practices to support green computing.
- Select appropriate technologies that are aimed to reduce energy consumption.
- Address design issues needed to achieve an organizations' green computing objectives.
- Analyze the functionality of Data Centers.
- Critically evaluate technologies and the environmental impact of computing resources for a given scenario.
- Compare the impact of Green Computing with other computing techniques.

GECY105 GAMING DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To master event-based programming
- To learn resource management as it relates to rendering time, including level-of-detail and culling.
- To become familiar with the various components in a game or game engine.
- To explore leading open source game engine components.
- To become familiar of game physics.
- To be compatible with game animation.

MODULE I INTRODUCTION 09

Magic Words – What Skills Does a Game Designer Need? – The Most Important Skill -The Five Kinds of Listening-The Secret of the Gifted.

MODULE II THE DESIGNER CREATES AN EXPERIENCE 09

The Game Is Not the Experience -Is This Unique to Games? -Three Practical Approaches to Chasing Rainbows -Introspection: Powers, Perils, and Practice -Dissect Your Feelings -Defeating Heisenberg -Essential Experience.

MODULE III THE EXPERIENCE IN THE PLAYER MIND AND GAME MECHANICS 08

Modeling – Focus -Empathy – Imagination – Motivation – Space – Objects, Attributes, and States – Actions – Rules.

MODULE IV GAMES THROUGH AN INTERFACE 09

Breaking it Down – The Loop of Interaction – Channels of Information – Other Interface.

MODULE V BALANCED GAME MECHANICS 10

Balance – The Twelve Most Common Types of Game Balance – Game Balancing Methodologies - Balancing Game Economies.

Theory: 45

REFERENCES:

1. Jesse Schell, "The Art of Game Design: A Book of Lenses", Second Edition 2nd Edition ISBN-10: 1466598646, 2014.
2. Ashok Kumar, Jim Etheredge, Aaron Boudreaux, “Algorithmic and Architectural Gaming Design: Implementation and Development", 1st edition, Idea Group, U.S ISBN-10: 1466616342, 2012.
3. Katie Salen Tekinba, Melissa Gresalfi, Kylie Peppler, Rafi Santo, "Gaming the System - Designing with Gamestar Mechanic" MIT Press , ISBN-10: 026202781X, 2014.
4. James M. Van Verth, Lars M. Bishop "Essential Mathematics for Games and Interactive Applications", Third Edition,A K Peters/CRC Press, ISBN-10: 1482250926, 2015.

OUTCOMES:

Students who complete this course will be able to

- Realize the basic history and genres of games
- Demonstrate an understanding of the overall game design process
- Explain the design tradeoffs inherent in game design
- Design and implement basic levels, models, and scripts for games
- Describe the mathematics and algorithms needed for game programming
- Design and implement a complete three-dimensional video game

GECY106 SOCIAL COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To create original social applications, critically applying appropriate theories and effective practices in a reflective and creative manner.
- To critically analyze social software in terms of its technical, social, legal, ethical, and functional features or affordances.
- To encourage the development of effective communities through the design, use, and management of social software.
- To give students with a base of knowledge and advances for them to critically examine existing social computing services.
- To plan and execute a small-scale research project in social computing in a systematic fashion.
- To become familiar with the concept of computational thinking.

MODULE I BASIC CONCEPTS 09

Networks and Relations: Relations and Attributes, Analysis of Network Data, Interpretation of network data -New Social Learning – Four Changes that Shift Work - Development of Social Network Analysis: Sociometric analysis and graph theory, Interpersonal Configurations and Cliques – Analysing Relational Data.

MODULE II SOCIAL LINK 09

Individual Actors, Social Exchange Theory, Social Forces, Graph Structure, Agent Optimization Strategies in Networks – Hierarchy of Social Link Motivation- Social Context.

MODULE III SOCIAL MEDIA 08

Trends in Computing – Motivations for Social Computing – Social Media: Social relationships, Mobility and Social context – Human Computation – Computational Models- Business use of social Media.

MODULE IV SOCIAL INFORMATION FILTERING 09

Mobile Location Sharing – Location based social media analysis – Social Sharing and Social Filtering – Automated recommender Systems – Traditional and Social Recommender Systems.

MODULE V SOCIAL NETWORK STRATEGY 10

Application of Topic Models – Opinions and Sentiments – Recommendation Systems – Language Dnamics and influence in online communities – Psychometric analysis – Case Study: Social Network Strategies for surviving the zombie apocalypse.

Theory: 45

REFERENCES:

1. Tony Bingham, Marcia Conner, “The New Social Learning, 2nd Edition: Connect. Collaborate. Work”, 2nd Edition, ATD Press, ISBN-10:1-56286-996-5, 2015.
2. Nick Crossley, Elisa Bellotti, Gemma Edwards, Martin G Everett, Johan Koskinen, Mark Tranmer, “Social Network Analysis for Ego-Nets”, SAGE Publication, 2015.
3. Zafarani, Abbasi and Liu, Social Media Mining: An Introduction, Cambridge University Press, 2014.
4. Christina Prell, “Social Network Analysis: History, Theory and Methodology”, 1st Edition, SAGE Publications Ltd, 2012.
5. John Scott, “Social Network Analysis”, Third Edition, SAGE Publication, 2013.
6. Jennifer Golbeck, “Analyzing the Social Web”, Elsevier Publication, 2013.
7. Huan Liu, John Salerno, Michael J. Young, “Social computing and Behavioral Modeling”, Springer Publication, 2009.

OUTCOMES:

Students who complete this course will be able to

- Realize the range of social computing applications and concepts.
- Analyze data left after in social media.

- Recognize and apply the concepts of computational models underlying social computing.
- Take out simple forms of social diagnostics, involving network and language models, applying existing analytic tools on social information.
- Evaluate emerging social computing applications, concepts, and techniques in terms of key principles.
- Design and prototype new social computing systems.

GECY107 SOFT COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To become familiar with AI and neural networks that can learn from available examples and generalize to form appropriate rules for inferencing systems.
- To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience.
- To provide the mathematical background for carrying out the optimization associated with neural network learning.
- To familiarize with genetic algorithms and other random search procedures useful while seeking global optimum in self-learning situations.
- To introduce case studies utilizing the above and illustrate the intelligent behavior of programs based on soft computing.

MODULE I INTRODUCTION 09

Introduction of soft computing, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing. Artificial Intelligence : Introduction, Various types of production systems, characteristics of production systems, breadth first search, depth first search techniques, other Search Techniques like hill Climbing, Best first Search, A* algorithm, AO* Algorithms and various types of control strategies. Knowledge representation issues, Prepositional and predicate logic, monotonic and non-monotonic reasoning, forward Reasoning, backward reasoning.

MODULE II INTRODUCTION TO NEURAL NETWROK 09

Structure and Function of a single neuron: Biological neuron, artificial neuron, definition of ANN, Taxonomy of neural net, Difference between ANN and human brain, characteristics and applications of ANN, single layer network, Perceptron training algorithm, Linear separability, Widrow & Hebb"s learning rule/Delta rule, ADALINE, MADALINE, AI v/s ANN. Introduction of MLP, different activation functions, Error back propagation algorithm, derivation of BPA, momentum, limitation, characteristics and application of EBPA.

MODULE III FUZZY LOGIC 09

Fuzzy set theory, Fuzzy set versus crisp set, crisp relation & fuzzy relations,

Fuzzy systems: crisp logic, fuzzy logic, introduction & features of membership functions, Fuzzy rule base system: fuzzy propositions, formation, decomposition & aggregation of fuzzy rules, fuzzy reasoning, fuzzy inference systems, fuzzy decision making & Applications of fuzzy logic.

MODULE IV GENETIC ALGORITHM 09

Fundamentals, basic concepts, working principle, encoding, fitness function, reproduction, Genetic modeling: Inheritance operator, cross over, inversion & deletion, mutation operator, Bitwise operator, Generational Cycle, Convergence of GA, Applications & advances in GA, Differences & similarities between GA & other traditional methods.

MODULE V APPLICATION OF COMPUTATIONAL INTELLIGENCE 09

Printed Character Recognition – Inverse Kinematics Problems – Automobile Fuel Efficiency Prediction – Soft Computing for Color Recipe Prediction.

Total Hours: 45

REFERENCES:

1. Jyh-shing Roger Jang, Chuen - Tsai Sun, Eiji Mizutani, “Neuro- Fuzzy and Soft Computing”, Prentice-Hall of India, 2003.
2. S.Rajasekaran & G.A. Vijayalakshmi Pai, “Neural Networks, Fuzzy Logic & Genetic Algorithms, Synthesis & applications”, PHI Publication, 2002.
3. S.N. Sivanandam & S.N. Deepa, “Principles of Soft Computing”, Wiley Publications, 2007.
4. N.K.Bose, “Neural Network Fundamentals with Graphs, Algorithms, and Applications” TMH, 1996.
5. Klir & Yuan, “Fuzzy sets & Fuzzy Logic: Theory & Application”, Prentice Hall of India Pub, 1995.
6. Kosko: “Neural Network & Fuzzy System”, PHI Publication, 1992.

OUTCOMES:

On completion of the programme students will be able to:

- Learn about soft computing techniques and their applications
- Analyze various neural network architectures and able to Understand perceptrons model

- Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
- Apply genetic algorithms to combinatorial optimization problems.
- Evaluate and compare solutions by various soft computing approaches for a given problem.

GECY108 EMBEDED SYSTEM PROGRAMMING

L	T	P	C
3	0	0	3

OBJECTIVES:

- This course provides an introduction to the design of embedded computing systems including their hardware and software architectures.
- Entire software development lifecycle and examine the various issues involved in developing software for embedded systems.
- To analyze the I/O programming and Embedded C coding techniques
- This course will equip students with the software development skills necessary for practitioners in the embedded systems field.

MODULE I INTRODUCTION OF EMBEDDED SYSTEM 09

Embedded computing - characteristics and challenges - embedded system design process-Overview of Processors and hardware units in an embedded system-Compiling, Linking and locating – downloading and debugging –Emulators and simulators processor – External peripherals – Memory testing – Flash Memory.

MODULE II SOFTWARE TECHNOLOGY 09

Software Architectures, Software development Tools, Software Development Process Life Cycle and its Model, Software Analysis, Design and Maintenance.

MODULE III INPUT/OUTPUT PROGRAMMING 09

I/O Instructions, Synchronization, Transfer Rate & Latency, Polled Waiting Loops, Interrupt – Driven I/O, Writing ISR in Assembly and C, Non Maskable and Software Interrupts

MODULE IV DATA REPRESENTATION IN EMBEDDED SYSTEMS 09

Data representation ,Twos complement, Fixed point and Floating Point Number Formats ,Manipulating Bits in -Memory, I/O Ports, Low level programming in C ,Primitive data types , Arrays, Functions ,Recursive Functions, Pointers, Structures & Unions ,Dynamic Memory Allocation ,File handling ,Linked lists, Queues, Stacks.

MODULE V EMBEDDED C 09

Embedded Systems programming in C – Binding & Running Embedded C program in Keil IDE – Dissecting the program -Building the hardware. Basic techniques for

reading & writing from I/O port pins – switch bounce - LED Interfacing using Embedded C.

Total Hours: 45

REFERENCES:

1. Marilyn Wolf, "Computers as components ", Elsevier, 2012.
2. Qing Li and Carolyn Yao, "Real-Time Concepts for Embedded Systems", CMP Books, 2003.
3. Daniel W. Lewis, "Fundamentals of embedded software where C and assembly meet", Pearson Education
4. Michael Bass, "Programming Embedded Systems in C and C++", Oreilly, 2003.

OUTCOMES:

On completion of this course the student will be able to

- Design the software and hardware components in embedded system
- Describe the software technology
- Use interrupt in effective manner
- Use keil IDE for programming
- Program using embedded C for specific microcontroller
- Design the embedded projects

GECY109 PRINCIPLES OF SUSTAINABLE DEVELOPMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge in the concepts and dimensions of sustainable development.
- To gain knowledge on the framework for achieving sustainability.

MODULE I CONCEPT OF SUSTAINABLE DEVELOPMENT 09

Environment and Development - Population poverty and Pollution –Global and Local environmental issues –Resource Degradation- Greenhouse gases- Desertification-industrialization –Social insecurity, Globalization and environment. History and emergence of the concept of sustainable development-Objectives of Sustainable Development.

MODULE II COMPONENTS AND DIMENSIONS OF SUSTAINABLE DEVELOPMENT 09

Components of Sustainability –Complexity of growth and equity – Social economic and environmental dimensions of sustainable development – Environment- Biodiversity- Natural -Resources- Ecosystem integrity- Clean air and water- Carrying capacity- Equity, Quality of Life, Prevention, Precaution-Preservation and Public Participation Structural and functional linking of developmental dimensions.

MODULE III FRAMEWORK FOR ACHIEVING SUSTAINABILITY 09

Operational guidelines- interconnected prerequisites for sustainable development Empowerment of Women, children, Youth, Indigenous People, Non-Governmental Organizations Local Authorities, Business and industry-Science and Technology for sustainable development- performance indicators of sustainability and assessment mechanism- Constraints and barriers for sustainable development.

MODULE IV SUSTAINABLE DEVELOPMENT OF SOCIO ECONOMIC SYSTEMS 09

Demographic dynamics of sustainability – Policies for socio-economic development -Strategies for implementing eco-development programmes Sustainable development through trade –Economic growth –Action plan for implementing sustainable development –Urbanization and sustainable Cities – Sustainable Energy and Agriculture –sustainable livelihoods.

MODULE V SUSTAINABLE DEVELOPMENT AND INTERNATIONAL RESPONSE 09

Role of developed countries in the development of developing countries – international summits – Stockholm to Johannesburg – Rio principles – Agenda-Conventions – Agreements – Tokyo Declaration – Doubling statement – Tran boundary issues integrated approach for resources protection and management

Total Hours: 45

REFERENCES:

1. Sayer J. and Campbell, B., The Science of Sustainable Development: Local Livelihoods and the Global environment - Biological conservation restoration & Sustainability, Cambridge university Press, London, 2003.
2. M.K. Ghosh Roy. and Timberlake, Sustainable Development, Ane Books Pvt. Ltd, 2011.
3. Mackenthun K.M., Concepts in Environmental Management, Lewis Publications London,1999.
4. APJ Abdul Kalam and Srijan Pal Singh, Target 3 Billion: Innovative Solutions Towards Sustainable Development, Penguin India, 2011

OUTCOMES:

At the end of the course the student will be able to

- Describe the concepts of sustainable development
- Define the components and dimensions of sustainable development
- Outline the Frame work for achieving sustainability.
- State the policies and strategies for implementing sustainable development for Socio economic programmes.
- Examine the role of developed countries in sustainable development.

GECY110	QUANTITATIVE TECHNIQUES IN MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVE:

To impart knowledge on

- operations research
- production management
- financial management
- decision theory and managerial economics

MODULE I OPERATIONS RESEARCH 09

Introduction to Operations research-Linear programming-Graphical and Simplex Methods, Duality and Post-Optimality Analysis-Transportation and Assignment Problems

MODULE II PRODUCTION MANAGEMENT 09

Inventory control, EOQ, Quantity Discounts, Safety Stock-Replacement Theory-PERT and CPM-Simulation Models-Quality Control.

MODULE III FINANCIAL MANAGEMENT 09

Working Capital Management-Compound Interest and Present Value methods-Discounted Cash Flow Techniques-Capital Budgeting.

MODULE IV DECISION THEORY 09

Decision Theory-Decision Rules-Decision making under conditions of certainity, risk and uncertainity-Decision trees-Utility Theory.

MODULE V MANAGERIAL ECONOMICS 09

Cost concepts-Break-even -Analysis-Pricing techniques-Game Theory applications.

Total Hours: 45

REFERENCES:

1. Vohra, N.D. , Quantitative Techniques in Management, Tata McGraw Hill Co., Ltd, New Delhi, 2009.

2. Seehroeder, R.G., Operations Management, McGraw Hill, USA, 2002.

3. Levin, R.I, Rubin, D.S., and Stinsonm J., Quantitative Approaches to Management, McGraw Hill Book Co., 2008.

4. Frank Harrison, E., The Managerial Decision Making Process, Houghton Miffin Co. Boston, 2005.

5. Hamdy A. Taha, Operations Research- An Introduction, Prentice Hall, 2002.

OUTCOME:

At the end of the course, the students will be able to

- Apply the concepts of operations research for various applications
- Create models for inventory control in production management
- Compute the cash flow for a project
- Choose a project using decision theory based on the risk criterion.
- Apply the concepts of managerial economics in construction management

GECY111 PROGRAMMING USING MATLAB & SIMULINK

L	T	P	C
1	0	2	2

OBJECTIVES:

The aim of this course is to:

- Teach students how to mathematically model engineering systems
- Teach students how to use computer tools to solve the resulting mathematical models. The computer tool used is MATLAB and the focus will be on developing and solving models of problems encountered in engineering fields

MODULE I INTRODUCTION MATLAB DATA PRESENTATION 03+06

Vectors, Matrices -Vector/Matrix Operations & Manipulation- Functions vs scripts-Making clear and compelling plots-Solving systems of linear equations numerically and symbolically- Least squares regression -Curve fitting.

MODULE II MATLAB PLOT FUNCTION 03+06

Introduction- Plot Function – Animation- 3D Plots-Customizing Plots – Plot Applications- Saving &Painting Plots.

MODULE III ROOT FINDING AND COMPUTER REPRESENTATION OF NUMBERS 03+06

Linearization and solving non-linear systems of equations- The Newton-Rapson method- Integers and rational numbers in different bases- Floating point numbers-Round off and errors in basic arithmetic-Significant digits when reporting results

MODULE IV ORDINARY DIFFERENTIAL EQUATIONS 03+06

Numerical integration and solving 1^{st} order, ordinary differential equations (Euler's method and Runge-Kutta) – Use of ODE function in MATLAB

MODULE V NON-LINEAR DIFFERENTIAL EQUATIONS 03+06

Converting 2^{nd} order and higher ODEs to systems of 1^{st} order ODEs- Solving systems of ODEs via Euler's method and Runge-Kutta) – Solving single and systems of non-linear differential equations by linearization-Use of the function ODE in MATLAB to solve differential equations

MODULE VI INTRODUCTION OF SIMULINK 03+06

Simulink & its relations to MATLAB – Modeling a Electrical Circuit- Modeling a fourth order differential equations- Modeling the solution of three equations with three unknowns- Representing a model as a subsystem-Simulink demos.

Total Hours: 45

REFERENCE:

1. Griffiths D V and Smith I M, Numerical Methods for Engineers, Blackwell, 1991.
2. Laurene Fausett, Applied Numerical Analysis Using MATLAB, Pearson 2008.
3. Moin P, Fundamentals of Engineering Numerical Analysis, Cambridge University Press, 2001.
4. Wilson HB, Turcotte LH, Advanced mathematics and mechanics applications using MATLAB. CRC Press, 1997
5. Ke Chen, Peter Giblin and Alan Irving, Mathematical Exploration with MATLAB, Cambridge University Press, 1999.

OUTCOMES:

At the end of this unit students will be able to:

- Use Matlab as a convenient tool for solving a broad range of practical problems in engineering from simple models to real examples.
- Write programs using first principles without automatic use of built-in ones.
- Write programs for solving linear and nonlinear systems, including those arising from boundary value problems and integral equations, and for root-finding and interpolation, including piecewise approximations.
- Be fluent in exploring Matlab's capabilities, such as using matrices as the fundamental data-storage unit, array manipulation, control flow, script and function m-files, function handles, graphical output.
- Make use of Maltab visual capabilities for all engineering applications.
- An ability to identify, formulate, and solve engineering problems. This will be accomplished by using MATLAB to simulate the solution to various problems in engineering fields

GECY112 JAVA PROGRAMMING

L	T	P	C
2	0	0	2

OBJECTIVES:

- To learn the fundamentals of Java programming such as data types, variables and arrays.
- To study the syntax and necessity of decision making and iterative statements.
- To create a class and invoke the methods.
- To instigate programming in overloading of methods.
- To emphasize the concept of packages.
- To learn the exception handling routines.

MODULE I INTRODUCTION TO JAVA PROGRAMMING 15

History and Evolution of Java – Overview of Java – Data types, variables and arrays – Operators – Control statements.

MODULE II METHODS AND CLASSES 15

Class fundamentals – Declaring objects – Methods – Constructors – Garbage collection – Overloading methods – Constructor overloading – Access control – Inheritance – Packages - Exception handling.

Total Hours: 30

REFERENCES:

1. Herbert Schildt, Java The Complete Reference, 9th Edition, Oracle Press, 2014, ISBN: 978007180855-2.
2. Nicholas S. Williams, Professional Java for Web Applications: Featuring WebSockets, Spring Framework, JPA Hibernate and Spring Security (WROX), John Wiley & Sons, 2014, ISBN:978111865651-8.
3. E Balagurusamy, Programming with Java, 5th Edition,Tata Mcgraw Hill,2014.
4. Yashavant Kanetka**,** Let Us Java, 2nd Edition, BPB Publications, 2012**.**

OUTCOMES:

Students to complete this course will be able to

- Implement basic Java programming.
- Create a class and invoke methods for real world problems.
- Construct simple overloading of methods programs.
- Implement various types of inheritance concepts.
- Describe the access control mechanism.

GECY113 PYTHON PROGRAMMING

L	T	P	C
2	0	0	2

OBJECTIVES:

- To learn the list and records of python programming.
- To study the control statements and string functions of python.
- To instigate the fundamental python programming.
- To emphasize GUI in python.
- To integrate python with embedded systems.
- To implement programs in python.

MODULE I INTRODUCTION TO PYTHON PROGRAMMING 15

Installation and environment set up – syntax used in python – variable types – operators – Loops – decision making – string functions - formatted files - GUI basics.

MODULE II EMBEDDED PROGRAMMING USING PYTHON 15

Web interface – system tools – script execution context - Motion-triggered LEDs-Python-arduino prototyping-storing and plotting arduino data-Remote home monitoring system.

Total Hours : 30

REFERENCES:

1. Nick Goddard, “Python Programming”, 2nd edition, ISBN: 1533337772, 2016.
2. Pratik Desai, “Python Programming for Arduino”, 1st edition, Packt publishing, 2015, ISBN: 9781783285938.
3. Mark Lutz, Learning Python: Powerful Object-Oriented Programming, 5th Edition, O'Reilly Media, 2013.

4. Richard H. Barnett, Sarah Cox, Larry O'Cull, “Embedded C Programming and the Atmel AVR”, 2nd edition, 2006.

5. Michael Barr, Anthony Massa, “Programming Embedded Systems”, 2nd Edition, O'Reilly Media, 2006.

OUTCOMES:

Students to complete this course will be able to

- Implement date and time function programming using python.
- Write formatted file programming.
- Construct simple python programs.
- Create web interface using python programming
- Develop embedded system with python programming.
- Build arduino prototype using python programming.

GECY114 INTELLECTUAL PROPERTY RIGHTS (IPR)

L	T	P	C
1	0	0	1

OBJECTIVES:

- To study about Intellectual property rights and its need
- To explore the patent procedure and related issues

MODULE I INTRODUCTION 07

Introduction and the need for intellectual property right (IPR) – IPR in India – Genesis and Development – IPR in abroad – Important examples of IPR – Copyrights, Trademarks, Patents, Designs, Utility Models, Trade Secrets and Geographical Indications – Industrial Designs

MODULE II PATENT 08

Concept of Patent – Product / Process Patents & Terminology – Duration of Patents – Law and Policy Consideration Elements of Patentability –- Patentable Subject Matter – Procedure for Filing of Patent Application and types of Applications – Procedure for Opposition – Revocation of Patents – Working of Patents- Patent Agent – Qualification and Registration Procedure – Patent databases and information system – Preparation of patent documents – Process for examination of patent application- Patent infringement – Recent developments in patent system

Total Hours: 15

REFERENCES

1. B.L.Wadehra; Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India 2000
2. Ajit Parulekar and Sarita D' Souza, Indian Patents Law – Legal & Business Implications; Macmillan India ltd , 2006
3. P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi, 2010.
4. E. T. Lokganathan, Intellectual Property Rights (IPRs): TRIPS Agreement & Indian Laws Hardcover, 2012
5. Alka Chawla, P N Bhagwati , Law of Copyright Comparative Perspectives 1st Edition, LexisNexis, 2013
6. V. K. Ahuja, Law Relating to Intellectual Property Rights 2nd Edition, LexisNexis, 2nd Edition, 2013

7. Deborah E. Bouchoux, Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets, 2015
8. Jatindra Kumar Das, Law of Copyright, PHI Learning, 2015

COURSE OUTCOMES:

Students should be able to

- Identify the various types of intellectual property and their value
- Apply the procedure to file a patent and to deal the related issues
- Search and extract relevant information from various intellectual database

CURRICULUM AND SYLLABI

REGULATIONS - 2016

(As approved by the 9th Academic Council)

M. Tech.

COMMUNICATION SYSTEMS

B.S.ABDUR RAHMAN UNIVERSITY

B.S. ABDUR RAHMAN INSTITUTE OF SCIENCE & TECHNOLOGY
(Estd. u/s 3 of the UGC Act, 1956)

(FORMERLY B.S. ABDUR RAHMAN CRESCENT ENGINEERING COLLEGE)
Rated with A Grade by National Assessment and Accreditation Council
Seethakathi Estate, G.S.T. Road, Vandalur, Chennai - 600 048
www.bsauniv.ac.in

REGULATIONS, CURRICULUM AND SYLLABI

M. Tech.
COMMUNICATION SYSTEMS

(As approved by the 9th Academic Council)

JULY 2016

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VISION AND MISSION OF THE DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

VISION

The Department of Electronics and Communication Engineering envisions to be a leader in providing state of the art education through excellence in teaching, training, and research in contemporary areas of Electronics and Communication Engineering and aspires to meet the global and socio economic challenges of the country.

MISSION

- The Department of Electronics and Communication Engineering, endeavors to produce globally competent Engineers prepared to face challenges of the society.
- To enable the students to formulate, design and solve problems in applied science and engineering.
- To provide excellent teaching and research environment using state of the art facilities.
- To provide adequate practical training to meet the requirement of the Electronics & communication industry.
- To train the students to take up leadership roles in their career or to pursue higher education and research.

PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES

M. Tech. (COMMUNICATION SYSTEMS)

PROGRAMME EDUCATIONAL OBJECTIVES:

- To educate and train the graduates with knowledge and skills necessary to formulate, design and solve problems in communication systems, advanced radiation systems, signal processing, optical and computer networks.
- To provide knowledge in software and hardware tools for real time applications in RF system design, Wireless Communication, Signal Processing and Network design.
- To provide scope for Applied Research and innovation in the various domains of communication system, enabling the graduates to carry out research and development in Industry and Academia.
- To enhance communication and soft skills of students to make them work effectively as a team.

PROGRAMME OUTCOMES:

On completion of the program, the graduates will

- Have the ability to design and analyze different types of communication systems.
- Have the capability to develop real time applications in the area of RF system design, Wireless Communication, Signal Processing and Network design using software and hardware tools.
- Be able to undertake research projects and disseminate the knowledge to the society in the related domains of communication systems.
- Be able to communicate effectively and work as a team in their professional career.

CURRICULUM & SYLLABI FOR M.TECH. (COMMUNICATION SYSTEMS) (FOUR SEMESTERS / FULL TIME)

CURRICULUM

Sl. No.	Course Code	Course Title	L	T	P	C
		SEMESTER I				
1	MAC6184	Probability Matrix Theory & Linear Programming	**3**	**1**	**0**	**4**
2	ECC6101	Mobile Communication Networks and Modeling	**3**	**0**	**2**	**4**
3	ECC6102	Satellite Communication	**3**	**0**	**0**	**3**
4	ECC6103	Advanced Digital Communication Techniques	**3**	**0**	**2**	**4**
5	ECC6104	Advanced Digital Signal Processing	**3**	**1**	**0**	**4**
6		Professional Elective – Minimum of ‘3’ credits to be earned				**3**
						22
		SEMESTER II				
1	GEC6201	Research Methodology for Engineers	**3**	**0**	**0**	**3**
2	ECC6201	Optical Networks	**3**	**0**	**0**	**3**
3	ECC6202	Advanced Radiation Systems and practice	**3**	**0**	**2**	**4**
4		Professional Electives – Minimum of ‘9’ credits to be earned				**9**
						19
		SEMESTER III				
1	GEC	General Elective	**3**	**0**	**0**	**3**
2		Professional Electives – Minimum of ‘6’ credits to be earned				**6**
3	ECC7101	Project Work - Phase I*	**0**	**0**	**12**	**6***
4	ECC7102	Mini Project / Internship**	**0**	**0**	**3**	**1**
						10

Sl. No.	Course Code	Course Title	L	T	P	C
		SEMESTER IV				
1	ECC7101	Project Work - Phase II	**0**	**0**	**36**	**18***
						18 + 6 = 24
						Total Credits: 75

* Credits for Project Work Phase I to be accounted along with Project Work Phase II in IV Semester

** Internship has to be carried out at the end of second semester during summer vacation

PROFESSIONAL ELECTIVES

Sl. No.	Course Code	Course Title	L	T	P	C
1	ECCY001	Digital Image Processing	**3**	**0**	**0**	**3**
2	ECCY002	Advanced Microwave systems	**3**	**0**	**0**	**3**
3	ECCY003	Cognitive and Cooperative Radio Communications	**3**	**0**	**0**	**3**
4	ECCY004	Digital Communication Receivers	**3**	**0**	**0**	**3**
5	ECCY005	Electromagnetic Interference and Compatibility in System Design	**3**	**0**	**0**	**3**
6	ECCY006	Error Control Coding	**3**	**0**	**0**	**3**
7	ECCY007	Global Tracking and Positioning Systems	**3**	**0**	**0**	**3**
8	ECCY008	High Performance Communication Networks	**3**	**0**	**0**	**3**
9	ECCY009	Internet of Things	**3**	**0**	**0**	**3**
10	ECCY010	Internet Working Multimedia	**3**	**0**	**0**	**3**
11	ECCY011	Medical Image Processing	**3**	**0**	**0**	**3**
12	ECCY012	Microstrip Antennas	**3**	**0**	**0**	**3**
13	ECCY013	Microwave Integrated Circuits	**3**	**0**	**0**	**3**
14	ECCY014	MIMO systems	**3**	**0**	**0**	**3**
15	ECCY015	Multimedia Compression Techniques	**3**	**0**	**0**	**3**
16	ECCY016	Network Security	**3**	**0**	**0**	**3**
17	ECCY017	QoS in Ad Hoc Wireless Networks	**3**	**0**	**0**	**3**
18	ECCY018	Quantum Computing	**3**	**0**	**0**	**3**
19	ECCY019	RF System Design	**3**	**0**	**0**	**3**
20	ECCY020	RF Wireless Systems and Standards	**3**	**0**	**0**	**3**
21	ECCY021	Simulation of Communication Systems & Networks	**3**	**0**	**0**	**3**
22	ECCY022	Speech and Audio Signal Processing	**3**	**0**	**0**	**3**

Sl. No.	Course Code	Course Title	L	T	P	C
23	ECCY023	Statistical Signal Processing	**3**	**0**	**0**	**3**
24	ECCY024	Vehicular AD HOC Networks	**3**	**0**	**0**	**3**
25	ECCY025	Wireless Communication	**3**	**0**	**0**	**3**
26	ECCY026	Wireless sensor Networks	**3**	**0**	**0**	**3**
27	ECCY027	Communication System Design and Analysis	**2**	**0**	**2**	**3**
28	ECCY028	Adaptive Signal Processing	**2**	**0**	**0**	**2**
29	ECCY029	Classical and Advanced Techniques For Optimization	**2**	**0**	**0**	**2**
30	ECCY030	Network Routing Algorithms	**2**	**0**	**0**	**2**
31	ECCY031	Pattern Recognition Techniques and Applications	**2**	**0**	**0**	**2**
32	ECCY032	Radiation Systems for Personal area Network	**2**	**0**	**0**	**2**
33	ECCY033	Bio signal Processing	**1**	**0**	**0**	**1**
34	ECCY034	Ultrasonic Principles and Applications	**1**	**0**	**0**	**1**
35	ECCY060	Software for Embedded Systems	**2**	**0**	**2**	**3**
36	MACY081	Signal Processing Techniques	**3**	**1**	**0**	**4**

GENERAL ELECTIVES FOR M.TECH PROGRAMMES

Sl. No.	Course Code	Course Title	L	T	P	C
1	GECY101	Project Management	**3**	**0**	**0**	**3**
2	GECY102	Society, Technology & Sustainability	**3**	**0**	**0**	**3**
3	GECY103	Artificial Intelligence	**3**	**0**	**0**	**3**
4	GECY104	Green Computing	**3**	**0**	**0**	**3**
5	GECY105	Gaming Design	**3**	**0**	**0**	**3**
6	GECY106	Social Computing	**3**	**0**	**0**	**3**
7	GECY107	Soft Computing	**3**	**0**	**0**	**3**
8	GECY108	Embedded System Programming	**3**	**0**	**0**	**3**
9	GECY109	Principles of Sustainable Development	**3**	**0**	**0**	**3**
10	GECY110	Quantitative Techniques in Management	**3**	**0**	**0**	**3**
11	GECY111	Programming using MATLAB & SIMULINK	**1**	**0**	**2**	**2**
12	GECY112	JAVA Programming	**1**	**0**	**2**	**2**
13	GECY113	PYTHON Programming	**1**	**0**	**2**	**2**
14	GECY114	Intellectual Property Rights	**1**	**0**	**0**	**1**

SEMESTER I

MAC 6184	PROBABILITY, MATRIX THEORY AND LINEAR PROGRAMMING	L	T	P	C
		3	1	0	4

OBJECTIVE:

The aim of this course is to

- provide a comprehensive introduction to the probability distributions used in engineering.
- familiarize students with advanced matrix theory and variational problems.
- expose the students to Operations Research using concepts of linear programming.

MODULE I PROBABILITY DISTRIBUTIONS 10+03

Axioms of probability – addition and multiplication theorem – conditional probability – total probability – random variables - moments – moments generating functions and their properties- Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

MODULE II TWO DIMENSIONAL RANDOM 08+03

Joint distributions - marginal and conditional distributions - functions of random variables - covariance - correlation and regression - Central limit theorem.

MODULE III ADVANCED MATRIX 09+03

Matrix norms - singular value decomposition - QR algorithm - pseudo inverse - least square approximations.

MODULE IV LINEAR PROGRAMMING 10+03

Formation - graphical method - simplex method - Big-M method - Two Phase method - transportation and assignment problems.

MODULE V CALCULUS OF VARIATIONS 08+03

Variation and its properties – Euler's equation – functional dependant on first and higher order derivatives – functional dependant on functions of several independent variables – variational problems with moving boundaries – isoperimetric problems – Ritz and Kantorovich methods.

L – 45; T – 15; Total – 60

TEXT BOOKS:

1. S.M.Ross, “A First Course in Probability”, 9th edition, Pearson Education, 2013.
2. Lewis.D.W., “Matrix Theory”, Allied Publishers, Chennai, 1995.
3. Taha, H.A., “Operations Research - An Introduction ", 10th edition, Pearson Prentice Hall, 2016.
4. A.S. Gupta, “Calculus of variations with applications”, PHI Pvt. Ltd, New Delhi, 2011.

REFERENCES:

1. H. Cramer., “Random Variables and Probability Distributions”, Cambridge University Press (2004).
2. Roger A. Horn, Charles R. Johnson, “Matrix Analysis”, Cambridge University Press; 2nd edition (2012).
3. Robert.J.Vanderbei., “Linear Programming: Foundations and Extensions”, Springer US(2014).
4. David. J. Rader., “Deterministic Operations Research”, Wiley (2010).
5. Elsgolts, “Differential Equations and Calculus of Variations", University Press of the Pacific (2003).

OUTCOMES:

At the end of the course students will be able to

- Solve problems using concept of standard, discrete and continuous distributions.
- Solve problems using one dimensional and two dimensional random variables.
- Find Eigen values and Eigen vectors of a higher order matrix.
- Solve problems of linear programming.
- Solve problems of calculus of variations by direct methods and using Euler’s formulae.

ECC6101 MOBILE COMMUNICATION NETWORKS AND MODELLING

L	T	P	C
3	0	2	4

OBJECTIVES:

- To define the principles used in the design of mobile communications networks.
- To learn the technical issues in the operation and management of mobile communications networks
- To discuss about various wireless local area networks
- To explain the security issues in wireless networks
- To introduce the propagation Models and Path Loss Estimation in Cellular Mobile Communication
- To analyze and evaluate the performance of mobile networks

MODULE I MOBILE COMMUNICATION NETWORKS 09

Review of 1G, 2G, 3G, 4G and 5G wireless networks, introduction to 3GPP cellular systems, medium access techniques, Mobile networks Elementary Principles of cellular Telephony Channel Division Techniques (TDMA, FDMA, CDMA), Cellular Coverage Methods, Network Planning and Resource Allocation, Network Dimensioning, Mobility Management Procedures.

Practical

Performance evaluation of CDMA System using simulation.

MODULE II PROPAGATION MODELS AND AIR PROTOCOL 09

Radio propagation models, error control techniques, handoff, power control, Soft handover, Forward link , Reverse link , common air protocols (AMPS, IS-95, IS-136, GSM, GPRS, EDGE, WCDMA, cdma2000, etc).

Practical

Simulation of Propagation Models and Path Loss. Estimation in Cellular Mobile Communication; Estimation of Received Bit Energy for Data Rates in Wireless Communication; Multipath Fading in Cellular Mobile Communication,

MODULE III MOBILE NETWORK ARCHITECTURE 09

General Architecture definition, Mobile Terminals (MT, SIM) Radio Section (BTS, BSC) Core Network (MSC, G-MSC, VLR, HLR, AuC) User and Control Plane Protocol Stack, MAP, Role of Signaling Interfaces, Network Entities Relation, The Physical Channel, The Logical Channels, Terminals, Call and Network Management Procedures.

Practical

Design of Cellular Mobile System

MODULE IV WIRELESS LOCAL AREA NETWORKS 09

Wireless Local Area Networks, General Characteristics of the Hyper LAN System, 802.11 Standard, Basic DCF access scheme DCF Access Scheme with Handshaking, PCF Access Scheme, The 802.11a Standard, Mobile Ad Hoc Networks, Wireless Sensor Networks, over view of Bluetooth technology.

MODULE V SECURITY ISSUES AND NETWORK SIMULATOR 09

Security in Wireless Networks, Secure routing, Key Pre-distribution and Management, Encryption and Authentication, Security in Group Communication, Trust Establishment and Management, Denial of Service Attacks, Energy-aware security mechanisms, Location verification, Security on Data fusion, Overview of Network Simulator.

Practical

Simulation of Security Algorithms;Simulator based performance analysis of wireless networks.

L – 45, P – 30; Total Hours :75

REFERENCES:

1. William Stallings, "Wireless Communications and Networks", Prentice Hall, 2002.
2. T.S. Rappaport, "Wireless Communications: Principles & Practice", Second Edition, Prentice Hall, 2002.
3. Leon-Garcia and I. Widjaja, "Communication Networks, Fundamental Concepts and Key Architectures", McGraw-Hill, 2000.
4. J.Schiller, “Mobile Communications", Addison Wesley, 2000.
5. Yi-Bang Lin, ImrichChlamtac, “Wireless and mobile network architectures”, Wiley India, 2011.
6. Holger Karl, Andreas Willing, “Protocols and Architectures for Wireless Sensor Networks” Wiley 2012.
7. William Stallings, “Cryptography and Network Security”, Pearson Education, 2004.

OUTCOMES:

At the end of the course the student will be able to

- Describe the architectures of mobile networks

- Compare various network management techniques
- Explain radio propagation Model in mobile networks
- Use simulation tools to design and validate the propagation Models and Path Loss Estimation in Cellular Mobile Communication
- Describe and analyze the performance of CDMA
- Analyze the security issues in Wireless Networks.

ECC6102 SATELLITE COMMUNICATION

L	T	P	C
3	0	0	3

OBJECTIVES:

The aim of this course is

- To describe the concept of orbits and spacecraft subsystems
- To design uplinks and down links with various multiple access techniques
- To list and choose the services of satellites for different application
- To discuss the functional details of VSAT, GPS and DTH system

MODULE I SATELLITE SUBSYSTEMS 09

Review of satellite orbital mechanics - satellite subsystem - altitude and orbit control system - telemetry tracking command and monitoring - power system - communication subsystem, satellite antennas.

MODULE II SATELLITE LINK DESIGN AND ERROR CONTROL FOR DIGITAL SATELLITE LINKS 09

Basic transmission - system noise temperature and G/T ratio - design of down links - satellite system using small earth station- uplink design - design of specified C/N - system design examples. Error detection and correction for digital satellite links - channel capacity - error control coding- performance of block error correction codes- convolutional codes, implementation of error detection on satellite links- concatenated coding and interleaving-turbo codes

MODULE III MULTIPLE ACCESS SCHEMES FOR SATELLITE COMMUNICATION 11

Frame structures of FDMA, TDMA and CDMA in Satellite communication - onboard processing - packet radio systems and protocols

MODULE IV VSAT & GPS SYSTEM 10

Overview of VSAT systems - network architecture- access control protocols-basic techniques, VSAT earth station Engineering - GPS Introduction - position location principles - Receivers and codes - satellite signal acquisition - GPS Signal Message - signal levels - timing accuracy - GPS receiver operation, GPS C/A code accuracy - differential GPS

MODULE V DTH 06

DTH system architecture – Satellite Architecture – Orbital Interference Limitation Difference among DTH systems- Current scenario in DTH

Total Hours: 45

References:

1. Timothy Pratt, Charles W Bostian, Jeremy E Allnut, “Satellite Communication” Wiley, Edition 2007.
2. Bruce R. Elbert, “The Satellite Communication Applications Hand Book”, Artech House Boston,1997.
3. Wilbur L. Pritchard, Hendri G. Suyderhood, Robert A.Nelson, “Satellite Communication Systems Engineering”, 2nd edition, Prentice Hall, New Jersey.1993.
4. Dennis Rody, “Satellite Communication”, 4th edition, Regents/Prentice Hall, Eaglewood Cliff, New Jersey, 2006.

OUTCOMES:

On completion of the course the student will be able to

- Define and discuss the orbital parameters, launching mechanism and various subsystems of spacecraft.
- Use the mathematical framework of satellite links to various types of satellites and its services
- Design and estimate the uplinks and down links with various multiple access techniques
- Analyze the services of satellites for various applications
- Estimate the performance measures of satellite link
- Assess the architecture of VSAT, GPS and DTH system to meet desired needs within realistic constraints.

ECC6103	ADVANCED DIGITAL COMMUNICATION TECHNIQUES	L	T	P	C
		3	0	2	4

OBJECTIVES:

To make the student understand

- concepts of coherent and non-coherent communications.
- the effects of communication over band limited and fading channels
- the concepts of various coding and spread spectrum techniques.

Prerequisites :

- Digital Communication
- Probability and Random Process
- Discrete time signal Processing
- Programming skills in Matlab/ Labview software

MODULE I POWER SPECTRUM AND COMMUNICATION OVER MEMORYLESS CHANNEL 09

Complex base band signal representation, PSD of a Synchronous Data Pulse Stream, PSD of random binary signals, Scalar and Vector communication over Memoryless Channel .

Practical

- Spectral estimation of random binary signals
- Performance evaluation of digital base band communication

MODULE II COHERENT AND NON-COHERENT COMMUNICATION 09

Coherent receivers, Optimum receivers in AWGN, IQ Modulation & Demodulation. Non-coherent receivers in Random Phase and Random Amplitude Channels, M-FSK receivers, Rayleigh and Rician channels. Detector: Optimum rule for ML and MAPDetection; Performance: Bit-error-rate, symbol error rate for coherent and non-coherent schemes.

Practical

- Generation of digitally modulated signals and their constellations
- DPSK – BER Performance analysis

MODULE III COMMUNICATION OVER BANDLIMITED CHANNELS 09

Pulse shape design for channels with ISI: Nyquistpulse,Partial response signaling (duobinary and modified duobinary pulses), demodulation; Channel with distortion:

Design of transmitting and receiving filters for a known channel and for time varying channel (equalization);Performance: Symbol by symbol detection and BER,CPM : CPFM,CPFSK, MSK and GMSK

Practical

- Performance evaluation IQ modulations : QPSK, QAM

MODULE IV BLOCK CODED DIGITAL COMMUNICATION 09

Architecture and performance of Binary block codes: Orthogonal, Bi- orthogonal and Transorthogonal. Linear block codes, cyclic codes. Shannon's channel coding theorem: Channel capacity, Matched filter. Concepts of TDMA, CDMA, OFDMA,FDD, TDD.

Practical

- Simulation of LBC and Cyclic codes
- Generation and detection of CDMA using various spreading codes

MODULE V CONVOLUTIONAL CODED DIGITAL COMMUNICATION 09

Representation of codes using Polynomial, State diagram, Tree diagram, and Trellis diagram .Decoding techniques using Maximum likelihood, Sequential and Threshold methods.Error probability performance for BPSK and Viterbi algorithm.Turbo Coding.

Practical

- Simulation of coding and decoding of Convolutional codes
- Error probability performance

L – 45, P – 30; Total – 75

REFERENCES:

1. J. G. Proakis and M. Salehi, "Fundamentals of Communication Systems", Pearson Education, 2005.
2. S. Haykins, "Communication Systems", 5th ed., John wiley, 2008.
3. M. K. Simon, S. M. Hinedi and W. C. Lindsey," Digital Communication Techniques: Signaling and detection", Prentice Hall India, N. Delhi, 1995.
4. Andrew J. Viterbi, Jim K. Omura, "Principles of Digital Communication and Coding", McGraw-Hill Inc.1979.
5. M. K. Simon and M. S. Alouini," Digital Communication over Fading Channe"l, 2nd Ed., Wiley publications,2000
6. Ian Glover, Peter Grant, "Digital Communications", Prentice Hall, 2003 Edition

7. Bernard Sklar – “Modern Digital Communication Technique – Fundamental & Applications”, Prentice Hall, 2001 Edition

OUTCOMES:

On completion of the course the student will be able to

- Summarize the concepts of coherent and non-coherent communication techniques
- Perform simulation experiments on various base band digital communication systems
- Evaluate theoretically bit/ symbol error probability analysis
- Apply the concepts of digital modulation schemes
- Design and develop various coding schemes for digital communication systems
- Assess and justify performance of band limited and coded digital communication systems

ECC6104 ADVANCED DIGITAL SIGNAL PROCESSING

L	T	P	C
3	1	0	4

OBJECTIVES:

Make the students to

- Describe the use of various transforms in digital signals & systems analysis.
- Estimate the spectrum of Discrete Random Signals.
- Model and design adaptive filters.
- Explain the concepts of multirate signal processing
- Choose the DSP processor for various applications

MODULE I TRANSFORMS AND THEIR APPLICATIONS 06

Review of Z Transform, Discrete Fourier Transform, Discrete Time Fourier Transform, Discrete Fourier series. Introduction to Discrete Wavelet Transform.Haarwavelet.Application of transforms to discrete signals.

MODULE II DISCRETE TIME RANDOM PROCESSES AND SPECTRUM ESTIMATION 09

Deterministic process – Stochastic (random) process – Auto correlation & auto covariance of random processes – Cross correlation of random variables – Ergodic random process – Gaussian random process – Stationary & WSS random process – Power spectrum – Parseval's theorem – Wiener-Khinchine theorem – Spectral factorization – Periodogram - Modified periodograms using Bartlett , Welch, Blackman &Tukey windows – AR, MA, ARMA model based spectral estimation – Yule-Walker Equations – Durbin's algorithm.

MODULE III SIGNAL MODELING AND OPTIMUM FILTERS 08

Least square method model – Prony's pole-zero model – Prony's all pole model – Levinson-Durbin's recursion – Lattice filters – Forward & backward linear prediction filters.

MODULE IV ADAPTIVE FILTERS 08

FIR adaptive filters – Steepest descent method - Widrow-Hoff LMS algorithm – Normalized LMS method – Adaptive channel equalization – Adaptive noise cancellation – IIR adaptive filters - RLS filters.

MODULE V MULTIRATE DIGITAL SIGNAL PROCESSING 08

Need for multirate sampling – Decimation – Interpolation - Poly-phase filters – Multistage implementation –Phase shifters – Sub-band coders – Trans multiplexers– Quadrature mirror filters.

MODULE VI DSP PROCESSORS 06

General and special purpose DSP Processors – Computer Architecture for signal processing – Havard Architecture – Pipelining – Hardware Multiply and Accumulate – Special Instructions – Replication – On-chip Memory Cache – Extended Parallelism – SIMD – VLIW and static super-scalar Processing – Brief study of TMS320C4X and ADSP 2106 processors.

Total Hours: 60

REFERENCES:

1. Monson H.Hayes , “Statistical digital signal processing and modeling” – JohnWiley& Sons – 2005.
2. John G.Proakis&DimitrisG.Maolakis –“ DSP principles, algorithms & applications” – 4th edition – Pearson Education – 2007.
3. A.V.Oppenheim and R.W Schafer, Englewood, “ Digital Signal Processing”, Prentice Hall, Inc. 2006.
4. B. Venkatramani&M.Bhaskar, “Digital Signal Procesors architecture”, “Programming and applications”, Tata McGraw Hill, 2002.
5. Andreas Antoniou, “Digital signal Processing Processing”, Tata McGraw Hill,second edition, 2008.
6. Stewen W. Smith, “Digital signal Processing Processing” –“ A practical guide for Engineers and scientist”, Elsevier Science, 2003

OUTCOMES:

The students will be able to,

- Apply various transforms in digital signals & systems analysis.
- Estimate the power spectrum of signals
- Design & analyze digital filters based on signal modeling
- Design & analyze the adaptive filters
- Implement multirate signal processing techniques.
- Summarize various DSP processorarchitectures.

SEMESTER II

GEC6201	RESEARCH METHODOLOGY FOR ENGINEERS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide a perspective on research to the scholars
- To educate on the research conceptions for designing the research
- To impart knowledge on statistical techniques for hypothesis construction
- To gain knowledge on methods of data analysis and interpretation
- To learn about the effective communication of research finding

MODULE I RESEARCH `PROBLEM FORMULATION 07

Research – objectives – types, Research process, Solving engineering problems, Identification of research topic, Formulation of research problem, Literature survey and review.

MODULE II HYPOTHESIS FORMULATION 08

Research design – meaning and need – basic concepts, Different research designs, Experimental design – principle – important experimental designs, Design of experimental setup, Mathematical modeling, Simulation – validation and experimentation, Dimensional analysis and similitude.

MODULE III STATISTICAL TECHNIQUES 12

Statistics in research – concept of probability – popular distributions –Hypothesis testing- sample design- Design of experiments – factorial designs -– orthogonal arrays- ANOM - ANOVA - Multivariate analysis - Use of optimization techniques – traditional methods – evolutionary optimization techniques –Transportation model.

MODULE IV STATISTICAL ANALYSIS OF DATA 10

Research Data analysis – interpretation of results – correlation with scientific facts- Accuracy and precision – error analysis, limitations - Curve fitting, Correlation and regression.

MODULE V RESEARCH REPORT 08

Purpose of written report – audience, synopsis writing, preparing papers for International journals, Thesis writing – organization of contents – style of writing –

graphs and charts – referencing, Oral presentation and defence, Ethics in research, Patenting, Intellectual Property Rights.

Total Hours: 45

REFERENCES:

1. Ganesan R., Research Methodology for Engineers, MJP Publishers, Chennai, 2011.
2. Ernest O., Doebelin, Engineering Experimentation: planning, execution, reporting, McGraw Hill International edition, 1995.
3. George E. Dieter., Engineering Design, McGraw Hill – International edition, 2000.
4. Madhav S. Phadke, Quality Engineering using Robust Design, Printice Hall, Englewood Cliffs, New Jersey, 1989.
5. Kothari C.R., Research Methodology – Methods and Techniques, New Age International (P) Ltd, New Delhi, 2003.
6. Kalyanmoy Deb., “Genetic Algorithms for optimization”, KanGAL report, No.2001002.
7. Holeman, J.P., Experimental methods for Engineers, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 2007.
8. Govt. of India, Intellectual Property Laws; Acts, Rules & Regulations, Universal Law Publishing Co. Pvt. Ltd., New Delhi 2010.
9. University of New South Wales, “How to write a Ph.D. Thesis” Sydney, Australia, Science @ Unsw.
10. Shannon. R.E., System Simulation: the art and science, Printice Hall Inc, Englewood Cliffs, N.J.1995.
11. Scheffer. R.L. and James T. Mc Clave, Probability and Statistics for Engineers, PWS – Kent Publishers Co., Boston, USA, 1990.

OUTCOMES:

Students should be able to

- Formulate the research problem
- Design and Analyse the research methodology
- Construct and optimize the research hypothesis
- Analyse and interpret the data
- Report the research findings

ECC6201 OPTICAL NETWORKS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the evolution of optical network and their classification.
- To impart knowledge on optical components and network.
- Toexplain optical networks architecture and standards
- Discussthe issues in design and management of optical networks.

MODULE I INTRODUCTION TO OPTICAL NETWORKS 06

Telecommunication networks, First generation optical networks, Multiplexing techniques, Second generation optical networks, Optical layer, Transmission basics,Introduction to Li-Fi, VLC, optical wireless, optical attocell, Network evolution.

MODULE II OPTICAL COMPONENTS 12

Optical Components - Couplers, Isolators & Circulators, Multiplexers & Filters Optical Amplifiers, Switches, Wavelength Converters.

Transmission System Engineering- System model, Power penalty - transmitter, receiver, Opticalamplifiers, crosstalk, dispersion; Wavelength stabilization ; Overall design considerations.

MODULE III OPTICAL NETWORK ARCHITECTURES 09

WDM networks, SONET / SDH, Metropolitan-Area Networks, Layered Architecture; Broadcast and Select Networks- Topologies for Broadcast Networks, Media Access Control Protocols, Wavelength Routing Architecture.

MODULE IV WAVELENGTH ROUTING NETWORKS 09

WDM Network Elements; WDM Network Design - Cost tradeoffs, Virtual Topology Design, Routing and wavelength assignment, Statistical Dimensioning Models.

MODULE V NETWORK MANAGEMENT AND SURVIVABILITY 09

Control and Management – Network management functions, Configuration management, Performance management, Fault management, Optical safety, Service interface; network Survivability- Protection in SONET / SDH and IP Networks, Optical layer Protection, Interworking between layers.

Total Hours:45

REFERENCES:

1. Rajiv Ramaswamy, Kumar N. Sivaranjan and Galen H. Sasaki, "Optical Networks – A practical perspective", 3rd edition, Elsevier, 2010.
2. C.Siva Ram Moorthy and Mohan Gurusamy, “WDM Optical Networks: Concept, Design and Algorithms”, PHI, 1st Edition, 2002.
3. P.E.Green, jr., "Fiber Optical Networks", Prentice Hall, New Jersy, 1993.
4. John M. Senior, “Optical Fiber Communications –Principles and Practice”, Pearson Education, 2009.
5. Biswanath Mukherjee, “Optical Communication Networks”, McGraw-Hill, 1997.

OUTCOMES:

After successful completion of the course, student will be able to

- Explain the operation of various optical components applied in optical networks.
- Define the fundamental concepts of optical networks and characteristics.
- Describe the optical network protocols.
- Distinguish between physical and logical topologies of WDM optical networks.
- Analyze the need and methods of efficient routing in optical networks.
- Analyze the main functions of the optical network management

ECC6202 ADVANCED RADIATION SYSTEMS AND PRACTICE

L	T	P	C
3	0	2	4

OBJECTIVES:

- To impart knowledge of antenna fundamentals.
- To design microstrip antenna with its feed network.
- To analyze different types of antenna synthesis method
- To discuss the concepts of different aperture antenna.
- To design the suitable antenna systems using antenna simulator
- To impart knowledge of antenna measurement.

MODULE I ANTENNA FUNDAMENTALS 15

Antenna parameters, Radiation from surface and line current distributions, Fields radiated by an alternating current element and half wave dipole, monopole, loop antenna: Total power radiated and radiation resistance. Mobile phone antenna, Broadband antennas and matching techniques: BALUN transformer, polarization states, Introduction to Simulation tool for antenna design.

MODULE II MICRO STRIP ANTENNA 12

Design and implementation: Microstrip dipole, Rectangular patch, Circular patch and Ring antenna. Radiation analysis from cavity model. Input impedance, Microstrip array and feed network, Design of microstrip and meander lineantennausing simulation tool.

MODULE III ARRAY ANTENNA 12

Linear arrays, Two dimensional uniform array: Phased array, beam scanning, grating lobe, feed network, Pattern multiplication, TheDolph-Tschebyscheff Antenna Synthesis,Design Procedures for a Tschebyscheff Synthesis, Genetic Algorithm for antenna synthesis, Simulation of Array antenna, Antenna synthesis.Design of array antenna for Baseband control.

MODULE IV RADIATION FROM APERTURES 09

Duality and the Equivalence Principle, Far-field Radiation from Electric and Magnetic Surface Currents, Tapered Field Distribution in Rectangular Aperture, The H-Sectoral Horn, Universal Radiation Patterns and Directivity for the H-Sectoral and E-Sectoral Horns, Circular Apertures, Paraboloidal Reflectors, Prime Focus Parabolic Reflector and Cassegrain Reflector, Spillover ,Efficiency,Aperture Blockage, and other effects in parabolic antenna.Simulation of slot antenna.

MODULE V ANTENNA MEASUREMENTS 12

Measurements of Gain, Power, HPBW, Impedance and antenna factor. Experimentation of antenna parameters using Microwave test bench.

Total Hours 60

REFERENCES:

1. E.C. Jordan and Balmain, "Electro Magnetic Waves and Radiating Systems", PHI, 1968, Reprint 2003.
2. Constantine A. Ballanis, "Antenna Theory", John Wiley & Sons, second edition, 2003.
3. John D.Kraus and Ronald J. Marhefka, "Antennas for all applications", 3rd Edition Tata McGraw-Hill Book Company, 2006.
4. John D.Kraus, “Radio Astronomy” McGraw-Hill 1966

OUTCOMES:

Students will able to

- Describe and analyze the various antenna parameters and different impedance matching techniques.
- Compare the merits and demerits of various microwave patch antenna structures.
- Analyze the types of antenna arrays.
- Synthesize the antenna arrays
- Distinguish the apertures antennas.
- Design, fabricate the antenna and measure the various antennameasurements.

SEMESTER III

ECC7101 PROJECT WORK – PHASE I

L	T	P	C
0	0	12	6

OBJECTIVES :

- To improve the professional competency and research aptitude
- Aims to develop the work practice of students to apply theoretical and practical tools/techniques
- To solve real life problems related to industry and current research
- To improve the skills towards report/documentation preparation

GUIDELINES:

Project work can be a design project/experimental project and/or computer simulation project on any of the topics of communication systems. The project work is allotted individually on different topics. The students shall be encouraged to do their project work in the parent institute itself. If found essential (Industry oriented Projects), they may be permitted to continue their project outside the parent institute. Department will constitute an Evaluation Committee to review the project work. The Evaluation committee consists of at least three faculty members of which internal guide and another expert in the specified area of the project shall be two essential members.

The student is required to undertake the master research project phase 1 during the third semester and the same is continued in the 4thsemester (Phase 2). Phase 1 consist of preliminary thesis work, two reviews of the work and the submission of preliminary report. First review would highlight the topic, objectives, methodology and expected results. Second review evaluates the progress of the work, preliminary report and scope of the work which is to be completed in the 4th semester. The Evaluation committee consists of at least four faculty members of which internal guide and other experts in the specified area of the project shall be two essential members.

OUTCOME

At the end of the project work phase I the student will be able to

- learn the tool required for the design, analysis of their preliminary work
- Select the specific devicesfor different application alongwith justification
- Apply the practical knowledge while solving real time problems
- Incorporate cost effective and efficient project models
- Conclude the subject knowledge through proto type models
- Prepare an appropriate documentation

ECC7102 MINI PROJECT

L	T	P	C
0	0	3	1

OBJECTIVES :

- To improve the professional competency and research aptitude of students

GUIDELINES:

1. This mini project will help the students to develop the work practice to apply the design skills for solving real life problems.
2. The project can be an experimental project on any of the topics in electronics and communication.
3. The project work is allotted individually on different topics.
4. The students shall be encouraged to do their project in the parent institute itself.
5. Department will constitute an Evaluation Committee to review the project periodically.

OUTCOMES:

At the end of the project the student will be able to

- Design and analyze an electronic system
- Fabricate an electronic system/device in their area of interest
- Improve their presentation skills
- Improve the documentation skills

SEMESTER IV

ECC7101 PROJECT WORK – PHASE II

L	T	P	C
0	0	36	18

OBJECTIVES :

- To improve the professional competency and research aptitude
- Aims to develop the work practice of students to apply theoretical and practical tools/techniques
- To solve real life problems related to industry and current research
- To improve the skills towards report/documentation preparation

GUIDELINES:

Project work can be a design project/experimental project and/or computer simulation project on any of the topics of communication systems. The project work is allotted individually on different topics. The students shall be encouraged to do their project work in the parent institute itself. If found essential (Industry oriented Projects), they may be permitted to continue their project outside the parent institute. Department will constitute an Evaluation Committee to review the project work. The Evaluation committee consists of at least three faculty members of which internal guide and another expert in the specified area of the project shall be two essential members.

The student is required to undertake the master research project phase 1 during the third semester and the same is continued in the 4thsemester (Phase 2). Phase 1 consist of preliminary thesis work, two reviews of the work and the submission of preliminary report. First review would highlight the topic, objectives, methodology and expected results. Second review evaluates the progress of the work, preliminary report and scope of the work which is to be completed in the 4th semester. The Evaluation committee consists of at least four faculty members of which internal guide and other experts in the specified area of the project shall be two essential members.

OUTCOMES:

At the end of the project work phase I the student will be able to

- learn the tool required for the design, analysis of their preliminary work
- Select the specific devicesfor different application alongwith justification
- Apply the practical knowledge while solving real time problems
- Incorporate cost effective and efficient project models
- Conclude the subject knowledge through proto type models
- Prepare an appropriate documentation

PROFESSIONAL ELECTIVES

ECCY001 DIGITAL IMAGE PROCESSING

L	T	P	C
3	0	0	3

OBJECTIVES:

- Describe and explain basic principles of digital image processing;
- Design and implement algorithms that perform basic image processing
- Design and implement algorithms for advanced image analysis
- Assess the performance of image processing algorithms and systems.

MODULE I DIGITAL IMAGE FUNDAMENTALS 09

Elements of digital image processing systems, Basics of visual perception,Psycho, visual model, Color image fundamentals, Brightness, contrast, hue,saturation, GB,HSI models, Image sampling & quantization.

MODULE II IMAGE TRANSFORMS 09

2D discrete transforms, DFT, DCT, WHT, KLT, DWT, Simulation of 2D transformby 1D transform.

MODULE III IMAGE ENHANCEMENT, RESTORATION, SEGMENTATION & RECOGNITION 12

Histogram modification and specification techniques, Noise distributions, Low and High Pass filters, Color image enhancement, Image degradation model – Unconstrained and constrained restoration, Geometric transformations, Spatial transformations, Gray level interpolation, Image Segmentation & its types, Pattern and Pattern classes.

MODULE IV IMAGE COMPRESSION 08

Need for image compression, Vector Quantization, Run Length Encoding, Shiftcodes, Block Truncation Coding, DCT and Wavelet Transform coding, Simulation of basic concepts.

MODULE V IMAGE PROCESSING APPLICATIONS 07

Biometric identification, Satellite image processing, Industrial machine vision application, Neural Networks in image processing, Medical image processing and Motion Analysis, Augmented \ Virtual reality.

Total Hours : 45

REFERENCES:

1. Rafael C. Gonzalez, Richard E.Woods, Digital Image Processing, PearsonEducation, Inc., Second Edition, 2004
2. Anil K. Jain, Fundamentals of Digital Image Processing, Prentice Hall of India,2002.
3. David Salomon: Data Compression The Complete Reference, SpringerVerlag New York Inc., 2nd Edition, 2001
4. Rafael C. Gonzalez, Richard E.Woods, Steven Eddins, Digital ImageProcessing using MATLAB, Pearson Education, Inc., 2004.
5. William K.Pratt, Digital Image Processing, John Wiley, NewYork, 2002
6. G.W.Awcock & R.Thomas,Applied Image Processing,Mc Graw-Hill Inc,1996
7. Sonka,Hlavac,Boyle,Digital Image Processing and Computer Vision ,Cengage Learning,India Edition,2008
8. Madhuri A.Joshi, Digital Image Processing-An Algorithmic approach,Prentice Hall of India,2008

OUTCOMES:

At the completion of the course, students will be able to

- Acquire the knowledge of fundamental concepts of a digital image processing system
- Analyze 2D signals in the frequency domain through the various transforms.
- Describe various techniques for image enhancement and restoration.
- Recognize and apply suitable image segmentation techniques
- Identify and use of appropriate image compression techniques.
- Implement concepts of image processing using simulation technique.
- Apply suitable image processing techniques for various applications

ECCY002 ADVANCED MICROWAVE SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To describe the basic principles and advanced applications of Microwave Engineering.
- To introduce the concept of transmission lines and waveguides.
- To illustrate the concepts of microwave network analysis and impedance matching.
- To learn about various types of resonators.
- To describe the procedures to design different amplifiers, oscillators, filters and mixers.

MODULE I ELECTROMAGNETIC AND TRANSMISSION LINES THEORY 07

Introduction to microwave Engineering, Maxewell's Equations, Fields in media and boundary conditions, wave equations and basic plane wave solutions. Lumped element circuit model for a transmission line, field analysis of a transmission lines, terminated lossless transmission lines, smith chart, quarter wave transformers, generator and load mismatches, lossy transmission lines.

MODULE II TRANSMISSION LINES AND WAVEGUIDES 07

General solutions for TEM, TE and TM waves, Parallel plate, rectangular, circular waveguide, Coax line, surface waves on a grounded dielectric shield, strip line, microstrip line.

MODULE III MICROWAVE NETWORK ANALYSIS, IMPEDANCE MATCHING AND TUNING 08

Impedance and equivalent voltages and currents, impedance and admittance matrices, scattering matrices, ABCD matrix, Signal flow graphs, discontinuities and modal analysis, excitation of waveguides-electric and magnetic currents, aperture coupling. Matching with lumped elements, single stub, double stub tuning, quarter wave transformer.

MODULE IV MICROWAVE RESONATORS 08

Series and parallel resonance circuits, transmission line resonators, rectangular waveguide cavity resonator, circular waveguide cavity resonator, dielectric resonator, excitation of resonator, cavity perturbation.

MODULE V MICROWAVE FILTERS 08

Periodic structures, filter design by: Image parameter method, insertion loss method, filter transformation, filter implementation, LPF, coupled line filters, filters using coupled resonators

MODULE VI MICROWAVE AMPLIFIER, OSCILLATOR AND MIXER DESIGN 07

Two port power gains, stability, single stage transistor amplifier design, broadband transistor amplifier design, power amplifier, RF oscillators, Microwave Oscillator, oscillator phase noise, frequency multipliers, mixers.

Total Hours : 45

REFERENCES:

1. R.E.Collin, “Foundations of Microwave Engineering”, McGraw-Hill, 1992.
2. Ramo, Whinnery and Van Duzer, “Fields and Waves in Communication Electronics”, 3rd Edition, Wiley, 1997
3. David .M Pozar “Microwave and RF System Design” Wiley 2001 Edition.
4. Wayne Tomasi, “Advanced Microwave Communication Systems” PHI 2002, 2nd Edition.

OUTCOMES:

On completion of this course the student will be able to

- Understand the underlying principles of microwave theory.
- Understand the concept and derive different characteristics of various transmission lines waveguides.
- Describe various parameters of microwave networks.
- Analyze and design microwave filters and resonators.
- Understand the concept of amplifier stability, gain and noise figure and also able to Design microwave small signal and power amplifiers.
- Design microwave oscillators and mixer

ECCY003 COGNITIVE AND CO-OPERATIVE RADIO COMMUNICATIONS

L	T	P	C
3	0	0	3

OBJECTIVES:

- • To acquire knowledge on cooperative communications
- • To learn cooperation protocols and networking
- • To acquire knowledge on broadband cooperative communications
- • To understand cognitive radio networks

MODULE I COOPERATIVE COMMUNICATIONS 09

Cooperation protocols- Hierarchical cooperation; Cooperative communications with single Relay – System model, DF Protocol, AF protocol; Multi-node cooperative communications – system model and protocol description; Distributed space–time coding (DSTC) – Distributed space–frequency coding (DSFC); Relay selection- protocol, criterion.

MODULE II DIFFERENTIAL MODULATION AND COOPERATIVE NETWORKING 09

Differential modulations for DF cooperative communications – Differential modulation for AF cooperative communications; Cognitive multiple access via cooperation – System model, CCMA protocol; Content-aware cooperative multiple access – system model, protocol; Distributed cooperative routing – network model and transmission models, cooperation based routing algorithm; Source–channel coding with cooperation- joint source channel coding bit rate allocation, joint source channel coding with user cooperation, source channel cooperation tradeoff problem.

MODULE III BROADBAND COOPERATIVE COMMUNICATIONS 09

System model - Cooperative protocol and relay assignment scheme – Network lifetime maximization - system model, via cooperation - System model – Lifetime maximization by employing a cooperative node - Deploying relays to improve device lifetime.

MODULE IV COGNITIVE RADIOS AND NETWORKS 09

Cognitive Radios and Dynamic Spectrum Access - Fundamental Limits of Cognitive Radios -Mathematical Models Toward Networking Cognitive Radios; Network Coding for Cognitive Radio Relay Networks - Cognitive Radio Networks Architecture; Overview of Spectrum Sensing concept.

Total Hours : 45

REFERENCES:

1. K.J. Rayliu, A.K. Sadek, Weifeng Su & Andres Kwasinski, “Cooperative Communications and Networking”, Cambridge University Press, 2009.
2. Kwang-Cheng Chen and Ramjee Prasad, “Cognitive Radio Networks”, John Wiley & Sons, 2009.

OUTCOMES:

At the end of the course, the student will be able to

- List various protocols used in co-operative communications.
- Describe the network and transmission models of cooperative communications.
- Demonstrate the channel coding techniques for cooperative communications.
- Explain the concepts of broadband cooperative communications.
- Identify the applications of cooperative communications.
- Apply the concepts of cognitive radio and spectrum sensing for their research.

ECCY004 DIGITAL COMMUNICATION RECEIVERS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To analyze liner and non-linear modulation techniques
- Toexplain optimum receivers and functions
- To describe the fading channel characterization and diversity techniques
- To discuss the receiver synchronization concepts
- To explain adaptive Equalization concepts and algorithms

MODULE I REVIEW OF DIGITAL COMMUNICATION TECHNIQUES 09

Base band and band pass communication, signal space representation, linear and non- linear modulation techniques, and spectral characteristics of digital modulation.

MODULE II OPTIMUM RECEIVERS FOR AWGN CHANNEL 09

Correlation demodulator, matched filter, maximum likelihood sequence detector, Optimum receiver for CPM signals, M-ary orthogonal signals, envelope detectors for M-ary and correlated binary signals.

MODULE III RECEIVERS FOR FADING CHANNELS 09

Characterization of fading multiple channels, statistical models, slow fading, frequency selective fading, diversity technique, RAKE demodulator, coded waveform for fading channel.

MODULE IV SYNCHRONIZATION TECHNIQUES 09

Carrier and symbol synchronization, carrier phase estimation, PLL, Decision directed loops, symbol timing estimation, maximum likelihood and non-decision directed timing estimation, joint estimation.

MODULE V ADAPTIVE EQUALIZATION 9

Zero forcing algorithm, LMS algorithm, Adaptive decision feedback equalizer, and equalization of Trellis-coded signals, Kalman algorithm, blind equalizers, and stochastic gradient algorithm.

Total Hours : 45

REFERENCES:

1. Heinrich Meyr, Mare Moeneclacy and Stefan.A. Fechtel, “Digital Communication Receivers”, Vol I & II, John Wiley, New York, 1997
2. John. G. Proakis, “Digital Communication”, 4th ed., McGraw Hill, New York, 2001
3. E.A. Lee and D.G. Messerschmitt, “Digital Communication”, 2nd edition, Allied Publishers, New Delhi, 1994
4. Simon Marvin, “Digital Communication Over Fading channel; An unified approach to performance Analysis”, John Wiley, New York, 2000
5. Bernard Sklar, “Digital Communication Fundamentals and Applications, Prentice Hall,1998

OUTCOMES:

On completion of this course, the students will be able to:

- Describe the various Digital communication techniques.
- Distinguish the performance of receivers for various channels.
- Construct optimum receivers for communication over AWGN channel and
- fading channels
- Analyze the various synchronization and estimation techniques for receivers.
- Categorize the equalization algorithms based on applications.
- Design a proper receiver for given application.

ECCY005 ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY SYSTEM DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To know about EMI environment
- To introduce the concepts of electromagnetic interference coupling principles.
- To learn electromagnetic interference measurements and standards
- To learn about the techniques to control electromagnetic interferences
- To explain electromagnetic compatibility design of PCBS

MODULE I EMI ENVIRONMENT 07

EMI/EMC concepts and definitions, Sources of EMI, conducted and radiated EMI, Transient EMI, Time domain Vs Frequency domain EMI, Units of measurement parameters, Emission and immunity concepts, ESD.

MODULE II EMI COUPLING PRINCIPLES 08

Conducted, Radiated and Transient Coupling, Common Impedance Ground Coupling, Radiated Common Mode and Ground Loop Coupling, Radiated Differential Mode Coupling, Near Field Cable to Cable Coupling, Power Mains and Power Supply coupling.

MODULE III EMI/EMC STANDARDS AND MEASUREMENTS 10

Civilian standards, FCC, CISPR, IEC, EN, Military standards : MIL STD 461D/ 462, EMI Test Instruments /Systems, EMI Shielded Chamber, Open Area Test Site, TEM Cell - Sensors/Injectors/Couplers, Test beds for ESD and EFT, Military Test Method

MODULE IV EMI CONTROL TECHNIQUES 10

Shielding, Filtering, Grounding, Bonding, Isolation Transformer, Transient Suppressors, Cable Routing, Signal Control, Component Selection and Mounting.

MODULE V EMC DESIGN OF PCBs 10

PCB Traces, Cross Talk, Impedance Control, Power Distribution Decoupling, Zoning, Motherboard Designs and Propagation Delay Performance Models.

Total Hours : 45

REFERENCES:

1. Henry W.Ott, "Noise Reduction Techniques in Electronic Systems", John Wiley and Sons, NewYork. 1988.
2. C.R.Paul, “Introduction to Electromagnetic Compatibility”, John Wiley and Sons, Inc, 1992
3. V.P.Kodali, "Engineering EMC Principles, Measurements and Technologies", IEEE Press, 1996.
4. Bernhard Keiser, "Principles of Electromagnetic Compatibility", Artech house, 3rd Ed, 1986.
5. R.Paul, “Introduction to EMC” Wiley 2006 2nd edition.

OUTCOMES:

On completion of this course the student will be able to:

- Describe the EMI Coupling Principles.
- Identify and describe the EMI Specifications.
- Identify the Standards and Limits.
- Understand the test methods and usage of test beds
- Describe the EMI Measurements and Control Techniques.
- Design EMC based PCBs.

ECCY006 ERROR CONTROL CODING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce modern coding techniques and coding Algebra.
- To study the behavior of codes in AWGN channel.
- To introduce the recent advancements in codes
- To develop a new code based on an application

MODULE I CODING AND ALGEBRA 09

Linear Block Codes: Generator and parity-check matrices, Minimum Distance, Sydrome decoding, Bounds on minimum distance. Cyclic Codes: Algebra-Finite fields- Groups, Fermat's Little theorem, Finite fields, Polynomials over fields, Polynomial Division. Polynomial factorization over a field, Irreducible polynomials, Existence and construction of fields of a given size.Examples of finite field construction, Binary BCH codes, RS codes.

MODULE II CODING IN AWGN CHANNELS 09

AWGN channel: Coding gain, Encoding and decoding in AWGN channels. BPSK modulation, Capacity, Coding gain, ML and MAP decoding for Repetition codes, Probability of decoding error, Channel Capacity, Capacity for various schemes, Eb/No, Coding Gain. Soft-versus hard-decision decoding .Convolutional Codes: Encoders, Trellis, Viterbi decoding, Recursive convolutional encoders.

MODULE III MODERN ITERATIVE CODING 09

Turbo codes: Encoders, interleavers, Puncturing. turbodecoder.Low-density Parity-check Codes (LDPC): Ensembles of LDPC codes, Gallager decoding algorithm for LDPC codes, LDPC Threshold. Message-passing decoders, and density evolution for AWGN channels.

MODULE IV RECENT DEVELOPMENTS IN TURBO CODES 09

Various interleavers, Nonsystematic Turbo codes, Turbo codes in 3G, Effect of Fast Correlation, Low complexity turbo decoder design, turbo codes and ARQ scheme, 3D Turbo codes

MODULE V ERROR CONTROL CODING – APPLICATIONS 09

Wireless Sensor Networks(WSN), low power WSN using ECC, Energy efficient WSN using ECC , Embedded WSN, ZIGBEE, WSN key Management. Embedded

Systems, Impact on Embedded system design

Total Hours :45

REFERENCES:

1. Shu Lin and Daniel Costello, “Error Control Coding”, Pearson, II edition, 2004.
2. RudigerUrbanke and Thomas Richardson “Modern coding theory”, Cambridge 2008.
3. F. J. MacWilliams and N. J. A. Sloane, “The theory of error-correcting codes”, North-Holland publishers, 1983.
4. Richard Blahut “Algebraic codes for data transmission” Cambridge, 2003.
5. Thierry Lestable, Moshe Ran, “Error Control Coding for B3G/4G Wireless Systems”, John Wiley & Sons ltd, 2011.
6. DhouhaKbaier Ben Ismail, Catherine Douillard and Sylvie Kerouédan, “A survey of three-dimensional turbo codes and recent performance enhancements” Journal on Wireless Communications and Networking 2013, Vol. 2013:115.
7. Kbaier Ben Ismail, C. Douillard and S. Kerouédan “Analysis of 3-Dimensional Turbo Codes”, annals of telecommunications 2011,Vol. 67, Issue 5-6 ,pp 257-268.

OUTCOMES:

On completion of this course, the students will be able to:

- Describe the modern coding techniques and basics of coding algebra.
- Explain the behavior of modern codes in AWGN Channel
- Employ the concept of convolutional codes in constructing a turbo coder.
- Analyze the performance of Turbo codes and LDPC.
- Develop a new design of channel coding.
- Recommend a channel coder based on the application.

ECCY007 GLOBAL TRACKING AND POSITIONING SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To know about history of GPS and various existing GPS Systems
- To learn about US based GPS System Segments
- To learn about various functionalities and techniques used in GPS
- To know about hindrances caused for GPS
- To acquire knowledge about various applications of GPS in various fields
- To learn about other constellations and augmentation systems

MODULE I INTRODUCTION TO TRACKING AND GPS SYSTEM 09

Basic concepts of GPS. Space segment, Control segment, user segment, History of GPS constellation, GPS measurement characteristics, selective availability(AS), ant spoofing (AS), GPS aided Geo-augmented navigation (GAGAN) architecture. Applications of Satellite and GPS for 3D position, Velocity, determination as function of time, Interdisciplinary application (eg,.Crystal dynamics, gravity field mapping, reference frame, atmospheric occultation)

MODULE II ORBITS AND REFERENCE SYSTEMS 09

Basics of satellite orbits and reference systems-Two-body problem, orbit elements, time system and time transfer using GPS, coordinate systems, GPS Orbit design, orbit determination problem, tracking networks, GPS force and measurement models for orbit determination, orbit broadcast ephemeris, precise GPS ephemeris, Tracking problems

MODULE III GPS MEASUREMENTS 09

GPS Observable-Measurement types (C/A Code, P-code, L1 and L2 frequencies for navigation, pseudo ranges), atmospheric delays(tropospheric and ionospheric), data format (RINEX), data combination (narrow/wide lane combinations, ionosphere-free combinations single, double, triple differences), undifferenced models, carrier phase Vs Integrated Doppler, integer biases, cycle slips, clock error.

MODULE IV PROCESSING TECHNIQUES 09

Pseudo range and carrier phase processing, ambiguity removal, Least square methods for state parameter determination, relation positioning, dilution of precision.

MODULE V OTHER CONSTELLATIONS AND AUGMENTATION SYSTEMS **09**

Other satellite navigation constellations GLONASS and Galileo IRNS System.Relative advantages of SBAS and GBAS, Wide area augmentation system (WAAS) architecture, GAGAN, EGNOS and MSAS.Local area augmentation system (LAAS) concept.

Total Hours : 45

REFERENCES:

1. B.HoffmanWellenhof, H.Lichtenegger and J.Collins, "GPS: Theory and Practice", 5th edition, Springer Wein, New york,2001
2. A.Leick, "GPS Satellites Surveying", 3rd edition, John Wiley & Sons, NewYork, 2003
3. A.Kleusberg and P.Teunisen(Eds), “GPS for Geodesy”, Springer-Verlag, Berlin,1996
4. G.S.Rao,”Global Navigation Satellite Systems”, McGraw-Hill Publications, New Delhi, 2010
5. Ahmed El-Rabbany, “Introduction to GPS,” Artech House, Boston, 2002.

OUTCOMES:

On completion of this course the student will be able to

- Understand the fundamental theory and concept of GPS
- Explain the satellite orbits and other navigational systems
- Explain various functionalities and techniques used in GPS
- Explain how a GPS receiver computes position and time from GPS signals.
- Describe the major error sources for GPS positioning projects.
- Analyze and compare different navigation systems

ECCY008 HIGH PERFORMANCE COMMUNICATION NETWORKS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To explore various high speed network architectures and protocols
- To discuss various advanced network architecture
- To explain the fundamentals and protocol architecture of WiMax and LTE networks
- To learn about Traffic management for congestion control in networks

MODULE I PACKET SWITCHED NETWORKS 09

OSI and IP models, Ethernet (IEEE 802.3), Token ring (IEEE 802.5), Wireless LAN (IEEE 802.11) FDDI, DQDB, SMDS: Internetworking with SMDS

MODULE II ISDN AND BROADBAND ISDN` 09

ISDN, Overview, Interfaces and functions, Layers and services, Signaling System 7, Broadband ISDN architecture and Protocols.

MODULE III ATM AND FRAME RELAY 09

ATM: Main features-Addressing, Signaling and Routing, ATM header structure-Adaptation layer, management and control, ATM switching and transmission.
Frame Relay: Protocols and services, Congestion control, Internetworking with ATM, Internet and ATM, Frame relay via ATM.

MODULE IV ADVANCED NETWORK ARCHITECTURE 09

IP forwarding architectures overlay model, Multi Protocol Label Switching, Integrated services in the Internet, Resource Reservation Protocol, Differentiated services

MODULE V HIGH PERFORMANCE NETWORKS 09

WiMAX overview –WiMAX Physical Layer – MAC layer overview – Advanced Features for Performance Enhancement – LTE – Technologies for LTE – Network Architecture – Protocol Architecture

Total Hours : 45

REFERENCES:

1. William Stallings, “ISDN and Broadband ISDN with Frame Relay and ATM”, 4th edition, Pearson education Asia, 2002.
2. Leon Gracia, Widjaja, “Communication networks”, Tata McGraw-Hill, New Delhi, 2000.
3. SumitKasera, PankajSethi, “ATM Networks”, Tata McGraw-Hill, New Delhi, 2000.
4. Jean Walrand and PravinVaraiya, “High Performance Communication Networks”, 2nd edition, Harcourt and Morgan Kauffman, London, 2000.
5. William Stallings, “High-speed Networks and Internets”, 2nd edition, Pearson education Asia, 2003.
6. Jeffrey G. Andrews, ArunabhaGhosh and RiasMuhamed, “Fundamentals of WiMAX Understanding Broadband Wireless Networking”, Prentice Hall of India, 2008.
7. StefaniaSesia, IssamToufik, Matthew Baker, “LTE – The UMTS Long Term Evolution”, Wiley, 2011.

OUTCOMES:

At the end of the course student will be able to

- Describe the fundamental concepts of packet switched networks.
- Distinguish various high speed network architectures and protocols
- Compare various advanced network architecture
- Describe the technologies used in wiMax and LTE
- Analyze the resource management techniques in advanced network architecture
- Asses various protocol architecture and services.

ECCY009 INTERNET OF THINGS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce emerging technological options and platforms
- To explain the architecture of IoT
- To explore application development for mobile Platforms
- To Provide the appropriate IoT solutions and recommendations according to the applications used.

MODULE I THE IoT NETWORKING CORE 10

History of IoT, Review of Technologies involved in IoT Development, Internet/Web and Networking Basics -OSI Model, Data transfer referred with OSI Model, IP Addressing, Point to Point Data transfer, Point to Multi Point Data transfer & Network Topologies, Sub-netting, Network Topologies referred with Web, Introduction to Web Servers, Introduction to Cloud Computing. Basics of Big Data, Data Science.

MODULE II IoT ARCHITECTURE AND APPLICATIONS 09

Architecture: M2M – Machine to Machine, Web of Things, IoT protocol, Introduction to wireless and mobile networks, ZigBee, BLE mesh, WiFi, MQTT, LoRa-Machine Applications: Remote Monitoring & Sensing, Remote Controlling, Performance Analysis

MODULE III IoT PLATFORM OVERVIEW 09

Overview of IoT supported Hardware platforms such as: Raspberry pi, ARM Cortex Processors, Arduino and Intel Galileo boards. Network Fundamentals: Overview and working principle of Wired Networking equipment's – Router, Switches, Overview and working principle of Wireless Networking equipment's – Access Points, Hubs etc. Linux Network configuration Concepts: Networking configurations in Linux Accessing Hardware & Device Files interactions.

MODULE IV IoT APPLICATION DEVELOPMENT 09

Application Protocols-MQTT, REST/HTTP, CoAP, MySQL -Back-end Application - Design Apache for handling HTTP Requests, PHP & MySQL for data processing, MongoDB Object type Database, HTML, CSS &jQuery for UI Designing, JSON lib for data processing, Security & Privacy during development, Application Development for mobile Platforms: Overview of Android / IOS 10 25 47 /97 App Development tools

MODULE V CASE STUDY & ADVANCED IOT APPLICATIONS 08

IoT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IoT electronic equipments. Use of Big Data and Visualization in IoT, Industry 4.0 concepts. Sensors and sensor Node and interfacing using any Embedded target boards

L:45, T:15, Total Hours: 60

REFERENCES

1. Jean-Philippe Vasseur, Adam Dunkels, " Interconnecting Smart Objects with IP: The Next Internet," Morgan Kuffmann-2010
2. Vijay Madisetti," Internet of Things (A Hands-on-Approach), "Arshdeep Bahga-2014
3. Adrian McEwen (Author), "Designing the Internet of Things , "Hakim Cassimally-2013
4. Dr. Peter Friess, Dr. OvidiuVermesan," Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems," River Publishers -2013
5. Barrie Sosinsky ,"Cloud Computing Bible," Wiley-India, 2010 10. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010
6. Asoke K Talukder and Roopa R Yavagal, "Mobile Computing," Tata McGraw Hill, 2010.
7. Adelstein and S.K.S. Gupta, "Fundamentals of Mobile and Pervasive Computing," McGraw Hill, 2009

OUTCOMES:

At the end of the course the student will be able to

- Articulate the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art Internet of things
- Identify the architecture and infrastructure of IoT.
- Explain the core issues of IoT such as security, privacy, and interoperability
- Choose the appropriate technologies, algorithms, and approaches for the related issues.
- Identify problems, and explain, analyze, and evaluate various IoT solutions
- Attempt to generate new ideas and innovations in IoT.

ECCY010 INTERNET WORKING MULTIMEDIA

L	T	P	C
3	0	0	3

OBJECTIVES:

- To explain Internet service models.
- To describe multimedia broadband networks.
- To describe different coding and compression techniques.
- To discuss multimedia standards.

MODULE I MULTIMEDIA NETWORKING 09

Digital sound, video and graphics, basic multimedia networking, multimedia characteristics, evolution of Internet services model, network requirements for audio/ video transform, multimedia coding and compression for text, image, audio and video.

MODULE II BROADBAND NETWORK TECHNOLOGY 09

Broadband services, ATM and IP, IPV6, High speed switching, resource reservation, Buffe management, traffic shaping, caching, scheduling, and policing, throughput, delay and jitter performance. Storage and media services, voice and video over IP, MPEG-2 over ATM/IP, indexing synchronization of requests, recording and remote control.

MODULE III RELIABLE TRANSPORT PROTOCOL AND APPLICATIONS 09

Multicast over shared media network, multicast routing and addressing, scaling multicast and NBMA networks, Reliable transport protocols, TCP adaptation algorithm, RTP, RTCP. MIME, Peer- to-Peer computing, shared application, video conferencing, centralized and distributed conference control, distributed virtual reality, light weight session philosophy.

MODULE IV MULTIMEDIA COMMUNICATION STANDARDS 09

Objective of MPEG- 7 standard, Functionalities and systems of MPEG-7, MPEG-21 MultimediaFramework Architecture - Content representation, Content Management and usage, Intellectualproperty management, Audio visual system-H322: Guaranteed QOS LAN systems; MPEG - 4 video Transport across internet.

MODULE V MULTIMEDIA COMMUNICATION ACROSS NETWORKS 09

Packet Audio/video in the network environment, video transport across Generic network Layered video coding, error Resilient video coding techniques, Scalable

Rate Control, Streaming video across Internet, Multimedia transport across ATM networks and IP network, Multimedia across wireless networks.

Total Hours : 45

REFERENCES:

1. Jon Crowcroft, Mark Handley, Ian Wakeman, “Internetworking Multimedia”, Harcourt Asia Pvt. Ltd. Singapore, 1998.
2. B.O. Szuprowicz, “Multimedia Networking”, McGraw Hill, Newyork. 1995.
3. Tay Vaughan, “Multimedia - Making it to work”, 4th edition, Tata McGraw Hill, NewDelhi, 2000.
4. K.R.Rao, Zoran S. Bojkovic and Dragorad A. Milovanovic, “Multimedia Communication systems”, PHI 2003.

OUTCOMES:

On completion of this course the student will be

- Describe the evolution of Internet service models.
- Analyze Multimedia broadband networks.
- Design Multimedia broadband networks.
- Differentiate various multimedia communication standards
- Apply different coding and compression techniques
- Analyze Multimedia communication across networks

ECCY011 MEDICAL IMAGE PROCESSING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To explain fundamental concepts of digital image processing
- Design and implement algorithms that perform basic image pre-processing
- To interpret medical images through various multimodal imaging sources
- To describe idea on image representation,analysis, classification, reconstruction, registration and visualization of medical images.

MODULE I IMAGE FUNDAMENTALS 09

Image perception, MTF of the visual system, Image fidelity criteria, Image model, Image sampling and quantization – two dimensional sampling theory, Image quantization, Optimum mean square quantizer, Image transforms – 2D-DFT and other transforms.

MODULE II IMAGE PREPROCESSING 09

Image enhancement, point operation, Histogram modeling, spatial operations, Transform operations, Image restoration, Image degradation model, Inverse and Weiner filtering. Image Compression, Spatial and Transform methods.

MODULE III MEDICAL IMAGE RECONSTRUCTION 09

Mathematical preliminaries and basic reconstruction methods, Imagereconstruction in CT scanners, MRI, functional MRI, Ultra sound imaging, 3DUltra sound imaging Nuclear Medicine Imaging Modalities-SPECT, PET,Molecular Imaging.

MODULE IV IMAGE ANALYSIS AND CLASSIFICATION 09

Image segmentation: pixel based, edge based, region based, segmentation. Image representation and analysis, Feature extraction and representation, Statistical, Shape, Texture, feature and image classification: Statistical, Rulebased, Neural Network approaches.

MODULE V IMAGE REGISTRATIONS AND VISUALIZATION 09

Rigid body visualization: Principal axis registration, Interactive principal axisregistration, Feature based registration, Elastic deformation based registration,Image visualization: 2D display methods, 3D display methods, virtual realitybased interactive visualization.

Total Hours : 45

REFERENCES:

1. AtamP.Dhawan, “Medical Image Analysis”, Wiley Interscience Publication,NJ, USA 2003.
2. R.C.Gonzalez and R.E.Woods, “Digital Image Processing”, Second Edition,Pearson Education, 2002.
3. Anil. K. Jain, “Fundamentals of Digital Image Processing”, Pearson education,Indian Reprint 2003.
4. Alfred Horowitz, “MRI Physics for Radiologists – A Visual Approach”, Secondedition Springer Verlag Network, 1991.
5. KavyanNajarian and Robert Splerstor, “Biomedical signals and Imageprocessing”, CRC, Taylor and Francis, New York, 2006.
6. John L.Semmlow, “Biosignal and Biomedical Image Processing Matlab Basedapplications”, Marcel Dekker Inc., New York, 2004.
7. Jerry L. Prince and Jonathan M.Links, “Medical Imaging Signals and Systems”, Pearson Education Inc. 2006.

OUTCOMES:

On completion of the course the student will be able to

- Explain the fundamental concepts of digital image processing
- Recognize & apply suitable image enhancement,compression and restoration techniques.
- Compare various imaging sources (i.e.,MRI,CT,SPECTetc)
- Solve Mathematical Preliminaries for image Reconstruction
- Describe various techniques for image analysis and classification
- Use appropriate image registration technique for various applications

ECCY012 MICROSTRIP ANTENNAS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To distinguish the properties and parameters of antenna such as radiation pattern, intensity, directivity, radiation pattern.
- To describe the response characterization of microstrip transmission lines, losses and substrate materials.
- To illustrate the basic concept of radiation mechanism and feeding techniques of microstrip patch antennas.
- To analyse and design of rectangular and circular microstrip antennas.

MODULE I BASIC ANTENNA CONCEPTS 09

Introduction- Definitions- Basic antenna Parameters - Radiation Intensity- Directivity- Directivity and Gain.Friis Transmission Formula- Duality of Antennas- Sources of Radiation.Antenna characteristics: Radiation pattern, Beam solid angle, Input impedance, Polarization, Bandwidth.

MODULE II MICROSTRIP TRANSMISSION LINES 09

Introduction - Microstrip Capacitance Evaluation - Characteristic Impedance - The Microstrip Line in free Space - Effective Relative Permittivity - Practical Microstrip Lines - Losses, Shielding, Substratematerials, Dispersion - Modes of Propagation.

MODULE III INTRODUCTION TO MICROSTRIP ANTENNA 09

Introduction – Definition - advantages, disadvantages of microstrip antenna - Radiation mechanism and radiated fields – Various configurations – Feeding techniques – Applicatios.

MODULE IV RECTANGULAR MICROSTRIP ANTENNAS 09

Models – Transmission Line Model Analysis – Design Considerations – Substrate Selection – Element width & Length – Radiation patterns and Radiation Resistance – losses & Q Factor – Bandwidth – Radiation efficiency – Polarisation- Antenna Ranges-Radiation Patterns

MODULE V CIRCULAR MICROSTRIP ANTENNAS 09

Analysis methods, Cavity model with feed, Model expansion model, Procedure to determine radius, Input impedance, Radiation pattern, Band width, Directivity,

Gain, Radiation resistance, Applications, Gain Measurements, Absolute Gain Measurement, Gain Transfer (Gain-Comparison).

Total Hours: 45

REFERENCES:

1. Constantine A. Balanis, “Antenna Theory Analysis and Design”, John Wiley, 2nd Edition, 2007.
2. E.C.Jordan and Balmain, “Electromagnetic waves and Radiating Systems”, Pearson Education / PHI, 2006.
3. S.W Lee, Y.T. Lo, “Antenna Handbook”, Morgan Kaufmann Publishers, Van Nostrand Reinhold, 1994.
4. John D.Kraus, Ronald J Marhefka and Ahmad S Khan, “Antennas for all Applications”, Tata McGraw-Hill Book Company, 3rded, 2007.
5. I.J. Bahl and P. Bhartia,” Microstrip Antennas”, Artech House, Inc.,1980

OUTCOMES:

On completion of this course the student will

- Describe the basic concepts of antenna properties and parameters.
- Analyze the radiation mechanism using transmission line.
- Design microstrip patch antenna with feed line technique.
- Analyze and design of various rectangular& circular microstrip antennas.
- Measure microstrip antenna parameters
- Estimate its performance measure

ECCY013 MICROWAVE INTEGRATED CIRCUITS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To explain the different technologies of microwave integrated circuits.
- To design and analyze micro strip lines.
- To describe and analyze coupled microstrip
- To learn about active and passive microwave devices.

MODULE I TECHNOLOGY OF MICs **08**

MIC Technology – Thick film and Thin film technology, Hybrid MIC's - Monolithic MIC technology, Characteristics of Materials in MIC.

MODULE II ANALYSIS OF MICROSTRIP LINES **09**

Characteristics of planar transmission lines: strip line, micro strip, suspended and inverted micro strip lines, slot line and coplanar lines. Comparison of various MIC transmission media, coupled line and discontinuities.

MODULE III ANALYSIS OF COUPLED MICROSTRIP **10**

Basic properties of dividers and couplers: T junction power dividers, even and odd mode analysis, waveguide directional couplers, Bethe hole coupler, design of multihole couplers, quadrature hybrid, design of coupled line directional couplers and 180 degree hybrid.

MODULE IV PASSIVE DEVICES **09**

Design of lumped elements: inductors, capacitors and resistors. Ferromagnetic substrate for non-reciprocal devices: microstrip and latching circulators, Isolators and phase shifters, dielectric resonators, Introduction to RF MEMS.

MODULE V ACTIVE DEVICES **09**

BJT, HBT, GaAs FET, HEMT, gunn diode, varactor diodes, PIN diodes & their application in oscillator, mixer and amplifiers.

Total Hours : 45

REFERENCES:

1. I.J.Bhal and P.Bhartia, "Microwave solid state circuit design", John Wiley & sons, 2003.

2. David M.Pozar, “Microwave Engineering”, John Wiley & sons, 4th Edition, 2011.
3. Mike Golio, Janet Golio, “The RF and Microwave Handbook”, CRC Press, 2008.
4. MIIC Design: GaAs FETs and HEMTs- Peter Ladbrooke ,Artech House, 1989.
5. Hoffman, R.K- “Handbook of Microwave Integrated Circuits”- Artech House, 1987
6. S.Y.Liao, “Microwave Circuit Analysis and Amplifier Design”, Prentice Hall, 1987.
7. Gupta.K.C and Amarjit Singh, “Microwave Integrated Circuits”- John Wiley & sons-Wiley Eastern Reprint, 1978.

OUTCOMES:

At the end of the course the student will be able to

- Understand the concepts of different technologies of MICs
- Design and analyze different types of micro strip line.
- Design and analyze coupled micro strip line.
- Design passive devices
- Design active devices
- Identify the microwave device for specific applications

ECCY014 MIMO SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce MIMO wireless communications
- To describe MIMO Architecture and physical modeling of MIMO channels
- To analyze MIMO channel capacity and information rates
- To Discuss Space time coding techniques
- To explain about MIMO receiver design

MODULE I INTRODUCTION TO MIMO SYSTEMS AND CHANNELS 09

Need for MIMO systems, MIMO wireless communications, MIMO channel and signal model, MIMO transceiver design.

MODULE II SPATIAL MULTIPLEXING AND CHANNEL MODELING 09

Multiplexing capability : Capacity via singular value decomposition – Physical modeling of MIMO channels: LOS - SIMO and MISO model, MIMO multipath channel model, degrees of freedom and diversity.

MODULE III CAPACITY AND INFORMATION RATES OF MIMO CHANNELS 09

Capacity of MIMO Channels, MIMO frequency selective channels, Single user MIMO, Multiuser MIMO

MODULE IV SPACE TIME CODING AND MIMO – OFDM 09

Space time coding principles,Alamouti scheme, optimal receiver for Alamouti and multiple receiver antennas, orthogonal STBC, Interpretation of MIMO FS channel,MIMO-OFDM,Space-Frequency coding.

MODULE V MULTI USER MIMO RECEIVER DESIGN 09

MIMO receivers for uncoded signals and coded signals, Multiple access MIMO systems, Multiuser detection in space time coded systems

Total Hours : 45

REFERENCES :

1. Andrea Goldsmith, “MIMO Wireless communications”, Cambrige university Press, 2005

2. Tolga M. Duman and Ali Ghrayeb, “Coding for MIMO communication systems”, John Wiley & sons, 2007
3. Davi Se, PramodViswanath, “Fundamentals of wireless communications”, Cambridge University press,2005
4. Theodore S.Rappaport, “Wireless communications: Principles and practice, Pearson Education”, 2002

OUTCOMES:

At the end of the course, the student will be able to

- Explain MMO wireless communications need and advantages
- Discuss MIMO channels and characteristics
- Assess Channel capacity and information rates
- Explain MIMO coding techniques
- Justify and design multiuser MIMO receivers
- Estimate capacity and information rates of MIMO channels

ECCY015 MULTIMEDIA COMPRESSION TECHNIQUES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To discuss the different categories of multimedia data and the need for their compression.
- To learn the various techniques for multimedia data compression.

MODULE I INTRODUCTION 09

Basics of multimedia data types - Text, audio, image & video – Digital representation of multimedia data -Storage memory requirements for multimedia data –Meaning of data compression –Need for data compression –Lossy compression-Lossless compression-Data compression by source coding and line coding- Mid-tread and Mid-rise quantization-Quantization Error- Scalar and vector quantization –Evaluation of Compression Factor, RMSE &PSNR values.

MODULE II TEXT COMPRESSION 09

Need for lossless compression of text data –Source codes for text compression-Uniquely decodable codes - Kraft-McMillanineequivality- Code trees- Shannon-Fano code - Huffman code – Adaptive Huffman Code – Arithmetic code – Dictionary- based LZW code.

MODULE III AUDIO COMPRESSION 09

Lossy and lossless compression of audio data - μ-law and A-law compression-Differential coder –Jayantquantizer- Differential linear predictive coder- Adaptive differential linear predictive coder-Frequency domain filtering – Sub-band coder – MPEG perceptual audio coder.

MODULE IV IMAGE COMPRESSION 12

Lossless compression of image data – Differential coder - Differential linear predictive coder- Optimal Predictors- Optimal Quantizers – Context based compression – Lossy compression of image data- DCT based compression - Sub-band coding for image compression- Zigzag scanning of transform coefficients - JPEG- JPEG 2000 – JBIG -JBIG 2- Haar wavelet based compression- EZW & SPIHT coders -Fractal compression.

MODULE V VIDEO COMPRESSION 06

Video compression techniques and standards – MPEG Video Coding – Motion estimation and compensation techniques – H.261 Standard – DVI technology.

Total Hours : 45

REFERENCES:

1. Khalid Sayood: “Introduction to Data Compression”, Morgan Kauffman Harcourt, 4th Edition, 2012.
2. David Salomon: “Data Compression - The Complete Reference”, Springer Verlag New York Inc., 3rd Edition,2004.
3. FredHalsall: “Multimedia communications - Applications, Networks, Protocols& Standards”, Pearson Education, 2001.

OUTCOMES:

On completion of this course the graduates will be able to:

- Distinguish and describe the basic of multimedia compression techniques.
- Describe various compression techniques and apply them for text compression.
- Describe various compression techniques and apply them for audio compression.
- Describe various compression techniques and apply them for image compression.
- Describe various compression techniques and apply them for video compression.
- Estimate the compression factor, RMSE & PSNR parameters.

ECCY016 NETWORK SECURITY

L	T	P	C
3	0	0	3

OBJECTIVES:

The student will be able to,

- Understand security concepts, Ethics in Network Security.
- Understand security threats, and the security services and mechanisms to counter them.
- Ability to analyze performance of various cryptographic and cryptanalytic algorithms.
- Gain knowledge about the role of Firewalls and Intrusion Detection Systems.

MODULE I SYMMETRIC CIPHERS (TECHNIQUES AND STANDARDS) –I 09

Introduction – Services, Mechanisms and Attacks, OSI security Architecture, Model for network Security; Classical Encryption Techniques- Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Machines, Stegnography; Block Ciphers and Data Encryption Standard Simplified DES, Block Cipher Principles, Data Encryption Standard, Strength of DES, Differential and Linear Crypt Analysis, Block Cipher Design Principles, Block Cipher Modes of Operation.

MODULE II SYMMETRIC CIPHERS (TECHNIQUES AND STANDARDS) – II 09

Advanced Encryption Standard- Evaluation Criteria for AES, AES Cipher; Contemporary Symmetric Ciphers- Triple DES, Blowfish, RC5, Characteristics of Advanced Symmetric Block Ciphers, RC4 Stream Cipher; Confidentiality using Symmetric Encryption- Placement of Encryption Function, Traffic Confidentiality, Key Distribution, and Random Number Generation.

MODULE III PUBLIC-KEY ENCRYPTION AND HASH FUNCTIONS 09

Public Key Cryptography and RSA- Principles of Public Key Cryptosystems, RSA Algorithm; Key Management and other public key cryptosystems- Key Management, Diffie-Hellman Key Exchange, Elliptic Curve arithmetic, Elliptic Curve Cryptography; Message Authentication and Hash Functions Authentication Requirements, Authentication Functions, Message Authentication Codes, Hash Functions and MACs; Hash Algorithms- MD5 Message Digest Algorithm; Secure Hash Algorithm, RIPEMD 160, HMAC; Digital Signatures and Authentication

Protocols - Digital Signatures, Authentication Protocols, Digital Signature Standards.

MODULE IV NETWORK SECURITY PRACTICE 09

Authentication Applications- Kerberos, X.509 Authentication Service; Electronic Mail Security- Pretty Good Privacy, S/MIME; IP Security- IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations; Web Security- Web Security Considerations, Secure Sockets Layer and Transport Layer Security, Secure Electronic Transaction.

MODULE V SYSTEM SECURITY 09

Intruders- Intruder Detection, Password Management; Malicious Software-Virus and Related Threats, Virus Counter Measures; Firewalls- Firewall Design Principles, Trusted Systems.

Total Hours : 45

REFERENCES:

1. William Stallings, “Cryptography and Network Security”, 3rd edition.Prentice Hall of India, New Delhi, 2004.
2. William Stallings, “Network Security Essentials”, 2rd edition.Prentice Hall of India, New Delhi, 2004.
3. Charlie Kaufman , “Network Security: Private Communication in Public World”, 2nd edition. Prentice Hall of India, New Delhi, 2004.

OUTCOMES:

On completion of the course the student will be able ,

- To identify common network security vulnerabilities/attacks; explain the foundations of network security;
- To identify the appropriate procedures required to secure networks;
- To evaluate the risks and threats to networked computers;
- To demonstrate detailed knowledge of the role of encryption to protect data;
- Get knowledge on development of security policies, standards and practices.
- To determine firewall requirements, and configure a firewall.

ECCY017 QoS IN ADHOC WIRELESS NETWORKS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To explain the concepts of Ad-hoc networks.
- To discuss the Medium access protocol, network protocols, and QoS support protocols.
- To describe the issues, challenges and solution of QOS in Ad-hoc networks.

MODULE I INTRODUCTION 09

Introduction to Adhoc networks, definition, characteristics features, applications. Characteristics of wireless channel, Adhoc Mobility Models: Indoor and Outdoor models.

MODULE II MEDIUM ACCESS PROTOCOLS 09

MAC Protocols: design issues, goals and classification. Contention based Protocols- with reservation, scheduling algorithms, protocols using directional antennas. IEEE standards:-802.11a, 802.11g, 802.15. HIPERLAN.

MODULE III NETWORK PROTOCOLS 09

Routing Protocols: Design issues, goals and classification. Proactive vs. reactive routing, Unicast routing algorithms, Multicast routing algorithms, energy aware routing algorithm, Hierarchical Routing, QoS aware routing.

MODULE IV PROTOCOLS FOR QOS SUPPORT 09

RSVP Goals & Characteristics, Data Flow, RSVP operations, Protocol Mechanisms, Multiprotocol Label Switching, Operations, Label Stacking, Protocol details, RTP: Protocol Architecture, Data transfer Protocol, RTCP.

MODULE V QOS IN AD-HOC NETWORKS 09

Issues and challenges, Classification of QoSsolution : MAC layer solutions, Network layer solutions, QoS frameworks for Ad-Hoc Wireless networks, Energy management in Ad-hoc wireless networks, Need for energy management in Ad-hoc wireless networks.

Total Hours : 45

REFERENCES:

1. C. Siva Ram Murthy and B.S.Manoj "Ad Hoc Wireless Networks: Architectures and Protocols", Prentice Hall PTR,2004
2. C.K. Toh, Ad Hoc Mobile Wireless Networks: Protocols and Systems, Prentice Hall PTR ,2001
3. William Stallings, "High Speed Networks and Internet", Pearson Education, Second Edition, 2002. [Chapter- 4-6,8, 10, 12, 13, 17,18]

OUTCOMES:

On completion of the course the students will

- Describe the general concept of Ad-hoc networks.
- List various protocols of ad hoc wireless networks.
- Explain Medium Access Protocols and Routing Protocols
- Analyze the issues, challenges involved forQoS in Ad-hoc networks
- Provide solution of QoS in Ad-hoc networks
- Describe Issues and challenges in Ad-hoc networks

ECCY018 QUANTUM COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the basics of quantum mechanics.
- To develop the knowledge of quantum computation and quantum information.
- To introduce the quantum algorithms.
- To describe the quantum error correction techniques.

MODULE I INTRODUCTIONTO QUANTUM MECHANICS 10

Introduction to quantum computing- Power of quantum computing- Quantum information-Quantum Computers.The Superposition probability rule- A Photon coincidence experiment-Quantum mechanics-Hilbert space- linear operators tensor and outer products- Quantum states- Quantum operators- spectral decomposition of a quantum operators.

MODULE II QUBITS AND QUANTUM GATES 10

Qubits, blocks sphere representation- Rotation operation-the measurement of a single qubits- A pair of qubits-Qubits-physical implementation-Measurement of the spin-Qubit as polarized photon- Entanglement, Exchange of information-single qubit gates- two, three and multiple qubit gates- The Toffoli gates- Matrix representation of quantum gates and circuits.

MODULE III QUANTUM CIRCUITS 09

The No-Cloning theorem- Full adder circuits- Single and multiple qubit controlled operations-Universal quantum gate-State transformation-Quantum circuit for the Walsh-Hadamard transform- Mathematical models of quantum computer.

MODULE IV QUANTUM ALGORITHM 10

Introduction to quantum algorithms.Deutsch-Jozsa algorithm, Grover's quantum search algorithm, Simon's algorithm.Shor's quantum factorization algorithm.

MODULE V ERROR CORRECTION 06

Errors and correction for errors.Simple examples of error correcting codes in classical computation.Linearcodes.Quantum error correction and simple examples.Shor code.

Total Hours: 45

REFERENCES:

1. Dan C.Marinescu, Gabriela M.Marinescu ,“Approaching Quantum Computing”, , Pearson Education, 2008-09.
2. Vishal SahniLov K Grover ,“Quantum Computing”, , Tata McGraw-Hill Publishing Company Limited,2007.ISBN: 9780070657007
3. Nielsen, Michael A and Isaac L. Chuang. Cambridge,UK “Quantum Computation and Quantum Information”,:Cambridge University Press, September 2000. ISBN: 9780521635035.
4. Eleanor G. Rieffel and Wolfgang H. Polak, “Quantum Computing: A Gentle Introduction”, The MIT Press Cambridge, Massachusetts London, England,2011.

OUTCOMES:

Upon successful completion of this course, students will be able to:

- Define the basics of Quantum mechanics.
- Use the mathematical framework of quantum computing to solve computational problems.
- Apply Quantum bit representation for quantum machines.
- Design and write simple algorithms for quantum machines.
- Analyze the quantum algorithms of quantum circuit and measurement-based quantum computing models.
- Describe simple error correction techniques.

ECCY019 RF SYSTEM DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To discuss the importance and issues involved in RF design.
- To introduce admittance transformation smith chart.
- To explain RF components and design techniques of filters, amplifiers and oscillators.
- To describe RF system module.
- To learn the design of RF amplifiers using transistors.

MODULE I RF ISSUES 09

Importance of RF design, Electromagnetic Spectrum, RF behavior of passive Components-resistors, capacitors and inductors, Chip components and Circuit .Board considerations, transmission line analysis.

MODULE II SMITH CHART AND SINGLE AND MULTI PORT NETWORKS 09

Reflection coefficient to load impedance, impedance transformation, admittance transformation, parallel and series connection.interconnecting networks, network properties and applications, scattering parameters-transformation on Z- and S-parameters, measurements of S-parameters.

MODULE III RF FILTER DESIGN 09

Reqiurement of filter, Basic resonator and filter configuration, types of filters, their realization and implementation, Coupled filter.Modeling of special filters.

MODULE IV ACTIVE RF COMPONENTS AND MATCHING NETWORKS 09

RF diodes, BJTs and FETs, Matching and Biasing Networks, discrete components based Impedance matching, Micro stripline based impedance matching networks, Operation of RF Amplifiers and biasing networks.

MODULE V RF AMPLIFIER DESIGNS USING SMITH CHART 09

Characteristics, Amplifier power relations, Stability considerations, Constant gain circles, noise figure circles, Constant VSWR circles, Low Noise circuits, modeling of amplifier circuits.

MODULE VI OSCILLATORS, MIXERS AND RF SYSTEMS 09

High frequency oscillator configuration, Basic characteristics of Mixers-types of mixers, Detector and demodulator circuits.Integrated model of RF systems.

Total Hours : 45

REFERENCES:

1. Reinhold Ludwig and Powel Bretchko, “RF Circuit Design - Theory and Applications”, Pearson Education Asia, First Edition, 2001.
2. Joseph . J. Carr, “Secrets of RF Circuit Design” , McGraw Hill Publishers, 3rd Edition, 2000.
3. Mathew M. Radmanesh, “Radio Frequency & Microwave Electronics”, Pearson Education Asia, Second Edition, 2002.
4. Ulrich L. Rohde and David P. NewKirk, “RF/ Microwave Circuit Design”, John Wiley & Sons, USA 2000.
5. Roland E. Best, “Phase - Locked Loops: Design, Simulation and Applications”, McGraw Hill Publishers, 5th edition 2003.
6. http://ece.wpi.edu/books/EM_RF_lab/book.htm

OUTCOMES:

On completion of this course the student will be able to

- Understand the importance of RF design.
- Understand the concept of networks, their interconnections and applications
- Analyze the characteristics of amplifier circuits.
- Solve impedance matching for RF circuits.
- Design RF filters, Oscillators and mixers
- Design RF system module.

ECCY020 RF WIRELESS SYSTEMS AND STANDARDS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn and acquire knowledge on Wireless and RF standards
- To introduce 2G, 3G and 4G technologies and its spectrum
- To introduce the concepts of WLAN standards
- To know about the concepts of WIMAX and their standards
- To learn about UWB technology

MODULE I INTRODUCTION TO CELLULAR STANDARDS 09

2G GSM, Cell structure, Frequency Bands and Channels- Call processing, Identity numbers, Frame structure, Interfaces, GMSK modulation, Voice and data processing, GPRS, EDGE, EDGE+, CDMA signal processing, IS-2000 system, Frequency bands, Channel allocation, CDMA cell capacity, services provided by IS-2000, 1xEVDO signal processing and data services-3G UMTS signal processing, WCDMA, HSPA, HSPA+, Towards 4th G, LTE and LTE advanced.

MODULE II WIRELESS SYSTEMS 09

Advanced Mobile Phone Systems (AMPS), Characteristics – Operation – General Working of AMPS Phone System – Global System for Mobile Communication – Frequency Bands and Channels – Frames – Identity Numbers – Layers, Planes and Interfaces of GSM – International Mobile Telecommunications (IMT-2000) – Spectrum Allocation – Services provided by 3G Cellular Systems – Harmonized 3G Systems – Universal Mobile Telecommunications Systems (UMTS).

MODULE III THE IEEE 802.11 WLAN STANDARD 09

Introduction to IEEE 802.11 – General Description – Medium Access Control (MAC) – Physical Layer for IEEE 802.11 Wireless LANs; Radio systems – IR Systems Applications.

MODULE IV THE IEEE 802.16 WIMAX STANDARD 09

Introduction to IEEE 802.16 – General Description – Medium Access Co0ntrol (MAC) –Radio systems – Physical Layer- Evolution to 802.16m-Bluetooth, Zigbee, RFID

MODULE V RECENT ADVANCES 09

Introduction, Ultra Wide Band (UWB) Technology, Characteristics, Signal Propagation, Current Status and Applications, Advantages, Disadvantages, Challenges and Future Directions.

Total Hours : 45

REFERENCES:

1. Assuncion Santamaria, Francisco Lopez-Hernandez, “Wireless LAN Standards and Applications”, Artech House, 2001.
2. Dharma PrakashAgarwal and Qing- Anzeng, “Introduction to Wireless and Mobile Systems”, Vikas publishing House, New Delhi, 2004.
3. Neeli Prasad and Anand Prasad, “WLAN System & Wireless IP for Next Generation Communications”, Artec House, 2002.
4. Moray Rumney :” LTE and the Evolution to 4G Wireless”, Wiley, 2009

OUTCOMES:

On completion of this course the students will be able to:

- Understand the concepts of wireless systems
- Describe about various cellular standards
- Identify various IEEE wireless standards and their layers
- Gain knowledge on various modulation techniques used.
- Explain the latest technologies introduced in wireless systems
- Describe the 3G, 4G and UWB standards

ECCY021	SIMULATION OF COMMUNICATION SYSTEMS ANDNETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To describe modeling of signals and channels in communication system
- To estimate performance of communication system
- To define the concept of communication networks in terms of modeling
- To analyze the routing model for any communication network

MODULE I MODELLING OF COMMUNICATION SYSTEM 09

Model of speech and picture signals, Pseudo noise sequences, Non-linearsequences, Analog channel model, Noise and fading, Digital channel model-Gilbert model of bursty channels, HF, Troposcatter and satellite channels,Switched telephone channels, Analog and Digital communication systemmodels, Light wave system models.

MODULE II SIMULATION OF RANDOM VARIABLES AND RANDOM PROCESS 09

Univariate and multivariate models, Transformation of randomvariables,Bounds and approximation, Random process models-Markov andARMA Sequences, Sampling rate for simulation, Computer generation andtesting of random numbers.

MODULE III ESTIMATION OF PERFORMANCE MEASURES 09

Quality of an estimator, estimator for SNR, Probability density functions of analog communication system, BER of digital communication systems, MonteCarlo method and Importance of sampling method, Estimation of powerspectral density.

MODULE IV COMMUNICATION NETWORKS 09

Queuing models, M/M/1 and M/M/m queues, Little formula, Burke's theorem,M/G/1 queue, Embedded Markov chain analysis of TDM systems, Polling,Random access systems.

MODULE V NETWORK OF QUEUES 09

Queues in tandem, Store and forward communication networks, Capacityallocation, Congestion and flow chart, Routing model, Network layout andReliability.

Total Hours : 45

REFERENCES:

1. M.C.Jeruchim, Philip Balaban and K.SamShanmugam, "Simulation ofcommunication systems", Plenum Press, New York,1992
2. A.M.Law and W.DavidKelton, "Simulation Modelling and analysis", McGrawHill Inc., New York ,1991
3. J.F.Hayes, “Modelling and Analysis of Computer Communication networks”,Plenum Press, New York,1984
4. Jerry Banks and John S.Carson, “Discrete-event System Simulation”, PrenticeHall Inc., New Jersey, 1984
5. MC. Jeruchim, P.Balaban, S.Shanmugam, “Simulation of Communicationsystems- Modelling methodology and techniques”, Plenum publication, 2000.

OUTCOMES:

At the end of the course the student will be able to

- Analyze different modeling methods of communication channel
- Implement concepts of random models using simulation techniques
- Estimate communication channels by different performance measures
- Explain the concepts of communication networks
- Use appropriately the routing mechanism for different communication network
- Summarize the concepts of wide range of communication systems and networks

ECCY022 SPEECH AND AUDIO SIGNAL PROCESSING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the speech and audio signal processing
- To discuss the speech mechanics, various analysis and synthesis methods
- To characterize speech , audio signals and hearing system.
- To introduce various algorithms for different applications.

MODULE I INTRODUCTION 05

Sources, propagation and environmental characteristics, audio sources, sampling, quantizing and compression. Human speech and hearing: speech generation, speech signal characteristics, the hearing system, hearing characteristics.

MODULE II MECHANICS OF SPEECH 07

Speech production mechanism, Nature of Speech signal, Discrete time modelling of Speech production, Representation of Speech signals, Classification of Speech Sounds, Phones, Phonemes, Phonetic and Phonemic alphabets, Articulatory features. Music production, Auditory perception, Anatomical pathways from the ear to the perception of sound, Peripheral auditory system, Psycho acoustics.

MODULE III TIME DOMAIN METHODS FOR SPEECH PROCESSING 07

Time domain parameters of Speech signal, Methods for extracting the parameters Energy, Average Magnitude, Zero crossing Rate, Silence Discrimination using ZCR and energy, Short Time Auto Correlation Function, Pitch period estimation using Auto Correlation Function.

MODULE IV FREQUENCY DOMAIN METHOD FOR SPEECH PROCESSING 08

Short Time Fourier analysis, Filter bank analysis, Formant extraction, Pitch Extraction, Analysis by Synthesis, Analysis synthesis systems, Phase vocoder, Channel Vocoder.omomorphic Speech Analysis: Cepstral analysis of Speech, Formant and Pitch Estimation – HomomorphicVocoders.

MODULE V LINEAR PREDICTIVE ANALYSIS OF SPEECH 09

Formulation of Linear Prediction problem in Time Domain, Basic Principle, Autocorrelation method, Covariance method, Solution of LPC equations, Cholesky method, Durbin’s Recursive algorithm, lattice formation and solutions, Comparison

of different methods, Application of LPC parameters, Pitch detection using LPC parameters, Formant analysis, VELP, CELP.

MODULE VI APPLICATION OF SPEECH & AUDIO SIGNAL PROCESSING 09

Algorithms: Dynamic time warping, K-means clustering and Vector quantization, Gaussian mixture modeling, hidden Markov modeling - Automatic Speech Recognition: Feature Extraction for ASR, Deterministic sequence recognition, Statistical Sequence recognition, Language models - Speaker identification and verification, Voice response system, Speech synthesis: basics of articulatory, source-filter, and concatenative synthesis, VOIP.

Total Hours : 45

REFERENCES:

1. Ben Gold and Nelson Morgan, “Speech and Audio Signal Processing”, John Wiley and Sons Inc., 2004.
2. L.R.Rabiner and R.W.Schaffer, “Digital Processing of Speech signals”, Prentice Hall 1978.
3. Quatieri, “Discrete-time Speech Signal Processing”, Prentice Hall , 2001.
4. J.L.Flanagan, “Speech analysis: Synthesis and Perception”, Springer-Verlag, Berlin.
5. I.H.Witten, “Principles of Computer Speech”, Academic Press, 1982.

OUTCOMES:

At the end of the course, the student will be able to

- Explain speech signal, audio signal and hearing characteristics , mechanics and their generation
- Manipulate, visualize and analyze speech signals and use various processing methods
- Apply various decomposition techniques and modifiy the speech signals.
- Analyze speech and audio signals in time domain and frequency domain.
- Apply various algorithms for speech and audio processing and synthesizing.
- Characterize and justify various speech processing techniques for various applications

ECCY023 STATISTICAL SIGNAL PROCESSING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the statistical signal processing techniques
- To study signal estimation parameters and methods
- To introduce various algorithms for signal analysis
- To discuss on spectral analysis of statisticl signals.

MODULE I REVIEW OF RANDOM VARIABLES 09

Vector-space representation of Random variables, Schwarz Inequality Orthogonality principle in estimation, Central Limit theorem, Random processes, wide-sense stationary processes, autocorrelation and autocovariance functions, Spectral representation of random signals, Wiener Khinchin theorem Properties of power spectral density, Gaussian Process and White noise process, Linear System with random input, Spectral factorization theorem and its importance, innovation process and whitening filter, .Random signal modelling: MA(q), AR(p) , ARMA(p,q) models.

MODULE II PARAMETER ESTIMATION THEORY 09

Principle of estimation and applications, non linear estimation, Properties of estimates, unbiased and consistent estimators, Minimum Variance Unbiased Estimates (MVUE), Cramer Rao bound, Efficient estimators; Criteria of estimation: the methods of maximum likelihood and its properties ;Baysean estimation : Mean square error and MMSE, Mean Absolute error, Hit and Miss cost function and MAP estimation.

MODULE III ESTIMATION OF SIGNAL IN PRESENCE OF WHITE GAUSSIAN NOISE 09

Linear Minimum Mean-Square Error (LMMSE) Filtering: Wiener Hoff Equation, FIR Wiener filter, Causal IIR Wiener filter, Noncausal IIR Wiener filter, Linear Prediction of Signals, Forward and Backward Predictions, Levinson Durbin Algorithm, Lattice filter realization of prediction error filters.

MODULE IV ADAPTIVE FILTERING 09

Principle and Application, Steepest Descent Algorithm Convergence characteristics; LMS algorithm, convergence, excess mean square error, Leaky LMS algorithm;Application of Adaptive filters ; RLS algorithm, derivation.

KalmanFiltering : State-space model and the optimal state estimation problem, discrete Kalman filter, continuous-time Kalman filter, extended Kalman filter.

MODULE V SPECTRAL ANALYSIS 09

Estimated autocorrelation function, periodogram, Averaging the periodogram (Bartlett Method), Welch modification, Blackman and Tukey method of smoothing periodogram, Parametric method, AR(p) spectral estimation and detection of Harmonic signals.

Total Hours : 45

REFERENCES :

1. M. Hays: “Statistical Digital Signal Processing and Modelling”, John Willey and Sons, 1996.
2. M.D. Srinath, P.K. Rajasekaran and R. Viswanathan: “Statistical Signal Processing with Applications”, PHI, 1996.
3. Simon Haykin: “Adaptive Filter Theory”,Prentice Hall, 1996.
4. D.G. Manolakis, V.K. Ingle and S.M. Kogon: “Statistical and Adaptive Signal Processing”, McGraw Hill, 2000.
5. S. M. Kay: “Modern Spectral Estimation”, Prentice Hall, 1987

OUTCOMES :

At the end of the course, the student will be able to

- Describe and summarize the techniques and concepts of Statistical signal processing
- Describe the criteria of estimation and applications
- Apply various estimation algorithms on statistical signals
- Analyse statistical signals using various filtering methods
- Carry out spectral analysis by different methods
- Justify and characterize the statistical signals.

ECCY024 VEHICULAR AD HOC NETWORKS (VANETs)

L	T	P	C
3	0	0	3

OBJECTIVES:

The student recognizes information, idea and principles of

- Vehicular networking and characteristics
- Congestion control mechanisms in Vehicular Ad hocNetworks
- Cluster based Routing Protocol for Vehicular Networks

MODULE I INTRODUCTION TO VANET 09

VANET characteristics and challenges, Layered architecture for VANETs-concepts and challenges, wireless technology- The IEEE 802 family, The IEEE 802.11 MAC foundations, IEEE 802.11 security, MAC in VANET, Physical layer of VANETs.

MODULE II CONGESTION CONTROL FOR SAFETY VANETs 09

Introduction to congestion control- Aspects of Congestion Control – The need for congestion control – Congestion control by means of transmit power control- Congestion control by means of rate control- Beaconing frequency, Data rate, Transmission power, Minimum contention window, physical carrier sense,Performance evaluation and modeling.

MODULE III CONVOY: CLUSTER-BASED ROUTING PROTOCOL FOR VEHICULARNETWORKS 09

Introduction to clustering or network partitioning, mobility based clustering in ad hoc networks, Clustering of VANETs for MAC and transport applications, CONVOY: a vehicle convoy formation protocol, Assessment of the convoy formation protocol.

MODULE IV GATEWAY SELECTION AND DATA SECURITY IN VEHICULAR NETWORKS 09

Clustering and gateway selection in VANET networks, Gateway selection in clustered VANET-LTE advanced hybrid network-Problem statement, LTE advanced standard, Challenges of Data Security in Vehicular Networks- Cryptographic Protocols- Privacy Protection Mechanisms- Implementation aspects.

MODULE V TRAFFIC SIGNAL CONTROL SYSTEMS AND CAR-TO-CAR COMMUNICATIONS 09

Classification of traffic signal control systems, static systems, Dynamic systems, traffic signal control and car-to-car communication, vehicular mobility modeling for VANET- Random Models- Traffic Models, Integration with Network Simulators.

Total Hours: 45

REFERENCES:

1. Andre-Luc Beylo, HoudaLabiod, “vehicular networks models and algorithms” wiley publications,2013.
2. Claudia campolo, antanellomolinaro, Riccardo scopigno, “VANET-standards solutions and research”, springer, 2015.
3. Al- sakibkhanpathan, “Security of self organizing networks MANET WSN WMN VANET”, Auerbach Publications, 2014.
4. Hannes Hartenstein, Kenneth Laberteaux, “VANET Vehicular Applications and Inter-Networking Technologies”, John Wiley & Sons, 2010.

OUTCOMES:

On completion of the course students will be able to

- Develop VANET algorithms that can be designed and applied on VANET.
- Implement congestion control in VANET
- Examine the vulnerabilities of vehicular ad-hoc networks and the salient challenges.
- Design vehicular mobility modeling for VANET
- Implement security in Vehicular Networks
- Develop routing protocols for VANET

ECCY025 WIRELESS COMMUNICATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce current wireless systems and spectrum allocation
- To explain general ray tracing models and path loss models
- To impart knowledge on wireless channels and capacity
- To introduce MIMO systems, multiuser system, OFDM and broadband modulation
- To impart knowledge on multiuser systems .

MODULE I INTRODUCTION 09

Current wireless systems, Wireless spectrum and allocation to existing systems, radio propagation models, path loss calculation, ray tracing methods, empirical path loss models, discrete time and space time statistical channel models.

MODULE II CAPACITY AND DIVERSITYOF WIRELESS CHANNELS 09

Capacity in AWGN, capacity of flat fading channels, capacity of frequency selective fading channels. Receiver Diversity& Transmitter Diversity techniques.

MODULE III MULTIPLE ANTENNA SYSTEMS 09

Narrow band MIMO model, MIMO channel capacity, MIMO Diversity and beam forming, diversity multiplexing tradeoff, space time modulation and coding, Smart antennas.

MODULE IV MULTI CARRIER MODULATION 09

Data transmission using multiple carriers, Multi carrier modulation with overlapping subchannels. Mitigation of subcarrier fading, Discrete implementation of multicarrier systems, OFDM, PAPR.

MODULE V SPREAD SPECTRUM AND MULTI USER SYSTEMS 09

Spread spectrum principle – DSSS – FHSS , multiuser DSSS – spreading codes, downlink and uplink channels , multicarrier CDMA system and multi user FHSS systems. Multiuser channels - uplink and downlink channel capacity – Multiuser detection .

Total Hours: 45

REFERENCES

1. Andrea Goldsmith, “Wireless Communication”, Cambridge Univ. Press, 2006.
2. Andreas F.Molisch, “Wireless Communications” 2nd Edition, Wiley publications, 2014
3. Theodore S.Rappaport., “Wireless Communications”, 2nd Edition, Pearson Education, 2002.
4. Yong SooCho , “MIMO – OFDM wireless communications with MATLAB”, IEEE press, John Wiley publications, 2010.

OUTCOMES:

On completion of this course, student will be able to

- Describe ray tracing models and path loss models
- Characterize wireless channels and describe channel models
- Discuss MIMO narrow band model and transmission techniques with multiple antennas.
- Explain multi carrier modulation schemes
- Explore on broadband modulation and multiuser systems
- Discuss on wireless communication techniques

ECCY026 WIRELESS SENSOR NETWORKS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To make the students list the Wireless Sensor Network Architecture and its Applications
- To explain the physical layer design,
- To describe the MAC protocols and time synchronization algorithms
- To discuss various routing protocols, localization algorithms used for sensor network.
- To explain basics of sensor network programming and Internet of Things

MODULE I NODE ARCHITECTURE 07

Introduction to sensor network – Application – Difference between Adhoc and Sensor Network - Node architecture - Hardware components overview - Energy consumption of Sensor nodes - Operating Systems and Execution Environment - some examples of Sensor nodes.

MODULE II NETWORK ARCHITECTURE 07

Sensor Network Scenarios – Optimization goals- Design Principles –Gateway Concepts–Wireless Channel fundamentals - Physical layer and transceiver design considerations in Wireless Sensor Network

MODULE III MAC PROTOCOLS & TIME SYNCHRONIZATION 10

Fundamentals of MAC Protocols – Low duty cycle protocols – Contention based Protocols – schedule based protocols – IEEE 802.15.4 MAC – Address and name management in wireless sensor network. Need for time synchronization

MODULE IV LOCALIZATION & ROUTING PROTOCOLS 12

Properties of localization and positioning procedures – Range based Localization – Range free Localization Routing Metrics – Data Centric Routing – Proactive Routing - On Demand Routing – Hierarchical Routing – QoS based Routing Protocols

MODULE V SENSOR NETWORK PROGRAMMING and IoT 09

Challenges in sensor network programming – Node Centric programming – Dynamic programming – Sensor Network Simulators - Internet of Things (IoT): overview, Applications, potential & challenges, and architecture.

Total Hours : 45

REFERENCES:

1. Holger Karl and Andreas Willig, “Protocols and Architectures for Wireless Sensor Networks”, John Wiley and Sons, 2012.
2. WaltenegusDargie and Christian Poellabauer, “Fundamentals of Wireless Sensor Networks – Theory and Practice”, John Wiley and Sons, First edition, 2010.
3. G.Anastasi, Marco Conti, Mario Di Francesco and Andrea Passarella, “Energy Conservation in Wireless Sensor Networks: A Survey”, Adhoc Networks, Vol.7, No.3 May 2009, Elsevier Publications, pp.537-568.
4. “Adrian McEWen and Hakim Cassimalli, “Designing the Internet of Things” Wiley publications, November 2013.

OUTCOMES:

At the end of the course students will be able to

- Describe Wireless Sensor Network Architecture and its Applications
- Explain the physical layer design
- Compare the various MAC protocols and illustrate time synchronization algorithms
- Distinguish various routing protocols, localization algorithms used for sensor network.
- To describe the basics of sensor network programming and Internet of Things
- Analyze various Sensor Network Simulators

ECCY027 COMMUNICATION SYSTEM DESIGN AND ANALYSIS

L	T	P	C
2	0	2	3

OBJECTIVES:

- To introduce the concepts of software radio
- To discuss the design issues in software radio
- To address the practical issues in Signal generation and processing and RF design

MODULE I INTRODUCTION TO SOFTWARE RADIO 07

The need for Software Radios.Characteristics and benefits of a software Radio – Design principles of a Software Radio.

MODULE II RADIO FREQUENCY IMPLEMENTATION ISSUES 08

The Purpose of the RF Front-End. Dynamic Range-The Principal Challenge of Receiver Design-RF Receiver Front-End Topologies- Enhanced Flexibility of the RF Chain with Software Radios-Importance of the Components to Overall Performance- Transmitter Architectures - Noise and Distortion in the RF Chain. ADCand DAC Distortion.

MODULE III DIGITAL GENERATION OF SIGNALS 08

Introduction-Comparison of Direct Digital Synthesis with Analog Signal Synthesis-Approaches to Direct Digital Synthesis-Analysis of Spurious Signals-Spurious Components due to Periodic Jitter-Band pass Signal Generation – Performance of Direct Digital Synthesis Systems-Hybrid DDS-PLL Systems-Applications of direct Digital Synthesis-Generation of Random Sequences-ROM Compression Techniques.

MODULE IV RADIO FREQUENCY DESIGN 07

Baseband Signal Processing, Radios with intelligence, ADC and DAC architectures- Smart antennas, Adaptive techniques, Phased array antennas, Applying SDR principles to antenna systems, Smart antenna architectures

LIST OF LABORATORY EXPERIMENTS 15

1. Software Defined Radio Architecture
2. Pulse Shaping Filter and Matched filter
3. Channel detection, Estimation and Equalization
4. Frame Synchronization and Channel Synchronization
5. IQ Modulation and Complex FFT

6. Error Vector Magnitude and Modulation Error Ratio
7. RF Power and Power gain
8. Intermodulation Distortion
9. Adjacent Channel Power Ratio (ACPR)
10. Dynamic Range and Spurious Free Dynamic Range
11. BER Measurement and Calculation of E_b/N_0
12. Real-Time record and playback of Data Streams.

Total Hours: 60

REFERENCES:

1. Jeffrey H Reed, “Software Radio: A Modern Approach to Radio Engineering”, Prentice Hall Publication, 2002.
2. Walter H.W. Tuttlebee, “Software Defined Radio: Enabling Technologies”, John Wiley Publications, 2007.
3. Paul Burns, "Software Defined Radio for 3G”, Artech House Publication, 2002.
4. Markus Dillinger, KambizMadani, Nancy Alonistioti, “Software Defined Radio: Architectures, Systems and Functions”, John Wiley, 2007
5. Bard,Kovarik,”Software Defined Radio, The Software Communications Architecture”, Wiley 2007
6. John Bard, Vincent J. Kovarik Jr. "Software Defined Radio: The Software Communications Architecture", John Wiley 2007.
7. Peter Kenington, “RF And Baseband Techniques for Software Defined Radio”. Artech House Publishers, 2005

OUTCOMES:

On completion of the course the student will be able to

- Discuss the concept and benefits of SDR
- Explain the issues in RF implementation of SDR
- Use the SDR with Analog and Digital Front End
- Analyze the various antenna structures to accommodate the needs of a SDR
- Choose SDR based on the application
- Evaluate the performance of SDR based communication system

ECCY028 ADAPTIVE SIGNAL PROCESSING

L	T	P	C
2	0	0	2

OBJECTIVES:

- To introduce the concept of adaptive signal processing
- To explore the basics of adaptive filters
- To develop various adaptation algorithms
- To assess the adaptation algorithms in terms of convergence rate,computational complexity, robustness against noisy data.

MODULE I INTRODUCTION TO ADAPTIVE FILTERS 06

Adaptive filter structures, issues and examples.Applications of adaptive filters: Channel equalization, active noise control. Echo cancellation, beamforming.

MODULE II WIENER FILTER, SEARCH METHODS AND THE LMS ALGORITHM 06

Wiener FIR filter (real case), Steepest descent search and the kernel LMS algorithm,Extension of optimal filtering to complex valued input, Complex LMS algorithm.

MODULE III CONVERGENCE AND STABILITY ANALYSES 06

Convergence analysis of the kernel LMS algorithm,Learning curve and mean square error behavior, Weight error correlation matrix.,Dynamics of the steady state mean square error (SSMSE), Misadjustment and stability of excess MSE.

MODULE IV VARIANTS OF THE LMS ALGORITHM 06

The sign-LMS and the normalized LMS algorithm.,BlockLMS,Review of circular convolution: Overlap and save method, circular correlation. FFT based implementation of the block LMS Algorithm.

MODULE V CASE STUDY AND APPLICATION 06

Survey and comparison of various adaptive filtering methods with its significance. Application of adaptive algorithms applied to signals using simulation tool.

Total Hours: 30

REFERENCES

1. S. Haykin, Prentice Hall, Englewood Cliffs, “Adaptive Filter Theory”, NJ, Fourth Edition
2. B. Farhang-Boroujeny, “Adaptive Filters ,Theory and Applications”, John Wiley and Sons, 2013.

OUTCOMES:

At end of the course the student will be able to,

- Summarize the concept of adaptive signal processing
- Train the filter coefficients to track the target signal
- Assess various adaptation algorithms in signal processing
- Analyze the adaptation algorithms in terms of computational complexity, hardware complexity, numerical stability etc.
- Apply mathematical tools like random variables, stochastic processes and correlation structure -in signal processing.
- To apply particular adaptive algorithm based on the signal constrains

ECCY029 CLASSICAL AND ADVANCED TECHNIQUES FOR OPTIMIZATION

L	T	P	C
2	0	0	2

OBJECTIVES:

- To introduce the concepts of Linear and Non-Linear programming
- To familiarize modern optimization methods.

MODULE I LINEAR PROGRAMMING 05

Introduction to Linear Programming - Simplex method, Duality theory, Linear programming Algorithms. Transportation and Assignment Models.

MODULE II NONLINEAR PROGRAMMING 05

One-variable unconstrained and multivariable unconstrained optimization, Quadratic Programming

MODULE III DYNAMIC PROGRAMING 07

Dynamic programming, Network Optimization Models, Integer programming, Metaheuristics, Game Theory, Queueing Theory, Inventory Theory, Markov Decision Process.

MODULE IV MODERN METHODS OF OPTIMIZATION 07

Genetic algorithms, Simulated annealing, Particle swarm and ant-colony optimization, Fuzzy and Neural networks based methods.

MODULE V PRACTICAL ASPECTS OF OPTIMIZATION. 06

Reduction of size, sensitivity of optimum solution to problem parameters, multi-level optimization, multi-objective optimization.

Total Hours: 30

REFERENCES:

1. Singiresu S. Rao "Engineering Optimization Theory and Practice", 4th Edition, John Wiley 2009.
2. Frederick S. Hillier & Gerald J. Lieberman, "Introduction to Operations Research", 10th Edition McGraw Hill Education, 2015.
3. Hamdy A. Taha, "Operations Research - An Introduction", 8th Edition, Pearson Education Inc., 2007.
4. G. Hadley, “Linear Programming”, 1st Edition, Addison-Wesley, 1962.

5. David G. Luenberger, “Optimization by Vector Space Methods”, John Wiley & Sons, 1969.

OUTCOMES:

On completion of the course the student will be able to

- Recognize problems and associate it with suitable optimization methods
- Solve practical optimization problems using both linear and non-linear methods
- Analyze the engineering issues for optimization using classical methods like Queueing theory, inventory theory, Markov chain, and Metaheuristics.
- Apply modern optimization methods to engineering designs
- Develop new models using Fuzzy and Neural networks.
- Evaluate the optimization methods for various practical applications.

ECCY030 NETWORK ROUTING ALGORITHMS

L	T	P	C
2	0	0	2

OBJECTIVES:

- To understand the basics of Network Routing concepts.
- To create in-depth awareness of routing algorithms and protocols.
- To provide comprehensive details of routing in IP networks and in Ad-hoc networks.

MODULE I NETWORK ROUTING – AN INTRODUCTION 06

Network Routing: An Overview, Protocol Stack Architecture, Router Architecture, Network Topology Architecture, Public Switched Telephone Network, Communication Technologies.

MODULE II ROUTING ALGORITHMS - SHORTEST PATH AND WIDEST PATH 06

Bellman–Ford Algorithm and the Distance Vector Approach, Dijkstra's Algorithm, Comparison of the Bellman–Ford Algorithm and Dijkstra's Algorithm, Shortest Path Computation with Candidate Path Caching, Widest Path Computation with Candidate Path Caching, Widest Path Algorithm, kShortest Paths Algorithm.

MODULEIII ROUTING PROTOCOLS - FRAMEWORK AND PRINCIPLES 06

Routing Protocol and Algorithm, Routing Information Representation and Protocol Messages, Distance Vector Routing Protocol, Link State Routing Protocol, Path Vector Routing Protocol.

MODULE IV ROUTING IN IP NETWORKS 06

Routers, Networks, and Routing Information: Some Basics, Routing Information Protocol (RIP), Interior Gateway Routing Protocol (IGRP), Enhanced Interior Gateway Routing Protocol (EIGRP), OSPF: Protocol Features, Integrated IS-IS - Key Features, BGP: A Brief Overview.

MODULE V ROUTING IN AD HOC NETWORK 06

Introduction to Ad hoc Networks – Features/ Characteristics, Types and Applications, Limitations, Advantages and Disadvantages, Classification of Routing Protocols in Ad hoc Networks – Proactive Routing Protocols (DSDV,

OLSR), Reactive Routing Protocols (DSR, AODV), Hybrid Routing Protocols (ZRP).

Total Hours: 30

TEXT BOOK:

1. DeepankarMedhi and Karthikeyan Ramasamy, “Network Routing: Algorithms, Protocols, and Architectures”, Elsevier, 2007.

REFERENCES:

1. William Stallings, "Data and Computer Communications", Pearson Education, 2006.
2. Martha SteenStrup, "Routing in Communication Networks", Prentice Hall, 1995.
3. Subir Kumar Sarkar, T G Basavaraju and C Puttamadappa, “Ad Hoc Mobile Wireless Networks – Principles, Protocols and Applications”, Auerbach publications.
4. Dharma PrakashAgrawal and Carlos De MoraisCordeiro, “Adhoc and Sensor Networks – Theory and Applications”, World Scientific publication.

OUTCOMES:

At the completion of this course the students will be able to

- Define the fundamentals of Network Routing.
- Decide the routing protocol for any level of complex network design.
- Select the routing algorithm suitable for the network considered.
- Relate the routing algorithms for different types of network.
- Explain the feature of various routing protocols.
- Recommend the routing protocol for a given network.
- Perform the research in the routing platform.

ECCY031 PATTERN RECOGNITION TECHNIQUES AND APPLICATIONS

L	T	P	C
2	0	0	2

OBJECTIVES:

- To familiarize with classical and modern techniques for pattern reco gnition
- To compare various classifiers

COURSE PREREQUISITES:

- Familiarity with concepts digital image processing
- Fundamental knowledge in mathematics and numerical methods.

MODULE I REPRESENTATION OF PATTERNS 08

Data structures, representation of cluster, proximity measures and size, Feature extraction.

MODULE II CLASSIFIERS 08

Nearest neighbor Based Classifiers, Bayes Classifiers, Hidden Markov Models, Decision trees Supprot Vector Machines.

MODULE III COMBINATION OF CLASSIFIERS 07

Ensembles of Classifiers, Methods for combining Classifiers.

MODULE IV CLUSTERING 07

Hierarchical algorithms, Partitiona, Clustering, Clustering large Data sets.

Total Hours: 30

REFERENCES:

1. M. NarasimhaMurty& V. Susheela Devi, "Pattern Recognition - An Algorithmic Approach", Springer 2011.
2. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer 2013.
3. J. P. Marques de Sa, "Pattern Recoanition - Concepts, Methods and Applications", Springer 2001

OUTCOMES:

On completion of the course the student will be able to

- Discuss the representation of cluster
- Apply the techniques for proximity measures

- Classify the pattern recognition methods for various applications.
- Summarize the methods used for representation of patterns
- Compare various classifiers for different applications
- Design pattern recognition methods using combination of classifiers.

ECCY032 RADIATION SYSTEMS FOR PERSONAL AREA NETWORK

L	T	P	C
2	0	0	2

OBJECTIVES:

- To List the various types of Printed Antennas
- To understand about Wearable Antennas
- To gain the knowledge about Active Integrated Antennas
- To apply the Reconfigurability function in Antenna Design
- To study about different array techniques

MODULE I INTRODUCTION TO WIRELESSS PAN AND PRINTED ANTENNAS 06

Introduction to IEEE 802.15, 15.1Bluetooth, IEEE 802.15.3A Ultra Wideband Wireless Pan, 15.4 Zigbee.Concepts of Printed Antennas, Broadband Microstrip Patch Antennas, Patch Antennas for Multiband Applications.

MODULE II WEARABLE ANTENNAS 06

Overview of Wearable Systems and its Characteristics, Antennas for Wearable Devices, DesignRequirements, Modeling and Characterization of Wearable Antennas, Domains of Operation, Compact Wearable Antenna for Healthcare Sensors.

MODULE III ACTIVE INTEGRATED ANTENNAS 06

Active Wearable Antenna Modules-Features, Electromagnetic Characterization of Fabrics and Flexible Foam Materials, Small-Band Inverse Planar Antenna,Resonator Method, Active Antenna Modules for Wearable Textile Systems.

MODULE IV RECONFIGURABLE ANTENNAS 06

Reconfigurable methodologies, Design Considerations for Reconfigurable systems, Reconfigurable Planar/printed antenna configurations, Active reconfigurable systems.

MODULE V ARRAY ANTENNAS 06

Linear and planar array fundamentals, Mutual Coupling in Arrays, Multidimensional Arrays, Switched beam and Phased Arrays, Array Feeding Techniques, Array optimization techniques.

Total Hours: 30

REFERENCES

1. DebatoshGuha, Yahia M.M. Antar, “Microstrip and Printed Antennas”, 1st Edition, JohnWiley & Sons, 2011.
2. Taming the Borg, “Moving Wearables into the Mainstream”, Springer, 2008.
3. Eng Hock Lim , Kwok Wa Leung, “Compact Multifunctional Antennas for WirelessSystems”, John Wiley & Sons, 2012.
4. ZhiNing Chen, “Antennas for Portable Devices”, John Wiley & Sons, 2007.
5. ApostolosGeorgiadis, HendrikRogier, Luca Roselli, Paolo Arcioni, “Microwave &Millimeter Wave Circuits & Systems”, First Edition, John Wiley & Sons, 2013.
6. Warren L Stutzman, Gary A.Thiele, “ Antenna Theory and Design”, 3rd edition, John Wiley & Sons, 2013.

OUTCOMES:

The students will be able

- To discuss the basics of PAN network
- To classify various types of Printed Antennas.
- To describe about Wearable Antennas
- To analyze different materials for Antennas
- To apply the reconfigurability function in any Antenna Design
- To optimize different array configurations.

ECCY033 BIO SIGNAL PROCESSING

L	T	P	C
1	0	0	1

OBJECTIVES:

- The basics of bio-signal and characteristics.
- The processing techniques of biomedical signals and parameter detection.
- Noise reduction in Bio signals.
- To expose the students with Simulation tools for bio signal processing.

MODULE I INTRODUCTION TO BIOMEDICAL SIGNALS 03

The origin of Bio signal - Typical waveforms -need of analyzing and classification.

MODULE II ANALYSIS OF PCG 03

PCG-Characteristics and analysis using NILABVIEW.

MODULE III ANALYSIS OF ECG 03

ECGsignalanalysis: parameters estimation-compression technique-MATLAB Simulation of analyzing ECG.

MODULE IV ANALYSIS OF EEG 03

EEG - artifacts in EEG & their characteristics and processing - EEG segmentation - MATLAB Simulation of analyzing ECG.

MODULE V ANALYSIS OF EMG 03

EMG - characteristics and analysis using NILABVIEW.

Total Hours:15

REFERENCES:

1. Leslie Cromwell, “Biomedical Instrumentation and measurement”, Prentice hall of India, NewDelhi, 2007.
2. D.C.Reddy, "Biomedical Signal Processing: Principles and techniques", Tata McGraw Hill, New Delhi, 2005
3. Myer Kutz, “Standard Handbook of Biomedical Engineering and Design”, McGraw HillPublisher, 2003.
4. Joseph J. Carr and John M. Brown, “Introduction to Biomedical Equipment Technology”, Pearson Education, 2004.
5. John G. Webster, “Medical Instrumentation Application and Design”, John Wiley andsons, New York, 2004.

6. Khandpur R.S, “Handbook of Biomedical Instrumentation”, Tata McGraw-Hill, New Delhi, 2003.

OUTCOMES:

On completion of the course the students will

- Explain the bio signal characteristics.
- Simulate & analyze of PCG.
- Simulate & analyze of ECG.
- Simulate & analyze of EEG.
- Simulate & analyze of EMG.
- To program with simulation tools.

ECCY034 ULTRASONIC PRINCIPLES AND APPLICATIONS

L	T	P	C
1	0	0	1

OBJECTIVES:

Make the students to

- state the basics of ultrasonics signals and types.
- Infer the ultrasonic wave propagation techniques and parameter detection.
- Manipulate the measurement technique in ultrasonic signals..
- expose with Simulation tools for ultrasonic signal processing.

MODULE I ULTRASONIC TECHNOLOGIES AND APPLICATIONS 08

Ultrasonic – Inroduction-Types of ultrsonics – Ultrsonics in electronics - Ultrasonic Systems: Transmitters and Receivers. Elastic Wave Propagation, Velocity of Sound - Transmission through Thin Plates. Attenuation of an ultrasonic wave. Fundamental equations employed in Ultrasonic design-wave equation: plane wave general wave and plate wave. Design of Ultrasonic Transducers

MODULE II SATTERING OF SOUND AND ADVANCED TECHNIQUES 07

Comparition of electromagnetic and Acoustic Propagation – Scattering theory: Description of weak scattering, Plane wave incident by single particle, Sattering by many particles-numerical calculation. Sattering from bubbles, Particle sizing, Propagation in viscoelastic materials.Automation and computer tools.

Total Hours:15

REFERENCES:

1 Dale Ensminger and Leonard J. Bond, “Ultrasonic Fundamentals Technologies and Applications, CRC Press third edition.
2 Malcolm J.W.Povey, “Ultrasonic Techniques for Fluids Characterisation”, Academic Press, Claifornia.
3 J. David N. Cheeke, "Fundamentals and Applications of Ultrasonic Waves", CRC Press LLC, 2002
4 E. G. Richardson, **“**Ultrasonic Physics”, ELSEVIER Publishing Company

OUTCOMES:

On completion of the course the students will be able to

- Identify the type of ultrasonic signal.
- Describe the ultrasonic wave propagation and attenuation through transmission media.

- Interpret the fundamental wave equations of ultrasonic signal.
- Design ultrasonic transducers for palne wave and plate wave.
- Synthesize the electromagnetic, acoustic propagation and scattering of ultrasonic waves.
- Program with simulation tools.

ECCY060 SOFTWARE FOR EMBEDDED SYSTEMS

L	T	P	C
2	0	2	3

OBJECTIVES:

The objective of the course is to

- To know the basic conepts of C Programming.
- To Introduce the GNU C Programming Tool Chain in Linux.
- To understand embedded C and Embedded OS
- To introduce the phython language

MODULE I C PROGRAMMING CONCEPTS 09

Programming Style - Declarations and Expressions - Arrays, Qualifiers and Reading Numbers - Decision and Control Statements - Programming Process - More Control Statements - Variable Scope and Functions - C Preprocessor - Advanced Types - Simple Pointers - Debugging and Optimization.

Laboratory Practice:

Practice C language programs illustrating the language constructs in the module I using C compiler

MODULE II C PROGRAMMING TOOLCHAIN IN LINUX 09

Introduction to GCC - Debugging with GDB - The Make utility - GNU Configure and Build System - GNU Binary utilities - Profiling - using gprof - Memory Leak Detection with valgrind - Introduction to GNU C Library .

Laboratory Practice:

Practice C language programs using GCC compiler in Linux environment

MODULE III EMBEDDED C USING 8051 MICROCONTROLLER 09

Adding Structure to ‘C’ Code: Object oriented programming with C, Header files for Project and Port, Examples. Meeting Real-time constraints: Creating hardware delays - Need for timeout mechanism - Creating loop timeouts - Creating hardware timeouts.

Laboratory Practice:

Practice Embedded C language programs illustrating the language construct in the module III using C Keil µvision IDE

MODULE IV EMBEDDED OS 09

Creating embedded operating system: Basis of a simple embedded OS, Introduction to sEOS, Using Timer 0 and Timer 1, Portability issue, Alternative system architecture, Important design considerations when using sEOS.

Laboratory Practice:

Practice Embedded C language programs illustrating the language construct in the module IV using C Keil µvision IDE

MODULE V PYTHON PROGRAMMING 09

Basics of PYTHON Programming Syntax and Style – Python Objects– Dictionaries – comparison with C programming on Conditionals and Loops – Files – Input and Output – Errors and Exceptions – Functions – Modules – Classes and OOP – Execution Environment.

Laboratory Practice:

Practice basic Python language programs illustrating the language construct in the module V using Python interactive shell software

Total Hours :45

REFERENCES:

1. Stephen Kochan, “Programming in C”, 3rd Edition, Sams Publishing, 2009.
2. Steve Oualline, “Practical C Programming 3rd Edition”, O’Reilly Media, Inc, 2006.
3. Michael J Pont, “Embedded C”, Pearson Education, 2007.
4. Mark Lutz, “Learning Python Powerful OOPs”, O’reilly, 2011.

OUTCOMES:

At the end of the course students will be able to

- Write, compile and debug programs in C language.
- compile the program in linux operating system
- Develop program using embedded C
- Describe operating system in embedded system
- Program using phython language
- Design projects using embedded C and python language

MACY081 SIGNAL PROCESSING TECHNIQUES

L	T	P	C
3	1	0	4

OBJECTIVES:

- To impart knowledge on various mathematical transforms for signal processing applications.

MODULE I LAPLACE TRANSFORM FOR CONTINUOUS TIME SIGNALS 06+03

Analog and digital signals - Periodic and aperiodic signals – Spectrum estimation for bandwidth requirement – Laplace Transform – Spectrum estimation – Frequency filtering for spectrum modification – Inverse Laplace Transform – Modified spectrum to get filtered signal.

MODULE II Z -TRANSFORM FOR DISCRETE TIME SIGNALS 12+03

Sampling of continuous time signals for discrete time signals – Nyquist sampling rate - Need for discrete signals – Quantization for digital signal – Z-Transform – Spectrum estimation of discrete signals – Digital filters for spectrum modification – Inverse Z-Transform – Modified spectrum to get filtered signal – Impulse response of digital systems - Bilinear Transform for analog to digital conversion.

MODULE III DISCRETE FOURIER TRANSFORM FOR DISCRETE TIME SIGNALS 09+03

Discrete Fourier Transform – Comparison with Z-Transform – Discrete signals for spectrum estimation – Digital filters for spectrum modification – Inverse Discrete Fourier Transform to get filtered signals – Fast Fourier Transform with decimation in either time or frequency

MODULE IV DISCRETE COSINE TRANSFORM FOR DISCRETE TIME SIGNALS 09+03

One dimensional and two dimensional discrete Cosine transforms – comparison with discrete Fourier transform – image processing applications like filtering & compression – two dimensional transform implementation using successive one dimensional transform – application in JPEG standards – zig zag scanning of transform coefficients – inverse discrete Cosine transform – expansion of compressed images – calculation of compression parameters of CF, RMSE, PSNR &CQ.

MODULE V DISCRETE WAVELET TRANSFORM FOR DISCRETE TIME SIGNALS (09+03

Wavelet – Haar wavelet – one dimensional forward discrete wavelet transform – comparison with discrete Cosine transform - two dimensional transform implementation using successive one dimensional transform – Image processing applications like filtering & compression - application in JPEG 2000 standards – zig zag scanning of transform coefficients – inverse discrete wavelet transform – expansion of compressed images – calculation of compression parameters of CF, RMSE, PSNR & CQ.

L – 45; T – 15; Total Hours– 60

REFERENCES:

1. Joel L.Schiff , “The Laplace Transform: Theory and Applications” – Springer – 1999.
2. Alexander D. Poularikas, “The Transforms and Applications Handbook” Chapter 6 on Z- Transforms - Boca Raton : CRC Press LLC - 2000.
3. D.Sundararajan, “The Discrete Fourier Transform: Theory”, Algorithm and Applications – World Scientific Publishers – 2001.
4. K.Rao and P.Yip, “Discrete Cosine Transform – Elsevier”, – 1990.
5. D.Sundararajan, “Discrete Wavelet Transform: A Signal Processing Approach”, Wiley – 2015.

OUTCOMES:

On completion of the course, the student will be able to apply

- Laplace transform for analog signal analysis.
- Z Transform for discrete signal analysis.
- Discrete Fourier Transform for discrete signal analysis.
- Discrete Cosine Transform for discrete signal analysis.
- Discrete Wavelet Transform for discrete signal analysis.
- The methods to calculate compression parameters.

GENERAL ELECTIVES

GECY101	PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The objectives of the course would be to make the students

- Learn to e valuate and choose an optimal project and build a project profile.
- Attain knowledge on risk identification and risk analysis
- Gain insight into a project plan and components
- Familiar with various gamut of technical analysis for effective project implementation
- Learn to apply project management techniques to manage resources.

MODULE I INTRODUCTION & PROJECT INITIATION 09

Introduction to project and project management - projects in contemporary organization – The project life cycle - project initiation - project evaluation methods & techniques - project selection criteria - project profile.

MODULE II RISK ANALYSIS 09

Sources of risk: project specific - competitive - industry specific - market and international risk – perspectives of risk – risk analysis: sensitivity analysis - scenario analysis - breakeven analysis - simulation analysis - decision tree analysis – managing/mitigating risk – project selection under risk.

MODULE III PROJECT PLANNING & IMPLEMENTATION 09

Project planning – importance – functions - areas of planning - project objectives and policies - steps in planning process - WBS – capital requirements - budgeting and cost estimation - feasibility analysis - creation of project plan – project implementation: pre-requisites - forms of project organization

MODULE IV TECHNICAL ANALYSIS 09

Technical analysis for manufacturing/construction/infrastructure projects – process/technology - materials and inputs - product mix - plant capacity – plant location and site selection – plant layout - machinery and equipment – structures and civil works – schedule of project implementation – technical analysis for software projects.

MODULE V PROJECT MANAGEMENT TECHNIQUES 09

Project scheduling - network construction – estimation of project completion time – identification of critical path - PERT & CPM – crashing of project network - complexity of project scheduling with limited resources - resource allocation - resource leveling – resource smoothing – overview of project management software.

Total Hours: 45

REFERENCES:

1. Projects: Planning, Analysis, Financing, Implementation and Review, Prasanna Chandra, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2004.
2. Project Management and Control, Narendra Singh, Himalaya Publishing, New Delhi, 2015.
3. A Management Guide to PERT/CPM, Jerome, D. Weist and Ferdinand K. Levy, Prentice Hall of India, New Delhi, 1994.

OUTCOMES:

On successfully completing this course, the student will be able to:

- Evaluate & select a project as well as develop a project profile.
- Identify various risks associated with the project and manage it effectively.
- Prepare a detailed project plan addressing its components.
- Perform technical analysis for effective project implementation
- Apply project management techniques for maximizing resource utilization.

GECY102 SOCIETY, TECHNOLGY & SUSTAINABILITY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To aware of new technologies through advances in Science and Engineering.
- To make them realise the profound impact on society.
- To understand the ethical issues raised by technological changes and its effect on society.
- To introduce students a broad range of perspectives on the adoption and use of technologies.
- To make them realize the need of sustainability in the context of emerging technologies.

MODULE I TECHNOLOGY AND ITS IMPACTS 09

Origin and evolution of technologies – Nature of technology- Innovation – Historical Perspective of technology – Sources of technological change - Co-evolution of technology and economy – Scientific knowledge and technological advance – Science and Engineering aspects of Technology – Impact on the Society – Social and Ethical Issues associated with technological change – Social and environmental consequences - Impact of technological change on human life – Technology and responsibility – Technology and social justice.

MODULE II TECHNOLOGY AND ITS ADVANCEMENT 09

Sociological aspects of technology – Ethics and technology – Technology and responsibility – International Economics, Globalisation and Human Rights – Sustainability and Technology – Population and environment - Technology, Energy and Environment – Organisations and technological change.

MODULE III SOCIETY AND TECHNOLOGY 09

Impact of technologies on contemporary society – Role of society in fostering the development of technology – Response to the adaption and use of technology – Impact of technology on developer and consumers – Technological change and globalisation.

MODULE IV IMPACT OF A SPECIFIC TECHNOLOGY ON HUMAN WELFARE 09

Impact of the following technologies on Human life – Medical and Biomedical – Genetics Technology – Electronics and Communications – Electronic media

Technology – Information Systems Technology – Nanotechnology – Space Technology and Energy Technology.

MODULE V THE IMPORTANCE OF SUSTAINABILITY 09

Sustainability – A brief history – Concepts and contexts for sustainability – Ecological imbalance and biodiversity loss – Climate change – Population explosion. Industrial ecology – systems approach to sustainability – Green engineering and technology- sustainable design- sustainable manufacturing- Green consumer movements – Environmental ethics – Sustainability of the planet Earth – Future planning for sustainability.

Total Hours: 45

REFERENCES:

1. Volti Rudi, “Society and Technology Change”, 6th Edition, Worth publishers Inc, USA, 2009.
2. Arthur W.A, “The nature of Technology: What it is and how it evolves”, Free Press, NY, USA, 2009.
3. Winston M and Edelbach R, “Society, Ethics and Technology”, 3rd Edition, San Francisco, USA, 2005.
4. Martin A.A Abraham, “Sustainability Science and Engineering: Defining Principles”, Elsevier Inc, USA, 2006.
5. R.V.G.Menon, “Technology and Society”, Pearson Education, India, 2011.

OUTCOMES:

At the end of this course, the students will be able to

- Understand the benefits of modern technology for the well-being of human life.
- Connect sustainability concepts and technology to the real world challenges.
- Find pathway for sustainable society.

GECY103 ARTIFICIAL INTELLIGENCE

L	T	P	C
3	0	0	3

OBJECTIVES:

- Expose the history and foundations of artificial intelligence.
- Showcase the complexity of working on real time problems underlying the need for intelligent approaches.
- Illustrate how heuristic approaches provide a good solution mechanism.
- Provide the mechanisms for simple knowledge representation and reasoning.
- Highlight the complexity in working with uncertain knowledge.
- Discuss the current and future applications of artificial intelligence.

MODULE I HISTORY AND FOUNDATIONS 08

History – Scope – Influence from life – Impact of computing domains - Agents in environments - Knowledge representation – Dimensions of Complexity – Sample application domains – Agent structure.

MODULE II SEARCH 10

Problem solving as search – State spaces – Uninformed Search – Heuristic search – Advanced search – Constraint satisfaction - Applications.

MODULE III KNOWLEDGE REPRESENTATION AND REASONING 10

Foundations of knowledge representation and reasoning, representing and reasoning about objects, relations, events, actions, time, and space predicate logic, situation calculus, description logics, reasoning with defaults, reasoning about knowledge, sample applications.

MODULE IV REPRESENTING AND REASONING WITH UNCERTAIN KNOWLEDGE 08

Probability, connection to logic, independence, Bayes rule, Bayesian networks, probabilistic inference, sample applications.

MODULE V CASE STUDY AND FUTURE APPLICATIONS 09

Design of a game / Solution for problem in student's domain. Natural Language processing, Robotics, Vehicular automation – Scale, Complexity, Behaviour – Controversies.

Total Hours: 45

TEXT BOOK:

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall, Third Edition, 2010.
2. David Poole, Alan Mackworth, Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010.
3. Nils J. Nilsson, The Quest for Artificial Intelligence, Cambridge University Press, Online edition, 2013.
4. Keith Frankish, William M. Ramsey (eds) The Cambridge Handbook of Artificial Intelligence, Cambridge University Press, 2014.

OUTCOMES:

Students who complete this course will be able to

- Discuss the history, current applications, future challenges and the controversies in artificial intelligence.
- Apply principle of AI in the design of an agent and model its actions.
- Design a heuristic algorithm for search problems.
- Analyze and represent the fact using logic for a given scenario
- Represent uncertainty using probabilistic models
- Develop a simple game or solution using artificial intelligence techniques.

GECY104 GREEN COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To focus on the necessity of green computing technology.
- To expose to various issues with information technology and sustainability.
- To attain knowledge on the technologies for enabling green cloud computing.
- To elaborate on the energy consumption issues
- To illustrate a Green and Virtual Data Center
- To develop into a Green IT Technologist.

MODULE I INTRODUCTION 08

Trends and Reasons to Go Green - IT Data Center Economic and Ecological Sustainment - The Growing Green Gap: Misdirected Messaging, Opportunities for Action - IT Data Center “Green” Myths and Realities - PCFE Trends, Issues, Drivers, and Related Factors - Green Computing and Your Reputation- Green Computing and Saving Money- Green Computing and the Environment

MODULE II CONSUMPTION ISSUES 10

Minimizing power usage – Cooling - Electric Power and Cooling Challenges - Electrical – Power -Supply and Demand Distribution - Determining Energy Usage - From Energy Avoidance to Efficiency - Energy Efficiency Incentives, Rebates, and Alternative Energy Sources - PCFE and Environmental Health and Safety Standards- Energy-exposed instruction sets- Power management in power-aware real-time systems.

MODULE III NEXT-GENERATION VIRTUAL DATA CENTERS 09

Data Center Virtualization - Virtualization beyond Consolidation - Enabling Transparency - Components of a Virtual Data Center - Datacenter Design and Redesign - Greening the Information Systems - Staying Green- Building a Green Device Portfolio- Green Servers and Data Centers- Saving Energy

MODULE IV TECHNOLOGIES FOR ENABLING GREEN AND VIRTUAL DATA CENTERS 08

Highly Effective Data Center Facilities and Habitats for Technology - Data Center Electrical Power and Energy Management - HVAC, Smoke and Fire Suppression

- Data Center Location - Virtual Data Centers Today and Tomorrow - Cloud Computing, Out-Sourced, and Managed Services.

MODULE V SERVERS AND FUTURE TRENDS OF GREEN COMPUTING 10

Server Issues and Challenges - Fundamentals of Physical Servers - Types, Categories, and Tiers of Servers - Clusters and Grids - Implementing a Green and Virtual Data Center - PCFE and Green Areas of Opportunity- 12 Green Computer Companies- What's in Green computer science-Green off the Grid aimed for data center energy evolution-Green Grid Consortium- Green Applications- Green Computing Making Great Impact On Research

Total Hours: 45

REFERENCES:

1. Bud E. Smith,"Green Computing Tools and Techniques for Saving Energy, Money, and Resources", Taylor & Francis Group, CRC Press, ISBN-13: 978-1-4665-0340-3, 2014.
2. Jason Harris, "Green Computing and Green IT Best Practices, On Regulations and Industry Initiatives, Virtualization and power management, materials recycling and Tele commuting, Emereo Publishing .ISBN-13: 978-1-9215-2344-1,2014.
3. Ishfaq Ahmed & Sanjay Ranka, "Handbook of Energy Aware and Green Computing", CRC Press, ISBN: 978-1-4665-0116-4, 2013.
4. Kawahara, Takayuki, Mizuno, "Green Computing with Emerging Memory", Springer Publications, ISBN:978-1-4614-0811-6, 2012
5. Greg Schulz, "The Green and Virtual Data Center", CRC Press, ISBN-13:978-1-4200-8666-9, 2009.
6. Marty Poniatowski, "Foundation of Green IT: Consolidation, Virtualization, Efficiency, and ROI in the Data Center", Printice Hall, ISBN: 9780-1-3704-375-0, 2009.

OUTCOMES:

Students who complete this course will be able to

- Demonstrate issues relating to a range of available technologies, systems and practices to support green computing.
- Select appropriate technologies that are aimed to reduce energy consumption.
- Address design issues needed to achieve an organizations' green

computing objectives.

- Analyze the functionality of Data Centers.
- Critically evaluate technologies and the environmental impact of computing resources for a given scenario.
- Compare the impact of Green Computing with other computing techniques.

GECY105 GAMING DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To master event-based programming
- To learn resource management as it relates to rendering time, including level-of-detail and culling.
- To become familiar with the various components in a game or game engine.
- To explore leading open source game engine components.
- To become familiar of game physics.
- To be compatible with game animation.

MODULE I INTRODUCTION 09

Magic Words – What Skills Does a Game Designer Need? – The Most Important Skill -The Five Kinds of Listening-The Secret of the Gifted.

MODULE II THE DESIGNER CREATES AN EXPERIENCE 09

The Game Is Not the Experience -Is This Unique to Games? -Three Practical Approaches to Chasing Rainbows -Introspection: Powers, Perils, and Practice -Dissect Your Feelings -Defeating Heisenberg -Essential Experience.

MODULE III THE EXPERIENCE IN THE PLAYER MIND AND GAME MECHANICS 08

Modeling – Focus -Empathy – Imagination – Motivation – Space – Objects, Attributes, and States – Actions – Rules.

MODULE IV GAMES THROUGH AN INTERFACE 09

Breaking it Down – The Loop of Interaction – Channels of Information – Other Interface.

MODULE V BALANCED GAME MECHANICS 10

Balance – The Twelve Most Common Types of Game Balance – Game Balancing Methodologies - Balancing Game Economies.

Total Hours: 45

REFERENCES:

1. Jesse Schell, "The Art of Game Design: A Book of Lenses", 2nd Edition

ISBN-10: 1466598646, 2014.

2. Ashok Kumar, Jim Etheredge, Aaron Boudreaux, “Algorithmic and Architectural Gaming Design: Implementation and Development", 1st edition, Idea Group, U.S ISBN-10: 1466616342, 2012.
3. Katie Salen Tekinba, Melissa Gresalfi, Kylie Peppler, Rafi Santo, "Gaming the System - Designing with Gamestar Mechanic" MIT Press , ISBN-10: 026202781X, 2014.
4. James M. Van Verth, Lars M. Bishop "Essential Mathematics for Games and Interactive Applications", Third Edition, A K Peters / CRC Press, ISBN-10: 1482250926, 2015.

OUTCOMES:

Students who complete this course will be able to

- Realize the basic history and genres of games
- Demonstrate an understanding of the overall game design process
- Explain the design tradeoffs inherent in game design
- Design and implement basic levels, models, and scripts for games
- Describe the mathematics and algorithms needed for game programming
- Design and implement a complete three-dimensional video game

GECY106 SOCIAL COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To create original social applications, critically applying appropriate theories and effective practices in a reflective and creative manner.
- To critically analyze social software in terms of its technical, social, legal, ethical, and functional features or affordances.
- To encourage the development of effective communities through the design, use, and management of social software.
- To give students with a base of knowledge and advances for them to critically examine existing social computing services.
- To plan and execute a small-scale research project in social computing in a systematic fashion.
- To become familiar with the concept of computational thinking.

MODULE I BASIC CONCEPTS 09

Networks and Relations: Relations and Attributes, Analysis of Network Data, Interpretation of network data -New Social Learning – Four Changes that Shift Work - Development of Social Network Analysis: Sociometric analysis and graph theory, Interpersonal Configurations and Cliques – Analysing Relational Data.

MODULE II SOCIAL LINK 09

Individual Actors, Social Exchange Theory, Social Forces, Graph Structure, Agent Optimization Strategies in Networks – Hierarchy of Social Link Motivation- Social Context.

MODULE III SOCIAL MEDIA 08

Trends in Computing – Motivations for Social Computing – Social Media: Social relationships, Mobility and Social context – Human Computation – Computational Models- Business use of social Media.

MODULE IV SOCIAL INFORMATION FILTERING 09

Mobile Location Sharing – Location based social media analysis – Social Sharing and Social Filtering – Automated recommender Systems – Traditional and Social Recommender Systems.

MODULE V SOCIAL NETWORK STRATEGY 10

Application of Topic Models – Opinions and Sentiments – Recommendation Systems – Language Dynamics and influence in online communities – Psychometric analysis – Case Study: Social Network Strategies for surviving the zombie apocalypse.

Total Hours: 45

REFERENCES:

1. Tony Bingham, Marcia Conner, “The New Social Learning, Connect. Collaborate. Work”, 2nd Edition, ATD Press, ISBN-10:1-56286-996-5, 2015.
2. Nick Crossley, Elisa Bellotti, Gemma Edwards, Martin G Everett, Johan Koskinen, Mark Tranmer, “Social Network Analysis for Ego-Nets”, SAGE Publication, 2015.
3. Zafarani, Abbasi and Liu, Social Media Mining: An Introduction, Cambridge University Press, 2014.
4. Christina Prell, “Social Network Analysis: History, Theory and Methodology”, 1st Edition, SAGE Publications Ltd, 2012.
5. John Scott, “Social Network Analysis”, Third Edition, SAGE Publication, 2013.
6. Jennifer Golbeck, “Analyzing the Social Web”, Elsevier Publication, 2013.
7. Huan Liu, John Salerno, Michael J. Young, “Social computing and Behavioral Modeling”, Springer Publication, 2009.

OUTCOMES:

Students who complete this course will be able to

- Realize the range of social computing applications and concepts.
- Analyze data left after in social media.
- Recognize and apply the concepts of computational models underlying social computing.
- Take out simple forms of social diagnostics, involving network and language models, applying existing analytic tools on social information.
- Evaluate emerging social computing applications, concepts, and techniques in terms of key principles.
- Design and prototype new social computing systems.

GECY107 SOFT COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

The aim of the course is to

- Enumerate the strengths and weakness of soft computing
- Illustrate soft computing methods with other logic driven and statistical method driven approaches
- Focus on the basics of neural networks, fuzzy systems, and evolutionary computing
- Emphasize the role of euro-fuzzy and hybrid modeling methods
- Trace the basis and need for evolutionary computing and relate it with other soft computing approaches

MODULE I SOFT COMPUTING - BASICS 06

Soft computing – Hard Computing – Artificial Intelligence as the basis of soft computing – Relation with logic driven and statistical method driven approaches- Expert systems – Types of problems: Classification, Functional approximation, Optimizations – Modeling the problem – Machine Learning – Hazards of Soft Computing – Current and future areas of research

MODULE II ARTIFICIAL NEURAL NETWORK 12

Artificial Neuron – Multilayer perceptron – Supervised learning – Back propagation network –Types of Artificial Neural Network: Supervised Vs Un Supervised Network – Radial basis function Network – Self Organizing Maps – Recurrent Network – Hopfield Neural Network – Adaptive Resonance Theory – Issues in Artificial Neural Network – Applications

MODULE III FUZZY SYSTEMS 09

Fuzzy Logic – Membership functions – Operators – Fuzzy Inference systems – Other sets: Rough sets, Vague Sets – Fuzzy controllers - Applications

MODULE IV NEURO FUZZY SYSTEMS 09

Cooperative Neuro fuzzy systems – Neural network driven fuzzy reasoning – Hybrid Neuro fuzzy systems – Construction of Neuro Fuzzy systems: Structure Identification phase, Parameter learning phase – Applications

MODULE V EVOLUTIONARY COMPUTING 09

Overview of evolutionary computing – Genetic Algorithms and optimization –

Genetic Algorithm operators – Genetic algorithms with Neural/Fuzzy systems – Variants of Genetic Algorithms– Population based incremental learning – Evolutionary strategies and applications

Total Hours: 45

TEXTBOOKS:

1. Samir Roy, “Introduction to Soft Computing: Neuro-Fuzzy and Genetic Algorithms”, Pearson, 2013
2. Anupam Shukla, Ritu Tiwari and Rahul Kala, “Real life applications of Soft Computing”, CRC press, 2010.
3. Fakhreddine O. Karray, “Soft Computing and Intelligent Systems Design: Theory, Tools and Applications”, Pearson, 2009

OUTCOMES:

At the end of the course the students will be able to

- Enumerate the theoretical basis of soft computing
- Explain the fuzzy set theory
- Discuss the neural networks and supervised and unsupervised learning networks
- Demonstrate some applications of computational intelligence
- Apply the most appropriate soft computing algorithm for a given situation

GECY108 EMBEDDED SYSTEM PROGRAMMING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the design of embedded computing systems with its hardware and software architectures.
- To describe entire software development lifecycle and examine the various issues involved in developing software for embedded systems.
- To analyze the I/O programming and Embedded C coding techniques
- To equip students with the software development skills necessary for practitioners in the field of embedded systems.

MODULE I INTRODUCTION OF EMBEDDED SYSTEM 09

Embedded computing – characteristics and challenges – embedded system design process – Overview of Processors and hardware units in an embedded system – Compiling, Linking and locating – downloading and debugging – Emulators and simulators processor – External peripherals – Memory testing – Flash Memory.

MODULE II SOFTWARE TECHNOLOGY 09

Software Architectures, Software development Tools, Software Development Process Life Cycle and its Model, Software Analysis, Design and Maintenance.

MODULE III INPUT/OUTPUT PROGRAMMING 09

I/O Instructions, Synchronization, Transfer Rate & Latency, Polled Waiting Loops, Interrupt – Driven I/O, Writing ISR in Assembly and C, Non Maskable and Software Interrupts

MODULE IV DATA REPRESENTATION IN EMBEDDED SYSTEMS 09

Data representation, Twos complement, Fixed point and Floating Point Number Formats, Manipulating Bits in -Memory, I/O Ports, Low level programming in C, Primitive data types, Arrays, Functions, Recursive Functions, Pointers, Structures & Unions, Dynamic Memory Allocation, File handling, Linked lists, Queues, Stacks.

MODULE V EMBEDDED C 09

Embedded Systems programming in C – Binding & Running Embedded C program in Keil IDE – Dissecting the program - Building the hardware. Basic techniques for

reading & writing from I/O port pins – switch bounce - LED Interfacing using Embedded C.

Total Hours: 45

REFERENCES:

1. Marilyn Wolf, "Computers as components ", Elsevier, 2012.
2. Qing Li and Carolyn Yao, "Real-Time Concepts for Embedded Systems", CMP Books, 2003.
3. Daniel W. Lewis, "Fundamentals of embedded software where C and assembly meet", Pearson Education
4. Michael Bass, "Programming Embedded Systems in C and C++", Oreilly, 2003.

OUTCOMES:

On completion of this course the student will be able to

- Design the software and hardware components in embedded system
- Describe the software technology
- Use interrupt in effective manner
- Use keil IDE for programming
- Program using embedded C for specific microcontroller
- Design the embedded projects

GECY109 PRINCIPLES OF SUSTAINABLE DEVELOPMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge in the concepts and dimensions of sustainable development.
- To gain knowledge on the framework for achieving sustainability.

MODULE I CONCEPT OF SUSTAINABLE DEVELOPMENT 09

Environment and Development - Population poverty and Pollution – Global and Local environmental issues – Resource Degradation- Greenhouse gases – Desertification-industrialization – Social insecurity, Globalization and environment. History and emergence of the concept of sustainable development-Objectives of Sustainable Development.

MODULE II COMPONENTS AND DIMENSIONS OF SUSTAINABLE DEVELOPMENT 09

Components of Sustainability – Complexity of growth and equity – Social economic and environmental dimensions of sustainable development – Environment – Biodiversity – Natural – Resources – Ecosystem integrity – Clean air and water – Carrying capacity – Equity, Quality of Life, Prevention, Precaution – Preservation and Public Participation Structural and functional linking of developmental dimensions.

MODULE III FRAMEWORK FOR ACHIEVING SUSTAINABILITY 09

Operational guidelines – interconnected prerequisites for sustainable development Empowerment of Women, children, Youth, Indigenous People, Non-Governmental Organizations Local Authorities, Business and industry – Science and Technology for sustainable development – performance indicators of sustainability and assessment mechanism – Constraints and barriers for sustainable development.

MODULE IV SUSTAINABLE DEVELOPMENT OF SOCIO ECONOMIC SYSTEMS 09

Demographic dynamics of sustainability – Policies for socio-economic development – Strategies for implementing eco-development programmes Sustainable development through trade – Economic growth – Action plan for implementing sustainable development – Urbanization and sustainable Cities – Sustainable Energy and Agriculture – sustainable livelihoods.

MODULE V SUSTAINABLE DEVELOPMENT AND INTERNATIONAL RESPONSE 09

Role of developed countries in the development of developing countries – international summits – Stockholm to Johannesburg – Rio principles – Agenda-Conventions – Agreements – Tokyo Declaration – Doubling statement – Tran boundary issues integrated approach for resources protection and management

Total Hours: 45

REFERENCES:

1. Sayer J. and Campbell, B., The Science of Sustainable Development: Local Livelihoods and the Global environment - Biological conservation restoration & Sustainability, Cambridge university Press, London, 2003.
2. M.K. Ghosh Roy. and Timberlake, Sustainable Development, Ane Books Pvt. Ltd, 2011.
3. Mackenthun K.M., Concepts in Environmental Management, Lewis Publications London, 1999.
4. APJ Abdul Kalam and Srijan Pal Singh, Target 3 Billion: Innovative Solutions Towards Sustainable Development, Penguin India, 2011

OUTCOMES:

At the end of the course the student will be able to

- Describe the concepts of sustainable development
- Define the components and dimensions of sustainable development
- Outline the Frame work for achieving sustainability.
- State the policies and strategies for implementing sustainable development for Socio economic programmes.
- Examine the role of developed countries in sustainable development.

GECY110	QUANTITATIVE TECHNIQUES IN MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVE:

To impart knowledge on

- Concepts of operations research
- Inventory control in production management
- Financial management of projects
- Decision theory and managerial economics

MODULE I OPERATIONS RESEARCH 09

Introduction to Operations research – Linear programming – Graphical and Simplex Methods, Duality and Post-Optimality Analysis – Transportation and Assignment Problems

MODULE II PRODUCTION MANAGEMENT 09

Inventory control, EOQ, Quantity Discounts, Safety Stock – Replacement Theory – PERT and CPM – Simulation Models – Quality Control.

MODULE III FINANCIAL MANAGEMENT 09

Working Capital Management – Compound Interest and Present Value methods – Discounted Cash Flow Techniques – Capital Budgeting.

MODULE IV DECISION THEORY 09

Decision Theory – Decision Rules – Decision making under conditions of certainty, risk and uncertainty – Decision trees – Utility Theory.

MODULE V MANAGERIAL ECONOMICS 09

Cost concepts – Break even Analysis – Pricing techniques – Game Theory applications.

Total Hours: 45

REFERENCES:

1. Vohra, N.D. , Quantitative Techniques in Management, Tata McGraw Hill Co., Ltd, New Delhi, 2009.
2. Seehroeder, R.G., Operations Management, McGraw Hill, USA, 2002.
3. Levin, R.I, Rubin, D.S., and Stinsonm J., Quantitative Approaches to Management, McGraw Hill Book Co., 2008.

4. Frank Harrison, E., The Managerial Decision Making Process, Houghton Miffin Co. Boston, 2005.
5. Hamdy A. Taha, Operations Research- An Introduction, Prentice Hall, 2002.

OUTCOME:

At the end of the course, the students will be able to

- Apply the concepts of operations research for various applications
- Create models for inventory control in production management
- Compute the cash flow for a project
- Choose a project using decision theory based on the risk criterion.
- Apply the concepts of managerial economics in construction management

GECY111 PROGRAMMING USING MATLAB & SIMULINK

L	T	P	C
1	0	2	2

OBJECTIVES:

The aim of this course is to:

- Teach students how to mathematically model engineering systems
- Teach students how to use computer tools to solve the resulting mathematical models. The computer tool used is MATLAB and the focus will be on developing and solving models of problems encountered in engineering fields

MODULE I INTRODUCTION TO MATLAB AND DATA PRESENTATION 10

Introduction to MATLAB-Vectors, Matrices -Vector/Matrix Operations & Manipulation- Functions vs scripts- Making clear and compelling plots-Solving systems of linear equations numerically and symbolically.

Lab Experiments

1. Study of basic matrix operations and manipulations.
2. Numerical and symbolical solution of linear equations.

MODULE II ROOT FINDING AND MATLAB PLOT FUNCTION 10

Linearization and solving non-linear systems of equations- The Newton-Raphson method- Integers and rational numbers in different bases- Least squares regression -Curve fitting-Polynomial fitting and exponential fitting.

Lab Experiments

1. Solution of non linear equations using Newton-Raphson method.
2. Determination of polynomial fit and exponential fit for the given data.

MODULE III LINEAR AND NON-LINEAR DIFFERENTIAL EQUATIONS 13

Numerical integration and solving first order, ordinary differential equations (Euler's method and Runge-Kutta) - Use of ODE function in MATLAB- Converting second order and higher ODEs to systems of first order ODEs- Solving systems of higher order ODEs via Euler's method and Runge-Kutta) - Solving single and systems of non-linear differential equations by linearization-Use of the function ODE in MATLAB to solve differential equations - Plot Function –Saving & Painting Plots.

Lab Experiments

1. Solution of fourth order linear differential equations using
    a. Trapezoidal Rule

b. Euler method

2. Solution of fourth order non-linear differential equations using
    a. Modified Euler method
    b. Runge – Kutta method

MODULE IV INTRODUCTION OF SIMULINK 12

Simulink & its relations to MATLAB – Modeling a Electrical Circuit- Modeling a fourth order differential equations- - Representing a model as a subsystem- Programme specific Simulink demos.

Lab Experiments

1. Solution of fourth order non-linear differential equations using simulink.
2. Programme specific experiment based on simulink.

Total Hours (Including Practicals): 45

REFERENCE:

1. Griffiths D V and Smith I M, “Numerical Methods for Engineers”, Blackwell, 1991.
2. Laurene Fausett, “Applied Numerical Analysis Using MATLAB”, Pearson 2008.
3. Moin P, “Fundamentals of Engineering Numerical Analysis”, Cambridge University Press, 2001.
4. Wilson HB, Turcotte LH, Advanced mathematics and mechanics applications using MATLAB”, CRC Press, 1997
5. Ke Chen, Peter Giblin and Alan Irving, “Mathematical Exploration with MATLAB”, Cambridge University Press, 1999.

OUTCOMES:

At the end of this unit students will be able to:

- Use Matlab as a convenient tool for solving a broad range of practical problems in engineering from simple models to real examples.
- Write programs using first principles without automatic use of built-in ones.
- Write programs for solving linear and nonlinear systems, including those arising from boundary value problems and integral equations, and for root-finding and interpolation, including piecewise approximations.
- Be fluent in exploring Matlab’s capabilities, such as using matrices as the fundamental data-storage unit, array manipulation, control flow, script and function m-files, function handles, graphical output.
- Make use of Maltab visual capabilities for all engineering applications.

- An ability to identify, formulate, and solve engineering problems. This will be accomplished by using MATLAB to simulate the solution to various problems in engineering fields

GECY112 JAVA PROGRAMMING

L	T	P	C
1	0	2	2

OBJECTIVES:

- To learn the fundamentals of Java programming such as data types, variables and arrays.
- To study the syntax and necessity of decision making and iterative statements.
- To create a class and invoke the methods.
- To instigate programming in overloading of methods.
- To emphasize the concept of packages.
- To learn the exception handling routines.

MODULE I INTRODUCTION TO JAVA PROGRAMMING 08

History and Evolution of Java – Overview of Java – Data types, variables and arrays – Operators – Control statements.

MODULE II METHODS AND CLASSES 07

Class fundamentals – Declaring objects – Methods – Constructors – Garbage collection – Overloading methods – Constructor overloading – Access control – Inheritance – Packages - Exception handling.

L: 15, P: 30, Total Hours: 15

REFERENCES:

1. Herbert Schildt, “Java The Complete Reference”, 9th Edition, Oracle Press, 2014, ISBN: 978007180855-2.
2. Nicholas S. Williams, **“**Professional Java for Web Applications: Featuring WebSockets, Spring Framework, JPA Hibernate and Spring Security (WROX)”, John Wiley & Sons, 2014, ISBN: 978111865651-8.
3. E Balagurusamy, “Programming with Java”, 5th Edition, Tata Mcgraw Hill, 2014.
4. Yashavant Kanetka**, “**Let Us Java”, 2nd Edition, BPB Publications, 2012**.**

OUTCOMES:

Students who complete this course will be able to

- Implement basic Java programming.
- Create a class and invoke methods for real world problems.

- Construct simple overloading of methods programs.
- Implement various types of inheritance concepts.
- Describe the access control mechanism.
- Handle exception thrown while implementing programming.

GECY113 PYTHON PROGRAMMING

L	T	P	C
1	0	2	2

OBJECTIVES:

- To learn the list and records of python programming.
- To study the control statements and string functions of python.
- To instigate the fundamental python programming.
- To emphasize GUI in python.
- To integrate python with embedded systems.
- To implement programs in python.

MODULE I INTRODUCTION TO PYTHON PROGRAMMING 08

Installation and environment set up – syntax used in python – variable types – operators – Loops – decision making – string functions - formatted files - GUI basics.

MODULE II EMBEDDED PROGRAMMING USING PYTHON 07

Web interface – system tools – script execution context - Motion-triggered LEDs – Python - Arduino prototyping-storing and plotting Arduino data-Remote home monitoring system.

L: 15, P: 30, Total Hours: 15

REFERENCES:

1. Nick Goddard, “Python Programming”, 2nd edition, ISBN: 1533337772, 2016.
2. Pratik Desai, “Python Programming for Arduino”, 1st edition, Packt publishing, 2015, ISBN: 9781783285938.
3. Mark Lutz, Learning Python: Powerful Object-Oriented Programming, 5th Edition, O'Reilly Media, 2013.
4. Richard H. Barnett, Sarah Cox, Larry O'Cull, “Embedded C Programming and the Atmel AVR”, 2nd edition, 2006.
5. Michael Barr, Anthony Massa, “Programming Embedded Systems”, 2nd Edition, O'Reilly Media, 2006.

OUTCOMES:

Students who complete this course will be able to

- Implement date and time function programming using python.

- Write formatted file programming.
- Construct simple python programs.
- Create web interface using python programming
- Develop embedded system with python programming.
- Build Arduino prototype using python programming.

GECY114 INTELLECTUAL PROPERTY RIGHTS (IPR)

L	T	P	C
1	0	0	1

OBJECTIVES:

- To study about Intellectual property rights and its need
- To explore the patent procedure and related issues

MODULE I INTRODUCTION 07

Introduction and the need for intellectual property right (IPR) – IPR in India – Genesis and Development – IPR in abroad – Important examples of IPR – Copyrights, Trademarks, Patents, Designs, Utility Models, Trade Secrets and Geographical Indications – Industrial Designs

MODULE II PATENT 08

Concept of Patent – Product / Process Patents & Terminology – Duration of Patents – Law and Policy Consideration Elements of Patentability –- Patentable Subject Matter – Procedure for Filing of Patent Application and types of Applications – Procedure for Opposition – Revocation of Patents – Working of Patents- Patent Agent – Qualification and Registration Procedure – Patent databases and information system – Preparation of patent documents – Process for examination of patent application- Patent infringement – Recent developments in patent system

Total Hours: 15

REFERENCES

1. B.L.Wadehra; Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India 2000
2. Ajit Parulekar and Sarita D' Souza, Indian Patents Law – Legal & Business Implications; Macmillan India ltd , 2006
3. P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi, 2010.
4. E. T. Lokganathan, Intellectual Property Rights (IPRs): TRIPS Agreement & Indian Laws Hardcover, 2012
5. Alka Chawla, P N Bhagwati , Law of Copyright Comparative Perspectives 1st Edition, LexisNexis, 2013
6. V. K. Ahuja, Law Relating to Intellectual Property Rights 2nd Edition, LexisNexis, 2nd Edition, 2013

7. Deborah E. Bouchoux, Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets, 2015
8. Jatindra Kumar Das, Law of Copyright, PHI Learning, 2015

COURSE OUTCOMES:

Students should be able to

- Identify the various types of intellectual property and their value
- Apply the procedure to file a patent and to deal the related issues
- Search and extract relevant information from various intellectual database

CURRICULUM AND SYLLABI

REGULATIONS - 2016

(As approved by the 9th Academic Council)

M. Tech.

VLSI and EMBEDDED SYSTEMS

B.S.ABDUR RAHMAN UNIVERSITY

B.S. ABDUR RAHMAN INSTITUTE OF SCIENCE & TECHNOLOGY
(Estd. u/s 3 of the UGC Act, 1956)

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JULY 2016

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VISION AND MISSION OF THE DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

VISION

The Department of Electronics and Communication Engineering envisions to be a leader in providing state of the art education through excellence in teaching, training, and research in contemporary areas of Electronics and Communication Engineering and aspires to meet the global and socio economic challenges of the country.

MISSION

- The Department of Electronics and Communication Engineering endeavors to produce globally competent Engineers prepared to face challenges of the society.
- To enable the students to formulate, design and solve problems in applied science and engineering.
- To provide excellent teaching and research environment using state of the art facilities.
- To provide adequate practical training to meet the requirement of the Electronics & communication industry.
- To train the students to take up leadership roles in their career or to pursue higher education and research.

PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES

PROGRAMME EDUCATIONAL OBJECTIVES:

The objective of the program is

PEO 1 To educate and train the graduates with knowledge and skills necessary to formulate, design and solve problems in Analog, Digital & Mixed Signal VLSI system design, VLSI Signal Processing, Real Time Embedded System design and Hardware Software Co-Design

PEO 2 To provide technical skills in software and hardware tools related to the design and implementation of integrated Circuits, System on Chip for real time applications

PEO 3 To provide scope for Applied Research and innovation in the various fields of VLSI and Embedded Systems, and enabling the students to work in the emerging areas

PEO 4 To enhance communication and soft skills of students to make them work effectively as a team

PROGRAM OUTCOMES:

The graduates will

PO1 Be able to analyze, design and implement Analog, Digital and Mixed Signal Circuits and real time embedded systems

PO2 Have in-depth knowledge and capability to use industry standard tools in the design and implementation of VLSI and real time Embedded Systems.

PO3 Be able to undertake research projects in related domains of VLSI and Embedded systems.

PO4 Possess the capability to communicate effectively and work as a team in the professional career

CURRICULUM & SYLLABI FOR

M. Tech. (VLSI &Embedded Systems)
(FOUR SEMESTERS / FULL TIME)

CURRICULUM

Sl. No.	Course Code	Course Title	L	T	P	C
		SEMESTER I				
1	MAC6184	Probability Matrix Theory & Linear Programming	**3**	**1**	**0**	**4**
2	ECC6121	Advanced Embedded System	**3**	**0**	**0**	**3**
3	ECC6122	Digital VLSI Design	**3**	**0**	**2**	**4**
4	ECC6123	Advanced Microcontroller architecture and Programming	**3**	**0**	**2**	**4**
5	ECC6124	Embedded System Lab	**0**	**0**	**2**	**1**
6		Professional Elective (Minimum of 3 credits to be earned)				**3**
						19
		SEMESTER II				
1	GEC6201	Research Methodology for Engineers	**3**	**0**	**0**	**3**
2	ECC6221	ASIC Design	**3**	**0**	**0**	**3**
3	ECC6222	Real Time Operating Systems	**3**	**0**	**0**	**3**
4	ECC6223	Analog Integrated Circuit Design	**3**	**0**	**2**	**4**
5	ECC6224	VLSI Physical Design Automation Lab	**0**	**0**	**2**	**1**
6		Professional Elective (Minimum of 9 credits to be earned)				**9**
						23

Sl. No.	Course Code	Course Title	L	T	P	C
		SEMESTER III				
1		General Elective	**3**	**0**	**0**	**3**
2	ECC7121	Project Work - Phase I	**0**	**0**	**12**	**6***
3	ECC7122	Mini Project/Internship	**0**	**0**	**2**	**1**
4		Professional Elective (Minimum of 6 credits to be earned)				**6**
						10
		SEMESTER IV				
1	ECC7121	Project Work - Phase II	**0**	**0**	**36**	**18***
						18 + 6 = 24

* Credits for Project Work Phase I to be accounted along with Project Work Phase II in IV Semester

Total Credits: 76

LIST OF PROFESSIONALELECTIVES

Sl. No.	Course Code	Course Title	L	T	P	C
1	ECCY009	Internet of Things	**3**	**0**	**0**	**3**
2	ECCY040	Advanced Digital System Design	**3**	**0**	**0**	**3**
3	ECCY041	CAD for VLSI Circuits	**3**	**0**	**0**	**3**
4	ECCY042	CMOS Mixed Signal Circuit Design	**3**	**0**	**0**	**3**
5	ECCY043	Control Area Network	**3**	**0**	**0**	**3**
6	ECCY044	Distributed Embedded Computing	**3**	**0**	**0**	**3**
7	ECCY045	Embedded Networking	**3**	**0**	**0**	**3**
8	ECCY046	Embedded LINUX	**3**	**0**	**0**	**3**
9	ECCY047	Hardware-software co-design	**3**	**0**	**0**	**3**
10	ECCY048	IC packaging and Interconnects	**3**	**0**	**0**	**3**
11	ECCY049	Low Power VLSI Design	**3**	**0**	**0**	**3**
12	ECCY050	MEMS System Design	**3**	**0**	**0**	**3**
13	ECCY051	Optimization Techniques and their applications in VLSI design	**3**	**0**	**0**	**3**
14	ECCY052	Programming Verilog HDL	**2**	**0**	**2**	**3**
15	ECCY053	Real Time Systems	**3**	**0**	**0**	**3**
16	ECCY054	Reconfigurable Computing	**3**	**0**	**0**	**3**
17	ECCY055	RF Integrated Circuits Design	**3**	**0**	**0**	**3**
18	ECCY056	RISC Processor Architecture and Programming	**3**	**0**	**0**	**3**
19	ECCY057	Semiconductor Memories	**3**	**0**	**0**	**3**
20	ECCY058	Signal integrity for high speed design	**3**	**0**	**0**	**3**
21	ECCY059	SoC design and Verification	**3**	**0**	**0**	**3**
22	ECCY060	Software for Embedded Systems	**2**	**0**	**2**	**3**

Sl. No.	Course Code	Course Title	L	T	P	C
23	ECCY061	Testing of VLSI Circuits	**3**	**0**	**0**	**3**
24	ECCY062	VLSI Digital Signal Processing	**3**	**0**	**0**	**3**
25	ECCY063	WSN Architecture and Programming	**3**	**0**	**0**	**3**
26	ECCY064	DSP System Design	**2**	**0**	**0**	**2**
27	ECCY065	Electronic Design Automation Tools	**2**	**0**	**0**	**2**
28	ECCY066	Programming System Verilog	**2**	**0**	**0**	**2**
29	ECCY067	Sensors Lab	**0**	**0**	**2**	**1**
30	ECCY068	Scripting Languages for VLSI Design Automation	**1**	**0**	**0**	**1**
31	EIC6212	Industrial Automation using PLC, DCS and SCADA	**3**	**0**	**2**	**4**
32	MACY081	Signal Processing Techniques	**3**	**1**	**0**	**4**

GENERAL ELECTIVES FOR M.TECH PROGRAMMES

Sl. No.	Course Code	Course Title	L	T	P	C
1	GECY101	Project Management	**3**	**0**	**0**	**3**
2	GECY102	Society, Technology & Sustainability	**3**	**0**	**0**	**3**
3	GECY103	Artificial Intelligence	**3**	**0**	**0**	**3**
4	GECY104	Green Computing	**3**	**0**	**0**	**3**
5	GECY105	Gaming Design	**3**	**0**	**0**	**3**
6	GECY106	Social Computing	**3**	**0**	**0**	**3**
7	GECY107	Soft Computing	**3**	**0**	**0**	**3**
8	GECY108	Embedded System Programming	**3**	**0**	**0**	**3**
9	GECY109	Principles of Sustainable Development	**3**	**0**	**0**	**3**
10	GECY110	Quantitative Techniques in Management	**3**	**0**	**0**	**3**
11	GECY111	Programming using MATLAB & SIMULINK	**1**	**0**	**2**	**2**
12	GECY112	JAVA Programming	**1**	**0**	**2**	**2**
13	GECY113	PYTHON Programming	**1**	**0**	**2**	**2**
14	GECY114	Intellectual Property Rights	**1**	**0**	**0**	**1**

SEMESTER I

		L	T	P	C
MAC6184	**PROBABILITY, MATRIX THEORY AND LINEAR PROGRAMMING**	**3**	**1**	**0**	**4**

OBJECTIVE:

The aim of this course is to

- Provide a comprehensive introduction to the probability distributions used in engineering.
- Familiarize students with advanced matrix theory and variational problems.
- Expose the students to Operations Research using concepts of linear programming.

MODULE I PROBABILITY DISTRIBUTIONS (10+03)

Axioms of probability – addition and multiplication theorem – conditional probability – total probability – random variables - moments – moments generating functions and their properties- Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

MODULE II TWO DIMENSIONAL RANDOM VARIABLES (08+03)

Joint distributions - marginal and conditional distributions - functions of random variables - covariance - correlation and regression - Central limit theorem.

MODULE III ADVANCED MATRIX THEORY (09+03)

Matrix norms - singular value decomposition - QR algorithm - Pseudo inverse - Least square approximations.

MODULE IV LINEAR PROGRAMMING (10+03)

Formation - graphical method - simplex method - Big-M method - Two Phase method - transportation and assignment problems.

MODULE V CALCULUS OF VARIATIONS (08+03)

Variation and its properties – Euler's equation – functional dependant on first and higher order derivatives – functional dependant on functions of several independent variables – variational problems with moving boundaries – isoperimetric problems – Ritz and Kantorovich methods.

L – 45; T – 15; Total – 60

TEXT BOOKS:

1. S.M.Ross, “A First Course in Probability”, 9th edition, Pearson Education, 2013.
2. Lewis.D.W., “Matrix Theory”, Allied Publishers, Chennai, 1995.
3. Taha, H.A., “Operations Research - An Introduction ", 10th edition, Pearson Prentice Hall, 2016.
4. A.S. Gupta, “Calculus of variations with applications”, PHI Pvt. Ltd, New Delhi, 2011.

REFERENCES:

1. H. Cramer., “Random Variables and Probability Distributions”, Cambridge University Press (2004).
2. Roger A. Horn, Charles R. Johnson, “Matrix Analysis”, Cambridge University Press; 2nd edition (2012).
3. Robert.J.Vanderbei., “Linear Programming: Foundations and Extensions”, Springer US(2014).
4. David. J. Rader., “Deterministic Operations Research”, Wiley (2010).
5. Elsgolts, “Differential Equations and Calculus of Variations", University Press of the Pacific (2003).

OUTCOMES:

At the end of the course students will be able to

- Solve problems using concept of standard, discrete and continuous distributions.
- Solve problems using one dimensional and two dimensional random variables.
- Find Eigen values and Eigen vectors of a higher order matrix.
- Solve problems of linear programming.
- Solve problems of calculus of variations by direct methods and using Euler’s formulae.

ECC6121 ADVANCED EMBEDDED SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To explore Embedded system lifecycle
- To Introduce the occurrence of shared data problem in embedded systems
- To describe need for power management techniques in embedded systems
- To familiarize the debugging in embedded systems

MODULE I EMBEDDED DESIGN LIFE CYCLE 09

Product specification – Hardware / Software partitioning – Detailed hardware and software design – Integration – Product testing – Selection Processes – Microprocessor Vs Micro Controller – Performance tools – Bench marking –RTOS Micro Controller – RTOS availability – Tool chain availability – Other issues in selection processes..

MODULE II EMBEDDED HARDWARE AND SOFTWARE 09

Review of basics in embedded hardware and software– Hardware software co design- Interrupts – Built interrupts – Interrupts basis – Shared data problems – Interrupt latency – Interrupt routines in an RTOS environment – Hard Real Time scheduling considerations - Embedded platform boot sequence.

MODULE III MEMORY AND INTERFACING 09

Memory: Memory write ability and storage performance – Memory types – composing memory – Advance RAM interfacing - communication basic – Microprocessor interfacing I/O addressing – Interrupts – Direct memory access– Arbitration -Multilevel bus architecture – Serial protocol – Parallel protocols – Wireless protocols

MODULE IV INTEGRATION AND TESTING OF EMBEDDED HARDWARE AND FIRMWARE 09

Integration of Hardware and Firmware-In system programming-The Integrated development environment-Debugging techniques- Host based debugging – Remote debugging – ROM emulators – Logic analyzer- Real time trace – Hardware break points – Overlay memory- Testing embedded software

MODULE V POWER OPTIMIZATION TECHNIQUES IN EMBEDDED SYSTEMS 09

The power profile of an Embedded Computing Systems – Constant versus Dynamic power – A simple model of power efficiency – Advanced Configuration and Power Interface – ACPI system states- Case Study- power optimization techniques in wireless sensor networks.

Total Hours: 45

REFERENCES:

1. Arnold S. Berger – “Embedded System Design: An introduction to processor, tools and techniques”, CMP books, USA, 2002.
2. David. E. Simon, “An Embedded Software Primer”, Pearson Education, 2001.
3. Frank Vahid and Tony Givargis ‘Embedded Systems Design: A Unified Hardware/Software Introduction’, John & Wiley Publications, 2002.
4. Peter Barry, Patrick Crowley, “Modern Embedded Computing” Morgan Kaufmann Publishers, 2012.

OUTCOMES:

On completion of program students will be able to

- Analyze the quality principles and tools in embedded system during product development process
- Analyze the division of hardware/software in embedded systems.
- Develop the interrupt routines in RTOS environment
- Design energy efficient embedded systems
- Design interface circuit with processor and peripheral devices
- Test and debug the coding in embedded systems

ECC6122 DIGITAL VLSI DESIGN

L	T	P	C
3	0	2	4

OBJECTIVES:

The objective of the course is

- To learn the fundamentals of digital CMOS VLSI design from the transistor up to the system level.
- To introduce the models for state-of-the-art VLSI components, fabrication steps, hierarchical design flow and semiconductor business economics.
- To design full custom digital integrated circuits

MODULE I MOS TRANSISTOR INTRODUCTION AND CMOS LOGIC 09+06

MOS Device Physics, MOS Models, MOS Device Design Equations Device Scaling & Short-channel effects Layout & Design Rules, CMOS Logic, CMOS Inverter - Static Characteristic, Dynamic Characteristic, Switch Models & Simple RC Models, Power, Energy, and Energy Delay parameters.

Laboratory Practice: Circuit Simulation of CMOS inverters -static and dynamic characteristics, CMOS NAND, NOR and XOR Gates.

MODULE II COMBINATIONAL, SEQUENTIAL AND DYNAMIC LOGIC CIRCUITS 11+06

Pass Transistors, Transmission Gates; Designing with transmission gates, Primitive Logic Gates; Complex Logic Circuits.SR Latch, clocked Latch and flip flop circuits, CMOS D-latch and edge triggered flip flop. Basic principle, non ideal effects, domino CMOS Logic, high performance dynamic CMOS Circuits, Clocking Issues, Two phase clocking.

Laboratory Practice: Circuit Simulation of Dynamic CMOS design- Domino and NORA logic – Flip flop -RS, D, JK, MS, T

MODULE III CMOS SUB SYSTEM DESIGN 09+06

Data path circuits, Architectures for Adders, Accumulators, Multipliers, Barrel Shifters, Speed and Area Tradeoffs, Memory Architectures, and Memory control circuits.

Laboratory Practice: Circuit Simulation of Arithmetic circuits in CMOS VLSI - Adders- multipliers- shifter –CMOS memory design - SRAM and DRAM

MODULE IV INTERCONNECT &TIMING METRICS 09+06

Interconnect Parameters – Capacitance, Resistance, and Inductance, Electrical Wire Models, Timing classification of Digital Systems, Synchronous Design, Self-Timed Circuit Design, Synchronizers and Arbiters, Clock Synthesis and Synchronization Using Phase-Locked Loop

Laboratory Practice: Circuit Simulation of the worst-case propagation delay of static and dynamic logic circuits

MODULE V SYSTEMS DESIGN AND DESIGN METHOD 07+06

Design Strategies CMOS Chip Design Options, Design Methods, Design Capture Tools, Design Verification Tools, Design Economics, Data Sheets, CMOS Testing -Manufacturing Test Principles, Design Strategies for Test, Chip Level Test Techniques, System Level Test Techniques, Layout Design for Improved Testability.

Laboratory Practice: Simulation and synthesis of Serial & Parallel adder using HDL Test bench and interpretation of synthesis report of EDA tools

L: 45, P:30 - Total Hours: 75

REFERENCES

1. Neil Weste and K. Eshragian, “Principles of CMOS VLSI Design: A System Perspective” 2nd edition, Pearson Education (Asia) Pte. Ltd., 2000.
2. Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, “Digital Integrated Circuits – A Design Perspective”, 2nd edn., Pearson Education, 2003. ISBN: 8178089912
3. Wayne, Wolf, “Modern VLSI design: System on Silicon” Pearson Education”, Second Edition
4. John P. Uyemura, “CMOS Logic Circuit Design”, Springer (Kluwer Academic Publishers), 2001.
5. Ken Martin, “Digital Integrated Circuit Design”, Oxford University Press, 2000
6. Douglas A Pucknell & Kamran Eshragian, “Basic VLSI Design” PHI 3rd Edition (original Edition – 1994).

7. Sung Mo Kang &Yosuf Lederabic Law, “CMOS Digital Integrated Circuits: Analysis and Design”, McGraw-Hill (Third Edition)

OUTCOMES:

On completion of program students will be able to

- Describe the MOS transistor characteristics and simple device models
- Design, simulate and analyze CMOS inverter characteristics.
- Design, simulate and analyze static and dynamic logic circuits
- Evaluate the timing performance of digital circuits.
- Design and analyze data path architectures.
- Discuss the digital system design process and verification methods

ECC6123	ADVANCED MICROCONTROLLER ARCHITECTURE AND PROGRAMMING	L	T	P	C
		3	0	2	4

OBJECTIVES:

- To know Microcontroller based system design, applications.
- To teach I/O interface in system Design
- To learn about Design and programming of MSP 430 microcontroller
- To involve the students to Practice on Workbench /Software Tools/ Hardware Processor Boards with the supporting Peripherals

MODULE I 8051 MICROCONTROLLER ARCHITETURE 09+06

Architecture – memory organization – addressing modes – instruction set-I/O programming-Timer programming – Serial port programming-Interrupt programming

Laboratory Practice: Practice in 8051 microcontroller based assembly/C language programming-I/O programming -Timer Counter Programming – Serial Communication- practice in KEIL µvision IDE complier

MODULE II PIC MICROCONTROLLER ARCHITETURE 09+06

Architecture – memory organization – addressing modes – instruction set : arithmetic, logic instruction, branch, call, and time delay loop–I/O ports-bank switching, table processing, macros and modules.

Laboratory Practice: Practice on PIC Microcontroller based Assembly/C language programming – Arithmetic Programming- practice in MPLAB compiler

MODULE III PIC PROGRAMMING IN ASSEMBLY AND C 09+06

I/O programming-Timer programming – Serial port programming-Interrupt programming-ADC, DAC and Sensor interfacing- Flash and EEPROM memories-I2C bus-CCP and ECCP programming-Practice in MPLAB

Laboratory Practice: Practice on PIC Microcontroller based Assembly/C language programming – Timer Counter Programming – Serial Communication-Programming Interrupt - practice in MPLAB compiler

MODULE IV MSP430 architecture and programming 09+06

Architecture – CPU features – Memory structure - Addressing modes – Instruction sets Interrupts programming– Input and Output programming– On-chip peripherals– Hardware considerations – Flash memory – Low power design- Practice in IAR workbench

Laboratory Practice: Practice on MSP430 Microcontroller based Assembly/C language I/O programming – Timer Counter Programming – Serial Communication- Programming Interrupt - practice in IAR workbench compiler

MODULE V SYSTEM DESIGN – CASE STUDY 09+06

Interfacing LCD Display – Keypad Interfacing - Motor Control – Controlling DC/ AC appliances – Measurement of frequency - Stand-alone Data Acquisition System.

Laboratory Practice: Design a mini project using PIC or MSP430

L: 45, P: 30 - Total Hours: 75

REFERENCES:

1. Muhammad Ali Mazidi, Rolin D. Mckinlay, Danny Causey “PIC Microcontroller and Embedded Systems using Assembly and C for PIC18”, Pearson Education 2008
2. John Iovine, “PIC Microcontroller Project Book”, McGraw Hill 2000
3. Rajkamal, “Microcontrollers Architecture, Programming”, Interfacing, & System Design”,Pearson,2012
4. Chris Nagy, “Embedded systems design using the TI MSP430 series”, Elsevier 2003.

OUTCOMES:

On completion of the course the students will be able to

- Describe the architecture of PIC series of microcontroller
- Create ALP and C programs to develop applications using 8051 & PIC microcontroller
- Describe the architecture of MSP series of microcontroller
- Create ALP and C programs to develop applications using the MSP microcontroller
- Interface the internal and External IOs of PIC and MSP microcontroller.
- Use KEIL µvision IDE,IAR Embedded workbench and MPLAB IDE

ECC6124 EMBEDDED SYSTEMS LAB

L	T	P	C
0	0	2	1

OBJECTIVES:

- To gain knowledge in programming with software tools and microcontrollers with peripheral interfaces.
- To develop a program and simulate 8, 16 and 32 bit microcontrollers in both assembly and C programming.
- To learn programming with sensors
- To focus on the embedded system hardware development

LIST OF EXPERIMENTS

1. Design with 8 bit Microcontrollers 8051/PIC Microcontrollers- Assembly and C Programming: I/O Programming, Timers.
2. Interrupts, Serial port programming with 8051/PIC Microcontrollers- Assembly and C programming.
3. PWM Generation, Motor Control, ADC/DAC with 8051/PIC Microcontrollers- Assembly and C programming.
4. LCD and RTC Interfacing, Sensor Interfacing with 8051/PIC Microcontrollers- Assembly and C programming
5. Design with 16 bit processors: I/O programming, Timers, Interrupts, Serial Communication
6. Design with ARM Processors: I/O programming, ADC/DAC, Timers, Interrupts
7. Study of one type of Real Time Operating Systems (RTOS)
8. Mini-project

P: 30 - Total Hours:30

OUTCOMES:

On completion of program students will be able to

- Simulate simple application programs through Keil µ vision.
- Interface I/O ports, timers, seven segments LED, serial ports with 8051/ PIC Microcontrollers.
- Demonstrate programming with sensors
- Employ Assembly language and C programming to verify the stepper motor and real time clock interface.
- Develop a real time embedded applications using 8051and PIC Microcontrollers.
- Appraise a real time operating system.

SEMESTER II

GEC6201	RESEARCH METHODOLOGY FOR ENGINEERS	L	T	P	C
		3	0	0	3

OBJECTIVES:

The objective of the course is

- To provide a perspective on research to the scholars
- To educate on the research conceptions for designing the research
- To impart knowledge on statistical techniques for hypothesis construction
- To gain knowledge on methods of data analysis and interpretation
- To learn about the effective communication of research finding

MODULE I RESEARCH PROBLEM FORMULATION 07

Research – objectives – types, Research process, Solving engineering problems, Identification of research topic, Formulation of research problem, Literature survey and review.

MODULE II HYPOTHESIS FORMULATION 08

Research design – meaning and need – basic concepts, Different research designs, Experimental design – principle – important experimental designs, Design of experimental setup, Mathematical modeling, Simulation – validation and experimentation, Dimensional analysis and similitude.

MODULE III STATISTICAL TECHNIQUES 12

Statistics in research – concept of probability – popular distributions –Hypothesis testing- sample design- Design of experiments – factorial designs -– orthogonal arrays- ANOM - ANOVA - Multivariate analysis - Use of optimization techniques – traditional methods – evolutionary optimization techniques –Transportation model

MODULE IV STATISTICAL ANALYSIS OF DATA 10

Research Data analysis – interpretation of results – correlation with scientific facts- Accuracy and precision – error analysis, limitations - Curve fitting, Correlation and regression.

MODULE V RESEARCH REPORT 08

Purpose of written report – audience, synopsis writing, preparing papers for International journals, Thesis writing – organization of contents – style of writing – graphs and charts – referencing, Oral presentation and defence, Ethics in research, Patenting, Intellectual Property Rights

L: 45 - Total Hours: 45

REFERENCES

1. Ganesan R., Research Methodology for Engineers, MJP Publishers, Chennai, 2011.
2. Ernest O., Doebelin, Engineering Experimentation: planning, execution, reporting, McGraw Hill International edition, 1995
3. George E. Dieter., Engineering Design, McGraw Hill – International edition, 2000
4. Madhav S. Phadke, Quality Engineering using Robust Design, Printice Hall, Englewood Cliffs, New Jersey, 1989.
5. Kothari C.R., Research Methodology – Methods and Techniques, New Age International (P) Ltd, New Delhi, 2003.
6. Kalyanmoy Deb., “Genetic Algorithms for optimization”, KanGAL report, No.2001002
7. Holeman, J.P., Experimental methods for Engineers, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 2007.
8. Govt. of India, Intellectual Property Laws; Acts, Rules & Regulations, Universal Law Publishing Co. Pvt. Ltd., New Delhi 2010.
9. University of New South Wales, “How to write a Ph.D. Thesis” Sydney, Australia, Science @ Unsw.
10. Shannon. R.E., System Simulation: the art and science, Printice Hall Inc, Englewood Cliffs, N.J.1995.
11. Scheffer. R.L. and James T. Mc Clave, Probability and Statistics for Engineers, PWS – Kent Publishers Co., Boston, USA, 1990.

OUTCOMES:

Students should be able to

- Formulate the research problem
- Design and Analyse the research methodology
- Construct and optimize the research hypothesis
- Analyse and interpret the data
- Report the research findings

ECC6221 ASIC DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

The objective of the course is to impart knowledge on

- The concept of structure and features of full custom and semicustom ASIC types.
- The fundamentals of digital logic design and the physical features of each ASIC.
- ASIC logic design, testing of physical design partitioning, floor planning, placement and routing.

MODULE I INTRODUCTION TO ASICs, ASIC LIBRARY DESIGN 09

Types of ASICs - Design flow - CMOS transistors, CMOS Design rules - Combinational Logic Cell – Sequential logic cell - Data path logic cell - Transistors as Resistors - Transistor Parasitic Capacitance- Logical effort –Library cell design.

MODULE II PROGRAMMABLE ASICs AND LOGIC CELLS 09

Anti fuse - static RAM - EPROM and EEPROM technology - PREP benchmarks - Actel ACT - Xilinx LCA –Altera FLEX - Altera MAX DC & AC inputs and outputs - Clock & Power inputs - Xilinx I/O blocks.

MODULE III INTERCONNECTS AND LOW LEVEL DESIGN LANGUAGES 09

Actel ACT -Xilinx LCA - Xilinx EPLD - Altera MAX 5000 and 7000 - Altera MAX 9000 - Altera FLEX –Design systems - Logic Synthesis - Half gate ASIC - Schematic entry - Low level design language .

MODULE IV LOGIC SYNTHESIS, SIMULATION AND TESTING 09

Verilog and logic synthesis - types of simulation -boundary scan test - fault simulation - automatic test pattern generation, Introduction to JTAG.

MODULE V PARTITIONING, FLOOR PLANNING, PLACEMENT & ROUTING 09

System partition - FPGA partitioning - partitioning methods - floor planning - placement - physical design flow –global routing - detailed routing - special routing - circuit extraction - DRC.

L: 45 - Total Hours: 45

REFERENCES

1. H. Bhatnagar, “Advanced ASIC Chip Synthesis Using Synopsys Design Compiler Physical Compiler and Prime Time”, 2nd edition, 2001
2. M.J.S .Smith, "Application Specific Integrated Circuits ", Addison -Wesley Longman Inc., 2003.
3. Keith Barr “ASIC Design in the Silicon Sandbox: A Complete Guide to Building Mixed-Signal Integrated Circuits”,McGrawHill,2006
4. Andrew Brown, "VLSI Circuits and Systems in Silicon", McGraw Hill, 1991

OUTCOMES:

At the end of the course the students will be able to

- Describe ASIC Design Flow and its Architecture.
- Describe the Logic Synthesis and Testing methodologies
- Architect ASIC library design
- Develop programmable ASIC logic cells
- Design I/O cells and interconnects
- Identify new developments in SOC

ECC6222 REAL TIME OPERATING SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

The objective of the course is to

- Introduce the concepts of Operating systems and Real-time Operating Systems
- Impart knowledge on Resource management, time-constrained communication, scheduling and imprecise computations, real-time kernels and case studies.
- Compare various RTOS.

MODULE I REVIEW OF OPERATING SYSTEMS 09

Basic Principles - Operating System structures – System Calls – Files –Concurrent Execution & Interrupts- Processes – Design and Implementation of processes – Communication between processes-Process Scheduling.

MODULE II OVERVIEW OF RTOS 09

Real-time System: Hard versus Soft Real-time systems – examples-Difference between Traditional OS and RTOS. RTOS Kernel -RTOS Task and Task state Multitasking – Task Assignment, Task Priorities, Scheduling.

MODULE III IPC MECHANISMS 09

Intertask Communication & Synchronization – Definition of Context Switching, Critical Section – Re-entrant Functions, Deadlocks, Interprocess Communication (IPC) – IPC through Semaphores, Mutex, Mailboxes, and Message Queues.

MODULE IV REAL TIME MODELS AND LANGUAGES 09

Event Based – Process Based and Graph based Models – Real Time Languages – RT scheduling -Interrupt processing -Control Blocks – Memory Requirements.

MODULE V REAL TIME KERNEL AND RTOS APPLICATION 09

Principles – Design issues – Polled Loop Systems – RTOS Porting to a Target – Comparison and study of various RTOS like QNX – VX works – µC/OS-II – RT Linux Case studies-RTOS for fault Tolerant Applications – RTOS for Control Systems.

L: 45 - Total Hours: 45

REFERENCES

1. Raj Kamal, “Embedded Systems- Architecture, Programming and Design” Tata McGraw Hill, 2006.
2. Jane W.S.Liu, Real Time Systems, Pearson Education, Asia, 2001.
3. Herma K., “Real Time Systems – Design for distributed Embedded Applications”, Kluwer Academic, 1997.
4. Charles Crowley, “Operating Systems-A Design Oriented approach” Tata McGraw Hill.

OUTCOMES:

After successful completion of the course, the students shall be able to

- Illustrate OS structure and explain process scheduling types.
- Compare the features of traditional OS and RTOS.
- Describe inter task communication and synchronization mechanisms.
- Analyze and design real time scheduling algorithms
- Select appropriate RTOS for the required application.
- Determine the common faults that occur in RTOS based embedded system.

ECC6223 ANALOG INTEGRATED CIRCUIT DESIGN

L	T	P	C
3	0	2	4

OBJECTIVES:

The objective of the course is to

- Introduce the principles of analog circuits and apply the techniques for the design of analog integrated circuit
- Analysis, design, and applications of modern analog circuits using CMOS technologies.
- Analysis of basic Multipliers, wave shaping circuits and basic operation of PLL.
- Implement a complete analog system.

MODULE I INTRODUCTION 09

Analog MOS transistor models Temperature effects and Noise in MOS transistor MOS resistors, characterization of resistive, capacitive elements and MOS devices. Passive and active CMOS current sink/ sources. Effects due to nonlinearity and mismatch in MOS circuits.

Laboratory Practice

Verification of MOS Device Characterization and parametric (PAR) analysis, Current Mirrors: Simple, cascode, feedback and low-voltage

MODULE II SINGLE STAGE CMOS AMPLIFIERS 09

Basics of single stage CMOS amplifiers - common Source, common gate and source follower. Frequency response of common Source, common gate and source follower.

Laboratory Practice

Simulation of Single stage Amplifiers-Diode connected, Current Mirror Load, PMOS with self biased load and self biased CMOS.

MODULE III CMOS DIFFERENTIAL AMPLIFIERS 09

CMOS Operational Amplifiers one stage and two stage gain boosting Common mode feedback (CMFB) Cascode and Folded cascade structures.

Laboratory Practice: Differential Amplifiers: Simple and cascode current mirrors.

MODULE IV HIGH PERFORMANCE OP-AMPS 09

High speed/ high frequency op-amps, micro power op-amps, low noise op-amps and low voltage op-amps. Current mirrors filter implementations. Supply

independent and temperature independent references Band gap references PTAT current generation and constant Gm biasing – CMOS comparators – Multipliers and wave shaping circuits .

Laboratory Practice

Operational Trans-conductance Amplifiers (OTA), Two stage OP-AMP.

MODULE V SWITCHED CAPACITOR CIRCUITS 09

First and Second Order Switched Capacitor Circuits, Switched Capacitor filters, CMOS oscillators, simple and charge pump CMOS PLLs non ideal effects in PLLs, Delay locked loops, frequency locked loops and applications, basics of CMOS data converters – Medium and high speed CMOS data converters, Over sampling converters.

Laboratory Practice

Verification of switched capacitor Integrators.

L:45, L:30 - Total Hours:75

REFERENCES

1. David. A. Johns and Ken Martin, “Analog Integrated Circuit Design”, John Wiley and Sons, 2001.
2. BehzadRazavi, “Design of Analog CMOS Integrated Circuit”, Tata McGraw HILL, 2002.
3. Philip Allen & Douglas Holberg, “CMOS Analog Circuit Design”, Oxford University Press, 2002.
4. Mohammed Ismail &Feiz, “Analog VLSI – Signal Information and Processing”, John Wiley and Sons.

OUTCOMES:

After successful completion of the course, the students shall be able to

- Characterize the MOSFET and perform parametric analysis for the simple MOS models.
- Analyze and design MOSFET based Amplifier circuits.
- Design and analyze band gap reference biasing sources.
- Design and analyze operational amplifier circuits
- Design and analyze switched capacitor based mixed signal circuits
- Use the Composer (schematic capture), Virtuoso (layout generation), Spectre HDL (circuit simulation), Diva tools (DRC, LVS, ERC, extraction) tools for designing analog integrated circuits.

ECC6224	VLSI PHYSICAL DESIGN AUTOMATION LAB	L	T	P	C
		0	0	2	1

OBJECTIVES:

The objective of the course is to

- Make the students capable to design FPGA based digital systems
- Analyze the performance of the digital systems using EDA Tools
- Impart hands-on experience on the VLSI physical design tools.

FPGA Based Experiments

1. Design Entry of Verilog examples using HDL languages sequential and concurrent statements.
2. Data path and Controller architecture Verilog examples of sequential & combinational circuits, Test vector generation.
3. Verilog examples for FPGA Implementation, I/O devices interfacing
4. Verilog examples illustrating Static and dynamic power Analysis-Xilinx ISE / Quartus
5. Verilog examples illustrating Static and dynamic Timing analysis procedures and constraints, Critical path considerations –. Xilinx ISE / Quartus
6. Designing FIR filter using Xilinx ISE System Generator and MATLAB simulink

ASIC Based Experiments

7. ASIC RTL realization using standard cell libraries- Cadence/Tanner/Mentor Graphics.
8. Static and dynamic power Analysis- Cadence/Tanner/Mentor Graphics.
9. Static and dynamic Timing analysis procedures and constraints.
10. Critical path considerations – Cadence/Tanner/Mentor Graphics.
11. Layout design, LVS, Back annotation- Cadence/TANNER/ Mentor Graphics

P: 30 - Total Hours:30

OUTCOMES:

After successful completion of the course, the students shall be able to

- Design digital circuits using verilog HDL
- Estimate and analyze the static and dynamic power of a digital system using EDA tools

- Estimate and analyze the timing performance of a digital system using EDA tools
- Develop digital systems meeting the functionality ,timing and power constraints using EDA tools
- Design layouts and schematic of digital circuit using EDA tools
- Work in projects involving the design of digital ICs

SEMESTER-III

		L	T	P	C
ECC7121	**PROJECT WORK – PHASE I**	**0**	**0**	**12**	**6**

OBJECTIVES :

- To improve the professional competency and research aptitude by touching the areas which otherwise not covered by theory or laboratory classes.
- The project work aims to develop the work practice of students
- To apply theoretical and practical tools/techniques to solve real life problems related to industry and current research.

GUIDELINES:

The project work can be a design project/experimental project and/or computer simulation project on any of the topics in electronics design related topics. The project work is allotted individually on different topics. The students shall be encouraged to do their project work in the parent institute itself. If found essential, they may be permitted to continue their project outside the parent institute. Department will constitute an Evaluation Committee to review the project work. The Evaluation committee consists of at least three faculty members of which internal guide and another expert in the specified area of the project shall be two essential members.

The student is required to undertake the master research project phase 1 during the third semester and the same is continued in the 4thsemester (Phase 2). Phase 1 consist of preliminary thesis work, two reviews of the work and the submission of preliminary report. First review would highlight the topic, objectives, methodology and expected results. Second review evaluates the progress of the work, preliminary report and scope of the work which is to be completed in the 4th semester. The Evaluation committee consists of at least four faculty members of which internal guide and other experts in the specified area of the project shall be two essential members.

OUTCOMES:

At the end of the project work phase I the student will be able to

- learn the tool required for the design, analysis of their preliminary work
- Select the specific devices for different application along with justification
- Apply the practical knowledge while solving real time problems
- Incorporate cost effective and efficient project models
- Conclude the subject knowledge through proto type models
- Prepare an appropriate documentation

ECC7122	MINI PROJECT	L	T	P	C
		0	0	2	1

OBJECTIVES :

- To improve the professional competency and research aptitude of students

GUIDELINES:

1. This mini project will help the students to develop the work practice to apply the design skills for solving real life problems.
2. The project can be an experimental project on any of the topics in electronics and communication.
3. The project work is allotted individually on different topics.
4. The students shall be encouraged to do their project in the parent institute itself.
5. Department will constitute an Evaluation Committee to review the project periodically.

OUTCOMES:

At the end of the project the student will be able to

- Design and analyze an electronic system
- Fabricate an electronic system/device in their area of interest
- Improve their presentation skills
- Improve the documentation skills

SEMESTER-IV

		L	T	P	C
ECB7121	**PROJECT WORK – PHASE II**	**0**	**0**	**36**	**18**

OBJECTIVES:

- To improve the professional competency and research aptitude by touching the areas which otherwise not covered by theory or laboratory classes.
- The project work aims to develop the work practice in students to apply theoretical and practical tools/techniques to solve real life problems related to industry and current research.

GUIDELINES:

The project work can be a design project/experimental project and/or computer simulation project on any of the topics in electronics design related topics. The project work is allotted individually on different topics. The students shall be encouraged to do their project work in the parent institute itself. If found essential, they may be permitted to continue their project outside the parent institute. Department will constitute an Evaluation Committee to review the project work. The Evaluation committee consists of at least three faculty members of which internal guide and another expert in the specified area of the project shall be two essential members.

The student is required to undertake the master research project phase 1 during the third semester and the same is continued in the 4thsemester (Phase 2). Phase 1 consist of preliminary thesis work, two reviews of the work and the submission of preliminary report. First review would highlight the topic, objectives, methodology and expected results. Second review evaluates the progress of the work, preliminary report and scope of the work which is to be completed in the 4th semester. The Evaluation committee consists of at least four faculty members of which internal guide and other experts in the specified area of the project shall be two essential members.

OUTCOMES:

- At the end of the project work student will be able to use the theoretical and practical tools/techniques to solve real life problems related to industry and current research problems.

PROFESSIONAL ELECTIVES

ECCY009	INTERNET OF THINGS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce emerging technological options and platforms
- To explain the architecture of IoT
- To explore application development for mobile Platforms
- To Provide the appropriate IoT solutions and recommendations according to the applications used.

MODULE I THE IOT NETWORKING CORE 10

History of IoT, Review of Technologies involved in IoT Development, Internet/Web and Networking Basics -OSI Model, Data transfer referred with OSI Model, IP Addressing, Point to Point Data transfer, Point to Multi Point Data transfer & Network Topologies, Sub-netting, Network Topologies referred with Web, Introduction to Web Servers, Introduction to Cloud Computing. Basics of Big Data, Data Science.

MODULE II IOT ARCHITECTURE AND APPLICATIONS 09

Architecture: M2M – Machine to Machine, Web of Things, IoT protocol, Introduction to wireless and mobile networks, ZigBee, BLE mesh, WiFi, MQTT, LoRa-Machine Applications: Remote Monitoring & Sensing, Remote Controlling, Performance Analysis

MODULE III IOT PLATFORM OVERVIEW 09

Overview of IoT supported Hardware platforms such as: Raspberry pi, ARM Cortex Processors, Arduino and Intel Galileo boards. Network Fundamentals: Overview and working principle of Wired Networking equipment's – Router, Switches, Overview and working principle of Wireless Networking equipment's – Access Points, Hubs etc. Linux Network configuration Concepts: Networking configurations in Linux Accessing Hardware & Device Files interactions.

MODULE IV IOT APPLICATION DEVELOPMENT 09

Application Protocols-MQTT, REST/HTTP, CoAP, MySQL -Back-end Application - Design Apache for handling HTTP Requests, PHP & MySQL for data processing, MongoDB Object type Database, HTML, CSS &jQuery for UI Designing, JSON lib for data processing, Security & Privacy during development, Application

Development for mobile Platforms: Overview of Android / IOS 10 25 47 /97 App Development tools

MODULE V CASE STUDY & ADVANCED IOT APPLICATIONS 08

IoT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IoT electronic equipments. Use of Big Data and Visualization in IoT, Industry 4.0 concepts. Sensors and sensor Node and interfacing using any Embedded target boards

L:45, T:15 - Total Hours:60

REFERENCES

1. Jean-Philippe Vasseur, Adam Dunkels, “Interconnecting Smart Objects with IP: The Next Internet”, Morgan Kuffmann-2010
2. Vijay Madisetti , Arshdeep Bahga, : Internet of Things (A Hands-on-Approach)” -2014
3. Adrian McEwen (Author), Hakim Cassimally, “Designing the Internet of Things” ,Wiley -2013
4. Dr. OvidiuVermesan, Dr. Peter Friess, “Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems,” River Publishers -2013
5. Barrie Sosinsky, “Cloud Computing Bible”, Wiley-India, 2010
6. Asoke K Talukder and Roopa R Yavagal, “Mobile Computing,” Tata McGraw Hill, 2010.
7. Adelstein and S.K.S. Gupta, “Fundamentals of Mobile and Pervasive Computing,” McGraw Hill, 2009
8. Ronald L. Krutz, Russell Dean Vines “Cloud Security: A Comprehensive Guide to Secure Cloud Computing”, Wiley-India, 2010

OUTCOMES:

At the end of the course the student will be able to

- Articulate the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art Internet of things
- Identify the architecture and infrastructure of IoT.
- Explain the core issues of IoT such as security, privacy, and interoperability
- Choose the appropriate technologies, algorithms, and approaches for the related issues.
- Identify problems, and explain, analyze, and evaluate various IoT solutions
- Attempt to generate new ideas and innovations in IoT.

ECCY040 ADVANCED DIGITAL SYSTEM DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide knowledge to design sequential and asynchronous sequential circuit.
- To introduce programmable logic devices and its application to circuit design
- To introduce the concepts involved in designing fault free circuits.

MODULE I SEQUENTIAL CIRCUIT DESIGN 09

Analysis of Clocked Synchronous Sequential Networks (CSSN) Modelling of CSSN – State Stable Assignment and Reduction – Design of CSSN – Design of Iterative Circuits, Design of Arithmetic circuits for Fast adder- Array Multiplier- Verilog design of clocked synchronous sequential circuits

MODULE II ASYNCHRONOUS SEQUENTIAL CIRCUIT DESIGN 09

Analysis of Asynchronous Sequential Circuit (ASC) – Flow Table Reduction – Races in ASC – State Assignment Problem and the Transition Table – Design of ASC using ASM charts – Derivation of SM charts, and Realization of SM charts.– Static and Dynamic Hazards – Essential Hazards – Designing vending Machine Controller – Mixed Operating Mode Asynchronous Circuits-Verilog design of Asynchronous sequential circuits

MODULE III DESIGNING WITH PROGRAMMABLE LOGIC DEVICES 09

ROM- Internal ROM structure – Implementation of Boolean functions using ROM-Design of Sequential circuits using ROM, PROM – Realization State machine using PLD, PAL, PLA, Programmable Gate Arrays, Programmable Logic sequencer, Field Programmable Gate Array Families. Verilog design of programmable logic devices

MODULE IV FAULT DIAGONOSIS AND TESTING 09

Fault detection and location, gate sensitivity, path sensitization, undetectable faults, bridging fault, two level circuit fault detection, Boolean difference -D algorithm - Tolerance techniques, compact testing technique; scan path testing, design for testability.

MODULE V SYSTEM DESIGN USING VERILOG 09

Hardware Modelling with Verilog HDL – Logic System, Data Types and Operators For Modelling in Verilog HDL - Behavioural Descriptions in Verilog HDL – HDL Based Synthesis – Synthesis of Finite State Machines– structural modeling – compilation and simulation of Verilog code –Test bench - Realization of combinational and sequential circuits using Verilog – Registers – counters – sequential machine – serial adder – Multiplier- Divider – Design of simple microprocessor

L:45 - Total Hours:45

REFERENCES

1. Donald G. Givone, “Digital principles and Design”, Tata McGraw Hill, 2002.
2. Stephen Brown and ZvonkVranesic, “Fundamentals of Digital Logic with Verilog Design”, Tata McGraw Hill, 2002.
3. Parag K Lala, “Digital System design using PLD”, BS Publications, 2003.
4. M.D.Ciletti, “Modeling, Synthesis and Rapid Prototyping with the Verilog HDL”, Prentice Hall, 1999
5. S. Palnitkar, “Verilog HDL – A Guide to Digital Design and Synthesis”, Pearson , 2003.

OUTCOMES:

After successful completion of the course, the students will be able to

- To analyze clocked synchronous sequential circuits and design digital systems based on the given specifications.
- To analyze asynchronous sequential circuits and design digital systems based on the given specifications.
- To make state machines and ASM charts for the given design requirements.
- To select and use appropriate PLDs to realize digital systems based on the requirements.
- To perform fault diagnosis and testing in digital circuit
- To apply the digital system design principles and make projects based on the requirements.

ECCY041 CAD FOR VLSI CIRCUITS

L	T	P	C
3	0	0	3

OBJECTIVES:

The objective of the course is to impart knowledge on

- The principles of operation of all the important modules that go into the construction of a complete VLSI CAD tool
- The standard cell based synthesis methodologies for digital VLSI.
- The floor planning and placement principles and related topics
- To use Computer Aided Design (CAD) VLSI design tools.

MODULE I VLSI DESIGN METHODOLOGIES 09

Introduction to VLSI Design methodologies - Review of Data structures and algorithms - Review of VLSI Design automation tools - Introduction to CAD tools - Evolution of Design Automation-Basic Transistor Fundamentals-CMOS realizations of basic gates - Modeling techniques, Types of CAD tools.

MODULE II PARTITIONING 09

Layout Compaction - Design rules - problem formulation - algorithms for constraint graph compaction - partitioning Classification of Partitioning Algorithms - Group Migration Algorithm, Simulated Annealing and Evolution, Other Partitioning Algorithms, Performance Driven Partitioning

MODULE III FLOOR PLANNING 09

Floor planning concepts - shape functions and floor plan sizing - Types of local routing problems - Area routing - channel routing - global routing - algorithms for global routing.

MODULE IV PLACEMENT 09

Problem Formulation, Classification of Placement Algorithms, Simulation Based Placement Algorithms, Partitioning Based Placement Algorithms, Other Placement Algorithms, Performance Driven Placement, Over-the-Cell Routing, Via Minimisation, Clock Routing, Power and Ground Routing

MODULE V MODELING AND SYNTHESIS 09

High level Synthesis - Hardware models - Internal representation - Allocation - assignment and scheduling - Simple scheduling algorithm - Assignment problem -

High level transformations. Introduction to Reconfigurable computing, FPGAs, the Altera Quartus II flow.

L:45 - Total Hours:45

REFERENCES

1. S.H. Gerez, "Algorithms for VLSI Design Automation", John Wiley & Sons, 2002..
2. N.A. Sherwani, "Algorithms for VLSI Physical Design Automation", Kluwer Academic Publishers, 2002.
3. Samir Palnitkar, “Verilog HDL”, Second Edition, Pearson Education, 2004.
4. J.Bhaskar, “Verilog HDL Synthesis”, BS publications, 2001.

OUTCOMES:

On completion of the course the students will be able to

- Discuss the operation of complete VLSI CAD tool
- Perform high level synthesis
- Discuss floor planning concepts
- Design algorithms for placement and partitioning
- Develop hardware models and synthesis algorithms for VLSI CAD tools
- Use VLSI design automation tools

ECCY042 CMOS MIXED SIGNAL CIRCUIT DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

The objective of the course is

- To know different mixed-signal circuit design methodologies.
- To acquire knowledge on design of sampling circuits and integrator.
- To discuss different design architectures in mixed signal mode.
- To gain knowledge on filter design in mixed signal mode.

MODULE I PLL AND SWITCHED CAPACITOR CIRCUITS 09

Characterization of a comparator, basic CMOS comparator design, analog multiplier design, PLL - simple PLL, charge-pump PLL, applications of PLL Switched Capacitor circuits - basic principles, some practical circuits such as switched capacitor integrator, biquad circuit, switched capacitor filter, switched capacitor amplifier, non-filtering applications of switched capacitor circuit such as programmable gate arrays, DAC and ADC, MOS comparators, modulators, rectifiers, detectors, oscillators.

MODULE II SAMPLING CIRCUITS 09

Sampling circuits: Basic sampling circuits for analog signal sampling, performance metrics of sampling circuits, different types of sampling switches. Sample-and-Hold Architectures: Open-loop & closed-loop architectures, openloop architecture with miller capacitance, multiplexed-input architectures, recycling architecture, switched capacitor architecture, current-mode architecture.

MODULE III DAC 09

Input/output characteristics of an ideal D/A converter, performance metrics of D/A converter, D/A converter in terms of voltage, current, and charge division or multiplication, switching functions to generate an analog output corresponding to a digital input. D/A converter architectures: Resistor-Ladder architectures, current-steering architectures.

MODULE IV ADC 09

Input/output characteristics and quantization error of an A/D converter, performance metrics of A/D converter. A/D converter architectures: Flash architectures, two-step architectures, interpolate and folding architectures,

pipelined architectures, Successive approximation architectures, interleaved architectures.

MODULE V FILTERS 09

Low Pass filters, active RC integrators, MOSFET-C integrators, transconductance-C integrator, discrete time integrators. Filtering topologies - bilinear transfer function and bi-quadratic transfer function.

L:45 - Total Hours:45

REFERENCES

1. Razavi, “Design of analog CMOS integrated circuits”, McGraw Hill, 2001.
2. Razavi, “Principles of data conversion system design”, S.Chand and company ltd, 2000.
3. Jacob Baker, “CMOS Mixed-Signal circuit design”, IEEE Press, 2002.
4. Gregorian, Temes, “Analog MOS Integrated Circuit for signal processing”, John Wiley & Sons, 1987.
5. Baker Li, Boyce, “CMOS: Circuit Design, layout and Simulation”, PHI, 2000.

OUTCOMES:

On completion of the course the students will be able to

- Describe the models for PLL circuits
- Summarize the low-voltage, low-power design techniques for mixed-signal CMOS ICs.
- Analyze CMOS based switched capacitor circuits.
- Design non-linear analog circuits and data converters.
- Design and analyze comparators, sample and hold circuits, switched capacitor circuits.
- To design and implement filters

ECCY043 CONTROL AREA NETWORK

L	T	P	C
3	0	0	3

OBJECTIVES:

The primary course objectives are

- To introduce the requirements of embedded networking
- To provide overview of CAN controller and its implementation.
- To explain CAN open configuration and its development tools.

MODULE I EMBEDDED NETWORK REQUIREMENTS 09

Embedded networking – code requirements – Communication requirements – Introduction to CAN open – CAN open standard – Object directory – Electronic Data Sheets & Device – Configuration files – Service Data Objectives – Network management CAN open messages – Device profile encoder.

MODULE II CAN OPEN 09

CAN open configuration – Evaluating system requirements choosing devices and tools – Configuring single devices – Overall network configuration – Network simulation – Network Commissioning – Advanced features and testing.

MODULE III CAN 09

Controller Area Network – Underlying Technology CAN Overview – Selecting a CAN Controller – CAN development tools.

MODULE IV IMPLEMENTATION OF CAN OPEN 09

Implementing CAN open Communication layout and requirements – Comparison of implementation methods – Micro CAN open – CAN open source code – Conformance test – Entire design life cycle, CAN Bus Analyzer.

MODULEV ISSUES 09

Physical layer – Data types – Object dictionary – Communication object identifiers – Emerging objects – Node states.

L: 45 - Total Hours:45

REFERENCES

1. GlafP.Feiffer, Andrew Ayre and Christian Keyold, “Embedded Networking with CAN and CAN open”. Embedded System Academy 2005.

2. Gregory J. Pottie, William J. Kaiser “Principles of Embedded Networked Systems Design”, Cambridge University Press, Second Edition, 2005.
3. Mohammed Farsi, Barbosa, “CANopen Implementation : Applications to Industrial Network (Industrial Control, Computers, and Communications Series,18),Research Studies Press,2000
4. D.Paret, “Multiplexed Networks for Embedded Systems”, John Wiley & Sons, 2007

OUTCOMES:

On completion of the course the students will be able to

- Demonstrate embedded networking and its requirements.
- Describe CAN controller.
- Interpret the CAN message format.
- Determine system requirements for choosing devices and tools
- Implement CAN and discuss CAN issues.
- Explain different types of noise commonly found in embedded networks.

ECCY044 DISTRIBUTED EMBEDDED COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

The primary course objectives are

- The various hardware and software architectures used for distributed embedded computing.
- Distributed computing system models and Distributed databases.
- The infrastructure required to support an Internet connection, uses of common Internet protocols, and basic principles of the DNS.
- The distributed computing technologies.

MODULE I THE HARDWARE INFRASTRUCTURE 09

Broad Band Transmission facilities – Open Interconnection standards – Local Area Networks – wide Area Networks – Network management – Network Security – Cluster computers.

MODULE II INTERNET CONCEPTS 09

Capabilities and limitations of the internet – Interfacing Internet server applications to corporate databases HTML and XML Web page design and the use of active components.

MODULE III DISTRIBUTED COMPUTING USING JAVA 09

I/O streaming – Object serialization – Networking – Threading – RMI – multicasting – distributed databases – embedded java concepts – case studies.

MODULE IV EMBEDDED AGENT 09

Introduction to the embedded agents – Embedded agent design criteria – Behaviour based, Functionality based embedded agents – Agent co-ordination mechanisms and benchmarks embedded-agent. Case study: Mobile robots.

MODULE V EMBEDDED COMPUTING ARCHITECTURE 09

Synthesis of the information technologies of distributed embedded systems – analog/digital co-design – optimizing functional distribution in complex system design – validation and fast prototyping of multiprocessor system-on-chip – a new dynamic scheduling algorithm for real-time multiprocessor systems.

L:45 - Total Hours:45

REFERENCES

1. Dietel&Dietel, “JAVA-How to program”, Prentice Hall 1999.
2. SapeMullender, “Distributed Systems”, Addison-Wesley, 1993.
3. Jorgen Staunstrup, Wayne Wolf, “Hardware/Software Co-Design: Principles and Practice”, Kluwer Academic Pub, 1997.
4. Bernd Kleinjohann “Architecture and Design of Distributed Embedded Systems”, C-lab, Universitat Paderborn, Germany, Kluwer Academic Publishers, Boston, 2001.

OUTCOMES:

On completion of the course the students will able to

- Describe the hardware infra structure of distributed embedded system
- Elucidate the architecture of embedded web server
- Create JAVA constructs for distributed computing
- Designing and analyze high-performance Embedded system
- Analyze the performance of multiprocessor system on chip architecture
- Select suitable embedded architecture for distributed embedded system

ECCY045 EMBEDDED NETWORKING

L	T	P	C
3	0	0	3

OBJECTIVES:

The primary course objectives are

- To study the concepts of embedded networking
- To explore various bus architectures.
- To explore the fundamentals of embedded security.

MODULE I THE AUTOMOTIVE CAN BUS 09

Introduction-Concepts of Bus Access and arbitration – error processing and management – definition of the CAN protocol ISO 11898-1-error properties-detection and processing – framing, signal propagation-Bit synchronization-high speed CAN – low speed CAN-CAN components and development tools for CAN.

MODULE II UNIVERSAL SERIAL BUS 06

USB bus –Introduction –Speed Identification on the bus – USB States –USB bus communication: Packets –Data flow types –Enumeration –Descriptors –PIC 18 Microcontroller USB Interface –C Programs

MODULE III INDUSTRIAL NETWORKING PROTOCOL 09

LIN – Local Interconnect Network - Basic concept of the LIN 2.0 protocol - Fail-safe SBC – Gateways - Managing the application layers - Safe-by-Wire - Safe-by-Wire Plus - Audio-video buses - I2C Bus - D2B (Domestic digital) bus - MOST (Media oriented systems transport) bus - IEEE 1394 bus or 'FireWire'- profi bus

MODULE IV ETHERNET BASICS 06

Elements of a network – Inside Ethernet – Building a Network: Hardware options – Cables, Connections and network speed – Design choices: Selecting components –Ethernet Controllers – Using the internet in local and internet communications – Inside the Internet protocol.

MODULE V BLUETOOTH AND ZIGBEE 09

Bluetooth: Specifications- Bluetooth Radio- Type of Antenna, Antenna Parameters-Bluetooth Networking- Connection establishment procedure, Profile and usage model - Wireless networking, wireless network types, devices roles and states – IEEE 802.15.4 –Zigbee specifications- Zigbee stack protocol stack-PAN formation.

MODULE V IRF COMMUNICATION 06

Adhoc network, scatter net- GSM- Overview of IrDA, Home RF, Wireless LANs- IEEE 802.11x - NFC (near-field communication)- Wireless sensor networks – Introduction – Applications.

L: 45 - Total Hours:45

REFERENCES

1. Dominique Paret,"Multiplexed Networks for Embedded Systems", Wiley 2007.
2. Jan Axelson, "USB Complete", Lakeview Research, 2005
3. Jan Axelson, "Embedded Ethernet Complete", Lakeview Research, 2005.
4. GlafP.Feiffer, Andrew Ayre and Christian Keyold, "Embedded networking with CAN and CAN open". Embedded System Academy 2005.
5. Gregory J. Pottie, William J. Kaiser "Principles of Embedded Networked Systems Design", Cambridge University Press, Second Edition, 2005.
6. C.S.R. Prabhu and A.P. Reddi ,"Bluetooth Technology and its Applications with JAVA and J2EE, PHI, 2006
7. Rappaport Theodore S, "Wireless Communications: Principles And Practice", Pearson Education, 2010
8. Shahin Farahani,"ZigBee Wireless Networks and Transceivers", Newnes Publications, 2008.

OUTCOMES:

On completion of the course the students will able to:

- Describe the components and significance of Embedded networking system
- Elucidate the principles of USB communications
- Create Embedded Ethernet controller
- Explain industrial networking protocols like I2C,D2B
- Use appropriate interfaces, protocols and buses in embedded systems
- Describe the architecture of Bluetooth and RF communication modules

ECCY046 EMBEDDED LINUX

L	T	P	C
3	0	0	3

OBJECTIVES:

The objective of the course is

- To learn fundamentals of embedded linux.
- To familiarize the use of GNU tool chain.
- To develop embedded applications in linux platform.
- To interface peripheral devices in Linux platform.

MODULE I LINUX FUNDAMENTALS 09

Introduction - host-target development setup - hardware support -development languages and tools – RT Linux.

MODULE II KERNEL INITIALIZATION 09

Linux kernel and kernel initialization - system initialization – hardware support - boot loaders.

MODULE III DEVICE HANDLING 09

Device driver basics - module utilities - file systems - MTD subsystems –busy box

MODULE IV DEVELOPMENT TOOLS 09

Embedded development environment - GNU debugger - tracing & profiling tools - binary utilities - kernel debugging - debugging embedded Linux applications - porting Linux - Linux and real time - SDRAM interface.

MODULE V DEVICE APPLICATIONS 09

Asynchronous serial communication interface - parallel port interfacing -USB interfacing - memory I/O interfacing - using interrupts for timing.

L:45 - Total Hours:45

REFERENCES:

1. Karim Yaghmour, Jon Masters, Gillad Ben Yossef, Philippe Gerum, “Building embedded linux systems”, O'Reilly, 2008.
2. Christopher Hallinan, “Embedded Linux Primer: A practical real world approach”, Prentice Hall, 2007.

3. Mohamed Gad-el-Hak, editor," The MEMS Handbook", CRC press Baco Raton, 2000.
4. Tai Ran Hsu," MEMS & Micro systems Design and Manufacture" Tata McGraw Hill, New Delhi, 2002.

OUTCOMES

At the end of the course students will be able to

- Explain RT linux fundamentals
- Identify difference between RT linux and embedded linux versions
- Analyze kernel and system initialization and porting Linux
- Debug and develop embedded linux applications
- Interface peripheral devices in linux platform
- Explain device handling in linux OS.

ECCY047 HARDWARE-SOFTWARE CO-DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

The objective of the course is to

- Introduce the basics of hardware software Co-design.
- Describe the modeling concepts in Co-design.
- Explain the applications of models.
- Apply object oriented techniques in Co-Design process.

MODULE I INTRODUCTION 09

Motivation hardware & software co-design, system design consideration, research scope & overviews Hardware Software back ground: Embedded systems, models of design representation, the virtual machine hierarchy, the performance3 modeling, Hardware Software development

MODULE II CO-DESIGN CONCEPTS 09

Functions, functional decomposition, virtual machines, Hardware Software partitioning, Hardware Software partitions, Hardware Software alterations, Hardware Software tradeoffs, co-design.

MODULE III METHODOLOGY FOR CO-DESIGN 09

Amount of unification, general consideration & basic philosophies, a framework for co-design Unified Representation for Hardware & Software: Benefits of unified representation, modeling concepts. An Abstract Hardware & Software Model: Requirement & applications of the models, models of Hardware Software system, an abstract Hardware Software models, generality of the model Performance Evaluation: Application of the abstract Hardware & Software model, examples of performance evaluation

MODULE IV OBJECT ORIENTED TECHNIQUES IN HARDWARE DESIGN 09

Motivation for object oriented technique, data types, modeling hardware components as classes, designing specialized components, data decomposition, and Processor example.

MODULE V SYSTEM ON CHIP 09

The System-on-Chip Concept, Four Design Principles in SoC Architecture, SoC Modeling in GEZEL. Applications: Trivium Crypto-Coprocessor, CORDIC Co-Processor.

L:45 - Total Hours:45

REFERENCES

1. Sanjaya Kumar, James H. Ayler “The Co-design of Embedded Systems: A Unified Hardware Software Representation”, Kluwer Academic Publisher, 2002 .
2. H. Kopetz, “Real-Time Systems”, Kluwer, 1997.
3. R. Gupta, “Co-synthesis of Hardware and Software for Embedded Systems”, Kluwer 1995.
4. S. Allworth, “Introduction to Real-time Software Design”, Springer-Verlag, 1984.
5. C. M. Krishna, K. Shin, “Real-time Systems”, Mc-Graw Hill, 1997.
6. Peter Marwedel, G. Goosens, “Code Generation for Embedded Processors”, Kluwer Academic Publishers, 1995.
7. Ralf Niemann, Hardware/Software Co-Design for Data flow Dominated Embedded Systems, Springer, 1998

OUTCOMES:

At the end of the course students will be able to

- Describe the design methodologies used in the hardware software co-design
- Identify the core issues in co-design
- Describe the functions of co-design
- Assess the benefits of unified representation
- Evaluate the performance of the model
- Apply object oriented techniques in Hardware Design

ECCY048 IC PACKAGING AND INTERCONNECTS

L	T	P	C
3	0	0	3

OBJECTIVES:

- Outline packaging techniques and materials used for packaging.
- Understanding the assembly process in electronic design.
- Design PCB for various applications
- Testing and interconnections of electronic modules.

MODULE I PACKAGING TECHNIQUES 09

Introduction to packaging, Package design considerations, VLSI Assembly Techniques, Packaging fabrication technology, THM, Surface Mounting.

MODULE II SYSTEM ASSEMBLY 09

Design for Reliability – Fundamentals, Induced failures. IC Assembly – Purpose, Requirements, Technologies, Wire bonding, Tape Automated Bonding, Flip Chip, Wafer Level Packaging.

MODULE III INTERCONNECTS 09

Small, Intermediate and long interconnects in VLSI, Interconnect Parasitics: Resistance, Inductance and Capacitance. Interconnect RC Delays: Elmore Delay Calculation. Interconnect Models: Lumped RC Model, Distributed RC Model, Transmission line model. SPICE Wire Models: Distributed RC lines in SPICE, Transmission line models in SPICE.

MODULE IV CMOS REPEATER DRIVEN INTERCONNECTS 09

The Static Behavior-Switching Threshold, Noise Margins, The Dynamic Behavior-Computing the capacitances, Propagation Delay: First order Analysis, Propagation Delay from a Design perspective. Power, energy and Energy – Delay-Dynamic Power Consumption, Static Consumption, Transient analysis of repeater loaded interconnects and analysis of Power Consumption using SPICE

MODULE V ADVANCED INTERCONNECT TECHNIQUES 09

Reduced - swing Circuits, Current – mode Transmission Techniques, Clocking of high - speed systems, CNT and Optical Interconnects.

L: 45 - Total Hours:45

REFERENCES

1. Rao R. Tummala : Fundamentals of Microsystem Packaging McGraw Hill.
2. H.K. Bakoglu, “Circuits, Interconnections & Packaging for VLSI”, Addison Wesley Publication Company Inc.
3. Richard K. Ulrich &William D. Brown “Advanced Electronic Packaging” - 2nd Edition : IEEE Press
4. A.K. Goel, High-Speed VLSI Interconnections, Wiley Interscience, 2nd Edition, 2007.

OUTCOMES:

At the end of the course students will be able to

- Describe the different types IC packaging techniques
- Describe the multidisciplinary aspects of IC packaging like electrical, thermal, material, reliability and testability design.
- Model the interconnects inside the IC using suitable models
- Analyze the performance of the Interconnects using SPICE
- Analyze the performance of the CMOS driven interconnects.
- Describe the advanced Interconnect Techniques

ECCY049 LOW POWER VLSI DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

To impart knowledge on

- Power analysis used in CMOS devices.
- Various techniques to reduce the power consumption in VLSI Circuits.
- Various Low power Architectures.
- Algorithm and Architecture level methodologies on low power devices.

MODULE I DEVICE & TECHNOLOGY IMPACT ON LOW POWER 09

Need for low power VLSI chips, Sources of power dissipation on Digital Integrated circuits. Emerging Low power approaches. Physics of power dissipation in CMOS devices. Dynamic dissipation in CMOS, Transistor sizing & gate oxide thickness, Impact of technology Scaling, Technology & Device innovation.

MODULE II SIMULATION POWER ANALYSIS AND PROBABILISTIC POWER ANALYSIS 09

SPICE circuit simulators, gate level logic simulation, capacitive power estimation, static state power, gate level capacitance estimation, architecture level analysis, data correlation analysis in DSP systems. Monte Carlo simulation -Random logic signals, probability & frequency, probabilistic power analysis techniques, signal entropy.

MODULE III LOW POWER DESIGN 09

Circuit level: Power consumption in circuits. Flip Flops & Latches design, high capacitance nodes, low power digital cells library. Logic level: Gate reorganization, signal gating, logic encoding, state machine encoding, pre computation logic.

MODULE IV LOW POWER ARCHITECTURE SYSTEMS & CLOCK DISTRIBUTION 09

Power & performance management, switching activity reduction, parallel architecture with voltage reduction, flow graph transformation, low power arithmetic components, low power memory design, Power dissipation in clock distribution, single driver Vs distributed buffers, Zero skew Vs tolerable skew, chip and package co-design of clock network.

MODULE V ALGORITHM AND ARCHITECTURAL LEVEL METHODOLOGIES 09

Introduction, design flow, algorithmic level analysis and optimization, Architectural level estimation and synthesis.

L: 45 - Total Hours:45

REFERENCES

1. Gary K. Yeap, Farid N. Najm, “Low power VLSI design and technology”, World Scientific Publishing Ltd., 1996.
2. DimitriosSoudris, Christian Piguet, Costas Goutis, “Designing CMOS circuits for low power”, Kluwer Academic Publishers, 2002
3. Kaushik Roy and Sharat C. Prasad, “Low-Power CMOS VLSI Circuit Design”, Wiley-Interscience, 2000.
4. Chandrakasan, R. Brodersen, “CMOS Low Power Digital Design”, Kluwer Academic Publications, 1995.
5. Rabaey, M. Pedram, “Low Power Design Methodologies”, Kluwer Academic Publications, 1996.
6. Christian Piguet, “Low-power CMOS circuits: technology, logic design and CAD tools”, CRC Press, Taylor & Francis Group, 2006.

OUTCOMES:

After successful completion of the course, the students will be able to

- Describe the static and dynamic power dissipation in integrated chips.
- Estimate the power for simple models.
- Apply low power dissipation techniques in Clocking strategies and I/O circuits.
- Design low power arithmetic circuits and systems.
- Analyze design chips used for battery-powered systems and high-performance circuits not exceeding the power limits.
- Decide at which level of abstraction it is advantageous to implement low power techniques in a VLSI system design

ECCY050 MEMS SYSTEM DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

The objective of the course is to

- Provide the basic of MEMS device fabrication
- Fulfill the need of electronic engineer who wants to create MEMS devices
- Introduce the concepts of MEMS Electronic Sensors, Optical and RF system

MODULE I INTRODUCTION TO MEMS 09

MEMS and Microsystems, Miniaturization, Typical products, Micro sensors, Micro actuation, MEMS with micro actuators, Micro accelerometers and Micro fluidics, MEMS materials, Micro fabrication.

MODULE II MECHANICS FOR MEMS DESIGN 09

Elasticity, Stress, strain and material properties, Bending of thin plates, Spring configurations, torsional deflection, Mechanical vibration, Resonance, Thermo mechanics - actuators, force and response time, Fracture and thin film mechanics.

MODULE III ELECTRO STATIC DESIGN 09

Electrostatics: basic theory, electro static instability. Surface tension, gap and finger pull up, Electro static actuators, Comb generators, gap closers, rotary motors, inch worms, Electromagnetic actuators. bistable actuators

MODULE IV CIRCUIT AND SYSTEM ISSUES 09

Electronic Interfaces, Feedback systems, Noise , Circuit and system issues, Case studies - Capacitive accelerometer, Peizo electric pressure sensor, Modelling of MEMS systems, CAD for MEMS.

MODULE V INTRODUCTION TO OPTICAL AND RF MEMS 09

Optical MEMS - System design basics - Gaussian optics, matrix operations, resolution. Case studies, MEMS scanners and retinal scanning display, Digital Micro mirror devices. RF MEMS - design basics, case study - Capacitive RF MEMS switch, performance issues.

L:45 - Total Hours:45

REFERENCES:

1. Stephen Santuria," Microsystems Design", Kluwer publishers, 2000
2. Nadim Maluf," An introduction to Micro electro mechanical system design", Artech House, 2000.
3. Mohamed Gad-el-Hak, editor," The MEMS Handbook", CRC press Baco Raton, 2000.
4. Tai Ran Hsu," MEMS & Micro systems Design and Manufacture" Tata McGraw Hill, New Delhi, 2002.

OUTCOMES

At the end of the course students will be able to

- Describe the process of MEMS fabrication
- Describe the mechanisms followed to design MEMS devices
- Elucidate the methods to make electrostatic MEMS sensors
- Elucidate the methods to make MEMS based accelerometers
- Describe the MEMS based RF Switches
- Discuss the MEMS based optical scanners and sensors

ECCY051	OPTIMIZATION TECHNIQUES AND THEIR APPLICATIONS IN VLSI DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

The objective of the course is

- To introduce the concepts of statistical modeling and test generation patterns
- To describe and analyze placement and power estimation
- To discuss about various convex optimization techniques
- To gain knowledge in fundamentals of generic algorithms

MODULE I STATISTICAL MODELING 07

Modeling sources of variations, Monte Carlo techniques, Process variation modeling- Pelgrom's model, Principal component based modeling, Quad tree based modeling, Performance modeling-Response surface methodology, delay modeling, interconnect delay models.

MODULE II STATISTICAL PERFORMANCE, POWER AND YIELD ANALYSIS 07

Statistical timing analysis, parameter space techniques, Bayesian networks Leakage models, High level statistical analysis, Gate level statistical analysis, dynamic power, leakage power, temperature and power supply variations, High level yield estimation and gate level yield estimation.

MODULE III CONVEX OPTIMIZATION 08

Convex sets, convex functions, geometric programming, trade-off and sensitivity analysis, Generalized geometric programming, geometric programming applied to digital circuit gate sizing, Floor planning, wire sizing, Approximation and fitting-Monomial fitting, Max- monomial fitting, Posynomial fitting.

MODULE IV GENETIC ALGORITHM 08

Introduction, GA Technology-Steady State Algorithm-Fitness Scaling-Inversion GA for VLSI Design, Layout and Test automation- partitioning-automatic Placement, Routing technology, Mapping for FPGA- Automatic test generation- Partitioning algorithm Taxonomy-Multiway Partitioning Hybrid genetic-encoding- local improvement-WDFR-Comparison of Cas-Standard cell placement-GASP algorithm-unified algorithm.

MODULE V GENETIC ENCODING 07

Hybrid genetic-genetic encoding- Local Improvement - WDFR- Comparison of Gas- Standard cell Placement- GASP Algorithm- Unified Algorithm.

MODULE VI GA ROUTING PROCEDURES AND POWER ESTIMATION 08

Global routing-FPGA technology mapping-circuit generation-test generation in a GA frame work-test generation procedures. Power estimation-application of GA-Standard cell placement-GA for ATG-problem encoding- fitness function- GA vs Conventional algorithm.

L:45 - Total Hours:45

REFERENCES

1. Ashish Srivastava, Dennis Sylvester, David Blaauw “Statistical Analysis and Optimization for VLSI: Timing and Power”, Springer, 2005.
2. Pinaki Mazumder, E.Mrudnick, “Genetic Algorithm for VLSI Design, Layout and test Automation”, Prentice Hall,1998.
3. Stephen Boyd, Lieven Vandenberghe “Convex Optimization”, Cambridge University Press, 2004.

OUTCOMES:

On completion of the course the students will be able to

- Apply Knowledge on basic optimization techniques.
- Select and implement appropriate formulations and algorithms.
- Develop the capability to analyze on various statistical methods in analyzing a Sample.
- Develop the capability to analyze the concepts of genetic algorithms and genetic encoding.
- Apply engineering tools and techniques to conduct engineering VLSI design.
- To adopt these techniques in solving problems in the real world.

ECCY052 PROGRAMMING VERILOG HDL

L	T	P	C
2	0	2	3

OBJECTIVES:

The primary course objectives is to

- Learn the hardware description language Verilog HDL.
- Learn the hardware description language Verilog AMS
- Become proficient in a design methodology that uses Verilog HDL to create and verify systems implemented using PLDs
- Strengthen and extend your understanding of the theory and fundamentals of digital system design.

MODULE I VERILOG HDL INTRODUCTION 06+06

Verilog as HDL, Levels of Design Description, Concurrency, Simulation and Synthesis, Language Constructs and Conventions, Keywords, Identifiers, White Space, Characters, Comments, Numbers, Strings, Logic Values, Strengths, Data Types, Scalars and Vectors, Parameters, Operators. Modeling at Dataflow Level, Continuous Assignment Structure, Delays Assignment to Vector, Operators

Laboratory Practice

Simulation of Verilog HDL programs illustrating the language constructs in the module I

MODULE II GATE LEVEL MODELING 06+06

Modeling at Gate Level, Gate Primitives, Tristate Gates, Array of Instances of Primitives, Design of Flip-Flops with Gate Primitives, Delay, Strengths and Construction Resolution, Net Types, Switch Level Modeling, Basic Transistor Switches, CMOS Switches, Bi-Directional Gates, Time Delays with Switch Primitives, Instantiation with 'Strengths' and 'Delays' Strength Contention with Trireg Nets.

Laboratory Practice

Simulation of Verilog HDL programs illustrating the language constructs in the module II

MODULE III BEHAVIORAL MODELING 06+06

Functional Bi-furcation, 'Intial' and ‘always’ Construct, 'Wait' Construct, Multiple ‘always’ Block, Designsat Behavioral Level, Blocking and Non-Blocking Assignments, The 'Case' Statement, Simulation Flow, 'If' an 'if-Else' Constructs, 'Assign- De-Assign' Constructs, 'Repeat' Construct, for loop, 'The Disable'

Construct, 'While Loop', Forever Loop, Parallel Blocks, Force-Release, Construct, Event. System Tasks, Functions and Compiler Directives, Path Delays, Module Parameters. System Tasks and Functions File Based Tasks and Functions, Computer Directives, Hierarchical Access, User Defined Primitives.

Laboratory Practice

Simulation of Verilog HDL programs illustrating the language constructs in the module III

MODULE IV SEQUENTIAL CIRCUIT DESCRIPTION 06+06

Basic Memory Components, Functional Register, Finite State Machine Coding, Sequential Synthesis. Components Test and Verification: Test Bench - Combinational Circuits Testing, Sequential Circuit Testing, Test Bench Techniques, Design Verification, Assetion Verification.

Laboratory Practice

Simulation of Verilog HDL programs illustrating the language constructs in the module IV

MODULEV VERILOG-AMS 06+06

Introduction to Verilog-AMS: Verilog Family of Languages Mixed Signal Simulators, Applications of Verilog-AMS, Analog Modeling. Language Reference: Basics, Data Types, Signals, Expressions, Analog Behavior.

Laboratory Practice

Simulation of Verilog AMS HDL programs illustrating the language constructs in the module V

L: 30, P: 30 - Total Hours:60

REFERENCES

1. Zainalabdien Navabi, Verliog Digital System Design, TMH, 2nd Edition.
2. Fundamentals of Digital Logic with Verilog Design - Stephen Brown, Zvonkoc Vranesic, TMH, 2nd Edition.
3. Verilog HDL - Samir Palnitkar, 2nd Edition, Pearson Education, 2009.
4. Advanced Digital Design with Verilog HDL - Michel D. Ciletti, PHI, 2009.
5. Kenneth S Kundert, Olaf Zinke, Designers Guide to Verilog AMS, Springer, 2004

OUTCOMES:

On completion of the course the students will be able to

- Differentiate sequential language and concurrent language

- Design and verify combinational logic circuits using Verilog HDL
- Design and verify sequential logic circuits using Verilog HDL
- Implement RTL models on FPGAs
- Model Analog circuits using Verilog AMS.
- Design digital and mixed signal systems using Verilog HDL

ECCY053 REAL TIME SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

The objective of the course is

- To know the fundamentals of Real Time systems
- To know the concepts related to Scheduling and Programming Languages
- To describe of real time database and communication
- To understand fault tolerance and techniques

MODULE I INTRODUCTION TO REAL TIME SYSTEM 09

Introduction – characterizing real time system -Performance Measures for Real Time Systems – Estimating Program Run Times – Task Assignment and Scheduling.

MODULE II PROGRAMMING LANGUAGES AND TOOLS 09

Desired language characteristics – Data typing – Control structures – Facilitating Hierarchical Decomposition, Packages, Run time Error handling – Overloading and Generics – Multitasking – Timing Specifications – Programming Environments – Run time support.

MODULE III REAL TIME DATABASES 09

Basic Definition, Real time Vs General Purpose Databases, Main Memory Databases, Transaction priorities, Transaction Aborts, Concurrency control issues, Disk Scheduling Algorithms, Two – phase Approach to improve Predictability – Maintaining Serialization Consistency – Databases for Hard Real Time Systems.

MODULE IV REAL TIME COMMUNICATION 09

Communications media, Network Topologies, Protocols- contention based, Token based, Stop-and-Go multihop, Polled Bus, Hierarchical Round Robin Protocol, Deadline-Based Protocols, Fault Tolerant Routing.

MODULE V FAULT TOLERANT AND EVALUATION TECHNIQUES 09

Fault Tolerance Techniques – Fault Types – Fault Detection-Fault Error containment- Redundancy- Reliability Evaluation Techniques – Obtaining parameter values, Reliability models for Hardware Redundancy – Software error models.

L: 45 - Total Hours:45

REFERENCES

1. C.M. Krishna, Kang G. Shin, “Real – Time Systems”, McGraw – Hill International Editions, 1997
2. Rajib Mall, ”Real-time systems: theory and practice”, Pearson Education, 2007
3. Stuart Bennett, “Real Time Computer Control – An Introduction”, Prentice Hall of India, 1998.
4. Peter D. Lawrence, “Real Time Micro Computer System Design – An Introduction”, McGraw Hill, 1988.
5. S.T. Allworth and R.N.Zobel, “Introduction to real time software design”, Macmillan

OUTCOMES:

At the end of the course students will be able to

- Describe the characteristics of real time system
- Apply scheduling algorithms based on application
- Analyze real-time systems designs
- Identify the fault tolerants in real time system
- Apply reliable evaluation techniques
- Design the real time systems

ECCY054 RECONFIGURABLE COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

The objective of the course is

- To investigate the state-of-the-art in reconfigurable computing both from a hardware and software perspective.
- To make the students understand both how to architect a reconfigurable systems and how to apply them to solving challenging computational problems.
- To examine specific contemporary reconfigurable computing systems and to identify existing system limitations and to highlight opportunities for research in dynamic and partial configuration areas.
- To impart knowledge on the application development of reconfigurable systems.

MODULE I INTRODUCTION 09

Introduction, origin of reconfigurable computing, Reconfigurable computing architecture, Reconfigurable computing hardware, Logic—The Computational Fabric, The Array and Interconnect, Extending Logic, Configuration, Case Studies, Altera Stratix, Xilinx Virtex-II Pro.

MODULE II RECONFIGURABLE COMPUTING ARCHITECTURES AND SYSTEMS 09

Reconfigurable Processing Fabric Architectures, RPF Integration into Traditional Computing Systems, Reconfigurable computing systems, Early Systems, PAM, VCC, and Splash , Small-scale Reconfigurable Systems, Circuit Emulation, Accelerating Technology, Reconfigurable Supercomputing, Other System Issues, The Future of Reconfigurable Systems.

MODULE III PROGRAMMING RECONFIGURABLE SYSTEMS, COMPUTATION MODELS AND SYSTEM ARCHITECTURES 09

Computation Models -- Challenges, Common Primitives, Dataflow, Sequential Control, Data Parallel, Data-centric , Multi-threaded, Other Compute Models, System Architectures - Streaming Dataflow, Sequential Control, Bulk Synchronous Parallelism, Data Parallel, Cellular Automata, Multi-threaded, Hierarchical Composition.

MODULE IV FPGA DESIGN 09

FPGA Physical Design Tools -Technology mapping - Placement & routing - Register transfer (RT)/Logic Synthesis - Controller/Data path synthesis - Logic minimization.

MODULE V APPLICATION DEVELOPMENT 09

Implementing Applications with FPGAs, Strengths and Weaknesses of FPGAs, Application Characteristics and Performance, General Implementation Strategies for FPGA-based Systems, Implementing Arithmetic in FPGAs, Hardware/Software Partitioning.

L:45 - Total Hours:45

REFERENCES

1. Scott Hauck, André DeHon, “Reconfigurable Computing: The Theory and Practice of FPGA-Based Computation”, Morgan Kauffman publishers, 2008.
2. M. Gokhale and P. Graham, “Reconfigurable Computing: Accelerating Computation with Field-Programmable Gate Arrays”, Springer, 2005.
3. C. Bobda, “Introduction to Reconfigurable Computing: Architectures, Algorithms and Applications”, Springer, 2007.
4. P. Lysaght and W. Rosenstiel, “New Algorithms, Architectures and Applications for Reconfigurable Computing”, Springer, 2005.
5. W. Wolf, “FPGA Based System Design”, Prentice-Hall, 2004.

OUTCOMES:

After successful completion of the course, the students will be able to

- Describe various Reconfigurable Computing architectures systems
- Summarize the Programming model for Reconfigurable computing
- Design reconfigurable computing architectures on FPGA
- Apply Reconfigurable computing for hardware and software partitioning.
- Design and build an SOPC for a specific application.
- Develop arithmetic and complex digital architectures on FPGA

ECCY055 RF INTEGRATED CIRCUIT DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

The objective of the course is to impart knowledge on

- The different RF transceiver architectures
- The methods of designing passive components in IC
- The design of LNA, Power amplifiers, PLL, Oscillators and frequency synthesizers

MODULE I TRANSCEIVER ARCHITECTURES 09

Introduction to MOSFET Physics, Noise: Thermal, shot, flicker, popcorn noise, Two port Noise theory, Noise Figure, THD, IP2, IP3, Sensitivity, SFDR, Phase noise - Specification distribution over a communication link, Homodyne Receiver, Heterodyne Receiver, Image reject, Low IF Receiver Architectures upconversion Transmitter.

MODULE II IMPEDANCE MATCHING AND AMPLIFIERS 09

S-parameters with Smith chart, Passive IC components, Impedance matching networks, Common Gate, Common Source Amplifiers, OC Time constants in bandwidth estimation and enhancement, High frequency amplifier design, Power match and Noise match, Single ended and Differential LNAs, Terminated with Resistors and Source Degeneration LNAs. MOSFET amplifier controlled by AGC.

MODULE III FEEDBACK SYSTEMS AND POWER AMPLIFIERS 09

Stability of feedback systems: Gain and phase margin, Root-locus techniques, Time and Frequency domain considerations , Compensation, General model – Class A, AB, B, C, D, E and F amplifiers, Power amplifier Linearisation Techniques, Efficiency boosting techniques, ACPR metric, Design considerations.

MODULE IV PLL AND FREQUENCY SYNTHESIZERS 09

Linearised Model, Noise properties, Phase detectors, Loop filters and Charge pumps, Integer- N frequency synthesizers, Direct Digital Frequency synthesizers.

MODULE V MIXERS AND OSCILLATORS 09

Mixer characteristics, Non-linear based mixers, Quadratic mixers, Multiplier based mixers, Single balanced and double balanced mixers, subsampling mixers,

Oscillators describing Functions, Colpitts oscillators, Resonators, Tuned Oscillators, Negative resistance oscillators, Phase noise.

L: 45 - Total Hours:45

REFERENCES

1. T.Lee, “Design of CMOS RF Integrated Circuits”, Cambridge, 2004.
2. B.Razavi, “RF Microelectronics”, Pearson Education, 1997.
3. Jan Crols, Michiel Steyaert, “CMOS Wireless Transceiver Design”, Kluwer Academic Publishers, 1997.
4. B.Razavi, “Design of Analog CMOS Integrated Circuits”, McGraw Hill, 2001.

OUTCOMES:

After successful completion of the course, the students will be able to

- Describe and select appropriate RF transceiver architectures based on the requirements.
- Describe the different topologies used to design passive components in IC
- Analyze Low Noise and power amplifier circuits and design the same based on the given requirements.
- Describe and analyze the performance of frequency synthesizers
- Analyze mixers and oscillator circuits and design the same based on the given requirements.
- Design the building blocks of RF transceiver system

ECCY056	RISC PROCESSOR ARCHITECTURE AND PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The objective of the course is to

- Compare CISC and RISC processor architectures
- Understand AVR microcontroller architecture and memory organization
- Introduce MSP430 processor architecture and programming
- Familiarize ARM architecture ,application and programming

MODULE I AVR MICROCONTROLLER ARCHITECTURE 09

Architecture – memory organization – addressing modes – instruction set – programming techniques –Assembly language & C programming-Development Tools – Cross Compilers – Hardware Design Issues.

MODULE II MSP430 ARCHITECTURE AND PROGRAMMING 09

Architecture – CPU features – Memory structure - Interrupts – Input and Output– On-chip peripherals – Addressing modes – Instruction sets – Hardware considerations – Flash memory – Programming in Low power design.

MODULE III ARM ARCHITECTURE AND PROGRAMMING 09

ARM processor fundamentals – Registers – Pipeline – Exceptions – Interrupts– core extension- Instruction set – Thumb instruction set - 'C' programming –writing and optimising ARM assembly code – Instruction scheduling – Register allocation – conditional execution – Looping constraints.

MODULE IV ARM APPLICATION DEVELOPMENT 09

Exception Handling – Interrupts – Interrupt handling schemes- Firmware and boot loader – Example: Standalone - Embedded Operating Systems –Fundamental Components - Example Simple little Operating System.

MODULE V DESIGN WITH ARM MICROCONTROLLERS 09

Integrated development environment – Standard I/O Libraries - User Peripheral Devices – Application of ARM processor: Wireless Sensor Networks.

L: 45 - Total Hours:45

REFERENCES:

1. Dananjay V. Gadre “Programming and Customizing the AVR microcontroller”,McGrawHill 2001
2. Chris Nagy, “Embedded systems design using the TI MSP430 series”, Elsevier 2003.
3. Andrew N. Sloss, Dominic Symes, Chris Wright, John Rayfield “ARM System Developer’s Guide Designing and Optimizing System Software”, Elsevier, 2007.
4. Steve Furber, “ARM system on chip architecture”, Addison Wesley, 2000.

OUTCOMES

On completion of program students will be able to:

- Analyze the features of CISC and RISC processor architectures
- Develop simple application program using AVR microcontroller
- Integrate low power modes with embedded system application
- Implement scheduling mechanism in ARM processor.
- Use simple little operating system for suitable applications.
- Estimate energy consumption of ARM processor in wireless sensor network

ECCY057 SEMICONDUCTOR MEMORIES

L	T	P	C
3	0	0	3

OBJECTIVES:

The objective of the course is

- To study the concepts of random access memory and nonvolatile memories.
- To learn the implementation methods and problems in designing and making semiconductor memories
- To understand different fault modeling and testing techniques.

MODULE I STATIC RANDOM ACCESS MEMORY TECHNOLOGY 09

Static Random Access Memories (SRAMs): SRAM Cell Structures-MOS SRAM Architecture-MOS SRAM Cell and Peripheral Circuit Operation-Bipolar SRAM Technologies-Silicon On Insulator (SOI) Technology-Advanced SRAM Architectures and Technologies-Application Specific SRAM

MODULE II DYNAMIC RANDOM ACCESS MEMORY TECHNOLOGY 09

Dynamic Random Access Memories (DRAMs): DRAM Technology Development-CMOS DRAMs-DRAMs Cell Theory and Advanced Cell Structures - BiCMOS, DRAMs-Soft Error Failures in DRAMs-Advanced DRAM Designs and Architecture-Application, Specific DRAMs.

MODULE III NONVOLATILE MEMORIES 09

Masked Read-Only Memories (ROMs)-High Density ROMs-Programmable Read-Only Memories (PROMs)-Bipolar PROMs-CMOS, PROMs-Erasable (UV) - Programmable Road-Only Memories (EPROMs)-Floating-Gate EPROM Cell-One-Time Programmable (OTP) EPROMs-Electrically Erasable PROMs (EEPROMs)-EEPROM Technology And Arcitecture - Nonvolatile SRAM-Flash Memories (EPROMs or EEPROM)-Advanced Flash Memory Architecture.

MODULE IV MEMORY FAULT MODELING, TESTING, AND MEMORY DESIGN FOR TESTABILITY AND FAULT TOLERANCE 09

RAM Fault Modeling, Electrical Testing, Pseudo Random Testing-Megabit DRAM Testing-Nonvolatile Memory Modeling and Testing-IDDQ Fault Modeling and Testing-Application Specific Memory Testing

MODULE V RELIABILITY AND RADIATION EFFECTS 09

General Reliability Issues-RAM Failure Modes and Mechanism-Nonvolatile Memory Reliability-Reliability Modeling and Failure Rate Prediction-Design for Reliability-Reliability Test Structures-Reliability Screening and Qualification. RAM Fault Modeling, Electrical Testing, Psuedo Random Testing-Megabit DRAM Testing-Nonvolatile Memory Modeling and Testing-IDDQ Fault Modeling and Testing-Application Specific Memory Testing.

L: 45 - Total Hours:45

REFERENCES

1. Ashok K.Sharma, "Semiconductor Memories Technology, Testing and Reliability", Prentice-Hall of India Private Limited, New Delhi, 1997.
2. Tegze P.Haraszti, “CMOS Memory Circuits”, Kluwer Academic publishers, 2001.
3. Betty Prince, “Emerging Memories: Technologies and Trends”, Kluwer Academic publishers, 2002.

OUTCOMES:

On completion of the course the students will be able to

- Discuss the advancements in the SRAM and DRAM based memory technologies
- Analyze and interpret the design parameters used to design memory cells
- Describe the advancements in non-volatile memory design techniques
- Use fault modeling techniques to test memories
- Select appropriate technique to test memory devices
- To use suitable memory devices based on the requirements

ECCY058 SIGNAL INTEGRITY FOR HIGH SPEED DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

The objective of the course is

- Analysis of high speed circuits with signal behavior modeling
- Signaling and coding strategies to improve signal integrity in high-speed serial link.
- Analysis procedures for signal measurements.
- clock distributions and clock oscillators

MODULE I SIGNAL PROPAGATION ON TRANSMISSION LINES 07

Transmission line equations, wave solution, wave vs. circuits, initial wave, delay time, Characteristic impedance , wave propagation, reflection, and bounce diagrams Reactive terminations – L, C , static field maps of micro strip and strip line cross-sections, per unit length parameters.

MODULE II PRINTED CIRCUIT BOARDS 07

PCB layer stackups and layer/Cu thicknesses, cross-sectional analysis tools, Zo and Td equations for microstrip and stripline Reflection and terminations for logic gates, fan-out, logic switching, input impedance into a transmissionline section, reflection coefficient, skin-effect, dispersion.

MODULE III MULTI-CONDUCTOR TRANSMISSION LINES AND CROSS TALK 09

Multi-conductor transmission-lines, coupling physics, per MODULE length parameters, Near and far-end cross-talk, minimizing cross-talk (stipline and microstrip) Differential signalling, termination, balanced circuits ,S-parameters, Lossy and Lossles models.

MODULE IV NON-IDEAL EFFECTS 07

Non-ideal signal return paths – gaps, BGA fields, via transitions, Parasitic inductance and capacitance, Transmission line losses – Rs, tan d, routing parasitic, Common-mode current, differential-mode current, Connectors.

MODULE V POWER CONSIDERATIONS AND SYSTEM DESIGN 09

SSN/SSO, DC power bus design, layer stack up, SMT decoupling, Logic families, power consumption, and system power delivery, Logic families and speed Package

types and parasitic, SPICE, IBIS models, Bit streams, PRBS and filtering functions of link-path components, Eye diagrams, jitter, inter-symbol interference Bit-error rate, Timing analysis

MODULE VI CLOCK DISTRIBUTION AND CLOCK OSCILLATORS 6

Timing margin, Clock slew, low impedance drivers, terminations, Delay Adjustments, canceling parasitic capacitance, Clock jitter

L: 45 - Total Hours:45

REFERENCES

1. H. W. Johnson and M. Graham, High-Speed Digital Design: A Handbook of Black Magic, Prentice Hall, 1993.
2. Douglas Brooks, Signal Integrity Issues and Printed Circuit Board Design, Prentice Hall PTR, 2003.
3. S. Hall, G. Hall, and J. McCall, High-Speed Digital System Design: A Handbook of Interconnect Theory and Design Practices, Wiley-Interscience, 2000.
4. Eric Bogatin, Signal Integrity – Simplified, Prentice Hall PTR, 2003.

OUTCOMES:

On completion of the course the students will be able to

- Describe the signal behavior on high speed circuits such as cross talk in transmission lines
- Analyze the fundamentals of high speed signal propagation in circuits and cables.
- Summarize power consideration and timing analysis and other losses in system design
- Apply the measurement techniques in clock oscillators
- Determine where signal integrity issues
- Solve problems of poor digital signal integrity.

ECCY059 SOC DESIGN AND VERIFICATION

L	T	P	C
3	0	0	3

OBJECTIVES:

The objective of the course is to

- Understand the System on Chip with its need, evolution, challenges, goals, superiority over system on board & stacked ICs in package.
- Analyze how the SoCs are designed in industrial environment using different design methodologies
- Analyze the on chip components interconnected in a SoC.
- Analyze and solve problems in traditional bus based communication architecture using network on chip.

MODULE I INTRODUCTION TO LOGIC GATES & COMBINATIONAL LOGIC NETWORKS 09

Introduction to logic gates & combinational logic networks, Combinational Logic Functions, Combinational Network Delay. Logic and interconnect Design. Power Optimization.

MODULE II SYSTEM ON CHIP DESIGN PROCESS 09

A canonical SoC Design, SoC Design flow waterfall vs spiral, topdown vs Bottomup. Specification requirement, Types of Specification , System Design process, System level design issues, Soft IP Vs Hard IP, Design for timing closure, Logic design issues Verification strategy, Onchip buses and interfaces, Low Power, Manufacturing test strategies.

MODULE III MACRO DESIGN PROCESS 09

Top level Macro Design, Macro Integration, Soft Macro productization, Developing hard macros, Design issues for hard macros, Design, System Integration with reusable macros.

MODULE IV SOC VERIFICATION 09

Verification technology options, Verification methodology, Verification languages, Verification approaches, and Verification plans. System level verification, Block level verification, Hardware/software co-verification and Static net list verification. Verification architecture, Verification components, Introduction to VMM, OVM and UVM.

MODULE V DESIGN OF COMMUNICATION ARCHITECTURES FOR SOCS 09

On chip communication architectures, System level analysis for designing communication, Design space exploration, Adaptive communication architectures, Communication architecture tuners, Communication architectures for energy/battery efficient systems. Introduction to bus functional models and bus functional model based verification.

L: 45 - Total Hours:45

REFERENCES

1. PrakashRashinkar Peter Paterson and Leena Singh “SoC Verification Methodology and Techniques”, Kluwer Academic Publishers, 2001.
2. Michael Keating, Pierre Bricaud, “Reuse Methodology manual for System on AChip Designs”, Kluwer Academic Publishers, second edition, 2001.
3. William K. Lam, “Design Verification: Simulation and Formal Method based Approaches”, Prentice Hall.
4. Rochit Rajsuman, “System- on -a- Chip Design and Test”, ISBN.
5. A.A. Jerraya, W.Wolf “Multiprocessor Systemsonchips”, M K Publishers.
6. Dirk Jansen “The EDA HandBook”, Kluwer Academic Publishers.

OUTCOMES:

On completion of the course the students will be able to

- Describe CMOS VLSI Technologies along with performance parameters
- Analyze the top-down and bottom-up design flows, timing problems.
- Design and implement data path elements such as ALUs, Multipliers.
- Investigate various power optimization and timing issues related to complex digital systems
- Use techniques for designing MP SoCs and its performance.
- Illustrate the bus architectures of NOCs and routing.

ECCY060 SOFTWARE FOR EMBEDDED SYSTEMS

L	T	P	C
2	0	2	3

OBJECTIVES:

The objective of the course is

- To know the basic conepts of C Programming.
- To Introduce the GNU C Programming Tool Chain in Linux.
- To understand embedded C and Embedded OS
- To introduce the phython language

MODULE I C PROGRAMMING CONCEPTS 09

Programming Style - Declarations and Expressions - Arrays, Qualifiers and Reading Numbers - Decision and Control Statements - Programming Process - More Control Statements - Variable Scope and Functions - C Preprocessor - Advanced Types - Simple Pointers - Debugging and Optimization.

Laboratory Practice

Practice C language programs illustrating the language constructs in the module I using C compiler

MODULE II C PROGRAMMING TOOLCHAIN IN LINUX 09

Introduction to GCC - Debugging with GDB - The Make utility - GNU Configure and Build System - GNU Binary utilities - Profiling - using gprof - Memory Leak Detection with valgrind - Introduction to GNU C Library .

Laboratory Practice

Practice C language programs using GCC compiler in Linux environment

MODULE III EMBEDDED C USING 8051 MICROCONTROLLER 09

Adding Structure to ‘C’ Code: Object oriented programming with C, Header files for Project and Port, Examples. Meeting Real-time constraints: Creating hardware delays - Need for timeout mechanism - Creating loop timeouts - Creating hardware timeouts.

Laboratory Practice

Practice Embedded C language programs illustrating the language construct in the module III using C Keil µvision IDE

MODULE IV EMBEDDED OS 09

Creating embedded operating system: Basis of a simple embedded OS, Introduction to sEOS, Using Timer 0 and Timer 1, Portability issue, Alternative system architecture, Important design considerations when using sEOS.

Laboratory Practice

Practice Embedded C language programs illustrating the language construct in the module IV using C Keil µvision IDE

MODULE V PYTHON PROGRAMMING 09

Basics of PYTHON Programming Syntax and Style – Python Objects– Dictionaries – comparison with C programming on Conditionals and Loops – Files – Input and Output – Errors and Exceptions – Functions – Modules – Classes and OOP – Execution Environment.

Laboratory Practice

Practice basic Python language programs illustrating the language construct in the module V using Python interactive shell software

L: 45 - Total Hours: 45

REFERENCES:

1. Stephen Kochan, “Programming in C”, 3rd Edition, Sams Publishing, 2009.
2. Steve Oualline, ‘Practical C Programming 3rd Edition’, O’Reilly Media, Inc, 2006.
3. Michael J Pont, “Embedded C”, Pearson Education, 2007.
4. Mark Lutz, “Learning Python Powerful OOPs”, O’reilly, 2011.

OUTCOMES

At the end of the course students will be able to

- Write, compile and debug programs in C language.
- compile the program in linux operating system
- Develop program using embedded C
- Describe operating system in embedded system
- Program using phython language
- Design projects using embedded C and python language

ECCY061 TESTING OF VLSI CIRCUITS

L	T	P	C
3	0	0	3

OBJECTIVES:

To impart knowledge on

- Automated and manual techniques for generating tests for faults in digital circuits and systems.
- Generation of test vectors for combinational and sequential circuits
- Fault diagnosis algorithms

MODULE I BASICS OF TESTING AND FAULT MODELING 09

Introduction to Testing - Faults in digital circuits - Modeling of faults - Logical Fault Models - Fault detection - Fault location - Fault dominance - Logic Simulation - Types of simulation - Delay models - Gate level Event-driven simulation.

MODULE II TEST GENERATION FOR COMBINATIONAL AND SEQUENTIAL CIRCUITS 09

SPICE circuit simulators, gate level logic simulation, capacitive power estimation, static state power, gate level capacitance estimation, architecture level analysis, data correlation analysis in DSP systems. Monte Carlo simulation -Random logic signals, probability & frequency, probabilistic power analysis techniques, signal entropy.

MODULE III DESIGN FOR TESTABILITY 09

Design for Testability - Ad-hoc design - Generic scan based design - Classical scan based design – System level DFT approaches.

MODULE IV SELF TEST AND TEST ALGORITHMS 09

Built-In Self-Test - Test pattern generation for BIST - Circular BIST - BIST Architectures - Testable Memory Design – Testing of Embedded RAMs.

MODULE V FAULT DIAGNOSIS 9

Logic Level Diagnosis - Fault Diagnosis for Combinational Circuits - Self-checking design - System Level Diagnosis.

L: 45 - Total Hours:45

REFERENCES

1. M. Abramovici, M.A. Breuer and A.D. Friedman, "Digital Systems and Testable Design", Jaico Publishing House, 2002.
2. P.K. Lala, "Digital Circuit Testing and Testability", Academic Press, 2002.
3. M.L. Bushnell and V.D. Agrawal, "Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits", Kluwer Academic Publishers, 2002
4. A.L. Crouch, "Design Test for Digital ICs and Embedded Core Systems", Prentice Hall International, 2002.

OUTCOMES:

After successful completion of the course, the students will be able to

- Detect faults in digital circuit using logicalfault models
- Generate test vectors using stuck at models for combinational circuits
- Design circuit with testability perspective
- Design test vector for sequential circuits
- Describe the architecture of built in self test and fault diagnosis.
- Diagnose faults in digital circuits at system level

ECCY062 VLSI DIGITAL SIGNAL PROCESSING

L	T	P	C
3	0	0	3

OBJECTIVES:

The objective of the course is

- To learn a complete DSP system and fundamentals of pipelining and parallel processing on FIR filters
- To study the concepts of retiming, unfolding, transforms and rank order filters.
- To understand different fast convolution algorithms and pipelining/parallel processing techniques for IIR filters
- To study different bit level architectures and their complexities

MODULE I INTRODUCTION TO DSP SYSTEMS, PIPELINING AND PARALLEL PROCESSING OF FIR FILTERS 09

Introduction to DSP systems, Data flow and Dependence graphs - critical path, Loop bound, iteration bound, Longest path matrix algorithm, Pipelining and Parallel processing of FIR filters, Pipelining and Parallel processing for low power.

MODULE II RETIMING, ALGORITHMIC STRENGTH REDUCTION 09

Retiming – definitions and properties, Unfolding – an algorithm for unfolding, properties of unfolding, sample period reduction and parallel processing application, Algorithmic strength reduction in filters and transforms – 2-parallel FIR filter, 2-parallel fast FIR filter, DCT architecture, rank-order filters, Odd Even merge-sort architecture

MODULE III FAST CONVOLUTION, PIPELINING AND PARALLEL PROCESSING OF IIR FILTERS 09

Fast convolution – Cook-Toom algorithm, modified Cook-Toom algorithm, Pipelined and parallel recursive filters – Look-Ahead pipelining in first-order IIR filters, Look-Ahead pipelining with power-of-2 decomposition, Parallel processing of IIR filters, combined pipelining and parallel processing of IIR filters.

MODULE IV SCALING, ROUND-OFF NOISE, BIT-LEVEL ARITHMETIC ARCHITECTURES 09

Scaling and round-off noise – scaling operation, round-off noise, state variable description of digital filters, scaling and round-off noise computation, round-off noise in pipelined IIR filters, Bit-level arithmetic architectures – parallel multipliers

with sign extension, parallel carry-ripple and carry-save multipliers, Design of Lyon's bit-serial multipliers using Horner's rule, bit-serial FIR filter, CSD representation, CSD multiplication using Horner's rule for precision improvement.

MODULE V NUMERICAL STRENGTH REDUCTION, SYNCHRONOUS, WAVE AND ASYNCHRONOUS PIPELINING 09

Numerical strength reduction – sub expression elimination, multiple constant multiplication, iterative matching, synchronous pipelining and clocking styles, clock skew in edge-triggered single phase clocking, two-phase clocking, wave pipelining. Asynchronous pipelining bundled data versus dual rail protocol.

L: 45 - Total Hours:45

REFERENCES

1. Keshab K. Parhi, "VLSI Digital Signal Processing Systems, Design and implementation", Wiley, Interscience, 2007.
2. U. Meyer – Baese, "Digital Signal Processing with Field Programmable Gate Arrays", Springer, Second Edition, 2004.

OUTCOMES:

After successful completion of the course, the students will be able to

- Describe various algorithms that can be designed and applied on application specific VLSI architecture
- Design fast convolution algorithms and high speed multipliers to improve the efficiency of DSP processors
- Analyze different number representations, arithmetic based binary representations and complexities involved in it for easier numerical computations on processors
- Identify solution for any research queries on DSP processors.
- Develop advanced DSP filters and processors.
- Develop optimized DSP designs by employing the advantages of VLSI concepts.

ECCY063 WSN ARCHITECTURE AND PROGRAMMING

L	T	P	C
3	0	0	3

OBJECTIVES:

The objective of the course is

- To understand the concepts of sensor networks.
- To understand the programming models of sensor node.
- To learn various algorithms in WSN
- To identify the operating system and processor used in particular sensor node.
- To do case study on WSN applications in surveillance and monitoring.

MODULE I INTRODUCTION TO WSN 09

Introduction to WSN-Challenges for WSNs - Characteristic requirements - Required mechanisms - Single-node architecture -Hardware components-Energy consumption of sensor nodes-Operating systems and execution environments

MODULE II NETWORK ARCHITECTURE 09

Sensor network scenarios- Optimization goals and figures of merit- Design principles for WSNs, Service interfaces of WSNs- Gateway concepts

MODULE III SENSOR NETWORK IMPLEMENTATION 09

Sensor Programming- Introduction to TinyOS Programming and fundamentals of Programming sensors using nesC - Algorithms for WSN – Techniques for Protocol Programming.

MODULE IV PROGRAMMING MODELS 09

An Introduction to the Concept of Cooperating Objects and Sensor Networks-System Architectures and Programming Models

MODULE V WSN APPLICATIONS 09

Case Studies- Wireless sensor networks for environmental monitoring, Wireless sensor networks with mobile nodes, Autonomous robotic teams for surveillance and monitoring, Inter-vehicle communication networks.

L: 45 - Total Hours:45

REFERENCES:

1. Holgerkarl, Andreas Willig, “Protocols and architectures for wireless sensor networks”, John Wiley, 2005.
2. Liljana Gavrilovska, SrdjanKrco, Veljko Milutinovic, Ivan Stojmenovic, Roman Trobec, “Application and Multidisciplinary Aspects of Wireless Sensor Networks”, Springer-Verlag, London Limited 2011.
3. Michel Banâtre, Pedro José Marrón, Anibal Ollero, Adam Wolisz, ”Cooperating Embedded Systems and Wireless Sensor Networks “, John Wiley & Sons, Inc .2008.
4. SeetharamanIyengar, Nandhan, “Fundamentals of Sensor Network Programming Applications and Technology”, John Wiley & Sons,Inc. 2008.

OUTCOMES

At the end of the course students will be able to

- Identify and relate the concepts and components of sensor architecture.
- To understand the programming models of sensor node.
- Choose various algorithms in WSN based on requirement
- Identify the operating system and processor used in particular sensor node.
- Understand usage of WSN in various applications like surveillance and monitoring.
- Implement the techniques for WSN programming

ECCY064 DSP SYSTEM DESIGN

L	T	P	C
2	0	0	2

OBJECTIVES:

The objective of the course is to

- State the basic of DSP processors and its types.
- Infer the architecture and peripherals of DSP processors
- Develop the coding skill for code composer studio and matlab tools
- Design DSP based system with advanced technologies.

MODULE I INTRODUCTION OF DSP PROCESSORS 07

Need for Special Digital Signal Processors, Processor trends: Von Newmann versus Harvard architecture, Architectures of superscalar, fixed and floating point processors, New Digital Signal Processing hardware trends, Selection of processors.

MODULE II DSP PROCESSOR ARCHITECTURE 07

Introduction to a popular DSP from Texas Instruments (TMS330C6000 Series), CPU Architecture, CPU Data Paths and Control, Internal Data / Program Memory. On chip peripherals: Timers - Multi channel buffered serial ports - Extended Direct Memory Access, Interrupts, Pipelining.

MODULE III DSK AND CODE COMPOSER STUDIO 08

Design aspects: Introduction to the C6713 DSK- Code Composer Studio IDE - Matlab and basic skills, FIR filter design techniques and tools, IIR filter design techniques and tools, Sampling, quantization and working with the AIC23 codec, Writing efficient code: optimizing compiler - effect of data types and memory map. TMS320C6713 Assembly language Programming: Instructions Set and Addressing Modes – Linear Assembly.

MODULE IV ADVANCED DSP PROCESSOR 08

Present trends: Current trend in Digital Signal Processors: DSP Controllers – Architecture of TMS320C28XX series DSP and its applications. Architecture trends of other Texas Instruments DSP processors, Analog Devices DS processors: Introduction to Sharc / Tiger Sharc / Blackfin series, Other major vendors in the DSP market and the latest trends.

L: 30 - Total Hours:30

REFERENCES

1. On-line TI materials for the TI C6713 DSK board: http://www.ti.com
2. Naim Dahnoun Digital Signal Processing Implementation using the TMS320C6000
3. DSP Platform, 1st Edition
4. R. Chassaing, Digital Signal Processing and Applications with the C6713 and C6416 DSK, John Wiley and Sons, Inc., New York, 2004
5. Sen M. Kuo and Woon-SengGan.Digital Signal Processors: Architectures,
6. Implementations, and Applications,
7. David J Defatta J, Lucas Joseph G & Hodkiss William S ;Digital Signal Processing: A System Design Approach, 1st Edition; John Wiley
8. Andrew Bateman, Warren Yates Digital Signal Processing Design, 1st Edition
9. A.V. Oppenheim and R.W. Schafer, Discrete-Time Signal Processing, Second edition, Prentice- Hall,Upper Saddle River, NJ, 1989
10. John G Proakis, Dimitris G Manolakis Introduction to Digital Signal Processing, 1stEdition.

OUTCOMES:

At the end of the course students will be able to

- Familiarize with the needs of special digital signal processors.
- Get basic knowledge about the DSP processor architectures.
- Learn the design aspects of various DSP processors using different software tools.
- Acquire the current trends in digital signal processors with examples.
- Design trainer kit based on DSP processors and its interfacing techniques.
- Develop the DSP processor based system.

ECCY065 ELECTRONIC DESIGN AUTOMATION TOOLS

L	T	P	C
2	0	0	2

OBJECTIVES:

- To study the concepts of simulation and synthesis of HDLs.
- To understand the concepts of SPICE and circuit simulation using Spice.
- To study the concepts of S-edit and Layout design using S-edit.

MODULE I BASICS OF EDA 07

VLSI Design Automation tools-An overview of the features of practical CAD tools – Modelsim - Leonardo spectrum -Xilinx ISE - Quartus II - VLSI backend tools –IC Station, Cadence and Synopsis.

MODULE II SYNTHESIS OF HDLS 08

Logic synthesis in Verilog – Logic synthesis in VHDL - Finite State Machines synthesis in Verilog – Finite State Machines synthesis in VHDL - Memory synthesis in Verilog – Memory synthesis in VHDL - Performance driven synthesis.

MODULE III SIMULATION OF SPICE 07

Circuit description - DC circuit analysis- Transient analysis - AC circuit analysis - Advanced spice commands and analysis- Models for Semiconductor diodes - Models for Bipolar Junction Transistors - Models for Field Effect Transistors.

MODULE IV SCHEMATIC AND LAYOUT DESIGN 08

Creating a project- Drawing, Selecting and Editing objects -Creating a schematic - Creating a symbol - Importing and Exporting Net lists and Schematics - Simulation and Waveform probing.

L: 30 - TOTAL:30

REFERENCES

1. M.J.S.Smith, Application Specific Integrated Circuits, Pearson Education, 2008.
2. M.H.Rashid, Spice for Circuits and Electronics using Pspice, PHI 1995.
3. J.Bhaskar, Verilog Synthesis Primer, Prentice Hall, 1998.
4. J.Bhaskar, A Verilog Primer, Prentice Hall, 2005

OUTCOMES:

On completion of the course the students will be able to

- Explain basic definitions and overview of different tools.
- Understand how to solve simulation, Synthesis of HDLs.
- Select and implement appropriate formulations and algorithms from SPICE.
- Choose an appropriate method to design an S-edit.
- Learn the process of netlist and schematic creation.
- Study the basics of SPICE modeling of all types of transistors.

ECCY066 PROGRAMMING SYSTEM VERILOG

L	T	P	C
2	0	0	2

OBJECTIVES:

The objective of the course is to

- Learn the basics of functional verification languages
- Impart knowledge on the OOPS concepts
- Learn the system verilog language constructs and the functional verification procedures

MODULE I INTRODUCTION TO FUNCTIONAL VERIFICATION LANGUAGES 07

Introduction to System Verilog, System Verilog data types. System Verilog procedures, Interfaces and modports, System Verilog routines.

MODULE II INTRODUCTION TO OBJECT ORIENTED PROGRAMMING 07

Classes and Objects, Inheritance, Composition, Inheritance v/s composition, Virtual methods. Parameterized classes, Virtual interface, Using OOP for verification, System Verilog Verification Constructs.

MODULE III SYSTEM VERILOG ASSERTIONS 08

Introduction to assertion, Overview of properties and assertion, Basics of properties and sequences, Advanced properties and sequences, Assertions in design and formal verification, some guidelines in assertion writing.

MODULE IV COVERAGE DRIVEN VERIFICATION AND FUNCTIONAL COVERAGE IN SV 08

Coverage Driven Verification, Coverage Metrics, Code Coverage, Introduction to functional coverage, Functional coverage constructs, Assertion Coverage, Coverage measurement, Coverage Analysis SV and C interfacing: Direct Programming Interface (DPI)

L: 30 - Total Hours:30

REFERENCES

1. Sutherland, Stuart, Davidmann, Simon, Flake “System Verilog for Design” : A Guide to Using System Verilog for Hardware Design and Modeling, Peter2nd ed., 2006

2. Chris Spear “System Verilog for Verification”: A Guide to Learning the Testbench Language Features, , 2006
3. Mintz, Mike, Ekendahl, Robert “Hardware Verification with System Verilog”: An Object-Oriented Framework 2007
4. Bergeron, Janick “Writing Testbenches using System Verilog” 2006
5. Meyyappan Ramanathan “A Practical Guide for System Verilog Assertions”

OUTCOMES:

On completion of the course the student will be able to

- Describe the OOPS concepts
- Describe system verilog syntax and language construct
- Write basic system Verilog constructs to verify digital systems
- Develop assertion constructs to verify digital systems
- Use EDA tools for formal verification
- Write system verilogconstructs for convergence driven verification procedures

ECCY067 SENSORS LAB

L	T	P	C
0	0	2	1

OBJECTIVES:

The objective of the course is to

- Introduce different types of sensors
- Learn how to condition the sensor signal
- Study the operations of the sensors

LIST OF EXPERIMENTS

1. To study characteristics of photosensor and its applications.
2. To study the operation and measurement of thermocouple sensors and to estimate their response times.
3. To study the operation of piezoelectric sensors and its applications.
4. To study the operation of sound sensors and its applications.
5. To study the operation of force sensitivity sensors and analyze the parameters.

Labs incorporate implementation concerns involving interference, isolation, linearity, amplification, and grounding.

OUTCOMES:

At the end of the course students will be able to

- Design and build a temperature control system using analog hardware.
- Measure several sensors and choose one appropriate for the system they are designing and building.
- Measure the sensor output and do the appropriate conversions.
- Identify the sensor for specific application
- Analyze the behavior of the sensors
- Develop the embedded system based application

ECCY068	SCRIPTING LANGUAGE FOR VLSI DESIGN AUTOMATION	L	T	P	C
		1	0	0	1

OBJECTIVES:

The objective of the course is to

- Learn the fundamentals of scripting languages to operate the EDA tools
- Study the basic syntax constructs of PERL scripts

MODULE I OVERVIEW OF SCRIPTING LANGUAGES 05

Overview of Scripting Languages – PERL, CGI, VB Script, Java Script.

MODULE II PERL 10

PERL: Operators, Statements Pattern Matching etc. Data Structures, Modules, Objects, Tied Variables. Debugger Internal & Externals Portable Functions. Extensive Exercises for Programming in PERL.

L: 15 - Total Hours:15

REFERENCES

1. Randal L, Schwartz Tom Phoenix, “Learning PERL”, Oreilly Publications, 3rd Edn., 2000
2. Larry Wall, Tom Christiansen, John Orwant, “Programming PERL”, Oreilly Publications, 3rd Edn., 2000
3. Tom Christiansen, Nathan Torkington, “PERL Cookbook”, Oreilly Publications, 3rd Edn,2000

OUTCOMES:

On completion of the course the students will be able to

- Describe the fundamentals of scripting languages
- Write basic scripts to operate EDA tools
- Apply scripting language like PERL to improve EDA tool flow
- Create scripts to synthesize Digital circuits using CAD tools

EIC6212	INDUSTRIAL AUTOMATION USING PLC, DCS ANDSCADA	L	T	P	C
		3	0	2	4

OBJECTIVES:

- To introduce emerging technological options and platforms for industrial automation
- To explain the architecture of PLC, DCS AND SCADA
- To explore application development for industrial automation
- To provide the appropriate automation solutions and recommendations according to the applications.

MODULE I PROGRAMMABLE LOGIC CONTROLLER: HARDWARE AND BASICOPERATIONS 09

Hard relay logic, Evolution of Programmable logic controller (PLC), Hardware Components of PLC: Input / Output modules, power supplies, isolators, CPU, memory and programming devices. Generic Control system Architecture and IO Assignments, General PLC programming procedures, Developing fundamental ladder logic programs (as per IEC61131) for Boolean operations, PLC basic functions : Register basics, timer functions, counter functions.

MODULE II PROGRAMMABLE LOGIC CONTROLLERS: ADVANCED OPERATIONS, INSTALLATIONS AND TROUBLESHOOTING 09

Developing program control instructions, data manipulation instructions, math instructions, sequencer and shift register instructions, Functional block diagram, Analog control using PLC (PID control configuration, PLC installations and troubleshooting

MODULE III DISTRIBUTED CONTROL SYSTEM 07

Introduction to Distributed control system, DCS architectures, Comparison, Local Control Unit, Process interfacing issues, Operator interfaces - Low level and high level operator interfaces - Operator displays - Engineering interfaces - Low level and high level engineering interfaces, Latest trends and developments.

MODULE IV DATA ACQUISITION SYSTEMS 07

Computers in Process control – Data Loggers – Data acquisition systems (DAS) – Alarms – Direct Digital Control (DDC) - Characteristics of digital data – Controller software – Computer Process interface for Data Acquisition and control –

Supervisory Digital Control (SCADA) -introduction and brief history of SCADA – SCADA Hardware and software.

MODULE V NETWORKING **07**

Signal Conditioners and Its interfaces

LABORATORY: **21**

1. Development of Ladder program for simple on-off applications.
2. Development of Ladder program for Timing and counting applications.
3. Automatic control of level using PLC.
4. Automatic control of temperature using PLC.
5. Control of pressure loop using PLC.
6. Configuring Screens and Graphics (DCS).
7. Programming of HMI interfacing with PLC.
8. Tag Assignments to Field Devices in DCS.
9. DCS based PID control for level loop.
10. Communicate PLC with SCADA.

L: 39, P:21 - Total Hours:60

REFERENCES:

1. W. Bolton, "PLC", Elsevier Newnes 4 John W. Webb Ronald & Areis "PLC"
2. Clarke, G., Reynders, D. and Wright, E., "Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems", Newnes, 1st Edition, 2004.
3. Petrezeulla," Programmable Controllers", Mc-Graw Hill, 1989.
4. Michael P.Lucas, "Distributed Control System", Van Nastrand Reinhold Company, New York, 1986.

OUTCOMES:

At the end of the course the student will be able to

- Articulate the main concepts, key technologies, strengths, and limitations of industrial automation
- Identify the architecture and infrastructure of PLC.
- Explain the core issues of PLC, DCS AND SCADA
- Choose the appropriate technologies, algorithms, and approaches for the related issues.
- Identify problems, and explain, analyze, and evaluate various automation solutions
- Attempt to generate new ideas and innovations in industrial automation.

MACY081 SIGNAL PROCESSING TECHNIQUES

L	T	P	C
3	1	0	4

OBJECTIVES:

- To impart knowledge on various mathematical transforms for signal processing applications.

MODULE I LAPLACE TRANSFORMATION FOR CONTINUOUS TIME SIGNALS 06+03

Analog and digital signals - Periodic and aperiodic signals – Spectrum estimation for bandwidth requirement – Laplace Transform – Spectrum estimation – Frequency filtering for spectrum modification – Inverse Laplace Transform – Modified spectrum to get filtered signal.

MODULE II Z -TRANSFORM FOR DISCRETE TIME SIGNALS 12+03

Sampling of continuous time signals for discrete time signals – Nyquist sampling rate - Need for discrete signals – Quantization for digital signal – Z-Transform – Spectrum estimation of discrete signals – Digital filters for spectrum modification – Inverse Z-Transform – Modified spectrum to get filtered signal – Impulse response of digital systems - Bilinear Transform for analog to digital conversion.

MODULE III DISCRETE FOURIER TRANSFORM FOR DISCRETE TIME SIGNALS 09+03

Discrete Fourier Transform – Comparison with Z-Transform – Discrete signals for spectrum estimation – Digital filters for spectrum modification – Inverse Discrete Fourier Transform to get filtered signals – Fast Fourier Transform with decimation in either time or frequency

MODULE IV DISCRETE COSINE TRANSFORM FOR DISCRETE TIME SIGNALS 09+03

One dimensional and two dimensional discrete Cosine transforms – comparison with discrete Fourier transform – image processing applications like filtering & compression – two dimensional transform implementation using successive one dimensional transform – application in JPEG standards – zig zag scanning of transform coefficients – inverse discrete Cosine transform – expansion of compressed images – calculation of compression parameters of CF,RMSE,PSNR &CQ.

MODULE V DISCRETE WAVELET TRANSFORM FOR DISCRETE TIME SIGNALS 09+03

Wavelet – Haar wavelet – one dimensional forward discrete wavelet transform – comparison with discrete Cosine transform - two dimensional transform implementation using successive one dimensional transform – Image processing applications like filtering & compression - application in JPEG 2000 standards – zig zag scanning of transform coefficients – inverse discrete wavelet transform – expansion of compressed images – calculation of compression parameters of CF,RMSE,PSNR &CQ.

L – 45; T – 15; - Total Hours– 60

REFERENCES:

1. Joel L.Schiff – The Laplace Transform: Theory and Applications – Springer – 1999.
2. Alexander D. Poularikas - The Transforms and Applications Handbook – Chapter 6 on Z- Transforms - Boca Raton : CRC Press LLC - 2000.
3. D.Sundararajan – The Discrete Fourier Transform: Theory, Algorithm and Applications – World Scientific Publishers – 2001.
4. K.Rao and P.Yip – Discrete Cosine Transform – Elsevier – 1990.
5. D.Sundararajan – Discrete Wavelet Transform: A Signal Processing Approach – Wiley – 2015.

OUTCOMES:

On completion of the course, the student will be able to apply

- Laplace transform for analog signal analysis.
- Z Transform for discrete signal analysis.
- Discrete Fourier Transform for discrete signal analysis.
- Discrete Cosine Transform for discrete signal analysis.
- Discrete Wavelet Transform for discrete signal analysis.
- Inverse Discrete Wavelet Transform for discrete signal analysis

GENERAL ELECTIVES

GECY101	PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The objectives of the course would be to make the students

- Learn to e valuate and choose an optimal project and build a project profile.
- Attain knowledge on risk identification and risk analysis
- Gain insight into a project plan and components
- Familiar with various gamut of technical analysis for effective project implementation
- Learn to apply project management techniques to manage resources.

MODULE I INTRODUCTION & PROJECT INITIATION 09

Introduction to project and project management - projects in contemporary organization – The project life cycle - project initiation - project evaluation methods & techniques - project selection criteria - project profile.

MODULE II RISK ANALYSIS 09

Sources of risk: project specific - competitive - industry specific - market and international risk – perspectives of risk – risk analysis: sensitivity analysis - scenario analysis - breakeven analysis - simulation analysis - decision tree analysis – managing/mitigating risk – project selection under risk.

MODULE III PROJECT PLANNING & IMPLEMENTATION 09

Project planning – importance – functions - areas of planning - project objectives and policies - steps in planning process - WBS – capital requirements - budgeting and cost estimation - feasibility analysis - creation of project plan – project implementation: pre-requisites - forms of project organization

MODULE IV TECHNICAL ANALYSIS 09

Technical analysis for manufacturing/construction/infrastructure projects – process/technology - materials and inputs - product mix - plant capacity – plant location and site selection – plant layout - machinery and equipment – structures and civil works – schedule of project implementation – technical analysis for software projects.

MODULE V PROJECT MANAGEMENT TECHNIQUES 09

Project scheduling - network construction – estimation of project completion time – identification of critical path - PERT & CPM – crashing of project network - complexity of project scheduling with limited resources - resource allocation - resource leveling – resource smoothing – overview of project management software.

Total Hours: 45

REFERENCES:

1. Projects: Planning, Analysis, Financing, Implementation and Review, Prasanna Chandra, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2004.
2. Project Management and Control, Narendra Singh, Himalaya Publishing, New Delhi, 2015.
3. A Management Guide to PERT/CPM, Jerome, D. Weist and Ferdinand K. Levy, Prentice Hall of India, New Delhi, 1994.

OUTCOMES:

On successfully completing this course, the student will be able to:

- Evaluate & select a project as well as develop a project profile.
- Identify various risks associated with the project and manage it effectively.
- Prepare a detailed project plan addressing its components.
- Perform technical analysis for effective project implementation
- Apply project management techniques for maximizing resource utilization.

GECY102 SOCIETY, TECHNOLGY & SUSTAINABILITY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To aware of new technologies through advances in Science and Engineering.
- To make them realise the profound impact on society.
- To understand the ethical issues raised by technological changes and its effect on society.
- To introduce students a broad range of perspectives on the adoption and use of technologies.
- To make them realize the need of sustainability in the context of emerging technologies.

MODULE I TECHNOLOGY AND ITS IMPACTS 09

Origin and evolution of technologies – Nature of technology- Innovation – Historical Perspective of technology – Sources of technological change - Co-evolution of technology and economy – Scientific knowledge and technological advance – Science and Engineering aspects of Technology – Impact on the Society – Social and Ethical Issues associated with technological change – Social and environmental consequences - Impact of technological change on human life – Technology and responsibility – Technology and social justice.

MODULE II TECHNOLOGY AND ITS ADVANCEMENT 09

Sociological aspects of technology – Ethics and technology – Technology and responsibility – International Economics, Globalisation and Human Rights – Sustainability and Technology – Population and environment - Technology, Energy and Environment – Organisations and technological change.

MODULE III SOCIETY AND TECHNOLOGY 09

Impact of technologies on contemporary society – Role of society in fostering the development of technology – Response to the adaption and use of technology – Impact of technology on developer and consumers – Technological change and globalisation.

MODULE IV IMPACT OF A SPECIFIC TECHNOLOGY ON HUMAN WELFARE 09

Impact of the following technologies on Human life – Medical and Biomedical – Genetics Technology – Electronics and Communications – Electronic media

Technology – Information Systems Technology – Nanotechnology – Space Technology and Energy Technology.

MODULE V THE IMPORTANCE OF SUSTAINABILITY 09

Sustainability – A brief history – Concepts and contexts for sustainability – Ecological imbalance and biodiversity loss – Climate change – Population explosion. Industrial ecology – systems approach to sustainability – Green engineering and technology- sustainable design- sustainable manufacturing- Green consumer movements – Environmental ethics – Sustainability of the planet Earth – Future planning for sustainability.

Total Hours: 45

REFERENCES:

1. Volti Rudi, “Society and Technology Change”, 6th Edition, Worth publishers Inc, USA, 2009.
2. Arthur W.A, “The nature of Technology: What it is and how it evolves”, Free Press, NY, USA, 2009.
3. Winston M and Edelbach R, “Society, Ethics and Technology”, 3rd Edition, San Francisco, USA, 2005.
4. Martin A.A Abraham, “Sustainability Science and Engineering: Defining Principles”, Elsevier Inc, USA, 2006.
5. R.V.G.Menon, “Technology and Society”, Pearson Education, India, 2011.

OUTCOMES:

At the end of this course, the students will be able to

- Understand the benefits of modern technology for the well-being of human life.
- Connect sustainability concepts and technology to the real world challenges.
- Find pathway for sustainable society.

GECY103 ARTIFICIAL INTELLIGENCE

L	T	P	C
3	0	0	3

OBJECTIVES:

- Expose the history and foundations of artificial intelligence.
- Showcase the complexity of working on real time problems underlying the need for intelligent approaches.
- Illustrate how heuristic approaches provide a good solution mechanism.
- Provide the mechanisms for simple knowledge representation and reasoning.
- Highlight the complexity in working with uncertain knowledge.
- Discuss the current and future applications of artificial intelligence.

MODULE I HISTORY AND FOUNDATIONS 08

History – Scope – Influence from life – Impact of computing domains - Agents in environments - Knowledge representation – Dimensions of Complexity – Sample application domains – Agent structure.

MODULE II SEARCH 10

Problem solving as search – State spaces – Uninformed Search – Heuristic search – Advanced search – Constraint satisfaction - Applications.

MODULE III KNOWLEDGE REPRESENTATION AND REASONING 10

Foundations of knowledge representation and reasoning, representing and reasoning about objects, relations, events, actions, time, and space predicate logic, situation calculus, description logics, reasoning with defaults, reasoning about knowledge, sample applications.

MODULE IV REPRESENTING AND REASONING WITH UNCERTAIN KNOWLEDGE 08

Probability, connection to logic, independence, Bayes rule, Bayesian networks, probabilistic inference, sample applications.

MODULE V CASE STUDY AND FUTURE APPLICATIONS 09

Design of a game / Solution for problem in student's domain. Natural Language processing, Robotics, Vehicular automation – Scale, Complexity, Behaviour – Controversies.

Total Hours: 45

TEXT BOOK:

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall, Third Edition, 2010.
2. David Poole, Alan Mackworth, Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010.
3. Nils J. Nilsson, The Quest for Artificial Intelligence, Cambridge University Press, Online edition, 2013.
4. Keith Frankish, William M. Ramsey (eds) The Cambridge Handbook of Artificial Intelligence, Cambridge University Press, 2014.

OUTCOMES:

Students who complete this course will be able to

- Discuss the history, current applications, future challenges and the controversies in artificial intelligence.
- Apply principle of AI in the design of an agent and model its actions.
- Design a heuristic algorithm for search problems.
- Analyze and represent the fact using logic for a given scenario
- Represent uncertainty using probabilistic models
- Develop a simple game or solution using artificial intelligence techniques.

GECY104 GREEN COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To focus on the necessity of green computing technology.
- To expose to various issues with information technology and sustainability.
- To attain knowledge on the technologies for enabling green cloud computing.
- To elaborate on the energy consumption issues
- To illustrate a Green and Virtual Data Center
- To develop into a Green IT Technologist.

MODULE I INTRODUCTION 08

Trends and Reasons to Go Green - IT Data Center Economic and Ecological Sustainment - The Growing Green Gap: Misdirected Messaging, Opportunities for Action - IT Data Center “Green” Myths and Realities - PCFE Trends, Issues, Drivers, and Related Factors - Green Computing and Your Reputation- Green Computing and Saving Money- Green Computing and the Environment

MODULE II CONSUMPTION ISSUES 10

Minimizing power usage – Cooling - Electric Power and Cooling Challenges - Electrical – Power -Supply and Demand Distribution - Determining Energy Usage - From Energy Avoidance to Efficiency - Energy Efficiency Incentives, Rebates, and Alternative Energy Sources - PCFE and Environmental Health and Safety Standards- Energy-exposed instruction sets- Power management in power-aware real-time systems.

MODULE III NEXT-GENERATION VIRTUAL DATA CENTERS 09

Data Center Virtualization - Virtualization beyond Consolidation - Enabling Transparency - Components of a Virtual Data Center - Datacenter Design and Redesign - Greening the Information Systems - Staying Green- Building a Green Device Portfolio- Green Servers and Data Centers- Saving Energy

MODULE IV TECHNOLOGIES FOR ENABLING GREEN AND VIRTUAL DATA CENTERS 08

Highly Effective Data Center Facilities and Habitats for Technology - Data Center Electrical Power and Energy Management - HVAC, Smoke and Fire Suppression

- Data Center Location - Virtual Data Centers Today and Tomorrow - Cloud Computing, Out-Sourced, and Managed Services.

MODULE V SERVERS AND FUTURE TRENDS OF GREEN COMPUTING 10

Server Issues and Challenges - Fundamentals of Physical Servers - Types, Categories, and Tiers of Servers - Clusters and Grids - Implementing a Green and Virtual Data Center - PCFE and Green Areas of Opportunity- 12 Green Computer Companies- What's in Green computer science-Green off the Grid aimed for data center energy evolution-Green Grid Consortium- Green Applications- Green Computing Making Great Impact On Research

Total Hours: 45

REFERENCES:

1. Bud E. Smith,"Green Computing Tools and Techniques for Saving Energy, Money, and Resources", Taylor & Francis Group, CRC Press, ISBN-13: 978-1-4665-0340-3, 2014.
2. Jason Harris, "Green Computing and Green IT Best Practices, On Regulations and Industry Initiatives, Virtualization and power management, materials recycling and Tele commuting, Emereo Publishing .ISBN-13: 978-1-9215-2344-1,2014.
3. Ishfaq Ahmed & Sanjay Ranka, "Handbook of Energy Aware and Green Computing", CRC Press, ISBN: 978-1-4665-0116-4, 2013.
4. Kawahara, Takayuki, Mizuno, "Green Computing with Emerging Memory", Springer Publications, ISBN:978-1-4614-0811-6, 2012
5. Greg Schulz, "The Green and Virtual Data Center", CRC Press, ISBN-13:978-1-4200-8666-9, 2009.
6. Marty Poniatowski, "Foundation of Green IT: Consolidation, Virtualization, Efficiency, and ROI in the Data Center", Printice Hall, ISBN: 9780-1-3704-375-0, 2009.

OUTCOMES:

Students who complete this course will be able to

- Demonstrate issues relating to a range of available technologies, systems and practices to support green computing.
- Select appropriate technologies that are aimed to reduce energy consumption.
- Address design issues needed to achieve an organizations' green

computing objectives.

- Analyze the functionality of Data Centers.
- Critically evaluate technologies and the environmental impact of computing resources for a given scenario.
- Compare the impact of Green Computing with other computing techniques.

GECY105 GAMING DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To master event-based programming
- To learn resource management as it relates to rendering time, including level-of-detail and culling.
- To become familiar with the various components in a game or game engine.
- To explore leading open source game engine components.
- To become familiar of game physics.
- To be compatible with game animation.

MODULE I INTRODUCTION 09

Magic Words – What Skills Does a Game Designer Need? – The Most Important Skill -The Five Kinds of Listening-The Secret of the Gifted.

MODULE II THE DESIGNER CREATES AN EXPERIENCE 09

The Game Is Not the Experience -Is This Unique to Games? -Three Practical Approaches to Chasing Rainbows -Introspection: Powers, Perils, and Practice -Dissect Your Feelings -Defeating Heisenberg -Essential Experience.

MODULE III THE EXPERIENCE IN THE PLAYER MIND AND GAME MECHANICS 08

Modeling – Focus -Empathy – Imagination – Motivation – Space – Objects, Attributes, and States – Actions – Rules.

MODULE IV GAMES THROUGH AN INTERFACE 09

Breaking it Down – The Loop of Interaction – Channels of Information – Other Interface.

MODULE V BALANCED GAME MECHANICS 10

Balance – The Twelve Most Common Types of Game Balance – Game Balancing Methodologies - Balancing Game Economies.

Total Hours: 45

REFERENCES:

1. Jesse Schell, "The Art of Game Design: A Book of Lenses", 2nd Edition

ISBN-10: 1466598646, 2014.

2. Ashok Kumar, Jim Etheredge, Aaron Boudreaux, “Algorithmic and Architectural Gaming Design: Implementation and Development", 1st edition, Idea Group, U.S ISBN-10: 1466616342, 2012.
3. Katie Salen Tekinba, Melissa Gresalfi, Kylie Peppler, Rafi Santo, "Gaming the System - Designing with Gamestar Mechanic" MIT Press , ISBN-10: 026202781X, 2014.
4. James M. Van Verth, Lars M. Bishop "Essential Mathematics for Games and Interactive Applications", Third Edition, A K Peters / CRC Press, ISBN-10: 1482250926, 2015.

OUTCOMES:

Students who complete this course will be able to

- Realize the basic history and genres of games
- Demonstrate an understanding of the overall game design process
- Explain the design tradeoffs inherent in game design
- Design and implement basic levels, models, and scripts for games
- Describe the mathematics and algorithms needed for game programming
- Design and implement a complete three-dimensional video game

GECY106 SOCIAL COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To create original social applications, critically applying appropriate theories and effective practices in a reflective and creative manner.
- To critically analyze social software in terms of its technical, social, legal, ethical, and functional features or affordances.
- To encourage the development of effective communities through the design, use, and management of social software.
- To give students with a base of knowledge and advances for them to critically examine existing social computing services.
- To plan and execute a small-scale research project in social computing in a systematic fashion.
- To become familiar with the concept of computational thinking.

MODULE I BASIC CONCEPTS 09

Networks and Relations: Relations and Attributes, Analysis of Network Data, Interpretation of network data -New Social Learning – Four Changes that Shift Work - Development of Social Network Analysis: Sociometric analysis and graph theory, Interpersonal Configurations and Cliques – Analysing Relational Data.

MODULE II SOCIAL LINK 09

Individual Actors, Social Exchange Theory, Social Forces, Graph Structure, Agent Optimization Strategies in Networks – Hierarchy of Social Link Motivation- Social Context.

MODULE III SOCIAL MEDIA 08

Trends in Computing – Motivations for Social Computing – Social Media: Social relationships, Mobility and Social context – Human Computation – Computational Models- Business use of social Media.

MODULE IV SOCIAL INFORMATION FILTERING 09

Mobile Location Sharing – Location based social media analysis – Social Sharing and Social Filtering – Automated recommender Systems – Traditional and Social Recommender Systems.

MODULE V SOCIAL NETWORK STRATEGY 10

Application of Topic Models – Opinions and Sentiments – Recommendation Systems – Language Dynamics and influence in online communities – Psychometric analysis – Case Study: Social Network Strategies for surviving the zombie apocalypse.

Total Hours: 45

REFERENCES:

1. Tony Bingham, Marcia Conner, “The New Social Learning, Connect. Collaborate. Work”, 2nd Edition, ATD Press, ISBN-10:1-56286-996-5, 2015.
2. Nick Crossley, Elisa Bellotti, Gemma Edwards, Martin G Everett, Johan Koskinen, Mark Tranmer, “Social Network Analysis for Ego-Nets”, SAGE Publication, 2015.
3. Zafarani, Abbasi and Liu, Social Media Mining: An Introduction, Cambridge University Press, 2014.
4. Christina Prell, “Social Network Analysis: History, Theory and Methodology”, 1st Edition, SAGE Publications Ltd, 2012.
5. John Scott, “Social Network Analysis”, Third Edition, SAGE Publication, 2013.
6. Jennifer Golbeck, “Analyzing the Social Web”, Elsevier Publication, 2013.
7. Huan Liu, John Salerno, Michael J. Young, “Social computing and Behavioral Modeling”, Springer Publication, 2009.

OUTCOMES:

Students who complete this course will be able to

- Realize the range of social computing applications and concepts.
- Analyze data left after in social media.
- Recognize and apply the concepts of computational models underlying social computing.
- Take out simple forms of social diagnostics, involving network and language models, applying existing analytic tools on social information.
- Evaluate emerging social computing applications, concepts, and techniques in terms of key principles.
- Design and prototype new social computing systems.

GECY107 SOFT COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

The aim of the course is to

- Enumerate the strengths and weakness of soft computing
- Illustrate soft computing methods with other logic driven and statistical method driven approaches
- Focus on the basics of neural networks, fuzzy systems, and evolutionary computing
- Emphasize the role of euro-fuzzy and hybrid modeling methods
- Trace the basis and need for evolutionary computing and relate it with other soft computing approaches

MODULE I SOFT COMPUTING - BASICS 06

Soft computing – Hard Computing – Artificial Intelligence as the basis of soft computing – Relation with logic driven and statistical method driven approaches- Expert systems – Types of problems: Classification, Functional approximation, Optimizations – Modeling the problem – Machine Learning – Hazards of Soft Computing – Current and future areas of research

MODULE II ARTIFICIAL NEURAL NETWORK 12

Artificial Neuron – Multilayer perceptron – Supervised learning – Back propagation network –Types of Artificial Neural Network: Supervised Vs Un Supervised Network – Radial basis function Network – Self Organizing Maps – Recurrent Network – Hopfield Neural Network – Adaptive Resonance Theory – Issues in Artificial Neural Network – Applications

MODULE III FUZZY SYSTEMS 09

Fuzzy Logic – Membership functions – Operators – Fuzzy Inference systems – Other sets: Rough sets, Vague Sets – Fuzzy controllers - Applications

MODULE IV NEURO FUZZY SYSTEMS 09

Cooperative Neuro fuzzy systems – Neural network driven fuzzy reasoning – Hybrid Neuro fuzzy systems – Construction of Neuro Fuzzy systems: Structure Identification phase, Parameter learning phase – Applications

MODULE V EVOLUTIONARY COMPUTING 09

Overview of evolutionary computing – Genetic Algorithms and optimization –

Genetic Algorithm operators – Genetic algorithms with Neural/Fuzzy systems – Variants of Genetic Algorithms– Population based incremental learning – Evolutionary strategies and applications

Total Hours: 45

TEXTBOOKS:

1. Samir Roy, “Introduction to Soft Computing: Neuro-Fuzzy and Genetic Algorithms”, Pearson, 2013
2. Anupam Shukla, Ritu Tiwari and Rahul Kala, “Real life applications of Soft Computing”, CRC press, 2010.
3. Fakhreddine O. Karray, “Soft Computing and Intelligent Systems Design: Theory, Tools and Applications”, Pearson, 2009

OUTCOMES:

At the end of the course the students will be able to

- Enumerate the theoretical basis of soft computing
- Explain the fuzzy set theory
- Discuss the neural networks and supervised and unsupervised learning networks
- Demonstrate some applications of computational intelligence
- Apply the most appropriate soft computing algorithm for a given situation

GECY108 EMBEDDED SYSTEM PROGRAMMING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the design of embedded computing systems with its hardware and software architectures.
- To describe entire software development lifecycle and examine the various issues involved in developing software for embedded systems.
- To analyze the I/O programming and Embedded C coding techniques
- To equip students with the software development skills necessary for practitioners in the field of embedded systems.

MODULE I INTRODUCTION OF EMBEDDED SYSTEM 09

Embedded computing – characteristics and challenges – embedded system design process – Overview of Processors and hardware units in an embedded system – Compiling, Linking and locating – downloading and debugging – Emulators and simulators processor – External peripherals – Memory testing – Flash Memory.

MODULE II SOFTWARE TECHNOLOGY 09

Software Architectures, Software development Tools, Software Development Process Life Cycle and its Model, Software Analysis, Design and Maintenance.

MODULE III INPUT/OUTPUT PROGRAMMING 09

I/O Instructions, Synchronization, Transfer Rate & Latency, Polled Waiting Loops, Interrupt – Driven I/O, Writing ISR in Assembly and C, Non Maskable and Software Interrupts

MODULE IV DATA REPRESENTATION IN EMBEDDED SYSTEMS 09

Data representation, Twos complement, Fixed point and Floating Point Number Formats, Manipulating Bits in -Memory, I/O Ports, Low level programming in C, Primitive data types, Arrays, Functions, Recursive Functions, Pointers, Structures & Unions, Dynamic Memory Allocation, File handling, Linked lists, Queues, Stacks.

MODULE V EMBEDDED C 09

Embedded Systems programming in C – Binding & Running Embedded C program in Keil IDE – Dissecting the program - Building the hardware. Basic techniques for reading & writing from I/O port pins – switch bounce - LED Interfacing using Embedded C.

Total Hours: 45

REFERENCES:

1. Marilyn Wolf, "Computers as components ", Elsevier, 2012.
2. Qing Li and Carolyn Yao, "Real-Time Concepts for Embedded Systems", CMP Books, 2003.
3. Daniel W. Lewis, "Fundamentals of embedded software where C and assembly meet", Pearson Education
4. Michael Bass, "Programming Embedded Systems in C and C++", Oreilly, 2003.

OUTCOMES:

On completion of this course the student will be able to

- Design the software and hardware components in embedded system
- Describe the software technology
- Use interrupt in effective manner
- Use keil IDE for programming
- Program using embedded C for specific microcontroller
- Design the embedded projects

GECY109 PRINCIPLES OF SUSTAINABLE DEVELOPMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge in the concepts and dimensions of sustainable development.
- To gain knowledge on the framework for achieving sustainability.

MODULE I CONCEPT OF SUSTAINABLE DEVELOPMENT 09

Environment and Development - Population poverty and Pollution – Global and Local environmental issues – Resource Degradation- Greenhouse gases – Desertification-industrialization – Social insecurity, Globalization and environment. History and emergence of the concept of sustainable development-Objectives of Sustainable Development.

MODULE II COMPONENTS AND DIMENSIONS OF SUSTAINABLE DEVELOPMENT 09

Components of Sustainability – Complexity of growth and equity – Social economic and environmental dimensions of sustainable development – Environment – Biodiversity – Natural – Resources – Ecosystem integrity – Clean air and water – Carrying capacity – Equity, Quality of Life, Prevention, Precaution – Preservation and Public Participation Structural and functional linking of developmental dimensions.

MODULE III FRAMEWORK FOR ACHIEVING SUSTAINABILITY 09

Operational guidelines – interconnected prerequisites for sustainable development Empowerment of Women, children, Youth, Indigenous People, Non-Governmental Organizations Local Authorities, Business and industry – Science and Technology for sustainable development – performance indicators of sustainability and assessment mechanism – Constraints and barriers for sustainable development.

MODULE IV SUSTAINABLE DEVELOPMENT OF SOCIO ECONOMIC SYSTEMS 09

Demographic dynamics of sustainability – Policies for socio-economic development – Strategies for implementing eco-development programmes Sustainable development through trade – Economic growth – Action plan for implementing sustainable development – Urbanization and sustainable Cities – Sustainable Energy and Agriculture – sustainable livelihoods.

MODULE V SUSTAINABLE DEVELOPMENT AND INTERNATIONAL RESPONSE 09

Role of developed countries in the development of developing countries – international summits – Stockholm to Johannesburg – Rio principles – Agenda-Conventions – Agreements – Tokyo Declaration – Doubling statement – Tran boundary issues integrated approach for resources protection and management

Total Hours: 45

REFERENCES:

1. Sayer J. and Campbell, B., The Science of Sustainable Development: Local Livelihoods and the Global environment - Biological conservation restoration & Sustainability, Cambridge university Press, London, 2003.
2. M.K. Ghosh Roy. and Timberlake, Sustainable Development, Ane Books Pvt. Ltd, 2011.
3. Mackenthun K.M., Concepts in Environmental Management, Lewis Publications London, 1999.
4. APJ Abdul Kalam and Srijan Pal Singh, Target 3 Billion: Innovative Solutions Towards Sustainable Development, Penguin India, 2011

OUTCOMES:

At the end of the course the student will be able to

- Describe the concepts of sustainable development
- Define the components and dimensions of sustainable development
- Outline the Frame work for achieving sustainability.
- State the policies and strategies for implementing sustainable development for Socio economic programmes.
- Examine the role of developed countries in sustainable development.

GECY110	QUANTITATIVE TECHNIQUES IN MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVE:

To impart knowledge on

- Concepts of operations research
- Inventory control in production management
- Financial management of projects
- Decision theory and managerial economics

MODULE I OPERATIONS RESEARCH 09

Introduction to Operations research – Linear programming – Graphical and Simplex Methods, Duality and Post-Optimality Analysis – Transportation and Assignment Problems

MODULE II PRODUCTION MANAGEMENT 09

Inventory control, EOQ, Quantity Discounts, Safety Stock – Replacement Theory – PERT and CPM – Simulation Models – Quality Control.

MODULE III FINANCIAL MANAGEMENT 09

Working Capital Management – Compound Interest and Present Value methods – Discounted Cash Flow Techniques – Capital Budgeting.

MODULE IV DECISION THEORY 09

Decision Theory – Decision Rules – Decision making under conditions of certainty, risk and uncertainty – Decision trees – Utility Theory.

MODULE V MANAGERIAL ECONOMICS 09

Cost concepts – Break even Analysis – Pricing techniques – Game Theory applications.

Total Hours: 45

REFERENCES:

1. Vohra, N.D. , Quantitative Techniques in Management, Tata McGraw Hill Co., Ltd, New Delhi, 2009.
2. Seehroeder, R.G., Operations Management, McGraw Hill, USA, 2002.
3. Levin, R.I, Rubin, D.S., and Stinsonm J., Quantitative Approaches to Management, McGraw Hill Book Co., 2008.

4. Frank Harrison, E., The Managerial Decision Making Process, Houghton Miffin Co. Boston, 2005.
5. Hamdy A. Taha, Operations Research- An Introduction, Prentice Hall, 2002.

OUTCOME:

At the end of the course, the students will be able to

- Apply the concepts of operations research for various applications
- Create models for inventory control in production management
- Compute the cash flow for a project
- Choose a project using decision theory based on the risk criterion.
- Apply the concepts of managerial economics in construction management

GECY111 PROGRAMMING USING MATLAB & SIMULINK

L	T	P	C
1	0	2	2

OBJECTIVES:

The aim of this course is to:

- Teach students how to mathematically model engineering systems
- Teach students how to use computer tools to solve the resulting mathematical models. The computer tool used is MATLAB and the focus will be on developing and solving models of problems encountered in engineering fields

MODULE I INTRODUCTION TO MATLAB AND DATA PRESENTATION 10

Introduction to MATLAB-Vectors, Matrices -Vector/Matrix Operations & Manipulation- Functions vs scripts- Making clear and compelling plots-Solving systems of linear equations numerically and symbolically.

Lab Experiments

1. Study of basic matrix operations and manipulations.
2. Numerical and symbolical solution of linear equations.

MODULE II ROOT FINDING AND MATLAB PLOT FUNCTION 10

Linearization and solving non-linear systems of equations- The Newton-Raphson method- Integers and rational numbers in different bases- Least squares regression -Curve fitting-Polynomial fitting and exponential fitting.

Lab Experiments

1. Solution of non linear equations using Newton-Raphson method.
2. Determination of polynomial fit and exponential fit for the given data.

MODULE III LINEAR AND NON-LINEAR DIFFERENTIAL EQUATIONS 13

Numerical integration and solving first order, ordinary differential equations (Euler's method and Runge-Kutta) - Use of ODE function in MATLAB- Converting second order and higher ODEs to systems of first order ODEs- Solving systems of higher order ODEs via Euler's method and Runge-Kutta) - Solving single and systems of non-linear differential equations by linearization-Use of the function ODE in MATLAB to solve differential equations - Plot Function –Saving & Painting Plots.

Lab Experiments

1. Solution of fourth order linear differential equations using
    a. Trapezoidal Rule

b. Euler method

2. Solution of fourth order non-linear differential equations using
    a. Modified Euler method
    b. Runge – Kutta method

MODULE IV INTRODUCTION OF SIMULINK 12

Simulink & its relations to MATLAB – Modeling a Electrical Circuit- Modeling a fourth order differential equations- - Representing a model as a subsystem- Programme specific Simulink demos.

Lab Experiments

1. Solution of fourth order non-linear differential equations using simulink.
2. Programme specific experiment based on simulink.

Total Hours (Including Practicals): 45

REFERENCE:

1. Griffiths D V and Smith I M, “Numerical Methods for Engineers”, Blackwell, 1991.
2. Laurene Fausett, “Applied Numerical Analysis Using MATLAB”, Pearson 2008.
3. Moin P, “Fundamentals of Engineering Numerical Analysis”, Cambridge University Press, 2001.
4. Wilson HB, Turcotte LH, Advanced mathematics and mechanics applications using MATLAB”, CRC Press, 1997
5. Ke Chen, Peter Giblin and Alan Irving, “Mathematical Exploration with MATLAB”, Cambridge University Press, 1999.

OUTCOMES:

At the end of this unit students will be able to:

- Use Matlab as a convenient tool for solving a broad range of practical problems in engineering from simple models to real examples.
- Write programs using first principles without automatic use of built-in ones.
- Write programs for solving linear and nonlinear systems, including those arising from boundary value problems and integral equations, and for root-finding and interpolation, including piecewise approximations.
- Be fluent in exploring Matlab’s capabilities, such as using matrices as the fundamental data-storage unit, array manipulation, control flow, script and function m-files, function handles, graphical output.
- Make use of Maltab visual capabilities for all engineering applications.

- An ability to identify, formulate, and solve engineering problems. This will be accomplished by using MATLAB to simulate the solution to various problems in engineering fields

GECY112 JAVA PROGRAMMING

L	T	P	C
1	0	2	2

OBJECTIVES:

- To learn the fundamentals of Java programming such as data types, variables and arrays.
- To study the syntax and necessity of decision making and iterative statements.
- To create a class and invoke the methods.
- To instigate programming in overloading of methods.
- To emphasize the concept of packages.
- To learn the exception handling routines.

MODULE I INTRODUCTION TO JAVA PROGRAMMING 08

History and Evolution of Java – Overview of Java – Data types, variables and arrays – Operators – Control statements.

MODULE II METHODS AND CLASSES 07

Class fundamentals – Declaring objects – Methods – Constructors – Garbage collection – Overloading methods – Constructor overloading – Access control – Inheritance – Packages - Exception handling.

L: 15, P: 30, Total Hours: 15

REFERENCES:

1. Herbert Schildt, “Java The Complete Reference”, 9th Edition, Oracle Press, 2014, ISBN: 978007180855-2.
2. Nicholas S. Williams, **“**Professional Java for Web Applications: Featuring WebSockets, Spring Framework, JPA Hibernate and Spring Security (WROX)”, John Wiley & Sons, 2014, ISBN: 978111865651-8.
3. E Balagurusamy, “Programming with Java”, 5th Edition, Tata Mcgraw Hill, 2014.
4. Yashavant Kanetka**, “**Let Us Java”, 2nd Edition, BPB Publications, 2012**.**

OUTCOMES:

Students who complete this course will be able to

- Implement basic Java programming.
- Create a class and invoke methods for real world problems.

- Construct simple overloading of methods programs.
- Implement various types of inheritance concepts.
- Describe the access control mechanism.
- Handle exception thrown while implementing programming.

GECY113 PYTHON PROGRAMMING

L	T	P	C
1	0	2	2

OBJECTIVES:

- To learn the list and records of python programming.
- To study the control statements and string functions of python.
- To instigate the fundamental python programming.
- To emphasize GUI in python.
- To integrate python with embedded systems.
- To implement programs in python.

MODULE I INTRODUCTION TO PYTHON PROGRAMMING 08

Installation and environment set up – syntax used in python – variable types – operators – Loops – decision making – string functions - formatted files - GUI basics.

MODULE II EMBEDDED PROGRAMMING USING PYTHON 07

Web interface – system tools – script execution context - Motion-triggered LEDs – Python - Arduino prototyping-storing and plotting Arduino data-Remote home monitoring system.

L: 15, P: 30, Total Hours: 15

REFERENCES:

1. Nick Goddard, “Python Programming”, 2nd edition, ISBN: 1533337772, 2016.
2. Pratik Desai, “Python Programming for Arduino”, 1st edition, Packt publishing, 2015, ISBN: 9781783285938.
3. Mark Lutz, Learning Python: Powerful Object-Oriented Programming, 5th Edition, O'Reilly Media, 2013.
4. Richard H. Barnett, Sarah Cox, Larry O'Cull, “Embedded C Programming and the Atmel AVR”, 2nd edition, 2006.
5. Michael Barr, Anthony Massa, “Programming Embedded Systems”, 2nd Edition, O'Reilly Media, 2006.

OUTCOMES:

Students who complete this course will be able to

- Implement date and time function programming using python.

- Write formatted file programming.
- Construct simple python programs.
- Create web interface using python programming
- Develop embedded system with python programming.
- Build Arduino prototype using python programming.

GECY114 INTELLECTUAL PROPERTY RIGHTS (IPR)

L	T	P	C
1	0	0	1

OBJECTIVES:

- To study about Intellectual property rights and its need
- To explore the patent procedure and related issues

MODULE I INTRODUCTION 07

Introduction and the need for intellectual property right (IPR) – IPR in India – Genesis and Development – IPR in abroad – Important examples of IPR – Copyrights, Trademarks, Patents, Designs, Utility Models, Trade Secrets and Geographical Indications – Industrial Designs

MODULE II PATENT 08

Concept of Patent – Product / Process Patents & Terminology – Duration of Patents – Law and Policy Consideration Elements of Patentability –- Patentable Subject Matter – Procedure for Filing of Patent Application and types of Applications – Procedure for Opposition – Revocation of Patents – Working of Patents- Patent Agent – Qualification and Registration Procedure – Patent databases and information system – Preparation of patent documents – Process for examination of patent application- Patent infringement – Recent developments in patent system

Total Hours: 15

REFERENCES

1. B.L.Wadehra; Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India 2000
2. Ajit Parulekar and Sarita D' Souza, Indian Patents Law – Legal & Business Implications; Macmillan India ltd , 2006
3. P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi, 2010.
4. E. T. Lokganathan, Intellectual Property Rights (IPRs): TRIPS Agreement & Indian Laws Hardcover, 2012
5. Alka Chawla, P N Bhagwati , Law of Copyright Comparative Perspectives 1st Edition, LexisNexis, 2013
6. V. K. Ahuja, Law Relating to Intellectual Property Rights 2nd Edition, LexisNexis, 2nd Edition, 2013

7. Deborah E. Bouchoux, Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets, 2015
8. Jatindra Kumar Das, Law of Copyright, PHI Learning, 2015

COURSE OUTCOMES:

Students should be able to

- Identify the various types of intellectual property and their value
- Apply the procedure to file a patent and to deal the related issues
- Search and extract relevant information from various intellectual database

REGULATIONS, CURRICULAM AND SYLLABUS

M. TECH. CONSTRUCTION ENGINEERING & PROJECT MANAGEMENT

(As approved by the 9th Academic Council)

JULY 2016

B.S.ABDUR RAHMAN UNIVERSITY

B.S.ABDUR RAHMAN INSTITUTE OF SCIENCE & TECHNOLOGY
(Estd.u/s 3 of the UGC Act, 1956)

(FORMERLY B.S.ABDUR RAHMAN CRESCENT ENGINEERING COLLEGE)
Seethakathi Estate, G.S.T. Road, Vandalur, Chennai - 600 048.

VISION & MISSION OF THE DEPARTMENT OF CIVIL ENGINEERING

VISION

To be a leading department for Education, Training and Research in Civil Engineering for a better future and overall socio-economic progress of the country in a sustainable manner.

MISSION

- To offer world class undergraduate, postgraduate and research programs of industrial and societal relevance in civil engineering.
- To nurture ethically strong civil engineers to address global challenges through quality education and application oriented research.
- To educate our students on design, construction, maintenance and advancements in civil engineering for providing solutions to the betterment of the society.
- To prepare competitive and responsible future citizens with good communication, leadership and managerial skills.
- To enrich and enhance the knowledge base for the best practices in various areas of civil & allied engineering through collaborations with Global Institutions of Excellence, Industries and Research organizations.
- To provide a healthy ambience for teaching, research, consultancy and extension activities.

PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES

M.Tech (Construction Engineering & Project Management)

PROGRAMME EDUCATIONAL OBJECTIVES:

- To educate graduates the concepts and practices of management in the construction industry.
- To impart organizational and leadership qualities for effective management of construction projects with ethical responsibility.
- To equip the graduates with knowledge, research and practical skills in modern construction practices and techniques giving importance to sustainable development.
- To provide necessary knowledge and skills in accounting, financing, risk analysis and contracting.
- To train the graduates in the use of relevant software packages for planning, scheduling, executing and controlling of construction projects and inculcate an urge for lifelong learning.
- To function effectively with individual capabilities as well as with a collective strength as a professional team with good communication skills.

PROGRAMME OUTCOMES:

Construction Engineering and Project Management Graduates will be able to

- Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- Use research –based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.

- Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
- Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES:

- Identify suitable modern construction materials, techniques, practices and equipments considering effective quality and safety management principles.
- Plan, estimate and schedule construction projects using relevant software's for civil engineering construction
- Implement various contract laws and regulations in the construction industry.

CURRICULUM & SYLLABI FOR M. Tech. (Construction Engineering & Project Management)

CURRICULUM

Sl. No.	Course Code	Course Title	L	T	P	C
		SEMESTER I				
1	MAC6183	Probability and Statistics	**3**	**1**	**0**	**4**
2	CEC6121	Modern Construction Materials and Practices	**3**	**0**	**0**	**3**
3	CEC6122	Construction Equipment Management	**2**	**0**	**0**	**2**
4	CEC6123	Project Management in Construction	**3**	**0**	**0**	**3**
5	CEC6124	Construction Planning, Scheduling and Control	**3**	**0**	**2**	**4**
6	CEC6104	Advanced Concrete Technology	**3**	**0**	**2**	**4**
						20
		SEMESTER II				
1	GEC6201	Research Methodology for Engineers	**3**	**0**	**0**	**3**
2	CEC6231	Construction Economics and Finance	**4**	**0**	**0**	**4**
3	CEC6232	Contract Laws and Regulations	**3**	**0**	**0**	**3**
4		Professional Electives #				**9**
5	CEC6233	Mini Project	**0**	**0**	**2**	**1**
						20
		SEMESTER III				
1		General Elective###	**3**	**0**	**0**	**3**
2		Professional Electives #				**9**
3	CEC7122	Industrial Internship* / Seminar**	**0**	**0**	**2**	**1**
4	CEC7121	Project Work - Phase I***	**0**	**0**	**12**	**6**
						13
		SEMESTER IV				
1	CEC7121	Project Phase II	**0**	**0**	**36**	**18**
						6+18=24
		Total				**78**

Student has to take courses for a minimum of 9 credits from list of odd and even semester professional electives.

Student has to take minimum of 3 credits from the list of general electives.

***** 15 days of Industrial training will be undertaken by regular candidates during first year summer vacation and the credit will be awarded in the 3rd semester.

** Seminar will be taken by working Professionals only.

*** Credits for Project Work Phase I to be accounted along with Project Work Phase II in IV Semester

PROFESSIONAL ELECTIVE

Sl. No.	Course Code	Course Title	L	T	P	C
		LIST OF ODD SEMESTER ELECTIVES				
1	CECY121	Construction Personnel Management	**3**	**0**	**0**	**3**
2	CECY122	Financing and Management of Infrastructure Projects	**3**	**0**	**0**	**3**
3	CECY123	Intelligent Building Management System	**3**	**0**	**0**	**3**
4	CECY124	Management Information System	**3**	**0**	**0**	**3**
5	CECY103	Maintenance and Rehabilitation of Structures	**3**	**0**	**0**	**3**
6	CECY125	Remote Sensing and GIS in Infrastructure Engineering	**3**	**0**	**0**	**3**
7	CECY126	Urban Planning and Design	**3**	**0**	**0**	**3**
8	CECY127	Material Management	**2**	**0**	**0**	**2**
9	CECY128	Construction Safety management	**2**	**0**	**0**	**2**
10	CECY129	Transportation Planning and Management	**2**	**0**	**0**	**2**
11	CECY130	Lean Construction	**1**	**0**	**0**	**1**
12	CECY131	Site Investigation and Soil Exploration Techniques	**1**	**0**	**0**	**1**
		LIST OF EVEN SEMESTER ELECTIVES				
1	CECY221	Construction Quality Management	**3**	**0**	**0**	**3**
2	CECY222	Environmental Impact Assessment of Infrastructure Projects	**3**	**0**	**0**	**3**
3	CECY223	Financial Accounting and Management	**3**	**0**	**0**	**3**
4	CECY224	Green Building and Energy Efficient Structures	**3**	**0**	**0**	**3**
5	CECY225	Green Concepts in Building Environment	**3**	**0**	**0**	**3**
6	CECY226	Infrastructure Planning and Management	**3**	**0**	**0**	**3**
7	CECY227	Shoring Scaffolding and Formwork	**3**	**0**	**0**	**3**
8	CECY228	Affordable Housing	**2**	**0**	**0**	**2**
9	CECY229	Application of Information Technology in Infrastructure Management	**1**	**0**	**2**	**2**
10	CECY230	Cost Estimation and Control	**2**	**0**	**0**	**2**
11	CECY231	Construction Risk Management	**1**	**0**	**0**	**1**

GENERAL ELECTIVES FOR M.TECH PROGRAMMES

Sl. No.	Course Code	Course Title	L	T	P	C
1	GECY101	Project management	**3**	**0**	**0**	**3**
2	GECY102	Society, Technology & Sustainability	**3**	**0**	**0**	**3**
3	GECY103	Artificial Intelligence	**3**	**0**	**0**	**3**
4	GECY104	Green Computing	**3**	**0**	**0**	**3**
5	GECY105	Gaming Design	**3**	**0**	**0**	**3**
6	GECY106	Social Computing	**3**	**0**	**0**	**3**
7	GECY107	Soft Computing	**3**	**0**	**0**	**3**
8	GECY108	Embedded System Programming	**3**	**0**	**0**	**3**
9	GECY109	Principles of Sustainable Development	**3**	**0**	**0**	**3**
10	GECY110	Quantitative Techniques in Management	**3**	**0**	**0**	**3**
11	GECY111	Programming using MATLAB & SIMULINK	**1**	**0**	**2**	**2**
12	GECY112	JAVA Programming	**2**	**0**	**0**	**2**
13	GECY113	PYTHON Programming	**2**	**0**	**0**	**2**
14	GECY114	Intellectual Property Rights	**1**	**0**	**0**	**1**

SEMESTER I

MAC6183	PROBABILITY AND STATISTICS	L	T	P	C
		3	1	0	4

OBJECTIVE:

This course intends to provide

- a comprehensive introduction to the probability distributions,
- familiarize with testing of hypothesis and estimation theory.
- basic knowledge in simulations used in engineering.

MODULE I PROBABILITY DISTRIBUTIONS 10+03

Axioms of probability – addition and multiplication theorem – conditional probability – total Probability – random variables- moments – moments generating functions and their properties- Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

MODULE II TWO DIMENSIONAL RANDOM VARIABLES 09+03

Joint distributions - Marginal and conditional distributions – functions of random variables - Covariance - Correlation and regression - Central limit theorem.

MODULE III ESTIMATION THEORY 09+03

Partial, Multiple correlations and regressions – Estimation of parameters using maximum likelihood estimator and method of moments.

MODULE IV TESTING OF HYPOTHESIS 08+03

Hypothesis, test statistic, decisions and errors - classical testing, significance and p-values – Student's t- test , Fisher's test and Chi-square tests.

MODULE V SIMULATION **09+03**

Simulation - definition - Monte Carlo simulation - random number generation, simulation model building - validation - run size determination - simulation applications - inventory control - facilities creation, simulation software.

L – 45; T – 15; Total : 60

TEXT BOOKS:

1. Douglas C. Montgomery, George C. Runger, “Applied Statistics and Probability for Engineers”, 4th Edition, Wiley publication, 2006.
2. Richard A. Johnson, “Probability and Statistics for Engineers”, 6th Edition, Pearson Education, Indian Reprint, 2002.
3. Sheldon M. Ross, “Introduction to probability models”, 10th edition, Academic Press, 2009.

REFERENCES:

1. Jerry Banks, John S. Carson, Barry L. Nelson, “Discrete – Event systems Simulation”, Prentice Hall India, New Delhi, 1999.
2. Jay L. Devore, “Probability and Statistics for Engineering and the Sciences”, Duxbury publication, 2007.
3. R. Lyman Ott, Michael Longnecker, “An Introduction to Statistical Methods and Data Analysis”, 6th edition, Brooks/Cole Cengage Learning, USA, 2010.

OUTCOME:

At the end of the course students will be able to

- identify and fit probability distribution for a given data.
- solve problems in modeling using simulation techniques.

CEC 6121	MODERN CONSTRUCTION MATERIALS AND PRACTICES	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To impart knowledge regarding the properties of modern construction materials used in construction and their suitability of applications in construction industry.
- To impart students the knowledge on modern construction practices related to sub structure, super structure and prefabricated construction.

MODULE I METALS AND NON STRUCTURAL MATERIALS 09

Metals

Different types of steel, aluminium and their products - other alloys - applications in civil engineering.

Non structural materials - water proofing compounds-types - non weathering materials - flooring - types - materials used for flooring - properties - facade materials - types - properties - selection - insulation materials - coatings - eco friendly materials - polymers.

MODULE II SMART AND INTELLIGENT MATERIALS 09

Smart materials – shape memory alloys - application in construction - smart windows -types - intelligent materials - nano materials - coatings & paints - nano sensors- aerogels - phase changing materials - translucent concrete – sensiTile - electrified wood – flexicomb - self-repairing cement/concrete - liquid granite - bendable concrete

MODULE III SUBSTRUCTURE CONSTRUCTION 09

Box jacking - pipe jacking - under water construction of diaphragm walls and basement - methods - stand by plant equipment for underground open excavation. under water construction – problems, encountered. underwater concreting – Sequence of construction activities for tunnels

MODULE IV SUPERSTRUCTURE CONSTRUCTION 09

Formwork& scaffolding – lift slab construction - drop slab construction - ready mix concrete - modes of transporting & continuous concrete placing in tall structure - erection techniques for tall structures, large span structures – launching techniques for heavy decks - Sequence of construction activities for bridges, tall Structures and dams

MODULE V PREFABRICATED STRUCTURES 09

Prefabricated structures - methods, techniques used – advantages - precautions, and pre engineered structures – practices and techniques, fast track construction – modern practices, materials and techniques used- interlocking panels – FRP Panels

Total Hours: 45

REFERENCES:

1. Mamlouk, M.S. and Zaniewski J.P, Materials for Civil and Construction Engineers, Prentice Hall Inc., 2011.
2. Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., Construction Planning, Equipment and Methods, 8th Edition, McGraw Hill, Singapore, 2010.
3. Sankar, S.K. and Saraswati, S., Construction Technology, Oxford University Press, New Delhi, 2008
4. Arora S.P. and Bindra S.P., Building Construction, Planning Techniques and Method of Construction, Dhanpat Rai and Sons, 1997.

OUTCOME:

At the end of the course, the student will be able to

- select the materials such as metal and non structural materials for various applications in construction.
- explain the advantages of using smart material in construction.
- choose the suitable technique to be adopted in sub structure construction.
- identify the appropriate technique to be used in super structure construction.
- defend the usage of pre fabricated structures in modern construction.

CEC6122 CONSTRUCTION EQUIPMENT MANAGEMENT

L	T	P	C
2	0	0	2

OBJECTIVE

- To impart knowledge about various equipments and methods used in construction Industry

MODULE I EARTH WORK EQUIPMENTS AND MATERIAL HANDLING EQUIPMENT 12

Fundamentals of earthwork operations-earth moving operations-types of earthwork equipment – tractors, motor graders, scrapers, front end waders, earth movers.- forklifts and related equipment- -cranes - hauling equipments and methods.

MODULE II OTHER CONSTRUCTION EQUIPMENTS 04

Equipments and methods for dredging, trenching, tunneling, drilling, blasting - equipment for compaction - erection methods and equipments-types of pumps used in construction - equipment and methods for dewatering and grouting - foundation and pile driving equipment.

MODULE III AGGREGATE AND CONCRETING EQUIPMENT 04

Crushers- feeders - screening equipment - handling equipment – batching and mixing equipment - pouring and pumping equipment - transporters and related methods- portable material bins - conveyors.

MODULE IV CONSTRUCTION EQUIPMENT MANAGEMENT 10

Compaction and stabilization of geotechnical materials-Selection of equipments – machine power- planning of construction plant and equipment with emphasis on site application - site layout – safety in handling equipments.

Total Hours: 30

REFERENCES:

1. Peurifoy, R.L., Ledbetter, W.B.and Schexnayder, C., Construction Planning, Equipment and Methods, 5th Edition, McGraw Hill, Singapore,2010.
2. Sharma S.C., Construction Equipment and its Management, Khanna Publishers New Delhi, 2002.
3. Deodhar, S.V., Construction Equipment and Job Planning, Khanna Publishers, New Delhi, 2001.

4. Saxena SC, Construction Equipment and Planning, Standard Publishes-Distributors-Delhi, 2009.

OUTCOME:

At the end of the course, students will be able to

- calculate the earthwork volume for cutting and filling
- interpret mass haul diagram for construction activities
- describe the features of construction equipments
- explain the methods for stabilization of soil
- identify suitable equipments according to the construction work
- describe the construction equipment safety measures

CEC6123 PROJECT MANAGEMENT IN CONSTRUCTION

L	T	P	C
3	0	0	3

OBJECTIVE:

To impart knowledge on

- project life cycle of construction projects
- organization for project management
- utilization of labour, material and equipment
- International construction risks

MODULE I PROJECT MANAGEMENT 09

Introduction - project life cycle - major types of construction - construction project participants - project procurement – appointment of parties to the contract - construction contracts – project managers – project management functions – financing alternatives – legal and regulatory requirements.

MODULE II CONSTRUCTION COMPANY ORGANIZATION 09

Trends in modern management - company objectives – company policies & Strategy – company organizational structures - effects of project risks on organization – project delivery systems - management attitude -perceptions of owners and contractors

MODULE III THE DESIGN AND CONSTRUCTION PROCESS 09

Design and construction as an integrated system-Innovation and technological Feasibility-Innovation and technological feasibility-Design Methodology-Functional Design-Physical Structures-Geo-Technical Engineering Investigation-Construction Site Environment-Value engineering-Construction Planning-Industrialized Construction and Prefabrication-Computer -Aided Engineering.

MODULE IV LABOUR,MATERIAL AND EQUIPMENT UTILIZATION 09

Historical perspective - labour productivity - factors affecting job - site productivity - labor relations in construction - problems in collective bargaining - materials management - materials procurement and delivery- inventory control -tradeoffs of cost in material management - construction equipment - choice of equipment and standard production rates-construction processes queues and resource bottlenecks.

MODULE V INTERNATIONAL CONSTRUCTION LOGISTICS AND RISKS 09

The international environment – seeking international work –project funding – finance and payment – conditions of contract – documentation and bureaucracy – construction labor – equipment – materials and equipment support items - supply and delivery – forming partnerships

Total Hours : 45

REFERENCES:

1. Frank Harris & Ronald McCaffer with Francis Edum – Fotwe, Modern Construction Management, Sixth Edition, Blackwell Publishing, 2006.
2. Chitkara, K.K. Construction Project Management: Planning, Scheduling and Control, Tata McGraw-Hill Publishing Company, New Delhi, 201.
3. Chris Hendrickson and Tung Au, Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2000.
4. Calin M. Popescu, Chotchai Charoenngam, Project Planning, Scheduling and Control in Construction: An Encyclopedia of terms and Applications, Wiley, New York, 1995.
5. Willis, E. M., Scheduling Construction Projects, John Wiley & Sons, 1986.
6. Halpin, D. W., Financial and Cost Concepts for Construction Management, John Wiley & Sons, New York, 1985.

OUTCOME:

Upon completion of the course, students will be able to

- define project life cycle and Project management functions
- outline the company's attitudes and activities, easing the transition from site to general management
- demonstrate and explain the various design and construction process
- interpret and apply various resource productivity for effective utilization
- summarize the problems in raising finance and dealing with unfamiliar conditions in international scenario.

CEC6124	CONSTRUCTION PLANNING SCHEDULING AND CONTROL	L	T	P	C
		3	0	0	3

OBJECTIVE:

To impart knowledge about

- planning construction projects
- scheduling the activities using network diagrams
- determining the cost of the project
- controlling the productivity of the project
- using the project information as an information and decision making tool
- process of planning and Scheduling of various construction projects using softwares

MODULE I CONSTRUCTION PLANNING 08

Basic concepts in the development of construction plans - choice of technology and construction method – project planning – functions of planning– objectives and policies- types and stages of planning- defining work tasks- work break down structure – bill of quantity (boq) - hierarchy of plan - coding systems – human aspects of project management- project definition rating index (PDRI).

MODULE II SCHEDULING TECHNIQUES 10

Development of project network - AOA and AON diagrams - defining precedence relationships among activities - estimating activity durations - estimating resource requirements for work activities - critical path method – PERT- construction schedules – scheduling calculations - float - presenting project schedules - scheduling for activity-on-node and with leads, lags, and windows.

MODULE III SCHEDULING WITH UNCERTAIN DURATION 09

Use of advanced scheduling techniques - scheduling with uncertain durations - calculations for monte carlo schedule simulation - crashing and time/cost tradeoffs - improving the scheduling process.- resources, leveling resources, resource leveling strategies- scheduling with resource constraints.

MODULE IV CONSTRUCTION CONTROL 09

Project integrated control system frame work- work scope control- product quality control- labour productivity control- equipment productivity control- material productivity control- ‘What-if’ analysis- time progress monitoring methodology- critical chain project management (CCPM).

MODULE V ORGANIZATION AND USE OF PROJECT INFORMATION 09

Types of project information - accuracy and use of information - computerized organization and use of information - organizing information in databases - relational model of databases - other conceptual models of databases - centralized database management systems - databases and applications programs - information transfer and flow- Product Data Management (PDM)- Line Of Business (LOB).

MODULE VI PLANNING AND SCHEDULING USING MS PROJECT 15

Planning and scheduling of a multi storey building - assigning activities in sequence – assigning duration for activities – preparation of Gantt chart – planning and scheduling of a road construction project

Preparation of resource sheet – assigning and leveling of resources – report preparation – variance graphs.

L : 45; P : 15; Total Hours: 60

REFERENCES:

1. Chitkara, K.K. Construction Project Management: Planning, Scheduling and Control, Tata McGraw-Hill Publishing Company, New Delhi, 1998.
2. Chris Hendrickson and Tung Au, Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2000.
3. Calin M. Popescu, Chotchai Charoenngam, Project Planning, Scheduling and Control in Construction: An Encyclopedia of terms and Applications, Wiley, New York, 1995.
4. Willis, E. M., Scheduling Construction Projects, John Wiley & Sons, 1986.
5. Halpin, D. W., Financial and Cost Concepts for Construction Management, John Wiley & Sons, New York, 1985.

OUTCOME:

Upon the completion of the course students will be able to

- plan the construction projects with coding and work breakdown structure.
- create the scheduling of activities using network diagrams.
- resolve scheduling constrains using advanced techniques.
- control the productivity of a construction projects.

- identify the project information as an information and decision making tool.
- create a plan and schedule of various construction projects using various software's.

CEC 6104 ADVANCED CONCRETE TECHNOLOGY

L	T	P	C
3	0	2	4

OBJECTIVE:

- To impart sufficient knowledge to students about properties of various concrete constituent materials, mix design for different types of concrete, fresh and hardened properties of concrete.
- To provide students knowledge on durability properties of concrete and different types of special concretes.

MODULE I CONCRETE CONSTITUENT MATERIALS 09+06

Cement - Grades and types - properties and testing as per Indian standards. Fine aggregate - coarse aggregate - classification - properties - testing as per Indian standards. Water - quality, properties and requirements. Mineral admixtures - fly ash, silica fume, metakaoline, ground granulated blast furnace slag, rice husk ash, titanium dioxide. Chemical admixtures - Super plasticizers, water reducers, set accelerators, set retarders, air entraining agents, viscosity modifying agents, corrosion inhibiting admixtures - working mechanism and application areas.

MODULE IICONCRETE MIX DESIGN 09+06

Principles of concrete mix design. Mix design for different types of concrete - control concrete, self compacting concrete, high performance concrete and ready mix concrete - Indian standards - ACI method - relevant standards. Design concrete mix for a desired application and subsequent validation.

MODULE III PROPERTIES OF FRESH AND HARDENED CONCRETE 09+06

Fresh concrete properties of control concrete, self compacting concrete and high performance concrete – workability related tests - slump, compaction factor, vee bee consistometer, flow test, L-box test, U-box test, V-funnel test, J-ring test. Hardened concrete properties – strength – modulus of elasticity – creep – shrinkage - bond strength.

MODULE IV DURABILITY PROPERTIES OF CONCRETE 09+06

Deteriorating mechanism : sulphate attack, alkali aggregate reaction, corrosion of steel rebar - mechanism, causes and consequences. Tests related to durability properties - water absorption, permeability, sorptivity, resistance to chemical attack, freeze and thaw resistance, accelerated corrosion test, RCPT test, half-cell potential test and macrocell corrosion test.

MODULE V SPECIAL CONCRETE 09+06

High performance concrete – fibre reinforced concrete – self compacting concrete - polymer concrete composites - light weight concrete – pervious concrete – ferrocement – shotcrete – coloured concrete – heavy density concrete.

Total Hours : 75

REFERENCES:

1. N.V. Nayak and A.K. Jain, “Handbook on Advanced Concrete Technology”, Narosa Publishing House Pvt. Ltd., New Delhi, 2012.
2. Neville, A.M., “Properties of Concrete”, Fourth Edition, John Wiley & Sons, London, 1996.
3. M.S. Shetty, “Concrete Technology”, S. Chand and Company Ltd., New Delhi, 2003.
4. A.R. Santhakumar, “Concrete Technology”, Oxford University Press, New Delhi, 2007
5. N. Krishnaraju, “Design of Concrete Mixes”, CBS Publishers, New Delhi, 2007.
6. Mehta P.K., and Paulo J.M. Monteiro, “Concrete: Microstructure, Properties, and Materials”, McGraw-Hill Professional, USA, 2005.
7. Yoshihiko Ohama, “Hand Book of Polymer-modified Concrete and Mortars – Properties and Process Technology”, Noyes Publications, 1995.
8. BIS 10262 – 1999, “Recommended Guidelines for Concrete Mix Design”, Bureau of Indian Standards, New Delhi.
9. ACI Committee 211.1 – 1991, “ Standard Practice for Selecting Proportions for Normal, Heavy weight, and Mass concrete (Part – I)”, ACI Manual of Concrete Practice, 1994.
10. ACI Committee 549.1R – 2009, “Guide for the Design, Construction and Repair of Ferro Cement”, American Concrete Institute, USA.
11. BIS 383 – 1970, “Specification for Coarse and Fine Aggregates from Natural Sources for Concrete”, Bureau of Indian Standards, New Delhi.
12. BIS 516 – 1968, “Methods of Tests for Strength of Concrete”, Bureau of Indian Standards, New Delhi.
13. BIS 1199 – 1959, “Methods of Sampling and Analysis of Concrete”, Bureau of Indian Standards, New Delhi.
14. BIS 2386 (Part I & 3) - 1963, “Methods of Test for Aggregates for Concrete”, Bureau of Indian Standards, New Delhi.
15. BIS 4031 (Part 1-6) : 1996, “Method of Physical Tests for Hydraulic Cement”, Bureau of Indian Standards, New Delhi.

16. BIS 5816-1999, Splitting Tensile Strength of Concrete - Method of Test, Bureau of Indian Standards.
17. BIS 13311 - 1992, Non destructive testing of concrete - Method of test, Part -2 : Rebound Hammer, Bureau of Indian Standards.

OUTCOME:

On completion of these modules, students will be able to

- conduct tests assess the properties of concrete constituent materials and its validation for the desired application.
- perform mix design for normal concrete, self compacting concrete and high performance concrete as per specified standards.
- conduct tests as per codal provisions to assess the fresh concrete and hardened concrete properties.
- carryout durability studies on different types of concrete.
- suggest type of concrete based on application and durability requirements.

GEC6201 RESEARCH METHODOLOGY FOR ENGINEERS

L	T	P	C
3	0	0	3

OBJECTIVE:

- To provide a perspective on research to the scholars
- To educate on the research conceptions for designing the research
- To impart knowledge on statistical techniques for hypothesis construction
- To gain knowledge on methods of data analysis and interpretation
- To learn about the effective communication of research finding

MODULE I RESEARCH PROBLEM FORMULATION 07

The research problem – Sources of research problem – Information, how to deal with it – Criteria / characteristics of a good research problem – Errors in selecting a good research problem – Types of research – Nature and use of arguments.

MODULE II HYPOTHESIS FORMULATION 08

Research design – meaning and need – basic concepts, Different research designs, experimental design – principle – important experimental designs, Design of experimental setup, mathematical modeling, simulation – validation and experimentation, dimensional analysis and similitude.

MODULE III STATISTICAL TECHNIQUES 12

Statistics in research – concept of probability – popular distributions –hypothesis testing- sample design- design of experiments – factorial designs -– orthogonal arrays- ANOM - ANOVA - Multivariate analysis - use of optimization techniques – traditional methods – evolutionary optimization techniques –transportation model

MODULE IV STATISTICAL ANALYSIS OF DATA 10

Research Data analysis – interpretation of results – correlation with scientific facts- Accuracy and precision – error analysis, limitations - Curve fitting, Correlation and regression.

MODULE V RESEARCH REPORT 08

Purpose of written report – audience, synopsis writing, preparing papers for International journals, thesis writing – organization of contents – style of writing – graphs and charts – referencing, oral presentation and defence, ethics in research, Patenting, Intellectual Property Rights.

Total Hours: 45

REFERENCES:

1. Ganesan R., Research Methodology for Engineers, MJP Publishers, Chennai, 2011.
2. Ernest O., Doebelin, Engineering Experimentation: planning, execution, reporting, McGraw Hill International edition, 1995.
3. George E. Dieter., Engineering Design, McGraw Hill – International edition, 2000.
4. Madhav S. Phadke, Quality Engineering using Robust Design, Printice Hall, Englewood Cliffs, New Jersey, 1989.
5. Kothari C.R., Research Methodology – Methods and Techniques, New Age International (P) Ltd, New Delhi, 2003.
6. Kalyanmoy Deb., “Genetic Algorithms for optimization”, KanGAL report, No.2001002.
7. Holeman, J.P., Experimental methods for Engineers, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 2007.
8. Govt. of India, Intellectual Property Laws; Acts, Rules & Regulations, Universal Law Publishing Co. Pvt. Ltd., New Delhi 2010.
9. University of New South Wales, “How to write a Ph.D. Thesis” Sydney, Australia, Science @ Unsw.
10. Shannon. R.E., System Simulation: the art and science, Printice Hall Inc, Englewood Cliffs, N.J.1995.
11. Scheffer. R.L. and James T. Mc Clave, Probability and Statistics for Engineers, PWS – Kent Publishers Co., Boston, USA, 1990.

OUTCOME:

Students who complete this course will be able to

- identify the research problem.
- become capable of analyzing the data using mathematical techniques.
- learn to apply the statistical concepts in research.
- demonstrate the different research methods applicable to a specific problem.

CEC6231 CONSTRUCTION ECONOMICS AND FINANCE

L	T	P	C
3	1	0	4

OBJECTIVE:

To impart knowledge about

- economic studies considering the time value of money
- the demonstration of different methods for the comparison of alternatives
- different methods of depreciation, taxes, and cost analysis of construction equipments
- cost estimating
- financial management

MODULE I ENGINEERING ECONOMICS 15

Introduction – Time value of money - quantifying alternatives for decision making - Cash flow diagrams - Equivalence- Single payment in the future (P/F, F/P) - Present payment compared to uniform series payments (P/A, A/P) - Future payment compared to uniform series payments (F/A, A/F) - Arithmetic gradient - Geometric gradient – Tutorial Problems

MODULE II COMPARISON OF ALTERNATIVES 12

Present, future and annual worth method of comparing alternatives - rate of return - incremental rate of return - break-even comparisons - capitalized cost analysis - benefit-cost analysis – tutorial problems

MODULE III EQUIPMENT ECONOMICS 12

Depreciation – inflation – taxes - equipment costs - ownership and operating costs - buy/rent/lease options – replacement analysis – tutorial problems

MODULE IV COST ESTIMATING 09

Types of estimates - approximate estimates – unit estimate - factor estimate - cost indexes - parametric estimate - life cycle cost – case study – tutorial problems

MODULE V FINANCIAL MANAGEMENT 12

Construction accounting - chart of accounts - financial statements – profit and loss - balance sheets - financial ratios - working capital management – case study – tutorial problems

Total Hours: 60

REFERENCES:

1. Blank, L. T. and Tarquin, A. J., “Engineering Economy”, Fourth Edition, WCB/McGraw-Hill,1998.
2. Bose, D. C., “Fundamentals of Financial management”, 2nd ed., PHI, New Delhi, 2010.
3. Gould, F. E., “Managing the Construction Process”, 2nd ed., Prentice Hall, Upper Saddle River, New Jersey, 2002.
4. Gransberg, D. G., Popescu, C. M. and Ryan, R. C., “Construction Equipment Management for Engineers, Estimators, and Owners, CRC/Taylor & Francis, Boca Raton, 2006.
5. Harris, F. , McCaffer, R. and Edum-Fotwe, F., “Modern Construction Management”, 6th ed., Blackwell Publishing, 2006.
6. Peterson, S. J., “Construction Accounting and Financial Management”, Pearson Education, Upper Saddle River, New Jersey, 2005
7. Sullivan, W. G., Bontadelli, J. A. and Wicks, E. M., “Engineering Economy”, 11th ed., Prentice Hall, Upper Saddle River, New Jersey, 2001.

OUTCOME:

Upon completion of the course, students will be able to

- understand Construction economies relating to time value of money
- analyze the various methods of alternatives based on present future and annual worth
- demonstrate and explain the choices of equipment selection with respect to buying, renting or leasing options.
- interpret and apply various cost estimating methods to calculate life cycle cost of a project.
- provide an overview of the financial management including construction accounting

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CEC6232 CONTRACT LAWS AND REGULATIONS

L	T	P	C
3	0	0	3

OBJECTIVE:

- To improve the knowledge of the students in various elements of contract, tendering procedures, arbitration, labor regulations and other laws related to it.

MODULE I CONSTRUCTION CONTRACTS 09

Indian contracts act – elements of contracts – types of contracts – public private partnership in contract - design of contract documents – international contract document - FIDIC– standard contract document – law of torts – fatigue contract.

MODULE II TENDERS 09

Prequalification – bidding – accepting – evaluation of tender from technical, contractual and commercial points of view – contract formation and interpretation – potential contractual problems – world bank procedures and guidelines – tamilnadu transparency in tenders act.

MODULE III ARBITRATION 09

Arbitration agreement- condition for arbitration- composition of arbitral tribunal- number of arbitrators, appointment of arbitrators, power and duties of arbitrator, ground for challenges, termination of mandate, substitution of arbitrator- jurisdiction of arbitral tribunals- conduct of arbitral proceedings- rules of evidence- default of a party- arbitral awards- termination of award- recourse against arbitral award- finality and enforcement of arbitral award- appeal against arbitral award- Newyork convention award- Geneva convention award- Foreign arbitral award.

MODULE IV LEGAL REQUIREMENTS 09

Insurance and bonding – laws governing sale, purchase and use of urban and rural land – land revenue codes – tax laws – income tax, sales tax, excise and custom duties and their influence on construction costs – legal requirements for planning – property law – agency law – benefits in public private partnership -local government laws for approval – statutory regulations.

MODULE V LABOUR REGULATIONS 09

Social security – welfare legislation – laws relating to wages, bonus and industrial disputes, labour administration – insurance and safety regulations Workmen's

Compensation Act – Indian Factory Act – Tamilnadu Factory Act – Child Labour Act - Other Labour Laws

Total Hours: 45

REFERENCES:

1. Gajaria G.T., Laws Relating to Building and Engineering Contracts in India, M.M.Tripathi Private Ltd., Bombay, 2000.
2. Jimmie Hinze,Construction Contracts, McGraw Hill, 2001.
3. Joseph T. Bockrath, Contracts and the Legal Environment for Engineers and Architects, McGraw Hill, 2000.
4. Patil. B.S, Civil Engineering Contracts and Estimates, Universities Press Private Limited, India, 2006.
5. The Indian Contracts Act, 1872,
6. Arbitration and Conciliation Act, 1996.
7. The Tamilnadu Transparency in Tenders act, 1998.

OUTCOME:

At the end of the course the students will be able to

- define the various elements, types and laws related to contract.
- list the various processes involved in tendering.
- elaborate the process involved in construction arbitration.
- describe the various legal requirements related to construction activities.
- list the available labor regulations and its benefits to the labour.

CEC6233 MINI PROJECT	L	T	P	C
	0	0	3	1

GENERAL GUIDELINES:

- The project aims to impart knowledge in construction planning and scheduling and to complement the practical work abilities of the students.
- The project allows students to generalize, apply and synthesize the concepts learned over the duration of the course.
- This approach encourages students to work as a team and “learn by doing”, thereby develop the problem-solving skills which is fundamental to industry practice in the field of construction management.
- Students, working in groups of two, must identify a construction project, Prepare a feasibility report for the project and list the activities, establish an activity logic sequence table, estimate the duration, prepare a network diagram, track, update and crash the project.
- The Students are expected to implement the same plan using Project Management softwares.
- The faculty act as facilitator in helping students to acquire the technical knowledge and basic proficiency needed to perform the master plan.

ODD SEMESTER PROFESSIONAL ELECTIVES

CECY121	CONSTRUCTION PERSONNEL MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To impart knowledge on man power planning, organization, people management and their welfare measures.

MODULE I MANPOWER PLANNING 09

Manpower planning, organizing, staffing, directing, and controlling – personnel principles – case studies.

MODULE II ORGANISATION 09

Organization – span of control – organization charts – staffing plan - development and operation of human resources - managerial staffing – recruitment – selection - placement, training and development

MODULE III HUMAN BEHAVIOUR 10

Introduction to the field of people management - basic individual psychology; motivation - job design and performance management - managing groups at work - self-managing work teams - intergroup behavior and conflict in organizations – leadership - behavioral aspects of decision-making; and communication for people management

MODULE IV WELFARE MEASURES 07

Compensation – Safety and health – GPF – EPF – group insurance – housing - pension – laws related to welfare measures.

MODULE V MANAGEMENT AND DEVELOPMENT METHODS 10

Compensation - wages and salary, employee benefits, employee appraisal and assessment - employee services - safety and health – discipline and discharge - special human resource problems, performance appraisal - employee hand book and personnel manual - job descriptions and organization structure and human relations – productivity of human resources.

Total Hours: 45

REFERENCES:

1. Carleton Counter II, Jill Justice Coutler, The Complete Standard Handbook of Construction Personnel Management, Prentice-Hall, Inc., New Jersey, 1989.
2. Memoria,C.B., Personnel Management, Himalaya Publishing Co., 1997.
3. Josy.J. Familaro, Handbook of Human Resources Administration, McGraw-Hill International Edition, 1985.
4. Dwivedi R.S, Human Relations and Organizational Behavior, Macmillan India Ltd., 2005.

OUTCOME:

At the end of the course, students will be able to

- classify and explain various man power resources required in construction industry
- outline the organizational structure and demonstrate staffing plans for a construction company.
- apply interpersonal human behavior principals to improve the morale and behavioral aspects of human resources.
- demonstrate various welfare measures available to human resources.
- analyze the various development benefits and principles to effectively manage the resources and increase in productivity

CECY222	FINANCING AND MANAGEMENT OF INFRASTRUCTURE PROJECTS	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To provide an understanding and appreciation of financing technique widely used to finance infrastructure projects
- To provide an exposure to various innovative financing methods and its applicability in infrastructure projects.
- To provide an understanding about public private parternership and risks associated with it.

MODULE I INFRASTRUCTURE DEVELOPMENT – INTRODUCTION 09

Infrastructure development - Multiplier effects of infrastructure development on economic development of the nation - Sources of financing infrastructure projects; Traditional and private investments; various financial instruments; Limitations of traditional procurement system of infrastructure; Legal frameworks and Incentives for private sector participation in infrastructure development.

MODULE II PUBLIC PRIVATE PARTNERSHIPS – PROCUREMENT PROCESS 09

Introduction to infrastructure development through ppp route; benefits of PPP mode of procurement; types of PPP Models and their contractual structure; stakeholders' perspectives; granting authority, funders and concessionaire; government's role in successful PPP projects; appraisal of projects; VFM evaluation; PPP procurement process; lifecycle of PPP projects; contractual package of PPP project; bankable concession agreement - case study

MODULE III CONCESSION – DESIGN AND AWARD 09

Introduction to concession design and award; concession design: price setting; price adjustment; specific performance targets; penalties and bonuses; public parties' security rights; duration, termination, and compensation; force majeure and other unforeseen changes; dispute settlement; concession award: competitive bidding; direct negotiations and unsolicited proposals; competitive negotiations; prequalification and unsolicited proposals; competitive negotiations; prequalification and short listing; bid structure and evaluation; bidding rules and procedures; case study

MODULE IV RISK MANAGEMENT OF INFRASTRUCTURE PROJECTS 09

Risks associated with various infrastructure projects; Introduction to risk

management concept; risk analysis techniques; risk mitigation strategies; risk allocation frameworks of major infrastructure projects procured through various ppp modes - environmental concerns and its impact on infrastructure development.

MODULE V PROJECT FINANCE 09

Introduction to project financing concept; analysis of project viability; designing security arrangements; preparing the project financing plan; introduction to credit rating of infrastructure projects and role of credit ratings in financing infrastructure projects; rating frameworks of various national and international credit rating agencies for infrastructure projects in various sectors. financing through international capital markets; urban infrastructure financing.

Total Hours: 45

REFERENCES:

1. Akintoye. A., Beck, M., & Hardcastle, C., Public-Private Partnerships - Managing risks and opportunities, Oxford: Blackwell Science Limited, 2003.
2. Finnerty, J. D. Project financing - Asset-based financial engineering, NewYork: John Wiley & Sons, Inc, 2013.
3. Merna, T., & Njiru, C. Financing infrastructure projects (First ed.),Thomas Telford, London, 2002.
4. Raghuram, G., Jain, R., Sinha, S., Pangotra, P., & Morris, S., Infrastructure Development and Financing: Towards a Public-Private Partnership, MacMillan, 2000.
5. Weber, B., & Alfen, H.W. Infrastructure as an asset class - Investment strategies, project finance and PPP, West Sussex: John Wiley & Sons, 2010.

OUTCOME:

Upon Completion of this course the learner will be able to

- Demonstrate the need for Infrastructure development for the growth of a country and explain the various means of financing an Infrastructure project
- Summarize the types, benefits and limitations of PPP.
- Develop the methods of procurement of infrastructure projects
- Deal with risk associated with Infrastructure Projects
- Appraise and access the various financial options to fund an Infrastructure project.

CECY123	INTELLIGENT BUILDING MANAGEMENT SYSTEM	L	T	P	C
		3	0	0	3

OBJECTIVE:

To provide knowledge on

- concepts of intelligent buildings
- working principles of building automation systems
- office automation systems and communication systems

MODULE I INTRODUCTION 09

Introduction to intelligent buildings - high performance buildings - basic concepts of intelligent buildings - intelligent building automation - building automation system- cost analysis of intelligent buildings – introduction to smart materials and embedded sensor technology – BMS and energy savings – BMS benefits

MODULE II INTELLIGENT COMFORT SYSTEMS 09

Introduction - Basic HVAC system - human comfort - artificial intelligent systems – occupancy sensors – temperature sensors; energy efficient HVAC systems – thermal energy storage – under floor air distribution – chilled beams – Other emerging HVAC technologies for high performance buildings - automated car parking management

MODULE III INTELLIGENT SAFETY SYSTEMS 09

Life safety factors – designing a security system- intrusion sensors and space sensors -closed circuit television & surveillance systems; access control & management system - portrait id system, swipe card access control system, biometric access control system; fire protection systems - smoke detection- automatic fire alarm detection – sprinklers -hose reels hydrants-foam systems - microprocessor based alarm. emergency control of elevator, doors, hvac systems; security & alarm system

MODULE IV BUILDING ELECTRONICS 09

Introduction - microprocessor based control - programmable logic controller – Communication principles - telephone systems - communal aerial broadcasting - satellite communication - fibre optic system

MODULE V PERFORMANCE BUILDINGS 09

High performance buildings - control theory - market trends - energy efficiency - environmental & green house gas emission reduction - CDM - practical benefits;

case studies & examples-smart home - smart office.

Total Hours: 45

REFERENCES:

1. Shengwei Wang, Intelligent Buildings and Building Automation, Spon Press, London, 2009.
2. Derek Clements Croome, Intelligernt Building Design, Management and Operations, 2nd edition, ICEP Publishers, London, 2012.
3. Ehrlich, C., Intelligent Building Dictionary: Terminology for Smart, Integrated Green Building Design, Construction, and Management San Francisco, Handson-Guide, 2007.

OUTCOME:

Upon completion of the course, the student will be able to

- illustrate the concept of Intelligent Buildings and compare the costs, energy savings applied to Building Management Systems.
- demonstrate and explain the various Intelligent Comfort Systems
- demonstrate and explain the various Intelligent Safety Systems
- construct a simple electronic system
- analyze high performance buildings based on energy efficiency

CECY124 MANAGEMENT INFORMATION SYSTEM

L	T	P	C
3	0	0	3

OBJECTIVE:

To lay emphasis on

- the various information systems
- their framework
- their methods of implementation, control and audit

MODULE I INTRODUCTION 09

Information systems - establishing the framework - business models - information system architecture - evolution of information systems.

MODULE II SYSTEM DEVELOPMENT 09

Modern information system - system development life cycle – structured methodologies - designing computer based methods, procedures, control - designing structured programs.

MODULE III INFORMATION SYSTEMS 09

Integrated construction management information system - project management information system - functional areas, finance, marketing, production, personnel - levels, dss, eis, and es - comparison, concepts and knowledge representation - managing international information system.

MODULE IV IMPLEMENTATION AND CONTROL 09

Control - testing security - coding techniques - defection of error - validating - cost benefit analysis - assessing the value and risk of information system.

MODULE V SYSTEM AUDIT 09

Software engineering qualities - design, production, service, software specification, software metrics, software quality assurance - systems methodology - objectives - time and logic, knowledge and human dimension - software life cycle models - verification and validation.

Total Hours: 45

REFERENCES:

1. Kenneth C Laudon and Jane Price Laudon, Management Information Systems Organisation and Technology, Prentice Hall, 1996.
2. Gordon B. Davis, Management Information System: Conceptual Foundations, Structure and Development, McGraw Hill, 1974.
3. Joyce J Elam, Case series for Management Information Systems, Simon and Schuster, Custom Publishing, 1996.
4. Ralph H Sprague and Huge J Watson, Decision Support for Managers, Prentice Hall, 1996.
5. Michael W. Evans and John J Marciniah, Software Quality assurance and Management, John Wiley and Sons, 1987.
6. 6 Card and Glass, Measuring Software Design quality, Prentice Hall, 1990.

OUTCOME:

Upon successful completion of the course, the students will be able to

- explain the procedures for successfully managing information systems in projects.
- identify the system development for designing structured problems.
- identify the international information system.
- analyse the coding techniques.
- design the verification and validation for system audit.

CECY103	MAINTENANCE AND REHABILITATION OF STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To impart students sound knowledge on various causes of failures, detailed assessment procedure for evaluating a distressed structure, materials available for effecting repair and techniques for effective rehabilitation.
- To offer knowledge to students on rehabilitation of real time distressed structures through case studies.

MODULE I CAUSES FOR FAILURES 09

Effects due to climate, temperature, chemicals, wear and erosion - design and construction errors. Corrosion – Mechanism, causes, consequences and remedial measures - effect of cover thickness and cracking on durability of concrete.

MODULE II MAINTENANCE AND ASSESSMENT PROCEDURE 09

Definition: Maintenance, repair and rehabilitation - facets of maintenance - importance of maintenance. Assessment procedure for evaluating a damaged structure - various aspects of inspection - destructive and non–destructive testing techniques.

MODULE III MATERIALS FOR REPAIR 09

Special concretes and mortar - concrete chemicals - elements for accelerated strength gain - expansive cement - polymer concrete composites - ferro cement - fibre reinforced concrete- fibre reinforced polymer composites - micro concrete. Methods of corrosion protection - corrosion inhibitors - protective coating materials for rebar and concrete - corrosion resistant steel - cathodic protection.

MODULE IV TECHNIQUES FOR REPAIR 09

Rust converters and polymer coating for rebars during repair - repair mortar for cracks - bonding agents - epoxy injection - guniting and shotcrete - FRP and ferro cement jacketing - vacuum concreting - bonding plates - overlays - protective coatings - shoring and underpinning technique.

MODULE V REHABILITATION OF STRUCTURES - CASE STUDIES 09

Case studies on repairs to overcome low member strength - deflection - cracking - chemical attack - damage due to wear - leakage - fire - marine exposure and

corrosion. Engineered demolition techniques for dilapidated structures - case study.

Total Hours : 45

REFERENCES:

1. Santha Kumar A.R., “Concrete Technology”, Oxford University Press, (2007).
2. Shetty M.S., “Concrete Technology – Theory and Practice”, S. Chand & Company Limited (2008).
3. Orchard D.F., "Concrete Technology -Vol. I - Properties of Materials, Wiley Publishers, 2010.
4. Yoshihiko Ohama, “Hand Book of Polymer – Modified Concrete and Mortars”, Noyes Publications, 1995.
5. Philip H. Perkins, "Repair, Protection and Waterproofing of Concrete Structures", Elsevier Applied Science Publishers, 1986.
6. W.H. Ransom, "Building Failures - Diagnosis and Avoidnce", E.& F.N. Spon Publishers, 1987.
7. Michael T. Kubal, "Waterproofing the Building Envelope", Mc-Graw Hill Inc., 1993.

OUTCOME:

At the end of course work students will be able to

- specify the various causes for distress in reinforced concrete structures.
- conduct systematic condition assessment of damaged structures using conventional and non-destructive testing methods.
- suggest suitable materials for repair based on damage level, deterioration mechanism and durability requirements of the distressed structures.
- recommend repair techniques for rehabilitation of damaged structural elements based on deterioration level, serviceability and durability requirements.
- specify rehabilitation procedure for fire affected, corrosion affected and other structurally distressed members and engineered demolition techniques.

CEBY125	REMOTE SENSING AND GIS IN INFRASTRUCTURE ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To make the student acquainted regarding the principles of remote sensing and the data acquisition and analysis of satellite data.
- To provide exposure to data models and data structure used in GIS.
- To introduce various raster and vector analysis capabilities of GIS for civil engineering.

MODULE I REMOTE SENSING 09

Concepts of remote sensing- energy sources and radiation principles-energy interactions in the atmosphere- spectral reflectance of earth surface features-concepts of microwave remote sensing- visual interpretation-digital image processing- image preprocessing- image enhancement-image classification-remote sensing satellites

MODULE II BASIC CONCEPTS OF GIS 09

Basic concepts and components- hardware, software-spatial and non-spatial data-geo referencing- map projection- types of projection- simple analysis-data retrieval and querying-data input

MODULE III DATA STRUCTURES AND ANALYSIS 09

Data base- data base models- raster and vector data structures- Topology-GIS modeling- Raster and Vector data analysis- Buffering and overlaying techniques-DEM TIN and DTM- network analysis- output devices, errors, types of errors.

MODULE IV APPLICATIONS IN TRANSPORTATION MANAGEMENT 09

Highway and railway alignment, location of transport terminals, and road side facilities, bus stops, route optimization, accident analysis-Integration of GIS, GPS, and remote sensing techniques, Advanced traveller information system and automatic vehicle location system.

MODULE V APPLICATIONS IN WATER AND ENVIRONMENT MANAGEMENT 09

GIS in watershed management, Irrigation management, drought management, flood management, waste land management- management and monitoring of

environment-conservation of resources.

Total Hours: 45

REFERENCES:

1. Burrow P.A.,Principles of GIS for Land Resources Assessment, Oxford Publication, 1994.
2. Marble D.F., CalkinsH.W and Penquest, Basic readings in GIS, Speed System Ltd, New York, 1984.
3. Lillisand T.M , Kiefer R.W., Remote sensing and image interpretation, John Wiley and Sons, New york, 2004.
4. C.P.Lo , Yeung, A.K.W, Concepts and technologies of Geographic Information systems, Prentice Hall India, New Delhi, 2004

OUTCOME:

At the end of the course the student will able to

- identify the energy sources and its target interactions, to be interpreted in a satellite image.
- enhance the satellite image to increase its interpretability of the target features.
- identify the projection suitable for different applications and to generate queries to solve real world problems.
- design GIS data structure to incorporate real world as a system component and to perform spatial queries.
- describe real world problem in transportation and to justify the solutions arrived technically.
- identify problem with respect to water and environmental management and to solve the problems using GIS and remote sensing techniques.

CECY126 URBAN PLANNING AND DESIGN

L	T	P	C
3	0	0	3

OBJECTIVE:

- To impart knowledge on urban planning, zoning rules and regulations, architectural design and implementation of management information system in urban planning.

MODULE I INTRODUCTION 06

Definition of terms –trend of urbanization at international, national, state and district levels .national and regional development policies and strategies – urbanization, housing and transportation sustainable urban development-definition and principles.

MODULE II PLANNING PROCESS 08

Types of urban and regional plans, stages in the planning process – delineation of planning areas, goals and objectives of plans, surveys and analysis, formulation of plans, evaluation of alternative plans, plan implementation, legal, financial and institutional constraints in the planning process .social orientation in the planning process.

MODULE III DEVELOPMENT MANAGEMENT SYSTEMS 08

Development control rules – zoning regulations, sub divisional regulations, building bye-laws, co-ordination between urban local bodies and other functional agencies such as water supply & sewerage boards, housing boards including slum boards and planning authorities

MODULE IV SMART CITIES 9

The Origins of smart cities - municipal information systems - gis and interoperability - confidentiality, privacy, the surveillant society - the next generation of sensors - opportunistic data: generated for one purpose, used for another - integrating data, open data - coordinating services, emergency response and location-based services - web mapping, real time sensing and information - making cities smarter, coupling networks, services and people, - new forms of electronic community.

MODULE V MANAGEMENT INFORMATION AND DECISION SUPPORT 08

Database, management information system, decision support system for land

suitability, urban renewal and network analysis.

Total Hours: 30

REFERENCES:

1. Master Plans for Cities and Towns prepared by Planning Authorities, Chennai Metropolitan Development Authority, 1995.
2. Development Control Rules for Chennai Metropolitan Area, CMDA, Chennai, 2004.
3. Rangwala S C, Town Planning, Charotar Publishing House, 2009.
4. Francis D.K.Ching Architecture: Forms, space and order , VNR, New York,2014.

OUTCOME:

At the end of the course the student will be able

- define the concept of urbanization and its trend in developed countries.
- create an plan using various stages of planning.
- describe the bye laws and the role of Urban Local Bodies and Other functional Agencies in urbanization
- define the concept of smart cities.
- manage the datas using various information systems.

CECY127 MATERIAL MANAGEMENT

L	T	P	C
2	0	0	2

OBJECTIVE:

- To impart knowledge on classification, procurement, store management of materials, and methods of disposal of waste.

MODULE I INTRODUCTION 08

Material classification- organizing for materials management – basis for forming organizations – conventional and modern approaches to organizing materials management. materials identification – classifying of materials – codification of materials – standardization – simplification and variety reduction of materials – integrated material management

MODULE II MATERIAL PROCUREMENT 10

Material purchasing– planning purchasing materials – norms of vendor rating – cei methodology – material selection and development – purchasing procedures and methods – legal aspects – insurance of materials - supply management – sources of supply – out sourcing material management- procurement organization - procurement planning – functions of material management - inventory control.

MODULE III STORE MANAGEMENT 06

Storing of materials-management of stores – location – different types of stores – methods of storing – safety and security of materials – stores equipment – materials handling equipment – factors affecting materials handling

MODULE IV WASTE MANAGEMENT 06

Scrap & Obsolete Materials-Management of surplus obsolete and scrap materials – reasons for accumulation of surplus obsolete and scrap materials – methods of disposal – regulations and procedures

Total Hours : 30

REFERENCES

1. 1. A.K. Datta, “Materials Management: Procedures, Text and Cases”, PHI Learning Pvt. Ltd.,2004.
2. 2. Arnold, “Introduction To Materials Management”, Pearson Education India,2009
3. 3. Richard J. Tersine, “Principles Of Inventory And Materials, Management”,

Prentice Hall,2004

4. 4. Richard J. Tersine, “Modern Materials Management”, John Hardin Campbell - 2007
5. 5. P. Gopalakrishnan, “Handbook of Materials Management”, PHI Learning Pvt. Ltd.2004

OUTCOME:

At the end of the course the student will be able to

- categorize and classify the various materials.
- describe the purchase procedure of materials.
- analyse the supply and outsourcing of material management.
- describe the safety and security of material storage.
- analyse the management of scrap and obsolete materials.

CECY128 CONSTRUCTION SAFETY MANAGEMENT

L	T	P	C
2	0	0	2

OBJECTIVE:

To impart knowledge in

- Safety aspects involved in construction industry.
- Policies followed and awareness in construction industry.

MODULE I INTRODUCTION 06

Construction Safety Management – OSHO - Role of various parties, duties and responsibilities of top management, site managers, supervisors etc. role of safety officers, responsibilities of general employees, safety committee, safety monitoring. Writing safety manuals, preparing safety checklists and inspection reports.

MODULE II SAFETY IN DIFFERENT OPERATIONS 12

Safety in construction operations – Safety of accidents on various construction sites such as buildings, dams, tunnels, bridges, roads, etc. safety at various stages of construction. Prevention of accidents. Safety measures. Safety in use of construction equipment e.g. vehicles, cranes, hoists and lifts etc. safety of scaffolding and working platforms. Safety while using electrical appliances. explosives used.

MODULE III SAFETY AWARENESS 06

Various safety equipment and gear used on site. First aid on site, Safety awareness program. Labor laws, legal requirement and cost aspects of accidents on site, Incentive for safety practices.

MODULE IV SAFETY POLICY 06

Study of safety policies, methods, equipment, training provided on any ISO approved construction company, safety in office, working on sites of high rise construction, deep excavation

Total Hours: 30

REFERENCES:

1. Construction safety manual – SP 70 published by National Safety Commission of India- 2007.
2. Safety Management in Construction Industry – A manual for project

managers. NICMAR Mumbai, 1998.
3. Construction Safety Handbook – Davies V.S.Thomasin K, Thomas Telford, London, 1990.
4. Construction Safety Management Tim Howarth, Paul Watson, Wiley-Blackwell,2008.

OUTCOME:

At the end of the course student will be able to

- define the roles and responsibilities of stakeholders in establishing safety in the project.
- describe the safety practices to be followed during various construction operations.
- state the awareness about safety in site.
- analyse the safety policies followed by organization in construction site.

CECY129	TRANSPORTATION PLANNING AND MANAGEMENT	L	T	P	C
		2	0	0	2

OBJECTIVE:

To impart knowledge on

- various transportation systems
- methods of demand forecasting, route choice modeling and transportation management

MODULE I TRANSPORTATION SYSTEMS 06

Systems approach to transport planning – interdependence of the land use and traffic– stages in transportation planning – transport planning considerations travel forecasting process – statutory land use planning process – planning issues

MODULE II TRANSPORTATION INVENTORIES & TRAVEL DEMAND FORECASTING 08

Concepts of zoning – methods of transportation surveys – inventory of transport and other activities – planning studies and methods – development of planning process conventional modeling process – four stage modeling processes – trip generation models – trip distribution models and calibration – advancement in trip end modeling

MODULE III ROUTE AND MODE CHOICE MODELING 08

Methods of trip assignment models – multi modal trip assignment – mode choice and modal split models – advancement in route choice and mode choice modeling

MODULE IV LAND USE TRANSPORT MODEL (LUT) 08

Accessibility measures and basic theories – lowery derivatives model- garim model – Basics of systems approach in LUT Model- classification of land use models – intercity travel demand models – transit planning and services.

Total Hours: 30

REFERENCES:

1. Jotin Khisty C, Kent Lall B, Transportation Engineering – An Introduction, Third Edition, Prentice Hall of India, New Delhi, 2002.
2. Papacostas C.S., Prevedouros, Transportation Engineering and Planning, Third Edition, Prentice Hall of India, New Delhi, 2002.
3. John D.Edwards (Edr.), Transportation Planning Hand Book, Second

Edition, Institute of Transportation Engineers, Prentice Hall Inc., Washington DC, USA, 1999.
4. John W Dicky, Metropolitan Transportation Planning – A Decision Oriented Approach, McGraw Hill, New York, 1984.
5. O'Flaherty C.A, Transport Planning and Traffic Engineering, Elesevier Publications, New Delhi,1997.

OUTCOME:

At the end of this course the student will be able to

- identify the stages of transportation planning.
- design and forecast the travel demand.
- identify the Advancement in Route Choice and Mode Choice Modeling.
- analyse the land use transport model.
- categorize the various transportation management system.

CECY130 LEAN CONSTRUCTION

L	T	P	C
1	0	0	1

OBJECTIVE:

To provide knowledge on

- the basics of lean production management,
- how Lean principles are applied to the Construction industry to improve the operation management and product development.

MODULE I LEAN PRINCIPLES 05

Historical Background – WIP – cycle time – little's law –queuing theory – lean production systems principles

MODULE II LEAN CONSTRUCTION 05

Issues with contemporary CM/PM practices – Lean Construction as Project production system – EZ strobe - lean construction Principles –TFV views on production

MODULE III LEAN PROJECT DELIVERY SYSTEM 05

Improving production design & planning – lean work structuring - improving project control: last planner system - improving design management – improving project delivery

Total Hours: 15

REFERENCES:

1. Liker, J. K., and Meier, D. (2005). The Toyota Way Fieldbook, McGraw-Hill, New York, NY. 476 pp.
2. Readings at http://www.leanconstruction.org/readings.htm
3. Liker, J. K. (2004). The Toyota Way, McGraw-Hill, New York, NY. 330 pp.
4. Hopp, W. J., and Spearman, M. L. (2011). Factory Physics, Third Edition, Waveland Press, Long Grove, Il. 720 pp.

OUTCOME:

Upon completion of the course, the student will be able to

- summarize the Lean Principles.
- explain the Lean construction principles and apply lean principles to a small construction project.
- demonstrate the Lean construction project delivery system

CECY131	SITE INVESTIGATION AND SOIL EXPLORATION TECHNIQUES	L	T	P	C
		1	0	0	1

OBJECTIVE:

- To familiarize the students with various site investigation programme, geotechnical terminology and important concepts

MODULE I SUB SURFACE EXPLORATION TECHNIQUES 07

Necessity of soil sampling -Methods of soil exploration- Direct method of exploration-Auger Boring-Wash Boring - Percussion boring-Core Drilling-Rotary Boring Indirect method of exploration –Geo physical method- Electrical resistivity method – Advantages - Sectional map-Location of ground water basin Sampling Techniques -Disturbed Sample -Undisturbed Sample - thin walled sampler- Split Spoon Sampler-Core Cutter-Area ratio-Core Recovery ratio

MODULE II DEEP EXPLORATION 08

Deep Boring-rock core drilling-Preservation of borelogs- Techniques for deep boring-Water test - Standard Penetration test-Limitations -Advantages- Static cone penetration test-Vane Shear test-Plate load - test- Cyclic plate load test - Pressure meter-subsoil - deformation test-Field Density.

Total Hours : 15

REFERENCES:

1. Tomlinson, M.J. and Boorman. R., Foundation Design and Construction, ELBS Longman, 6th edition, 2013.
2. Nayak, N.V., Foundation Design manual for Practicing Engineers, Dhanpat Rai and Sons, 2012.
3. Winterkorn H.F and Fang H.Y., Foundation Engineering Hand Book, Van Nostrard – Reinhold, 1991.
4. Braja M. Das, Principles of Foundations Engineering, Thomson Asia (P) Ltd., 2012.
5. Bowels J. E., Foundation Analysis and Design, Mc Graw-Hill International Book Co., 1996.

OUTCOME:

At the end of the course students will be able to

- interpret subsurface information to report soil properties
- determine bearing capacity and settlement.

LIST OF EVEN SEMESTER ELECTIVES

		L	T	P	C
CECY221	**CONSTRUCTION QUALITY MANAGEMENT**	**3**	**0**	**0**	**3**

OBJECTIVE:

To impart knowledge in

- quality planning, assurance and improvement techniques.
- Statistical control and standards in construction industry.

MODULE I QUALITY MANAGEMENT 09

Introduction – definitions and objectives – factor influencing construction quality - responsibilities and authority - quality plan - quality management guidelines – quality circles.– requirements – preparing quality system documents – quality related training – implementing a quality system – third party certification.

MODULE II QUALITY PLANNING ASSURANCE AND CONTROL 09

Quality policy, objectives and methods in construction industry - taguchi's concept of quality – codes and standards – documents –— inspection procedures - Total QA / QC programme and cost implication- techniques and needs of QA/QC - different aspects of quality – appraisals- critical, major failure aspects and failure mode analysis

MODULE III QUALITY CONTROL AND IMPROVEMENT TECHNIQUES 09

Quality improvement - selection of new materials - influence of drawings, detailing, specification, standardization - bid preparation - quality checklist in sites - masonry-plastering-concrete construction- batching, mixing, transporting, placing, compaction, finishing, curing - reinforcement work - formwork - timber & steel construction, - doors & windows, - plumbing & drainage - duties, responsibilities, qualification of staff in organization - purpose of inspection: inspection of various components of construction; reports and records;

MODULE IV STATISTICAL QUALITY CONTROL 09

Statistical quality control - quality measurement: attributes and variables - statistical process control (spc) methods - control charts for attributes - p-charts - proportion defective - c-charts - number of defects per unit - control charts for variables - other types of attribute-sampling plans acceptance sampling

MODULE V QUALITY STANDARDS 09

Quality standard codes from its application point of views- List important clauses with range of acceptable parameters related to quality of cement, bricks, steel and concrete as given in quality standards. Important provisions of Indian standards about different construction activities- ISO9000 and ISO14000 standards.

Total Hours: 45

REFERENCES:

1. Abdul Razzak Rumane, Quality Management in Construction Projects, CRC Press, 2010
2. James, J.o' Brian, Construction Inspection Handbook – Quality Assurance and Quality Control, Van Nostrand, New York, 2012.
3. Juran Frank, J.M. and Gryna, F.M. Quality Planning and Analysis, Tata McGraw Hill, 2000.
4. Arora.K.C., ISO 9000 to OHAS 18001, S.K. Kataria & Sons; Reprint 2012 edition
5. Er. S.C. Basu Roy, Modern Concept of Total Quality Control and Management for Construction, Nabhi Publication (2013)

OUTCOME:

At the end of the course, students will be able to

- apply total quality management in civil construction.
- check the quality in civil construction works.
- improve the quality of construction.
- identify the variations in quality of civil works.
- use various standard codes in civil construction works.

CECY222	ENVIRONMENTAL IMPACT ASSESSMENT OF INFRASTRUCTURE PROJECTS	L	T	P	C
		3	0	0	3

OBJECTIVE:

To impart the knowledge about

- the need of civil engineering professionals to be acquainted with the potential environmental risks of infrastructure projects.
- methods of qualitative and quantitative assessments, environmental risk evaluation, risk management and remediation techniques.

MODULE I INTRODUCTION 06

Environmental impact assessment (EIA), definitions and concepts, rationale and historical development of EIA, EIA in civil engineering, initial environmental examination, environmental appraisal, environmental impact factors and areas of consideration, measurement of environmental impact, Status of EIA in India, types and limitations of EIA

MODULE II EIA: PROCESSES AND PROCEDURES 10

Components of EIA – methods, techniques & procedure for EIA – processes – screening- scoping- setting- analysis- mitigation. matrices- networks – checklists – connections and combinations of processes - cost benefit analysis – analysis of alternatives – expert systems in eia - environmental impact statement. Technical components of environmental impact assessment - case studies -water resources, water quality, and land resources - land use, ecology and wetlands - traffic and transportation - waste management and hazardous materials.

MODULE III SOCIO-ECONOMIC IMPACT ASSESSMENT 09

Prediction tools for EIA – mathematical modeling for impact prediction – assessment of impacts – air – water – soil – noise – biological –– socio-cultural environments -cumulative impact assessment – documentation of eia findings – planning – organization of information and visual display materials – report preparation.

MODULE IV ENVIRONMENTAL MANAGEMENT 10

Environmental management - principles, problems and strategies; environmental management plan - preparation, implementation and review – mitigation and rehabilitation plans – policy and guidelines for planning and monitoring programmes; review of political, ecological and remedial actions; future strategies; multidisciplinary environmental strategies, the human, planning, decision-making

and management dimensions; environmental planning and the future of EIA - ethical and quality aspects of environmental impact assessment.

MODULE V ENVIRONMENTAL AUDIT, LIFE CYCLE ASSESSMENT & STANDARDIZATION 10

Environmental audit - definitions and concepts, partial audit, compliance audit, post project audit methodologies and regulations. life cycle assessment; triple bottom line approach; industrial ecology; ecological foot printing; carbon trading; sustainable development; introduction to ISO and ISO 14000; EMAS regulations; wider application of system based approach.

Total Hours: 45

REFERENCES:

1. Charles H. Eccleston , Environmental Impact Assessment: A Guide to Best Professional Practices, CRC Press, 2011.
2. Lawrence, D.P., Environmental Impact Assessment – Practical solutions to recurrent problems, Wiley-Interscience, New Jersey, 2003.
3. A. K. Shrivastava, Environmental Impact Assessment, APH Publishing, 2003.
4. R. R. Barthwal, Environmental Impact Assessment, New Age International, 2002.

OUTCOME:

Upon successful completion of this course, the student will be able to

- understand factors, status, measurement and limitations of an EIA
- classify the components and explain the methods and procedures of an EIA
- appreciate specific methods and tools used in EIA for prediction and assessment
- plan the environmental management policy for multi-disciplinary environmental strategies
- Execute an environmental audit and life cycle assesment.

CECY223 FINANCIAL ACCOUNTING & MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVE:

- To provide conceptual knowledge on Accounting
- To prepare Financial Statement like Trading Account, P & L Account, Balance Sheet, and Fund flow & Cash flow statements with specific reference to construction industry
- To understand the Financial Statement s & Analyse the same
- To prepare certain functional budgets
- To apply marginal costing technique for managerial decision making

MODULE I INTRODUCTION TO ACCOUNTING 04

Introduction to accounting - meaning of accounting, branches of accounting, objectives of accounting -fundamental concepts-principles and rules of accounting

MODULE II FINANCIAL ACCOUNTING 12

Basic accounting cycles -journal, ledger and trial balance – preparation of trading account, profit and loss account, balance sheet – ratio analysis

MODULE III CASH FLOW AND FUND FLOW 08

Cash flow statement, meaning and concepts of fund flow & cash flow, difference between fund flow statement and income statement. preparation fund flow & cash flow statement

MODULE IV BUDGETS 09

Types of budgets-techniques for budgeting, preparation of cash budget and flexible budget

MODULE V COST ACCOUNTING 12

Cost - meaning and objective, elements of cost - marginal costing - cost-volume profit analysis- breakeven point. Application of marginal costing techniques to managerial decision making

Total Hours: 45

REFERENCES

1. Maheswari S. N., Suneel K Maheswari and Sharad K Maheswari, “A Text Book of Accounting for management”, Vikas publishing house pvt. Ltd., Noida, 2013
2. Shashi K Gupta and Sharma R K, “ Management Accounting – Principles and practice”, Kalyani publishers, Ludiana, 2013
3. Reddy T S and Murthy A, “Financial Accounting” Margham Pucblications, 2012
4. S.P. JainJain and K.L. Narang, “Cost Accounting Principles and Practice” Kalyani publishers, 2012

OUTCOME

At the end of the course the students will be able to

- ascertain profitability of construction company
- depict the financial position of construction company
- prepare Cash Budget and flexible budget
- take managerial decisions by applying Marginal costing techniques

CECY224	GREEN BUILDING AND ENERGY EFFICIENT STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVE:

To impart the knowledge on

- design of energy efficient buildings which balances all aspects of energy lighting.
- space conditioning
- ventilation by providing a mix of passive solar design strategies
- use of materials with low embodied energy.

MODULE I INTRODUCTION 09

Energy required for building construction - heat transfer – measuring conduction – thermal storage – measurement of radiation – the green house effect – psychrometry chart – measuring latent and sensible heat. thermal comfort – site planning and development – temperature – humidity – wind – optimum site location sun protection – types of shading devices – conservation – heating and cooling loads - igbc's rating systems - sustainable sights - water efficiency - energy efficiency - materials and resources - indoor environmental quality.

MODULE II PASSIVE SOLAR HEATING AND COOLING 09

General principles of passive solar heating – key design elements - direct gain trombe walls, water walls, convective air loops – concepts – case studies – general principles of passive cooling – ventilation – predicting ventilation in building-window ventilation calculations - radiation – evaporation and dehumidification–mass effect–load control – air filtration and odour removal – heat recovery in large buildings

MODULE III DAYLIGHTING AND ELECTRICAL LIGHTING 09

Materials, components and details - insulation – optical materials – radiant barriers glazing materials - day lighting – sources and concepts – building design strategies – case studies – electric lighting –light distribution – electric lighting control for day lighted buildings – illumination requirement – components of daylight factor – recommended daylight factors – day lighting analysis – supplementary artificial lighting design

MODULE IV HEAT CONTROL AND VENTILATION 09

Requirements – heat transmission through building sections – thermal performance of building sections – orientation of buildings – building characteristics

for various climates – thermal design of buildings influence of design parameters – mechanical controls – examples. ventilation – requirements – minimum standards for ventilation – ventilation design – energy conservation in ventilating systems – design for natural ventilation.

MODULE V DESIGN FOR CLIMATIC ZONES 09

Energy efficiency – an overview of design concepts and architectural interventions – energy efficient buildings for various zones – cold and cloudy – cold and sunny – composite – hot and dry – moderate – warm and humid – case studies of residences, office buildings and other buildings in each zones – energy audit – certification.

Total Hours: 45

REFERENCES:

1. Moore F., Environmental Control system, Mc Graw Hill Inc., 1994.
2. Brown, GZ Sun, Wind and Light: Architectural design strategies, John Wiley,1985.
3. Cook. J, Award –Winning passive Solar Design, Mc-Graw Hill, 1984.

OUTCOME:

At the end of the course, the students will be able to

- identify the required energy for building construction.
- design and analyse the passive solar cooling and heating techniques.
- identify the required amount of daylight and electrical lighting for a building.
- analyse the ventilation and thermal design of a building.
- design a specific type of building for special climatic zones.

CECY225	GREEN CONCEPTS IN BUILDING ENVIRONMENT	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To impart the knowledge on Green buildings concept ,indoor environment quality and economics of green building

MODULE I DEFINING "GREEN" AND "SUSTAINABILITY" 06

Green Design – concepts and definitions - sustainability begins with climate - recent upsurge in the green building movement -incentives for building green - incentives and tax deductions-green building programs -defining sustainable communities- emerging directions- liability - spectacular landmarks

MODULE II DESIGN STRATEGIES AND THE GREEN DESIGN PROCESS 10

Conventional versus Green Delivery Systems- green design strategies- The Integrated Design Process (IDP) -the green-building project delivery process- the integrated multidisciplinary project team - design process for high-performance buildings -sustainable site selection-general considerations- site selection - development density and community connectivity -brownfield redevelopment - alternative transportation -site development –storm water design-heat-island effect - light-pollution reduction -commissioning process -overview -fundamental commissioning –retro commissioning -enhanced commissioning -cost management

MODULE III GREEN MATERIALS AND PRODUCTS 10

General- green building materials - natural versus synthetic - storage and collection of recyclables- low-emitting materials -adhesives, finishes, and sealants -paints and coatings- flooring systems- earthen building materials- windows - miscellaneous building elements- roofing – wood - concrete - building and material reuse - building reuse -materials reuse- construction waste management-recycled materials- regional materials- rapidly renewable materials- bamboo-cork - insulation- linoleum- straw-bale construction-wheat board - use and selection of green office equipment- certified wood- life-cycle assessment of building materials and products- life-cycle cost analysis- third party certification

MODULE IV INDOOR ENVIRONMENTAL QUALITY (IEQ) & WATER EFFICIENCY 10

IEQ- general overview - indoor environmental quality and factors affecting the indoor environment -indoor-air quality -thermal comfort -noise pollution -day lighting and daylight factor (df) -ventilation and filtration -building materials and finishes emittance levels- water efficiency and sanitary waste- general issues- waste-water strategy: water reuse/recycling water- efficient landscaping – innovative wastewater technologies -water-use reduction- construction waste management- water fixtures and conservation strategies- toilets - urinals –faucets -shower heads -baseline water-consumption calculations- retention ponds, bio swales, and other systems

MODULE V ECONOMICS OF GREEN DESIGN 09

General Overview - costs and benefits of green design- the economic benefits of green buildings - cost considerations- life-cycle costing -life-cycle cost method - increased productivity - improved tenant/employee health -enhancement of property value and marketability - other indirect benefits external economic effects - increased recruitment and retention -tax benefits -miscellaneous green-building costs -energy costs- operation, maintenance, and repair costs -replacement costs - other costs - design and analysis tools and methods - present-value analysis - sensitivity analysis -breakeven analysis - computer programs - relevant codes and standards - liability issues - general overview -traditional litigation: pretrial and trial procedures -alternative dispute resolution

Total Hours :45

REFERENCES:

1. “LEED - Practices, Certification andAccreditation Handbook”. Sam kubba Ph.D., LEED AP
2. “Alternative Building Materials and Technologies”. K.S.Jagadish, B. U. Venkataramareddy and K. S. Nanjundarao New Age International, 2007.
3. “ Low Energy Cooling For Sustainable Buildings”. John Wiley and Sons Ltd, 2009.

OUTCOME:

At the end of the course, students will able to

- identify the basic concepts in green and sustainability.
- design and implement green building concepts in high rise buildings.
- identify various green materials and products in construction.

- analyze the indoor environmental quality and water efficiency of building.
- design the perform economic analysis of a green building.

CECY226	INFRASTRUCTURE PLANNING AND MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVE:

To impart knowledge on

- basic understanding of Infrastructure's impact on development of a country
- status of various sectors in Indian Infrastructure
- private Sector participation in infrastructure models
- infrastructure planning
- problems in infrastructure development and management

MODULE I BASIC CONCEPTS RELATED TO INFRASTRUCTURE. 09

Introduction to Infrastructure. -Power Sector - Water Supply and Sanitation Sector - Road, Rail, Air and Port Transportation Sectors - Telecommunications Sector - Urban Infrastructure - Rural Infrastructure - Special Economic Zones. - Organizations and Players in the field of Infrastructure. - The Stages of an Infrastructure. Project Lifecycle.- An Overview of Infrastructure Project Finance.

MODULE II PRIVATE INVOLVEMENT IN INFRASTRUCTURE 09

A Historical overview of infrastructure privatization. - the benefits -problems with infrastructure privatization - pre – requisites necessary to ensure success for switching over from public sector management to private sector management, issues in developing, funding and managing infrastructure projects, role, and responsibility of project management consultants. challenges in privatization of water supply - case study - challenges in privatization of power - privatization of road transportation infrastructure in india.

MODULE III CHALLENGES TO SUCCESSFUL INFRASTRUCTURE PLANNING AND IMPLEMENTATION 09

Mapping and facing the landscape of risks in infrastructure projects.-economic and demand risks: political risks -socio-environmental risks – case study - cultural risks in international infrastructure projects- legal and contractual issues in infrastructure .challenges in construction and maintenance of infrastructure

MODULE IV STRATEGIES FOR SUCCESSFUL INFRASTRUCTURE PROJECT IMPLEMENTATION 09

Risk management framework for infrastructure projects - shaping the planning phase of infrastructure projects to mitigate risks-designing sustainable contracts-introduction to fair process and negotiation. negotiating with multiple stakeholders

on infrastructure projects - sustainable development of infrastructure.

MODULE V INFRASTRUCTURE MANAGEMENT 09

Information technology and systems for successful infrastructure management - innovative design and maintenance of infrastructure facilities-infrastructure modelling and life cycle analysis techniques - capacity building and improving the governments role in infrastructure implementation - an integrated framework for successful infrastructure planning and management - infrastructure management systems and future directions.

Total Hours: 45

REFERENCES:

1. Alvin S. Goodman, P.E , Makarand Hastak, Infrastructure Planning Handbook Planning, Engineering, and Economics, ASCE Press, 2006.
2. Raghuram, G., Jain, R., Sinha, S., Pangotra, P., Morris, S., Infrastructure Development and Financing: Towards a Public-Private Partnership, MacMillan, 2000.
3. Weber, B., & Alfen, H.W., Infrastructure as an asset class - Investment strategies, project finance and PPP, West Sussex: John Wiley & Sons, 2010.

OUTCOME:

At the end of the course the students will be able to

- classify the various types of infrastructure systems, stages and players in the field.
- summarize the influence of private partnership in infrastructure development
- discover the various risks involved in the infrastructure projects
- develop a successful Infrastructure project implementation strategy
- recommend successful infrastructure management systems for a given condition

CECY227 SHORING, SCAFFOLDING AND FORMWORK

L	T	P	C
3	0	0	3

OBJECTIVE:

To impart knowledge on

- Planning of formwork, plant and site equipments required for formwork.
- Design and erection of forms for various elements such as slabs, beams, columns, walls, shells and tunnels.
- Advanced methods of form construction.

MODULE I PLANNING, SITE EQUIPMENT & PLANT FOR FORM WORK **09**

Introduction - forms for foundations, columns, beams and walls - general objectives of formwork building - planning for safety - development of a basic system - key areas of cost reduction - planning examples. Overall planning - detailed planning - labour requirement - costing - planning crane arrangements - site layout plan - transporting plant - formwork accessories.

MODULE II MATERIALS ACCESSORIES & PRESSURES **09**

Lumber - types - finish - sheathing boards working stresses - repetitive member stress - plywood - types and grades - jointing boarding - textured surfaces and strength - reconstituted wood - steel - aluminum - hardware and fasteners - nails in plywood - allowable withdrawal load and lateral load - pressures on formwork with examples.

MODULE III DESIGN OF FORMS AND SHORES **09**

Basic simplification - beam formulae - allowable stresses - deflection, bending - lateral stability - shear, bearing - design of wall, slab, beam and column forms - simple wood stresses - slenderness ratio - allowable load vs length behaviour of wood shores - form lining design tables for wall, slab and column formwork - slab props - rosett shoring - shoring tower - heavy duty props.

MODULE IV BUILDING AND ERECTING THE FORM WORK **09**

Carpentry shop and job mill - forms for footings – wall, column, sloped, strap and stepped footing - slab form systems - sky deck and multiflex - customized slab table - standard table module forms - swivel head and uniportal head - assembly sequence cycling with lifting fork - moving with table trolley and table prop. various causes of failures.

MODULE V FORMS FOR DOMES AND TUNNELS, SLIP FORMS AND SCAFFOLDS 09

Hemispherical, parabolic, translational shells - forms for thin shell roof slabs design considerations - building the forms - placing concrete - forms removal -strength requirements -tunnel forming components - curb forms invert forms - arch forms - concrete placement methods - cut and cover construction, bulk head method - pressures on tunnels - continuous advancing slope method - slip forms – principles, types, advantages and functions of various components - planning -desirable characteristics of concrete - common problems faced - safety in slip forms - special structures built with slip form technique - types of scaffolds - putlog and independent scaffold, single pole scaffolds, truss suspended, gantry and system scaffolds.

Total Hours: 45

REFERENCES:

1. Austin, C.K., Formwork for Concrete, Cleaver -Hume Press Ltd., London, 1996.
2. Hurd, M.K., Formwork for Concrete, Special Publication No.4, American Concrete Institute, Detroit, 1996.
3. Michael P. Hurst, Construction Press, London and New York, 2003.
4. Robert L. Peurifoy and Garold D. Oberlender, Formwork For Concrete Structures, McGraw - Hill, 1996.
5. “Safety requirements for scaffolding”, American National Standards Institute, New York, 1994.

OUTCOME:

On completion of this course the students will be able to

- plan for the formwork accessories.
- identify the required materials and their properties of the formwork.
- design and construct formwork for various structural elements.
- built and erect formwork in different conditions.
- design formwork for domes, tunnels and scaffolds.

CECY228 AFFORDABLE HOUSING

L	T	P	C
3	0	0	3

OBJECTIVE:

- To impart knowledge on low cost housing technology and infrastructure services.

MODULE I HOUSING SCENARIO 09

Status of urban housing- status of rural housing. **Housing finance:** introducing- existing finance system in india- government role as facilitator- status at rural housing finance- impedimently in housing finance and related issues

MODULE II LAND USE AND PHYSICAL PLANNING FOR HOUSING: 09

Planning of urban land- urban land ceiling and regulation act- efficiency of building bye laws -residential densities. **Housing the Urban Poor:** living conditions in slums- approaches and strategies for housing urban poor.

MODULE III DEVELOPMENT AND ADOPT ON OF LOW COST HOUSING TECHNOLOGY 09

Adoption of innovative cost effective construction techniques- adoption of precast elements in partial prefabrication- adopting of total prefabrication of mass housing in india- general remarks on pre cast rooting/flooring systems- economical wall system- single brick thick loading bearing wall- 19cm thick load bearing masonry walls- half brick thick load bearing wall- fly ash, gypsum thick for masonry- stone block masonry- adoption of precast r.c. plank and join system for roof/floor in the building. alternative building materials for low cost housing: substitute for scarce materials- ferro cement- gypsum boards- timber substitutions- industrial wastes- agricultural wastes

MODULE IV LOW COST INFRASTRUCTURE SERVICES 09

Present status- technological options- low cost sanitation’s- domestic wall- water supply energy. rural housing: introduction- traditional practice of rural housing continuous- mud housing technology- mud roofs- characteristics of mud- fire resistant treatment for thatched roof- soil stabilization- rural housing programs.

MODULE V HOUSING IN DISASTER PRONE AREAS 09

Earthquake- damages to houses- traditional houses in disaster prone areas type of damages and railways of non-engineered buildings- repair and restore action of earthquake damaged non-engineered buildings recommendations for future

constructions- requirement's of structural safety of thin precast roofing units against - earthquake forces- status of r&d in earthquake strengthening measures- floods- cyclone- future safety.

Total Hours : 45

REFERENCES:

1. Building materials for low –income houses – International council for building research studies and documentation.
2. Low-Cost Housing in Developing Countries, Guru Charan Mathur, Oxford & IBH Publishing Company, 01-Jan-1993
3. Goodman L J.Low Cost Housing Technology : East - West Perspectives, Pergatmon Press, 1981
4. Hand book of low cost housing - by A. K. Lal – Newage international publishers, 2003

OUTCOME:

At the end of the course, students will able to

- describe the scenario of low cost housing and its financing.
- create a plan for housing the urban poor.
- define the types of low cost housing technology used.
- state the services to be provided in low cost housing.
- identify the types of low cost house to be provided in different disaster prone areas.

CECY229	APPLICATION OF INFORMATION TECHNOLOGY IN INFRASTRUCTURE MANAGEMENT	L	T	P	C
		1	0	2	2

OBJECTIVE:

- To impart knowledge on softwares and applications to manage Infrastructure.

MODULE I INTRODUCTION 08

Introduction to system hardware – languages – feasibility study and analysis – procurement, training, implementation and system management – procedural language - developing application with spread sheet -developing application with files and database software.

MODULE II BUILDING INFORMATION MODELING SOFTWARE 12

Introduction to BIM Software - application to enhance efficiency during and post construction phases, and facility management - applications like determination of quantities of items and material inventory - to build a building virtually prior to building it physically - work out problems and simulate and analyze potential impacts - anticipation and ease of project delivery, the overall safety of the project – introduction to navis works

MODULE III CONSTRUCTION ACCOUNTING 10

Accounting and cost engineering– enterprises – introduction to erp systems - operations simulation financial management- for use of tracking and developing the cost reports and issuing the change orders - computer applications – cash flow – case study

Total Hours: 30

REFERENCES:

1. Bily E. Gillet., Introduction to Operation Research - A Computer Oriented Algorithmic Approach, Tata McGraw Hill, 1990.Inc., 1999.
2. Paulson, B.R., Computer Applications in Construction, McGraw Hill, 2014.
3. Patti Feldman and William Feldman,Construction and Computers,McGraw Hill, 1996.

OUTCOME:

At the end of the course the student will be able to

- manage the database of a project/ organization using database softwares.
- define the application of BIM in construction industry.
- perform accounting using ERP softwares.

CECY 65 COST ESTIMATION AND CONTROL

L	T	P	C
2	0	0	2

OBJECTIVE:

To provide knowledge on

- Cost estimation
- Cost control

MODULE I ESTIMATING AND TENDERING 06

Introduction to estimating and tendering–estimation in large and small organizations- parties involved in estimating and tendering – estimating process – decision to tender –programming the estimate

MODULE II COST ESTIMATION 08

Collection and calculation of cost information – labor – materials – equipment – subcontractors – project study – preparing the estimates – types of estimates – site overheads – estimators reports – tendering adjustments.

MODULE III MANAGEMENT CONTRACT & USE OF SOFTWARE 08

Estimating in management contracting –management contractor's fee – use of estimating software – characteristics of estimating systems – methods of estimating – reports

MODULE IV BUDGETARY CONTROL 08

The Project budget–types of budget – classifications of costs – example of budgetary control - cost control problem – need for cash flow forecasting by contractors – requirements of a forecasting system - forecasting for activity cost control - control of project cash flows - relating cost and schedule information.

Total Hours: 30

REFERENCES:

1. Chris Hendrickson and Tung Au, Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2000.
2. Calin M. Popescu, Chotchai Charoenngam, Project Planning, Scheduling and Control in Construction: An Encyclopedia of terms and Applications, Wiley, New York, 1995.
3. Frank Harris & Ronald McCaffer with Francis Edum – Fotwe, Modern

Construction Management, Sixth Edition, Blackwell Publishing, 2006.
4. Halpin, D. W., Financial and Cost Concepts for Construction Management, John Wiley & Sons, New York, 1985.

OUTCOME:

Upon completion of the course, the student will be able to

- summarize the estimating and tendering process of a project.
- explain the cost estimation process and also estimate a small construction project.
- demonstrate the use of estimation software.
- apply budget controls for a construction project.
- apply cost control techniques to monitor a construction project

CECY231	CONSTRUCTION RISK MANAGEMENT	L	T	P	C
		1	0	0	1

OBJECTIVE:

- To impart the knowledge of risk management in construction projects.

MODULE I INTRODUCTION TO RISK MANAGEMENT 08

Definitions of risk - elements of risk management - causes of risk - components of risk management - planning for risk management – project charter – risk management policies, roles and responsibilities, examining stakeholder tolerance, risk management plan template – revisiting the work breakdown structure – risk management plan, creating the risk management plan, risk analysis, tracking.

MODULE II RISK IDENTIFICATION, RESPONSE AND COMMUNICATION 07

Identifying risk, preparing for risk identification, risk categories, referring to historical information – identifying the project risk – reviewing project documents, brainstorming, the delphi technique, analyzing swot – diagrammatic techniques - examining the results of risk identification, qualitative and quantitative risk analysis - preparing for risk response, creating risk response, results of risk response planning. risk monitoring and control - risk communication, informing public about risk and responding to expressed concerns, education.

Total Hours: 15

REFERENCES:

1. Bruce Barkley, Project Risk Management (Project Management), McGraw-Hill Professional, 2004
2. John R. Schuyler, Risk and Decision Analysis in Projects (Cases in project and program management series), Project Management Institute, 2002
3. Chris Chapman and Stephen Ward, Project Risk Management: Processes, Techniques and Insights, Wiley, 2003
4. Dale F. Cooper, Stephen Grey, Geoffrey Raymond, and Phil Walker, Project Risk Management Guidelines: Managing Risk in Large Projects and Complex Procurements, Wiley, 2004
5. James B. Atkins and Grant A. Simpson, Managing Project Risk: Best Practices for Architects and Related Professionals, Wiley, 2008

OUTCOME:

At the end of the course student will be able to

- define the risks in a project and its management.
- compute the risk mitigation strategies for a project.

GENERAL ELECTIVES

GECY101	PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The objectives of the course would be to make the students

- Learn to evaluate and choose an optimal project and build a project profile.
- Attain knowledge on risk identification and risk analysis
- Gain insight into a project plan and components
- Familiar with various gamut of technical analysis for effective project implementation
- Learn to apply project management techniques to manage resources.

MODULE I INTRODUCTION & PROJECT INITIATION 09

Introduction to project and project management - projects in contemporary organization – The project life cycle - project initiation - project evaluation methods & techniques - project selection criteria - project profile.

MODULE II RISK ANALYSIS 09

Sources of risk: project specific - competitive - industry specific - market and international risk – perspectives of risk – risk analysis: sensitivity analysis - scenario analysis - breakeven analysis - simulation analysis - decision tree analysis – managing/mitigating risk – project selection under risk.

MODULE III PROJECT PLANNING & IMPLEMENTATION 09

Project planning – importance – functions - areas of planning - project objectives and policies - steps in planning process - WBS – capital requirements - budgeting and cost estimation - feasibility analysis - creation of project plan – project implementation: pre-requisites - forms of project organization

MODULE IV TECHNICAL ANALYSIS 09

Technical analysis for manufacturing/construction/infrastructure projects – process/technology - materials and inputs - product mix - plant capacity – plant location and site selection – plant layout - machinery and equipment – structures and civil works – schedule of project implementation – technical analysis for software projects.

MODULE V PROJECT MANAGEMENT TECHNIQUES 09

Project scheduling - network construction – estimation of project completion time – identification of critical path - PERT & CPM – crashing of project network - complexity of project scheduling with limited resources - resource allocation - resource leveling – resource smoothing – overview of project management software.

Total Hours: 45

REFERENCES:

1. Projects: Planning, Analysis, Financing, Implementation and Review, Prasanna Chandra, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2004.
2. Project Management and Control, Narendra Singh, Himalaya Publishing, New Delhi, 2015.
3. A Management Guide to PERT/CPM, Jerome, D. Weist and Ferdinand K. Levy, Prentice Hall of India, New Delhi, 1994.

OUTCOMES:

On successfully completing this course, the student will be able to:

- Evaluate & select a project as well as develop a project profile.
- Identify various risks associated with the project and manage it effectively.
- Prepare a detailed project plan addressing its components.
- Perform technical analysis for effective project implementation
- Apply project management techniques for maximizing resource utilization.

GECY102 SOCIETY, TECHNOLGY & SUSTAINABILITY

L	T	P	C
3	0	0	3

OBJECTIVES:

- Aware of new technologies through advances in Science and Engineering.
- To make them realise the profound impact on society.
- Understand the ethical issues raised by technological changes and its effect on society.
- To introduce students a broad range of perspectives on the adoption and use of technologies.
- To make them realize the need of sustainability in the context of emerging technologies.

MODULE I TECHNOLOGY AND ITS IMPACTS 09

Origin and evolution of technologies – Nature of technology- Innovation – Historical Perspective of technology – Sources of technological change - Co-evolution of technology and economy – Scientific knowledge and technological advance – Science and Engineering aspects of Technology – Impact on the Society – Social and Ethical Issues associated with technological change – Social and environmental consequences - Impact of technological change on human life – Technology and responsibility – Technology and social justice.

MODULE II TECHNOLOGY AND ITS ADVANCEMENT 09

Sociological aspects of technology – Ethics and technology – Technology and responsibility – International Economics, Globalisation and Human Rights – Sustainability and Technology – Population and environment - Technology, Energy and Environment – Organisations and technological change.

MODULE III SOCIETY AND TECHNOLOGY 09

Impact of technologies on contemporary society – Role of society in fostering the development of technology – Response to the adaption and use of technology – Impact of technology on developer and consumers – Technological change and globalisation.

MODULE IV IMPACT OF A SPECIFIC TECHNOLOGY ON HUMAN WELFARE 09

Impact of the following technologies on Human life – Medical and Biomedical – Genetics Technology – Electronics and Communications – Electronic media Technology – Information Systems Technology – Nanotechnology – Space

Technology and Energy Technology.

MODULE V THE IMPORTANCE OF SUSTAINABILITY 09

Sustainability – A brief history – Concepts and contexts for sustainability – Ecological imbalance and biodiversity loss – Climate change – Population explosion. Industrial ecology – systems approach to sustainability – Green engineering and technology- sustainable design- sustainable manufacturing- Green consumer movements – Environmental ethics – Sustainability of the planet Earth – Future planning for sustainability.

Total Hours: 45

REFERENCES:

1. Volti Rudi, “Society and Technology Change”, 6th Edition, Worth publishers Inc, USA, 2009.
2. Arthur W.A, “The nature of Technology: What it is and how it evolves”, Free Press, NY, USA, 2009.
3. Winston M and Edelbach R, “Society, Ethics and Technology”, 3rd Edition, San Francisco, USA, 2005.
4. Martin A.A Abraham, “Sustainability Science and Engineering: Defining Principles”, Elsevier Inc, USA, 2006.
5. R.V.G.Menon, “Technology and Society”, Pearson Education, India, 2011.

OUTCOMES:

At the end of this course, the students will be able to

- Understand the benefits of modern technology for the well-being of human life.
- Connect sustainability concepts and technology to the real world challenges.
- Find pathway for sustainable society.

GECY103 ARTIFICIAL INTELLIGENCE

L	T	P	C
3	0	0	3

OBJECTIVES:

- Expose the history and foundations of artificial intelligence.
- Showcase the complexity of working on real time problems underlying the need for intelligent approaches.
- Illustrate how heuristic approaches provide a good solution mechanism.
- Provide the mechanisms for simple knowledge representation and reasoning.
- Highlight the complexity in working with uncertain knowledge.
- Discuss the current and future applications of artificial intelligence.

MODULE I HISTORY AND FOUNDATIONS 08

History – Scope – Influence from life – Impact of computing domains - Agents in environments - Knowledge representation – Dimensions of Complexity – Sample application domains – Agent structure.

MODULE II SEARCH 10

Problem solving as search – State spaces – Uninformed Search – Heuristic search – Advanced search – Constraint satisfaction - Applications.

MODULE III KNOWLEDGE REPRESENTATION AND REASONING 10

Foundations of knowledge representation and reasoning, representing and reasoning about objects, relations, events, actions, time, and space predicate logic, situation calculus, description logics, reasoning with defaults, reasoning about knowledge, sample applications.

MODULE IV REPRESENTING AND REASONING WITH UNCERTAIN KNOWLEDGE 08

Probability, connection to logic, independence, Bayes rule, Bayesian networks, probabilistic inference, sample applications.

MODULE V CASE STUDY AND FUTURE APPLICATIONS 09

Design of a game/Solution for problem in student's domain. Natural Language processing, Robotics, Vehicular automation – Scale, Complexity, Behaviour – Controversies.

Theory: 45

TEXT BOOK:

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall, Third Edition, 2010.
2. David Poole, Alan Mackworth, Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010.
3. Nils J. Nilsson, The Quest for Artificial Intelligence, Cambridge University Press, Online edition, 2013.
4. Keith Frankish, William M. Ramsey (eds) The Cambridge Handbook of Artificial Intelligence, Cambridge University Press, 2014.

OUTCOMES:

Students who complete this course will be able to

- Discuss the history, current applications, future challenges and the controversies in artificial intelligence.
- Apply principle of AI in the design of an agent and model its actions.
- Design a heuristic algorithm for search problems.
- Analyze and represent the fact using logic for a given scenario
- Represent uncertainty using probabilistic models
- Develop a simple game or solution using artificial intelligence techniques.

GECY104 GREEN COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To focus on the necessity of green computing technology.
- To expose to various issues with information technology and sustainability.
- To attain knowledge on the technologies for enabling green cloud computing.
- To elaborate on the energy consumption issues
- To illustrate a Green and Virtual Data Center
- To develop into a Green IT Technologist.

MODULE I INTRODUCTION 08

Trends and Reasons to Go Green - IT Data Center Economic and Ecological Sustainment - The Growing Green Gap: Misdirected Messaging, Opportunities for Action - IT Data Center “Green” Myths and Realities - PCFE Trends, Issues, Drivers, and Related Factors - Green Computing and Your Reputation- Green Computing and Saving Money- Green Computing and the Environment

MODULE II CONSUMPTION ISSUES 10

Minimizing power usage – Cooling - Electric Power and Cooling Challenges - Electrical – Power -Supply and Demand Distribution - Determining Energy Usage - From Energy Avoidance to Efficiency - Energy Efficiency Incentives, Rebates, and Alternative Energy Sources - PCFE and Environmental Health and Safety Standards- Energy-exposed instruction sets- Power management in power-aware real-time systems.

MODULE III NEXT-GENERATION VIRTUAL DATA CENTERS 09

Data Center Virtualization - Virtualization beyond Consolidation - Enabling Transparency - Components of a Virtual Data Center - Datacenter Design and Redesign - Greening the Information Systems - Staying Green- Building a Green Device Portfolio- Green Servers and Data Centers- Saving Energy

MODULE IV TECHNOLOGIES FOR ENABLING GREEN AND VIRTUAL DATA CENTERS 08

Highly Effective Data Center Facilities and Habitats for Technology - Data Center Electrical Power and Energy Management - HVAC, Smoke and Fire Suppression

- Data Center Location - Virtual Data Centers Today and Tomorrow - Cloud Computing, Out-Sourced, and Managed Services.

MODULE V SERVERS AND FUTURE TRENDS OF GREEN COMPUTING 10

Server Issues and Challenges - Fundamentals of Physical Servers - Types, Categories, and Tiers of Servers - Clusters and Grids - Implementing a Green and Virtual Data Center - PCFE and Green Areas of Opportunity- 12 Green Computer Companies- What's in Green computer science-Green off the Grid aimed for data center energy evolution-Green Grid Consortium- Green Applications- Green Computing Making Great Impact On Research

Theory: 45

REFERENCES:

1. Bud E. Smith,"Green Computing Tools and Techniques for Saving Energy, Money, and Resources", Taylor & Francis Group, CRC Press, ISBN-13: 978-1-4665-0340-3, 2014.
2. Jason Harris, "Green Computing and Green IT Best Practices, On Regulations and Industry Initiatives, Virtualization and power management, materials recycling and Tele commuting, Emereo Publishing .ISBN-13: 978-1-9215-2344-1,2014.
3. Ishfaq Ahmed & Sanjay Ranka, "Handbook of Energy Aware and Green Computing", CRC Press, ISBN: 978-1-4665-0116-4, 2013.
4. Kawahara, Takayuki, Mizuno, "Green Computing with Emerging Memory", Springer Publications, ISBN:978-1-4614-0811-6, 2012
5. Greg Schulz, "The Green and Virtual Data Center", CRC Press, ISBN-13:978-1-4200-8666-9, 2009.
6. Marty Poniatowski, "Foundation of Green IT: Consolidation, Virtualization, Efficiency, and ROI in the Data Center", Printice Hall, ISBN: 9780-1-3704-375-0, 2009.

OUTCOMES:

Students who complete this course will be able to

- Demonstrate issues relating to a range of available technologies, systems and practices to support green computing.
- Select appropriate technologies that are aimed to reduce energy consumption.
- Address design issues needed to achieve an organizations' green

computing objectives.

- Analyze the functionality of Data Centers.
- Critically evaluate technologies and the environmental impact of computing resources for a given scenario.
- Compare the impact of Green Computing with other computing techniques.

GECY105 GAMING DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To master event-based programming
- To learn resource management as it relates to rendering time, including level-of-detail and culling.
- To become familiar with the various components in a game or game engine.
- To explore leading open source game engine components.
- To become familiar of game physics.
- To be compatible with game animation.

MODULE I INTRODUCTION 09

Magic Words – What Skills Does a Game Designer Need? – The Most Important Skill -The Five Kinds of Listening-The Secret of the Gifted.

MODULE II THE DESIGNER CREATES AN EXPERIENCE 09

The Game Is Not the Experience -Is This Unique to Games? -Three Practical Approaches to Chasing Rainbows -Introspection: Powers, Perils, and Practice -Dissect Your Feelings -Defeating Heisenberg -Essential Experience.

MODULE III THE EXPERIENCE IN THE PLAYER MIND AND GAME MECHANICS 08

Modeling – Focus -Empathy – Imagination – Motivation – Space – Objects, Attributes, and States – Actions – Rules.

MODULE IV GAMES THROUGH AN INTERFACE 09

Breaking it Down – The Loop of Interaction – Channels of Information – Other Interface.

MODULE V BALANCED GAME MECHANICS 10

Balance – The Twelve Most Common Types of Game Balance – Game Balancing Methodologies - Balancing Game Economies.

Theory: 45

REFERENCES:

1. Jesse Schell, "The Art of Game Design: A Book of Lenses", Second Edition 2nd Edition ISBN-10: 1466598646, 2014.
2. Ashok Kumar, Jim Etheredge, Aaron Boudreaux, “Algorithmic and Architectural Gaming Design: Implementation and Development", 1st edition, Idea Group, U.S ISBN-10: 1466616342, 2012.
3. Katie Salen Tekinba, Melissa Gresalfi, Kylie Peppler, Rafi Santo, "Gaming the System - Designing with Gamestar Mechanic" MIT Press , ISBN-10: 026202781X, 2014.
4. James M. Van Verth, Lars M. Bishop "Essential Mathematics for Games and Interactive Applications", Third Edition,A K Peters/CRC Press, ISBN-10: 1482250926, 2015.

OUTCOMES:

Students who complete this course will be able to

- Realize the basic history and genres of games
- Demonstrate an understanding of the overall game design process
- Explain the design tradeoffs inherent in game design
- Design and implement basic levels, models, and scripts for games
- Describe the mathematics and algorithms needed for game programming
- Design and implement a complete three-dimensional video game

GECY106 SOCIAL COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To create original social applications, critically applying appropriate theories and effective practices in a reflective and creative manner.
- To critically analyze social software in terms of its technical, social, legal, ethical, and functional features or affordances.
- To encourage the development of effective communities through the design, use, and management of social software.
- To give students with a base of knowledge and advances for them to critically examine existing social computing services.
- To plan and execute a small-scale research project in social computing in a systematic fashion.
- To become familiar with the concept of computational thinking.

MODULE I BASIC CONCEPTS 09

Networks and Relations: Relations and Attributes, Analysis of Network Data, Interpretation of network data -New Social Learning – Four Changes that Shift Work - Development of Social Network Analysis: Sociometric analysis and graph theory, Interpersonal Configurations and Cliques – Analysing Relational Data.

MODULE II SOCIAL LINK 09

Individual Actors, Social Exchange Theory, Social Forces, Graph Structure, Agent Optimization Strategies in Networks – Hierarchy of Social Link Motivation- Social Context.

MODULE III SOCIAL MEDIA 08

Trends in Computing – Motivations for Social Computing – Social Media: Social relationships, Mobility and Social context – Human Computation – Computational Models- Business use of social Media.

MODULE IV SOCIAL INFORMATION FILTERING 09

Mobile Location Sharing – Location based social media analysis – Social Sharing and Social Filtering – Automated recommender Systems – Traditional and Social Recommender Systems.

MODULE V SOCIAL NETWORK STRATEGY 10

Application of Topic Models – Opinions and Sentiments – Recommendation Systems – Language Dnamics and influence in online communities – Psychometric analysis – Case Study: Social Network Strategies for surviving the zombie apocalypse.

Theory: 45

REFERENCES:

1. Tony Bingham, Marcia Conner, “The New Social Learning, 2nd Edition: Connect. Collaborate. Work”, 2nd Edition, ATD Press, ISBN-10:1-56286-996-5, 2015.
2. Nick Crossley, Elisa Bellotti, Gemma Edwards, Martin G Everett, Johan Koskinen, Mark Tranmer, “Social Network Analysis for Ego-Nets”, SAGE Publication, 2015.
3. Zafarani, Abbasi and Liu, Social Media Mining: An Introduction, Cambridge University Press, 2014.
4. Christina Prell, “Social Network Analysis: History, Theory and Methodology”, 1st Edition, SAGE Publications Ltd, 2012.
5. John Scott, “Social Network Analysis”, Third Edition, SAGE Publication, 2013.
6. Jennifer Golbeck, “Analyzing the Social Web”, Elsevier Publication, 2013.
7. Huan Liu, John Salerno, Michael J. Young, “Social computing and Behavioral Modeling”, Springer Publication, 2009.

OUTCOMES:

Students who complete this course will be able to

- Realize the range of social computing applications and concepts.
- Analyze data left after in social media.
- Recognize and apply the concepts of computational models underlying social computing.
- Take out simple forms of social diagnostics, involving network and language models, applying existing analytic tools on social information.
- Evaluate emerging social computing applications, concepts, and techniques in terms of key principles.
- Design and prototype new social computing systems.

GECY107 SOFT COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To become familiar with AI and neural networks that can learn from available examples and generalize to form appropriate rules for inferencing systems.
- To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience.
- To provide the mathematical background for carrying out the optimization associated with neural network learning.
- To familiarize with genetic algorithms and other random search procedures useful while seeking global optimum in self-learning situations.
- To introduce case studies utilizing the above and illustrate the intelligent behavior of programs based on soft computing.

MODULE I INTRODUCTION 09

Introduction of soft computing, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing. Artificial Intelligence : Introduction, Various types of production systems, characteristics of production systems, breadth first search, depth first search techniques, other Search Techniques like hill Climbing, Best first Search, A* algorithm, AO* Algorithms and various types of control strategies. Knowledge representation issues, Prepositional and predicate logic, monotonic and non-monotonic reasoning, forward Reasoning, backward reasoning.

MODULE II INTRODUCTION TO NEURAL NETWROK 09

Structure and Function of a single neuron: Biological neuron, artificial neuron, definition of ANN, Taxonomy of neural net, Difference between ANN and human brain, characteristics and applications of ANN, single layer network, Perceptron training algorithm, Linear separability, Widrow & Hebb"s learning rule/Delta rule, ADALINE, MADALINE, AI v/s ANN. Introduction of MLP, different activation functions, Error back propagation algorithm, derivation of BPA, momentum, limitation, characteristics and application of EBPA.

MODULE III FUZZY LOGIC 09

Fuzzy set theory, Fuzzy set versus crisp set, crisp relation & fuzzy relations, Fuzzy systems: crisp logic, fuzzy logic, introduction & features of membership functions, Fuzzy rule base system: fuzzy propositions, formation, decomposition & aggregation of fuzzy rules, fuzzy reasoning, fuzzy inference

systems, fuzzy decision making & Applications of fuzzy logic.

MODULE IV GENETIC ALGORITHM 09

Fundamentals, basic concepts, working principle, encoding, fitness function, reproduction, Genetic modeling: Inheritance operator, cross over, inversion & deletion, mutation operator, Bitwise operator, Generational Cycle, Convergence of GA, Applications & advances in GA, Differences & similarities between GA & other traditional methods.

MODULE V APPLICATION OF COMPUTATIONAL INTELLIGENCE 09

Printed Character Recognition – Inverse Kinematics Problems – Automobile Fuel Efficiency Prediction – Soft Computing for Color Recipe Prediction.

Total Hours: 45

REFERENCES:

1. Jyh-shing Roger Jang, Chuen - Tsai Sun, Eiji Mizutani, “Neuro- Fuzzy and Soft Computing”, Prentice-Hall of India, 2003.
2. S.Rajasekaran & G.A. Vijayalakshmi Pai, “Neural Networks, Fuzzy Logic & Genetic Algorithms, Synthesis & applications”, PHI Publication, 2002.
3. S.N. Sivanandam & S.N. Deepa, “Principles of Soft Computing”, Wiley Publications, 2007.
4. N.K.Bose, “Neural Network Fundamentals with Graphs, Algorithms, and Applications” TMH, 1996.
5. Klir & Yuan, “Fuzzy sets & Fuzzy Logic: Theory & Application”, Prentice Hall of India Pub, 1995.
6. Kosko: “Neural Network & Fuzzy System”, PHI Publication, 1992.

OUTCOMES:

On completion of the programme students will be able to:

- Learn about soft computing techniques and their applications
- Analyze various neural network architectures and able to Understand perceptrons model
- Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
- Apply genetic algorithms to combinatorial optimization problems.
- Evaluate and compare solutions by various soft computing approaches for a given problem.

GECY108 EMBEDED SYSTEM PROGRAMMING

L	T	P	C
3	0	0	3

OBJECTIVES:

- This course provides an introduction to the design of embedded computing systems including their hardware and software architectures.
- Entire software development lifecycle and examine the various issues involved in developing software for embedded systems.
- To analyze the I/O programming and Embedded C coding techniques
- This course will equip students with the software development skills necessary for practitioners in the embedded systems field.

MODULE I INTRODUCTION OF EMBEDDED SYSTEM 09

Embedded computing - characteristics and challenges - embedded system design process-Overview of Processors and hardware units in an embedded system-Compiling, Linking and locating – downloading and debugging –Emulators and simulators processor – External peripherals – Memory testing – Flash Memory.

MODULE II SOFTWARE TECHNOLOGY 09

Software Architectures, Software development Tools, Software Development Process Life Cycle and its Model, Software Analysis, Design and Maintenance.

MODULE III INPUT/OUTPUT PROGRAMMING 09

I/O Instructions, Synchronization, Transfer Rate & Latency, Polled Waiting Loops, Interrupt – Driven I/O, Writing ISR in Assembly and C, Non Maskable and Software Interrupts

MODULE IV DATA REPRESENTATION IN EMBEDDED SYSTEMS 09

Data representation ,Twos complement, Fixed point and Floating Point Number Formats ,Manipulating Bits in -Memory, I/O Ports, Low level programming in C ,Primitive data types , Arrays, Functions ,Recursive Functions, Pointers, Structures & Unions ,Dynamic Memory Allocation ,File handling ,Linked lists, Queues, Stacks.

MODULE V EMBEDDED C 09

Embedded Systems programming in C – Binding & Running Embedded C program in Keil IDE – Dissecting the program -Building the hardware. Basic techniques for reading & writing from I/O port pins – switch bounce - LED Interfacing using Embedded C.

Total Hours: 45

REFERENCES:

1. Marilyn Wolf, "Computers as components ", Elsevier, 2012.
2. Qing Li and Carolyn Yao, "Real-Time Concepts for Embedded Systems", CMP Books, 2003.
3. Daniel W. Lewis, "Fundamentals of embedded software where C and assembly meet", Pearson Education
4. Michael Bass, "Programming Embedded Systems in C and C++", Oreilly, 2003.

OUTCOMES:

On completion of this course the student will be able to

- Design the software and hardware components in embedded system
- Describe the software technology
- Use interrupt in effective manner
- Use keil IDE for programming
- Program using embedded C for specific microcontroller
- Design the embedded projects

GECY109 PRINCIPLES OF SUSTAINABLE DEVELOPMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge in the concepts and dimensions of sustainable development.
- To gain knowledge on the framework for achieving sustainability.

MODULE I CONCEPT OF SUSTAINABLE DEVELOPMENT 09

Environment and Development - Population poverty and Pollution –Global and Local environmental issues –Resource Degradation- Greenhouse gases- Desertification-industrialization –Social insecurity, Globalization and environment. History and emergence of the concept of sustainable development-Objectives of Sustainable Development.

MODULE II COMPONENTS AND DIMENSIONS OF SUSTAINABLE DEVELOPMENT 09

Components of Sustainability –Complexity of growth and equity – Social economic and environmental dimensions of sustainable development – Environment- Biodiversity- Natural -Resources- Ecosystem integrity- Clean air and water- Carrying capacity- Equity, Quality of Life, Prevention, Precaution-Preservation and Public Participation Structural and functional linking of developmental dimensions.

MODULE III FRAMEWORK FOR ACHIEVING SUSTAINABILITY 09

Operational guidelines- interconnected prerequisites for sustainable development Empowerment of Women, children, Youth, Indigenous People, Non-Governmental Organizations Local Authorities, Business and industry-Science and Technology for sustainable development- performance indicators of sustainability and assessment mechanism- Constraints and barriers for sustainable development.

MODULE IV SUSTAINABLE DEVELOPMENT OF SOCIO ECONOMIC SYSTEMS 09

Demographic dynamics of sustainability – Policies for socio-economic development -Strategies for implementing eco-development programmes Sustainable development through trade –Economic growth –Action plan for implementing sustainable development –Urbanization and sustainable Cities – Sustainable Energy and Agriculture –sustainable livelihoods.

MODULE V SUSTAINABLE DEVELOPMENT AND INTERNATIONAL RESPONSE 09

Role of developed countries in the development of developing countries – international summits – Stockholm to Johannesburg – Rio principles – Agenda-Conventions – Agreements – Tokyo Declaration – Doubling statement – Tran boundary issues integrated approach for resources protection and management

Total Hours: 45

REFERENCES:

1. Sayer J. and Campbell, B., The Science of Sustainable Development: Local Livelihoods and the Global environment - Biological conservation restoration & Sustainability, Cambridge university Press, London, 2003.
2. M.K. Ghosh Roy. and Timberlake, Sustainable Development, Ane Books Pvt. Ltd, 2011.
3. Mackenthun K.M., Concepts in Environmental Management, Lewis Publications London,1999.
4. APJ Abdul Kalam and Srijan Pal Singh, Target 3 Billion: Innovative Solutions Towards Sustainable Development, Penguin India, 2011

OUTCOMES:

At the end of the course the student will be able to

- Describe the concepts of sustainable development
- Define the components and dimensions of sustainable development
- Outline the Frame work for achieving sustainability.
- State the policies and strategies for implementing sustainable development for Socio economic programmes.
- Examine the role of developed countries in sustainable development.

GECY110	QUANTITATIVE TECHNIQUES IN MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVE:

To impart knowledge on

- operations research
- production management
- financial management
- decision theory and managerial economics

MODULE I OPERATIONS RESEARCH 09

Introduction to Operations research-Linear programming-Graphical and Simplex Methods, Duality and Post-Optimality Analysis-Transportation and Assignment Problems

MODULE II PRODUCTION MANAGEMENT 09

Inventory control, EOQ, Quantity Discounts, Safety Stock-Replacement Theory-PERT and CPM-Simulation Models-Quality Control.

MODULE III FINANCIAL MANAGEMENT 09

Working Capital Management-Compound Interest and Present Value methods-Discounted Cash Flow Techniques-Capital Budgeting.

MODULE IV DECISION THEORY 09

Decision Theory-Decision Rules-Decision making under conditions of certainity, risk and uncertainity-Decision trees-Utility Theory.

MODULE V MANAGERIAL ECONOMICS 09

Cost concepts-Break-even -Analysis-Pricing techniques-Game Theory applications.

Total Hours: 45

REFERENCES:

1. Vohra, N.D. , Quantitative Techniques in Management, Tata McGraw Hill Co., Ltd, New Delhi, 2009.
2. Seehroeder, R.G., Operations Management, McGraw Hill, USA, 2002.
3. Levin, R.I, Rubin, D.S., and Stinsonm J., Quantitative Approaches to Management, McGraw Hill Book Co., 2008.

4. Frank Harrison, E., The Managerial Decision Making Process, Houghton Miffin Co. Boston, 2005.
5. Hamdy A. Taha, Operations Research- An Introduction, Prentice Hall, 2002.

OUTCOME:

At the end of the course, the students will be able to

- Apply the concepts of operations research for various applications
- Create models for inventory control in production management
- Compute the cash flow for a project
- Choose a project using decision theory based on the risk criterion.
- Apply the concepts of managerial economics in construction management

GECY111 PROGRAMMING USING MATLAB & SIMULINK

L	T	P	C
1	0	2	2

OBJECTIVES:

The aim of this course is to:

- Teach students how to mathematically model engineering systems
- Teach students how to use computer tools to solve the resulting mathematical models. The computer tool used is MATLAB and the focus will be on developing and solving models of problems encountered in engineering fields

MODULE I INTRODUCTION MATLAB DATA PRESENTATION 03+06

Vectors, Matrices -Vector/Matrix Operations & Manipulation- Functions vs scripts-Making clear and compelling plots-Solving systems of linear equations numerically and symbolically- Least squares regression -Curve fitting.

MODULE II MATLAB PLOT FUNCTION 03+06

Introduction- Plot Function – Animation- 3D Plots-Customizing Plots – Plot Applications- Saving &Painting Plots.

MODULE III ROOT FINDING AND COMPUTER REPRESENTATION OF NUMBERS 03+06

Linearization and solving non-linear systems of equations- The Newton-Rapson method- Integers and rational numbers in different bases- Floating point numbers-Round off and errors in basic arithmetic-Significant digits when reporting results

MODULE IV ORDINARY DIFFERENTIAL EQUATIONS 03+06

Numerical integration and solving 1st order, ordinary differential equations (Euler's method and Runge-Kutta) – Use of ODE function in MATLAB

MODULE V NON-LINEAR DIFFERENTIAL EQUATIONS 03+06

Converting 2nd order and higher ODEs to systems of 1st order ODEs- Solving systems of ODEs via Euler's method and Runge-Kutta) – Solving single and systems of non-linear differential equations by linearization-Use of the function ODE in MATLAB to solve differential equations

MODULE VI INTRODUCTION OF SIMULINK 03+06

Simulink & its relations to MATLAB – Modeling a Electrical Circuit- Modeling a fourth order differential equations- Modeling the solution of three equations with three unknowns- Representing a model as a subsystem-Simulink demos.

Total Hours: 45

REFERENCE:

1. Griffiths D V and Smith I M, Numerical Methods for Engineers, Blackwell, 1991.
2. Laurene Fausett, Applied Numerical Analysis Using MATLAB, Pearson 2008.
3. Moin P, Fundamentals of Engineering Numerical Analysis, Cambridge University Press, 2001.
4. Wilson HB, Turcotte LH, Advanced mathematics and mechanics applications using MATLAB. CRC Press, 1997
5. Ke Chen, Peter Giblin and Alan Irving, Mathematical Exploration with MATLAB, Cambridge University Press, 1999.

OUTCOMES:

At the end of this unit students will be able to:

- Use Matlab as a convenient tool for solving a broad range of practical problems in engineering from simple models to real examples.
- Write programs using first principles without automatic use of built-in ones.
- Write programs for solving linear and nonlinear systems, including those arising from boundary value problems and integral equations, and for root-finding and interpolation, including piecewise approximations.
- Be fluent in exploring Matlab's capabilities, such as using matrices as the fundamental data-storage unit, array manipulation, control flow, script and function m-files, function handles, graphical output.
- Make use of Maltab visual capabilities for all engineering applications.
- An ability to identify, formulate, and solve engineering problems. This will be accomplished by using MATLAB to simulate the solution to various problems in engineering fields

GECY112 JAVA PROGRAMMING

L	T	P	C
2	0	0	2

OBJECTIVES:

- To learn the fundamentals of Java programming such as data types, variables and arrays.
- To study the syntax and necessity of decision making and iterative statements.
- To create a class and invoke the methods.
- To instigate programming in overloading of methods.
- To emphasize the concept of packages.
- To learn the exception handling routines.

MODULE I INTRODUCTION TO JAVA PROGRAMMING 15

History and Evolution of Java – Overview of Java – Data types, variables and arrays – Operators – Control statements.

MODULE II METHODS AND CLASSES 15

Class fundamentals – Declaring objects – Methods – Constructors – Garbage collection – Overloading methods – Constructor overloading – Access control – Inheritance – Packages - Exception handling.

Total Hours: 30

REFERENCES:

1. Herbert Schildt, Java The Complete Reference, 9th Edition, Oracle Press, 2014, ISBN: 978007180855-2.
2. Nicholas S. Williams, Professional Java for Web Applications: Featuring WebSockets, Spring Framework, JPA Hibernate and Spring Security (WROX), John Wiley & Sons, 2014, ISBN:978111865651-8.
3. E Balagurusamy, Programming with Java, 5th Edition,Tata Mcgraw Hill,2014.
4. Yashavant Kanetka**,** Let Us Java, 2nd Edition, BPB Publications, 2012**.**

OUTCOMES:

Students to complete this course will be able to

- Implement basic Java programming.
- Create a class and invoke methods for real world problems.
- Construct simple overloading of methods programs.
- Implement various types of inheritance concepts.
- Describe the access control mechanism.

GECY113 PYTHON PROGRAMMING

L	T	P	C
2	0	0	2

OBJECTIVES:

- To learn the list and records of python programming.
- To study the control statements and string functions of python.
- To instigate the fundamental python programming.
- To emphasize GUI in python.
- To integrate python with embedded systems.
- To implement programs in python.

MODULE I INTRODUCTION TO PYTHON PROGRAMMING 15

Installation and environment set up – syntax used in python – variable types – operators – Loops – decision making – string functions - formatted files - GUI basics.

MODULE II EMBEDDED PROGRAMMING USING PYTHON 15

Web interface – system tools – script execution context - Motion-triggered LEDs-Python-arduino prototyping-storing and plotting arduino data-Remote home monitoring system.

Total Hours : 30

REFERENCES:

1. Nick Goddard, “Python Programming”, 2nd edition, ISBN: 1533337772, 2016.
2. Pratik Desai, “Python Programming for Arduino”, 1st edition, Packt publishing, 2015, ISBN: 9781783285938.
3. Mark Lutz, Learning Python: Powerful Object-Oriented Programming, 5th Edition, O'Reilly Media, 2013.
4. Richard H. Barnett, Sarah Cox, Larry O'Cull, “Embedded C Programming and the Atmel AVR”, 2nd edition, 2006.
5. Michael Barr, Anthony Massa, “Programming Embedded Systems”, 2nd Edition, O'Reilly Media, 2006.

OUTCOMES:

Students to complete this course will be able to

- Implement date and time function programming using python.
- Write formatted file programming.
- Construct simple python programs.
- Create web interface using python programming
- Develop embedded system with python programming.
- Build arduino prototype using python programming.

GECY114 INTELLECTUAL PROPERTY RIGHTS (IPR)

L	T	P	C
1	0	0	1

OBJECTIVES:

- To study about Intellectual property rights and its need
- To explore the patent procedure and related issues

MODULE I INTRODUCTION 07

Introduction and the need for intellectual property right (IPR) – IPR in India – Genesis and Development – IPR in abroad – Important examples of IPR – Copyrights, Trademarks, Patents, Designs, Utility Models, Trade Secrets and Geographical Indications – Industrial Designs

MODULE II PATENT 08

Concept of Patent – Product / Process Patents & Terminology – Duration of Patents – Law and Policy Consideration Elements of Patentability –- Patentable Subject Matter – Procedure for Filing of Patent Application and types of Applications – Procedure for Opposition – Revocation of Patents – Working of Patents- Patent Agent – Qualification and Registration Procedure – Patent databases and information system – Preparation of patent documents – Process for examination of patent application- Patent infringement – Recent developments in patent system

Total Hours: 15

REFERENCES

1. B.L.Wadehra; Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India 2000
2. Ajit Parulekar and Sarita D' Souza, Indian Patents Law – Legal & Business Implications; Macmillan India ltd , 2006
3. P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi, 2010.
4. E. T. Lokganathan, Intellectual Property Rights (IPRs): TRIPS Agreement & Indian Laws Hardcover, 2012
5. Alka Chawla, P N Bhagwati , Law of Copyright Comparative Perspectives 1st Edition, LexisNexis, 2013
6. V. K. Ahuja, Law Relating to Intellectual Property Rights 2nd Edition, LexisNexis, 2nd Edition, 2013

7. Deborah E. Bouchoux, Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets, 2015
8. Jatindra Kumar Das, Law of Copyright, PHI Learning, 2015

COURSE OUTCOMES:

Students should be able to

- Identify the various types of intellectual property and their value
- Apply the procedure to file a patent and to deal the related issues
- Search and extract relevant information from various intellectual database

REGULATIONS, CURRICULAM AND SYLLABUS

M. TECH.
POWER ELECTRONICS AND DRIVES

(As approved by the 9th Academic Council)

JULY 2016

B.S.ABDUR RAHMAN
UNIVERSITY
B.S.ABDUR RAHMAN INSTITUTE OF SCIENCE & TECHNOLOGY
(Estd.u/s 3 of the UGC Act, 1956)

(FORMERLY B.S.ABDUR RAHMAN CRESCENT ENGINEERING COLLEGE)
Seethakathi Estate, G.S.T. Road, Vandalur, Chennai - 600 048.

VISION AND MISSION OF THE DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

VISION

To achieve excellence in the programs offered by the Department of Electrical and Electronics Engineering through quality teaching, holistic learning and innovative research

MISSION

- To offer Under Graduate, Post Graduate & Research programs of industrial and societal relevance
- To provide knowledge and skill in the Design and realization of Electrical and Electronic circuits and systems
- To impart necessary managerial and soft skills to face the industrial challenges
- To pursue academic and collaborative research with industry and research institutions in India and abroad
- To disseminate the outcome of research and projects through publications, seminars and workshops

PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES

PROGRAMME EDUCATIONAL OBJECTIVES

1. **Engineering knowledge**:
   Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**:
   Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**:
   Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**:
   Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**:
   Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**:
   Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**:
   Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**:
   Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work**:
   Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**:
    Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**:
    Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**:
    Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME OUTCOMES

(i) Be able to formulate and solve complex problems through efficient Power Electronic components.

(ii) Be able to use modern software packages for modeling, design and analysis of Power Electronic components and systems

(iii) Have the capability to work in areas like embedded technology and evolutionary computing and develop power electronic hardware systems for societal needs.

(iv) Have the ability to trouble shoot problems in power electronics and drives

CURRICULUM & SYLLABI FOR
M. Tech (Power Electronics and Drives)

CURRICULUM
FOUR SEMESTERS / FULL TIME)

Sl. No.	Course Code	Course Title	L	T	P	C
		SEMESTER I				
1	MAC6184	Probability, Matrix Theory And Linear Programming	**3**	**1**	**0**	**4**
2	EEC6125	Modeling and Analysis of Electrical Machines	**3**	**0**	**0**	**3**
3	EEC6126	Advanced Power Semiconductor Devices	**3**	**0**	**0**	**3**
4	EEC6127	Analysis of Power Converters	**3**	**0**	**0**	**3**
7	EEC6128	Embedded Control of Electric Drives	**3**	**0**	**2**	**4**
8		Professional Elective #				**3 #**
8	EEC6129	Simulation of Power Electronic Systems - Laboratory	**0**	**0**	**3**	**1**
9	EEC6130	Design / Fabrication Lab	**0**	**0**	**3**	**1**
		@ Minimum of 3 credits				**22**
		SEMESTER II				
1	EEC6235	Solid State AC and DC Drives	**3**	**0**	**0**	**3**
2	EEC6236	Analysis of Power Inverters	**3**	**0**	**0**	**3**
4	CSB6101	Research Methodology	**3**	**1**	**0**	**4**
5		Professional Electives #				**9#**
6	EEC6238	Power Electronics and Drives Laboratory	**0**	**0**	**3**	**1**
7	EEC6239	Self Learning	**0**	**0**	**2**	**2**
8	EEC6240	Industrial Internship	**0**	**0**	*****	******
		# Minimum of 9 credits				**22**
		SEMESTER III				
1	EEC6240	Industrial Internship	**0**	**0**	*****	**2**
2		General Elective	**3**	**0**	**0**	**3**
3		Professional Elective				**3**

* Minimum 30 days of industrial internship

** Industrial internship will be undertaken during first year summer vacation. The credit will be awarded in the 3rd semester.

4	EEC7111	Project Work - Phase I###	**0**	**0**	**12**	**6###**
		## Minimum of 3 credits				**8**
		SEMESTER IV				
1	EEC7111	Project work - Phase II###	**0**	**0**	**36**	**18**
				18+6=24		
		Total		**76**		

Credits for Project Work Phase I to be accounted along with Project Work Phase II in IV Semester.

PROFESSIONAL ELECTIVE

Sl. No.	Course Code	Course Title	L	T	P	C
1	EECY004	Power Quality	**3**	**0**	**0**	**3**
2	EECY006	Advanced Digital Signal Processing	**3**	**0**	**0**	**3**
3	EECY011	High Voltage Direct Current Transmission	**3**	**0**	**0**	**3**
4	EECY012	Wind Energy Conversion Systems	**3**	**0**	**0**	**3**
5	EEC015	Flexible A.C. Transmission Systems	**3**	**0**	**0**	**3**
6	EECY018	Smart Power Grid	**3**	**0**	**0**	**3**
7	EECY019	Distributed Generation and Micro Grid	**3**	**0**	**0**	**3**
8	EECY041	Digital Signal Processors	**3**	**0**	**0**	**3**
9	EECY042	Robotics And Factory Automation	**3**	**0**	**0**	**3**
10	EECY043	SCADA and DCS	**3**	**0**	**0**	**3**
11	EECY044	Spacecraft Power Systems	**3**	**0**	**0**	**3**
12	EECY045	Modern Electric, Hybrid Electric And Fuel Cell Vehicles	**3**	**0**	**0**	**3**
13	EECY046	Transformers and Inductors for Power Electronics	**3**	**0**	**0**	**3**
14	EECY047	Special Electrical Machines and Controllers	**3**	**0**	**0**	**3**
15	EECY048	Vector Control of AC Drives	**3**	**0**	**0**	**3**
16	EECY049	Solar and Energy storage systems	**3**	**0**	**0**	**3**
17	EECY050	Fundamentals of grid connected photo voltaic power electronic converter design	**3**	**0**	**0**	**3**
18	EECY051	Solar power system design	**3**	**0**	**0**	**3**
19	EECY052	Switched Mode Power Conversion Systems	**3**	**0**	**0**	**3**
20	EEC6101	System theory	**3**	**0**	**0**	**3**
21	GEC71XX	Soft Computing Techniques	**3**	**0**	**0**	**3**

GENERAL ELECTIVES FOR M.TECH PROGRAMMES

Sl. No.	Course Code	Course Title	L	T	P	C
1	GECY101	Project management	**3**	**0**	**0**	**3**
2	GECY102	Society, Technology & Sustainability	**3**	**0**	**0**	**3**
3	GECY103	Artificial Intelligence	**3**	**0**	**0**	**3**
4	GECY104	Green Computing	**3**	**0**	**0**	**3**
5	GECY105	Gaming Design	**3**	**0**	**0**	**3**
6	GECY106	Social Computing	**3**	**0**	**0**	**3**
7	GECY107	Soft Computing	**3**	**0**	**0**	**3**
8	GECY108	Embedded System Programming	**3**	**0**	**0**	**3**
9	GECY109	Principles of Sustainable Development	**3**	**0**	**0**	**3**
10	GECY110	Quantitative Techniques in Management	**3**	**0**	**0**	**3**
11	GECY111	Programming using MATLAB & SIMULINK	**1**	**0**	**2**	**2**
12	GECY112	JAVA Programming	**2**	**0**	**0**	**2**
13	GECY113	PYTHON Programming	**2**	**0**	**0**	**2**
14	GECY114	Intellectual Property Rights	**1**	**0**	**0**	**1**

SEMESTER I

		L	T	P	C
MAC6184	**PROBABILITY, MATRIX THEORY AND LINEAR PROGRAMMING**	**3**	**1**	**0**	**4**

(M.Tech.: PSE, PED, VLSI, Communication, EIE & Structural)

OBJECTIVE:

The aim of this course is to

- provide a comprehensive introduction to the probability distributions used in engineering.
- familiarize students with advanced matrix theory and variation problems.
- expose the students to Operations Research using concepts of linear programming.

MODULE I PROBABILITY DISTRIBUTIONS 10+03

Axioms of probability – addition and multiplication theorem – conditional probability –total probability – random variables - moments – moments generating functions and their properties- Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

MODULE II TWO DIMENSIONAL RANDOM VARIABLES 08+03

Joint distributions - marginal and conditional distributions - functions of random variables - covariance - correlation and regression - Central limit theorem.

MODULE III ADVANCED MATRIX THEORY 09+03

Matrix norms - singular value decomposition - QR algorithm - pseudo inverse - least square approximations.

MODULE IV LINEAR PROGRAMMING 10+03

Formation - graphical method - simplex method - Big-M method - Two Phase method - transportation and assignment problems.

MODULE V CALCULUS OF VARIATIONS 08+03

Variation and its properties – Euler's equation – functional dependant on first and higher order derivatives – functional dependant on functions of several independent variables – variational problems with moving boundaries – isoperimetric problems – Ritz and Kantorovich methods.

L – 45; T – 15; Total – 60

TEXT BOOKS:

1. S.M.Ross, “A First Course in Probability”, 9th edition, Pearson Education, 2013.
2. Lewis.D.W., “Matrix Theory”, Allied Publishers, Chennai, 1995.
3. Taha, H.A., “Operations Research - An Introduction ", 10th edition, Pearson Prentice Hall, 2016.
4. A.S. Gupta, “Calculus of variations with applications”, PHI Pvt. Ltd, New Delhi, 2011.

REFERENCES:

1. H. Cramer., “Random Variables and Probability Distributions”, Cambridge University Press (2004).
2. Roger A. Horn, Charles R. Johnson, “Matrix Analysis”, Cambridge University Press; 2nd edition (2012).
3. Robert.J.Vanderbei., “Linear Programming: Foundations and Extensions”, Springer US(2014).
4. David. J. Rader., “Deterministic Operations Research”, Wiley (2010).
5. Elsgolts, “Differential Equations and Calculus of Variations", University Press of the Pacific (2003).

OUTCOME:

At the end of the course students will be able to

- Solve problems using concept of standard, discrete and continuous distributions.
- Solve problems using one dimensional and two dimensional random variables.
- Find Eigen values and Eigen vectors of a higher order matrix.
- Solve problems of linear programming.
- Solve problems of calculus of variations by direct methods and using Euler’s formulae.

EEC 6125	MODELING AND ANALYSIS OF ELECTRIC MACHINES	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To give an in-depth input on generalized theory of electric machines.
- To impart knowledge on the Modeling aspects of reference frame theory and transformational variables of electrical machines using reference frame theory.
- To impart knowledge on Analysis of electric machines using the reference frame theory model.
- Prediction of torque and other related variables for static and dynamic analysis of electric machines.

MODULE I PRICIPLE OF ELECTOMAGNETIC ENERGY CONVERSION 07

Stored magnetic energy – Co-energy – flux-linkage vs current curves – Singly excited and Doubly excited systems – Force and Torque predictions.

MODULE II BASIC CONCEPTS OF ELECTRIC MACHINES 07

Generalized theory of electric machines – Concept of d-q model – Kron's Primitive Model – Airgap MMF, Per phase machine inductance, Voltage and Torque equations for DC machine and AC machines.

MODULE III MODELING AND ANALYSIS OF DC MACHINES 09

Static and Rotating reference frames and Transformation Relationships – R, L, M, V, I and T equations using direct and quadrature axes in: Modeling of separately excited DC machines – Modeling of DC series machines – Influence of brush shift.

MODULE IV REFERENCE FRAME THEORY FOR 3-PHASE INDUCTION MACHINES 09

Modeling of 3-phase symmetrical induction machines – V, I, L and T equations in actual variables and hypothetical variables – Rotor transformation – V, I, L and T equations in transformed machine.

MODULE V REFERENCE FRAME THEORY FOR 3-PHASE SYNCHRONOUSMACHINES 08

Modeling of Synchronous Machines – Determination of self inductances and mutual inductances – Transformation of self inductances and mutual inductances – Dynamic Modeling of AC machines.

MODULE VI MODELING OF SPECIAL ELECTRIC MACHINES 05

Modeling aspects of Magnetic Systems – Modeling Switched Reluctance Machines – Case Study (Modeling of DC and AC machines.)

Total Hours: 45

REFERENCES:

1. C.V. Jones, 'The Unified Theory of Electric Machines', Butterworth, London, 1967
2. R. Krishnan, 'Switched Reluctance Motor Drives', CRC Press.
3. MAGNET software rule book for Case study purpose.

OUTCOMES:

- Ability to understand the rudiments of electric machines for modeling and analysis.
- Ability to apply generalized machine theory for DC and AC machine modeling.
- Ability to apply Reference Frame theory for DC and AC machine modeling and analysis.
- Ability to model and analyze any new electric machine.
- Ability to use modeling software tools for machine modeling and analysis.

EEC 6126	ADVANCED POWER SEMICONDUCTOR DEVICES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basics of devices selection.
- To understand the static and dynamic characteristics of power semiconductor devices
- To enable the students for the selection of devices for different power electronics applications
- To get the knowledge about the datasheet of power semiconductor Devices.
- To understand the control and firing circuit for different devices.
- Study about the thermal protection of the Devices

MODULE I INTRODUCTION 06

Power switching devices overview; Attributes of an ideal switch, application requirements, and circuit symbols. Power handling capability, Device selection strategy – On-state and switching losses -Power diodes - Types, forward and reverse characteristics, switching characteristics – rating.

MODULE II SILICON POWER ELECTRONIC SEMICONDUCTORS DEVICES and DRIVER CIRCUITS 10

Construction, static characteristics, switching characteristics and Gate characteristics of Thyristor – GTO – MOSFET- IGBTs – SIC – GAN – FCT – RCT. Converter grade and inverter grade SCR. High Speed Opto-Couplers – Zero Crossing Detectors - Optically Isolated High Voltage and High Current sensing circuits, Driver ICs**:** MOC series SCR , IR2XXX Series Full Bridge and Half Bridge MOSFET / IGBT Driver ICs.

MODULE III DATASHEET RATINGS FOR SEMICONDUCTOR DEVICES 09

Standards, Symbols and terms-Maximum ratings – Thermal Impedance and resistance-Component (type) designation system - Mechanical data –Safe Operating Area during switching and short circuit.

MODULE IV PROTECTION AND NOISE 07

Over voltage, Over current and gate protections and Design of snubber circuits - Noise generated due to switching-Common noise sources in SMPS-Noises Due to High frequency transformer-Measurement of Noise.

MODULE V THERMAL PROTECTION 07

Heat transfer – conduction, convection and radiation, Cooling – liquid cooling, vapour – phase cooling, Guidance for heat sink selection- heat sink types and design-Electrical analogy of thermal components– Mounting types.

MODULE VI CASE STUDY 06

Switching characteristics and VI characteristics of Thyristor – GTO – MOSFET-IGBTs – SIC – GAN. Design of drivers and Snubber Circuit.

Total Hours: 45

REFERENCES:

1. Rashid M.H., “Power Electronics circuits, Devices and Applications”, Prentice Hall India, Third Edition, New Delhi, 2008.
2. M.D. Singh and K.B.Khanchandani, “Power Electronics”, Tata McGraw Hill, 2006.
3. Vedam Subramanian, "Power Electronics", New Age International (P) Limited, New Delhi, 1997.
4. Ned Mohan, Undcland and Robins, “Power Electronics – Concepts, applications and Design, John Wiley and Sons, Singapore, 2000.
5. B.W. Williams, “Power Electronics – Devices, Drivers, Applications and Passive Components”, Macmillan, 1992.
6. Dr.-Ing. Arendt Wintrich,Dr.-Ing. Ulrich Nicolai,Dr. techn. Werner Tursky,Univ.-Prof. Dr.-Ing. Tobias Reimann,Application Manual Power Semiconductors ,published by SEMIKRON International GmbH

OUTCOMES:

At the end of the course, the student will

- Understand the operation and characteristics of the semiconductor devices
- Understand the gate drive circuits and its necessity.
- Select suitable component for the particular application with the help of data sheet.
- Design protection circuit for the semiconductor devices.
- Design heat sinks for semiconductor devices

EEC 6127 ANALYSIS OF POWER CONVERTERS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge, analyze and to design the power Electronic converters.
- To discuss in depth the main families of PWM strategies.
- To enable the students to design Power Factor Correction(PFC) controller.

MODULE I AC – DC CONVERTER 08

Circuits and operating principles: Analysis of Single phase and three phase controlled rectifiers with RLE loads - Input line current harmonics and power factor – Fourier Analysis of controlled rectifiers - Dual converters.

MODULE II PERFORMANCE CHARACTERISTICS OFPHASE CONTROLLED CONVERTERS 08

Performance parameters: Dc voltage ratio – input displacement angle – displacement factor - power factor – current distortion factor- Harmonic content of DC terminal voltage and input current - THD of Two quadrant converters and one quadrant converters - reduction of reactive loading of the supply by the Two quadrant converter by means of consecutive firing angle control.

MODULE III PHASE CONTROLLED CYCLOCONVERTER 08

Symmetrical - open delta - Ring connected cycloconverter circuits - Harmonic distortion in the output voltage – General Expression for Three pulse waveform for an arbitrary firing angle control method - Harmonic series of three and six pulse cycloconverters – cosine wave control method – Firing pulse generation: Functional schemes – End stop control : reverence voltage - clamp method – pulse isolating output stage.

MODULE IV AC – AC CONVERTERS 08

Analysis of Single-phase and Three phase AC Voltage Controllers- Matrix converter - Bi-directional switch topologies, Modulation techniques for matrix converters, Concept of Direct AC-AC frequency Converter.

MODULE V ACTIVE FRONT END RECTIFIERS 07

Overview of Power Factor Correction Approaches - Unity power factor rectifiers - Resistor emulation principle –mathematical modeling – control schemes- Design of feedback compensators -front end rectifiers with real and reactive power control

– Phase shifter.

MODULE VI DUAL ACTIVE BRIDGE CONVERTER 07

Dual active bridge converter – circuit configuration – steady state analysis – steady state model of DC-DC DAB Converters - Steady-State Model for AC-AC DAB Converters - soft switching analysis – DAB for Solid state transformer.

Total Hours: 45

REFERENCES:

1. M. H. Rashid, "Power Electronics - Circuits, Devices and Applications", Pearson Education India, 2003
2. Ned Mohan, Tore M. Undeland. "Power Electronics- Converters, Applications and Design", John Wiley & Sons (Asia) Private Ltd., 2003.
3. M.D.Singh, " Power Electronics"Tata McGraw-Hill Education, 07-Jul-2008.
4. Eric Monmasson, Power Electronic *Converters* PWM Strategies and Current Control Techniques, John Wiley & Sons, Inc, © ISTE Ltd 2011.
5. ON Semiconductor "Power Factor Correction (PFC) Handbook", HBD853/D Rev. 5, Apr−2014.
6. D.M.Mitchell, DC-DC Switching Regulator Analysis McGraw-Hill Ryerson, Limited, 1988.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following

- Understand the concept of Converters, choppers, and AC voltage controllers.
- Select the suitable devices for the required applications in power Electronic controller for rectification, inversion, frequency conversion.
- Analyze the performance parameters of the converter circuit.
- Provides a comprehensive overview of PFC circuits and details of operation and design considerations for commonly used PFC circuits.
- Able to learn more about advanced power electronics converters.

EEC 6128	EMBEDDED AND ADVANCED CONTROL OF ELECTRICAL DRIVES	L	T	P	C
		3	0	2	4

OBJECTIVES:

- The objective of this course is to introduce embedded application design for Electrical Drives.
- To provide practical experience with microcontroller systems
- Introduces Mikro C compiler for 16 series PICs.
- Demonstrates the use of the PIC Microcontrollers for Electrical Drives.

MODULE I PIC16F8XX- MICROCONTROLLERS 04

Device Overview- Features and Function- Core SFRs- I/O Ports- Timers-CCP MODULEs- Serial Communication MODULEs- Analog MODULEs - Internal oscillator - External oscillator in LP, XT or HS, RC and RCIO modes – EEPROM – Watch Dog Timer- Black-out and Brown-out Resets.

MODULE II MIKRO C COMPILER 05

Mikro C Compiler reference- Valid C Characters- Variables- Constants- Types- Increment and decrement - structure-Operators and expressions-Loops- Conditionals-micro C Libraries- ADC, CAN, CANSPI, EEPROM, Ethernet, PWM, Keypad, LCD, SPI Ethernet, RS485,USART and Trigonometric Libraries - Preprocessor- Statements.

MODULE III MIKRO C BUILDING APPLICATIONS 05

Mikro C IDE : Code Editor- Code Explorer – Debugger – Error Window – Statistics – Integrated Tools - Building applications :Projects – Source Files :Search Paths – Managing Source Files – Compilation : Output Files – Assembly View – Error Messages.- Flashing Software : Overview of PICkit2.

MODULE IV ALGORITHM AND PROGRAMMING IN MIKROC 20

Digital realization of error amplifier, limiter and Proportional-Integral-Derivative (PID) controller - PID algorithm - Source codes in Mikro C: ADC and PWM – SVPWM – Unipolar and Bipolar SPWM – Phase Angle Control with Zero Crossing Detection.

MODULE V MICROCONTROLLER COMMUNICATION 06

PIC to PIC Communication using UART - Communication with RS232 Serial Bus - Interfacing EEPROM -I²C Communication with PIC Microcontroller - Interfacing lcd and Temperature sensors - ZigBee communication between PICs.

MODULE VI CLOSED LOOP CONTROL OF ELECTRIC DRIVES 20

Closed Loop Control of the Plant Model - Hardware and Software Implementation using PIC Microcontrollers: Speed control of Chopper fed separately excited DC Motor – AC Motor Control Using TRIAC Phase Controller, SPWM and SVPWM inverter fed induction motor - Stepper Motor Interfacing – Servo Motor control.

Total Hours: 60

REFERENCES:

1. John Main, “PIC Microcontroller C”, 2006-2007 Edition, 2007.
2. Mikro C- Compiler for PIC Microchip controllers- mikro Electronik, 2012.
3. Martin P. Bates,” Programming 8-bit PIC Microcontrollers in C: With Interactive Hardware Simulation. Tim Wilmshurst “Designing Embedded Systems with PIC Microcontrollers- Principles and applications”
4. Martin P. Bates,” PIC Microcontrollers –An Introduction” Newnes,2011.
5. Dogan Ibrahim, “Advanced PIC Microcontroller Projects in C: From USB to RTOS”, Elsevier Ltd, 2008.
6. Han-Way Huang, Leo Chartrand, "PIC Microcontroller: An Introduction to Software & Hardware Interfacing", Delmar Cengage Learning, 2004.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Work on different projects making use of the PIC microcontroller
- Implement external interfaces in various embedded system projects by using various interfacing techniques.
- Enable the student to design software to interact with real-world systems
- Design and develop both the hardware and software microcontroller based Electric Drive systems.
- Develop and demonstrate how to accomplish a given task using Embedded “C” language on a microcontroller.
- Demonstrate a working knowledge of the necessary steps and methods used to interface a microcontroller system to devices such as motors, sensors, etc.

EEC 6129	SIMULATION OF POWER ELECTRONIC SYSTEMS LABORATORY	L	T	P	C
		0	0	3	1

OBJECTIVES:

The aim of this course is

- To enable the students to understand the modeling details of Power electronic Components and circuits in detail.
- To understand the behavior of controlled rectifier circuits for different types of electrical loads and the working of different type of Power Electronic Converters.
- To learn different gating circuits for converters turn-on.
- To understand the control methods of inverters and choppers.

LIST OF EXPERIMENTS

MATLAB / SIMULINK BASED EXPERIMENTS

1. Switching Characteristics of MOSFET and Diode.
2. Step-Down (Buck) DC-DC Converters. Step-Up (Boost) DC-DC Converter.
3. Step-Down/Up (Buck-Boost) DC-DC Converter .
4. Three phase controlled Rectifiers with R-L-E loads.
5. Single phase inverter with PWM control.
6. Three phase inverter with PWM control.
7. Single phase AC voltage regulator.
8. Single phase cycloconverter.

PSIM BASED EXPERIMENTS

1. Frequency Response Analysis of a Buck Converter using an Averaged Model.
2. Designing the Feedback Control for a Buck Converter using the Voltage-Mode Control.
3. Flyback DC-DC Converter.
4. Full-Bridge DC-DC Converters.
5. TRIAC based phase angle controller.
6. Closed loop speed control of dc motor using PID controller.

Total Hours: 45

OUTCOMES:

At the end of the course, the student will be able to

- Model & Simulate the Power Electronic Components and Circuits using various Simulation Softwares.
- Select a suitable power electronic device for different applications.
- Analyze the all types of converters by using simulation
- Regulation of output voltage using converters.
- Design a closed control of Motor drives.

EEC 6130 DESIGN / FABRICATION LAB

L	T	P	C
0	0	3	1

OBJECTIVES:

To prepare students to design and fabricate power electronics circuitry for various electrical applications.

- Applying tools and methodologies of a field of practice in a design project
- Developing knowledge of organizational and social contexts of a chosen field of practice

LIST OF EXPERIMENTS:

1. Design and fabrication of Zero Crossing Detector for Phase angle Controllers.
2. Fabrication of Optically isolated gate driver circuit for Phase angle Controllers.
3. Design and fabrication of TRIAC Phase angle Controller.
4. Design and fabrication of controlled Rectifiers.
5. Fabrication of Optically Isolated MOSFET /IGBT Driver circuit.
6. Design and fabrication of Buck converter.
7. Design and fabrication of Boost converter.
8. Design and fabrication of PWM based AC choppers.
9. Design and fabrication of Half Bridge Driver circuit for MOSFET/ IGBT.
10. Fabrication of self-Oscillating gate driver circuit for MOSFET/ IGBT.
11. Fabrication of Three phase gate driving stage for three phase Inverters.
12. Fabrication of single phase full bridge Inverter.

Total Hours: 45

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Awareness of the impact of Power Electronic circuits on utility supply
- The students are assessed on their performance in meeting the criteria of Open-ended, design-oriented labs. Three small projects have to be designed, built and tested. The students should justify their design.
- Ability to build power electronic circuits
- Ability to read and understand datasheets of power electronic devices and related ICs
- Ability to build Micro Inverters for solar power generation.

SEMESTER II

		L	T	P	C
EEC 6235	**SOLID STATE AC AND DC DRIVES DRIVES PRINCIPLES OF SEC URITY ENGINEERING**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To understand the stable steady-state operation and transient dynamics of a motor-load system.
- To study and analyze the operation of the converter / chopper fed dc drive and to solve simple Problems.
- To study and understand the operation of both classical and modern induction motor drives.
- To understand the differences between synchronous motor drive and induction motor drive and to learn the basics of permanent magnet synchronous motor drives with converter.
- To analyze and design the current and speed controllers for a closed loop solid-state DC and AC motor drive and simulation using a software package

MODULE I FUNDAMENTAL OF DC AND AC MOTOR 06

Components of electrical Drives-electric machines, power converter, controllers-dynamics of electric drive - torque equation - equivalent values of drive parameters - components of load torques types of load - four quadrant operation of a motor– steady state stability– load equalization – classes of motor duty - determination of motor rating.

MODULE II SENSORS FOR DRIVES 06

Hall Effect Sensors – Mechanical SWensors for speed and angular positions – Absolute Encoders – Incremental Encoders – Resolvers

MODULE III CLOSED LOOP CONTROL POD DC AND AC DRIVES 09

Transient analysis of separately excited motor – converter control of dc motors – analysis of separately excited & series motor with 1 - phase and 3 - phase converters – dual converter – analysis of chopper controlled dc drives – converter ratings and closed loop control – transfer function of self, separately excited DC motors – linear transfer function model of power converters – sensing and feeds back elements – current and speed loops, P, PI and PID controllers – response comparison – simulation of converter and chopper fed DC drive.

MODULE IV SCALAR METHODS FOR IM DRIVES FROM STATOR SIDE 09

Stator voltage control of induction motor–torque-slip characteristics-operation with different types of loads – operation with unbalanced source voltages and single phasing – analysis of induction motor fed from non - sinusoidal voltage supply – stator frequency control - variable frequency operation – V/F control, controlled current and controlled slip operation – effect of harmonics and control of harmonics

MODULE V SCALAR METHODS FOR IM DRIVES FROM ROTOR SIDE 08

PWM inverter drives – multiquadrant drives – rotor resistance control – slip torque characteristic – torque equations, constant torque operation – slip power recovery scheme – torque equation – torque slip characteristics – power factor – methods of improving power factor – limited sub synchronous speed operation – super synchronous speed operation.

MODULE VI SYNCHRONOUS MOTOR DRIVES 07

Principle of synchronous motor control – Introduction to CSI Single phase and three phase CSI – CSI fed synchronous machines – adjustable frequency operation of synchronous motors –voltage source inverter drive with open loop control – self controlled synchronous motor with electronic commutation – self controlled synchronous motor drive using load commutated thyristor inverter.

Total Hours: 45

REFERENCES:

1. R. Krishnan, Electrical Motor Drives, PHI 2003.
2. G.K.Dubey, Powersemiconductor controlled drives, Prentice Hall- 2000.
3. G.K.Dubey, Fundamentals of Electrical Drives, Narosa-1999.
4. Nasar, Boldea , Electrical Drives, Second Edition, CRCPress-2006.
5. M. A. ElSharkawi , Fundamentals of Electrical Drives , Thomson Learning - 2000. 49
6. Vedam Subrahmaniam, Electric Drives, TMH-2000.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following: Analyse the system considering the steady state and dynamic characteristics.

- Abilty to design a closed loop control of AC and DC drives.
- Talent in selection of motor for various application.
- Software knowledge in matlab , for drive application.
- Modeling AC,DC machines with appropriate loads
- Design a system with suitable parameters to control a drive system.

EEC 6236 ANALYSIS OF POWER INVERTERS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge, analyze modern inverters with improved performance.
- To prepare the students to analyze and design different power converter circuits.
- To understand the use of power converters in commercial and industrial applications.
- To identify basic requirements for power electronics based design application

MODULE I SINGLE PHASE INVERTERS 08

Principle of operation of half and full bridge inverters with R and RL loads – Performance parameters –Steady –state Analysis and Fourier Analysis of Single – phase Inverter.

MODULE II THREE PHASE VOLTAGE SOURCE INVERTERS 07

180 degree and 120 degree conduction mode inverters with star and delta connected loads- Steady –state Analysis and Harmonics Analysis of Three – phase Inverters. **7**

MODULE III PWM STRATEGIES AND VOLTAGE CONTROL 07

Single-pulse Modulation, Multiple-pulse Modulation, Sinusoidal – Pulse Modulation (sin M), Reduction of Harmonics in the Inverters Output Voltage, Harmonic Reduction By PWM - Voltage control of three phase inverters: sinusoidal, space vector modulation (SVPWM) techniques.

MODULE V MULTILEVEL INVERTERS 07

Multilevel concept –Comparison of multilevel inverters - application of multilevel inverters - Diode clamped – flying capacitor – cascade type multilevel inverters - PWM for multilevel inverters

MODULE VI RESONANT INVERTERS 08

Series and parallel resonant inverters - zero current and Zero voltage switching resonant converters, frequency response.

MODULE VI GRID TIE INVERTER 08

Phase locked loop for synchronization, P-Q Control - Structure of the VSI PQ

Controller - Power-Voltage (PV) Control Scheme - Frequency (V/f) Control Scheme - generation Control based on droop Concept - adaptive droop control.

Total Hours: 45

REFERENCES:

1. M. H. Rashid, "Power Electronics - Circuits, Devices and Applications", Pearson Education India, 2003
2. Ned Mohan, Tore M. Undeland. "Power Electronics- Converters, Applications and Design", John Wiley & Sons (Asia) Private Ltd., 2003.
3. M.D.Singh , " Power Electronics"Tata McGraw-Hill Education, 07-Jul-2008
4. R W Erickson and D Makgimovic,"Fundamental of Power Electronics"Springer, 2001 2nd Edition.
5. Vedam Subrahmanyam, "Power Electronics", New Age International (P) Limited, New Delhi, 1997.
6. D.M.Mitchell, DC-DC Switching Regulator Analysis McGraw-Hill Ryerson, Limited, 1988

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following

- Ability to analyze the operation of single and three phase inverters.
- Select the suitable devices for the required applications in power Electronic controller for inversion, frequency conversion.
- Ability to determine the performance parameters of single phase and three phase inverters.
- Ability to design a PWM control of inverter.
- Design and implement multi level and resonant inverter.
- Know the control aspects of grid tied inverters

CSB6101	RESEARCH METHODOLOGY FOR ENGINEERS	L	T	P	C
		3	1	0	4

(Common to M .Tech PSE, PED, VLSI, EIE)

OBJECTIVES:

- To make the students well versed in statistical methods used in engineering.
- To describe the steps involved in research process.
- To explain how to formalize research problems.
- To discuss clearly the approaches for research through some case studies.

MODULE I RESEARCH PROBLEM 08

The research problem – Sources of research problem – Information, how to deal with it – Criteria / characteristics of a good research problem – Errors in selecting a good research problem – Types of research – Nature and use of arguments.

MODULE II ANALYSIS OF VARIANCE 07

Anova – one way – two way classification – Collection of Secondary Latin square design – 2^2 factorial design.

MODULE III DESIGN OF EXPERIMENTS 08

Experimental factors – interaction of factors, Types of experimental design – blocking design – factorial – fractional factorial, Taguchi's orthogonal approach.

MODULE IV REGRESSION, CORRELETION AND CURVE FITTING 10

Regression analysis – simple linear regression – regression coefficient, multiple regression – multiple & partial correlation coefficient, curve fitting – graphical – least square – method testing of goodness of fit.

MODULE V TRANSPORTATION AND ASSIGMENT MODELS 06

Transportation Problem – Assignment Problem – Travelling Sales man. Problem.

MODULE VI CASE STUDIES 06

Presentation by students on their area of research.

Total Hours: 60

REFERENCES:

1. Kothari, C.R., "Research Methodology: Methods and Techniques", 2nd Edition, New Age International, New Delhi, 2012.

2. Nicholas Walliman, “Your Research Project”, 2nd Edition, Vistaar Publication, New Delhi, 2005.
3. Taha H.A., “Operations Research: An Introduction”, 7th Edition, Pearson Education Edition, Asia, New Delhi, 2002.
4. Richard A. Johnson, “Miller and Freund’s Probability and Statistics for Engineers”, 8th Edition, Pearson Education, Asia, 2011.

OUTCOMES:

Students who complete this course will be able to

- Identify the research problem.
- Become capable of analyzing the data using mathematical techniques.
- Learn to apply the statistical concepts in research.
- Demonstrate the different research methods applicable to a specific problem.

EEC 6238	PRINCIPLES OF SECURITY ENGINEERING	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To understand the design and modelling of Electric drives in detail
- To enable the student to obtain a firm grasp of various Power Electronic Circuits and their practical applications in drives.
- To acquire knowledge of the application of Embedded Controllers to the conversion and control of electrical energy.
- To perform the experiments on various motor drive applications.

LIST OF EXPERIMENTS

1. Fabrication of Chopper fed DC drive using PIC 16F877A micro controller.
2. Brushed DC motor drive with C2000 Piccolo F28035 MCU control CARD
3. Closed loop control of Chopper fed DC motor drive using PIC 16F877A micro controller.
4. Stepper motor drive with C2000 Piccolo F28035 MCU control CARD.
5. Three phase brushless DC motor- sensor less field oriented/vector control (FOC) using C2000 Piccolo TMS320F28069M and TMS320F28027F MCU DSPs
6. Three phase Induction motor drive using Hercules RM42L432- dual core ARM Cortex-R4 based MCU.
7. PSIM interfaced Piccolo docking station that features on board USB JTAG emulation with F28035 control CARD
8. Inverter fed Induction motor drive using Intelligent Power Module 3-phase IGBT inverter IC with integral gate drivers.
9. Lab VIEW controlled AC and DC drives.

Total Hours: 45

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- This course allows the students to gain knowledge in advanced controllers.
- Power electronics circuit design, control systems, and a tremendous range of sub-areas.
- Strong experience of design with embedded processors and peripherals.
- Experience of real-time application programming and embedded operating system.
- To fabricate complete AC and DC Drives.

EEC6239	SELF LEARNING	L	T	P	C
		0	2	0	2

OBJECTIVE:

- To provide fundamental and advanced knowledge in the area of final year project work the student intends to do.

COURSE DESCRIPTION:

A student is expected to do the self learning course on his own, relating to the area of Project work. For discussion and interaction with the project supervisor, two hours per week is allocated. The course content and the materials for self learning course shall be decided by the student and the respective supervisor and the same will be approved by the Head of the Department. A broader choice will be given to the student so that a student is permitted to choose a course in the areas of his/her interest.

OUTCOME:

At the end of the course, the student will be able to

- understand research papers through self learning
- self enquiry the technical advancements in the field of power electronics and drives
- Narrow down the area of project work to focus on specific topic.
- Acquire sufficient fundamental and advanced knowledge to carry out the project work.
- Under take any such new ideas on his/her own

EEC 6240	INDUSTRIAL INTERNSHIP	L	T	P	C
		0	0	*	**

* Minimum of 30 days Industrial Internship.

** Industrial internship will be undertaken during first year summer vacation. Two credits will be awarded in the 3rd semester.

OBJECTIVE:

- To provide fundamental and advanced knowledge in the area of final year project work the student intends to do.

COURSE DESCRIPTION:

- To earn credits for this course, a minimum 30 days of industrial training, in a single slot, is mandatory. The course has to be undertaken during the first year summer vacation and the credits will be awarded in the third semester.
- If the student is not able to complete the internship during the first year summer vacation, he/she can complete the course in a single slot between 2th and 4th semester vacation.
- For effective implementation of the course Industry Internship, a teaching faculty is appointed as the coordinator by the Head of the department.
- The students of EEE will be allowed to undergo training only in reputed companies/research labs/design centres. The co-ordinator identifies the companies related to core engineering for internship during second semester. He/she assists the students in every process of getting into the companies as an intern.
- To enable the students to focus on the internship, no two students are allowed to be in the same site.
- Interacting with the respective industries, where the students do their internship, the Coordinator continuously monitors the performance of the students during the internship.
- After completion of the internship, the students are required to submit a detailed report and present what they had learned through the internship, in the form of posters. The students should submit the industry certificate at the time of giving the presentation.
- The performance of the student will be evaluated by the industry as well as the University. Both the evaluations will be considered and aggregated to award the final grade. 50% weightage is given to the evaluation by the industry and remaining 50% weightage to the evaluation by the committee appointed by the Head of the Department.

- The 50 % weightage of evaluation done at the department comprises of (a) 20/50 for viva-voce, (b) 20/50 for the Intern report and (c) 10 /50 for poster presentation.

OUTCOME:

At the end of the course, the student will be able to

- Solve problems typically encountered by engineers in industry.
- Identify and address social, economic, and safety issues in an engineering problem and develop a solution that addresses this.
- Learn new concepts and apply them to the solution of engineering problems.
- Function effectively on a multidisciplinary team and interface effectively with other areas of the organization.
- Clearly communicate their ideas orally and in writing.
- Prepare for a lifelong productive career as an engineer.

SEMESTER III

EEC 7111	**PROJECT WORK**	**L**	**T**	**P**	**C**
	PHASE - I (SEMESTER III)	**0**	**0**	**12**	**6***
	PHASE - II (SEMESTER IV)	**0**	**0**	**36**	**18+6***

* Credits for Project work (Phase-I) of third semester will be accounted along with Project work (Phase-II) of fourth semester

OBJECTIVES:

- To enable a student to do an individual project work which may involve design, modelling, simulation and/or fabrication.
- To analyze a problem both theoretically and practically.
- To motivate the students to involve in research activities leading to innovative solutions for industrial and societal problems.

COURSE DESCRIPTION:

Project work shall be carried out by each and every individual student under the supervision of a faculty of this department. A student may however, in certain cases, be permitted to work for the project in association with other departments or in an Industrial/Research Organization, on the recommendation of the Head of the Department. In such cases, the project work shall be jointly supervised by a faculty of the Department and the faculty of the other department of the University or an Engineer / Scientist from the organization. The student shall meet the faculty periodically and attend the periodic reviews for evaluating the progress.

Project work will be carried out in two phases, Phase-I during the pre-final semester and Phase-2 during the final semester. Phase-I shall be pursued for a minimum of 12 periods per week and Phase - II in 36 periods per week. Credits for Phase I will be accounted along with Phase II in the final semester.

In each phase, there will be three reviews for continuous assessment and one final review and viva voce at the end of the semesters. The Project Report prepared according to approved guidelines and duly signed by the supervisor(s) and the Head of the Department shall be submitted to the concerned department.

OUTCOMES:

At the end of the course, the student will be able to

- Comprehend a problem thoroughly and provide an appropriate solution.
- Do a systematic literature survey.
- Derive a mathematical model for the system under study.
- Get proficiency over the software used for simulation and analysis.
- Present the findings of a research work in conferences and publish in journals.
- Identify and provide solution for the industrial and societal problems.

LIST OF ELECTIVES

EECY004	POWER QUALITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- The main objective of the course is to enhance the knowledge of the participants in the emerging area of power quality and several key issues related to its modeling, assessment and mitigation.
- The course will provide a platform to an in-depth discussion on the various challenges and their possible remedies with respect to maintaining power quality in electricity sector, which will benefit participants from academic and R & D institutions, professional engineers from utilities, industries and policy makers

MODULE I INTRODUCTION 06

Power Quality – Significance of power quality, Terms and Definitions (IEC Standards) – Transients, Voltage Imbalance, Waveform distortion, Power frequency variations, DC offset, Electric Noise, Voltage Fluctuation and Flicker Sources of Sags and Interruptions, Estimating Voltage Sag Performance - Solutions at the End-User Level.

MODULE II DISCRETE FREQUENCY DOMAIN ANALYSIS 08

Harmonics versus Transients -Harmonic Indexes -Harmonic Sources from Commercial Loads -Harmonic Sources from Industrial Loads - Time domain methods and Frequency domain methods: Laplace's, Fourier and Hartley transform – The Walsh Transform – Wavelet Transform- Harmonic Distortion - Voltage versus Current Distortion - Locating Harmonic Sources -System Response Characteristics -Effects of Harmonic

MODULE III FUNDAMENTALS OF HARMONICS 07

Harmonic Distortion Evaluations – End users, utility -Principles for Controlling Harmonics- Where to Control Harmonics - Harmonic Studies – Computer tools for harmonic analysis- Harmonic analyzer - Devices for Controlling Harmonic Distortion -Harmonic Filter Design

MODULE IV DISTRIBUTED GENERATION AND POWER QUALITY 08

Resurgence of DG-DG Technologies – Interfacing DG to the Utility System -Power Quality Issues - Operating Conflicts - DG on Distribution Networks - Sitting DG Distributed Generation - Interconnection Standards (IEC)

MODULE V POWER QUALITY MONITORING AND ANALYSIS 08

Monitoring considerations: Power line disturbance analyzer, power quality measurement equipment, harmonic / spectrum analyzer, flicker meters, disturbance analyzer. Analysis of power outages, Analysis of unbalance: Symmetrical components of phasor quantities, Instantaneous symmetrical components, Instantaneous real and reactive powers, Analysis of distortion: On–line extraction of fundamental sequence components from measured samples

MODULE VI GROUNDING 08

Impact of grounding on power quality- Terms and definitions, Reasons for grounding, problems associated with grounding- Problems with conductors and Connectors, Missing safety ground, Multiple neutral-to-ground connections, additional ground rods, ground loops

Solutions to wiring and grounding- Proper grounding practices, Ground electrode (rod), Service entrance connections, Panel board, Isolated ground, Separately derived systems, Grounding techniques for signal Reference, grounding for sensitive equipment

REFERENCES:

1. G.T.Heydt, "Electric Power Quality", Stars in a Circle Publications, (2nd edition) 1994.
2. Arindam Ghosh, “Power Quality Enhancement Using Custom Power Devices”, Kluwer Academic Publishers, 2002.
3. R.C. Duggan,” Power Quality “McGraw-Hill, 2003.
4. Arrillaga, j.. Bradley. D.a.. And bodger, P.S.,“Power system harmonics”, Wiley, 1985.
5. Derek A. Paice, “Power electronic converter harmonics : Calculations and multipulse methods”, Paice and Associates -1994.
6. Andreas Eberhard, “Power Quality”, Published by InTech, March 2011.
7. Surajit Chattopadhyay, Madhuchhanda Mitra,Samarjit Sengupta, “Electric Power Quality”, Springer, 2010.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Understand the power quality issues and its importance
- Evaluate the characteristics of power quality disturbances
- Know the power quality issues caused due to the insertion of DG
- Able to monitor the power quality parameters
- Identify the techniques to mitigate power quality disturbances
- Know the importance of grounding to improve power quality

EECY006	ADVANCED DIGITAL SIGNAL PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Provide the student with a broad, yet strong background in the traditional topics associated with processing of deterministic digital signals, e.g., discrete-time transforms, and linear filtering.
- Provide student with a strong background in traditional topics associated with processing of stochastic signals, e.g., spectrum estimation and linear prediction.
- To understand different types of prediction and filtering methods
- Introduce the student to some of the more recent developments that promise to have a broad impact on digital signal processing, e.g., nonlinear filtering and adaptive filtering.

MODULE I DISCRETE RANDOM SIGNAL PROCESSING 08

Discrete Random Processes - Ensemble Averages, Stationary processes, Bias and Estimation, Autocovariance, Autocorrelation, Parseval's theorem, Wiener-Khintchine relation, White noise, Power Spectral Density, Spectral factorization, Filtering Random Processes, Special types of Random Processes – ARMA, AR, MA – Yule-Walker equations.

MODULE II SPECTRAL ESTIMATION 08

Estimation of spectra from finite duration signals, Nonparametric methods - Periodogram, Modified periodogram, Bartlett, Welch and Blackman-Tukey methods, Parametric methods – ARMA, AR and MA model based spectral estimation, Solution using Levinson-Durbin algorithm.

MODULE III LINEAR ESTIMATION AND PREDICTION 08

Linear prediction – Forward and Backward prediction, Solution of Prony's normal equations, Least mean-squared error criterion, Wiener filter for filtering and prediction, FIR and IIR Wiener filters, Discrete Kalman filter

MODULE IV ADAPTIVE FILTERS 07

FIR adaptive filters – adaptive filter based on steepest descent method- Widrow-Hopf LMS algorithm, Normalized LMS algorithm, Adaptive channel equalization, Adaptive echo cancellation, Adaptive noise cancellation, RLS adaptive algorithm.

MODULE V MULTIRATE DIGITAL SIGNAL PROCESSING 08

Mathematical description of change of sampling rate – Interpolation and Decimation, Decimation by an integer factor, Interpolation by an integer factor, Sampling rate conversion by a rational factor, Polyphase filter structures, Multistage implementation of multirate system, Application to subband coding – Wavelet transform.

MODULE VI WAVELET TRANSFORM 06

Introduction to continuous discrete and fast wavelet transforms. Families of Wavelets: orthogonal and biorthogonal wavelets, Daubechies' family of wavelets in detail.

Total Hours: 45

REFERENCES:

1. Monson H. Hayes, 'Statistical Digital Signal Processing and Modeling", John Wiley and Sons, Inc, Singapore, 2002
2. John J. Proakis, Dimitris G. Manolakis, : Digital Signal Processing', Pearson Education, 2002
3. Rafael C. Gonzalez, Richard E. Woods, " Digital Image Processing", Pearson Education Inc.,Second Edition, 2004 (For Wavelet Transform Topic)

OUTCOMES:

- Have a more thorough understanding of the relationship between time and frequency domain interpretations and implementations of signal processing algorithms;
- Understand and be able to implement adaptive signal processing algorithms based on second order statistics;
- Students will have the ability to solve various types of practical problems in DSP
- Be familiar with some of the most important advanced signal processing techniques,
- understand the multi-rate processing wavelet transform and time-frequency analysis techniques to solve real time process.
- Apply the above tools to real-world problems including spectral analysis, filter design, noise cancellation, signal compression, rate conversion, feature extraction, inverse problems.

EECY011	HIGH VOLTAGE DIRECT CURRENT TRANSMISSION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- • To identify situations where HVDC is a better alternative
- • To acquire knowledge of HVDC converters, system control and development
- of MTDC systems
- • To perform power flow analysis in an integrated EHVAC - HVDC system.

MODULE I COMPARISON OF EHVAC AND HVDC SYSTEMS 07

Technical and economic problems in bulk power transmission over long distances using EHV / UHV AC lines - HVDC alternatives for transmission - Description of HVDC systems - its application - comparison of EHVAC and HVDC systems.

MODULE II ANALYSIS OF HVDC CONVERTERS 08

Planning of HVDC transmission - modern trends in HVDC transmission – DC breakers - U/G cable transmission - VSC based HVDC - pulse number – choice of converter configuration - simplified analysis of Graetz circuit - 6 pulse converter bridge characteristics - generation of harmonics and filtering.

MODULE III ANALYSIS AND CONTROL OF HVDC SYSTEMS 08

Twelve pulse converter characteristics - its advantages - detailed analysis of Converters - Principles of DC link control - converter / inverter control characteristics - system control hierarchy - firing angle control - current and extinction angle control - power control - higher level controllers.

MODULE IV MULTI TERMINAL HVDC SYSTEMS 07

Introduction to MTDC systems – potential applications of MTDC systems – Types of MTDC systems – Control and protection of MTDC systems – Detailed study about developments of MTDC systems.

MODULE V POWER FLOW ANALYSIS 08

Per unit system for DC quantities – modeling of DC links – solution of DC power flow – solution of AC – DC power flow – case studies

MODULE VI SIMULATION 07

System simulation – philosophy and tools – HVDC systems simulation: modeling of HVDC systems for digital simulation – dynamic interaction between DC and AC systems.Application in Wind Power generation.

Total Hours: 45

REFERENCES:

1. K.R. Padiyar, “HVDC Power Transmission Systems”, New Age International (P) Ltd., New Delhi, 2002.
2. J. Arrillaga, “High Voltage Direct Current Transmission”, Peter Pregrinus, London, 1983.
3. P. Kundur, “Power System stability and Control”, Tata McGraw Hill, 1993.
4. Erich Uhlmann, “Power Transmission by Direct Current”, BS Publications, 2004.
5. V.K. Sood, “HVDC and FACTS Controllers - Applications of Static Converters in power system”, Kluwer Academic Publishers, April 2004.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Identification of situations where HVDC transmission is a better alternative to EHVAC transmission
- The operation and control of converter/Inverter for power control
- The development and applications of MTDC systems
- Power flow analysis used for Integrated EHVAC-HVDC system
- Steady state performance simulation and analysis
- Analysis of HVDC controllers.

EECY012 WIND ENERGY CONVERSION SYSTEM

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the demand for electrical power generation from the renewable wind and fundamentals of wind power.
- To study and understand about the wind turbine components, power generation machinery, and its control systems.
- To simulate the wind turbine dynamic behavior when integrated to grid and in standalone operation.

MODULE I INTRODUCTION 08

Introduction-Historical Development and current status of Wind power-Generators and Power Electronics for wind turbines - Power System Impacts of Wind turbines-Wind speed estimation-wind speed measurements-Rayleigh distribution-Maximum Power obtainable-Bertz limit-Power coefficient –aerodynamics of Wind rotor-Blade element theory-aerodynamic efficiency-Wind energy Conversion System Components.

MODULE II WIND TURBINE 08

Types of Wind Turbine-Rotor design consideration-Tip speed ratio-blade profile-Power regulation-Yaw control –Pitch angle control-stall control-schemes for maximum power extraction.

MODULE III FIXED SPEED AND VARIABLE SPEED SYSTEMS 08

Fixed speed and variable speed wind turbine- Need of variable speed systems-Power-wind speed characteristics-Generation schemes with fixed and variable speed turbines-Comparison of different schemes.

MODULE IV MODELING AND SIMULATION OF FIXED SPEED AND VARIABLE SPEED WIND GENERATORS 08

Modeling of Fixed speed Induction generator-axes transformation-flux linkage equations-voltage equations-state equations-modeling of variable speed DFIG for Wind Energy Conversion Systems-Converter Control System- transient stability simulation of fixed speed induction generator using EUROSTAG 4.3-Doubly Fed Induction Generator(DFIG) modeling - controller modelling -modelling of DFIG in EUROSTAG - transient stability simulation of powersystems with induction generators using EUROSTAG 4.3.

MODULE V POWER ELECTRONICS IN WIND ENERGY CONVERSION SYSTEM 08

Induction generator-Controlled firing angle scheme with AC and DC side Capacitor-Scalar method-flux vector scheme-Control scheme for Synchronous generator with variable speed drive-Variable speed synchronous generator control with boost converter

MODULE VI GRID CONNECTED SYSTEMS 05

Stand alone and Grid Connected WECS system-Grid connection Issues- Impacts of wind power on Power System Stability-wind plant reactive power capability and its requirements-voltage Control and active power control -Storage technologies.

Total Hours: 45

REFERENCES:

1. S.N.Bhadra, D.Kasthra,S.Banerjee, “Wind Electrical Systems”,OxfordHigherEduction, 2005.
2. Thomas Ackermann,”Wind Power in Power system”,Wiley 2012.
3. L.L.Freris ,"Wind Energy conversion Systems", Prentice Hall, 1990.
4. Jian Zhang, Adam Dysko, John O'Reilly, William E. Leithead," Modeling andperformance of fixed-speed induction generators in power system oscillationstability studies", Electric Power System Research Vol. 78,pp: 1416-1424,2008.
5. Andre´s Feijoo, Jose Cidras, Camilo Carrillo, "A third order model for thedoubly-fed induction machine", Electric Power Systems Research 56 (2000)121-127.
6. Eurostag 4.3 Theory Manual Part I.
7. Ion Boldea, "Variable speed generators", Taylor & Francis group, 2006.
8. E.W.Golding, "The generation of Electricity by wind power", Redwood burn Ltd., Trowbridge, 1976.
9. S.Heir, "Grid Integration of WECS", Wiley 1998.

OUTCOMES:

At the end of the course, the student will be able to:

- Recognize the need of renewable energy technologies and their role in the world energy demand.
- Identify and mathematically model the wind turbine components, calculate the available wind power, predict mechanical loads based on design, and discuss the generation of electrical power.

- To numerically simulate the wind turbine dynamic system behavior with integration of component, and control for given real time application.
- Mathematically model and simulate the transient and steady state performance of the stand-alone and grid connected wind generators using EUROSTAGE, MATLAB, CYME packages.
- Analyze the wind power integration issues and their mitigation techniques.
- Identify the present and the future energy storage technologies used for standalone operation and grid connected operation .

EEC 015 FLEXIBLE A.C. TRANSMISSION SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce students to the transmission challenges of modern electrical power systems
- To present the basic concepts, principles and operation of fast high power electronic controllers known as Flexible AC Transmission Systems (FACTS)
- To provide advanced knowledge and understanding of power electronics applications in power transmission systems
- To introduce the operating principles, control systems and modelling of different FACTS devices (SVC, SSSC, SR, TCSC, STATCOM, UPFC, IPFC, etc.)
- To understand the influence of measurement systems, network resonances and harmonic interactions on the performance of FACTS control systems
- To provide the techniques of FACTS controller design for enhancing power transfer, stability and damping, mitigating sub-synchronous resonances, preventing voltage instability, etc.
- To understand the interactions amongst various FACTS Controllers and techniques for their coordination and placement

MODULE I INTRODUCTION 08

Reactive power - uncompensated transmission lines - load compensation - system compensation - lossless distributed parameter lines -symmetrical lines - midpoint conditions of a symmetrical line case study passive compensation - shunt compensation -series compensation - effect on power-transfer capacity.

MODULE II STATIC VAR COMPENSATOR (SVC) 08

Voltage control by SVC - advantages of slope in dynamic characteristics - influence of svc on system voltage - design of SVC voltage regulator - modelling of SVC for power flow and transient stability.

MODULE III THYRISTOR CONTROLLED SERIES CAPACITOR (TCSC) 07

Operation of the TCSC - different modes of operation - modelling of TCSC - variable reactance model - modeling for power flow and stability studies. sub synchronous resonance- torsional interaction,- torsional torque - NGH damping schemes.

MODULE IV VOLTAGE SOURCE CONVERTER BASED FACTS CONTROLLERS 7

Static synchronous compensator (STATCOM) - principle of operation - V-I characteristics. SSSC-operation of SSSC and the control of power flow - modeling of SSSC in load flow and transient stability studies -UPFC and IPFC.

MODULE V CO-ORDINATION OF FACTS CONTROLLERS 07

Controller interactions - SVC - SVC interaction - co-ordination of multiple controllers using linear control techniques - control coordination using genetic algorithms.

MODULE VI APPLICATIONS OF FACTS CONTROLLERS 08

Applications of SVC - enhancement of transient stability - steady state power transfer - enhancement of power system damping - prevention of voltage instability. -applications of TCSC- improvement of the system stability limit - enhancement of system damping. applications of STATCOM- steady state power transfer- enhancement of transient stability - prevention of voltage instability - applications of SSSC – SSR mitigation.

Total Hours: 45

REFERENCES:

- R.Mohan Mathur, Rajiv K.Varma, “Thyristor - Based FACTS Controllers for Electrical Transmission Systems”, IEEE press and John Wiley & Sons, Inc., 2002.
- Narain G. Hingorani, “Understanding FACTS -Concepts and Technology of Flexible AC Transmission Systems”, Standard Publishers Distributors, Delhi- 110 006,1999.
- K.R.Padiyar, “FACTS Controllers in Power Transmission and Distribution”, New Age International (P) Limited, Publishers, New Delhi, 2008 .
- A.T.John, “Flexible A.C. Transmission Systems”, Institution of Electrical and Electronic Engineers (IEEE)”, Wiley IEEE Press,1999.
- V.K.Sood, “HVDC and FACTS controllers - Applications of Static Converters in Power System”, Kluwer Academic Publishers, 2004.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Identify the needs of power systems and utility networks where installation of FACTS Controllers/Devices becomes essential
- Compute power transmission capability of a transmission system and apply reactive compensation methods for its improvement
- Comprehend the operating principles, control systems and modeling of different FACTS Controllers
- Understand the influence of measurement systems, network resonances and harmonic interactions on the performance of FACTS control systems
- Apply the techniques of FACTS controller design for enhancing power transfer, increasing stability, augmenting system damping, mitigating sub-synchronous resonances, preventing voltage instability, performing load compensation, etc.
- Analyze the interactions amongst various FACTS Controllers

EECY018 SMART POWER GRID

L	T	P	C
3	0	0	3

OBJECTIVES :

- Introduce the fundamentals of smart grids.
- Introduce modeling of devices associated with smart grids.
- Introduce the different automation and networking standards.
- Introduce the concept of Wide area measuring systems and Phasor measurement units.(PMU)

MODULE I SMART GRID FUNDAMENTALS 09

Smart grid structure – Interactive grid – Micro grid – Distributed Resources modeling – communication infrastructure – sensing and Control devices – smart grid characteristics.

MODULE II COMPONENTS AND STANDARDS 09

Smart grid components – Metering – Virtual power plants- Benefits and cost elements – Pricing regulations – Networking Standards and integration – Analytics.

MODULE III AUTOMATION TECHNOLOGIES 09

Control centre systems – Data management principles – Smart Grid implementation standards and procedure – Advanced Metering Infrastructure – Outage management – Distribution and Substation automation .

MODULE IV WIDE AREA MEASUREMENT SYSTEMS AND PMU 06

Wide area measurement systems –Phasor Measurement Units- Optimal placement algorithm for PMUs. Smart grid experimentation plan for load forecasting.

MODULE V CASE STUDY I 06

Smart meters – Cloud computing and security issues - Forecasting – Coordination between cloud computing and Smart power grids – Development of power system models and control and communication software.

MODULE VI RECENT TRENDS IN SMART POWER GRIDS 06

Demand Response – concepts and models.Real time pricing models for practical applications-SCADA in smart grids.

Total Hours: 45

REFERENCES :

1. Ali Keyhani :" Design of Smart Power Grid Renewable Energy Systems ", First Edition , John Wiley Inc., 2011
2. Tony Flick and Justin Morehouse : "Securing the Smart Grid – Next generation Power Grid security ", Elsevier Publications,2011.
3. Krzysztof Iniewski:Smart Grid Infrastructure and Networking , 1st Edition , 2012.
4. Stephen F Bush :Smart Grid Communication – Enabled Intelligence for Electric Power Grid, Wiley IEEE .,2014
5. James Momoh : Smart Grids , Fundamentals of Design and Analysis .,2014.
6. Mini . S. Thomas :Power System SCADA and Smart Grids.
7. Kenneth . C.Budka , Jayant G.Deshpande :Communication Networks for Smart Grids:Making Smart Grid Real , 2014

OUTCOMES:

At the end of the course the student is expected to possess knowledge and skills on the following :

- Ability to design and implement Smart Power Grid Power Systems
- Ability to apply the concept of demand response in Smart grids.
- Ability to apply Smart grid concepts to real applications.
- Ability to co ordinate between cloud computing and smart grids
- Ability to apply SCADA in smart power grids
- Ability to use PMUs for optimal placement in smart grids.

EECY019	DISTRIBUTED GENERATION AND MICROGRID	L	T	P	C
		3	0	0	3

Course Objectives:

- To impart the importance of renewable based generation system to meet the growing demands
- To locate distributed generation system optimally in the distribution system network and to study its impacts

MODULE I INTRODUCTION 08

Microgrid basic concepts – architecture - operational conditions, Microgrid : merits and demerits - functionalities and variables in microgrid - issues in microgrid. Types of microgrid (LV microgrid, MV microgrid - DC microgrid, AC microgrid, hybrid) - Microgrid as part of smarter grid Modes of operation : grid connected mode - islanded mode - transition between grid connected mode and islanded mode.primary control strategy - secondary control strategy - Control of distribution generation - demand side management - Opportunities and risk of different market players

MODULE II DISTRIBUTED ENERGY RESOURCES AND STORAGE DEVICES 08

Distributed Energy Resources: solar – wind – CHP – MCHP – Microturbine - Diesel generators –geo thermal –working, characteristics and mathematical modeling, Storage devices-Batteries - fuel cells - super capacitors.

MODULE III DISTRIBUTED SYSTEM EXPANSION 08

Power flow, Short circuit and loss calculations- with and without distributed generation- Distribution system reliability analysis –Distribution system expansion planning – load characteristics – load forecasting – design concepts – optimal location of distributed generation – solution technique.

MODULE IV CONTROLLERS 08

Three phase converter - Three phase Voltage source Inverter (VSI) – Boost Converter – PWM Techniques - P-Q Control - Structure of the VSI PQ Controller - Power-Voltage (PV) Control Scheme - Frequency (Vf) Control Scheme - generation Control Based on Droop Concept - adaptive droop control, Phase locked loop for synchronization.

MODULE V PROTECTION ISSUES 07

Requirements of protection - issues in protection (LOM, Blinding of protection, unwanted islanding, lack of selectivity, failure of co-ordination between fuse and recloser) - challenges in protection scheme – Solutions for microgrid protection - digital relays- Adaptive protection scheme : centralized, decentralized–Multiagent based protection scheme – protection scheme based on variables

MODULE VI MICROGRID COMPONENTS 06

PMU basic concepts - International Electrotechnical Commission (IEC) 61850, 61850-7-420, 61850-8. Renewable Microgrid controller RMC 600. Microgrid pilots : KERI – CERTS - Intelligent Electronic Device (IED) - Microgrid Management system (MMS) - Static Transfer switch (STS) - RTU/ gateway - Smart metering – Sensing Devices.

Total Hours: 45

REFERENCES:

1. Jukka Ihamäki, **"Integration of microgrids into electricity distribution networks"** Master's Thesis in Lappeenranta University of Technology, 2012, pages-105
2. Amirhossein Hajimiragha, "**Generation Control in Small Isolated Power Systems"** Master of Science Thesis -Royal Institute of Technology, Department of Electrical Engineering Stockholm 2005.
3. *Juan Carlos V´asquez Quintero, "*Decentralized Control Techniques Applied to Electric Power Distributed Generation in Microgrids *dissertation submitted for the degree of European Doctor of Philosophy,* June 10, 2009.
4. *Stanley H.Horowitz and Arun G. Phadke, " Power System Relaying third edition, John Wiley & sons*
5. Renewable Microgrid controller RMC 600 – ABB Brochure
6. Taha Selim Ustun, Cagil Ozansoy and Aladin Zayegh, " Fault current coefficient and time delay assignment for microgrid protection system with central protection unit" IEEE Transaction (accepted for publication in future issue of the journal-DOI-10.1109/TPWRS.2012.2214489
7. Taha Selim Ustun, Cagil Ozansoy and Aladin Zayegh, " Modelling of a centralized Microgrid Protection system and Distributed Energy Resources according to IEC 61850-7-420" IEEE Transaction on power systems, vol 27, No.3, pp 1560-1567, 2012.
8. M. Amin Zamani, Amirnaser Yazdani, and Tarlochan S. , "A Communication-Assisted Protection Strategy for Inverter-Based Medium-

Voltage Microgrids", IEEE Transactions on Smart Grid, Vol. 3, No. 4,pp.2088-2099, 2012

9. Eric Sorotomme, S.S. Venkata, Joydeep Mitra, " Microgrid protection using communication assisted digital relays" IEEE transaction on power delivery, vol.25, No.4, pp.2789-2796, 2010

OUTCOMES:

At the end of the course, the student will be able to

- Know the basic concepts with respect to microgrid
- Model the distributed generator for distribution network
- Optimally locate the distributed generator in the distribution system
- Address the Issues involved in microgrid protection
- Model controllers for distributed generator to interface it to the distribution system network

EECY041 DIGITAL SIGNAL PROCESSORS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge on the architectural details and instruction set of TMS320F2812 processor.
- To provide practical experience with Digital Signal Processors.
- Introduces Code Composer Studio IDE for C 2000 Processors.
- To implement DSP Processor in real time Digital Motor Control application.

MODULE I ARCHITECTURE OF F2812 06

TMS320F2812 Architecture - The F2812 CPU-F2812 Math Units-Data Memory Access -Internal Bus Structure- Atomic Arithmetic Logic Unit (ALU) -Instruction Pipeline - Memory Map - Code Security Module - Interrupt Response- Operating Modes - Reset Behaviour.

MODULE II PROGRAM DEVELOPMENT TOOLS 08

Code Composer Studio IDE - The Software Flow - Code Composer Studio – Basics - Lab Hardware Setup - Code Composer Studio – Step by Step procedure - Create a project - Setup Build Options Linker Command File - Download code into DSP - beginner's project - Objective Procedure - Open Files, Create Project File- C28x Flash Programming - C28x Start-up Sequences -C28x Flash Memory Sectors Flash Flash Configuration Registers - Flash Programming Procedure .

MODULE III DIGITAL I/O 07

Data Memory Mapped Peripherals - The Peripheral Frames - Unit Digital I/O Registers Module - Watchdog Timer - System Control and Status Register - Low Power Mode – Digital Input / Output programmes.

MODULE IV INTERRUPT SYSTEM 08

C28x Core Interrupt Lines - The C28x RESET - Reset Bootloader - Interrupt Sources - Maskable Interrupt Processing - Peripheral Interrupt Expansion - C28x CPU Timers - Serial Peripheral Interface (SPI) Data Transfer - SPI Registers - SPI communication.

MODULE V C28X EVENT MANAGER AND C28X ANALOGUE DIGITAL CONVERTER 08

Event Manager Block Diagram - General Purpose Timer Timer Operating Modes - Interrupt Sources - GP Timer Registers - GP Timer Interrupts - Event Manager

Compare Units Capture Units - Quadrature Encoder Pulse Unit (QEP).- Generate a PWM sine wave -.ADC Module Overview - ADC in Cascaded Mode -ADC in Dual Sequencer Mode - ADC Register Block .

MODULE VI DIGITAL MOTOR CONTROL APPLICATIONS 08

C28x IQ – Math Library - IQ – Math Library Functions - IQ- Math Application- FOC -C28x FIR – Filter - Texas Instruments C28x Filter Library- . C28x Digital Motor Control - . Field Orientated Control (FOC) Core Math Operations - PARK Transform - CLARKE Transform - Texas Instruments Digital Motor Control Library Modules . FOC for PMSM - Hardware Laboratory Setup - PMSM control project – Build levels. .

Total Hours: 45

REFERENCES:

1. Code Composer Studio User's Guide Literature Number: SPRU328 February 2000, Copyright © 1999-2000, Texas Instruments Incorporated.
2. TMS320F2810, TMS320F2811, TMS320F2812, TMS320C2810, TMS320C2811, TMS320C2812 Digital Signal Processors Data Manual, Copyright © 2001–2012, Texas instrument Incorporated.
3. TMS320F2812 DIGITAL SIGNAL PROCESSOR IMPLEMENTATION TUTORIAL – Texas instruments.
4. B. B. Venkatramani & M.Bhaskar, " Digital Signal Procesors architecture, Programming and applications, Tata McGraw Hill 2002.
5. TMS320F/C24/X DSP controllers, Refernce guide literature No : SPRU 160c, June 1994.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Programming Knowledge in DSP and its real time application.
- To configure DSPBIOS to handle hardware interrupts (HWI)
- Implementing Digital Motor Control Library Modules.
- Computing steps necessary to build a control scheme for Field Oriented Control (FOC).
- Board level operations of the Digital Signal Processors (DSP)based on the Texas Instruments TMS320F2812 Processor.

EECY042 ROBOTICS AND FACTORY AUTOMATION

L	T	P	C
3	0	0	3

OBJECTIVES :

- To identify the basic component of manufacturing automation and categorize the different types of automated production Process.
- To understand how knowledge based system technology can Improve manufacturing enterprises, to design elementary Mechanisms for automation.
- To understand the principle of industrial sensors.
- To understand the working of Robots.

MODULE I FUNDAMENTAL CONCEPTS OF ROBOTICS 07

History,Present status and future trends in Robotics and automation-Laws of Robotics-Robot definitions –Robot anatomy Specification of Robots-resolution, repeatability and accuracy of a manipulator – Robotics applications.

MODULE II ROBOT DRIVES AND POWER TRANSMISSION SYSTEMS 08

Robot drive mechanisms, hydraulic, electric servomotor, stepper Motor, pneumatic drives-Mechanical transmission method, Gear Transmission, Belt drives, cables, Roller chains, Link-Rod systems- Rotary to Rotary motion conversion, Rotary to Rotary motion conversion ,Rotary to Linear motion conversion, Rack and Pinion Drives, Lead screws, Ball Bearing screws, End effectors, Types.

MODULE III SENSORS 08

Sensor characteristics , Position sensors, Potientiometers, Encoders, Resolvers, LVDT, Velocity sensors, Tachogenerators- Encoders-Proximity sensors, Limit switches, Tactile sensors - Touch sensors – Force and torque sensors.

MODULE IV VISION SYSTEMS FOR ROBOTICS 08

Robot vision systems, Image capture-cameras ,vision and solid State Image representation- Gray scale and colour images, image sampling and quantization-Image processing and analysis – Image Data reduction- Segmentation – Feature extraction – Object Recognition – Image capturing and communication – JPEG,MPEG And H.26x standards ,packet video,error concealment – Image Texture analysis.

MODULE V PLC 08

Building blocks of automation , Controllers, PLC – Role of PLC in FA – Architecture of PLC – Advantages – Types of PLC – Types of Programming – Simple process control programs using Relay Ladder Logic and Boolean logic – PLC arithmetic functions.

MODULE VI FACTORY AUTOMATION 06

Flexible Manufacturing Systems concept – Automatic feeding Lines, ASRS, Lines, automatic inspection – Computer Integrated Manufacture – CNC, intelligent automation. Industrial networking, Bus standards, HMI systems, DCS and SCADA , Wireless controls.

Total Hours: 45

REFERENCES :

1. Richard D. Klafter, Thomas .A.Chmielewski, Michael Negin,“Robotics Engineering Integrated Approach”,Eastern Economy Edition , PHI , 1989
2. Fu K.S., Gonzalez R.C., Lee C.S.G, “Robotics:Control ,Sensing, Vision and Intelligence “McGraw Hill Book Company , 1987. Mikell P Groover et al ., “Industial Robots – Technology , Programming and applications”McGraw Hill , New York, 1986.
3. Saeed B Niku ,”Introduction to Robotics Analysis , Systems, Applications Prentice Hall of India Pvt. Ltd New Delhi , 2003.
4. Deb S.R. , “Robotics Technology and Flexible Automation “, Tata McGraw Hill Publishing Company Ltd., 1994.
5. Jegannathan .R, “Introduction to Robotics”, 2004.

OUTCOMES:

At the end of the course the student is expected to possess knowledge and skills on the following :

- Ability to design a Robot.
- Ability to troubleshoot Factory Automation products.
- Ability to master PLC programming and applications.
- Ability to apply Robotic concepts in Industrial systems.

EECY043 SCADA AND DCS

L	T	P	C
3	0	0	3

OBJECTIVES:

- The aim of this course is to give an in depth study of SCADA and PLC.
- To acquire knowledge of application of software automation blocks and DCS.
- To expose the students to the Micro SCADA techniques

MODULE I INTRODUCTION 06

Introduction to automation tools PLC, DCS, SCADA, Hybrid DCS/PLC.

MODULE II DCS PROJECT 08

Development of User Requirement Specifications - Functional Design Specifications for automation tool - GAMP, FDA.

MODULE III PROGRAMMABLE LOGIC CONTROLLERS 08

Introduction of Advanced PLC programming, Selection of processor, Input/ output MODULEs - Interfacing of Input/output devices, Operator Interface - OPC- study of SCADA software - Interfacing of PLC with SCADA software.

MODULE IV DCS 09

Introduction to architecture of different makes - DCS Specifications, configuration of DCS blocks for different applications - Interfacing of protocol based sensors - Actuators and PLC systems, Plant wide database management- Security and user access management - MES, ERP Interface.

MODULE V STUDY OF ADVANCE PROCESS CONTROL BLOCKS 09

Statistical Process Control - Model Predictive Control - Fuzzy Logic Based Control - Neural-Network Based Control Higher Level Operations: Control & Instrumentation for process optimization - Applications of the above techniques to the same standard units/processes.

MODULE VI MICRO SCADA FOR POWER ELECTRONICSYSTEMS 05

System concept –Hardware: Base computer - Workstations-Front ends-Peripherals Software Programming-Process Objects – Command Procedures – RTU Integration –Communication to Third Party Systems –Functional description: process pictures- operation-Alarm handling-Event Handling- reports- Trends

Total Hours: 45

REFERENCES:

1. Gary Dunning, “Introduction to Programmable logic Controllers”, Delmar Thomson learning, 2001.
2. Webb & Reis, “Programmable logic Controllers”, (Prentice Hall), 2003.
3. Jose A. Romagnoli, Ahmet Palazoglu, 'Introduction to process Control' (CRC Taylor and Francis group), 2013.
4. “Statistical Process Control” -ISA Handbook.
5. B.G. Liptak “Handbook of Instrumentation- Process Control”.
6. Installation and user manuals of different DCS, PLC Vendors, 2004.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Basics of SCADA & DCS.
- Appropriate knowledge and skills in Industrial automation systems with the use of DCS, PLCs, and SCADA.
- An ability to apply creativity in design of systems, components or processes appropriate to power electronic circuits.
- Ability to get a grip on micro scada for power electronics applications
- Ability to perform programming in SCADA and DCS.

EECY044 SPACECRAFT POWER SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide covers the entire scope of spacecraft power systems.
- To study and analyze the power conditioning, energy management and the operational
- aspects of spacecraft power systems
- To study and understand the Satellite overview, space environment and its effects.
- To understand the power electronics and magnetics, distribution harness, protection, and ancillary components of the spacecraft.

MODULE I SATELLITE OVERVIEW 07

Satellite systems - Earth orbit classification–Orbit mechanics-Satellite stabilization methods- Near-Earth Space Environment - Power System Options- Environmental Effects. Solar Array– I–V and P–V characteristics - Array construction – Array performance- Array design- Advances in PV technology - Concentrator array- Battery: Types of batteries - Properties and performance

MODULE II POWER ELECTRONICS 08

Switching devices - Shunt regulator - Linear and PWM shunts – Shunt circuit design - Bus ripple filter design - Power converters - Battery charge converter - Battery discharge converter - Load power converter - Voltage and current regulators

MODULE III ENERGY BALANCE AND POWER MANAGEMENT 08

Energy balance analysis - Energy balance simulation runs - Dynamic Performance and Stability - Electromagnetic Interference and Compatibility - Electrostatic Discharge.

MODULE IV DISTRIBUTION HARNESS, PROTECTION AND ANCILLARY COMPONENTS 06

Ampacity of wires - R-C-L parameters - Conductor materials - Wire insulation and cable shield- Harness mass minimization-Fuse protection Remote power controllers - Early fault detection - Solar array drive -Deployment devices – Relays - Battery let-down unit - Radiation shield - EMI shield

MODULE V SPECIAL POWER SYSTEMS 08

Interplanetary and Deep Space Missions–Radioisotope Thermoelectric Generator (RTG) - High-Power High-Voltage Systems: High-voltage PV array- High-power nuclear TEC - High-voltage design issues - High-voltage direct current - High-frequency alternating current - High-power components - Very-high-voltage system - Repetitive pulse power - Multi-megawatt burst-power.

MODULE VI ELECTRIC PROPULSION 08

Types of electric propulsion– Solar PV propulsion -Solar thermal propulsion Nuclear power propulsion -Microwave beam propulsion - Tether power propulsion-Fuel Cell Power - Flywheel Energy Storage - Superconductors in Space - Microwave Beam Power Satellite.

Total Hours: 45

REFERENCES:

1. Mukund R. Patel, Modern SPACECRAFT POWER © 2005 by CRC Press LLC.
2. Grechnev, A.B. et al. Centralized power as basis of new philosophy of space power engineering, in Proceedings of the 34th Intersociety Energy, Conversion Engineering Conference, SAE, 1999, Paper No. 2436.
3. SAIC and Futron Corporation, Space Solar Power Concept Definition Study,NASA Report No. SAIC-99/1016, February 1999.
4. Mankins, J.C. and Howell, J., Overview of the space solar power exploratory research and technology program, in Proceedings of the 35th Intersociety Energy Conversion Engineering Conference, AIAA, 2000, Paper No. 3060.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Abilty to design a closed loop control of AC and DC drives
- Ability to analyze the new developments Spacecraft power systems.
- Ability to maintain a leading edge in designing and operating a variety of Spacecraft power systems.
- This course allows the students to the knowledge Special systems such as interplanetary and deep space.
- The students is expected to become a professional in Energy management.

EECY045	MODERN ELECTRIC, HYBRID ELECTRIC AND FUEL CELL VEHICLES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the dynamics of a motor-load Vehicles.
- To study the Configurations and Performance of Electric, Hybrid Electric and Fuel Cell Vehicles
- To analyze the operation of modern converters for Electric Vehicles.
- To understand the Battery Technologies and Electrical breaking.

MODULE I VEHICLE FUNDAMENTALS 06

General Description of Vehicle Movement-Dynamic Equation: power converter Tire–Ground Adhesion and Maximum Tractive Effort - Power Train Tractive Effort and Vehicle Speed - Vehicle Power Plant and Transmission Characteristics-Power Plant Characteristics - Transmission Characteristics - Vehicle Performance.

MODULE II ELECTRIC AND HYBRID ELECTRIC VEHICLES 08

Configurations of Electric Vehicles– Performance of Electric Vehicles– Tractive Effort in Normal Driving- Energy Consumption- Hybrid Electric Vehicles: – Concept of Hybrid Electric Drive Trains– Architectures of Hybrid Electric Drive Trains: Series and Parallel Hybrid Electric Drive Trains.

MODULE III ELECTRIC PROPULSION SYSTEMS 08

DC Motor Drives: Multiquadrant Control of Chopper Fed DC Motor - Induction Motor Drives: Constant Volt/Hertz Control - Field Orientation Control(FOC) - Voltage Source Inverter for FOC - Permanent Magnetic Brush-Less DC Motor Drives: Control of BLDC Machines - Sensorless Techniques: Switched Reluctance Motor Drives - Sensorless Control.

MODULE IV ENERGY STORAGES 08

Electrochemical Batteries-Battery Technologies-Lead-Acid Batteries - Nickel-based Batteries– Lithium-Based Batteries- Ultracapacitors– Ultrahigh-Speed Flywheels– Hybridization of Energy Storages.

MODULE V REGENERATIVE BRAKING 08

Fundamentals of Regenerative Braking: Energy Consumption in Braking - Braking Power and Energy on Front and Rear Wheels - Brake System of EVs and HEVs - Series Brake: Optimal Feel - Optimal Energy Recovery - Parallel Brake - Antilock Brake System (ABS).

MODULE VI FUEL CELL VEHICLES 07

Operating Principles of Fuel Cells – Fuel Cell Technologies – Fuel Supply : Hydrogen Storage.- Hydrogen Production – Ammonia as Hydrogen Carrier - Nonhydrogen Fuel Cells - Fuel Cell Hybrid Electric Drive Train Design: Configuration - Control Strategy Parametric Design.

Total Hours: 45

REFERENCES:

1. Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay, Ali Emad, Modern electric, hybrid electric, and fuel cell vehicles: fundamentals, theory, and design © 2005 by CRC Press LLC.
2. G.K.Dubey, Powersemiconductor controlled drives, Prentice Hall- 2000.
3. G.K.Dubey, Fundamentals of Electrical Drives, Narosa-1999.
   A. Nasar, Boldea , Electrical Drives, Second Edition, CRCPress-2006.
4. M. A. ElSharkawi , Fundamentals of Electrical Drives , Thomson Learning - 2000.
5. W. Leohnard, Control of Electric Drives,-Springer-2001.
6. Murphy and Turnbull, Power Electronic Control of AC motors, Pergamon Press, 1973.
7. Vedam Subrahmaniam, Electric Drives, TMH-2000.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Ability to analyze the vehicle power source characteristics, transmission characteristics.
- Solve equations used to describe vehicle performance.
- Able to analyze different controls of regenerative braking
- Design of electric propulsion systems and energy storage devices
- Ability to design the fuel cell system, electric propulsion, and the energy storage system.

ECY046	TRANSFORMERS AND INDUCTORS FOR POWER ELECTRONICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the magnetic core characteristics of different core materials.
- To study design methods for converter Transformers and high frequency.
- Inductors.
- To provide real-world step-by-step design examples.
- To offer a practical approach with design examples for design engineers.

MODULE I RECTIFIER TRANSFORMER DESIGN 06

Multiphase Rectifier Circuits - Area Product, Ap, and Core Geometry, Kg, for Three-Phase Transformers - Output Power Versus Apparent, Pt, Capability - Relationship, Kg and Ap to Power Transformer Regulation - Relationship, Ap, to Transformer Power Handling Capability.

MODULE II INDUCTOR DESIGN 08

DC Inductor Design: Critical Inductance for Sine Wave Rectification - Critical Inductance for Buck Type Converters - Core Materials, Used in PWM Converters - Gapped Inductor Design- DC Inductor Design Using Powder Cores- Toroidal Powder Core - Design AC Inductor Design - Input Filter Design – Capacitor – Inductor – Oscillation - Applying Power - Resonant Charge - Input Filter Inductor Design Procedure.

MODULE III FLYBACK CONVERTER, TRANSFORMER DESIGN 08

Energy Transfer - Discontinuous Current Mode - Continuous Current Mode - Continuous and Discontinuous Boundary - The Buck Converter and Boost Converter - Continuous and Discontinuous Current Design Equations - Discontinuous Current and Continuous Current Isolated, Buck-Boost Design Equations - Designing Boost Inductors for Power Factor Correction (PFC).

MODULE IV FORWARD CONVERTER TRANSFORMER AND OUTPUT INDUCTOR DESIGN 08

Circuit Operation - Comparing the Dynamic B-H Loops - Forward Converter Waveforms - Transformer Design Using the Core Geometry, Kg, Approach Forward Converter Output Inductor Design - Output Inductor Design Using the Core Geometry, Kg, Approach.

MODULE V QUIET CONVERTER DESIGN 08

The Voltage-fed Converter - Regulating and Filtering - The Current-fed Converter - The Quiet Converter - Regulating and Filtering - Quiet Converter Waveforms - Technology on the Move - Window Utilization Factor, Ku - Temperature Stability - Calculating the Apparent Power, P,. Quiet Converter Design Equations - Transformer Design, Using the Core Geometry, Kg, Approach Winding Termination - PC Board Base Materials - Core Mounting and Assembly.

MODULE VI PLANAR TRANSFORMERS 07

Planar Transformer Basic Construction-Planar Integrated PC Board Magnetics - Core Geometries - Planar Transformer and Inductor Design Equations - Window Utilization, Ku - Current Density, J - Printed Circuit Windings - Calculating the Mean Length Turn, MLT - Winding Resistance and Dissipation - PC Winding Capacitance - Planar Inductor Design - Winding Termination - PC Board Base Materials - Core Mounting and Assembly.

Total Hours: 45

REFERENCES:

1. COLONEL WM. T. MCLYMAN, TRANSFORMER AND INDUCTOR DESIGN, Third Edition, Revised and Expanded © Copyright © 2004 by Marcel Dekker, Inc.
2. Charles A. *Harper, Handbook of Electronic Packaging,* McGraw-Hill Book Company, pp. 1-51-1-53.
3. W.G. Hurley, W.H. Wölfle Transformers and Inductors for Power Electronics *Theory, Design and Applications,* Wiley, February 2013
4. Vencislav Cekov Valchev, Alex Van den Bossche, Inductors and Transformers for Power Electronics, March 24, 2005 by CRC Press

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Ability to design magnetics with faster and tighter control.
- Able to work on state-of-the-art design or high-volume or low-cost production.
- To analyze and design the planar transformer design and planar construction.
- To design lightweight, high-frequency aerospace transformers or low-frequency commercial transformers.
- Ability to use various approaches in arriving at suitable transformer and inductor designs.

EECY047	SPECIAL ELECTRICAL MACHINES AND CONTROLLERS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart knowledge on Construction, principle of operation and performance of switched reluctance motors.
- To understand the Construction, principle of operation and performance of SM.
- To impart knowledge on Construction, principle of operation and performance of AC commutator motors.
- To study about the Construction, principle of operation and performance of permanent magnet brushless D.C. motors and PMSM.
- To impart knowledge on Construction, principle of operation and performance of linear motors.
- To learn the softwares Magnet AND ANSYS for performance analysis of motor.

MODULE I SWITCHED RELUCTANCE MOTORS 07

Constructional features - principle of operation - Torque equation - Power controllers Characteristics and control - Microprocessor based controller.

MODULE II STEPPING MOTORS 07

Constructional features, principle of operation-modes of excitation torque, production in Variable Reluctance (VR) stepping motor- dynamic characteristics, Drive systems - circuit for open loop control- closed loop control of stepping motor.

MODULE III AC COMMUTATOR MOTORS 07

Principle of operation – Equivalent circuit – Phasor diagram – Performance of Repulsion motor and Universal motor.

MODULE IV PERMANENT MAGNET MOTORS 07

Principle of operation – types – magnetic circuit analysis – EMF and Torque equations – Power Controllers – Motor characteristics and control of PMSM and BLDC motors.

MODULE V LINEAR MOTORS 07

Linear Induction motor (LIM) classification – construction – Principle of operation –

Concept of current sheet – goodness factor – DC Linear motor (DCLM) types – circuit equation , DCLM control applications ,Linear Synchronous motor(LSM) – Types - Performance equations – Applications.

MODULE VI CASE STUDY 10

Modeling and simulation – Switched Reluctance Machines – Permanent magnet BLDC Motor – PMSM – MAGNET 6.0, ANSYS software.

Total Hours: 45

REFERENCES:

1. Taylor E O, “The performance and design of AC Commutator motors”, Sir Issac Pitman & Sons, London, 1998.
2. Kenjo T, “Stepping Motors and their Microprocessor Controls”, Clarendon Press London, 1984.
3. Miller T J E, “Brushless Permanent Magnet and Reluctance Motor Drives”, Clarendon Press, Oxford, 1989.
4. Naser A and Boldea L,”Linear Electric Motors: Theory Design and Practical Applications”, Prentice Hall Inc., New Jersey 1987.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Talent in selection of motor for various application
- A thorough understanding of various special electric machines and their applications.
- Able to analyse any electric machine.
- Ability to model small power rating of motor for real time application
- Software knowledge in Magnet, ANSYS for electrical application.
- Able to present the rudiments of linear machines.

ECY048 VECTOR CONTROL OF AC DRIVES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge, on advanced aspects of AC drives
- To prepare the students to analyze Vector control of IM drives..
- To prepare the students to analyze advanced control aspects of synchronous machines.
- To prepare the students to analyze control of special machines

MODULE I CONTROL OF INDUCTION MOTOR DRIVES I 08

Principle of Vector control of IM drives – Direct torque control – Direct flux control – torque, voltage and current equations – problems.

MODULE II CONTROL OF INDUCTION MOTOR DRIVES II 07

Sensorless control of IM drives – Flux Observers – Multi-level converter fed IM drive – Utility friendly IM drive. **7**

MODULE III CONTROL OF SYNCHRONOUS MOTOR DRIVE 07

Self controlled SM drives – Vector control of SM drives – Cyclo-converter fed SM machines – torque and speed control of SM drives (including sensorless).

MODULE IV CONTROL OF SPECIAL ELECTRIC DRIVES 07

Control of : PM drives – PM Synchronous Motor drives – Brushless DC motor – switched reluctance motor – stepper motor

MODULE V PARAMETER SENSITIVITY AND SATURATION EFFECTS

Phasor diagram for detuned operation: Field orientation flux, Torque characteristics – influence of saturation – transient response : Torque response with slip gain error- optimal selection of flux level.

MODULE VI FLUX WEAKENING OPERATION

Maximum Speed - Voltage Limit Eclipse - Flux Weakening Operation Scheme - Flux Weakening Control Schemes: Indirect Flux Weakening Algorithm and controllers - Model - free control schemes : six step and Adaptive control - and Model – based control schemes: direct and Indirect control of Flux.

Total Hours: 45

REFERENCES

1. Bimal K. Bose ,Power Electronics and Variable Frequency Drives
2. *Technology and Applications,* Institute of Electrical and Electronics Engineers, Inc.
3. D. W. Novotny, T. A. Lipo, Vector Control and Dynamics of AC Drives, Clarendon Press, 1996 - Technology & Engineering
4. Bin Wu High-Power Converters and AC Drives, John Wiley & Sons, 17-Feb-2006 - Technology & Engineering
5. Haitham Abu-Rub, Atif Iqbal ,Jaroslaw Guzinski ,High Performance Control Of Ac Drives With Matlab/Simulink Models , 2012 John Wiley & Sons Ltd

OUTCOMES

- Able to develop induction motor models for variable speed operations using scalar and vector control techniques.
- Apply the knowledge of sensors which can be used for controllers and synchronous machines.
- Able to implement Field oriented control (FOC) for synchronous motor, BLDC motors and PMSM motor.
- Able to analyze the characteristics of flux and flux weakening operation.

EECY049 SOLAR AND ENERGY STORAGE SYSTEM

L	T	P	C
3	0	0	3

OBJECTIVES

- To Study about solar modules and PV system design and their applications
- To Deal with grid connected PV systems
- To Discuss about different energy storage systems

MODULE I INTRODUCTION 06

Characteristics of sunlight – semiconductors and P-N junctions –behaviour of solar cells – cell properties – PV cell interconnection

MODULE II STAND ALONE PV SYSTEM 08

Solar modules – storage systems – power conditioning and regulation - protection – stand alone PV systems design – sizing

MODULE III GRID CONNECTED PV SYSTEMS 09

PV systems in buildings – design issues for central power stations – safety – Economic aspect – Efficiency and performance - International PV programs

MODULE IV POWER CONDITIONING SCHEMES 08

DC Power conditioning Converters - Maximum Power point tracking algorithms - AC Power conditioners Synchronized operation with grid supply - Harmonic problem – building integrated PV systems.

MODULE IV ENERGY STORAGE SYSTEMS 08

Impact of intermittent generation – Battery energy storage – solar thermal energy storage – pumped hydroelectric energy storage

MODULE V APPLICATIONS 06

Water pumping – battery chargers – solar car – direct-drive applications –Space – Telecommunications.

Total : 45 Periods

TEXT BOOKS

1. Eduardo Lorenzo G. Araujo, Solar electricity engineering of photovoltaic systems, Progensa,1994.

2. Stuart R.Wenham, Martin A.Green, Muriel E. Watt and Richard Corkish, Applied Photovoltaics, 2007,Earthscan, UK.

REFERENCES

1. Frank S. Barnes & Jonah G. Levine, Large Energy storage Systems Handbook , CRC Press, 2011.
2. Solar & Wind energy Technologies – McNeils, Frenkel, Desai, Wiley Eastern, 1990
3. Solar Energy – S.P. Sukhatme, Tata McGraw Hill,1987.

OUTCOME

Students will develop more understanding on solar energy storage systems:

- Students will develop basic knowledge on standalone PV system
- Students will understand the issues in grid connected PV systems
- Able to develop various power conditioning schemes for solar systems.
- Able to explain the Grid connected PV systems.
- Students will study about the modelling of different energy storage systems and their performances
- Students will attain more on different applications of solar energy

EECY050	FUNDAMENTALS OF GRID CONNECTED PHOTO-VOLTAIC POWER ELECTRONIC CONVERTER DESIGN	L	T	P	C
		3	0	0	3

MODULE I INTRODUCTION **04**

Characteristics of sunlight – semiconductors and P-N junctions –behaviour of solar cells – cell properties – PV cell interconnection

MODULE II OVERVIEW OF PHOTO VOLTAIC SYSTEMS AND CONVERTERS **08**

Grid connection standards, Solar Cell Characteristics, Solar panel and converter configurations, Converter topologies,Grid filter topologies, Temporary storage

MODULE III CONTROL OF PHOTO VOLTAIC CONVERTERS **09**

Maximum power utilization of photo voltaic power sources, DC-DC Converter Control, DC- AC Converter control, Harmonic compensation, Grid synchronisation, Anti Islanding

MODULE IV POWER CONDITIONING SCHEMES **09**

DC Power conditioning Converters - Maximum Power point tracking algorithms - AC Power conditioners Synchronized operation with grid supply - Harmonic problem – building integrated PV systems.

MODULE V SYSTEM DESCRIPTION, MODELLING AND OPTIMIZATION **09**

Converter topology and control description, P&O Maximum Power Point Tracker optimization, Phase Locked Loop PI Regulator, Current Regulator,Voltage Controller , Complete control system model.

MODULE VI SIMULATIONS **06**

DC-DC Converter, DC-AC Converter- PLL, Current control, Voltage control, The LCL filter.

Total Hours: 45

TEXT BOOKS

1. Svein Erik Evju,Fundamentals of Grid Connected Photo-Voltaic Power Electronic Converter Design', Norwegian University of Science and Technology.

REFERENCES

1. Eduardo Lorenzo G. Araujo, Solar electricity engineering of photovoltaic systems, Progensa,1994. 2. Stuart R.Wenham, Martin A.Green, Muriel E. Watt and Richard Corkish, Applied Photovoltaics, 2007,Earthscan, UK.
2. Frank S. Barnes & Jonah G. Levine, Large Energy storage Systems Handbook , CRC Press, 2011.
3. Solar & Wind energy Technologies – McNeils, Frenkel, Desai, Wiley Eastern, 1990
4. Solar Energy – S.P. Sukhatme, Tata McGraw Hill,1987.

Outcomes:

- Will become familiar with the operation of the components of PV systems, including solar modules, power control components, and the balance of system components.
- Able to carry out a credible design of a grid-connected PV system.
- Able to model and design MPPT and controllers of grid tied inverters.
- Use of simulation software for energy yield estimation

EECY051 SOLAR POWER SYSTEMS DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge, analyze and to design the modern semi-conductor devices and their applications in power Electronic controller for rectification, inversion, frequency conversion with improved performance.

MODULE I SOLAR POWER SYSTEM PHYSICS 07

Solar Cell Physics - Solar Cell Electronics - Types of Solar Cells Technologies - Concentrators - Solar Panel Arrays - Solar Power System Components.

MODULE II SOLAR POWER TECHNOLOGIES 08

Solar Power System Components - Crystalline Solar Photovoltaic Module Production - Amonix Megaconcentrators - Film Technologies - Solar Photovoltaic System Power Research and Development.

MODULE III SOLAR POWER SYSTEM DESIGN 09

Solar Power System Components and Materials - - Storage Battery Technologies - Solar Power System Wiring - Considerations for - Lightning Protection - Central Monitoring and Logging System Requirements - Ground-Mount and Roof-Mount Photovoltaic Module Installations - Shading Analysis and Solar Energy Performance Multiplier - Site Evaluation - Solar Power Design.

MODULE IV SOLAR POWER GENERATION PROJECT IMPLEMENTATION 07

Designing a Typical Residential Solar Power System - Example of Typical Solar Power System Design and Installation Plans for a Single Residential Unit - Commercial Applications -Small-Scale Solar Power Pumping Systems -Large-Capacity Solar Power Pumping Systems - Pump Operation Characteristics - Semitropic Open Field Single-Axis Tracking System PV Array

MODULE V ECONOMICS OF SOLAR POWER SYSTEMS 06

Current Preliminary Engineering Design - Meteorological Data - Energy Cost Factor - Project Cost Analysis - Feasibility Study Report.

MODULE VI PASSIVE SOLAR HEATING TECHNOLOGIES 08

Passive Solar Water Heating - Pool Heating - Concentrator Solar Technologies - Solar Cooling and Air Conditioning - Direct Solar Power Generation - Innovations

in Passive Solar Power Technology.

Total Hours: 45

REFERENCES:

1. Mukund R. Patel, "Wind and Solar Power Systems Design, Analysis, and Operation", Published in 2006 by CRC Press, Taylor & Francis Group
2. Ned Mohan, Tore M. Undeland. "Power Electronics- Converters, Applications and Design", John Wiley & Sons (Asia) Private Ltd., 2003.
3. M.D.Singh , " Power Electronics"Tata McGraw-Hill Education, 07-Jul-2008
4. R W Erickson and D Makgimovic,"Fundamental of Power Electronics" Springer, 2001 2nd Edition.
5. Vedam Subrahmanyam, "Power Electronics", New Age International (P) Limited, New Delhi, 1997.
6. D.M.Mitchell, DC-DC Switching Regulator Analysis McGraw-Hill Ryerson, Limited, 1988

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following

- Understand the characteristics of solar cell.
- Understand the constructional details of solar panel.
- Know about the monitoring and commissioning of solar panel
- Know about the solar pumping and mechanical tracking of solar power generation system.
- Cost analysis of solar power generation system.

EECY052	SWITCHED MODE POWER CONVERSION SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To apply the basic concepts of power electronics for designing converters and protection circuits.
- To apply mathematics in analyzing switching converter circuit performance.
- To solve engineering problems related to switching converters.
- To understand the modeling of the switched mode power converter.
- Design and implement practical circuits for UPS, SMPS etc.

MODULE I SWITCHED MODE POWER CONVERSION – OVERVIEW 07

Overview of switched mode power conversion, Prior art, Power semi conductor switches – ideal, non ideal switch characteristics, issues related to switches. Design of Transformer, inductor, capacitor for SMPS.

MODULE II DC – DC CONVERTERS 08

Introduction to DC – DC Converters, Continuous and Dis- continuous operation of DC- DC Converters Primitive converter, Non- isolated converter, Isolated Converters – Performance analysis under ideal and non ideal conditions.

MODULE III MODELING OF CONVERTERS 08

Modeling of DC – DC converter- State space representation - Circuit Averaging – DC-DC converter controller structure

MODULE IV CONTROLLER DESIGN FOR DC-DC CONVERTER 08

Controllers and Sensing Circuit, Current Control, Implementation of PID controller for DC- DC converter – Controller Design, Regulation of Multiple outputs

MODULE V STABILITY AND CONTROL-LOOP COMPENSATION IN SMPS 08

Causes of Instability in Switch mode Supplies - Methods of Stabilizing the Loop - Stability Testing Methods - Test Procedure Transient Testing Analysis - Bode Plots - Measurement-Procedures for Bode Plots of Closed - Loop Power Supply Systems - Test Equipment for Bode Plot Measurement - Test Techniques - Measurement Procedures for Bode Plots of Open-Loop Power Supply Systems - Establishing Optimum Compensation Characteristic by the “Difference Method” - Some Causes of Stubborn Instability – Problems

MODULE VI SIMULATION EXERCISES 06

Complete closed loop controller design for: dc-dc systems – Step down, boost, isolated converters - System id tool based linearization model creation by Matlab

Total Hours: 45

REFERENCES:

1. M.H.Rashid, " Power Electronics Handbook", Elsevier Press,2005.
2. Nihal Kularatna, "Power Electronics Design Handbook: Low Power
1. Components and Applications", 2012.
2. Keith.H.Sueker, "Power Electronics Design:A Practitioner's Guide", 2003.
3. Issa Batarseh, "Power Electronic Circuits ", John Wiley, 2004.
4. Philip T Krein, "Elements of Power Electronics ",Oxford Press,1997.
5. Mohan, Un del and and Robbins; Power Electronics: Converters, Applications
6. and Design, John Wiley and Sons, 2011.
7. Umanand.L, Power Electronics: Essentials and Applications, Wiley India, 2009.
8. Umanand.L, Bhat,S.R., Design of Magnetic Components for Switched Mode
9. Power Converters, Wiley Eastern Publication, 1992.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Understand the importance of switched mode power conversion
- Ability to design DC-Dc converter
- Ability to design controller circuit for DC – DC Converter
- Ability to design and implement switched mode power conversion devices.
- Ability to choose appropriate power converter topologies and design the power stage and feedback controllers for various applications

EEC6101	PR SYSTEMS THEORY INCIPLES OF SECURITY ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide knowledge on state space approach, state feedback controllers and observers for different processes.
- To enhance knowledge on stability analysis of multivariable processes.
- To introduce nonlinear systems and its linearization methods.
- To evaluate Stability of Linear and Non Linear Systems.

MODULE I STATE SPACE APPROACH 08

Introduction to State Space Approach - System representation in state variable form – State transition equation – Methods of computing the state transition matrix.

MODULE II STATE FEEDBACK CONTROL AND STATE ESTIMATOR 08

Stability analysis - Controllability and Observability of linear time invariant systems - State Feedback – Output Feedback – Pole placement technique – Full order and Reduced Order Observers.

MODULE III STABILITY FOR LINEAR SYSTEMS 08

Introduction – Equilibrium points – Stability in the sense of Lyapunov - BIBO Stability – Stability of LTI systems – The direct method of Lyapunov and the Linear continuous time autonomous systems – Popov Stability Criterion.

MODULE IV NON-LINEAR SYSTEMS 06

Types of Non-Linearity – Typical Examples – Phase plane analysis (analytical and graphical methods) – Limit cycles – Equivalent Linearization.

MODULE V STABILITY FOR NON-LINEAR SYSTEMS 08

Equilibrium stability of non linear continuous time autonomous systems – Finding Lyapunov functions for nonlinear continuous time autonomous systems – Krasovskii and variable gradient method.

MODULE VI STABILITY FOR NON-LINEAR SYSTEMS USING DESCRIBING FUNCTION 07

Describing Function Analysis for Non Linear Systems, Describing Functions for different non-linear elements- backlash, deadzone, saturation and hysteresis.

Total Hours: 45

REFERENCES:

1. M.Gopal, “Modern Control System Theory”, New Age International, 2005.
2. K.Ogata, “Modern Control Engineering”, Prentice Hall of India, 2002.
3. John .S.Bay, “Fundamentals of Linear State Space Systems”, Tata McGraw Hill, 1999.
4. Z.Bubnicki, “Modern Control Theory”, Springer, 2005.

OUTCOMES:

At the end of the course, the students will have knowledge and achieve skills on the following:

- Implement state space approach for the process and obtain the solution.
- Design state feedback controller and observers.
- Perform stability analyses of the system using conventional mathematical approach
- Ability to analyze complex systems using mathematical models.
- Ability to analyze the stability of Linear Systems using Lyapnov and Popov Stability Criterions
- Ability to analyze the stability of Non-Linear Systems using novel techniques.

GEC71XX SOFT COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES

The aim of the course is to

- Enumerate the strengths and weakness of soft computing
- Illustrate soft computing methods with other logic driven and statistical method driven approaches
- Focus on the basics of neural networks, fuzzy systems, and evolutionary computing
- Emphasize the role of euro-fuzzy and hybrid modeling methods
- Trace the basis and need for evolutionary computing and relate it with other soft computing approaches

MODULE I SOFT COMPUTING - BASICS 06

Soft computing – Hard Computing – Artificial Intelligence as the basis of soft computing – Relation with logic driven and statistical method driven approaches- Expert systems – Types of problems: Classification, Functional approximation, Optimizations – Modeling the problem – Machine Learning – Hazards of Soft Computing – Current and future areas of research

MODULE II ARTIFICIAL NEURAL NETWORK 12

Artificial Neuron – Multilayer perceptron – Supervised learning – Back propagation network –Types of Artificial Neural Network: Supervised Vs Un Supervised Network – Radial basis function Network – Self Organizing Maps – Recurrent Network – Hopfield Neural Network – Adaptive Resonance Theory – Issues in Artificial Neural Network – Applications

MODULE III FUZZY SYSTEMS 09

Fuzzy Logic – Membership functions – Operators – Fuzzy Inference systems – Other sets: Rough sets, Vague Sets – Fuzzy controllers – Applications

MODULE IV NEURO FUZZY SYSTEMS 09

Cooperative Neuro fuzzy systems – Neural network driven fuzzy reasoning – Hybrid Neuro fuzzy systems – Construction of Neuro Fuzzy systems: Structure Identification phase, Parameter learning phase – Applications

MODULE V EVOLUTIONARY COMPUTING 09

Overview of evolutionary computing – Genetic Algorithms and optimization – Genetic Algorithm operators – Genetic algorithms with Neural/Fuzzy systems – Variants of Genetic Algorithms– Population based incremental learning – Evolutionary strategies and applications

Total Hours: 45

TEXTBOOKS:

1. Samir Roy, “Introduction to Soft Computing: Neuro-Fuzzy and Genetic Algorithms”, Pearson, 2013
2. AnupamShukla, RituTiwari and Rahul Kala, “Real life applications of Soft Computing”, CRC press, 2010.
3. Fakhreddine O. Karray, “Soft Computing and Intelligent Systems Design: Theory, Tools and Applications”, Pearson, 2009

OUTCOMES

The students will be able to

- Enumerate the theoretical basis of soft computing
- Explain the fuzzy set theory
- Discuss the neural networks and supervised and unsupervised learning networks
- Demonstrate some applications of computational intelligence
- Apply the most appropriate soft computing algorithm for a given situation

GENERAL ELECTIVES

GECY101 PROJECT MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

The objectives of the course would be to make the students

- Learn to evaluate and choose an optimal project and build a project profile.
- Attain knowledge on risk identification and risk analysis
- Gain insight into a project plan and components
- Familiar with various gamut of technical analysis for effective project implementation
- Learn to apply project management techniques to manage resources.

MODULE I INTRODUCTION & PROJECT INITIATION 09

Introduction to project and project management - projects in contemporary organization – The project life cycle - project initiation - project evaluation methods & techniques - project selection criteria - project profile.

MODULE II RISK ANALYSIS 09

Sources of risk: project specific - competitive - industry specific - market and international risk – perspectives of risk – risk analysis: sensitivity analysis - scenario analysis - breakeven analysis - simulation analysis - decision tree analysis – managing/mitigating risk – project selection under risk.

MODULE III PROJECT PLANNING & IMPLEMENTATION 09

Project planning – importance – functions - areas of planning - project objectives and policies - steps in planning process - WBS – capital requirements - budgeting and cost estimation - feasibility analysis - creation of project plan – project implementation: pre-requisites - forms of project organization

MODULE IV TECHNICAL ANALYSIS 09

Technical analysis for manufacturing/construction/infrastructure projects – process/technology - materials and inputs - product mix - plant capacity – plant location and site selection – plant layout - machinery and equipment – structures and civil works – schedule of project implementation – technical analysis for software projects.

MODULE V PROJECT MANAGEMENT TECHNIQUES 09

Project scheduling - network construction – estimation of project completion time – identification of critical path - PERT & CPM – crashing of project network - complexity of project scheduling with limited resources - resource allocation - resource leveling – resource smoothing – overview of project management software.

Total Hours: 45

REFERENCES:

1. Projects: Planning, Analysis, Financing, Implementation and Review, Prasanna Chandra, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2004.
2. Project Management and Control, Narendra Singh, Himalaya Publishing, New Delhi, 2015.
3. A Management Guide to PERT/CPM, Jerome, D. Weist and Ferdinand K. Levy, Prentice Hall of India, New Delhi, 1994.

OUTCOMES:

On successfully completing this course, the student will be able to:

- Evaluate & select a project as well as develop a project profile.
- Identify various risks associated with the project and manage it effectively.
- Prepare a detailed project plan addressing its components.
- Perform technical analysis for effective project implementation
- Apply project management techniques for maximizing resource utilization.

GECY102 SOCIETY, TECHNOLGY & SUSTAINABILITY

L	T	P	C
3	0	0	3

OBJECTIVES:

- Aware of new technologies through advances in Science and Engineering.
- To make them realise the profound impact on society.
- Understand the ethical issues raised by technological changes and its effect on society.
- To introduce students a broad range of perspectives on the adoption and use of technologies.
- To make them realize the need of sustainability in the context of emerging technologies.

MODULE I TECHNOLOGY AND ITS IMPACTS 09

Origin and evolution of technologies – Nature of technology- Innovation – Historical Perspective of technology – Sources of technological change - Co-evolution of technology and economy – Scientific knowledge and technological advance – Science and Engineering aspects of Technology – Impact on the Society – Social and Ethical Issues associated with technological change – Social and environmental consequences - Impact of technological change on human life – Technology and responsibility – Technology and social justice.

MODULE II TECHNOLOGY AND ITS ADVANCEMENT 09

Sociological aspects of technology – Ethics and technology – Technology and responsibility – International Economics, Globalisation and Human Rights – Sustainability and Technology – Population and environment - Technology, Energy and Environment – Organisations and technological change.

MODULE III SOCIETY AND TECHNOLOGY 09

Impact of technologies on contemporary society – Role of society in fostering the development of technology – Response to the adaption and use of technology – Impact of technology on developer and consumers – Technological change and globalisation.

MODULE IV IMPACT OF A SPECIFIC TECHNOLOGY ON HUMAN WELFARE 09

Impact of the following technologies on Human life – Medical and Biomedical – Genetics Technology – Electronics and Communications – Electronic media Technology – Information Systems Technology – Nanotechnology – Space

Technology and Energy Technology.

MODULE V THE IMPORTANCE OF SUSTAINABILITY 09

Sustainability – A brief history – Concepts and contexts for sustainability – Ecological imbalance and biodiversity loss – Climate change – Population explosion. Industrial ecology – systems approach to sustainability – Green engineering and technology- sustainable design- sustainable manufacturing- Green consumer movements – Environmental ethics – Sustainability of the planet Earth – Future planning for sustainability.

Total Hours: 45

REFERENCES:

1. Volti Rudi, “Society and Technology Change”, 6th Edition, Worth publishers Inc, USA, 2009.
2. Arthur W.A, “The nature of Technology: What it is and how it evolves”, Free Press, NY, USA, 2009.
3. Winston M and Edelbach R, “Society, Ethics and Technology”, 3rd Edition, San Francisco, USA, 2005.
4. Martin A.A Abraham, “Sustainability Science and Engineering: Defining Principles”, Elsevier Inc, USA, 2006.
5. R.V.G.Menon, “Technology and Society”, Pearson Education, India, 2011.

OUTCOMES:

At the end of this course, the students will be able to

- Understand the benefits of modern technology for the well-being of human life.
- Connect sustainability concepts and technology to the real world challenges.
- Find pathway for sustainable society.

GECY103 ARTIFICIAL INTELLIGENCE

L	T	P	C
3	0	0	3

OBJECTIVES:

- Expose the history and foundations of artificial intelligence.
- Showcase the complexity of working on real time problems underlying the need for intelligent approaches.
- Illustrate how heuristic approaches provide a good solution mechanism.
- Provide the mechanisms for simple knowledge representation and reasoning.
- Highlight the complexity in working with uncertain knowledge.
- Discuss the current and future applications of artificial intelligence.

MODULE I HISTORY AND FOUNDATIONS 08

History – Scope – Influence from life – Impact of computing domains - Agents in environments - Knowledge representation – Dimensions of Complexity – Sample application domains – Agent structure.

MODULE II SEARCH 10

Problem solving as search – State spaces – Uninformed Search – Heuristic search – Advanced search – Constraint satisfaction - Applications.

MODULE III KNOWLEDGE REPRESENTATION AND REASONING 10

Foundations of knowledge representation and reasoning, representing and reasoning about objects, relations, events, actions, time, and space predicate logic, situation calculus, description logics, reasoning with defaults, reasoning about knowledge, sample applications.

MODULE IV REPRESENTING AND REASONING WITH UNCERTAIN KNOWLEDGE 08

Probability, connection to logic, independence, Bayes rule, Bayesian networks, probabilistic inference, sample applications.

MODULE V CASE STUDY AND FUTURE APPLICATIONS 09

Design of a game/Solution for problem in student's domain. Natural Language processing, Robotics, Vehicular automation – Scale, Complexity, Behaviour – Controversies.

Theory: 45

TEXT BOOK:

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall, Third Edition, 2010.
2. David Poole, Alan Mackworth, Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010.
3. Nils J. Nilsson, The Quest for Artificial Intelligence, Cambridge University Press, Online edition, 2013.
4. Keith Frankish, William M. Ramsey (eds) The Cambridge Handbook of Artificial Intelligence, Cambridge University Press, 2014.

OUTCOMES:

Students who complete this course will be able to

- Discuss the history, current applications, future challenges and the controversies in artificial intelligence.
- Apply principle of AI in the design of an agent and model its actions.
- Design a heuristic algorithm for search problems.
- Analyze and represent the fact using logic for a given scenario
- Represent uncertainty using probabilistic models
- Develop a simple game or solution using artificial intelligence techniques.

GECY104 GREEN COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To focus on the necessity of green computing technology.
- To expose to various issues with information technology and sustainability.
- To attain knowledge on the technologies for enabling green cloud computing.
- To elaborate on the energy consumption issues
- To illustrate a Green and Virtual Data Center
- To develop into a Green IT Technologist.

MODULE I INTRODUCTION 08

Trends and Reasons to Go Green - IT Data Center Economic and Ecological Sustainment - The Growing Green Gap: Misdirected Messaging, Opportunities for Action - IT Data Center “Green” Myths and Realities - PCFE Trends, Issues, Drivers, and Related Factors - Green Computing and Your Reputation- Green Computing and Saving Money- Green Computing and the Environment

MODULE II CONSUMPTION ISSUES 10

Minimizing power usage – Cooling - Electric Power and Cooling Challenges - Electrical – Power -Supply and Demand Distribution - Determining Energy Usage - From Energy Avoidance to Efficiency - Energy Efficiency Incentives, Rebates, and Alternative Energy Sources - PCFE and Environmental Health and Safety Standards- Energy-exposed instruction sets- Power management in power-aware real-time systems.

MODULE III NEXT-GENERATION VIRTUAL DATA CENTERS 09

Data Center Virtualization - Virtualization beyond Consolidation - Enabling Transparency - Components of a Virtual Data Center - Datacenter Design and Redesign - Greening the Information Systems - Staying Green- Building a Green Device Portfolio- Green Servers and Data Centers- Saving Energy

MODULE IV TECHNOLOGIES FOR ENABLING GREEN AND VIRTUAL DATA CENTERS 08

Highly Effective Data Center Facilities and Habitats for Technology - Data Center Electrical Power and Energy Management - HVAC, Smoke and Fire Suppression

- Data Center Location - Virtual Data Centers Today and Tomorrow - Cloud Computing, Out-Sourced, and Managed Services.

MODULE V SERVERS AND FUTURE TRENDS OF GREEN COMPUTING 10

Server Issues and Challenges - Fundamentals of Physical Servers - Types, Categories, and Tiers of Servers - Clusters and Grids - Implementing a Green and Virtual Data Center - PCFE and Green Areas of Opportunity- 12 Green Computer Companies- What's in Green computer science-Green off the Grid aimed for data center energy evolution-Green Grid Consortium- Green Applications- Green Computing Making Great Impact On Research

Theory: 45

REFERENCES:

1. Bud E. Smith,"Green Computing Tools and Techniques for Saving Energy, Money, and Resources", Taylor & Francis Group, CRC Press, ISBN-13: 978-1-4665-0340-3, 2014.
2. Jason Harris, "Green Computing and Green IT Best Practices, On Regulations and Industry Initiatives, Virtualization and power management, materials recycling and Tele commuting, Emereo Publishing .ISBN-13: 978-1-9215-2344-1,2014.
3. Ishfaq Ahmed & Sanjay Ranka, "Handbook of Energy Aware and Green Computing", CRC Press, ISBN: 978-1-4665-0116-4, 2013.
4. Kawahara, Takayuki, Mizuno, "Green Computing with Emerging Memory", Springer Publications, ISBN:978-1-4614-0811-6, 2012
5. Greg Schulz, "The Green and Virtual Data Center", CRC Press, ISBN-13:978-1-4200-8666-9, 2009.
6. Marty Poniatowski, "Foundation of Green IT: Consolidation, Virtualization, Efficiency, and ROI in the Data Center", Printice Hall, ISBN: 9780-1-3704-375-0, 2009.

OUTCOMES:

Students who complete this course will be able to

- Demonstrate issues relating to a range of available technologies, systems and practices to support green computing.
- Select appropriate technologies that are aimed to reduce energy consumption.
- Address design issues needed to achieve an organizations' green

computing objectives.

- Analyze the functionality of Data Centers.
- Critically evaluate technologies and the environmental impact of computing resources for a given scenario.
- Compare the impact of Green Computing with other computing techniques.

GECY105 GAMING DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To master event-based programming
- To learn resource management as it relates to rendering time, including level-of-detail and culling.
- To become familiar with the various components in a game or game engine.
- To explore leading open source game engine components.
- To become familiar of game physics.
- To be compatible with game animation.

MODULE I INTRODUCTION 09

Magic Words – What Skills Does a Game Designer Need? – The Most Important Skill -The Five Kinds of Listening-The Secret of the Gifted.

MODULE II THE DESIGNER CREATES AN EXPERIENCE 09

The Game Is Not the Experience -Is This Unique to Games? -Three Practical Approaches to Chasing Rainbows -Introspection: Powers, Perils, and Practice -Dissect Your Feelings -Defeating Heisenberg -Essential Experience.

MODULE III THE EXPERIENCE IN THE PLAYER MIND AND GAME MECHANICS 08

Modeling – Focus -Empathy – Imagination – Motivation – Space – Objects, Attributes, and States – Actions – Rules.

MODULE IV GAMES THROUGH AN INTERFACE 09

Breaking it Down – The Loop of Interaction – Channels of Information – Other Interface.

MODULE V BALANCED GAME MECHANICS 10

Balance – The Twelve Most Common Types of Game Balance – Game Balancing Methodologies - Balancing Game Economies.

Theory: 45

REFERENCES:

1. Jesse Schell, "The Art of Game Design: A Book of Lenses", Second Edition 2nd Edition ISBN-10: 1466598646, 2014.
2. Ashok Kumar, Jim Etheredge, Aaron Boudreaux, “Algorithmic and Architectural Gaming Design: Implementation and Development", 1st edition, Idea Group, U.S ISBN-10: 1466616342, 2012.
3. Katie Salen Tekinba, Melissa Gresalfi, Kylie Peppler, Rafi Santo, "Gaming the System - Designing with Gamestar Mechanic" MIT Press , ISBN-10: 026202781X, 2014.
4. James M. Van Verth, Lars M. Bishop "Essential Mathematics for Games and Interactive Applications", Third Edition,A K Peters/CRC Press, ISBN-10: 1482250926, 2015.

OUTCOMES:

Students who complete this course will be able to

- Realize the basic history and genres of games
- Demonstrate an understanding of the overall game design process
- Explain the design tradeoffs inherent in game design
- Design and implement basic levels, models, and scripts for games
- Describe the mathematics and algorithms needed for game programming
- Design and implement a complete three-dimensional video game

GECY106 SOCIAL COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To create original social applications, critically applying appropriate theories and effective practices in a reflective and creative manner.
- To critically analyze social software in terms of its technical, social, legal, ethical, and functional features or affordances.
- To encourage the development of effective communities through the design, use, and management of social software.
- To give students with a base of knowledge and advances for them to critically examine existing social computing services.
- To plan and execute a small-scale research project in social computing in a systematic fashion.
- To become familiar with the concept of computational thinking.

MODULE I BASIC CONCEPTS 09

Networks and Relations: Relations and Attributes, Analysis of Network Data, Interpretation of network data -New Social Learning – Four Changes that Shift Work - Development of Social Network Analysis: Sociometric analysis and graph theory, Interpersonal Configurations and Cliques – Analysing Relational Data.

MODULE II SOCIAL LINK 09

Individual Actors, Social Exchange Theory, Social Forces, Graph Structure, Agent Optimization Strategies in Networks – Hierarchy of Social Link Motivation- Social Context.

MODULE III SOCIAL MEDIA 08

Trends in Computing – Motivations for Social Computing – Social Media: Social relationships, Mobility and Social context – Human Computation – Computational Models- Business use of social Media.

MODULE IV SOCIAL INFORMATION FILTERING 09

Mobile Location Sharing – Location based social media analysis – Social Sharing and Social Filtering – Automated recommender Systems – Traditional and Social Recommender Systems.

MODULE V SOCIAL NETWORK STRATEGY 10

Application of Topic Models – Opinions and Sentiments – Recommendation Systems – Language Dnamics and influence in online communities – Psychometric analysis – Case Study: Social Network Strategies for surviving the zombie apocalypse.

Theory: 45

REFERENCES:

1. Tony Bingham, Marcia Conner, “The New Social Learning, 2nd Edition: Connect. Collaborate. Work”, 2nd Edition, ATD Press, ISBN-10:1-56286-996-5, 2015.
2. Nick Crossley, Elisa Bellotti, Gemma Edwards, Martin G Everett, Johan Koskinen, Mark Tranmer, “Social Network Analysis for Ego-Nets”, SAGE Publication, 2015.
3. Zafarani, Abbasi and Liu, Social Media Mining: An Introduction, Cambridge University Press, 2014.
4. Christina Prell, “Social Network Analysis: History, Theory and Methodology”, 1st Edition, SAGE Publications Ltd, 2012.
5. John Scott, “Social Network Analysis”, Third Edition, SAGE Publication, 2013.
6. Jennifer Golbeck, “Analyzing the Social Web”, Elsevier Publication, 2013.
7. Huan Liu, John Salerno, Michael J. Young, “Social computing and Behavioral Modeling”, Springer Publication, 2009.

OUTCOMES:

Students who complete this course will be able to

- Realize the range of social computing applications and concepts.
- Analyze data left after in social media.
- Recognize and apply the concepts of computational models underlying social computing.
- Take out simple forms of social diagnostics, involving network and language models, applying existing analytic tools on social information.
- Evaluate emerging social computing applications, concepts, and techniques in terms of key principles.
- Design and prototype new social computing systems.

GECY107 SOFT COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To become familiar with AI and neural networks that can learn from available examples and generalize to form appropriate rules for inferencing systems.
- To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience.
- To provide the mathematical background for carrying out the optimization associated with neural network learning.
- To familiarize with genetic algorithms and other random search procedures useful while seeking global optimum in self-learning situations.
- To introduce case studies utilizing the above and illustrate the intelligent behavior of programs based on soft computing.

MODULE I INTRODUCTION 09

Introduction of soft computing, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing. Artificial Intelligence : Introduction, Various types of production systems, characteristics of production systems, breadth first search, depth first search techniques, other Search Techniques like hill Climbing, Best first Search, A* algorithm, AO* Algorithms and various types of control strategies. Knowledge representation issues, Prepositional and predicate logic, monotonic and non-monotonic reasoning, forward Reasoning, backward reasoning.

MODULE II INTRODUCTION TO NEURAL NETWROK 09

Structure and Function of a single neuron: Biological neuron, artificial neuron, definition of ANN, Taxonomy of neural net, Difference between ANN and human brain, characteristics and applications of ANN, single layer network, Perceptron training algorithm, Linear separability, Widrow & Hebb"s learning rule/Delta rule, ADALINE, MADALINE, AI v/s ANN. Introduction of MLP, different activation functions, Error back propagation algorithm, derivation of BPA, momentum, limitation, characteristics and application of EBPA.

MODULE III FUZZY LOGIC 09

Fuzzy set theory, Fuzzy set versus crisp set, crisp relation & fuzzy relations, Fuzzy systems: crisp logic, fuzzy logic, introduction & features of membership functions, Fuzzy rule base system: fuzzy propositions, formation, decomposition & aggregation of fuzzy rules, fuzzy reasoning, fuzzy inference

systems, fuzzy decision making & Applications of fuzzy logic.

MODULE IV GENETIC ALGORITHM 09

Fundamentals, basic concepts, working principle, encoding, fitness function, reproduction, Genetic modeling: Inheritance operator, cross over, inversion & deletion, mutation operator, Bitwise operator, Generational Cycle, Convergence of GA, Applications & advances in GA, Differences & similarities between GA & other traditional methods.

MODULE V APPLICATION OF COMPUTATIONAL INTELLIGENCE 09

Printed Character Recognition – Inverse Kinematics Problems – Automobile Fuel Efficiency Prediction – Soft Computing for Color Recipe Prediction.

Total Hours: 45

REFERENCES:

1. Jyh-shing Roger Jang, Chuen - Tsai Sun, Eiji Mizutani, “Neuro- Fuzzy and Soft Computing”, Prentice-Hall of India, 2003.
2. S.Rajasekaran & G.A. Vijayalakshmi Pai, “Neural Networks, Fuzzy Logic & Genetic Algorithms, Synthesis & applications”, PHI Publication, 2002.
3. S.N. Sivanandam & S.N. Deepa, “Principles of Soft Computing”, Wiley Publications, 2007.
4. N.K.Bose, “Neural Network Fundamentals with Graphs, Algorithms, and Applications” TMH, 1996.
5. Klir & Yuan, “Fuzzy sets & Fuzzy Logic: Theory & Application”, Prentice Hall of India Pub, 1995.
6. Kosko: “Neural Network & Fuzzy System”, PHI Publication, 1992.

OUTCOMES:

On completion of the programme students will be able to:

- Learn about soft computing techniques and their applications
- Analyze various neural network architectures and able to Understand perceptrons model
- Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
- Apply genetic algorithms to combinatorial optimization problems.
- Evaluate and compare solutions by various soft computing approaches for a given problem.

GECY108 EMBEDED SYSTEM PROGRAMMING

L	T	P	C
3	0	0	3

OBJECTIVES:

- This course provides an introduction to the design of embedded computing systems including their hardware and software architectures.
- Entire software development lifecycle and examine the various issues involved in developing software for embedded systems.
- To analyze the I/O programming and Embedded C coding techniques
- This course will equip students with the software development skills necessary for practitioners in the embedded systems field.

MODULE I INTRODUCTION OF EMBEDDED SYSTEM 09

Embedded computing - characteristics and challenges - embedded system design process-Overview of Processors and hardware units in an embedded system-Compiling, Linking and locating – downloading and debugging –Emulators and simulators processor – External peripherals – Memory testing – Flash Memory.

MODULE II SOFTWARE TECHNOLOGY 09

Software Architectures, Software development Tools, Software Development Process Life Cycle and its Model, Software Analysis, Design and Maintenance.

MODULE III INPUT/OUTPUT PROGRAMMING 09

I/O Instructions, Synchronization, Transfer Rate & Latency, Polled Waiting Loops, Interrupt – Driven I/O, Writing ISR in Assembly and C, Non Maskable and Software Interrupts

MODULE IV DATA REPRESENTATION IN EMBEDDED SYSTEMS 09

Data representation ,Twos complement, Fixed point and Floating Point Number Formats ,Manipulating Bits in -Memory, I/O Ports, Low level programming in C ,Primitive data types , Arrays, Functions ,Recursive Functions, Pointers, Structures & Unions ,Dynamic Memory Allocation ,File handling ,Linked lists, Queues, Stacks.

MODULE V EMBEDDED C 09

Embedded Systems programming in C – Binding & Running Embedded C program in Keil IDE – Dissecting the program -Building the hardware. Basic techniques for reading & writing from I/O port pins – switch bounce - LED Interfacing using Embedded C.

Total Hours: 45

REFERENCES:

1. Marilyn Wolf, "Computers as components ", Elsevier, 2012.
2. Qing Li and Carolyn Yao, "Real-Time Concepts for Embedded Systems", CMP Books, 2003.
3. Daniel W. Lewis, "Fundamentals of embedded software where C and assembly meet", Pearson Education
4. Michael Bass, "Programming Embedded Systems in C and C++", Oreilly, 2003.

OUTCOMES:

On completion of this course the student will be able to

- Design the software and hardware components in embedded system
- Describe the software technology
- Use interrupt in effective manner
- Use keil IDE for programming
- Program using embedded C for specific microcontroller
- Design the embedded projects

GECY109 PRINCIPLES OF SUSTAINABLE DEVELOPMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge in the concepts and dimensions of sustainable development.
- To gain knowledge on the framework for achieving sustainability.

MODULE I CONCEPT OF SUSTAINABLE DEVELOPMENT 09

Environment and Development - Population poverty and Pollution –Global and Local environmental issues –Resource Degradation- Greenhouse gases- Desertification-industrialization –Social insecurity, Globalization and environment. History and emergence of the concept of sustainable development-Objectives of Sustainable Development.

MODULE II COMPONENTS AND DIMENSIONS OF SUSTAINABLE DEVELOPMENT 09

Components of Sustainability –Complexity of growth and equity – Social economic and environmental dimensions of sustainable development – Environment- Biodiversity- Natural -Resources- Ecosystem integrity- Clean air and water- Carrying capacity- Equity, Quality of Life, Prevention, Precaution-Preservation and Public Participation Structural and functional linking of developmental dimensions.

MODULE III FRAMEWORK FOR ACHIEVING SUSTAINABILITY 09

Operational guidelines- interconnected prerequisites for sustainable development Empowerment of Women, children, Youth, Indigenous People, Non-Governmental Organizations Local Authorities, Business and industry-Science and Technology for sustainable development- performance indicators of sustainability and assessment mechanism- Constraints and barriers for sustainable development.

MODULE IV SUSTAINABLE DEVELOPMENT OF SOCIO ECONOMIC SYSTEMS 09

Demographic dynamics of sustainability – Policies for socio-economic development -Strategies for implementing eco-development programmes Sustainable development through trade –Economic growth –Action plan for implementing sustainable development –Urbanization and sustainable Cities – Sustainable Energy and Agriculture –sustainable livelihoods.

MODULE V SUSTAINABLE DEVELOPMENT AND INTERNATIONAL RESPONSE 09

Role of developed countries in the development of developing countries – international summits – Stockholm to Johannesburg – Rio principles – Agenda-Conventions – Agreements – Tokyo Declaration – Doubling statement – Tran boundary issues integrated approach for resources protection and management

Total Hours: 45

REFERENCES:

1. Sayer J. and Campbell, B., The Science of Sustainable Development: Local Livelihoods and the Global environment - Biological conservation restoration & Sustainability, Cambridge university Press, London, 2003.
2. M.K. Ghosh Roy. and Timberlake, Sustainable Development, Ane Books Pvt. Ltd, 2011.
3. Mackenthun K.M., Concepts in Environmental Management, Lewis Publications London,1999.
4. APJ Abdul Kalam and Srijan Pal Singh, Target 3 Billion: Innovative Solutions Towards Sustainable Development, Penguin India, 2011

OUTCOMES:

At the end of the course the student will be able to

- Describe the concepts of sustainable development
- Define the components and dimensions of sustainable development
- Outline the Frame work for achieving sustainability.
- State the policies and strategies for implementing sustainable development for Socio economic programmes.
- Examine the role of developed countries in sustainable development.

GECY110	QUANTITATIVE TECHNIQUES IN MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVE:

To impart knowledge on

- operations research
- production management
- financial management
- decision theory and managerial economics

MODULE I OPERATIONS RESEARCH 09

Introduction to Operations research-Linear programming-Graphical and Simplex Methods, Duality and Post-Optimality Analysis-Transportation and Assignment Problems

MODULE II PRODUCTION MANAGEMENT 09

Inventory control, EOQ, Quantity Discounts, Safety Stock-Replacement Theory-PERT and CPM-Simulation Models-Quality Control.

MODULE III FINANCIAL MANAGEMENT 09

Working Capital Management-Compound Interest and Present Value methods-Discounted Cash Flow Techniques-Capital Budgeting.

MODULE IV DECISION THEORY 09

Decision Theory-Decision Rules-Decision making under conditions of certainity, risk and uncertainity-Decision trees-Utility Theory.

MODULE V MANAGERIAL ECONOMICS 09

Cost concepts-Break-even -Analysis-Pricing techniques-Game Theory applications.

Total Hours: 45

REFERENCES:

1. Vohra, N.D. , Quantitative Techniques in Management, Tata McGraw Hill Co., Ltd, New Delhi, 2009.
2. Seehroeder, R.G., Operations Management, McGraw Hill, USA, 2002.
3. Levin, R.I, Rubin, D.S., and Stinsonm J., Quantitative Approaches to Management, McGraw Hill Book Co., 2008.

4. Frank Harrison, E., The Managerial Decision Making Process, Houghton Miffin Co. Boston, 2005.
5. Hamdy A. Taha, Operations Research- An Introduction, Prentice Hall, 2002.

OUTCOME:

At the end of the course, the students will be able to

- Apply the concepts of operations research for various applications
- Create models for inventory control in production management
- Compute the cash flow for a project
- Choose a project using decision theory based on the risk criterion.
- Apply the concepts of managerial economics in construction management

GECY111 PROGRAMMING USING MATLAB & SIMULINK

L	T	P	C
1	0	2	2

OBJECTIVES:

The aim of this course is to:

- Teach students how to mathematically model engineering systems
- Teach students how to use computer tools to solve the resulting mathematical models. The computer tool used is MATLAB and the focus will be on developing and solving models of problems encountered in engineering fields

MODULE I INTRODUCTION MATLAB DATA PRESENTATION 03+06

Vectors, Matrices -Vector/Matrix Operations & Manipulation- Functions vs scripts-Making clear and compelling plots-Solving systems of linear equations numerically and symbolically- Least squares regression -Curve fitting.

MODULE II MATLAB PLOT FUNCTION 03+06

Introduction- Plot Function – Animation- 3D Plots-Customizing Plots – Plot Applications- Saving &Painting Plots.

MODULE III ROOT FINDING AND COMPUTER REPRESENTATION OF NUMBERS 03+06

Linearization and solving non-linear systems of equations- The Newton-Rapson method- Integers and rational numbers in different bases- Floating point numbers-Round off and errors in basic arithmetic-Significant digits when reporting results

MODULE IV ORDINARY DIFFERENTIAL EQUATIONS 03+06

Numerical integration and solving 1^{st} order, ordinary differential equations (Euler's method and Runge-Kutta) – Use of ODE function in MATLAB

MODULE V NON-LINEAR DIFFERENTIAL EQUATIONS 03+06

Converting 2^{nd} order and higher ODEs to systems of 1^{st} order ODEs- Solving systems of ODEs via Euler's method and Runge-Kutta) – Solving single and systems of non-linear differential equations by linearization-Use of the function ODE in MATLAB to solve differential equations

MODULE VI INTRODUCTION OF SIMULINK 03+06

Simulink & its relations to MATLAB – Modeling a Electrical Circuit- Modeling a fourth order differential equations- Modeling the solution of three equations with three unknowns- Representing a model as a subsystem-Simulink demos.

Total Hours: 45

REFERENCE:

1. Griffiths D V and Smith I M, Numerical Methods for Engineers, Blackwell, 1991.
2. Laurene Fausett, Applied Numerical Analysis Using MATLAB, Pearson 2008.
3. Moin P, Fundamentals of Engineering Numerical Analysis, Cambridge University Press, 2001.
4. Wilson HB, Turcotte LH, Advanced mathematics and mechanics applications using MATLAB. CRC Press, 1997
5. Ke Chen, Peter Giblin and Alan Irving, Mathematical Exploration with MATLAB, Cambridge University Press, 1999.

OUTCOMES:

At the end of this unit students will be able to:

- Use Matlab as a convenient tool for solving a broad range of practical problems in engineering from simple models to real examples.
- Write programs using first principles without automatic use of built-in ones.
- Write programs for solving linear and nonlinear systems, including those arising from boundary value problems and integral equations, and for root-finding and interpolation, including piecewise approximations.
- Be fluent in exploring Matlab's capabilities, such as using matrices as the fundamental data-storage unit, array manipulation, control flow, script and function m-files, function handles, graphical output.
- Make use of Maltab visual capabilities for all engineering applications.
- An ability to identify, formulate, and solve engineering problems. This will be accomplished by using MATLAB to simulate the solution to various problems in engineering fields

GECY112 JAVA PROGRAMMING

L	T	P	C
2	0	0	2

OBJECTIVES:

- To learn the fundamentals of Java programming such as data types, variables and arrays.
- To study the syntax and necessity of decision making and iterative statements.
- To create a class and invoke the methods.
- To instigate programming in overloading of methods.
- To emphasize the concept of packages.
- To learn the exception handling routines.

MODULE I INTRODUCTION TO JAVA PROGRAMMING 15

History and Evolution of Java – Overview of Java – Data types, variables and arrays – Operators – Control statements.

MODULE II METHODS AND CLASSES 15

Class fundamentals – Declaring objects – Methods – Constructors – Garbage collection – Overloading methods – Constructor overloading – Access control – Inheritance – Packages - Exception handling.

Total Hours: 30

REFERENCES:

1. Herbert Schildt, Java The Complete Reference, 9th Edition, Oracle Press, 2014, ISBN: 978007180855-2.
2. Nicholas S. Williams, Professional Java for Web Applications: Featuring WebSockets, Spring Framework, JPA Hibernate and Spring Security (WROX), John Wiley & Sons, 2014, ISBN:978111865651-8.
3. E Balagurusamy, Programming with Java, 5th Edition,Tata Mcgraw Hill,2014.
4. Yashavant Kanetka**,** Let Us Java, 2nd Edition, BPB Publications, 2012**.**

OUTCOMES:

Students to complete this course will be able to

- Implement basic Java programming.
- Create a class and invoke methods for real world problems.
- Construct simple overloading of methods programs.
- Implement various types of inheritance concepts.
- Describe the access control mechanism.

GECY113 PYTHON PROGRAMMING

L	T	P	C
2	0	0	2

OBJECTIVES:

- To learn the list and records of python programming.
- To study the control statements and string functions of python.
- To instigate the fundamental python programming.
- To emphasize GUI in python.
- To integrate python with embedded systems.
- To implement programs in python.

MODULE I INTRODUCTION TO PYTHON PROGRAMMING 15

Installation and environment set up – syntax used in python – variable types – operators – Loops – decision making – string functions - formatted files - GUI basics.

MODULE II EMBEDDED PROGRAMMING USING PYTHON 15

Web interface – system tools – script execution context - Motion-triggered LEDs-Python-arduino prototyping-storing and plotting arduino data-Remote home monitoring system.

Total Hours : 30

REFERENCES:

1. Nick Goddard, “Python Programming”, 2nd edition, ISBN: 1533337772, 2016.
2. Pratik Desai, “Python Programming for Arduino”, 1st edition, Packt publishing, 2015, ISBN: 9781783285938.
3. Mark Lutz, Learning Python: Powerful Object-Oriented Programming, 5th Edition, O'Reilly Media, 2013.
4. Richard H. Barnett, Sarah Cox, Larry O'Cull, “Embedded C Programming and the Atmel AVR”, 2nd edition, 2006.
5. Michael Barr, Anthony Massa, “Programming Embedded Systems”, 2nd Edition, O'Reilly Media, 2006.

OUTCOMES:

Students to complete this course will be able to

- Implement date and time function programming using python.
- Write formatted file programming.
- Construct simple python programs.
- Create web interface using python programming
- Develop embedded system with python programming.
- Build arduino prototype using python programming.

GECY114 INTELLECTUAL PROPERTY RIGHTS (IPR)

L	T	P	C
1	0	0	1

OBJECTIVES:

- To study about Intellectual property rights and its need
- To explore the patent procedure and related issues

MODULE I INTRODUCTION 07

Introduction and the need for intellectual property right (IPR) – IPR in India – Genesis and Development – IPR in abroad – Important examples of IPR – Copyrights, Trademarks, Patents, Designs, Utility Models, Trade Secrets and Geographical Indications – Industrial Designs

MODULE II PATENT 08

Concept of Patent – Product / Process Patents & Terminology – Duration of Patents – Law and Policy Consideration Elements of Patentability –- Patentable Subject Matter – Procedure for Filing of Patent Application and types of Applications – Procedure for Opposition – Revocation of Patents – Working of Patents- Patent Agent – Qualification and Registration Procedure – Patent databases and information system – Preparation of patent documents – Process for examination of patent application- Patent infringement – Recent developments in patent system

Total Hours: 15

REFERENCES

1. B.L.Wadehra; Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India 2000
2. Ajit Parulekar and Sarita D' Souza, Indian Patents Law – Legal & Business Implications; Macmillan India ltd , 2006
3. P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi, 2010.
4. E. T. Lokganathan, Intellectual Property Rights (IPRs): TRIPS Agreement & Indian Laws Hardcover, 2012
5. Alka Chawla, P N Bhagwati , Law of Copyright Comparative Perspectives 1st Edition, LexisNexis, 2013
6. V. K. Ahuja, Law Relating to Intellectual Property Rights 2nd Edition, LexisNexis, 2nd Edition, 2013

7. Deborah E. Bouchoux, Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets, 2015
8. Jatindra Kumar Das, Law of Copyright, PHI Learning, 2015

COURSE OUTCOMES:

Students should be able to

- Identify the various types of intellectual property and their value
- Apply the procedure to file a patent and to deal the related issues
- Search and extract relevant information from various intellectual database

CURRICULUM AND SYLLABI

REGULATIONS - 2016

(As approved by the 9th Academic Council)

M. Tech.

MANUFACTURING ENGINEERING

B.S.ABDUR RAHMAN UNIVERSITY

B.S. ABDUR RAHMAN INSTITUTE OF SCIENCE & TECHNOLOGY
(Estd. u/s 3 of the UGC Act, 1956)
(FORMERLY B.S. ABDUR RAHMAN CRESCENT ENGINEERING COLLEGE)
Rated with A Grade by National Assessment and Accreditation Council
Seethakathi Estate, G.S.T. Road, Vandalur, Chennai - 600 048
www.bsauniv.ac.in

REGULATIONS, CURRICULUM AND SYLLABI

M. Tech.
MANUFACTURING ENGINEERING

(As approved by the 9th Academic Council)

JULY 2016

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VISION AND MISSION OF THE DEPARTMENT OF MECHANICAL ENGINEERING

VISION

To excel in providing quality education and training through Undergraduate and Postgraduate programmes and carryout quality research in the field of Mechanical Engineering.

MISSION

- To provide a good learning experience through appropriate design of curriculum and syllabi that facilitate students to gain thorough understanding of the fundamental concepts and applications in Mechanical Engineering
- To equip students to solve challenging problems in Mechanical Engineering and related areas taking in to account their impact on the society
- To facilitate students to develop good communication, leadership and managerial skills through team approach in conducting experiments and projects
- To pursue academic and collaborative research activities with industry and other research institutions ensuring high quality in publications and other research outputs

PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES

M. Tech. (Manufacturing Engineering)

PROGRAMME EDUCATIONAL OBJECTIVES:

- To provide intensive learning opportunities through well designed courses involving state-of-the-art concepts and techniques not only in the field of Manufacturing Engineering and in the related interdisciplinary aspects to ensure holistic approach
- To equip the post graduates, with knowledge and skill to undertake design, analysis, evaluation of manufacturing systems and processes
- To supplement course work through seminars, workshops, case studies and through paper presentation
- To inculcate research culture by way of solving typical problems, project works from real life situation, innovative assignments relating to the field of Manufacturing
- To employ multiple strategies to evaluate acquisition of knowledge and skill to enable the students to face real life situation in the globalised scenario
- To provide scope for self-study thereby preparing post graduates for lifelong learning to meet the varied needs in their future careers

PROGRAMME OUTCOMES:

On completion of programme, the graduates will

- have the ability to provide solutions for Product Realization
- have the ability to appreciate the relation between Design and Manufacturing
- have a broad understanding and knowledge about the various software in the area of Computer Aided Manufacturing and Inspection
- have ability to undertake research and address open ended problems
- have ability to articulate concepts and ideas with clarity
- have ability to acquire the knowledge in any specific area through study and research

CURRICULUM & SYLLABI FOR
M. Tech. (Manufacturing Engineering)
(FOUR SEMESTERS / FULL TIME)

CURRICULUM

Sl. No.	Course Code	Course Title	L	T	P	C
		SEMESTER I				
1	MAC6183	Probability and Statistics	**3**	**1**	**0**	**4**
2	MEC6121	Non-Traditional Machining and Modern Fabrication	**3**	**0**	**0**	**3**
3	MEC6101	Applied Materials Engineering	**3**	**0**	**0**	**3**
4	MEC6122	Mechatronics in Manufacturing Systems (Integrated Lab)	**3**	**0**	**2**	**4**
5	MEC6103	Advanced Finite Element Analysis (Integrated Lab)	**2**	**1**	**2**	**4**
6		Professional Electives #				**3**
						21
		SEMESTER II				
1	GEC6201	Research Methodology for Engineers	**3**	**0**	**0**	**3**
2	MEC6221	Automated and Computer Integrated Manufacturing (Integrated Lab)	**3**	**0**	**2**	**4**
3	MEC6222	Metal Forming Techniques	**2**	**0**	**0**	**2**
4	MEC6202	Advanced Metrology and NDT (Integrated Lab)	**3**	**0**	**2**	**4**
5		Professional Electives ##				**6**
6	MEC6223	Manufacturing and Measurement Project	**0**	**0**	**2**	**1**
						20
		SEMESTER III				
1		General Electives*				**3**
2		Professional Electives###				**9**
3	MEC7122	Industry Internship				**1**
4	MEC7121	Project Phase I	**0**	**0**	**12**	**6****
						13

Sl. No.	Course Code	Course Title	L	T	P	C
		SEMESTER IV				
1	MEC7121	Project Phase II	**0**	**0**	**36**	**18****
		Total Credit (semester IV)				**18 + 06 = 24**
		Grand Total Credit				**78**

Professional Electives can be chosen from the list, provided that the cumulative credits should not be less than 3

Professional Electives can be chosen from the list, provided that the cumulative credits should not be less than 6

Professional Electives can be chosen from the list, provided that the cumulative credits should not be less than 9

* General Electives can be chosen from the list, provided that the cumulative credits should not be less than 3

** Credits for project work phase I to be accounted along with project work phase II in IV semester

LIST OF PROFESSIONAL ELECTIVES

Sl. No.	Course Code	Course Title	L	T	P	C
		PROFESSIONAL ELECTIVES ON MANUFACTURING				
1	MECY031	Advances in Casting and Welding	**3**	**0**	**0**	**3**
2	MECY032	Cellular Manufacturing System	**3**	**0**	**0**	**3**
3	MECY033	Lean Manufacturing System and Implementation	**3**	**0**	**0**	**3**
4	MECY034	Manufacturing System Simulation	**3**	**0**	**0**	**3**
5	MECY035	Mechatronics in CNC Machines	**3**	**0**	**0**	**3**
6	MECY036	Additive Manufacturing	**2**	**0**	**0**	**2**
7	MECY037	Advanced Joining Process	**2**	**0**	**0**	**2**
8	MECY038	Laser Material Processing	**2**	**0**	**0**	**2**
9	MECY039	Plant Layout and Material Handling	**2**	**0**	**0**	**2**
10	MECY020	Automotive Manufacturing	**1**	**0**	**0**	**1**
11	MECY040	Failure Mode and Effect Analysis	**1**	**0**	**0**	**1**
12	MECY041	Reliability Engineering	**1**	**0**	**0**	**1**
13	MECY021	Virtual Manufacturing	**1**	**0**	**0**	**1**
		PROFESSIONAL ELECTIVES ON DESIGN ENGINEERING				
14	MECY003	Advanced Tool Design	**3**	**0**	**0**	**3**
15	MECY042	Design for Manufacturing	**3**	**0**	**0**	**3**
16	MECY043	Industrial Robotics and Expert Systems	**3**	**0**	**0**	**3**
17	MECY044	Reverse Engineering	**3**	**0**	**0**	**3**
18	MECY045	Tribology of Machines	**3**	**0**	**0**	**3**
19	MECY046	Hydraulics and Pneumatics	**2**	**0**	**0**	**2**
20	MECY047	AI based Optimization Techniques	**1**	**0**	**0**	**1**
21	MECY048	Finite Element Analysis In Manufacturing	**1**	**0**	**0**	**1**
22	MECY013	Geometric Dimensioning and Tolerancing	**1**	**0**	**0**	**1**

Sl. No.	Course Code	Course Title	L	T	P	C
		PROFESSIONAL ELECTIVES ON MATERIAL SCIENCE ENGINEERING				
23	MECY049	Corrosion and Surface Engineering	**3**	**0**	**0**	**3**
24	MECY050	MEMS & Nano Technology	**3**	**0**	**0**	**3**
25	MECY051	Polymers and Composite Materials	**3**	**0**	**0**	**3**
		PROFESSIONAL ELECTIVES ON MANUFACTURING MANAGEMENT				
26	MECY052	Lean Six sigma	**3**	**0**	**0**	**3**
27	MECY053	Manufacturing Management	**3**	**0**	**0**	**3**
28	MECY054	Production and Inventory Management	**3**	**0**	**0**	**3**
29	MECY055	Productivity Management and Re-engineering	**3**	**0**	**0**	**3**
30	MECY056	Supply Chain Management	**3**	**0**	**0**	**3**
31	MECY057	Technology Management	**3**	**0**	**0**	**3**
32	MECY058	Total Quality System and Management	**3**	**0**	**0**	**3**
33	MECY059	Entrepreneurship	**1**	**0**	**0**	**1**

GENERAL ELECTIVES FOR M.TECH PROGRAMMES

Sl. No.	Course Code	Course Title	L	T	P	C
1	GECY101	Project Management	**3**	**0**	**0**	**3**
2	GECY102	Society, Technology & Sustainability	**3**	**0**	**0**	**3**
3	GECY103	Artificial Intelligence	**3**	**0**	**0**	**3**
4	GECY104	Green Computing	**3**	**0**	**0**	**3**
5	GECY105	Gaming Design	**3**	**0**	**0**	**3**
6	GECY106	Social Computing	**3**	**0**	**0**	**3**
7	GECY107	Soft Computing	**3**	**0**	**0**	**3**
8	GECY108	Embedded System Programming	**3**	**0**	**0**	**3**
9	GECY109	Principles of Sustainable Development	**3**	**0**	**0**	**3**
10	GECY110	Quantitative Techniques in Management	**3**	**0**	**0**	**3**
11	GECY111	Programming using MATLAB & SIMULINK	**1**	**0**	**2**	**2**
12	GECY112	JAVA Programming	**1**	**0**	**2**	**2**
13	GECY113	PYTHON Programming	**1**	**0**	**2**	**2**
14	GECY114	Intellectual Property Rights	**1**	**0**	**0**	**1**

SEMESTER I

MAC6183 PROBABILITY AND STATISTICS

L	T	P	C
3	1	0	4

COURSE EDUCATIONAL OBJECTIVES:

This course intends to provide

- a comprehensive introduction to the probability distributions,
- familiarize with testing of hypothesis and estimation theory.
- basic knowledge in simulations used in engineering.

MODULE I PROBABILITY DISTRIBUTIONS 10+03

Axioms of probability – addition and multiplication theorem – conditional probability – total Probability – random variables- moments – moments generating functions and their properties- Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

MODULE II TWO DIMENSIONAL RANDOM VARIABLES 09+03

Joint distributions - Marginal and conditional distributions – functions of random variables - Covariance - Correlation and regression - Central limit theorem.

MODULE III ESTIMATION THEORY 09+03

Partial, Multiple correlations and regressions – Estimation of parameters using maximum likelihood estimator and method of moments.

MODULE IV TESTING OF HYPOTHESIS 08+03

Hypothesis, test statistic, decisions and errors - classical testing, significance and p-values – Student's t- test , Fisher's test and Chi-square tests.

MODULE V SIMULATION 09+03

Simulation - definition - Monte Carlo simulation - random number generation, simulation model building - validation - run size determination - simulation applications - inventory control - facilities creation, simulation software.

L – 45; T – 15; Total Hours: 60

TEXT BOOKS:

1. Douglas C. Montgomery, George C. Runger, “Applied Statistics and Probability for Engineers”, 4th Edition, Wiley publication, 2006.
2. Richard A. Johnson, “Miller and Freund’s Probability and Statistics for Engineers”, 8th Edition, PHI, 2011.
3. Sheldon M. Ross, “Introduction to probability models”, 10th edition, Academic Press, 2009.

REFERENCES:

1. Jerry Banks, John S. Carson, Barry L. Nelson, “Discrete – Event systems Simulation”, Prentice Hall India, New Delhi, 1999.
2. Jay L. Devore, “Probability and Statistics for Engineering and the Sciences”, Duxbury publication, 2007.
3. R. Lyman Ott, Michael Longnecker, “An Introduction to Statistical Methods and Data Analysis”, 6th edition, Brooks/Cole Cengage Learning, USA, 2010.

COURSE OUTCOMES:

At the end of the course students will be able to

- identify and fit probability distribution for a given data.
- solve two dimensional random variable problem.
- solve estimation theory problem.
- testing the hypothesis.
- solve problems in modeling using simulation techniques.

MEC6121	NON-TRADITIONAL MACHINING AND MODERN FABRICATION	L	T	P	C
		3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To gain knowledge on mechanical and chemical energy based non - traditional manufacturing process
- To impart the working principles of electrical energy based non -traditional manufacturing process
- To inculcate the electro thermal energy based non-traditional manufacturing process
- To educate various methods of micro fabrication process
- To learn about micro fabrication technology

MODULE I NON-TRADITIONAL MANUFACTURING PROCESS I (MECHANICAL & CHEMICAL ENERGY BASED) 09

Non thermal energy process – Abrasive machining – Water jet machining - Ultrasonic machining – Chemical machining – Electro chemical machining – construction working principle – steps - types – process parameters – derivations – problems, merits, demerits and applications.

MODULE II NON-TRADITIONAL MANUFACTURING PROCESS II (ELECTRICAL ENERGY BASED) 09

Electro chemical machining – Electro chemical grinding - Electric discharge machining – Wire cut EDM - construction – principle – types – control - circuits – tool design – merits, demerits & applications.

MODULE III NON-TRADITIONAL MANUFACTURING PROCESS III (ELECTRO THERMAL ENERGY BASED) 09

Laser beam machining – Electron beam machining – Plasma arc machining – Ion beam machining – construction working principle types – process parameters – derivations – problems, merits, demerits and applications.

MODULE IV MICROFABRICATION PROCESS 09

Semiconductors – films and film depurification – Oxidation - diffusion – ion implantation – etching – metallization – bonding – surface and bulk machining – LIGA (lithography) Process – Solid free form fabrication.

MODULE V MICROFABRICATION TECHNOLOGY (WAFER LEVEL) 09

Wafer preparation – monolithic processing – moulding – Printed circuit board hybrid & multi chip module technology – programmable devices & application specific integrated circuits (ASIC) – electronic material and processing– steriolithography surface acoustic wave (SAW) devices, Surface Mount Technology.

Total Hours: 45

REFERENCES:

1. Serope kalpakjian & Stevan R. Schmid- Manufacturing Process for Engineering Material, Pearson education, 2008.
2. Julian W.Hardner, Vijay K. Varadan, Osama O. Awadelkarim, Micro sensors MEMS & Smart Devices, John Wiley& Sons Ltd., 2002.
3. Brahem T. Smith, Advanced Machining I.F.S. UK 1989.
4. Jaeger R.C., Introduction to Microelectronic Fabrication, Addison Wesley, 1988.
5. Nario Taniguchi – Nano technology – Oxford University Press 1996.
6. Pandey P.C. & Shan H.S., Modern Machining Processes, Standard Publishing Co., 1980.
7. More Madon, Fundamentals of Microfabrication, CRC Press, 1997.

COURSE OUTCOMES:

Students should be able to

- perform mechanical and chemical energy based non -traditional manufacturing process
- execute electrical energy based non -traditional manufacturing process
- use electro thermal energy based non-traditional manufacturing process
- identify various methods of micro fabrication process
- select suitable micro fabrication technology

MEC6101 APPLIED MATERIALS ENGINERING

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To study the elastic and plastic behavior of engineering materials
- To understand the fracture behavior of engineering materials
- To gain the knowledge on selection of materials for specific applications
- To select the modern materials and identify their applications
- To suggest suitable non-metallic materials for various engineering applications

MODULE I ELASTIC AND PLASTIC BEHAVIOUR 12

Elasticity in metals and polymers - Anelastic and visco-elastic behaviour – Mechanism of plastic deformation and non metallic shear strength of perfect and real crystals – Strengthening mechanisms - work hardening, solid solutioning, grain boundary strengthening, poly phase mixture, precipitation, particle, fiber and dispersion strengthening - Effect of temperature, strain and strain rate on plastic behaviour – Super plasticity – Deformation of non crystalline materials.

MODULE II FRACTURE BEHAVIOUR 15

Griffith's theory, stress intensity factor and fracture toughness – Toughening mechanisms – Ductile, brittle transition in steel – High temperature fracture, creep – Larson Miller parameter – Deformation and fracture mechanism maps

Fatigue, low and high cycle fatigue test, crack initiation and propagation mechanisms and Paris law - Effect of surface and metallurgical parameters on fatigue – Fracture of non metallic materials – Failure analysis, sources of failure, procedure of failure analysis.

MODULE III SELECTION OF MATERIALS 08

Motivation for selection, cost basis and service requirements – Selection for mechanical properties, strength, toughness, fatigue and creep – Selection for surface durability corrosion and wear resistance – Relationship between materials selection and processing – Case studies in materials selection with relevance to aero, auto, marine, machinery and nuclear applications – Computer aided materials selection.

MODULE IV MODERN METALLIC MATERIALS 05

Dual phase steels, High strength low alloy (HSLA) steel, Transformation induced plasticity (TRIP) Steel, Maraging steel, Nitrogen steel – Intermetallics, Ni and Ti aluminides – Smart materials, Shape memory alloys – Metallic glass and Nano crystalline materials.

MODULE V NON METALLIC MATERIALS 05

Polymeric materials – Formation of polymer structure – Production techniques of fibers, foams, adhesives and coating – structure, properties and applications of engineering polymers – Advanced structural ceramics, WC, TiC, TaC, Al2O3, SiC, Si3N4 CBN and Diamond – properties, processing and applications.

Total Hours: 45

REFERENCES:

1. George E.Dieter, Mechanical Metallurgy, McGraw Hill, 1988.
2. Thomas H. Courtney, Mechanical Behaviour of Materials, (2nd edition), McGraw Hill, 2000.
3. Charles, J.A., Crane, F.A.A. and Fumess, J.A.G., Selection and use of engineering materials, (3rd edition), Butterworth-Heiremann, 2001.
4. Flinn, R.A., and Trojan, P.K., Engineering Materials and their Applications, (4th Edition) Jaico, 1999.
5. ASM Hand book, Vol.11, Failure Analysis and Prevention, (10th Edition), ASM, 2002.
6. Ashby M.F., Material Selection in Mechanical Design, 3rd Edition, Butter Worth 2005.

COURSE OUTCOMES:

Students should be able to

- Describe the elastic and plastic behaviour of engineering materials
- Interpret the fracture behavior of engineering materials
- Use the suitable materials for specific applications
- Choose the modern materials for appropriate applications
- Employ the non- metallic materials for various engineering applications

MEC6122	MECHATRONICS IN MANUFACTURING SYSTEMS	L	T	P	C
		3	0	2	4

COURSE EDUCATIONAL OBJECTIVES:

- To study the fundamentals of mechatronic systems
- To educate the working principles of various sensors and transducers
- To understand the role of actuators in manufacturing technology
- To learn the functions of programmable logic controllers
- To impart knowledge on Mechatronics design in factory automation through case studies

MODULE I INTRODUCTION 10

Mechatronics definition - Systems- Need for Mechatronics - Emerging area of Mechatronics - Classification of Mechatronics - Measurement Systems - Control Systems.

Practices on LabVIEW.

MODULE II SENSORS AND TRANSDUCERS 15

Introduction - Performance Terminology – Potentiometers - LVDT - Capacitance sensors - Strain gauges - Eddy current sensor - Hall effect sensor - Temperature sensors - Light sensors – Motion sensor - Selection of sensors - Signal processing.

Practices on Sensors - Potentiometer, Strain gauge, Torque, LVDT, Hall-effect, speed, Vibration, Pressure - Practices on Transducer – Temperature, optical - operational amplifier circuits.

MODULE III ACTUATORS 15

Actuators – Mechanical - Electrical - Fluid Power - Piezoelectric – Magnetostrictive - Shape memory alloy - Applications - Selection of actuators.

Practices on various hydraulics and pneumatics circuits - Hydraulic circuits, Hydraulic and Pneumatic components, Electro Pneumatic Sequencing circuits, Hydraulic and Pneumatic Circuits using simulation software, Hydraulic and Pneumatic circuits using Programmable Logic Controllers (PLC), Electronic Power controls of DC and AC motors.

MODULE IV PROGRAMMABLE LOGIC CONTROLLERS 10

Introduction - Basic structure - Input and output processing - Programming - Mnemonics- Timers, counters and Internal relays - Data handling - Selection of PLC.

Practices on Simulation of bottling plant and punching operation using PLC.

MODULE V DESIGN AND MECHATRONICS CASE STUDIES 10

Designing - Possible design solutions-Traditional and Mechatronics design concepts - Case studies of Mechatronics systems - Pick and place Robot - Conveyor based material handling system - PC based CNC drilling machine – Mechatronics control in automated manufacturing - Data acquisition Case studies. **Practices on** heating and ventilation control using NI-6009.

Total Hours: 60

REFERENCES:

1. Bolton. W, Mechatronics , Pearson education, second edition, fifth Indian Reprint, 2003.
2. Smaili. A and Mrad. F, Mechatronics Integrated Technologies for Intelligent Machines, Oxford University Press, 2008.
3. Devadas Shetty and Richard A. Kolk, Mechatronics Systems Design, PWS Publishing Company, 2007.
4. Godfrey C. Onwubolu, Mechatronics Principles and Applications, Elsevier, 2006.
5. Nitaigour Premchand Mahalik, Mechatronics Principles, Concepts and Applications, Tata McGraw-Hill Publishing Company Limited, 2003.
6. Michael B. Histand and Davis G. Alciatore, Introduction to Mechatronics and Measurement systems. McGraw Hill International Edition, 1999.
7. Bradley D.A, Dawson. D, Buru N.C and Loader A.J, Mechatronics, Nelson Thornes Ltd, Eswar Press, Indian Print, 2004.

COURSE OUTCOMES:

Students should be able to

- Summarize the fundamentals of mechatronic systems
- Select suitable sensor and transducer based on the requirement
- Choose appropriate actuators for an engineering application
- Use Programmable Logic Controller and write simple PLC programs
- Design simple mechatronics systems

MEC6103 ADVANCED FINITE ELEMENT ANALYSIS

L	T	P	C
2	1	2	4

COURSE EDUCATIONAL OBJECTIVES:

- To introduce the mathematical and physical principles underlying the Finite Element Method (FEM).
- To uncover iso-parametric formulation and its importance
- To describe the elementary concepts of plate bending behaviour and theory.
- To introduce time dependent finite element procedure
- To introduce error norms and convergence rates

MODULE I REVIEW OF 1D FEM 12

Historical background - Concept of finite element method - Finite element formulation based on weighted residual method and stationary of a functional - Review of static analysis using 1D element – Bar, truss, Beam element.

Practice on FEA analysis of Machine elements under static loads

MODULE II 2D & 3D FEM 12

Triangular, quadrilateral, tetrahedral element, Lower order and higher order element, Iso-parametric formulation, Static structural and thermal analysis applications.

Practice on FEA analysis of Heat transfer – steady state and transient

MODULE III BENDING OF PLATES & SHELLS 12

Bending of plate and shells - Thin (Kirchoff) and Thick (Mindlin) plate elements – Finite Element Formulation of Plate and Shell Elements – Applications and Examples.

Practice on FEA analysis of Modal analysis, Harmonic analysis

MODULE IV STRUCTURAL DYNAMICS 12

Dynamical equations of motion, Consistent and lumped Mass Matrices, Damping matrices, Vibration Analysis, Eigenvalue problems and solution techniques, Transient dynamical and structural dynamical problems, Explicit and implicit schemes of integrations, Stability issues.

Practice on FEA analysis of Plate bending analysis

MODULE V ERROR ESTIMATES AND ADAPTIVE REFINEMENT 12

Classification of errors – Error tests - Convergence rates- Mesh revision and Gradient Recovery – Adaptive meshing - h refinement with adaptivity – adaptive refinement.

Practice on FEA analysis of Error estimation and convergence tests

Total Hours: 60

REFERENCES:

1. Reddy J.N. An Introduction to the Finite Element Method, McGraw Hill, International Edition, 1993.
2. Cook, Robert Davis et al “Concepts and Applications of Finite Element Analysis”, Wiley, John & Sons, 1999.
3. Nitin S. Gokhale , Sanjay S. Deshpande and Sanjeev V. Bedekar, “Practical Finite Element Analysis”, Amazon India, 2008.
4. Chandrupatla & Belagundu, “Finite Elements in Engineering”, Prentice Hall of India Private Ltd., 1997.
5. Zienkiewicz.O.C, Taylor.R.L “The Finite Element Method” McGraw Hill International Editions, Fourth Edition, 1991, Volume 2.
6. Bathe, K.J., “Finite Element Procedures in Engineering Analysis, 1990.
7. S.S.Rao, Finite Element Analysis, 2002 Edition.
8. David V Hutton “Fundamentals of Finite Element Analysis”. McGraw-Hill International Edition, 2004.

COURSE OUTCOMES:

Students will be able to

- Solving static structural problem by functional approximation and finite element method.
- Solving structural and thermal problems involving complex geometries.
- Model and analyse structures such as pressure vessel, automobile parts and chimney stacks.
- Perform Modal analysis, Harmonic analysis and transient analysis.
- Enhance the skills of interpreting results

SEMESTER II

GEC6201 RESEARCH METHODOLOGY FOR ENGINEERS

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To provide a perspective on research to the scholars
- To educate on the research conceptions for designing the research
- To impart knowledge on statistical techniques for hypothesis construction
- To gain knowledge on methods of data analysis and interpretation
- To learn about the effective communication of research finding

MODULE I RESEARCH PROBLEM FORMULATION 07

Research – objectives – types, Research process, Solving engineering problems, Identification of research topic, Formulation of research problem, Literature survey and review.

MODULE II HYPOTHESIS FORMULATION 08

Research design – meaning and need – basic concepts, Different research designs, Experimental design – principle – important experimental designs, Design of experimental setup, Mathematical modeling, Simulation – validation and experimentation, Dimensional analysis and similitude.

MODULE III STATISTICAL TECHNIQUES 12

Statistics in research – concept of probability – popular distributions –Hypothesis testing- sample design- Design of experiments – factorial designs -– orthogonal arrays- ANOM - ANOVA - Multivariate analysis - Use of optimization techniques – traditional methods – evolutionary optimization techniques –Transportation model.

MODULE IV STATISTICAL ANALYSIS OF DATA 10

Research Data analysis – interpretation of results – correlation with scientific facts- Accuracy and precision – error analysis, limitations - Curve fitting, Correlation and regression.

MODULE V RESEARCH REPORT 08

Purpose of written report – audience, synopsis writing, preparing papers for International journals, Thesis writing – organization of contents – style of writing –

graphs and charts – referencing, Oral presentation and defense, Ethics in research, Patenting, Intellectual Property Rights.

Total Hours: 45

REFERENCES:

1. Ganesan R., Research Methodology for Engineers, MJP Publishers, Chennai, 2011.
2. Ernest O., Doebelin, Engineering Experimentation: planning, execution, reporting, McGraw Hill International edition, 1995.
3. George E. Dieter., Engineering Design, McGraw Hill – International edition, 2000.
4. Madhav S. Phadke, Quality Engineering using Robust Design, Printice Hall, Englewood Cliffs, New Jersey, 1989.
5. Kothari C.R., Research Methodology – Methods and Techniques, New Age International (P) Ltd, New Delhi, 2003.
6. Kalyanmoy Deb., “Genetic Algorithms for optimization”, KanGAL report, No.2001002.
7. Holeman, J.P., Experimental methods for Engineers, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 2007.
8. Govt. of India, Intellectual Property Laws; Acts, Rules & Regulations, Universal Law Publishing Co. Pvt. Ltd., New Delhi 2010.
9. University of New South Wales, “How to write a Ph.D. Thesis” Sydney, Australia, Science @ Unsw.
10. Shannon. R.E., System Simulation: the art and science, Printice Hall Inc, Englewood Cliffs, N.J.1995.
11. Scheffer. R.L. and James T. Mc Clave, Probability and Statistics for Engineers, PWS – Kent Publishers Co., Boston, USA, 1990.

COURSE OUTCOMES:

Students should be able to

- Formulate the research problem
- Design and Analyse the research methodology
- Construct and optimize the research hypothesis
- Analyse and interpret the data
- Report the research findings

MEC6221	AUTOMATED AND COMPUTER INTEGRATED MANUFACTURING	L	T	P	C
		3	0	2	4

COURSE EDUCATIONAL OBJECTIVES:

- To understand basic concepts of Computer Integrated Manufacturing System
- To learn the various mechanisms of automated manufacturing system
- To acquire the knowledge on group technology (GT) and Flexible Manufacturing Systems (FMS)
- To study the various process planning (PP) methods
- To gain the knowledge in computer aided process control and data capturing techniques

MODULE I INTRODUCTION 12

Introduction to CAD/CAM and CIM - Evolution of CIM – CIM wheel and cycle – Production concepts – CIM hardware and software – Major elements of CIM system –Implementation of CIM –– Computer networks for manufacturing – The future automated factory – Management of CIM – Impact of CIM on personnel.

MODULE II AUTOMATED MANUFACTURING SYSTEMS 12

Automated production line – System configurations, Work part transfer mechanisms – Fundamentals of automated assembly system – System configuration, Part delivery at workstations – Design for automated assembly– Overview of material handling equipments – Consideration in material handling system design - Automated Guided Vehicle (AGV) system – Automated storage/Retrieval system and Carousel storage system.

Practices on CNC Lathe: Plain Turning, Step turning, Taper turning, Threading, Grooving & canned cycle.

MODULE III GROUP TECHNOLOGY AND FMS 12

Part families – Visual – Parts classification and coding – Production flow analysis – Grouping of parts and Machines by rank order clustering method – Benefits of GT – Case studies – FMS – Components – Workstations – FMS layout configurations – FMS planning and implementation issues – Architecture of FMS – Flow chart showing various operations in FMS –FMS applications, Benefits.

MODULE IV PROCESS PLANNING 12

Typical process sheet – Case studies in manual process planning, Computer aided process planning – Process planning module and data base – Variant process

planning (VPP) – Two stages in VPP – Generative process planning – Flow chart showing various activities in generative PP – Semi generative process planning.

MODULE V TYPES OF PROCESS CONTROL AND AUTOMATIC DATA CAPTURE 12

Introduction to process model formulation – Linear feedback control systems – Optimal control – Adaptive control –Sequence control and Programmable Logic Controller (PLC), Computer process control – Computer process interface – Interface hardware – Computer process monitoring – Direct digital control and Supervisory computer control - Overview of Automatic identification methods – Bar code technology – Other automatic data capture technologies.

Practices on CNC Milling Machine: Profile Milling, Mirroring, Scaling & canned cycle.

Total Hours : 60

REFERENCES:

1. Mikell P.Groover, Automation, Production system and Computer integrated Manufacturing, Prentice Hall of India Pvt. Ltd., 2008.
2. Radhakrishnan,P., Subramanian,S., and Raju,V., CAD/CAM/CIM, New Age International Publishers, 2000.
3. James A. Retrg, Herry W. Kraebber, Computer Integrated Manufacturing, Pearson Education, Asia, 2001.
4. Gideon Halevi and Ronald D.Weill, Principles of Process Planning, Chapman Hall, 1995.
5. Viswanathan. N., and Narahari,Y.,Performance Modeling and Automated Manufacturing Systems, Prentice Hall of India Pvt. Ltd., 2000.
6. Kant Vajpayee S., Computer Integrated Manufacturing, Prentice Hall of India, New Delhi, 2007.
7. Alavudeen and Venkateshwaran, Computer Integrated Manufacturing, PHI Learning Pvt. Ltd., New Delhi, 2008.

COURSE OUTCOMES:

Students should be able to

- Describe the basic concepts of Computer Integrated Manufacturing System
- Apply the mechanisms of automated manufacturing system
- Execute the concepts of group technology and Flexible Manufacturing Systems
- Establish various process planning methods
- Perform computer aided process control and data capturing techniques

MEC6222 METAL FORMING TECHNIQUES

L	T	P	C
2	0	0	2

COURSE EDUCATIONAL OBJECTIVES:

- To understand the plasticity theories
- To learn the various bulk forming process and their applications
- To study the different sheet metal forming process

MODULE I THEORY OF PLASTICITY 10

Theory of plastic deformation – Yield criteria – Tresca and Von-mises – Distortion energy – Stress-strain relation – Mohr's circle representation of a state of stress – Cylindrical and spherical co-ordinate system – Upper and lower bound solution methods – Overview of FEM applications in metal forming analysis.

MODULE II THEORY AND PRACTICE OF BULK FORMING PROCESSES 10

Analysis of plastic deformation in forging, rolling, extrusion, rod/wire drawing and tube drawing – Effect of friction – Calculation of forces, Work done – Process parameters, Equipment used – Defects – Applications – Recent advances in forging, rolling, extrusion and drawing processes – Design consideration in forming.

MODULE III SHEET METAL FORMING 10

Formability studies – Conventional processes – High energy rate Forming (HERF) techniques – Super plastic forming techniques – Hydroforming – Stretch forming – Water hammer forming – Principles and process parameters – Advantage, limitations and application

Total Hours: 30

REFERENCES:

1. Dieter G.E., Mechanical Metallurgy (Revised Edition II), McGraw Hill Co., 2004.
2. Altan T., Metal forming – Fundamentals and Applications – American Society of Metals, Metals Park, 2003.
3. ASM Hand book, Forming and Forging, Ninth edition, Vol. – 14, 2003.
4. Shiro Kobayashi, Soo-Ik-Oh-Altan. T, Metal forming and Finite element method, Oxford University Press, 2001.

5. Altan.T, Soo-Ik-Oh, Gegel, HL – Metal forming, Fundamentals and Applications, American Society of Metals, Metals Park, Ohio, 1983.
6. Marciniak,Z., Duncan J.L., Hu S.J., Mechanics of Sheet Metal Forming, Butterworth-Heinemann, Elsevier, 2006

COURSE OUTCOMES:

Students should be able to

- Express the plasticity theories
- Apply various bulk forming process for different applications
- Use appropriate sheet metal forming techniques based on the needs

MEC6202 ADVANCED METROLOGY AND NDT

L	T	P	C
3	0	2	4

COURSE EDUCATIONAL OBJECTIVES:

- To train the students in recent measurement systems
- To educate the students on laser based measuring instruments usage
- To gain knowledge in liquid penetrant and magnetic particle test
- To impart knowledge in radiography and its applications
- To perceive ultrasonic and acoustic emission techniques

MODULE I MEASURING MACHINES 15

Tool Maker's microscope - Coordinate measuring machine (CMM)- Universal measuring machine - Machine vision technology -Microprocessors in metrology- Nano-metrology -Measurement system analysis.

Practices on Tool Makers Microscope- - Machine vision technology and surface roughness measurement- CMM

MODULE II LASER METROLOGY 12

Precision instruments based on laser-Principles- laser interferometer-application in linear, angular measurements and machine tool metrology- need, constructional features – types, applications – computer aided inspection.

Practices on measuring the quality using linear measuring Instruments

MODULE III LIQUID PENETRANT AND MAGNETIC PARTICLE TESTS 12

Characteristics of liquid penetrates - Different washable systems – Developers - Applications - Methods of production of magnetic fields - Principles of operation of magnetic particle test - Applications - Advantages and limitations.

Practices on Liquid Penetrant and Magnetic Particle Tests

MODULE IV RADIOGRAPHY 12

Sources of ray-x-ray production - Properties of gamma and x rays – Film characteristics - Exposure charts - Contrasts - Operational characteristics of x ray equipment - Applications.

MODULE V ULTRASONIC AND ACOUSTIC EMISSION TECHNIQUES 09

Production of ultrasonic waves - Different types of waves – General characteristics of waves - Pulse echo method - A, B, C scans - Principles of acoustic emission techniques - Advantages and limitations – Instrumentation and applications.

Total Hours: 60

REFERENCES:

1. Jain, R.K. Engineering Metrology, Khanna Publishers, 1997.
2. Barry Hull and Vernon John, Non Destructive Testing, MacMillan, 1988.
3. American Society for Metals, Metals Hand Book, Vol. II, 1976.
4. I. G. Scott, Basic Acoustic Emission, CRC Press, 1991.

COURSE OUTCOMES:

Students should be able to

- Measure various engineering specifications using recent measurement system
- Use advanced measurement tools such as CMM
- Adopt liquid penetrant and magnetic particle test for engineering applications
- Execute radiography techniques
- Perform ultrasonic and acoustic emission techniques

		L	T	P	C
MEC6223	**MANUFACTURING AND MEASUREMENT PROJECT**	**0**	**0**	**2**	**1**

The main objective is to inculcate problem based learning and to promote team spirit. Students will be asked to take a real world problem in manufacturing and measurement. The students will work in groups.

SEMESTER III

		L	T	P	C
MEC7122	**INDUSTRY INTERNSHIP**	**0**	**0**	**0**	**1**

Students must undergo two weeks industrial training to gain practical experience.

MEC7121	PROJECT WORK - PHASE I	L	T	P	C
		0	0	12	6

The main objective is to promote project based learning.

(Refer to clause 3.15 of B.S. Abdur Rahman University regulations)

SEMESTER IV

		L	T	P	C
MEC7121	**PROJECT WORK - PHASE II**	**0**	**0**	**36**	**18**

This is in continuation with Phase I. The main objective is to promote project based learning.

(Refer to clause 3.15 of B.S. Abdur Rahman University regulations)

PROFESSIONAL ELECTIVES

PROFESSIONAL ELECTIVES ON MANUFACTURING

		L	T	P	C
MECY031	**ADVANCES IN CASTING AND WELDING**	**3**	**0**	**0**	**3**

COURSE EDUCATIONAL OBJECTIVES:

- To impart knowledge on casting design
- To instruct about metallurgical aspects of castings
- To study various casting process and foundry layout
- To educate metallurgical aspects of welding and design
- To understand various welding process

MODULE I CASTING DESIGN 08

Heat transfer between metal and mould — Design considerations in casting – Designing for directional solidification and minimum stresses - Principles and design of gating and risering.

MODULE II CASTING METALLURGY 08

Solidification of pure metal and alloys – Shrinkage in cast metals – Progressive and directional solidification — Degasification of the melt - Casting defects – Castability of steel, cast iron, Al alloys, babbit alloy and Cu alloy.

MODULE III RECENT TRENDS IN CASTING AND FOUNDRY LAYOUT 08

Shell moulding, Precision investment casting, CO2 moulding, Centrifugal casting, Die casting, Continuous casting, Counter gravity low pressure casting, Squeeze casting and semisolid processes - Layout of mechanized foundry – Sand reclamation – Material handling in foundry - Pollution control in foundry — Computer aided design of casting.

MODULE IV WELDING METALLURGY AND DESIGN 10

Heat affected zone and its characteristics – Weldability of steels, cast iron, stainless steel, aluminum, Mg, Cu, Zr and Ti alloys – Carbon equivalent of plain and alloy steels - Hydrogen embrittlement – Lamellar tearing – Residual stress – Distortion and its control - Heat transfer and solidification - Analysis of stresses in welded structures – Pre and post welding heat treatments – Weld joint design – Welding defects – Testing of weldment.

MODULE V RECENT TRENDS IN WELDING 11

Friction welding, friction stir welding – Explosive welding – Diffusion bonding – High frequency induction welding – Ultrasonic welding – Electron beam welding– Laser beam welding –Plasma welding – Electroslag welding - Narrow gap, hybrid twin wire active TIG – Tandem MIG- Modern brazing and soldering techniques – Induction, dip resistance, diffusion processes – Hot gas, wave and vapour phase soldering - Overview of automation of welding in aerospace, nuclear, surface transport vehicles and under water welding.

Total Hours: 45

REFERENCES:

1. ASM Handbook, Vol. 15, Casting, 2004.
2. ASM Handbook Vol. 6, Welding, Brazing & Soldering, 2003.
3. Parmer R.S., Welding Engineering and Technology, Khanna Publishers, 2002.
4. Srinivasan N.K., Welding Technology, Khanna Tech Publishers, 2002.
5. Heineloper & Rosenthal, Principles of Metal Casting, Tata McGraw Hill, 2000.
6. Jain P.L., Principles of Foundry Technology, Tata McGraw Hill Publishers, 2003.
7. Carrry B., Modern Welding Technology, Prentice Hall Pvt Ltd., 2002.
8. Iotrowski, Robotic welding – A guide to selection and application – Society of Mechanical Engineers, 1987.
9. Schwariz M.M., Source book on innovative welding processes – American Society for Metals (OHIO), 1981.
10. Cornu. J. Advanced Welding Systems – Vol. I, II and III, Jaico Publishers, 1994.
11. Lancaster. J .F., Metallurgy of Welding – George Alien & Unwin Publishers, 1980.

COURSE OUTCOMES:

Students should be able to

- Demonstrate the casting design
- Interpret the metallurgical aspects of materials
- Distinguish various casting processes and layouts
- Exhibit metallurgical aspect of welding and design
- Perform various welding process

MECY032 CELLULAR MANUFACTURING SYSTEM

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To understand the basic concepts of cellular manufacturing system
- To impart knowledge on cellular manufacturing system planning and design
- To educate implementation of cellular manufacturing system
- To study the performance measurement and control of cellular manufacturing system
- To gain knowledge on conventional and cellular manufacturing system framework

MODULE I INTRODUCTION 12

Introduction to Group Technology, Limitations of traditional manufacturing systems, characteristics and design of groups, benefits of GT and issues in GT.

MODULE II CMS PLANNING AND DESIGN 10

Problems in GT/CMS - Design of CMS - Models, traditional approaches and non-traditional approaches -Genetic Algorithms, Simulated Annealing, Neural networks.

MODULE III IMPLEMENTATION OF GT/CMS 10

Inter and Intra cell layout, cost and non-cost based models, establishing a team approach, Managerial structure and groups, batch sequencing and sizing, life cycle issues in GT/CMS.

MODULE IV PERFORMANCE MEASUREMENT AND CONTROL 08

Measuring CMS performance - Parametric analysis - PBC in GT/CMS, cell loading, GT and MRP - framework.

MODULE V ECONOMICS OF GT/CMS 05

Conventional Vs group use of computer models in GT/CMS, Human aspects of GT/CMS - cases.

Total Hours: 45

TEXT BOOKS:

1. Askin, R.G. and Vakharia, A.J., G.T "Planning and Operation, in the automated factory-Hand Book: Technology and Management", Cleland.D.I. and Bidananda, B (Eds), TAB Books , NY, 1991.
2. Kamrani, A.K, Parsaei, H.R and Liles, D.H. (Eds), "Planning, design and analysis of cellular manufacturing systems", Elsevier, 1995.

REFERENCES:

1. Burbidge, J.L. Group "Technology in Engineering Industry", Mechanical Engineering pub.London, 1979.
2. Irani, S.A. "Cellular Manufacturing Systems", Hand Book.

COURSE OUTCOMES:

- Illustrate the concepts of cellular manufacturing system
- Perform cellular manufacturing system planning and design
- Execute cellular manufacturing system
- Assess the performance and control of cellular manufacturing system
- Critique conventional and cellular manufacturing system

MECY033	LEAN MANUFACTURING SYSTEM AND IMPLEMENTATION	L	T	P	C
		3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To educate the concepts of lean manufacturing system
- To understand the concepts of modern manufacturing
- To instruct the principles of TQM
- To impart knowledge on six sigma
- To gain knowledge on implementation of lean manufacturing through case studies

MODULE I INTRODUCTION TO LEAN MANUFACTURING 07

Conventional Manufacturing versus Lean Manufacturing – Principles of Lean Manufacturing – Basic elements of lean manufacturing – Introduction to lean manufacturing Tools.

MODULE II CELLULAR MANUFACTURING, JIT, TPM 09

Cellular Manufacturing – Types of Layout, Principles of cell layout, Implementation, JIT – Principles of JIT and Implementation of Kanban. TPM – Pillars of TPM, Principles and implementation of TPM.

MODULE III SET UP TIME REDUCTION, TQM 10

Set up time reduction – Definition, philosophies and reduction approaches, TQM – Principles and implementation, 5S Principles and implementation - Value stream mapping - Procedure and principles.

MODULE IV SIX SIGMA 09

Six Sigma – Definition, statistical considerations, variability reduction, design of experiments – Six Sigma implementation.

MODULE V CASE STUDIES 10

Case studies - Implementation of lean manufacturing in industries.

Total Hours: 45

REFERENCES:

1. Ronald G. Askin & Jeffrey B. Goldberg, Design and Analysis of Lean Production Systems, John Wiley & Sons, 2003.

2. Rother M. and Shook J, 'Learning to See: Value Stream Mapping to Add Value and Eliminate Muda', Lean Enterprise Institute, Brookline, MA. 1999.
3. Mikell P. Groover, Automation, Production Systems and CIM, 2002.

COURSE OUTCOMES:

Students should be able to

- Explain the concepts of lean manufacturing system
- Utilize the modern manufacturing concepts
- Apply principles of TQM
- Execute the concepts of six sigma
- Implement lean manufacturing system for industries

MECY034 MANUFACTURING SYSTEM SIMULATION

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To understand the basic concepts of manufacturing system and simulation
- To learn the random number generation methods
- To perform the design of simulation experiments
- To perceive the simulation languages used in manufacturing system simulation
- To represent the case studies of simulation models

MODULE I INTRODUCTION 08

Basic concepts of system – Elements of manufacturing system - Concept of simulation – Simulation as a decision making tool – Types of simulation – Monte-Carlo simulation - System modeling – Types of modeling – Limitations and application.

MODULE II RANDOM NUMBERS GENERATION 09

Probability and statistical concepts of simulation – Pseudo random numbers – Methods of generating random numbers – Discrete and continuous distribution– Testing of random numbers – Kolmogorov-Smirnov test, Chi-Square test - Sampling - Simple, random and simulated.

MODULE III DESIGN OF SIMULATION EXPERIMENTS 10

Problem formulation – Data collection and reduction – Time flow - Mechanical key variables - Logic flow chart starting condition – Run size – Experimental design consideration – Output analysis, interpretation and validation – Application of simulation in engineering industry.

MODULE IV SIMULATION LANGUAGE 09

Comparison and selection of simulation languages - Study of General Purpose Simulation System (GPSS) - Basic blocks - Generate, queue, depart, size, release, advance, terminate, transfer, enter and leave.

MODULE V CASE STUDIES 09

Development of simulation models using GPSS for queuing, production, inventory, maintenance and replacement systems – Case studies.

Total Hours: 45

REFERENCES:

1. Jerry Banks and John S.Carson, Discrete event system simulation, Prentice Hall 1991.
2. John H.Mize and J.Grady Cox, Essentials of simulation, Prentice hall 1989.
3. Geoffrey Gordon, System simulation, Prentice Hall of India, 1992.
4. Jeffrey L. Written, Lonnie D, Bentley and V.M. Barice, System analysis and Design Methods, Galgotia publication, 1995.
5. Averill M.Law and W.David Kelton, Simulation Modeling and analysis, McGraw Hill International Editions, 1991.

COURSE OUTCOMES:

Students should be able to

- Describe the basic concepts of manufacturing system simulation
- Ascertain the random number generation methods
- Execute the design of simulation experiments
- Distinguish the simulation languages used in manufacturing system simulation
- Interpret the case studies of simulation models

MECY035 MECHATRONICS IN CNC MACHINES

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To understand the fundamentals of adaptive controls
- To learn about mechatronic elements in CNC machine
- To educate mechatronic elements in CNC measuring system and tooling
- To impart knowledge on CNC programming
- To gain knowledge on installation and maintenance of CNC machines

MODULE I INTRODUCTION OF NC, CNC, DNC AND ADAPTIVE CONTROL 06

Classification of machine tools – types, functions and processes - fundamentals of NC and CNC technologies Adaptive control - types, application and benefits - general configuration of adaptive control and function – reasons for process change - practical problems with adaptive control - example for feedback and adaptive control.

MODULE II MECHATRONIC ELEMENTS IN CNC MACHINE 09

CNC systems - configuration of the CNC system – interfacing – monitoring – diagnostics - machine data - compensations for machine accuracies - PLC in CNC – PLC programming for CNC, steps in programming and case studies - machine structure -types of loads on CNC machine - guide ways and types - mechanical transmission elements - elements for rotary motion to linear motion - ball screw and types - roller screw and types - rack and pinion - various torque transmission elements - requirements of feed drives and spindle drive.

MODULE III MECHATRONIC ELEMENTS IN CNC MEASURING SYSTEM AND TOOLING 12

Measuring systems - feedback devices - velocity feedback - analog and digital - position feedback - rotary and linear. Tooling - requirement and planning - preset, qualified and semi qualified tools. Fixtures – requirement - unified and modular fixtures - tool identification - touch trigger probe- tool coding - EEPROM tools.

Tool condition monitoring - various indirect and direct methods. Identification and gauging of work piece. Tool locking system - ball lock mechanism and contact pressure monitoring. Automatic tool changing system - types and benefits - tool magazine –sensors in CNC.

MODULE IV CNC PROGRAMMING 13

Machine axes identification - primary, secondary and tertiary - manual CNC programming - Milling programming fundamentals - compensation and offset in milling -fixed cycles in milling - repetitive programming - loops, sub programs and macros. Turning programming fundamentals - compensation and offset in turning - fixed cycles in turning – Computer assisted programming in APT - basic geometry definition - cutter motion definition - postprocessor statements - generation and execution of APT programs.

MODULE V TESTING AND MAINTENANCE OF CNC MACHINES 05

Verification of technical specification and functional aspects, Verification during idle running & machine tool and the work piece accuracy - Installation of CNC machines - Maintenance of CNC machines - machine elements – hydraulic elements - electrical and electronic elements – maintenance schedules.

Total Hours: 45

REFERENCES:

1. Jonathan Lin,S.C., “Computer Numerical Control (From Programming to Networking)”, Delmar Publishers Inc., 2000.
2. HMT Limited, “Mechatronics”, Tata Mcgraw-Hill Publishing Co Ltd, 2002.
3. Groover,M.P., “Automation, Production System and CIM”, Prentice Hall of India Pvt. Ltd, 2003.
4. Grahamt.Smith, “Advanced Machining: The Handbook of Cutting Technology”, IFS Publications Ltd., 1989
5. Sehrawatt,M.S., and Narang,J.S., “CNC Machine”, Dhanpat Rai And Co, 2002.
6. Jayakumar,V., and Mahendran, B., “Computer Aided Manufacturing”, Lakshmi Publications 2005.
7. Radhakrishnan,P., “CNC Machine”, New Central Book Agency, 2000.
8. Stenerson and Curran, “Computer Numerical Control-Operation and Programming”, PHI Learning Pvt. Ltd., 2008

COURSE OUTCOMES

Students should be able to

- Describe the fundamentals of adaptive controls
- Express the mechatronic elements in CNC machine
- Use various mechatronic elements in CNC measuring system and tooling
- Write CNC programming for various parts
- Execute the installation and maintenance of CNC machines

MECY036 ADDITIVE MANUFACTURING

L	T	P	C
2	0	0	2

COURSE EDUCATIONAL OBJECTIVES:

- To gain knowledge on cad modeling and slicing techniques
- To learn various additive processes
- To understand various applications of additive manufacturing

MODULE I CAD MODELING AND SLICING 10

Basic concept- Digitization techniques – Model reconstruction – Data Processing for Rapid Prototyping: CAD model preparation, Data requirements – Geometric modeling techniques: Wire frame, surface and solid modeling – data formats Data interfacing, Part orientation and support generation, Support structure design, Model Slicing, Tool path generation-Software for AM- Case studies.

MODULE II ADDITIVE PROCESS 15

Material extrusion - Fused deposition Modeling (FDM): Principle, Process details, process variables, types, suitable materials and products, Shape Deposition Manufacturing (SDM) – sheet lamination - Laminated Object Manufacturing (LOM): Working Principles, details of processes, products, materials, advantages, limitations - Photo polymerization – Stereolithography (SLA): Principle, pre-build process, part-building and post-build processes, photo polymerization of SL resins, recoating issues, materials, advantages, limitations Solid Ground Curing (SGC): working principle, process, strengths, weaknesses - Powder bed fusion - Selective Laser Sintering (SLS): Principle, process, Indirect and direct SLS- powder structures, materials, post processing, surface deviation and accuracy, Ballastic Particle Manufacturing (BPM), Selective Laser Melting (SLM), Electron Beam Melting (EBM)- Direct energy deposition - Laser Engineered Net Shaping (LENS): Processes, materials, products, advantages, limitations, case studies – Material Jetting and Binder jetting - Three dimensional Printing (3DP): Principle, basic process, Physics of 3DP, types of printing, process capabilities, materials

MODULE III ADDITIVE PROCESS APPLICATIONS 05

Functional models, Medical models, art models, Engineering analysis models, new materials development, Bi-metallic parts, Re-manufacturing - Application examples for Aerospace, defense, automobile, Bio-medical and general engineering industries - comparison of additive manufacturing methods - business opportunities and future directions

Total Hours: 30

REFERENCES

1. Gibson, I., Rosen, D.W. and Stucker, B., “Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing”, Springer, 2010.
2. Chua, C.K., Leong K.F. and Lim C.S., “Rapid prototyping: Principles and applications”, second edition, World Scientific Publishers, 2010.
3. Gebhardt, A., “Rapid prototyping”, Hanser Gardener Publications, 2003.
4. Liou, L.W. and Liou, F.W., “Rapid Prototyping and Engineering applications : A tool box for prototype development”, CRC Press, 2011.
5. Kamrani, A.K. and Nasr, E.A., “Rapid Prototyping: Theory and practice”, Springer, 2006.
6. Hilton, P.D. and Jacobs, P.F., Rapid Tooling: Technologies and Industrial Applications, CRC press, 2005.
7. D.T. Pham, S.S. Dimov, Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling, Springer 2001
8. Ian Gibson, David W Rosen, Brent Stucker., “Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing”, Springer, 2010.

COURSE OUTCOMES:

Students should be able to

- Describe different cad modeling and slicing techniques
- Use suitable additive manufacturing process for different materials
- Apply additive manufacturing techniques

MECY037 ADVANCED JOINING PROCESS

L	T	P	C
2	0	0	2

COURSE EDUCATIONAL OBJECTIVES:

- To gain knowledge on unique welding processes
- To educate different welding techniques of polymers
- To instruct the design of weld structures based on stress

MODULE I UNIQUE WELDING PROCESSES 10

Plasma welding-Laser Beam Welding-Electron Beam Welding-Friction Welding-Cold Pressure Welding-Ultrasonic Welding-Diffusion Welding-Accumulative Roll Bonding (ARB)

MODULE II WELDING OF POLYMERS 10

Hot plate, Butt fusion, Hot gas welding - extrusion welding - induction welding, resistance welding - implant welding, high frequency, friction, electro – fusion, ultrasonic and vibration welding - adhesive bonding.

MODULE III JOINT DESIGN BASED ON STRESSES IN WELD STRUCTURES 10

Joint design for structural elements such as bars, beams, plates, slabs, columns, trusses, plate girders, cylindrical shells and pressure vessels and pipe lines - Design for flanged connections

Total Hours: 30

REFERENCES

1. Md. Ibrahim Khan, Welding Science & Technology
2. Welding Technology and Design – V. M. Radhakrishnan, Revised Second Ed., New Age International Publishers.
3. A Guide to Designing Welds – J.G. Hicks, Woodhead Publising Ltd.,
4. Welding Engineering and Technology-R.S. Parmar, M/s.Khanna Publishers, 2B Nath Market, Nai Sarak, Delhi-10006.
5. A Textbook of Welding Technology - O. P. Khanna.
6. Welding Handbook, American Welding Society, Section-II : Gas, Arc Resistance.
7. The Science and Practice of Welding, Vol-1: Welding Science and Technology.

8. The Science and practice of Welding, Vol-2: The Practice of Welding: A.C. Davies, Cambridge University Press (Website: www.cambridge.org).
9. Messler R.W., Principles of Welding, John Wiley & Sons, 1999.
10. Welding Technology for Engineers, Eds. Baldev Raj, V. Shankar, A.K. Bhaduri, Narora Publishing House, 3rd Reprint, 2009.

COURSE OUTCOMES:

Students should be able to

- Use unique welding processes
- Apply different welding techniques of polymers
- Execute design of weld structures based on stress

MECY038 LASER MATERIAL PROCESSING

L	T	P	C
2	0	0	2

COURSE EDUCATIONAL OBJECTIVES:

- To understand the fundamentals of laser processing
- To gain knowledge of laser in processing of materials
- To impart knowledge of laser in manufacturing

MODULE I FUNDAMENTALS OF LASER PROCESSING 10

Laser processing fundamentals: Laser beam interaction with metal, semiconductor and insulator, Ultra short laser pulse interaction, heat flow theory and metallurgical considerations

MODULE II LASER IN PROCESSING 10

Laser Material Processing Applications: Laser cutting and drilling: Process characteristics, material removal modes, practical performances - Laser welding: Process mechanisms like keyhole and plasma effect, operating characteristics and process variation Laser surface modifications: Heat treatment, surface remelting, surface alloying and cladding, surface texturing, LCVD and LPVD

MODULE III LASER IN MANUFACTURING 10

Laser rapid manufacturing - Laser metal forming: Mechanisms involved including thermal temperature gradient, buckling, upsetting Laser peening - Fundamentals of Laser Shock Processing, Effects of various laser and process parameters, Mechanical effects and microstructure modification during laser shock processing

Total Hours: 30

TEXT BOOKS

1. Steen, William M., Mazumder, Jyotirmoy, Laser Material Processing by William M.Steen, Springer-Verlag 3rd Ed., 2010

REFERENCES

1. Elijah Kannatey-Asibu, Jr, Principles of Laser Materials Processing, John Wiley & Sons, USA,2009
2. John IonLaser Processing of Engineering Materials: Principles, Procedure and Industrial Application, Butterworth Heinemann,2005

COURSE OUTCOMES:

Students should be able to

- Explain the fundamentals of laser processing
- Use laser in processing of materials
- Apply knowledge of laser in manufacturing

MECY039 PLANT LAYOUT AND MATERIAL HANDLING

L	T	P	C
2	0	0	2

COURSE EDUCATIONAL OBJECTIVES:

- To study the fundamentals of plant layout
- To impart knowledge on space determination and area allocation
- To learn various materials handling equipment and approaches

MODULE I PLANT LAYOUT 10

Importance of plant layout in plant design - Types of layout - Factors affecting design of plant layout - Principles of plant layout design – methods of constructing the layout – Present the layout to the management – Implement the layout

MODULE II SPACE DETERMINATION AND AREA ALLOCATION 10

Factors for consideration in space planning- receiving, storage, production, shipping, tool room and tool crib, other auxiliary service actions - Establishing total space requirement - area allocation factors to be considered, expansion, flexibility, aisles column- area allocation procedure - Design of layout using Travel chart, plot plan, block plan, Sequence demand straight line method and non-directional method

MODULE III MATERIAL HANDLING 10

Definition – Principles - system design and selection of equipment – characteristic features of various MH systems- unit load concepts - basic layout types – Immer, Nadler, Muther, Apple James and Ree's approaches to plant layout - automated guided vehicle systems and automated storage & retrieval systems.

Total Hours: 30

REFERENCES

1. Facilities Planning -Thompkins. J A and White, J. A.
2. Facility layout and Location -Francies, R.L. and White, J.A..
3. Plant Layout and Material handling -James M Apple, 2nd Edition, John, Wiely and Sail.
4. Practical plant layout -Muther Richard, - McGraw Hill-1955.
5. Facilities Design -Sunderesh Heragu, PWS Publishing Company, ISBN- 0-534-95183.
6. Plant Layout Design -James M Moore., Mac Millon Co. 1962 LCCCN: 61-5204.

7. Richard Muther, Practical Plant layout, McGraw Hill Book Company, New York
8. Vijay Sheth, Facilities Planning and Materials Handling, Marcle Decker, New York.
9. Tompkins, While Facilities Planning, John Wiley & Sons, New York.
10. J.M Apple, Plant Layout & Material Handing, John Woley & Sons, N. York.
11. Francis White, Facility Location & Layout, PHI, New Delhi
12. G.K Aggarwal, Plant layout & material handling, Jain Publishers, New Delhi
13. Krajewski, Operations Management, Pearson Education, New Delhi

COURSE OUTCOMES:

Students should be able to

- Explain the fundamentals of plant layout
- Analyze space determination and area allocation
- Use various material handling equipment and approaches

MECY020 AUTOMOTIVE MANUFACTURING

L	T	P	C
1	0	0	1

COURSE EDUCATIONAL OBJECTIVES:

- To impart knowledge on various machining processes of automotive components
- To gain knowledge on different forming processes

MODULE I MACHINING PROCESS 08

Machining of connecting rods - crank shafts - cam shafts - pistons - piston pins – piston rings – valves - front and rear axle housings - fly wheel - Honing of cylinder bores - Copy turning and profile grinding machines

MODULE II FORMING PROCESS 07

Powder injection molding - Production of aluminum MMC liners for engine blocks - Plasma spray coated engine blocks and valves - Recent developments in auto body panel forming –Squeeze Casting of pistons - aluminum composite brake rotors - Sinter diffusion bonded idler sprocket – gas injection molding of window channel – cast con process for auto parts

Total Hours: 15

TEXT BOOK

1. Heldt. P.M., “High Speed Combustion Engines”, Oxford Publishing Co., New York, 1990

REFERENCES

1. Haslehurst.S.E., “Manufacturing Technology”, ELBS, London, 1990
2. Rusinoff, “Forging and Forming of metals”, D.B. Taraporevala Son & Co. Pvt Ltd., Mumbai, 1995.
3. Sabroff.A.M. & Others, “Forging Materials & Processes”, Reinhold Book Corporation, New York, 1988.
4. Upton, “Pressure Die Casting”, Pergamon Press, 1985.
5. High Velocity “Forming of Metals”, ASTME, prentice Hall of India (P) Ltd., New Delhi, 1990

COURSE OUTCOMES:

Students should be able to

- Execute various machining processes
- Apply suitable forming process for various automotive components

MECY040 FAILURE MODE AND EFFECT ANALYSIS

L	T	P	C
1	0	0	1

COURSE EDUCATIONAL OBJECTIVES:

- To study about FMEA and its need
- To understand different types of FMEA in space and automotive industries

MODULE I INTRODUCTION 05

Definition - General overview of FMEA – History of FMEA – Origin and development – objectives of FMEA – need of FMEA – FMEA team synergy.

MODULE II TYPES AND APPLICATIONS OF FMEA 10

Types of FMEA – System FMEA, Design FMEA, Process FMEA, Service FMEA, Machine FMEA - FMEA software – Applications of FMEA in space and automotive industries

Total Hours: 15

REFERENCES

1. D. H. Stamatis, Failure Mode and Effect Analysis, FMEA From Theory to Execution, 2nd Edition, American Society for Quality Press, 2003.
2. Robin E. McDermott, Raymond J. Mikulak, Michael R. Beauregard, The Basics of FMEA, Productivity Press, 1st edition, 1996.
3. Kenneth Dailey, The FMEA pocket handbook, DW Publishing Co, 1st edition, 2004.
4. Dyadem Press, Guidelines for Failure Mode and Effects Analysis (FMEA), for Automotive, Aerospace, and General Manufacturing Industries 1st Edition, CRC Press, 1st edition, 2003.

COURSE OUTCOMES:

Students should be able to

- Describe FMEA and its need
- Apply various FMEA techniques in industry

MECY041 RELIABILITY ENGINEERING

L	T	P	C
1	0	0	1

COURSE EDUCATIONAL OBJECTIVES:

- To understand various reliability concepts and their analysis
- To gain knowledge on risk assessment and reduction techniques

MODULE I RELIABILITY CONCEPT AND ANALYSIS 10

Reliability function - failure rate - Mean Time between Failures (MTBF) - Mean Time to Failure (MTTF) - a priori and a posteriori concept - mortality curve - useful life availability - maintainability – system effectiveness - Time-to-failure distributions - Exponential, normal, Gamma, Weibull, ranking of data – probability plotting techniques - Hazard plotting

MODULE II RISK ASSESSMENT 05

Definition and measurement of risk - risk analysis techniques - risk reduction resources - industrial safety and risk assessment

Total Hours: 15

REFERENCES

1. Modarres, “Reliability and Risk analysis ", Mara Dekker Inc., 1993.
2. John Davidson, “The Reliability of Mechanical system ", Institution of Mechanical Engineers,London, 1988.
3. C.O. Smith" Introduction to Reliability in Design ", McGraw Hill, London, 1976

COURSE OUTCOMES:

Students should be able to

- Interpret various reliability concepts and their analysis
- Analyse risk assessment and apply suitable reduction techniques

MECY021 VIRTUAL MANUFACTURING

L	T	P	C
1	0	0	1

COURSE EDUCATIONAL OBJECTIVES:

- To understand the fundamentals of virtual manufacturing
- To introduce different facets of virtual manufacturing

MODULE I FUNDAMENTALS OF VIRTUAL MANUFACTURING 08

Paradigms of VM: Design-centered VM, Production-centered VM and Control-centered VM. Generic VM Issues - relationships between VM, Virtual Prototyping, the Virtual Enterprise. Role of object oriented technology in VM - Integrated Simulation Method to Support Virtual Factory Engineering Application of Virtual Reality.

MODULE II FACETS OF VIRTUAL MANUFCATURING 07

Dispersed Network Manufacturing - Virtual factory, enterprise collaborative modeling system - virtual manufacturing (VM) system - Web-based work flow management, collaborative product commerce - applications of multi-agent technology - e-supply chain management and tele-manufacturing

Total Hours: 15

TEXT BOOKS

1. Warim Ahmed Khan Abdul Raouz, Kari Chens, Virutal Manufacturing, Springer Series in Advanced Manufacturing.

REFERENCES

1. Crabb, C. H., The Virtual Engineer-21st Century Product Development, Society of Manufacturing Engineers, 1998.
2. Rao Ming, Qun Wang, Jianzhong Cha, Integrated Distributed Intelligent Systems in Manufacturing (Intelligent Manufacturing), Chapman & Hall, 1993.
3. Prasant Banerjee, Virtual manufacturing a willey, I addition, 2001, ISBN:-10: 047135443

COURSE OUTCOMES:

Students should be able to

- Describe the fundamentals of virtual manufacturing
- Explain different facets of virtual manufacturing

PROFESSIONAL ELECTIVES ON DESIGN ENGINEERING

MECY003 ADVANCED TOOL DESIGN

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To learn tool design methods and techniques of manufacturing dies and its accessories.
- To acquire knowledge on different materials available for cutting tools and necessary heat treatment procedures to get the required properties.
- To acquire knowledge in selecting suitable materials for calibrating and inspecting gauges.
- To learn to design fixtures for various machining and metal forming operations.
- To acquire knowledge on designing fixtures and cutting tools for NC machine tools.

MODULE I TOOL DESIGN METHODS 05

Introduction – The Design Procedure – Statement of the problem – The Needs Analysis –Research and Ideation – Tentative Design Solutions – The Finished Design – Drafting and Design Techniques in Tooling drawings – Screws and Dowels – Hole location – Jig-boring practice –Installation of Drill Bushings – Punch and Die Manufacture – Electro-discharge machining –Electro-discharge machining for cavity.

MODULE II TOOLING MATERIALS AND HEAT TREATMENT 09

Introduction – Properties of Materials – Ferrous Tooling Materials – Tool steels – Cast Iron – Mild, or low-carbon Steel – Nonmetallic Tooling Materials – Nonferrous Tooling Materials – Metal cutting Tools – Single-point cutting tools – Milling cutters – Drills and Drilling – Reamer classification –Taps – Tap classification- selection of carbide cutting tools – Determining the insert thickness for carbide tools.

MODULE III DESIGN OF DRILL JIGS 09

Introduction – Fixed Gages – Gage Tolerances – The selection of material for Gages – Indicating Gages – Automatic gages – Principles of location – Locating methods and devices – Principles of clamping – Drill jigs – Chip formation in drilling – General considerations in the design of drill jigs – Drill bushings – Methods of construction – Drill jigs and modern manufacturing.

MODULE IV DESIGN OF FIXTURES AND DIES 14

Introduction – Fixtures and economics – Types of Fixtures – Vise Fixtures – Milling Fixtures –Boring Fixtures – Broaching Fixtures – Lathe Fixtures – Grinding Fixtures – Types of Die construction – Die-design fundamentals – Blanking and Piercing die construction – Pilots – Strippers and pressure pads Presswork materials – Strip layout – Short-run tooling for Piercing – Bending dies – Forming dies – Drawing operations.

MODULE V TOOL DESIGN FOR NUMERICALLY CONTROLLED MACHINE TOOLS 08

Introduction – The need for numerical control – A basic explanation of numeric control – Numerical control systems in use today – Fixture design for numerically controlled machine tools – Cutting tools for numerical control – Tool holding methods for numerical control – Automatic tool changers and tool positioners – Tool presetting – Introduction – General explanation of the Brown and sharp machine – tooling for Automatic screw machines.

Total Hours: 45

REFERENCES:

1. Cyrll Donaldson, George H.LeCain, V.C. Goold, “Tool Design”, Tata McGraw Hill Publishing Company Ltd., 2000.
2. Prakash Hiralal Joshi, “Tooling data”, Wheeler Publishing, 2000.

COURSE OUTCOMES:

Students will be able to

- Summarize tool design methods and punch and die manufacturing techniques
- Judge in selecting materials for cutting tools and identify their nomenclature.
- Identify the materials for gauges and to make them with the available technology
- Design fixtures for milling, boring, lathe, grinding and welding
- Design and analyse fixtures and cutting tools for NC machine tools

MECY042 DESIGN FOR MANUFACTURING

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To obtain knowledge on design principles for manufacturing
- To instruct casting design and weldment design
- To recognize the design considerations for metal forming techniques
- To train the design for machined parts
- To educate the students on case studies of assembly design

MODULE I INTRODUCTION 06

Economics of Process selection – General design principles of manufacturability – Proper material selection – Strength and Mechanical factors - application of form design.

MODULE II CASTING DESIGN AND WELDMENT DESIGN 10

Factors affecting casting design- Strength aspects – Sand casting and die casting design-Factors affecting weldment design-Gas and arc welding design.

MODULE III DESIGN OF METAL FORMING PROCESS 10

Design considerations for the manufacture of extruded, cold headed metal parts – Tube and section bends – Powder metal parts-Thermo setting plastic parts-Reinforced – Plastic/Composite parts.

MODULE IV DESIGN FOR MACHINED PARTS 10

Design considerations for the manufacture of Turned parts-drilled parts-milled parts, planned, shaped and slotted parts-Ground parts-parts produced by EDM.

MODULE V DESIGN FOR ASSEMBLY (DFA) 09

Types of assembly – DFA –Index – evaluation of assembly – assembly cost reduction – case of assembly – impact on quality – related software usage – case studies.

Total Hours: 45

TEXT BOOKS:

1. James G. Bralla – “Handbook of product design for manufacture”, McGraw Hill Book Co., 1986.

REFERENCE BOOKS:

1. Henry Peck – “Designing for manufacture”, Sir Isaac Pitman & Sons Ltd., 1973.
2. Matousek – “Engineering Design”, Blackie & sons, 1956.

COURSE OUTCOMES:

Students should be able to

- Express the design principles for manufacturing
- Execute casting design and weldment design
- Prepare the design needs of metal forming techniques
- Apply the design for machined parts
- Propose the assembly design for industry needs

MECY043	INDUSTRIAL ROBOTICS AND EXPERT SYSTEMS	L	T	P	C
		3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To impart the fundamentals of robots and its kinematics
- To study various drives and controls of robot
- To gain knowledge on working principles of different sensors
- To inculcate robot cell design
- To learn robot programming, artificial intelligence and their applications.

MODULE I INTRODUCTION AND ROBOT KINEMATICS 10

Definition need and scope of Industrial robots – Robot anatomy – Work volume – Precision movement – End effectors – Sensors. Robot Kinematics – Direct and inverse kinematics – Robot trajectories – Control of robot manipulators – Robot dynamics – Methods for orientation and location of objects.

MODULE II ROBOT DRIVES AND CONTROL 09

Controlling the Robot motion – Position and velocity sensing devices – Design of drive systems – Hydraulic and Pneumatic drives – Linear and rotary actuators and control valves – Electro hydraulic servo valves, electric drives – Motors – Designing of end effectors – Vacuum, magnetic and air operated grippers.

MODULE III ROBOT SENSORS 09

Transducers and Sensors – Tactile sensor – Proximity and range sensors – Sensing joint forces – Robotic vision system – Image Representation - Image Grabbing –Image processing and analysis – Edge Enhancement – Contrast Stretching – Band Rationing - Image segmentation – Pattern recognition – Training of vision system.

MODULE IV ROBOT CELL DESIGN AND APPLICATION 09

Robot work cell design and control – Safety in Robotics – Robot cell layouts – Multiple Robots and machine interference – Robot cycle time analysis – Industrial application of robots.

MODULE V ROBOT PROGRAMMING, ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS 08

Methods of Robot Programming – Characteristics of task level languages lead through programming methods – Motion interpolation. Artificial intelligence – Basics – Goals of artificial intelligence – AI techniques – problem representation in

AI – Problem reduction and solution techniques - Application of AI and KBES in Robots.

Total Hours: 45

TEXT BOOK:

1. K.S.Fu, R.C. Gonzalez and C.S.G. Lee, “Robotics Control, Sensing, Vision and Intelligence”, Mc Graw Hill, 1987.

REFERENCE:

1. Yoram Koren,” Robotics for Engineers’ Mc Graw-Hill, 1987.
2. Kozyrey, Yu. “Industrial Robots”, MIR Publishers Moscow, 1985.
3. Richard. D, Klafter, Thomas, A, Chmielewski, Michael Negin, “Robotics Engineering – An Integrated Approach”, Prentice-Hall of India Pvt. Ltd., 1984.
4. Deb, S.R.” Robotics Technology and Flexible Automation”, Tata Mc Graw-Hill, 1994.
5. Mikell, P. Groover, Mitchell Weis, Roger, N. Nagel, Nicholas G. Odrey,” Industrial Robotics Technology, Programming and Applications”, Mc Graw- Hill, Int. 1986.
6. Timothy Jordanides et al ,”Expert Systems and Robotics “, Springer – Verlag, New York, May 1991.

COURSE OUTCOMES:

Students should be able to

- Demonstrate the fundamentals of robots and its kinematics
- Apply suitable drives and controls for robot design
- Choose appropriate sensors
- Execute the design for robot cell
- Use robot programming and artificial intelligence

MECY044 REVERSE ENGINEERING

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To explain reverse engineering and its scope
- To learn the tools for reverse engineering
- To study the concepts of reverse engineering
- To enlighten the students on data management
- To study different integration methods of reverse engineering

MODULE I INTRODUCTION 05

Scope and tasks of reverse engineering - Domain analysis- Process of duplicating.

MODULE II TOOLS FOR REVERSE ENGINEERING 08

Functionality- Dimensional- Developing technical data - Digitizing techniques - Construction of surface model - Solid-part material- Characteristics evaluation - Software and application- Prototyping - Verification.

MODULE III CONCEPTS 12

History of reverse engineering – Preserving and preparation for the four stage process – Evaluation and verification- Technical data generation, Data verification, Project implementation.

MODULE IV DATA MANAGEMENT 10

Data reverse engineering – Three data reverse engineering strategies – Definition – Organization data issues - Software application – Finding reusable software components – Recycling real-time embedded software – Design of experiments to evaluate a reverse engineering tool – Rule based detection for reverse engineering user interfaces – Reverse engineering of assembly programs: A model based approach and its logical basics.

MODULE V INTEGRATION 10

Cognitive approach to program understated – Integrating formal and structured methods in reverse engineering – Integrating reverse engineering, reuse and specification tool environments to reverse engineering - Coordinate measurement – Feature capturing – Surface and solid members.

Total Hours: 45

REFERENCES:

1. Bigger staff T J, Design Recovery for Maintenance and Reuse, IEEE Corpn. July 1991.
2. Rugaban S, White paper on RE, Technical Report, Georgia Instt. of Technology, 1994.
3. Katheryn A. Ingle, Reverse Engineering, McGraw-Hill, 1994
4. Aiken Peter, Data Reverse Engineering, McGraw-Hill, 1996
5. Linda Wills, Reverse Engineering, Kluiver Academic Publishers, 1996
6. Donald R. Honsa, Co-ordinate Measurement and reverse engineering, American Gear Manufacturers Association.

COURSE OUTCOMES:

Students should be able to

- Describe about reverse engineering and its scope
- Use relevant tools for reverse engineering
- Apply the concepts of reverse engineering
- Practice data management
- Synthesize various integration methods of reverse engineering

MECY045 TRIBOLOGY OF MACHINES

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To understand theories of friction its surface interaction
- To study various types of wear and surface treatment
- To gain knowledge on lubricants and lubrication system
- To impart knowledge on hydrostatics and hydrodynamic applications
- To educate high pressure contacts and elasto hydrodynamic lubrication

MODULE I SURFACE INTERACTION AND FRICTION 07

Topography of Surfaces – Surface features-Properties and measurement – Surface interaction – Adhesive Theory of Sliding Friction –Rolling Friction-Friction properties of metallic and non-metallic materials – friction in extreme conditions – Thermal considerations in sliding contact.

MODULE II WEAR AND SURFACE TREATMENT 08

Types of wear – Mechanism of various types of wear – Laws of wear – Theoretical wear models-Wear of Metals and Non metals – Surface treatments – Surface modifications – surface coatings methods- Surface Topography measurements – Laser methods – instrumentation - International standards in friction and wear measurements

MODULE III LUBRICANTS AND LUBRICATION REGIMES 08

Lubricants and their physical properties- Viscosity and other properties of oils – Additives - selection of Lubricants - Lubricants standards ISO, SAE, AGMA, BIS standards – Lubrication Regimes – Solid Lubrication - Dry and marginally lubricated contacts - Boundary Lubrication.

MODULE IV THEORY OF HYDRODYNAMIC AND HYDROSTATIC LUBRICATION 12

Reynolds Equation,-Assumptions and limitations-One and two dimensional Reynolds Equation-Reynolds and Sommerfeld boundary conditions- Pressure wave, flow, load capacity and friction calculations in Hydrodynamic bearings-Long and short bearings-Pad bearings and Journal bearings-Squeeze film effects-Thermal considerations-Hydrostatic lubrication of Pad bearing-Pressure, flow , load and friction calculations-Stiffness considerations- Various types of flow restrictors in hydrostatic bearings

MODULE V HIGH PRESSURE CONTACTS AND ELASTO HYDRODYNAMIC LUBRICATION 10

Rolling contacts of Elastic solids- contact stresses – Hertzian stress equation- Spherical and cylindrical contacts-Contact Fatigue life- Oil film effects- Elasto Hydrodynamic lubrication Theory-Soft and hard EHL-Reynolds equation for elasto hydrodynamic lubrication- Film shape within and outside contact zones-Film thickness and friction calculation- Rolling bearings- Stresses and deflections- Traction drives

Total Hours: 45

REFERENCES:

1. Rabinowicz.E, “Friction and Wear of materials”, John Willey & Sons, UK, 1995
2. Cameron, A. “Basic Lubrication Theory”, Ellis Herward Ltd., UK, 1981
3. Halling, J. (Editor) – “Principles of Tribology”, Macmillian – 1984.
4. Williams J.A. “Engineering Tribology”, Oxford Univ. Press, 1994.
5. S.K.Basu, S.N.Sengupta & B.B.Ahuja, “Fundamentals of Tribology”, Prentice –Hall of India Pvt Ltd, New Delhi, 2005
6. G.W.Stachowiak & A.W.Batchelor, Engineering Tribology, Butterworth-Heinemann, UK, 2005

COURSE OUTCOMES:

Students should be able to

- Express theories of friction its surface interaction
- Describe various types of wear and surface treatment
- Use suitable lubrication systems
- Apply hydrostatics and hydrodynamic lubrication systems
- Illustrate high pressure contacts and elasto hydrodynamic lubrication

MECY046 HYDRAULICS AND PNEUMATICS

L	T	P	C
2	0	0	2

COURSE EDUCATIONAL OBJECTIVES:

- To study the basics of hydraulic systems and pumps
- To gain knowledge on various hydraulic actuators and valves
- To impart knowledge on pneumatic systems

MODULE I HYDRAULIC BASICS AND PUMPS 10

Basic hydraulic systems and components- Reservoir, Strainers/filters, Accumulators, gauges, meters, circuitry systems, fittings/connections, leakage, seals – Pumps- Positive and non-positive displacement types-hydraulic symbols.

MODULE II HYDRAULIC ACTUATORS AND VALVES 10

Hydraulic actuators- (Linear- single acting, double acting, differential, non-differential, cushioned) and rotary – maintenance of actuators – Hydraulic valves – Pressure control valves, directional control valves, flow control valves-valve installation (Meter-in, Meter-out, Bleed-off circuits) – Troubleshooting valves

MODULE III PNEUMATICS 10

Pneumatics basics- Air filter and lubricators and regulators – Pneumatic actuators and valves – pneumatic circuits – pneumatic logic control

Total Hours: 30

REFERENCES

1. Hydraulic Control Systems by H.E. Merritt, Wiley New York.
2. Fluid Power by Esposito, Peaerson Education
3. Hydraulics and Pneumatics by Andrew Parr, Jaico Publishers.
4. Hydraulics and Pneumatics, A Technician's and Engineer's Guide, Third edition, Andrew Parr, Elsevier publications
5. “Oil Hydraulic Systems – Principles and Maintenance” by S.R. Majumdar
6. “Fundamentals of Pneumatic Control Engineering” by J.P. Hasebrink and R. Kobble

COURSE OUTCOMES:

Students should be able to

- Express the basics of hydraulic systems and pumps
- Use various hydraulic actuators and valves
- Implement pneumatic systems

MECY047 AI BASED OPTIMIZATION TECHNIQUES

L	T	P	C
1	0	0	1

COURSE EDUCATIONAL OBJECTIVES:

- To gain knowledge on novel methods for optimization
- To impart knowledge on neural networks and its application

MODULE I NOVEL METHODS FOR OPTIMIZATION 07

Introduction to simulated annealing - selection of simulated annealing parameters - simulated annealing algorithm - Genetic Algorithm (GA), Design of GA, Key concepts of GA.

MODULE II NEURAL NETWORKS 08

Basics - A framework for Neural Network models - Construction of Neural Network algorithm - Examples of simulated algorithm - genetic annealing and Neural Network method

Total Hours: 15

REFERNCES

1. Engineering Optimization S. S. Rao New Age International
2. Applied Optimal Design E. J. Haug and J.S. Arora Wiley, New York
3. Optimization for Engineering Design Kalyanmoy Deb Prentice Hall of India
4. Optimization G.V. Reklaites, A. Ravindran and K.M. Rogsdeth

COURSE OUTCOMES:

Students should be able to

- Practice on novel methods for optimization
- Apply neural networks for various applications

MECY048	FINITE ELEMENT ANALYSIS IN MANUFACTURING	L	T	P	C
		1	0	0	1

COURSE EDUCATIONAL OBJECTIVES:

- To study the application FEA in casting and welding
- To understand the application of FEA in plastic deformation process

MODULE I FEA IN CASTING AND WELDING 07

Steady state and Transient Thermal analysis of different casting processes – Thermo- mechanical analysis of welding processes

MODULE II FEA IN PLASTIC DEFORMATION PROCESS 08

Basic concepts of plasticity and fracture – Solid and flow formulation – small incremental deformation formulation – Fracture criteria – FE analysis of metal cutting and metal forming

Total Hours: 15

REFERENCES

1. Reddy, J.N. An Introduction to the Finite Element Method, McGraw Hill, 1985.
2. Rao, S.S., Finite Element method in engineering, Pergammon press, 1989.
3. Bathe, K.J., Finite Element procedures in Engineering Analysis, 1990
4. Kobayashi,S, Soo-ik-Oh and Altan,T, Metal Forming and the Finite Element Methods, Oxford University Press, 1989.
5. Lewis R.W.Morgan, K, Thomas, H.R. and Seetharaman, K.N. The Finite Element Method in Heat Transfer Analysis, John Wiley, 1994.

COURSE OUTCOMES:

Students should be able to

- Apply the concepts FEA in casting and welding
- Use FEA in plastic deformation process

MECY013	GEOMETRIC DIMENSIONING AND TOLERANCING	L	T	P	C
		1	0	0	1

COURSE EDUCATIONAL OBJECTIVES:

- To teach the principles of geometric product definition
- To educate the students on types of tolerances.

MODULE I INTRODUCTION 05

Introduction to limits fits and tolerances – GDNT definitions and importance -Datum reference frame – Feature control frame - MMC & LMC – General Rules – Datum System.

MODULE II PRINCIPLES OF MEASUREMENT FOR GEOMETRIC CHARACTERISTICS 10

Geometric characteristic symbols and meanings – Form tolerances – Profile tolerances – Location tolerances – Runout tolerances – Orientation tolerances – True position theory – Dimensional and tolerance schemes

Total Hours: 15

REFERENCES

1. ASME Y – 14.5
2. Rao Ming, Harry Peck, “Designing for Manufacture”, Pitman Publications, London, 1983.
3. Krulikowski. A, “Fundamentals of Geomtric Dimensioning and Tolerancing”, Delmar Publishers – New York, 1997
4. Spotts.M.F, “Dimensioning and Tolerance for Quality Production”, Prentice Hall Inc., New Jersey, 1983.
5. Oliver R Wade, “Tolerance Control in Design and Manufacturing”, Industrial Press Inc., New York, 2008.

COURSE OUTCOMES:

Students should be able to

- Analyze situations and proceed to the logical end to solve product’s geometric definitions in order to function and be cost effective
- Totally consider function, manufacturing process and inspection methods in order to guarantee function with reduction in manufacturing and inspection cost

PROFESSIONAL ELECTIVES ON MATERIAL SCIENCE ENGINEERING

MECY049	CORROSION AND SURFACE ENGINEERING	L	T	P	C
		3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To understand various types of corrosion and its mechanism
- To impart knowledge on testing and prevention of corrosion
- To gain knowledge on corrosion behavior of materials
- To learn surface protection techniques
- To study various surface modification processes

MODULE I MECHANISMS AND TYPES OF CORROSION 09

Principles of direct and Electro chemical Corrosion, Hydrogen evolution and Oxygen absorption mechanisms – Galvanic corrosion, Galvanic series-specific types of corrosion such as uniform, Pitting, Intergranular, Cavitations, Crevice Fretting, Erosion and Stress Corrosion –Factors influencing corrosion.

MODULE II TESTING AND PREVENTION OF CORROSION 09

Corrosion testing techniques and procedures- Prevention of Corrosion-Design against corrosion – Modifications of corrosive environment –Inhibitors – Cathodic Protection –Protective surface coatings

MODULE III CORROSION BEHAVIOR OF MATERIALS 09

Corrosion of steels, stainless steel, Aluminum alloys, copper alloys, Nickel and Titanium alloys corrosion of Polymers, Ceramics and Composite materials.

MODULE IV SURFACE PROTECTION 09

Diffusion coatings –Electro and Electroless Plating –Hot dip coating –Hard facing-Metal spraying, Flame and Arc processes- Conversion coating – Selection of coating for wear and Corrosion resistance.

MODULE V SURFACE MODIFICATION PROCESSES 09

Laser and Electron Beam hardening – Effect of process variables such as power and scan speed - Physical vapor deposition, Thermal evaporation, Arc vaporization, Sputtering, Ion plating – Chemical vapor deposition – Coating of

tools, TiC, TiN, Al2O3 and Diamond coating – Properties and applications of thin coatings.

Total Hours: 45

REFERENCES:

1. Fontana. G., “Corrosion Engineering”, McGraw Hill, 1985.
2. Serope Kalpakjian – “Manufacturing Engineering & Technology- Addison Wesley Publishing Co; New York 1995.
3. Schweitzer.P.A., “Corrosion Engineering Hand Book”, 3rd Edition, Marcel Decker, 1996.
4. Winston Revie. R. Uhlig, Corrosion, Hand Book 2nd edition. John Wiley, 2000.
5. Kenneth G.Budinski, “Surface Engineering for Wear Resistance”, Prentice hall, 1988.
6. ASM Metals Hand Book –Vol. 5, Surface Engineering, 1996.

COURSE OUTCOMES:

Students should be able to

- Describe various types of corrosion and its mechanism
- Utilize different testing to prevent corrosion
- Interpret corrosion behaviour of materials
- Use various surface protection techniques
- Implement a variety of surface modification processes

MECY050 MEMS & NANO TECHNOLOGY

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To learn the fundamentals of MEMS and microsystems
- To understand the materials and fabrication process for MEMS
- To impart knowledge on materials for micro devices
- To instruct the behaviour of nano materials
- To gain knowledge on characterization of nano materials

MODULE I OVER VIEW OF MEMS AND MICROSYSTEMS 06

Definition – Historical development – fundamentals – properties, micro fluidics, design and fabrication micro-system, microelectronics, working principle and applications of micro system.

MODULE II MATERIALS, FABRICATION PROCESSES AND MICRO SYSTEM PACKAGING 10

Substrates and wafers, silicon as substrate material, mechanical properties of Si, Silicon Compounds silicon piezo resistors, Galium arsenide, quartz, polymers for MEMS, conductive polymers. Photolithography, photo resist applications, light sources, in implantation, diffusion process exudation – thermal oxidation, silicon diode, chemical vapour deposition, sputtering - deposition by epitoxy – etching – bulk and surface machining – LIGA process Micro system packaging – considerations packaging – levels of micro system packaging die level, device level and system level.

MODULE III MICRO DEVICES AND MATERIALS 08

Sensors – classification – signal conversion ideal characterization of sensors micro actuators, mechanical sensors – measurands displacement sensors, pressure and flow sensors, micro actuators – smart materials – applications.

MODULE IV SCIENCE OF NANO MATERIALS 10

Classification of nano structures – effect of the nanometer length scale - effects of nano scale dimensions on various properties – structural, thermal, chemical, mechanical, magnetic, optical and electronic properties – effect of nanoscale dimensions on biological systems - Fabrication methods – Top down processes – bottom up process.

MODULE V CHARACTERIZATION OF NANO MATERIALS 11

Nano-processing systems – Nano measuring systems – characterization – analytical imaging techniques – microscopy techniques, electron microscopy scanning electron microscopy, transmission electron microscopy, scanning tunneling microscopy, atomic force microscopy, diffraction techniques – spectroscopy techniques – Raman spectroscopy, 3D surface analysis – Mechanical, Magnetic and thermal properties – Nano positioning systems.

Total Hours: 45

REFERENCES:

1. Tai – Ran Hsu, MEMS and Microsystems Design and Manufacture, Tata-McGraw Hill, New Delhi, 2002.
2. Mark Madou Fundamentals of Microfabrication, CRC Press, New York, 1997.
3. Norio Taniguchi, Nano Technology, Oxford University Press, New York, 2003
4. The MEMS Hand book, Mohamed Gad-el-Hak, CRC Press, New York, London.
5. Charles P Poole, Frank J Owens, Introduction to Nano technology, John Wiley and Sons, 2003
6. Julian W. Hardner Micro Sensors, Principles and Applications, CRC Press 1993.

COURSE OUTCOMES:

Students should be able to

- Exhibit the fundamentals of MEMS and Microsystems
- Suggest the materials and fabrication process for MEMS
- Select materials for micro devices
- Express the behaviour of nano materials
- Perform the characterization of nano materials

MECY051 POLYMERS AND COMPOSITE MATERIALS

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To study the various properties of polymers
- To impart knowledge on processing of polymers
- To learn various fibres and matrix materials
- To educate various processing methods of polymer matrix composites
- To inculcate processing of metal matrix composites and ceramic matrix composites

MODULE I PROPERTIES OF POLYMERS 08

Chemistry and Classification of Polymers – Properties of Thermo plastics – Properties of Thermosetting plastics – Applications – Merits and Disadvantages.

MODULE II PROCESSING OF POLYMERS 09

Extrusion – Injection Moulding – Blow Moulding – Compression and Transfer Moulding – Casting – Thermo Forming – General Machining properties of Plastics – Machining parameters and their effect – Joining of plastics – Mechanical fasteners – Thermal bonding – Press fitting.

MODULE III INTRODUCTION TO FIBRES AND COMPOSITE MATERIALS 09

Fibres – Fabrication, Structure, properties and applications - Glass, boron, carbon, organic, ceramic and metallic fibers whiskers – Matrix materials structure – polymers, – metals and ceramics – Physical and chemical properties

MODULE IV PROCESSING OF POLYMER MATRIX COMPOSITES 09

Open mould process, bag moulding, compression moulding with BMC and SMC filament winding – pultrusion – centrifugal casting – injection moulding – structure, properties and application of PMC’s – Carbon Matrix Composites - Interfaces – Properties – recycling of PMC.

MODULE V PROCESSING OF METAL MATRIX COMPOSITES AND CERAMIC MATRIX COMPOSITES 10

Solid state fabrication techniques – diffusion bonding – powder metallurgy techniques – plasma spray, chemical and physical vapour deposition of matrix on fibres – Chemical vapour infiltration – Sol gel – liquid state fabrication methods –

infiltration – squeeze, casting – rheo casting – compocasting - Interfaces properties– application of MMC and ceramic matrix composites.

Total Hours: 45

REFERENCES:

1. Krishnan K Chawla, “Composite Materials Science and Engineering, International Edition”, Springer, 2006
2. Harold Belofsky, Plastics, Product Design and Process Engineering, Hanser Publishers, 2002.
3. Bera.E and Moet. A, High performance polymers, Hanser Publishers, 2001.
4. Rauwendaal,C., Polymer extrusium, Hanser publishers, 2000.
5. Rosatao, D.V. Blow moulding HandBook, Hanser Publishers, 1989.
6. Seamour, E.B. Modern Plastics Technology, Prentice Hall, 2002
7. Mallick, P.K. and Newman.S., Composite Materials Technology, Hanser Publishers, 2003

COURSE OUTCOMES

Students should be able to

- Describe the properties of polymers
- Report various processing of polymers
- Use various fibres and matrix materials for production of composite
- Prepare polymer matrix composites using various processing methods
- Produce metal matrix composites and ceramic matrix composites

PROFESSIONAL ELECTIVES ON MANUFACTURING MANAGEMENT

MECY052 LEAN SIX SIGMA

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To understand the concepts and principles of lean Six Sigma
- To impart knowledge on lean six sigma methodologies
- To learn various tools and techniques of six sigma
- To instruct various lean tools
- To educate implementation of lean six sigma

MODULE I EVOLUTION OF LEAN SIX SIGMA 05

Introduction to Lean Principles and Six Sigma Concepts-Similarities and differences – Synergy-Evolution of Lean Six Sigma.

MODULE II LEAN SIX SIGMA APPROACH 08

Lean Six Sigma Methodology - Phases of Lean Six Sigma Method, Managing Lean Six sigma Project, Six sigma Methodologies (DMAIC, DMADV, DFSS)

MODULE III SIX SIGMA TOOLS AND TECHNIQUES 12

Advanced Statistical Tools - Statistical Process Control – Process Capability Analysis – Sigma computation - Hypothesis Testing – ANOVA-Design of Experiments- Chi – square test, Regression analysis – Case studies.

MODULE IV LEAN TOOLS 10

Value Stream Mapping – Poka Yoke-5S-Cycle Time Analysis-Push-Pull Systems-Waste Elimination – Total Productive Maintenance- Failure Mode Effect Analysis-Standard Work Practices-Control Plans, SMED, Kanban, Visual control, Kaizen – Case studies.

MODULE V LEAN SIX SIGMA IMPLEMENTATION 10

Identifying Lean Six Sigma Projects, Define Scope, Planning for Implementation, Selection of tools and techniques for each phase, Measuring the Benefits

Total Hours: 45

REFERENCES:

1. Michael L. George, David Rowlands, Bill Kastle ,What is Lean Six Sigma, McGraw-Hill, 2003
2. Thomas Pyzdek,The Six Sigma Handbook ,McGraw-Hill, 2000
3. James P. Womack, Daniel T. Jones, Lean Thinking, Free press business, 2003.
4. Forrest W. Breyfogle III, Implementing Six Sigma: Smarter Solutions Using Statistical Methods, 1999.
5. Liker, Jeffrey; Meier, David,Toyota Talent, Tata Mcgraw Hills

COURSE OUTCOMES:

Students should be able to

- Describe the concepts and principles of lean six sigma
- Use lean six sigma methodologies
- Apply various tools and techniques of six sigma
- Implement various lean tools
- Adopt lean six sigma for relevant industries

MECY053 MANUFACTURING MANAGEMENT

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To understand the basic concepts of various layouts and material handling systems
- To learn work study techniques
- To gain knowledge on process planning and forecasting methods
- To inculcate knowledge on scheduling and project management
- To impart knowledge on functions of personnel and marketing management

MODULE I PLANT ENGINEERING 07

Plant location – Factors affecting plant location – Techniques – Plant layout - principles - Types –Comparison of layouts – Materials handling – Principles – Factors affecting selection of Materials handling system – Types of materials handling systems – Techniques.

MODULE II WORK STUDY 08

Method study – Principles of motion economy – steps in method study – Tools and Techniques – Work measurement – Purpose – stop watch time study – Production studies – work sampling – Ergonomics – Value analysis.

MODULE III PROCESS PLANNING AND FORECASTING 09

Process planning – Aims of process planning – steps to prepare the detailed work sheets for manufacturing a given component – Break even analysis – Forecasting – Purpose of forecasting – Methods of forecasting – Time series – Regression and Correlation – Exponential smoothing – Forecast errors.

MODULE IV SCHEDULING AND PROJECT MANAGEMENT 12

Scheduling – Priority rules scheduling – sequencing – Johnson's algorithm for job sequencing – n job M machine problems – Project Network analysis – PERT/CPM – Critical path –Floats – Resource leveling – Queuing analysis.

MODULE V PERSONNEL AND MARKETING MANAGEMENT 09

Principles of Management – Functions of personnel management – Recruitment – Training – Motivation – Communication – conflicts – Industrial relations – Trade Union – Functions of marketing – Sales promotion methods – Advertising – Product packaging – Distribution channels – Market research and techniques.

Total Hours: 45

REFERENCES

1. Dr. R. Kesavan, C.Elanchezian and B.Vijayaramnath, Production Planning and Control, Anuratha Publications, Chennai – 2008
2. Dr. R. Kesavan,C. Elanchezian and T.Sundar Selwyn, Engineering Management – Eswar Press, Chennai – 2005
3. Dr. R. Kesavan, C. Elanchezian, and B.Vijayaramnath, Principles of Management – Eswar Press – Chennai – 2004
4. R. Panneerselvam, Production and Operations Management, Prentice Hall of India, 2002
5. Martand T. Telsang, Production Management, S.Chand & Co., 2005
6. Thomas E Mortan, Production and Operations Management, Vikas Publications, 2003.

COURSE OUTCOMES:

Students should be able to

- Describe the basic concepts of various layouts and material handling systems
- Apply the work study techniques in industries
- Perform process planning and forecasting for a manufacturing industry
- Implement the scheduling and project management techniques
- Execute the functions of personnel and marketing management

MECY054 PRODUCTION AND INVENTORY MANAGEMENT

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To understand the fundamentals of production management
- To instruct various forecasting methods
- To inculcate planning methodologies and strategies
- To acquire knowledge on various control activities
- To gain knowledge on types of inventory systems

MODULE I INTRODUCTION 05

Production Management – Input-output model, Trends and challenges, value chains, operations strategy – Technological Innovations in Manufacturing – Corporate strategic choices – Process planning and selection.

MODULE II FORECASTING 10

Forecasting process – Time series forecasting models – moving averages, exponential smoothing – multi-item forecasting – regression models, qualitative methods, forecasting system controls.

MODULE III PLANNING ACTIVITIES 10

Capacity planning – Aggregate production planning strategies and methods – Master Production Schedule, MRP, MRP II, CRP, ERP.

MODULE IV CONTROL ACTIVITIES 10

Production Activity Control – Just-in-time systems – Scheduling in Manufacturing – Theory of constraints and synchronous manufacturing.

MODULE V INVENTORY MANAGEMENT 10

Classification of Inventory - Inventory costs - Deterministic and probabilistic models – Inventory control systems.

Total Hours: 45

REFERENCES:

1. Seetharama L.Narasimhan, Dennis W.McLeavey, Peter J.Billington, “Production Planning and Inventory Control”, PHI, 2002.
2. Panneerselvam, R. Production and operations management, PHI, 2005

3. Lee J.Krajewski, Larry P.Ritzman, “Operations Management”, Pearson Education, 2000
4. Mahadevan,B. Operations- Theory & Practice, Pearson Education, 2007.

COURSE OUTCOMES:

Students should be able to

- Explain the fundamentals of production management
- Apply various forecasting methods in production management
- Execute planning methodologies and strategies
- Implement different types of control activities
- Choose relevant inventory systems

MECY055	PRODUCTIVITY MANAGEMENT AND RE - ENGINEERING	L	T	P	C
		3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To learn productivity concepts and its measurement
- To impart knowledge on systems approach for productivity measurement
- To gain knowledge in organizational transformation concepts and models
- To study the Re-engineering process improvement models
- To educate Re-engineering tools and its implementation

MODULE I PRODUCTIVITY AND MEASUREMENT 09

Productivity concepts – Macro and micro factors of productivity – Dynamics of productivity - Productivity cycle - Productivity measurement at International, national and organisation level - Productivity measurement models.

MODULE II SYSTEMS APPROACH TO PRODUCTIVITY MEASUREMENT 09

Conceptual frame work – Management by objectives (MBO) - Performance objective productivity (POP) – Methodology and application to manufacturing and service sector.

MODULE III ORGANISATIONAL TRANSFORMATION 09

Elements of organisational transformation and re-engineering - Principles of organizational transformation and re-engineering – Fundamentals of process re-engineering – Preparing the workforce for transformation and re-engineering - Methodology, guidelines, LMI CIP Model – DSMC Q & PMP model.

MODULE IV RE-ENGINEERING PROCESS IMPROVEMENT MODELS 09

PMI models – PASIM model – Moen and Nolan strategy for process improvement – LMICIP model – NPRDC model.

MODULE V RE-ENGINEERING TOOLS AND IMPLEMENTATION 09

Analytical and process tools and techniques – Information and communication technology – Implementation of re-engineering projects – Success factors and common implementation problem – Cases.

Total Hours: 45

REFERENCES

1. Sumanth, D.J., Productivity Engineering and Management, TMH, New Delhi, 1990.
2. Edosomwan, J.A., Organisational Transformation and Process Re-engineering, Library Cataloging in Pub. Data, 1996.
3. Rastogi, P.N., Re-engineering and Re-inventing the Enterprise, Wheeler Pub. New Delhi, 1995.
4. Premvrat, Sardana, G.D. and Sahay, B.S., Productivity Management – A Systems Approach, Narosa Publishing House, New Delhi, 1998.

COURSE OUTCOMES:

Students should be able to

- Reproduce productivity concepts and its measurement
- Communicate systems approach for productivity measurement
- Apply organizational transformation concepts and models
- Implement the Re-engineering process improvement models
- Execute the Re-engineering tools

MECY056 SUPPLY CHAIN MANAGEMENT

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To study the basic concepts of supply chain management
- To acquire knowledge on logistics management
- To instruct the design of supply chain network
- To communicate the sourcing and pricing of supply chain
- To impart knowledge on technology involved in supply chain

MODULE I INTRODUCTION 06

Definition of Logistics and SCM: Evolution, Scope, Importance & Decision Phases – Drivers of SC Performance and Obstacles.

MODULE II LOGISTICS MANAGEMENT 10

Factors – Modes of Transportation - Design options for Transportation Networks- Routing and Scheduling – Inbound and outbound logistics- Reverse Logistics – 3PL- Integrated Logistics Concepts- Integrated Logistics Model – Activities - Measuring logistics cost and performance – Warehouse Management - Case Analysis.

MODULE III SUPPLY CHAIN NETWORK DESIGN 10

Distribution in Supply Chain – Factors in Distribution network design –Design options-Network Design in Supply Chain – Framework for network Decisions - Managing cycle inventory and safety.

MODULE IV SOURCING AND PRICING IN SUPPLY CHAIN 09

Supplier selection and Contracts - Design collaboration - Procurement process. Revenue management in supply chain

MODULE V COORDINATION AND TECHNOLOGY IN SUPPLY CHAIN 10

Supply chain coordination - Bullwhip effect – Effect of lack of co-ordination and obstacles – IT and SCM - supply chain IT frame work. E Business & SCM. Metrics for SC performance – Case Analysis.

Total Hours: 45

REFERENCES:

1. Sunil Chopra and Peter Meindl,Supply Chain Management, Strategy, Planning, and operation –- PHI, Second edition, 2007
2. David J.Bloomberg, Stephen Lemay and Joe B.Hanna,Logistics, , PHI 2002
3. Martin Christopher, Logistics and Supply Chain Management –Strategies for Reducing Cost and Improving Service. Pearson Education Asia, Second Edition
4. Jeremy F.Shapiro, Thomson Duxbury Modeling the supply chain, 2002
5. James B.Ayers, Handbook of Supply chain management, St.Lucle Press, 2000

COURSE OUTCOMES:

Students should be able to

- Confer the basic concepts of supply chain management
- Express the concepts of logistics management
- Execute the design of supply chain network
- Apply the thoughts of sourcing and pricing of supply chain
- Use relevant technology involved in supply chain

MECY057 TECHNOLOGY MANAGEMENT

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To understand the basic methods of technology management in the global context
- To gain exposure in technology forecasting methods
- To communicate choice and evaluation of decision making studies
- To impart knowledge on technology transfer and acquisition
- To study technology absorption and innovation

MODULE I INTRODUCTION 09

Technology management - Scope, components, and overview – Technology and environment – Technology and society – Technology Impact analysis, environmental, social, legal, political aspects, techniques for analysis - steps involved. Technology policy strategy: Science and technology Policy of India, implications to industry – The dynamics of technology change.

MODULE II TECHNOLOGY FORECASTING 09

Need, methodology and methods - trend Analysis, Analogy, Delphi, Soft System Methodology, Mathematical Models, Simulation, and System Dynamics.

MODULE III TECHNOLOGY CHOICE AND EVALUATION 09

Issues in the development of new high tech products – Methods of analyzing alternate technologies – Techno-economic feasibility studies – Need for multi-criteria considerations such as, social, environmental, and political – Analytic hierarchy method – Fuzzy multi-criteria decision making, and other methods.

MODULE IV TECHNOLOGY TRANSFER AND ACQUISITION 09

Import regulations – Implications of agreements like Uruguay Round and WTO – Bargaining process – Transfer option, MOU- Technology Adoption and Productivity - Adopting technology-human interactions – Organisational redesign and re-engineering – Technology productivity.

MODULE V TECHNOLOGY ABSORPTION AND INNOVATION 09

Present status in India – Need for new outlook – Absorption strategies for acquired technology – creating new/improved technologies – Innovations – Technology Measurement – Technology Audit, Risk and exposure, R&D portfolio management.

Total Hours: 45

REFERENCES:

1. Joseph M. Putti, Management – A Functional Approach, McGraw Hill, 1997
2. Kenneth C. Lauden , MIS: Organisation and Technology, Prentice Hall, 1995
3. James A.Senn, Information technology in Business, Prentice Hall, 1995
4. Ronald J. Jordan, Security analysis and Portfolio Management, Prentice Hall, 1995
5. Irvin M. Rubin, Organisational behavior an experimental approach, Prentice Hall, 1995
6. Gerard H. Gaynor, Handbook of Technology Management, McGraw-Hill Professional, 1996
7. Richard C. Dorf, Technology Management Handbook, CRC, 1999

COURSE OUTCOMES:

Students should be able to

- Describe the methods of technology management in the global context
- Illustrate technology forecasting methods
- Apply decision making studies for the choice and evaluation of technology
- Present knowledge on technology transfer and acquisition
- Critique technology absorption and innovation

MECY058 TOTAL QUALITY SYSTEM AND MANAGEMENT

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To study the basic concepts of TQM
- To communicate the knowledge on practice of TQM
- To learn the techniques of TQM
- To understand the concepts of statistical quality control
- To educate various sampling techniques

MODULE I INTRODUCTION 09

Principles of Quality Management – Pioneers of TQM –Quality Cost-Quality System- Customer Orientation –Bench marking – Re-engineering - Concurrent Engineering.

MODULE II PRACTICE OF TQM 09

Leadership – Organizational Structure - Team Building- Information Systems and Documentation –Quality Auditing-ISO 9000-QS 9000.

MODULE III TECHNIQUES OF TQM 09

Single vendor Concept –J.I.T –Quality Function Deployment- Quality Circles – KAIZEN- POKA YOKE - Taguchi Methods.

MODULE IV STATISTICAL QUALITY CONTROL 09

Methods and Philosophy of statistical process control –Control Charts for Variables and Attributes – Cumulative sum and Exponential - weighted moving average control charts- other SPC techniques –Process Capability Analysis – Six Sigma accuracy.

MODULE V SAMPLING TECHNIQUES 09

Acceptance sampling Problem –Single Sampling Plans for Attributes –Double, Multiple and Sequential sampling, Military standards – Dodge – Romig Sampling plans.

Total Hours: 45

REFERENCES:

1. Mohamed Zairi, “Total Quality Management for Engineers”, Woodhead Publishing limited 1991.

2. Harvind Noori and Russel, “Production and operations Management-Total quality and Responsiveness”, McGraw-Hill Inc.1995.
3. Suresh Dalela and saurabh. “ISO 9000 A manual for Total Quality Management”, S.Chand and Company Ltd., 1997.
4. John Bank, “The Essence of Total Quality Management”, Prentice Hall of India Pvt., Ltd., 1995.
5. Monttgomery. D.C. “Introduction to Statistical Quality Control”, 2nd Edition, John Wiley and Sons, 1991.
6. Leavensworth. G.E.L., “Statistical Quality Control”, McGraw-Hill,1984.

COURSE OUTCOMES:

Students should be able to

- Express the basic concepts of TQM
- Implement the practice of TQM
- Apply the techniques of TQM
- Anayze the defects using control charts
- Use various sampling techniques for industrial products

MECY059 ENTREPRENEURSHIP

L	T	P	C
1	0	0	1

COURSE EDUCATIONAL OBJECTIVES:

- To introduce the fundamentals of entrepreneurship
- To impart knowledge on managerial skills and leadership qualities

MODULE I ENTREPRENEURSHIP 08

Entrepreneurship – Functions – Types – Expectations – Sources of finance – Concept of small scale and ancillary units – Sickness and Remedies in SMEs

MODULE II MANAGERIAL SKILLS AND LEADERSHIP QUALITIES 07

Characteristics of Management – Managerial Skills – Contribution of F.W.Taylor and Henry Fayol – Industrial Ownership - Leadership Styles – Qualities of Leadership – Morale – Motivation Theories (Maslow, Herzberg and ERG theory).

Total Hours: 15

TEXT BOOKS

1. “Text book of production management”, Shridhara Bhat.K, 1st Edition, Himalaya Publishing House.
2. “Industrial Engineering and Management”, Khanna.O.P, 2nd Edition, Dhanpat Rai Publications.

REFERENCES

1. “Entrepreneurial Development”, Jayshree Suresh, 5th Edition, Margham Publications.
2. “Entrepreneurship”, Robert D. Hisrich, 6th Edition, Tata McGraw Hill Publications.
3. “Entrepreneurship: Theory”, Process and Practice, Donald F. Kuratko, 9th Edition, Cengage Learning.

COURSE OUTCOMES:

Students should be able to

- Discuss the fundamentals of entrepreneurship
- Execute managerial skills and leadership qualities

GENERAL ELECTIVES

GECY101 PROJECT MANAGEMENT

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

The objectives of the course would be to make the students

- Learn to e valuate and choose an optimal project and build a project profile.
- Attain knowledge on risk identification and risk analysis
- Gain insight into a project plan and components
- Familiar with various gamut of technical analysis for effective project implementation
- Learn to apply project management techniques to manage resources.

MODULE I INTRODUCTION & PROJECT INITIATION 09

Introduction to project and project management - projects in contemporary organization – The project life cycle - project initiation - project evaluation methods & techniques - project selection criteria - project profile.

MODULE II RISK ANALYSIS 09

Sources of risk: project specific - competitive - industry specific - market and international risk – perspectives of risk – risk analysis: sensitivity analysis - scenario analysis - breakeven analysis - simulation analysis - decision tree analysis – managing/mitigating risk – project selection under risk.

MODULE III PROJECT PLANNING & IMPLEMENTATION 09

Project planning – importance – functions - areas of planning - project objectives and policies - steps in planning process - WBS – capital requirements - budgeting and cost estimation - feasibility analysis - creation of project plan – project implementation: pre-requisites - forms of project organization

MODULE IV TECHNICAL ANALYSIS 09

Technical analysis for manufacturing/construction/infrastructure projects – process/technology - materials and inputs - product mix - plant capacity – plant location and site selection – plant layout - machinery and equipment – structures and civil works – schedule of project implementation – technical analysis for software projects.

MODULE V PROJECT MANAGEMENT TECHNIQUES 09

Project scheduling - network construction – estimation of project completion time – identification of critical path - PERT & CPM – crashing of project network - complexity of project scheduling with limited resources - resource allocation - resource leveling – resource smoothing – overview of project management software.

Total Hours: 45

REFERENCES:

1. Projects: Planning, Analysis, Financing, Implementation and Review, Prasanna Chandra, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2004.
2. Project Management and Control, Narendra Singh, Himalaya Publishing, New Delhi, 2015.
3. A Management Guide to PERT/CPM, Jerome, D. Weist and Ferdinand K. Levy, Prentice Hall of India, New Delhi, 1994.

OUTCOMES:

On successfully completing this course, the student will be able to:

- Evaluate & select a project as well as develop a project profile.
- Identify various risks associated with the project and manage it effectively.
- Prepare a detailed project plan addressing its components.
- Perform technical analysis for effective project implementation
- Apply project management techniques for maximizing resource utilization.

GECY102 SOCIETY, TECHNOLGY & SUSTAINABILITY

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To aware of new technologies through advances in Science and Engineering.
- To make them realise the profound impact on society.
- To understand the ethical issues raised by technological changes and its effect on society.
- To introduce students a broad range of perspectives on the adoption and use of technologies.
- To make them realize the need of sustainability in the context of emerging technologies.

MODULE I TECHNOLOGY AND ITS IMPACTS 09

Origin and evolution of technologies – Nature of technology- Innovation – Historical Perspective of technology – Sources of technological change - Co-evolution of technology and economy – Scientific knowledge and technological advance – Science and Engineering aspects of Technology – Impact on the Society – Social and Ethical Issues associated with technological change – Social and environmental consequences - Impact of technological change on human life – Technology and responsibility – Technology and social justice.

MODULE II TECHNOLOGY AND ITS ADVANCEMENT 09

Sociological aspects of technology – Ethics and technology – Technology and responsibility – International Economics, Globalisation and Human Rights – Sustainability and Technology – Population and environment - Technology, Energy and Environment – Organisations and technological change.

MODULE III SOCIETY AND TECHNOLOGY 09

Impact of technologies on contemporary society – Role of society in fostering the development of technology – Response to the adaption and use of technology – Impact of technology on developer and consumers – Technological change and globalisation.

MODULE IV IMPACT OF A SPECIFIC TECHNOLOGY ON HUMAN WELFARE 09

Impact of the following technologies on Human life – Medical and Biomedical – Genetics Technology – Electronics and Communications – Electronic media

Technology – Information Systems Technology – Nanotechnology – Space Technology and Energy Technology.

MODULE V THE IMPORTANCE OF SUSTAINABILITY 09

Sustainability – A brief history – Concepts and contexts for sustainability – Ecological imbalance and biodiversity loss – Climate change – Population explosion. Industrial ecology – systems approach to sustainability – Green engineering and technology- sustainable design- sustainable manufacturing- Green consumer movements – Environmental ethics – Sustainability of the planet Earth – Future planning for sustainability.

Total Hours: 45

REFERENCES:

1. Volti Rudi, “Society and Technology Change”, 6th Edition, Worth publishers Inc, USA, 2009.
2. Arthur W.A, “The nature of Technology: What it is and how it evolves”, Free Press, NY, USA, 2009.
3. Winston M and Edelbach R, “Society, Ethics and Technology”, 3rd Edition, San Francisco, USA, 2005.
4. Martin A.A Abraham, “Sustainability Science and Engineering: Defining Principles”, Elsevier Inc, USA, 2006.
5. R.V.G.Menon, “Technology and Society”, Pearson Education, India, 2011.

COURSE OUTCOMES:

At the end of this course, the students will be able to

- Understand the benefits of modern technology for the well-being of human life.
- Connect sustainability concepts and technology to the real world challenges.
- Find pathway for sustainable society.

GECY103 ARTIFICIAL INTELLIGENCE

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- Expose the history and foundations of artificial intelligence.
- Showcase the complexity of working on real time problems underlying the need for intelligent approaches.
- Illustrate how heuristic approaches provide a good solution mechanism.
- Provide the mechanisms for simple knowledge representation and reasoning.
- Highlight the complexity in working with uncertain knowledge.
- Discuss the current and future applications of artificial intelligence.

MODULE I HISTORY AND FOUNDATIONS 08

History – Scope – Influence from life – Impact of computing domains - Agents in environments - Knowledge representation – Dimensions of Complexity – Sample application domains – Agent structure.

MODULE II SEARCH 10

Problem solving as search – State spaces – Uninformed Search – Heuristic search – Advanced search – Constraint satisfaction - Applications.

MODULE III KNOWLEDGE REPRESENTATION AND REASONING 10

Foundations of knowledge representation and reasoning, representing and reasoning about objects, relations, events, actions, time, and space predicate logic, situation calculus, description logics, reasoning with defaults, reasoning about knowledge, sample applications.

MODULE IV REPRESENTING AND REASONING WITH UNCERTAIN KNOWLEDGE 08

Probability, connection to logic, independence, Bayes rule, Bayesian networks, probabilistic inference, sample applications.

MODULE V CASE STUDY AND FUTURE APPLICATIONS 09

Design of a game / Solution for problem in student's domain. Natural Language processing, Robotics, Vehicular automation – Scale, Complexity, Behaviour – Controversies.

Total Hours: 45

TEXT BOOK:

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall, Third Edition, 2010.
2. David Poole, Alan Mackworth, Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010.
3. Nils J. Nilsson, The Quest for Artificial Intelligence, Cambridge University Press, Online edition, 2013.
4. Keith Frankish, William M. Ramsey (eds) The Cambridge Handbook of Artificial Intelligence, Cambridge University Press, 2014.

COURSE OUTCOMES:

Students who complete this course will be able to

- Discuss the history, current applications, future challenges and the controversies in artificial intelligence.
- Apply principle of AI in the design of an agent and model its actions.
- Design a heuristic algorithm for search problems.
- Analyze and represent the fact using logic for a given scenario
- Represent uncertainty using probabilistic models
- Develop a simple game or solution using artificial intelligence techniques.

GECY104 GREEN COMPUTING

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To focus on the necessity of green computing technology.
- To expose to various issues with information technology and sustainability.
- To attain knowledge on the technologies for enabling green cloud computing.
- To elaborate on the energy consumption issues
- To illustrate a Green and Virtual Data Center
- To develop into a Green IT Technologist.

MODULE I INTRODUCTION 08

Trends and Reasons to Go Green - IT Data Center Economic and Ecological Sustainment - The Growing Green Gap: Misdirected Messaging, Opportunities for Action - IT Data Center “Green” Myths and Realities - PCFE Trends, Issues, Drivers, and Related Factors - Green Computing and Your Reputation- Green Computing and Saving Money- Green Computing and the Environment

MODULE II CONSUMPTION ISSUES 10

Minimizing power usage – Cooling - Electric Power and Cooling Challenges - Electrical – Power -Supply and Demand Distribution - Determining Energy Usage - From Energy Avoidance to Efficiency - Energy Efficiency Incentives, Rebates, and Alternative Energy Sources - PCFE and Environmental Health and Safety Standards- Energy-exposed instruction sets- Power management in power-aware real-time systems.

MODULE III NEXT-GENERATION VIRTUAL DATA CENTERS 09

Data Center Virtualization - Virtualization beyond Consolidation - Enabling Transparency - Components of a Virtual Data Center - Datacenter Design and Redesign - Greening the Information Systems - Staying Green- Building a Green Device Portfolio- Green Servers and Data Centers- Saving Energy

MODULE IV TECHNOLOGIES FOR ENABLING GREEN AND VIRTUAL DATA CENTERS 08

Highly Effective Data Center Facilities and Habitats for Technology - Data Center Electrical Power and Energy Management - HVAC, Smoke and Fire Suppression

- Data Center Location - Virtual Data Centers Today and Tomorrow - Cloud Computing, Out-Sourced, and Managed Services.

MODULE V SERVERS AND FUTURE TRENDS OF GREEN COMPUTING 10

Server Issues and Challenges - Fundamentals of Physical Servers - Types, Categories, and Tiers of Servers - Clusters and Grids - Implementing a Green and Virtual Data Center - PCFE and Green Areas of Opportunity- 12 Green Computer Companies- What's in Green computer science-Green off the Grid aimed for data center energy evolution-Green Grid Consortium- Green Applications- Green Computing Making Great Impact On Research

Total Hours: 45

REFERENCES:

1. Bud E. Smith,"Green Computing Tools and Techniques for Saving Energy, Money, and Resources", Taylor & Francis Group, CRC Press, ISBN-13: 978-1-4665-0340-3, 2014.
2. Jason Harris, "Green Computing and Green IT Best Practices, On Regulations and Industry Initiatives, Virtualization and power management, materials recycling and Tele commuting, Emereo Publishing .ISBN-13: 978-1-9215-2344-1,2014.
3. Ishfaq Ahmed & Sanjay Ranka, "Handbook of Energy Aware and Green Computing", CRC Press, ISBN: 978-1-4665-0116-4, 2013.
4. Kawahara, Takayuki, Mizuno, "Green Computing with Emerging Memory", Springer Publications, ISBN:978-1-4614-0811-6, 2012
5. Greg Schulz, "The Green and Virtual Data Center", CRC Press, ISBN-13:978-1-4200-8666-9, 2009.
6. Marty Poniatowski, "Foundation of Green IT: Consolidation, Virtualization, Efficiency, and ROI in the Data Center", Printice Hall, ISBN: 9780-1-3704-375-0, 2009.

COURSE OUTCOMES:

Students who complete this course will be able to

- Demonstrate issues relating to a range of available technologies, systems and practices to support green computing.
- Select appropriate technologies that are aimed to reduce energy consumption.
- Address design issues needed to achieve an organizations' green

computing objectives.

- Analyze the functionality of Data Centers.
- Critically evaluate technologies and the environmental impact of computing resources for a given scenario.
- Compare the impact of Green Computing with other computing techniques.

GECY105 GAMING DESIGN

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To master event-based programming
- To learn resource management as it relates to rendering time, including level-of-detail and culling.
- To become familiar with the various components in a game or game engine.
- To explore leading open source game engine components.
- To become familiar of game physics.
- To be compatible with game animation.

MODULE I INTRODUCTION 09

Magic Words – What Skills Does a Game Designer Need? – The Most Important Skill -The Five Kinds of Listening-The Secret of the Gifted.

MODULE II THE DESIGNER CREATES AN EXPERIENCE 09

The Game Is Not the Experience -Is This Unique to Games? -Three Practical Approaches to Chasing Rainbows -Introspection: Powers, Perils, and Practice -Dissect Your Feelings -Defeating Heisenberg -Essential Experience.

MODULE III THE EXPERIENCE IN THE PLAYER MIND AND GAME MECHANICS 08

Modeling – Focus -Empathy – Imagination – Motivation – Space – Objects, Attributes, and States – Actions – Rules.

MODULE IV GAMES THROUGH AN INTERFACE 09

Breaking it Down – The Loop of Interaction – Channels of Information – Other Interface.

MODULE V BALANCED GAME MECHANICS 10

Balance – The Twelve Most Common Types of Game Balance – Game Balancing Methodologies - Balancing Game Economies.

Total Hours: 45

REFERENCES:

1. Jesse Schell, "The Art of Game Design: A Book of Lenses", 2nd Edition

ISBN-10: 1466598646, 2014.

2. Ashok Kumar, Jim Etheredge, Aaron Boudreaux, “Algorithmic and Architectural Gaming Design: Implementation and Development", 1st edition, Idea Group, U.S ISBN-10: 1466616342, 2012.
3. Katie Salen Tekinba, Melissa Gresalfi, Kylie Peppler, Rafi Santo, "Gaming the System - Designing with Gamestar Mechanic" MIT Press , ISBN-10: 026202781X, 2014.
4. James M. Van Verth, Lars M. Bishop "Essential Mathematics for Games and Interactive Applications", Third Edition, A K Peters / CRC Press, ISBN-10: 1482250926, 2015.

COURSE OUTCOMES:

Students who complete this course will be able to

- Realize the basic history and genres of games
- Demonstrate an understanding of the overall game design process
- Explain the design tradeoffs inherent in game design
- Design and implement basic levels, models, and scripts for games
- Describe the mathematics and algorithms needed for game programming
- Design and implement a complete three-dimensional video game

GECY106 SOCIAL COMPUTING

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To create original social applications, critically applying appropriate theories and effective practices in a reflective and creative manner.
- To critically analyze social software in terms of its technical, social, legal, ethical, and functional features or affordances.
- To encourage the development of effective communities through the design, use, and management of social software.
- To give students with a base of knowledge and advances for them to critically examine existing social computing services.
- To plan and execute a small-scale research project in social computing in a systematic fashion.
- To become familiar with the concept of computational thinking.

MODULE I BASIC CONCEPTS 09

Networks and Relations: Relations and Attributes, Analysis of Network Data, Interpretation of network data -New Social Learning – Four Changes that Shift Work - Development of Social Network Analysis: Sociometric analysis and graph theory, Interpersonal Configurations and Cliques – Analysing Relational Data.

MODULE II SOCIAL LINK 09

Individual Actors, Social Exchange Theory, Social Forces, Graph Structure, Agent Optimization Strategies in Networks – Hierarchy of Social Link Motivation- Social Context.

MODULE III SOCIAL MEDIA 08

Trends in Computing – Motivations for Social Computing – Social Media: Social relationships, Mobility and Social context – Human Computation – Computational Models- Business use of social Media.

MODULE IV SOCIAL INFORMATION FILTERING 09

Mobile Location Sharing – Location based social media analysis – Social Sharing and Social Filtering – Automated recommender Systems – Traditional and Social Recommender Systems.

MODULE V SOCIAL NETWORK STRATEGY 10

Application of Topic Models – Opinions and Sentiments – Recommendation Systems – Language Dynamics and influence in online communities – Psychometric analysis – Case Study: Social Network Strategies for surviving the zombie apocalypse.

Total Hours: 45

REFERENCES:

1. Tony Bingham, Marcia Conner, “The New Social Learning, Connect. Collaborate. Work”, 2nd Edition, ATD Press, ISBN-10:1-56286-996-5, 2015.
2. Nick Crossley, Elisa Bellotti, Gemma Edwards, Martin G Everett, Johan Koskinen, Mark Tranmer, “Social Network Analysis for Ego-Nets”, SAGE Publication, 2015.
3. Zafarani, Abbasi and Liu, Social Media Mining: An Introduction, Cambridge University Press, 2014.
4. Christina Prell, “Social Network Analysis: History, Theory and Methodology”, 1st Edition, SAGE Publications Ltd, 2012.
5. John Scott, “Social Network Analysis”, Third Edition, SAGE Publication, 2013.
6. Jennifer Golbeck, “Analyzing the Social Web”, Elsevier Publication, 2013.
7. Huan Liu, John Salerno, Michael J. Young, “Social computing and Behavioral Modeling”, Springer Publication, 2009.

COURSE OUTCOMES:

Students who complete this course will be able to

- Realize the range of social computing applications and concepts.
- Analyze data left after in social media.
- Recognize and apply the concepts of computational models underlying social computing.
- Take out simple forms of social diagnostics, involving network and language models, applying existing analytic tools on social information.
- Evaluate emerging social computing applications, concepts, and techniques in terms of key principles.
- Design and prototype new social computing systems.

GECY107 SOFT COMPUTING

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

The aim of the course is to

- Enumerate the strengths and weakness of soft computing
- Illustrate soft computing methods with other logic driven and statistical method driven approaches
- Focus on the basics of neural networks, fuzzy systems, and evolutionary computing
- Emphasize the role of euro-fuzzy and hybrid modeling methods
- Trace the basis and need for evolutionary computing and relate it with other soft computing approaches

MODULE I SOFT COMPUTING - BASICS 06

Soft computing – Hard Computing – Artificial Intelligence as the basis of soft computing – Relation with logic driven and statistical method driven approaches- Expert systems – Types of problems: Classification, Functional approximation, Optimizations – Modeling the problem – Machine Learning – Hazards of Soft Computing – Current and future areas of research

MODULE II ARTIFICIAL NEURAL NETWORK 12

Artificial Neuron – Multilayer perceptron – Supervised learning – Back propagation network –Types of Artificial Neural Network: Supervised Vs Un Supervised Network – Radial basis function Network – Self Organizing Maps – Recurrent Network – Hopfield Neural Network – Adaptive Resonance Theory – Issues in Artificial Neural Network – Applications

MODULE III FUZZY SYSTEMS 09

Fuzzy Logic – Membership functions – Operators – Fuzzy Inference systems – Other sets: Rough sets, Vague Sets – Fuzzy controllers - Applications

MODULE IV NEURO FUZZY SYSTEMS 09

Cooperative Neuro fuzzy systems – Neural network driven fuzzy reasoning – Hybrid Neuro fuzzy systems – Construction of Neuro Fuzzy systems: Structure Identification phase, Parameter learning phase – Applications

MODULE V EVOLUTIONARY COMPUTING 09

Overview of evolutionary computing – Genetic Algorithms and optimization –

Genetic Algorithm operators – Genetic algorithms with Neural/Fuzzy systems – Variants of Genetic Algorithms– Population based incremental learning – Evolutionary strategies and applications

Total Hours: 45

TEXTBOOKS:

1. Samir Roy, “Introduction to Soft Computing: Neuro-Fuzzy and Genetic Algorithms”, Pearson, 2013
2. Anupam Shukla, Ritu Tiwari and Rahul Kala, “Real life applications of Soft Computing”, CRC press, 2010.
3. Fakhreddine O. Karray, “Soft Computing and Intelligent Systems Design: Theory, Tools and Applications”, Pearson, 2009

COURSE OUTCOMES:

At the end of the course the students will be able to

- Enumerate the theoretical basis of soft computing
- Explain the fuzzy set theory
- Discuss the neural networks and supervised and unsupervised learning networks
- Demonstrate some applications of computational intelligence
- Apply the most appropriate soft computing algorithm for a given situation

GECY108 EMBEDDED SYSTEM PROGRAMMING

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To introduce the design of embedded computing systems with its hardware and software architectures.
- To describe entire software development lifecycle and examine the various issues involved in developing software for embedded systems.
- To analyze the I/O programming and Embedded C coding techniques
- To equip students with the software development skills necessary for practitioners in the field of embedded systems.

MODULE I INTRODUCTION OF EMBEDDED SYSTEM 09

Embedded computing – characteristics and challenges – embedded system design process – Overview of Processors and hardware units in an embedded system – Compiling, Linking and locating – downloading and debugging – Emulators and simulators processor – External peripherals – Memory testing – Flash Memory.

MODULE II SOFTWARE TECHNOLOGY 09

Software Architectures, Software development Tools, Software Development Process Life Cycle and its Model, Software Analysis, Design and Maintenance.

MODULE III INPUT/OUTPUT PROGRAMMING 09

I/O Instructions, Synchronization, Transfer Rate & Latency, Polled Waiting Loops, Interrupt – Driven I/O, Writing ISR in Assembly and C, Non Maskable and Software Interrupts

MODULE IV DATA REPRESENTATION IN EMBEDDED SYSTEMS 09

Data representation, Twos complement, Fixed point and Floating Point Number Formats, Manipulating Bits in -Memory, I/O Ports, Low level programming in C, Primitive data types, Arrays, Functions, Recursive Functions, Pointers, Structures & Unions, Dynamic Memory Allocation, File handling, Linked lists, Queues, Stacks.

MODULE V EMBEDDED C 09

Embedded Systems programming in C – Binding & Running Embedded C program in Keil IDE – Dissecting the program - Building the hardware. Basic techniques for

reading & writing from I/O port pins – switch bounce - LED Interfacing using Embedded C.

Total Hours: 45

REFERENCES:

1. Marilyn Wolf, "Computers as components ", Elsevier, 2012.
2. Qing Li and Carolyn Yao, "Real-Time Concepts for Embedded Systems", CMP Books, 2003.
3. Daniel W. Lewis, "Fundamentals of embedded software where C and assembly meet", Pearson Education
4. Michael Bass, "Programming Embedded Systems in C and C++", Oreilly, 2003.

COURSE OUTCOMES:

On completion of this course the student will be able to

- Design the software and hardware components in embedded system
- Describe the software technology
- Use interrupt in effective manner
- Use keil IDE for programming
- Program using embedded C for specific microcontroller
- Design the embedded projects

GECY109 PRINCIPLES OF SUSTAINABLE DEVELOPMENT

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To impart knowledge in the concepts and dimensions of sustainable development.
- To gain knowledge on the framework for achieving sustainability.

MODULE I CONCEPT OF SUSTAINABLE DEVELOPMENT 09

Environment and Development - Population poverty and Pollution – Global and Local environmental issues – Resource Degradation- Greenhouse gases – Desertification-industrialization – Social insecurity, Globalization and environment. History and emergence of the concept of sustainable development-Objectives of Sustainable Development.

MODULE II COMPONENTS AND DIMENSIONS OF SUSTAINABLE DEVELOPMENT 09

Components of Sustainability – Complexity of growth and equity – Social economic and environmental dimensions of sustainable development – Environment – Biodiversity – Natural – Resources – Ecosystem integrity – Clean air and water – Carrying capacity – Equity, Quality of Life, Prevention, Precaution – Preservation and Public Participation Structural and functional linking of developmental dimensions.

MODULE III FRAMEWORK FOR ACHIEVING SUSTAINABILITY 09

Operational guidelines – interconnected prerequisites for sustainable development Empowerment of Women, children, Youth, Indigenous People, Non-Governmental Organizations Local Authorities, Business and industry – Science and Technology for sustainable development – performance indicators of sustainability and assessment mechanism – Constraints and barriers for sustainable development.

MODULE IV SUSTAINABLE DEVELOPMENT OF SOCIO ECONOMIC SYSTEMS 09

Demographic dynamics of sustainability – Policies for socio-economic development – Strategies for implementing eco-development programmes Sustainable development through trade – Economic growth – Action plan for implementing sustainable development – Urbanization and sustainable Cities – Sustainable Energy and Agriculture – sustainable livelihoods.

MODULE V SUSTAINABLE DEVELOPMENT AND INTERNATIONAL RESPONSE 09

Role of developed countries in the development of developing countries – international summits – Stockholm to Johannesburg – Rio principles – Agenda-Conventions – Agreements – Tokyo Declaration – Doubling statement – Tran boundary issues integrated approach for resources protection and management

Total Hours: 45

REFERENCES:

1. Sayer J. and Campbell, B., The Science of Sustainable Development: Local Livelihoods and the Global environment - Biological conservation restoration & Sustainability, Cambridge university Press, London, 2003.
2. M.K. Ghosh Roy. and Timberlake, Sustainable Development, Ane Books Pvt. Ltd, 2011.
3. Mackenthun K.M., Concepts in Environmental Management, Lewis Publications London, 1999.
4. APJ Abdul Kalam and Srijan Pal Singh, Target 3 Billion: Innovative Solutions Towards Sustainable Development, Penguin India, 2011

COURSE OUTCOMES:

At the end of the course the student will be able to

- Describe the concepts of sustainable development
- Define the components and dimensions of sustainable development
- Outline the Frame work for achieving sustainability.
- State the policies and strategies for implementing sustainable development for Socio economic programmes.
- Examine the role of developed countries in sustainable development.

GECY110 QUANTITATIVE TECHNIQUES IN MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVE:

To impart knowledge on

- Concepts of operations research
- Inventory control in production management
- Financial management of projects
- Decision theory and managerial economics

MODULE I OPERATIONS RESEARCH 09

Introduction to Operations research – Linear programming – Graphical and Simplex Methods, Duality and Post-Optimality Analysis – Transportation and Assignment Problems

MODULE II PRODUCTION MANAGEMENT 09

Inventory control, EOQ, Quantity Discounts, Safety Stock – Replacement Theory – PERT and CPM – Simulation Models – Quality Control.

MODULE III FINANCIAL MANAGEMENT 09

Working Capital Management – Compound Interest and Present Value methods – Discounted Cash Flow Techniques – Capital Budgeting.

MODULE IV DECISION THEORY 09

Decision Theory – Decision Rules – Decision making under conditions of certainty, risk and uncertainty – Decision trees – Utility Theory.

MODULE V MANAGERIAL ECONOMICS 09

Cost concepts – Break even Analysis – Pricing techniques – Game Theory applications.

Total Hours: 45

REFERENCES:

1. Vohra, N.D. , Quantitative Techniques in Management, Tata McGraw Hill Co., Ltd, New Delhi, 2009.
2. Seehroeder, R.G., Operations Management, McGraw Hill, USA, 2002.
3. Levin, R.I, Rubin, D.S., and Stinsonm J., Quantitative Approaches to Management, McGraw Hill Book Co., 2008.

4. Frank Harrison, E., The Managerial Decision Making Process, Houghton Miffin Co. Boston, 2005.
5. Hamdy A. Taha, Operations Research- An Introduction, Prentice Hall, 2002.

OUTCOME:

At the end of the course, the students will be able to

- Apply the concepts of operations research for various applications
- Create models for inventory control in production management
- Compute the cash flow for a project
- Choose a project using decision theory based on the risk criterion.
- Apply the concepts of managerial economics in construction management

GECY111 PROGRAMMING USING MATLAB & SIMULINK

L	T	P	C
1	0	2	2

COURSE EDUCATIONAL OBJECTIVES:

The aim of this course is to:

- Teach students how to mathematically model engineering systems
- Teach students how to use computer tools to solve the resulting mathematical models. The computer tool used is MATLAB and the focus will be on developing and solving models of problems encountered in engineering fields

MODULE I INTRODUCTION TO MATLAB AND DATA PRESENTATION 10

Introduction to MATLAB-Vectors, Matrices -Vector/Matrix Operations & Manipulation- Functions vs scripts- Making clear and compelling plots-Solving systems of linear equations numerically and symbolically.

Lab Experiments

1. Study of basic matrix operations and manipulations.
2. Numerical and symbolical solution of linear equations.

MODULE II ROOT FINDING AND MATLAB PLOT FUNCTION 10

Linearization and solving non-linear systems of equations- The Newton-Raphson method- Integers and rational numbers in different bases- Least squares regression -Curve fitting-Polynomial fitting and exponential fitting.

Lab Experiments

1. Solution of non linear equations using Newton-Raphson method.
2. Determination of polynomial fit and exponential fit for the given data.

MODULE III LINEAR AND NON-LINEAR DIFFERENTIAL EQUATIONS 13

Numerical integration and solving first order, ordinary differential equations (Euler's method and Runge-Kutta) - Use of ODE function in MATLAB- Converting second order and higher ODEs to systems of first order ODEs- Solving systems of higher order ODEs via Euler's method and Runge-Kutta) - Solving single and systems of non-linear differential equations by linearization-Use of the function ODE in MATLAB to solve differential equations - Plot Function –Saving & Painting Plots.

Lab Experiments

1. Solution of fourth order linear differential equations using
    a. Trapezoidal Rule

b. Euler method

2. Solution of fourth order non-linear differential equations using
   a. Modified Euler method
   b. Runge – Kutta method

MODULE IV INTRODUCTION OF SIMULINK 12

Simulink & its relations to MATLAB – Modeling a Electrical Circuit- Modeling a fourth order differential equations- - Representing a model as a subsystem- Programme specific Simulink demos.

Lab Experiments

1. Solution of fourth order non-linear differential equations using simulink.
2. Programme specific experiment based on simulink.

Total Hours (Including Practicals): 45

REFERENCE:

1. Griffiths D V and Smith I M, “Numerical Methods for Engineers”, Blackwell, 1991.
2. Laurene Fausett, “Applied Numerical Analysis Using MATLAB”, Pearson 2008.
3. Moin P, “Fundamentals of Engineering Numerical Analysis”, Cambridge University Press, 2001.
4. Wilson HB, Turcotte LH, Advanced mathematics and mechanics applications using MATLAB”, CRC Press, 1997
5. Ke Chen, Peter Giblin and Alan Irving, “Mathematical Exploration with MATLAB”, Cambridge University Press, 1999.

COURSE OUTCOMES:

At the end of this unit students will be able to:

- Use Matlab as a convenient tool for solving a broad range of practical problems in engineering from simple models to real examples.
- Write programs using first principles without automatic use of built-in ones.
- Write programs for solving linear and nonlinear systems, including those arising from boundary value problems and integral equations, and for root-finding and interpolation, including piecewise approximations.
- Be fluent in exploring Matlab’s capabilities, such as using matrices as the fundamental data-storage unit, array manipulation, control flow, script and function m-files, function handles, graphical output.
- Make use of Maltab visual capabilities for all engineering applications.

- An ability to identify, formulate, and solve engineering problems. This will be accomplished by using MATLAB to simulate the solution to various problems in engineering fields

GECY112 JAVA PROGRAMMING

L	T	P	C
1	0	2	2

COURSE EDUCATIONAL OBJECTIVES:

- To learn the fundamentals of Java programming such as data types, variables and arrays.
- To study the syntax and necessity of decision making and iterative statements.
- To create a class and invoke the methods.
- To instigate programming in overloading of methods.
- To emphasize the concept of packages.
- To learn the exception handling routines.

MODULE I INTRODUCTION TO JAVA PROGRAMMING 08

History and Evolution of Java – Overview of Java – Data types, variables and arrays – Operators – Control statements.

MODULE II METHODS AND CLASSES 07

Class fundamentals – Declaring objects – Methods – Constructors – Garbage collection – Overloading methods – Constructor overloading – Access control – Inheritance – Packages - Exception handling.

L: 15, P: 30, Total Hours: 15

REFERENCES:

1. Herbert Schildt, “Java The Complete Reference”, 9th Edition, Oracle Press, 2014, ISBN: 978007180855-2.
2. Nicholas S. Williams, **“**Professional Java for Web Applications: Featuring WebSockets, Spring Framework, JPA Hibernate and Spring Security (WROX)”, John Wiley & Sons, 2014, ISBN: 978111865651-8.
3. E Balagurusamy, “Programming with Java”, 5th Edition, Tata Mcgraw Hill, 2014.
4. Yashavant Kanetka**, “**Let Us Java”, 2nd Edition, BPB Publications, 2012**.**

COURSE OUTCOMES:

Students who complete this course will be able to

- Implement basic Java programming.
- Create a class and invoke methods for real world problems.

- Construct simple overloading of methods programs.
- Implement various types of inheritance concepts.
- Describe the access control mechanism.
- Handle exception thrown while implementing programming.

GECY113 PYTHON PROGRAMMING

L	T	P	C
1	0	2	2

COURSE EDUCATIONAL OBJECTIVES:

- To learn the list and records of python programming.
- To study the control statements and string functions of python.
- To instigate the fundamental python programming.
- To emphasize GUI in python.
- To integrate python with embedded systems.
- To implement programs in python.

MODULE I INTRODUCTION TO PYTHON PROGRAMMING 08

Installation and environment set up – syntax used in python – variable types – operators – Loops – decision making – string functions - formatted files - GUI basics.

MODULE II EMBEDDED PROGRAMMING USING PYTHON 07

Web interface – system tools – script execution context - Motion-triggered LEDs – Python - Arduino prototyping-storing and plotting Arduino data-Remote home monitoring system.

L: 15, P: 30, Total Hours: 15

REFERENCES:

1. Nick Goddard, “Python Programming”, 2nd edition, ISBN: 1533337772, 2016.
2. Pratik Desai, “Python Programming for Arduino”, 1st edition, Packt publishing, 2015, ISBN: 9781783285938.
3. Mark Lutz, Learning Python: Powerful Object-Oriented Programming, 5th Edition, O'Reilly Media, 2013.
4. Richard H. Barnett, Sarah Cox, Larry O'Cull, “Embedded C Programming and the Atmel AVR”, 2nd edition, 2006.
5. Michael Barr, Anthony Massa, “Programming Embedded Systems”, 2nd Edition, O'Reilly Media, 2006.

COURSE OUTCOMES:

Students who complete this course will be able to

- Implement date and time function programming using python.

- Write formatted file programming.
- Construct simple python programs.
- Create web interface using python programming
- Develop embedded system with python programming.
- Build Arduino prototype using python programming.

GECY114 INTELLECTUAL PROPERTY RIGHTS (IPR)

L	T	P	C
1	0	0	1

COURSE EDUCATIONAL OBJECTIVES:

- To study about Intellectual property rights and its need
- To explore the patent procedure and related issues

MODULE I INTRODUCTION 07

Introduction and the need for intellectual property right (IPR) – IPR in India – Genesis and Development – IPR in abroad – Important examples of IPR – Copyrights, Trademarks, Patents, Designs, Utility Models, Trade Secrets and Geographical Indications – Industrial Designs

MODULE II PATENT 08

Concept of Patent – Product / Process Patents & Terminology – Duration of Patents – Law and Policy Consideration Elements of Patentability –- Patentable Subject Matter – Procedure for Filing of Patent Application and types of Applications – Procedure for Opposition – Revocation of Patents – Working of Patents- Patent Agent – Qualification and Registration Procedure – Patent databases and information system – Preparation of patent documents – Process for examination of patent application- Patent infringement – Recent developments in patent system

Total Hours: 15

REFERENCES

1. B.L.Wadehra; Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India 2000
2. Ajit Parulekar and Sarita D' Souza, Indian Patents Law – Legal & Business Implications; Macmillan India ltd , 2006
3. P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi, 2010.
4. E. T. Lokganathan, Intellectual Property Rights (IPRs): TRIPS Agreement & Indian Laws Hardcover, 2012
5. Alka Chawla, P N Bhagwati , Law of Copyright Comparative Perspectives 1st Edition, LexisNexis, 2013
6. V. K. Ahuja, Law Relating to Intellectual Property Rights 2nd Edition, LexisNexis, 2nd Edition, 2013

7. Deborah E. Bouchoux, Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets, 2015
8. Jatindra Kumar Das, Law of Copyright, PHI Learning, 2015

COURSE OUTCOMES:

Students should be able to

- Identify the various types of intellectual property and their value
- Apply the procedure to file a patent and to deal the related issues
- Search and extract relevant information from various intellectual database

REGULATIONS, CURRICULAM AND SYLLABUS

M. TECH.
ELECTRONICS AND INSTRUMENTATION ENGINEERING

(As approved by the 9th Academic Council)

JULY 2016

B.S.ABDUR RAHMAN UNIVERSITY
B.S.ABDUR RAHMAN INSTITUTE OF SCIENCE & TECHNOLOGY
(Estd.u/s 3 of the UGC Act, 1956)
(FORMERLY B.S.ABDUR RAHMAN CRESCENT ENGINEERING COLLEGE)
Seethakathi Estate, G.S.T. Road, Vandalur, Chennai - 600 048.

VISION AND MISSION OF THE DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

VISION

The Department aspires to excel in providing quality education, training and research in the area of Electronics and Instrumentation Engineering to meet the industrial and societal needs.

MISSION

- To provide quality education in the field of Electronics and Instrumentation Engineering by offering Under Graduate, Post Graduate and Doctoral Programs.
- To impart technical knowledge and hands on experience, leadership and managerial skills to meet the current industrial and societal needs.
- To enhance problem solving capabilities through design projects, internship and industrial projects.
- To maintain active linkages with industries and research institutions
- To develop analytical skills, leadership quality and team spirit through balanced curriculum and a judicial mix of co-curricular, extra-curricular and professional society activities.
- To enrich the knowledge and skills of faculty through continuous learning and active research.

PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES

PROGRAMME EDUCATIONAL OBJECTIVES

1. To provide advanced knowledge in the areas of Instrumentation, Control & Electronics and be aware of latest trends in the fields
2. To develop ability to design, implement and maintain the automation systems for the process industries
3. To develop skill by providing practical exposure in the areas of Electronics and Instrumentation Engineering, to interpret and evaluate the experimental results
4. To kindle interest in the development of innovative ideas in the real time problems related to electronics, Instrumentation and Control and take up projects to implement these ideas
5. To impart necessary managerial and soft skills required to face the challenges in process industries and software companies.
6. To inculcate sustained interest in the process of lifelong learning to keep abreast of new developments in the field of Electronics, Instrumentation and Control.

PROGRAMME OUTCOME

1. Identify real-time problems in the areas of instrumentation, industrial automation & microelectronics and carryout industry standard project
2. Apply the in-depth knowledge gained in the areas of Electronics , Instrumentation and Process Control to find feasible and optimal solutions for industrial problems
3. Formulate/Select and apply relevant techniques, resources and Engineering & IT tools for the design of instrumentation systems; process modeling and control
4. Function actively and efficiently as a lead of different teams and multidisciplinary projects
5. Communicate effectively the engineering concepts and ideas with a wide range of engineering community and others, to understand and prepare reports, to make effective presentations and to frame instructions and guidelines.
6. Carry out the assigned task in the career with professional approach and ethical responsibility
7. Recognize the need for self and life-long learning keeping pace with technological changes.

CURRICULUM & SYLLABI FOR

M. Tech (Electronics and Instrumentation Engineering)

CURRICULUM

FOUR SEMESTERS / FULL TIME)

S. No	Course Code	Course Name	L	T	P	C
		Semester I				
1	MAC6184	Probability, Matrix Theory And Linear Programming	**3**	**1**	**0**	**4**
2	EEC6101	System Theory	**3**	**0**	**0**	**3**
3	EIC6101	Microcontroller based system design	**3**	**0**	**0**	**3**
4	EIC6102	Frequency based Control System	**3**	**0**	**2**	**4**
5	EIC6103	Applied Industrial Instrumentation	**3**	**0**	**0**	**3**
6		Professional Elective				**2/3**
		Total Credit (semester I)				**19/20**
		Semester II				
1	GEC6201	Research Methodology for Engineers	**3**	**0**	**0**	**3**
2	EIC6211	Advanced Process Control	**3**	**0**	**2**	**4**
3	EIC6212	Industrial Automation using PLC, SCADA and DCS	**3**	**0**	**2**	**4**
4		Professional Elective (min credit of 9)				**9**
5	EIC6213	Mini project/Seminar	**0**	**0**	**2**	**1**
		Total Credit (semester II)				**21**
		Semester III				
1		Professional Elective				**7/6**
2		General Elective (min credit of 3)				**3**
3	EIC7102	Industry Internship	**0**	**0**	#	**1**
4	EIC7101	Project Phase I	**0**	**0**	**12**	**6***
		Total Credit (semester III)				**17/16**
		# - Two week summer internship				
		Semester IV				
1	EIC7101	Project Phase II	**0**	**0**	**36**	**18**
		Total Credit (semester IV)				**18**

S. No	Course Code	Course Name	L	T	P	C

*Credit for Project Phase I to be accounted along with Project work phase II in IV semester

**Value added course by industrial person / Academician with 1 credit

Grand Total of credits **75**

List of Electives

General Elective (GE1) (to be appended) (3 credits)

S. No	Course Code	Course Name	L	T	P	C
Professional Elective (Semester 1 Electives)			**(2/3 credits)**			
1.	EICY101	Piping & Instrumentation for Process Industries	**2**	**0**	**0**	**2**
2.	EICY102	Applied soft computing techniques for Process Modeling, Control and Optimization	**2**	**0**	**2**	**3**
3.	EICY103	Instrumentation System Design	**2**	**0**	**2**	**3**
Professional Elective - (Semester 2 Electives)			**(9 credits)**			
1	EICY201	System Identification and Modeling	**2**	**0**	**2**	**3**
2	EICY202	Adaptive Control	**3**	**0**	**0**	**3**
3	EICY203	Optimal Control	**3**	**0**	**0**	**3**
4	EICY204	Virtual Instrumentation	**2**	**0**	**2**	**3**
5	EICY205	Advanced Fibre optics and Laser Instrumentation	**3**	**0**	**0**	**3**
6	EICY206	Applied Biomedical Instrumentation	**3**	**0**	**0**	**3**
7	ECCY001	Digital Image Processing	**3**	**0**	**0**	**3**
8	ECC6104	Advanced Digital Signal Processing	**3**	**1**	**0**	**4**
9	ECCY022	Speech and Audio Signal Processing	**3**	**0**	**0**	**3**
10	ECCY016	Network Security	**3**	**0**	**0**	**3**
11	MACY081	Signal Processing Techniques	**3**	**1**	**0**	**4**
12	ECCY050	MEMS System Design	**3**	**0**	**0**	**3**
Professional Elective (Semester 3 Electives)			**(7/6 credits)**			
1	EICY130	Fault Tolerant Control	**3**	**0**	**0**	**3**
2	EICY131	Robotics and Automation	**3**	**0**	**0**	**3**
3	EICY132	Instrumentation in Power Plant	**3**	**0**	**0**	**3**
4	EICY133	Instrumentation in Petrochemical Industry	**3**	**0**	**0**	**3**
5	EICY134	Value Added Course	**1**	**0**	**0**	**1**
6	ECCY025	Wireless Communication	**3**	**0**	**0**	**3**
7	ECCY011	Medical Image Processing	**3**	**0**	**0**	**3**
8	ECCY026	Wireless sensor Networks	**3**	**0**	**0**	**3**
9	EEC6128	Embedded and Advanced Control of	**3**	**0**	**2**	**4**

		Electric Drives				
10	EEC6235	Solid State AC and DC Drives	**3**	**0**	**0**	**3**
11	EECY047	Special Electrical Machines and Controllers	**3**	**0**	**0**	**3**

GENERAL ELECTIVES FOR M.TECH PROGRAMMES

Sl. No.	Course Code	Course Title	L	T	P	C
1	GECY101	Project management	**3**	**0**	**0**	**3**
2	GECY102	Society, Technology & Sustainability	**3**	**0**	**0**	**3**
3	GECY103	Artificial Intelligence	**3**	**0**	**0**	**3**
4	GECY104	Green Computing	**3**	**0**	**0**	**3**
5	GECY105	Gaming Design	**3**	**0**	**0**	**3**
6	GECY106	Social Computing	**3**	**0**	**0**	**3**
7	GECY107	Soft Computing	**3**	**0**	**0**	**3**
8	GECY108	Embedded System Programming	**3**	**0**	**0**	**3**
9	GECY109	Principles of Sustainable Development	**3**	**0**	**0**	**3**
10	GECY110	Quantitative Techniques in Management	**3**	**0**	**0**	**3**
11	GECY111	Programming using MATLAB & SIMULINK	**1**	**0**	**2**	**2**
12	GECY112	JAVA Programming	**2**	**0**	**0**	**2**
13	GECY113	PYTHON Programming	**2**	**0**	**0**	**2**
14	GECY114	Intellectual Property Rights	**1**	**0**	**0**	**1**

SEMESTER I

		L	T	P	C
MAC6184	**PROBABILITY, MATRIX THEORY AND LINEAR PROGRAMMING**	**3**	**1**	**0**	**4**

OBJECTIVE:

The aim of this course is to

- provide a comprehensive introduction to the probability distributions used in engineering.
- familiarize students with advanced matrix theory and variational problems.
- expose the students to Operations Research using concepts of linear programming.

MODULE I PROBABILITY DISTRIBUTIONS 10+03

Axioms of probability – addition and multiplication theorem – conditional probability – total probability – random variables - moments – moments generating functions and their properties- Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

MODULE II TWO DIMENSIONAL RANDOM VARIABLES 08+03

Joint distributions - marginal and conditional distributions - functions of random variables - covariance - correlation and regression - Central limit theorem.

MODULE III ADVANCED MATRIX THEORY 09+03

Matrix norms - singular value decomposition - QR algorithm - pseudo inverse - least square approximations.

MODULE IV LINEAR PROGRAMMING 10+03

Formation - graphical method - simplex method - Big-M method - Two Phase method - transportation and assignment problems.

MODULE V CALCULUS OF VARIATIONS 08+03

Variation and its properties – Euler's equation – functional dependant on first and higher order derivatives – functional dependant on functions of several independent variables – variational problems with moving boundaries – isoperimetric problems – Ritz and Kantorovich methods.

L – 45; T – 15; Total – 60

TEXT BOOKS:

1. S.M.Ross, “A First Course in Probability”, 9th edition, Pearson Education, 2013.
2. Lewis.D.W., “Matrix Theory”, Allied Publishers, Chennai, 1995.
3. Taha, H.A., “Operations Research - An Introduction '', 10th edition, Pearson Prentice Hall, 2016.
4. A.S. Gupta, “Calculus of variations with applications”, PHI Pvt. Ltd, New Delhi, 2011.

REFERENCES:

1. H. Cramer., “Random Variables and Probability Distributions”, Cambridge University Press (2004).
2. Roger A. Horn, Charles R. Johnson, “Matrix Analysis”, Cambridge University Press; 2nd edition (2012).
3. Robert.J.Vanderbei., “Linear Programming: Foundations and Extensions”, Springer US(2014).
4. David. J. Rader., “Deterministic Operations Research”, Wiley (2010).
5. Elsgolts, “Differential Equations and Calculus of Variations", University Press of the Pacific (2003).

OUTCOME:

At the end of the course students will be able to

- Solve problems using concept of standard, discrete and continuous distributions.
- Solve problems using one dimensional and two dimensional random variables.
- Find eigenvalues and eigen vectors of a higher order matrix.
- Solve problems of linear programming.
- Solve problems of calculus of variations by direct methods and using Euler’s formulae.

EEC6101 SYSTEM THEORY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide knowledge on state space approach, state feedback controllers and observers for different processes.
- To enhance knowledge on stability analysis of multivariable processes.
- To introduce nonlinear systems and its linearization methods.
- To evaluate Stability of Linear and Non Linear Systems.

MODULE I STATE SPACE APPROACH 08

Introduction to State Space Approach - System representation in state variable form – State transition equation – Methods of computing the state transition matrix.

MODULE II STATE FEEDBACK CONTROL AND STATE ESTIMATOR 08

Stability analysis - Controllability and Observability of linear time invariant systems - State Feedback – Output Feedback – Pole placement technique – Full order and Reduced Order Observers.

MODULE III STABILITY FOR LINEAR SYSTEMS 08

Introduction – Equilibrium points – Stability in the sense of Lyapunov - BIBO Stability – Stability of LTI systems – The direct method of Lyapunov and the Linear continuous time autonomous systems – Popov Stability Criterion.

MODULE IV NON-LINEAR SYSTEMS 06

Types of Non-Linearity – Typical Examples – Phase plane analysis (analytical and graphical methods) – Limit cycles – Equivalent Linearization.

MODULE V STABILITY FOR NON-LINEAR SYSTEMS 08

Equilibrium stability of non linear continuous time autonomous systems – Finding Lyapunov functions for nonlinear continuous time autonomous systems – Krasovskii and variable gradient method.

MODULE VI STABILITY FOR NON-LINEAR SYSTEMS USING DESCRIBING FUNCTION 07

Describing Function Analysis for Non Linear Systems, Describing Functions for different non-linear elements- backlash, deadzone, saturation and hysteresis

Total Hours: 45

REFERENCES:

- M.Gopal, “Modern Control System Theory”, New Age International, 2005.
- K.Ogata, “Modern Control Engineering”, Prentice Hall of India, 2010.
- John .S.Bay, “Fundamentals of Linear State Space Systems”, Tata McGraw– Hill, 1999.
- Z.Bubnicki, “Modern Control Theory”, Springer, 2005.

OUTCOMES:

At the end of the course, the students will have knowledge and achieve skills on the following:

- Implement state space approach for the process and obtain the solution.
- Design state feedback controller and observers.
- Perform stability analyses of the system using conventional mathematical approach
- Ability to analyze complex systems using mathematical models.
- Ability to analyze the stability of Linear Systems using Lyapnov and Popov Stability Criterions
- Ability to analyze the stability of Non-Linear Systems using novel techniques.

EIC 6101	MICROCONTROLLER BASED SYSTEM DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To expose the students to the fundamentals of embedded Programming
- To provide knowledge about the architectures and features of various microcontrollers
- To impart knowledge about both hardware and software aspects of integrating digital devices into microcontroller based systems.
- To understand the concepts of algorithm development and programming on software tools and microcontrollers with peripheral interfaces.
- To design embedded system for real time applications.

MODULE I INTRODUCTION TO EMBEDDED SYSTEM 09

Microprocessor and Microcontroller architecture, Comparison, Advantages and applications of each Harvard and Von Neumann architecture, RISC and CISC comparison, Definition of embedded system and its characteristics. Role of microcontroller in embedded System. Study of RS232, RS 485, I2C, SPI protocols. Serial communications, Memory,Software and hardware tools for development of microcontroller based system.

MODULE II PIC MICROCONTROLLER 09

Introduction to PIC Microcontroller, PIC16F877A Architecture and Instruction Set , Memory Organization, I/O Ports and SFRs , Interrupts , Timers and ADC,addressing modes – instruction set – PIC programming in Assembly & C.

MODULE III AVR MICROCONTROLLER 09

Overview of AVR family, AVR family Categories and importance (ATmega/ Xmega).AVR Microcontroller architecture, Register, AVR status register, ROM space and other hardware modules, ATmega32 pin configuration & function of each pin. AVR Assembly Language Programming, Timers, Interrupts.

MODULE IV LPC 2148 MICROCONTROLELR 09

LPC2148 ARM 7 microcontroller, Features of LPC2148, Block diagram of LPC2148, Pin diagram of LPC2148, Architectural overview, On-chip flash program memory, On-chip static RAM. System control, Timers, ADC, DAC, UART.

MODULE V CASE STUDIES 09

Home security system, Smart card application, Design of DAS system, Design of Digital Multimeter, Stepper motor control, Design of DC Motor control using PWM, Line Following Robotic Circuit using ATMega8 Microcontroller.

Total Hours:45 hours

TEXT BOOKS:

1. "The PIC Microcontroller and Embedded systems – Using Assembly and C for PIC18," Muhammad Ali Mazidi, Rolin D. McKinlay, and Danny Causey, Prentice Hall, 2013
2. The AVR Microcontroller and Embedded Systems Using Assembly and C, By Muhammad Ali Mazidi, Sarmad Naimi and Sepehr Naimi, Pearson Education, 2011.
3. Programming and Customizing the AVR Microcontroller, By Dhananjay Gadre, McGraw Hill Education,2008
4. Lyla B Das," Embedded Systems-An Integrated Approach",Pearson2013

REFERENCE BOOKS:

1. Rajkamal, 'Embedded system-Architecture, Programming, Design', TMH,2011.
2. Peckol, "Embedded system Design",JohnWiley&Sons,2010
3. Microcontrollers, Principles and Applications – Ajit pal – PHI Ltd., - 2011.

OUTCOMES:

At the end of the course the student will be able to

- Compare microprocessor and microcontroller and analyze the tools in an embedded system
- Distinguish the architecture of three microcontroller's namely PIC, AVR microcontrollers.
- Interface PIC,AVR microcontrollers to various peripheral devices such as ADC, DAC, Motor , LCD etc.
- Develop the programming skills with simple arithmetic and control instructions for PIC, AVR microcontrollers
- Design and implement a microcontroller based embedded system for selected industrial projects.

EIC6102	FREQUENCY BASED CONTROL SYSTEM	L	T	P	C
		3	0	2	4

OBJECTIVES:

- To review the methods of stability analysis of systems
- To enhance knowledge on frequency domain based controller design
- To provide in depth knowledge on the synthesis of linear time invariant controllers for linear systems
- To introduce the concept of fractional calculus for control applications
- To impart knowledge on fractional order controller design

MODULE I BASICS OF FEEDBACK CONTROL SYSTEMS 08

Theory

Introduction – Basic frequency domain characteristics- Stability analysis using Bode plot - Nichol's charts – Closed loop specification – Performance limitations of NMP/Unstable systems.

Practical

Modeling of a process, stability analysis using Bode Plot, Nichol's chart using Matlab and Labview

MODULE II CONTROLLER DESIGN USING FREQUENCY RESPONSE PLOTS 08

Theory

Frequency response plots - reshaping the Bode plot – compensator design using bode plot – Lag, Lead, Lag-Lead design – Frequency domain analysis and its applications - Quantitative Feedback Theory – Quantitaive Feedback ApplicationsLoop shaping

Practical

Reshaping the Bode plot, Compensator design and Loop shaping using Matlab

MODULE III CONTROLLER DESIGN USING QUANTITATIVE FEEDBACK THEORY 08

Theory

Quantitative feedback theory – Overview, Design objective, control system performance specifications, Insight to QFT techniques – Open Loop Plant, Closed Loop formulation, Insight to the use of Nichols Chart in the QFT – MISO Analog Control System – Design Procedure Outline : LTI plant models, performance specifications, plant templates, stability bound, tracking bounds, disturbance bounds, Loop shaping, design of prefilter, Design Example.

Practical

Controller design, tuning and simulation using QFT toolbox

MODULE IV FRACTIONAL ORDER SYSTEM 09

Theory

Fractional-order Calculus and Its Computations – Frequency and Time Domain Analysis of Fractional-Order Linear Systems - Filter Approximations to Fractional-Order Differentiations – Model reduction Techniques for Fractional Order Systems.

Practical

Fractional order modeling and control using Matlab for process setups

MODULE V FRACTIONAL ORDER CONTROLLER DESIGN 12

Theory

Design of fractional order PI, PD, PID controller for first order plus dead time process - using graphical method, analytical method & optimization techniques - tuning of fractional order lead-lag compensators.

Practical

Fractional order controller design and simulation using Matlab

L: 45, T:15, Total :60

TEXT BOOK:

1. Oded Yaniv, 'Quantitative feedback theory for linear and non-linear systems', Kluwer Academic publishers, 1999.
2. M.Gopal, 'Control systems, principles and design' fourth edition, Tata McGraw Hill publishers pvt ltd, 2014
3. Monje, C.A., Chen, Y., Vinagre, B.M., Xue, D., Feliu-Batlle, V.,' Fractional-order Systems and Controls Fundamentals and Applications', Springer-Verlag London,2010.

OUTCOMES:

At the end of the course, the student will be able to

- Analyze the techniques used for estimating the stability of systems
- Design controllers/compensators using frequency domain approach
- Synthesize linear time invariant controllers for linear systems
- Analyze fractional order system in frequency and time domains
- Design of fractional order controllers using different techniques

EIC6103	APPLIED INDUSTRIAL INSTRUMENTATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To review the various techniques used for the measurement of primary industrial parameters like flow, level, temperature and pressure.
- To provide knowledge about the important parameters to be monitored and analyzed in Thermal power Plant
- To give an exposure on the important parameters to be monitored and analyzed in Petrochemical Industry
- To impart knowledge about the hazardous zone classification and intrinsic safety techniques to the adapted in industries.
- To introduce special purpose instruments like Nuclear radiation detection techniques, fibre optic sensors, Instrumentation for NDT applications etc

MODULE I REVIEW OF INDUSTRIAL INSTRUMENTATION 10

Overview of Measurement of Flow, level, Temperature, Pressure, Viscosity, Humidity, Force, Torque and Acceleration, Intelligent Sensors and its Interfaces with Process controllers and PLC, Process Analysers (Toxic,Combustible, Gas Detectors, Flame scanners)

MODULE II MEASUREMENT IN THERMAL POWER PLANT 10

Selection and Installation of instruments used for the Measurement of fuel flow, Air flow, Drum level, Steam pressure, Steam temperature – Feed water quality measurement Flue gas Oxygen Analyzers- pH measurement – Pollution monitoring instruments

MODULE III MEASUREMENT IN PETROLEUM REFINERY 10

Flow, Level, Temperature and Pressure measurement in Distillation. Pyrolysis, catalytic cracking and reforming process-Hydrocarbon analyzers, oil in water analysers - sulphur in oil Analyzer- Selection and maintenance of measuring instruments

MODULE IV INSTRUMENTATION FOR INDUSTRIAL SAFETY 05

Area Classification - Electrical and Intrinsic Safety - Explosion Suppression and Deluge systems - Conservation and emergency vents - Flame, fire and smoke detectors - Leak Detectors - Intrinsic Safety.

Process Industry Practices : Field Insts, Estimation, Control Panel, Analyser Housing, Inst Air, Electrical interfaces, Selection, Inst Tools, cabels/wires, Value proposition, Installation Support, Safety Systems, Project Documentation

MODULE V SPECIAL PURPOSE INSTRUMENTATION 10

Detection of Nuclear Radiation – Corrosion monitoring – Fibre optic sensors - smart transmitters and wireless transmitters – Instrumentation for NDT applications - Instrumentation for energy conservation and management - Image based measurements.

Total Hours: 45

TEXT BOOKS:

1. B.G.Liptak, “Instrumentation Engineers Handbook (Process Measurement & Analysis)”, Fourth Edition, Chilton Book Co, 2003.
2. K.Krishnaswamy and M.Ponnibala, “Power Plant Instrumentation”, PHI Learning Pvt Ltd, 2013. 25
3. John G Webster, “The Measurement, Instrumentation, and Sensors Handbook”, CRC and IEEE Press, 1999.

REFERENCE BOOKS:

1. Håvard Devold, “Oil and Gas Production Handbook - An Introduction to Oil and Gas Production”, ABB ATPA oil and gas, 2006.
2. M.Arumugam, “Optical Fibre Communication and Sensors”, Anuradha Agencies, 2002.
3. Paul E. Mix, “Introduction to Nondestructive Testing”, John Wiley and Sons, 2005.

OUTCOMES:

At the end of the course the student will be able to:

- select suitable measuring instruments for real time industrial applications
- select and install various measuring instruments used in thermal power plants and petroleum industries
- Analyze industrial safety measures and select appropriate techniques to provide intrinsic safety
- Adapt industrial practices for instrument housing, electrical interfaces, and installation support
- Apply the special purpose instruments for NDT, energy conservation and management.

SEMESTER II

GEC6201	RESEARCH METHODOLOGY FOR ENGINEERS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide a perspective on research to the scholars
- To educate on the research conceptions for designing the research
- To impart knowledge on statistical techniques for hypothesis construction
- To gain knowledge on methods of data analysis and interpretation
- To learn about the effective communication of research finding

MODULE I RESEARCH PROBLEM FORMULATION 07

Research – Objectives**:** – types, Research process, Solving engineering problems, Identification of research topic, Formulation of research problem, Literature survey and review.

MODULE II HYPOTHESIS FORMULATION 08

Research design – meaning and need – basic concepts, Different research designs, Experimental design – principle – important experimental designs, Design of experimental setup, Mathematical modeling, Simulation – validation and experimentation, Dimensional analysis and similitude.

MODULE III STATISTICAL TECHNIQUES 12

Statistics in research – concept of probability – popular distributions –Hypothesis testing- sample design- Design of experiments – factorial designs -– orthogonal arrays- ANOM - ANOVA - Multivariate analysis - Use of optimization techniques – traditional methods – evolutionary optimization techniques –Transportation model.

MODULE IV STATISTICAL ANALYSIS OF DATA 10

Research Data analysis – interpretation of results – correlation with scientific facts- Accuracy and precision – error analysis, limitations - Curve fitting, Correlation and regression.

MODULE V RESEARCH REPORT 08

Purpose of written report – audience, synopsis writing, preparing papers for International journals, Thesis writing – organization of contents – style of writing –

graphs and charts – referencing, Oral presentation and defence, Ethics in research, Patenting, Intellectual Property Rights.

Total Hours: 45

REFERENCES:

1. Ganesan R., Research Methodology for Engineers, MJP Publishers, Chennai, 2011.
2. Ernest O., Doebelin, Engineering Experimentation: planning, execution, reporting, McGraw Hill International edition, 1995.
3. George E. Dieter., Engineering Design, McGraw Hill – International edition, 2000.
4. Madhav S. Phadke, Quality Engineering using Robust Design, Printice Hall, Englewood Cliffs, New Jersey, 1989.
5. Kothari C.R., Research Methodology – Methods and Techniques, New Age International (P) Ltd, New Delhi, 2003.
6. Kalyanmoy Deb., “Genetic Algorithms for optimization”, KanGAL report, No.2001002.
7. Holeman, J.P., Experimental methods for Engineers, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 2007.
8. Govt. of India, Intellectual Property Laws; Acts, Rules & Regulations, Universal Law Publishing Co. Pvt. Ltd., New Delhi 2010.
9. University of New South Wales, “How to write a Ph.D. Thesis” Sydney, Australia, Science @ Unsw.
10. Shannon. R.E., System Simulation: the art and science, Printice Hall Inc, Englewood Cliffs, N.J.1995.
11. Scheffer. R.L. and James T. Mc Clave, Probability and Statistics for Engineers, PWS – Kent Publishers Co., Boston, USA, 1990.

OUTCOMES:

Students should be able to

- Formulate the research problem
- Design and Analyse the research methodology
- Construct and optimize the research hypothesis
- Analyse and interpret the data
- Report the research findings

EIC6211 ADVANCED PROCESS CONTROL

L	T	P	C
3	0	2	4

OBJECTIVES:

- To review the various processes and basic control schemes used for linear processes
- To determine the multivariable models for the Single Input Single Output, Multi Input Single Output, Single Input Multi Output and Multi Input and Multi Output systems.
- To analyse the interaction among the loops in the MIMO system
- To design and develop the multiloop and multivariable control schemes
- To model and control time varying and nonlinear systems

MODULE I REVIEW OF PROCESS CONTROL 09+03

Need for process control –Continuous and batch processes – Self regulation – Servo and regulatory operations – Interacting and non-interacting systems – Degrees of freedom - Linearization of nonlinear systems- Mathematical model of Level and Thermal processes – Lumped and Distributed parameter models - ON-OFF, P, P+I, P+D and P+I+D control - Controller Tuning:- Process reaction curve method, Continuous cycling method and Damped oscillation method

MODULE II MULTIVARIABLE SYSTEMS 09+03

Theory

Introduction to Multivariable systems -Transfer Matrix Representation -State Space representation - Poles and Zeros of MIMO System - Multivariable frequency response analysis - Directions in Multivariable systems - Singular Value Decomposition - Demonstration of Multivariable Systems analysis

Practicals

Differential equation modelling using matlab and simulink, determination of State space around an operating condition, Computation of Transfer Function Matrix, SVD computation, Frequency analysis using Matlab.

MODULE III MULTI-LOOP REGULATORY CONTROL 09+03

Theory

Introduction to Multi Loop Control - Process Interaction, Pairing of Inputs and Outputs - Relative Gain Array (RGA) – Properties and Application of RGA - Multi Loop PID Controller - Biggest Log Modulus Tuning Method - Decoupling Control - LQG Control - RGA for Non-Square Plant

Practicals

Computation of RGA, simulation of multiloop PID controller, Implementation of Decouplers, LQG design for a process

MODULE IV MULTIVARIABLE REGULATORY CONTROL 09+03

Theory

Introduction to Multivariable Control - Multivariable PID Controller - Multivariable IMC, Multivariable Dynamic Matrix Controller - Multivariable Model Predictive Control - Generalized Predictive Controller - Multiple Model based Predictive Controller - Constrained Model Predictive Controller - Implementation Issues

Practicals

Multivariable PID controller, Multivariable Dynamic Matrix controller simulation, multivariable IMC simulation

MODULE V CONTROL OF TIME VARYING AND NONLINEAR SYSTEMS 09+03

Theory

Model for Time varying systems - Models for Nonlinear Systems - Real time parameter estimation - Gain Scheduling Adaptive Control - Deterministic Self tuning controller - Model Reference Adaptive controller - Nonlinear PID Controller - Hammerstein and Wiener Systems

Practicals

Simulation of time varying process and analysis, Self tuning regulator design and simulation, Gain scheduler for control of a nonlinear process

SAMPLE CASE STUDIES

Students will be asked to select a case study given below or any other process of their choice. He/She has to do the advanced control schemes which will suit their process and demonstrate.

Control Schemes for Distillation Column, CSTR, Bioreactor, Three Tank System, Quadruple Tank System, pH process control system, Polymerization Reactor Automation

L: 45, P:15, Total :60

TEXT BOOK:

1. Thomas E. Merlin,"Process Control – Designing Processes and Control Systems for Dynamic Performance", McGraw Hill, Inc., 2000.

REFERENCE BOOKS:

1. Bequette B.W, "Process Control Modeling, Design and Simulation", Prentice Hall of India, 2004
2. Stephanopoulous. G., "Chemical Process Control – An Introduction to Theory and Practice", Prentice Hall of India, 2008
3. Seborg D.E., Edgar T.F. and Mellichamp D.A., "Process Dynamics and Control", Wiley John and Sons, 3rd Edition, 2010.
4. Coughanowr. D.R., "Process Systems Analysis and Control", McGraw Hill,
5. Third Edition, 2009.
6. E. Ikonen and K. Najim, "Advanced Process Identification and Control", Marcel Dekker, Inc New York, 2002.
7. P. Albertos and S. Antonio, "Multivariabl control Systems: An Engineering Approach", Springer Verilog, 2004.
8. Sigurd Skogestad, Iam Postlethwaite, "Multivariable Feedback Control: Analysis and Design", John Wiley and Sons, 'Second Edition',2005.

OUTCOMES:

At the end of the course the student will be able to:

- Identify real world industrial or biomedical process and carry out dynamic performance analysis
- Perform interaction study in multivariable process and select the control scheme to be used
- Devise the process model of a multivariable system and apply multiloop and multivariable control
- Design and simulate the control scheme and evaluate the servo-regulatory response
- Model the time varying, nonlinear systems and perform control for the same

EIC6212	INDUSTRIAL AUTOMATION USING PLC, SCADA AND DCS	L	T	P	C
		3	0	2	4

OBJECTIVES:

- To provide in depth knowledge about PLC hardware and its programming
- To train the students to take up industrial applications and solve it using PLC
- To provide basic knowledge in the architecture and local control unit of distributed control system
- To give adequate knowledge about hardware, interfaces used in DCS and communication protocols
- To impart skill in developing data acquisition and supervisory control

MODULE I PROGRAMMABLE LOGIC CONTROLLER: HARDWARE AND BASIC OPERATIONS 09+04

Hard relay logic, Evolution of Programmable logic controller (PLC), Hardware Components of PLC: Input/Output modules, power supplies, isolators, CPU, memory and programming devices. Generic Control system Architecture and IO Assignments, General PLC programming procedures, Developing fundamental ladder logic programs (as per IEC61131) for Boolean operations, PLC basic functions : Register basics, timer functions, counter functions.

Practical: Development of Ladder program for simple on-off applications, Development of Ladder program for Timing and counting applications.

MODULE II PROGRAMMABLE LOGIC CONTROLLERS : ADVANCED OPERATIONS, INSTALLATIONS AND TROUBLESHOOTING 09+04

Developing program control instructions, data manipulation instructions, math instructions, sequencer and shift register instructions, Functional block diagram, Analog control using PLC (PID control configuration, PLC installations and troubleshooting.

Practical: Development of FBD in PLC, Automatic control of level using PLC, Automatic control of temperature using PLC, Control of pressure loop using PLC.

MODULE III DISTRIBUTED CONTROL SYSTEM 09+04

Introduction to Distributed control system, DCS architectures, Comparison, Local Control Unit, Process interfacing issues, Operator interfaces - Low level and high level operator interfaces - Operator displays - Engineering interfaces - Low level and high level engineering interfaces, Latest trends and developments.

Practical: Configuring Screens and Graphics (DCS), Tag Assignments to Field Devices in DCS, DCS based PID control for level loop.

MODULE IV DATA ACQUISITION SYSTEMS 09+03

Computers in Process control – Data Loggers – Data acquisition systems (DAS) – Alarms – Direct Digital Control (DDC) - Characteristics of digital data – Controller software – Computer Process interface for Data Acquisition and control – Supervisory Digital Control (SCADA) -introduction and brief history of SCADA – SCADA Hardware and software.

Practical: Programming of HMI interfacing with PLC, Communicate PLC with SCADA

MODULE V COMMUNICATIONS IN DCS 09

Introduction - Evolution of signal standard - HART communication protocol - communication modes - HART networks - HART commands - HART field controller implementation - HART and OSI model - Field bus – Introduction Profibus, Modbus - Foundation field bus - General field bus architecture – basic requirement - basic requirements of field bus standard - field bus topology. Introduction to AS-Interface (As-i), Device net and Industrial Ethernet.

L: 45, P:15, Total :60

REFERENCES:

1. W. Bolton, "Programmable Logic Controllers", published by Elsevier Newnes 4th edition, Copyright @2006.
2. Webb, John W., Reis, Ronald A. “Programmable Logic Controllers: Principles and Applications”, 5th edition, Published by Prentice Hall College Div, 2002.
3. Clarke, G., Reynders, D. and Wright, E., "Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems", Newnes, 1st Edition, 2004.
4. Petrezeulla, Programmable Controllers, Mc-Graw Hill, 1989.5TH edition,2016.
5. Michael P.Lucas, Distributed Control System, Van Nastrand Reinhold Company, New York,1986.

OUTCOMES:

At the end of the course, the student will be able to

- Analyze the hardware components of PLC and its programming languages
- Develop programs for the use of PLC in industrial application
- Analyze the different architecture and interfaces of DCS
- Design and develop supervisory control and data acquisition system for given application
- Apply the various communication protocols in process industries

ELECTIVE COURSES

GENERAL ELECTIVE

Professional Elective (Semester 1 Electives) (2/3 credits)

		L	T	P	C
EICY 101	**PIPING AND INSTRUMENTATION FOR PROCESS INDUSTRIES**	**2**	**0**	**0**	**2**

OBJECTIVES:

- To provide in depth knowledge on piping and instrumentation
- Learn about detail engineering and P & ID
- Other discipline support to Instrumentation
- How to do the Installation and commissioning
- Learn about calibration and fault finding

MODULE I DESCRIPTION OF PROCESS PLANT 05

General Project Cycle, Plant description, feed, component and Areas of plant, Plant layout, Plant location, accessibility, Marketing and Sales.

MODULE II PIPING AND INSTRUMENTATION DIAGRAM PREPARATION 05

Main description of a plant, P & ID Symbols, line numbering, line schedule P& ID development, various stages of P & ID, Process flow scheme plant legend finalization.

MODULE III SYSTEM DESIGN AND DETAIL ENGINEERING 05

Major Discipline involvement and Inter discipline Interaction, Major Instrumentation and Control Systems – Development Phase – Instrument List, I / O Count, Specification Sheets, Instrument Installation, Control Philosophy, Detail Engineering.

MODULE IV BOILET CONTROL-II 05

Plot plan, Piping, equipment plan, Electrical area classification, Fire Hazardous classification, Control Network architecture.

MODULE V ANALYSERS – FLUE GAS ANALYSIS 10

i. Dearator in Boiler and associated Instrumentation.
ii. Turbine monitoring – speed, vibrations, Lubricant oil temperature control systems how it functions.
iii. Boiler Drum Level Pressure compensation.
iv. Control of distillation column and instruments designed for Level, Pressure, flow etc.
v. Detailed study of intrinsic safety of Instruments.

Total hours: 30

REFERENCE:

1. Duncan C. Richardson, Plant Equipment and Maintenance Engineering Handbook, McGraw-Hill Education: New York, Chicago, San Francisco, Athens, London, Madrid, Mexico City, Milan, New Delhi, Singapore, Sydney, Toronto, 2014 McGraw-Hill Education.
2. Gabriel Salvendy, Handbook of Industrial Engineering – Technology and operations management, John Wiley & Sons, 2001.
3. Robert C Rosaler, Standard Handbook of Plant Engineering, McGraw-Hill third edition, 2004.
4. R.Keith Mobley, Plant Engineer's Handbook, Technology and Engineering, 2001.

OUTCOMES:

- System testing and startup
- Development of correct P & IDs
- Install and commissioning of new plants
- Apply piping and Instrumentation in design and maintenance of process Industry
- Understanding area classification

EICY102	APPLIED SOFT COMPUTING TECHNIQUES FOR PROCESS MODELING, CONTROL AND OPTIMIZATION	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To expose the students to the basic concepts of neural networks, fuzzy logic and evolutionary algorithms
- To foster their abilities in designing and implementing soft computing based solutions for real-world problems in modeling and control
- To familiarize the Neural Network, Fuzzy Logic, Adaptive Neuro Fuzzy Inference System toolbox to the students
- To facilitate the student to optimize the model and controller parameters using Evolutionary and swarm intelligence techniques

MODULE I REVIEW OF NEURAL NETWORK AND FUZZY LOGIC 06+03

Theory

Introduction to Neural network - Biological Neuron - Artificial neuron — Activation functions — Network Architecture — Learning Process — Single Layer Perception — Limitations — Multi Layer Perception —Back propagation algorithm — RNN — Reinforcement learning — Discrete time hop field networks RBF — ART, SVM.

Fuzzy set theory — Fuzzy sets — Operation on Fuzzy sets — Fuzzy relations — Fuzzy membership functions — Fuzzy conditional statements — Fuzzy rules – MAMDANI – TAKAGI SUGENO.

Practicals

Familiarization of Neural Network Control Tool Box and Fuzzy Logic Tool Box

MODULE II NEURAL NETWORKS FOR MODELING AND CONTROL 06+03

Theory

Modeling of non linear systems using ANN- NARX,NNSS,NARMAX – Generation of training data - Model validation- Control of non linear system using ANN

Practicals

NARX, NNSS, NARMAX modeling using Neural Network toolbox

MODULE III FUZZY LOGIC FOR MODELING AND CONTROL 06+03

Theory

Modeling of non linear systems using fuzzy models (Mamdani and Sugeno) – TSK model - Fuzzy Logic controller – Adaptive fuzzy systems- Gain scheduling using Fuzzy Logic

Practicals

Modeling and Gain Scheduling of Nonlinear process using Fuzzy toolbox

MODULE IV HEURISTIC OPTIMIZATION ALGORITHMS AND HYBRID CONTROL SCHEMES 06+03

Theory

Particle Swarm Optimization – Ant colony optimization-Introduction to Evolutionary Algorithm — Optimization of membership function and rule base using Genetic Algorithm — Adaptive Neuro Fuzzy Inference Systems(ANFIS)

Practicals

Optimization of benchmark optimization problems using swarm intelligence and evolutionary algorithms in MATLAB

MODULE V OPTIMAL IDENTIFICATION AND PARAMETER OPTIMIZATION USING EVOLUTIONARY AND SWARM INTELLIGENCE TECHNIQUES 06+03

Theory

Process identification, PID controller parameter optimization, State feedback controller parameter optimization of process loops using evolutionary optimization techniques and swarm intelligence technique

Practicals

Optimal process modeling, controller parameter optimization, state feedback using soft computing techniques in MATLAB

L: 30; P: 15;Total Hours: 45

TEXT BOOKS:

1. Laurence Fausett, Fundamentals of Neural Networks, Prentice Hall, Englewood cliffs, N.J., 1992.
2. Jacek M.Zurada, Introduction to Artificial Neural Systems, Jaico Publishing House, Mumbai, 1997.
3. Timothy J.Ross, Fuzzy Logic with Engineering Applications, McGraw Hill Inc.,1997.

REFERENCES:

1. Freeman Neural network : Algorithms Applications and Programming Techniques,1991

2. Goldberg, Genetic Algorithm in Search, Optimization, and Machine Learning, Addison Wesley Publishing Company, Inc. 1989.
3. Tsoukalas L.H., and Robert E.Uhrig, Fuzzy and Neural approach in Engineering, John Wiley and Sons, 1997.
4. Millon W.T., Sutton R.S., and Webrose P.J., Neural Networks for control, MIT Press,1992.
5. MATLAB Neural Network Tool Box, mathworks publications, 2011.
6. MATLAB Fuzzy Logic Tool Box Manual mathworks publications, 2011.
7. R. Eberhart, P.simpson and R.Dobbins,Computional Intelligence PC Tools, AP Professional, Boston, 1996.

OUTCOMES:

At the end of the course the student will be able to:

- Identify and analyze soft computing techniques and their roles in building intelligent machines.
- Recognize the feasibility of applying a soft computing methodology for modeling and control
- Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
- Effectively use existing software tools to solve problems using a soft computing approach.
- Evaluate and compare solutions of engineering problems various soft computing approaches
- Optimize the performance using Evolutionary and swarm intelligence techniques.

EIC Y103 INSTRUMENTATION SYSTEM DESIGN

L	T	P	C
2	0	2	3

OBJECTIVES:

- To provide knowledge in amplifier and filter circuits.
- To learn about transmitters, data loggers and annunciators.
- To get knowledge in design of controllers
- To enhance knowledge on selection of control valves and flow meters.

MODULE I DESIGN OF SIGNAL CONDITIONING CIRCUITS 07+05

Design of V/I Converter and I/V Converter- Design of first and second order analog and digital filters– Signal conditioning circuit for pH measurement –Design of Instrumentation amplifiers – Signal Conditioning circuit for strain gauge circuits – Thermocouple compensation circuits- Cold Junction Compensation – Thermocouple Linearization.

Practical: Design of instrumentation amplifiers, Design of active filters, Design of V/I and I/V converters, Design of linearising circuit and cold – junction compensation circuit for thermocouples.

MODULE II DESIGN OF TRANSMITTERS 07+04

Design of Transmitters for RTD &Thermocouple Instruments – Design of transmitters for Pressure measurement - Capacitance based Level Transmitter – Air purge flow measurement -Smart Flow Transmitters.

Practical:

Design of signal conditioning circuits for strain gauge and RTD, Measurement of level using capacitance method.

MODULE III DESIGN OF DATA LOGGER AND PID CONTROLLER 08+03

Design of ON / OFF Controller using Linear Integrated Circuits- Electronic PID Controller –Digital PID Controller design – Microcontroller based Data Logger – PC based Data Acquisition Cards (NI DAQ mx)

Practical: Design of on-off controller, PID controllers using operational amplifier, Design of digital PID using Matlab/simulink.

MODULE IV ORIFICE AND CONTROL VALVE SIZING 08+03

Orifice Sizing: - Liquid, Gas and steam services - Control Valves – Valve body:- Commercial valve bodies – Control valve sizing – Liquid, Gas and steam services – Cavitation and flashing –Selection criteria – Rotameter Design.

Practical: Determine the coefficient of discharge using orifice plate, study of flow-lift characteristics of control valve.

L: 30, P:15, Total :45

TEXT BOOKS:

1. B. G. Liptak, “Instrument Engineers Handbook”, Vol. I and II, 3rd edition, Chilton and Book Company, 2010.
2. D. M. Considine, “Process/Industrial Instruments and Control Handbook”, 4th Edition, McGraw-Hill Inc., 1999.
3. C. D. Johnson, “Process Control Instrumentation Technology”, 4th Edition, PHI, 2005.

REFERENCES:

1. Andrew and Williams, “Applied Instrumentation in Process Industries”, Vol. I, II, III, IV, Gulf Publishing Company, 1979.
2. John P. Bentley, “Principles of Measurement Systems”, Addison-Wesley publication, 1999.
3. T.R.Padmanabhan, “Industrial Instrumentation: Principles and Design”, Springer-Verlag Publications, 1999.
4. B. C. Nakra and K. K. Choudhari, “Instrumentation: Measurement and Analysis”, Tata McGraw Hill pub, 2008.

OUTCOMES:

- At the end of the course the student will be able to:
- design amplifiers and filters circuits for any requirement
- design signal conditioning circuits for transmitters
- Design the suitable controllers for various process
- select the suitable control valves for process

PROFESSIONAL ELECTIVE (SEMESTER 2 ELECTIVES) (9 CREDITS)

		L	T	P	C
EICY201	**SYSTEM IDENTIFICATION AND MODELING**	**2**	**0**	**2**	**3**

OBJECTIVES:

- To introduce various model structures for system identification
- To impart knowledge on parametric and non-parametric identification
- To introduce non-linear identification and model validation techniques
- To illustrate the identification techniques through case studies

MODULE I MODELS FOR IDENTIFICATION 12

Theory

Introduction - Need for modeling. Types of models: On the basis of their information source for development: first principle models, empirical models. On the basis of mathematical property: linear and non linear, deterministic and probabilistic, static and dynamic, lumped and distributed models. On the basis of transparency: white-box, black box models with examples

Practical

Empirical models using real time data for linear and non linear systems

MODULE II NON-PARAMETRIC AND PARAMETRIC IDENTIFICATION 09

Theory

Transient response and Correlation Analysis – Frequency response analysis – Spectral Analysis – Least Square – Recursive Least Square –Forgetting factor-Maximum Likelihood – Instrumental Variable methods.

Practical

Identification using time domain and frequency domain analysis

MODULE III NON-LINEAR IDENTIFICATION AND MODEL VALIDATION 12

Theory

Open and closed loop identification: Approaches – Direct and indirect identification –Joint input-output identification – Non-linear system identification – Wiener models –Power series expansions - State estimation techniques – Non linear identification using Neural Network and Fuzzy Logic-Model validation and verification

Practical

Neural and fuzzy modeling and model validation using Matlab

MODULE IV CASE STUDIES 12

Theory

Development of detailed mathematical model of Inverted Pendulum, heat exchanger, Distillation column and continuous stirred tank reactor

Practical

Mathematical model of Inverted Pendulum, heat exchanger, Distillation column and continuous stirred tank reactor using Matlab (any 2)

L:30; P:15;Total Hours : 45

TEXT BOOKS:

1. Soderstorm.T and Petre stioca, System Identification, Prentice Hall International (UK) Ltd. 1989

REFERENCE BOOKS:

1. Ljung, “System Identification Theory for the User”, PHI, 1999.
2. William S.Levine, “Control Systems Advanced Methods, the Control Handbook, CRC Press, 2011.

OUTCOMES:

At the end of the course the student will be able to:

- compare the different types of models used for describing systems
- estimate system parameters using parametric and non-parametric identification approaches
- analyze the techniques used for identification of nonlinear systems
- validate the developed models for linear and nonlinear systems with real time data
- implement the modeling and simulation for selected processes used in industry

EICY202 ADAPTIVE CONTROL

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide knowledge on parametric and nonparametric identification of system.
- To impart knowledge on adaptive control techniques.
- To enhance knowledge on the implementation issues and practical consideration by investigating the adaptive schemes

MODULE I INTRODUCTION 09

Introduction to adaptive control - Effects of process variations – Adaptive control schemes – Adaptive control problem – Applications – Real time parameter estimation - Estimating parameters in dynamical system

MODULE II PARAMETRIC AND NON-PARAMETRIC IDENTIFICATION 04

Non-parametric identification : Step response method – Impulse response method – Frequency response method.

Parameter identification : ARX – ARMAX – ARIMAX – Least square estimation – Recursive least square estimation – Extended least square estimation – Maximum likelihood estimation

MODULE III SELF-TUNING REGULATOR 09

Deterministic in-direct self-tuning regulators – Deterministic direct self-tuning regulators – Stochastic self-tuning regulators – Linear Quadratic STR – Adaptive Predictive Control.

MODULE IV MODEL REFERENCE ADAPTIVE 09

The MIT rule – Lyapunov theory – Design of model reference adaptive controller using MIT rule and Lyapunov theory – Relation between model reference adaptive controller and self-tuning regulator

MODULE V AUTOTUNING AND GAIN SCHEDULER 09

Design of gain scheduling controller - Auto-tuning of PID controller : Relay Feedback test, parameter estimation using autotuning

CASE STUDIES **05**

Application of adaptive control in distillation column, Continuous Stirred Tank Reactor, Heat exchanger and variable area tank system.

Total Hours: 45

TEXT BOOKS:

1. Karl J. Astrom & Bjorn Wittenmark, “Adaptive Control”, (Pearson Education, Singapore), Second Edition, 2003.
2. Landau, I.D., Lozano, R., M'Saad, M., Karimi, A., “Adaptive Control: Algorithms, Analysis and Applications”, Series: Communications and Control Engineering, 2nd edition. 2011.
3. Shankar Sastry, Marc Bodson, “Adaptive Control : Stability, Convergence and Robustness”, Prentice-Hall Advanced Reference Series (Engineering), 1994, Republished by Dover Publications in 2011 (ISBN-10: 0486482022)

REFERENCE BOOKS:

1. T. C.H.A. Hsia, “System Identification”, Lexington books, 1974.
2. Stephanopoulis G. “Chemical Process Control”, Prentice Hall of India, New Delhi, 1990.
3. Ljung, L., “System Identification: Theory for the user”, Prentice Hall, Englewood cliffs, 1987. 4. Sastry S. and Bodson M., “Adaptive control – stability, Convergence ad Robustness”, Prentice Hall inc., New Jersey, 1989.

OUTCOMES:

The student will be able to

- Analyze the circumstances in which adaptive control is to be used
- Identify the process parameters using the experimental data obtained from step response, impulse response and frequency response
- Estimate the process parameters using recursive least square method and maximum likelihood method
- Design deterministic and stochastic self tuning regulators
- Compare the design procedure and performance of model reference adaptive controllers and self tuning regulator
- Analyze the stability of adaptive controller and design adaptive controllers for selected processes.

EICY 203 OPTIMAL CONTROL

L	T	P	C
3	0	0	3

OBJECTIVES:

- To explain the significance of optimal control in process industries and the different methods of optimization
- To introduce the concept of variational approach for the design of optimal control system
- To formulate linear quadratic optimal control system with a specified degree of stability
- To impart knowledge about discrete time linear state regulator system and discrete time linear quadratic tracking system
- To illustrate the application of dynamic programming and HJB equation in the design of constrained and/or time optimal control system

MODULE I INTRODUCTION TO OPTIMAL CONTROL 07

Statement of optimal control problem - problem formulation and forms of optimal control - performance measures - various methods of optimization - Linear programming - nonlinear programming

MODULE II CALCULUS OF VARIATIONS 09

Basic concepts – variational problem - Extreme functions with conditions - variational approach to optimal control systems

MODULE III LINEAR QUADRATIC OPTIMAL CONTROL SYSTEM 09

Problem formulation - finite time LQR - infinite time LQR - Linear Quadratic tracking system – LQR with a specified degree of stability

MODULE IV DISCRETE TIME OPTIMAL CONTROL SYSTEM 10

Variational calculus for DT system – DT optimal control system - DT linear state regulator system -- DT linear quadratic tracking system

MODULE V CONSTRAINED OPTIMAL CONTROL 10

Constrained system – Pontryagin minimum principle - Dynamic programming – Hamilton - Jacobi - Bellman equation - LQR system using HJB equation - Time optimal control system – fuel optimal control system – energy optimal control system

Total hours: 45

TEXT BOOK:

1. Naidu D.S, Optimal Control System, CRC Press, 2003.

REFERENCE BOOKS::

1. Kirk D.E, Optimal Control Theory, Dover publication, 2004.
2. Lewis F.L, Draguna Vrabia, Syrmos V.L, Optimal Control, John Wiley & Sons, 2012.

OUTCOMES:

At the end of the course the student will be able to

- Formulate the optimization problem based on the requirement and evaluate its performance
- Apply the variational approach to optimal control system with conditions
- Differentiate finite time LQR and infinite time LQR and design linear quadratic tracking system
- Analyze discrete time optimal control systems used in different applications
- Design constrained optimal control system and time optimal control system

EICY204 VIRTUAL INSTRUMENTATION

L	T	P	C
2	0	2	3

OBJECTIVES:

- To familiarize the concepts in VI and to realize its architecture.
- To learn the various programming techniques available in LABVIEW.
- To enhance knowledge in various VI tools
- To provide the knowledge in various analysis tools and develop programs
- To analyze the application of VI for measurement, control and simulation study.

MODULE I INTRODUCTION VIRTUAL INSTRUMENTATION 09

Historical perspective - advantages - block diagram and architecture of a virtual instrument - Conventional Instruments versus Traditional Instruments - data-flow techniques, graphical programming in data flow, comparison with conventional programming

MODULE II VI PROGRAMMING TECHNIQUES 09

VIs and sub-VIs, loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, State machine, string and file I/O

MODULE III DATA ACQUISITION 09

Introduction to latest ADCs, DACs. Introduction to PC based data acquisition - typical plug-in data acquisition board - multiplexing of analog inputs - single ended and differential inputs - different strategy for sampling of multichannel analog inputs. Concept of universal DAQ card - use of timers/counters

MODULE IV VI TOOLSETS 09

Use of Analysis tools, Fourier transforms, power spectrum, correlation methods, windowing and filtering. Simulation of level, thermal, reactor processes. On-Off controller PID Controller

MODULE V APPLICATIONS 09

Distributed I/O modules-Virtual Laboratory, Virtual Oscilloscope, Virtual function generator, Simulation of systems using VI, Development of Control system, Industrial Communication, Image acquisition and processing, Motion control.

Development of Virtual Instrument using GUI, Real-time systems, Embedded Controller, OPC, HMI / SCADA software, Active X programming

Total Hours: 45

LABORATORY COMPONENT

1. Creating Virtual Instrumentation for simple applications
2. Programming exercises for loops and charts
3. Programming exercises for clusters and graphs.
4. Programming exercises on case and sequence structures, file Input / Output.
5. Data acquisition through Virtual Instrumentation.
6. Developing voltmeter using DAQ cards.
7. Developing signal generator using DAQ cards.
8. Simulating reactor control using Virtual Instrumentation.
9. Real time temperature control using Virtual Instrumentation.
10. Real time sequential control of any batch process

OUTCOMES:

At the end of the course, the students will be able to

- Analyze the concepts and architecture of virtual instrumentation
- Develop a program for loops, charts, clusters, and graphs.
- Design data acquition system and interface analog and digital instruments with PC.
- Analyze the various tools used for signal processing and simulate process in PC.
- Design selected virtual instruments and develop simulation system using VI

EICY205	ADVANCED FIBER OPTIC AND LASER INSTRUMENTATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To review the methods of Propagation of light, way of connecting connectors and splicer.
- To enhance working models on measurement of varies parameters and gain knowledge of working of fiber optic sensors.
- To provide in depth knowledge on the types of lasers and way of generation of laser
- To provide practical exposure in industry for measurement of critical parameters like velocity, acceleration and voltage and show the application of lasers in various applications
- To impart knowledge on procedure for medical treatment using lasers in biomedical field.

MODULE I OPTICAL FIBERS AND THEIR PROPERTIES 09

Principles of light propagation through a fiber - Different types of fibers and their properties — Fiber materials and their characteristics - Transmission characteristics of fibers - absorption losses - scattering losses — Dispersion– Connectors and splicers - Optical sources - Optical detectors.

MODULE II INDUSTRIAL APPLICATION OF OPTICAL FIBERS 09

Fiber optic instrumentation system - Fiber optic sensors Different types of modulators -Application in instrumentation - Interferometric method of measurement of length -Measurement of pressure, temperature, current, voltage, liquid level and strain.

MODULE III LASER FUNDAMENTALS 09

Fundamental characteristics of laser - three level and four level lasers - properties of lasers - laser modes - resonator configuration - Q-switching and mode locking - cavity dumping - types of laser - gas laser, solid laser, liquid laser - semi conductor laser.

MODULE IV LASERS IN MEASUREMENTS AND TESTING 09

Laser for measurement of distance, length, velocity, acceleration, current, voltage, and atmospheric effect - material processing - laser heating, welding, melting and trimming of materials - removal and vaporization. Holography - Basic principle; methods; Holographic interferometry and applications; Holography for non-

destructive testing - Holographic components

MODULE V MEDICAL APPLICATIONS OF LASERS 09

Medical applications of lasers; laser and tissue interaction - Laser instruments for surgery. Removal of tumors of vocal cards, brain surgery, plastic surgery, gynaecology, endoscopy, photodynamic laser surgery and oncology.

Total hours: 45

REFERENCES:

1. John and Harry, Industrial lasers and their applications, McGraw Hill, 1st Edition, 1974.
2. John F Ready, Industrial applications of lasers, Academic press, 2nd Edition, 1978.
3. John Crisp & Darry Elliott, Introduction to Fiber Optics, Newnes Publication, 3rd Edition 2005.
4. Jasprit Singh, Semi Conductor Optoelectronics: Physics & Technology, McGraw Hill, ISE Edition, 1995.
5. Silvano Donati, Electro-optical Instrumentation Sensing and Measurement with Laser, Prentice Hall, 1st Edition, 2004.

OUTCOMES:

At the end of the course, the student will be able to

- Analyze the techniques used for Propagation of light, way of connecting connectors and splicer.
- Design working model on measurement of atleast one parameter.
- Analyze the techniques of generation of laser beam.
- Implement the method to measure parameter and Develop the appropriate model for industrial application
- Design the electronic laser system for biomedical field to treat various problems like tumors, blood clot removal etc..

EICY206	APPLIED BIO-MEDICAL INSTRUMENTATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide knowledge on biomedical measurable variables, standards and awareness of electrical safety of medical equipments
- To have knowledge on modeling, simulation and analysis of biomedical signals
- To acquire and analyze biomedical signals
- To bring out the important and modern methods of imaging techniques and latest knowledge of medical monitoring equipments.
- To provide the latest information on implantable and prosthetic devices

MODULE I INTRODUCTION TO BIOMEDICAL MEASUREMENTS 09

Physiological systems and measurable variables - Components of a medical instrumentation system, Problems encountered in a measuring system, Nature and complexities of biomedical measurements - Medical equipment standards - organization, classification and regulation - Human and Equipment safety – Physiological effects of electricity, Methods of accident prevention

MODULE II ADVANCES IN MODELING AND SIMULATION IN BIOMEDICAL INSTRUMENTATION 09

Introduction to modeling and simulation – Difference in modeling engineering systems and physiological systems – Model based analysis of Action Potentials - cardiac output – respiratory mechanism and breath analysis - Blood glucose regulation

MODULE III BIOMEDICAL SIGNALS AND THEIR ANALYSIS 09

Types and Classification of biological signals – Signal transactions – Noise and artifacts and their management - characteristics - Origin, recording schemes and analysis of biomedical signals: Electrocardiography(ECG), Electroencephalography (EEG) , Electroretinography (ERG) and Electromyography (EMG) – Processing and transformation of signals - applications of wavelet transforms in signal compression and denoising.

MODULE IV INSTRUMENTATION FOR DIAGNOSIS AND MONITORING 09

Tests and instrumentation for mechanics of breathing - Advanced medical imaging techniques and modalities - Computed tomography, Magnetic Resonance Imaging and ultrasound - Algorithms and applications of artificial intelligence in medical image analysis and diagnosis -Telemedicine and its applications in tele monitoring.

MODULE V BIOMEDICAL IMPLANTS, PROSTHETIC AND ORTHOTIC DEVICES 09

Implantable medical devices: artificial valves, vascular grafts and artificial joints- cochlear implants - cardiac pacemakers – Principal and components of prosthesis and orthoses – orthoses for spinal pain – orthoses for osteoporosis – Arm and foot orthoses – future trends and research in orthoses .

Total Hours: 45

TEXT BOOK:

1. John G.Webster (editor), Medical Instrumentation Application and design, John Wiley & Sons, 2005.
2. R.S.Khandpur, “Hand Book of Bio-Medical Instrumentation”, 12th reprint, Tata McGraw Hill Publishing Co Ltd., 2008.
3. Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer, “Bio-Medical Instrumentation and Measurements”, 2nd edition, Pearson Education, 2008 / PHI.

REFERENCES:

1. Shayne Cox Gad, Safety Evaluation of Medical Devices, Marcel Deckle Inc, 2002.
2. Michael C. K. Khoo, Physiological Control Systems- Analysis Simulation and Estimation, 2001.
3. Rangaraj M.Rangayan, Biomedical signal analysis, John Wiley & Sons (ASIA) Pvt. Ltd., 2008.
4. John M.Semmlow, Biosignal and Bio medical Image processing, CRC Press, 2004.
5. Joseph J. Carr and John M Brown, Introduction to Biomedical Equipment Technology,Pearson Education, 2004

OUTCOMES:

The students will be able to

- Identify Unscrupulous manufacturers / importers who move equipments into India which are not safe.
- Model and simulate physiological systems
- Analyze typical waveforms of bio potentials
- Apply the modern methods of imaging techniques and analyse
- Choose implantable , prosthetic and orthotic devices for specific bio application

PROFESSIONAL ELECTIVES FROM OTHER DEPARTMENT

ECCY001	DIGITAL IMAGE PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- • Describe and explain basic principles of digital image processing;
- • Design and implement algorithms that perform basic image processing
- • Design and implement algorithms for advanced image analysis
- • Assess the performance of image processing algorithms and systems.

MODULE I DIGITAL IMAGE FUNDAMENTALS 09

Elements of digital image processing systems, Basics of visual perception,Psycho, visual model, Color image fundamentals, Brightness, contrast, hue,saturation, GB,HSI models, Image sampling & quantization.

MODULE II IMAGE TRANSFORMS 09

2D discrete transforms, DFT, DCT, WHT, KLT, DWT, Simulation of 2D transformby 1D transform.

MODULE III IMAGE ENHANCEMENT, RESTORATION, SEGMENTATION & RECOGNITION 12

Histogram modification and specification techniques, Noise distributions, Low and High Pass filters, Color image enhancement, Image degradation model – Unconstrained and constrained restoration, Geometric transformations, Spatial transformations, Gray level interpolation, Image Segmentation & its types, Pattern and Pattern classes.

MODULE IV IMAGE COMPRESSION 08

Need for image compression, Vector Quantization, Run Length Encoding, Shiftcodes, Block Truncation Coding, DCT and Wavelet Transform coding, Simulation of basic concepts.

MODULE V IMAGE PROCESSING APPLICATIONS 07

Biometric identification, Satellite image processing, Industrial machine vision application, Neural Networks in image processing, Medical image processing and Motion Analysis, Augmented\Virtual reality.

Total Hours : 45

REFERENCES:

1. Rafael C. Gonzalez, Richard E.Woods, Digital Image Processing, PearsonEducation, Inc., Second Edition, 2004
2. Anil K. Jain, Fundamentals of Digital Image Processing, Prentice Hall of India,2002.
3. David Salomon : Data Compression The Complete Reference, SpringerVerlag New York Inc., 2nd Edition, 2001
4. Rafael C. Gonzalez, Richard E.Woods, Steven Eddins, Digital ImageProcessing using MATLAB, Pearson Education, Inc., 2004.
5. William K.Pratt, Digital Image Processing, John Wiley, NewYork, 2002
6. G.W.Awcock & R.Thomas,Applied Image Processing,Mc Graw-Hill Inc,1996
7. Sonka,Hlavac,Boyle,Digital Image Processing and Computer Vision ,Cengage Learning,India Edition,2008
8. Madhuri A.Joshi, Digital Image Processing-An Algorithmic approach,Prentice Hall of India,2008

OUTCOMES:

At the completion of the course, students will be able to

- Acquire the knowledge of fundamental concepts of a digital image processing system
- Analyze 2D signals in the frequency domain through the various transforms.
- Describe various techniques for image enhancement and restoration.
- Recognize and apply suitable image segmentation techniques
- Identify and use of appropriate image compression techniques.
- Implement concepts of image processing using simulation technique.
- Apply suitable image processing techniques for various applications

ECC6104 ADVANCED DIGITAL SIGNAL PROCESSING

L	T	P	C
3	1	0	4

OBJECTIVES:

Make the students to

- Describe the use of various transforms in digital signals & systems analysis.
- Estimate the spectrum of Discrete Random Signals.
- Model and design adaptive filters.
- Explain the concepts of multirate signal processing
- Choose the DSP processor for various applications

MODULE I TRANSFORMS AND THEIR APPLICATIONS 06

Review of Z Transform, Discrete Fourier Transform, Discrete Time Fourier Transform, Discrete Fourier series. Introduction to Discrete Wavelet Transform.Haarwavelet.Application of transforms to discrete signals.

MODULE II DISCRETE TIME RANDOM PROCESSES AND SPECTRUM ESTIMATION 09

Deterministic process – Stochastic (random) process – Auto correlation & auto covariance of random processes – Cross correlation of random variables – Ergodic random process – Gaussian random process – Stationary & WSS random process – Power spectrum – Parseval's theorem – Wiener-Khinchine theorem – Spectral factorization – Periodogram - Modified periodograms using Bartlett , Welch, Blackman &Tukey windows – AR, MA, ARMA model based spectral estimation – Yule-Walker Equations – Durbin's algorithm.

MODULE III SIGNAL MODELING AND OPTIMUM FILTERS 08

Least square method model – Prony's pole-zero model – Prony's all pole model – Levinson-Durbin's recursion – Lattice filters – Forward & backward linear prediction filters.

MODULE IV ADAPTIVE FILTERS 08

FIR adaptive filters – Steepest descent method - Widrow-Hoff LMS algorithm – Normalized LMS method – Adaptive channel equalization – Adaptive noise cancellation – IIR adaptive filters - RLS filters.

MODULE V MULTIRATE DIGITAL SIGNAL PROCESSING 08

Need for multirate sampling – Decimation – Interpolation - Poly-phase filters – Multistage implementation –Phase shifters – Sub-band coders – Trans multiplexers– Quadrature mirror filters.

MODULE VI DSP PROCESSORS 06

General and special purpose DSP Processors – Computer Architecture for signal processing – Havard Architecture – Pipelining – Hardware Multiply and Accumulate – Special Instructions – Replication – On-chip Memory Cache – Extended Parallelism – SIMD – VLIW and static super-scalar Processing – Brief study of TMS320C4X and ADSP 2106 processors.

Total Hours: 60

REFERENCES:

1. Monson H.Hayes , “Statistical digital signal processing and modeling” – JohnWiley& Sons – 2005.
2. John G.Proakis&DimitrisG.Maolakis –“ DSP principles, algorithms & applications” – 4th edition – Pearson Education – 2007.
3. A.V.Oppenheim and R.W Schafer, Englewood, “ Digital Signal Processing”, Prentice Hall, Inc. 2006.
4. B. Venkatramani&M.Bhaskar, “Digital Signal Procesors architecture”, “Programming and applications”, Tata McGraw Hill, 2002.
5. Andreas Antoniou, “Digital signal Processing Processing”, Tata McGraw Hill,second edition, 2008.
6. Stewen W. Smith, “Digital signal Processing Processing” –“ A practical guide for Engineers and scientist”, Elsevier Science, 2003

OUTCOMES:

The students will be able to,

- Apply various transforms in digital signals & systems analysis.
- Estimate the power spectrum of signals
- Design & analyze digital filters based on signal modeling
- Design & analyze the adaptive filters
- Implement multirate signal processing techniques.
- Summarize various DSP processorarchitectures.

ECCY022 SPEECH AND AUDIO SIGNAL PROCESSING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the speech and audio signal processing
- To discuss the speech mechanics, various analysis and synthesis methods
- To characterize speech , audio signals and hearing system.
- To introduce various algorithms for different applications.

MODULE I INTRODUCTION 05

Sources, propagation and environmental characteristics, audio sources, sampling, quantizing and compression. Human speech and hearing: speech generation, speech signal characteristics, the hearing system, hearing characteristics.

MODULE II MECHANICS OF SPEECH 07

Speech production mechanism, Nature of Speech signal, Discrete time modelling of Speech production, Representation of Speech signals, Classification of Speech Sounds, Phones, Phonemes, Phonetic and Phonemic alphabets, Articulatory features. Music production, Auditory perception, Anatomical pathways from the ear to the perception of sound, Peripheral auditory system, Psycho acoustics.

MODULE III TIME DOMAIN METHODS FOR SPEECH PROCESSING 07

Time domain parameters of Speech signal, Methods for extracting the parameters Energy, Average Magnitude, Zero crossing Rate, Silence Discrimination using ZCR and energy, Short Time Auto Correlation Function, Pitch period estimation using Auto Correlation Function.

MODULE IV FREQUENCY DOMAIN METHOD FOR SPEECH PROCESSING 08

Short Time Fourier analysis, Filter bank analysis, Formant extraction, Pitch Extraction, Analysis by Synthesis, Analysis synthesis systems, Phase vocoder, Channel Vocoder.omomorphic Speech Analysis: Cepstral analysis of Speech, Formant and Pitch Estimation – HomomorphicVocoders.

MODULE V LINEAR PREDICTIVE ANALYSIS OF SPEECH 09

Formulation of Linear Prediction problem in Time Domain, Basic Principle, Autocorrelation method, Covariance method, Solution of LPC equations, Cholesky method, Durbin’s Recursive algorithm, lattice formation and solutions, Comparison

of different methods, Application of LPC parameters, Pitch detection using LPC parameters, Formant analysis, VELP, CELP.

MODULE VI APPLICATION OF SPEECH & AUDIO SIGNAL PROCESSING 09

Algorithms: Dynamic time warping, K-means clustering and Vector quantization, Gaussian mixture modeling, hidden Markov modeling - Automatic Speech Recognition: Feature Extraction for ASR, Deterministic sequence recognition, Statistical Sequence recognition, Language models - Speaker identification and verification, Voice response system, Speech synthesis: basics of articulatory, source-filter, and concatenative synthesis, VOIP.

Total Hours : 45

REFERENCES:

1. Ben Gold and Nelson Morgan," Speech and Audio Signal Processing", John Wiley and Sons Inc., 2004.
2. L.R.Rabiner and R.W.Schaffer, "Digital Processing of Speech signals", Prentice Hall 1978.
3. Quatieri, "Discrete-time Speech Signal Processing", Prentice Hall , 2001.
4. J.L.Flanagan, "Speech analysis: Synthesis and Perception", Springer-Verlag, Berlin.
5. I.H.Witten, "Principles of Computer Speech", Academic Press, 1982.

OUTCOMES:

At the end of the course, the student will be able to

- Explain speech signal, audio signal and hearing characteristics , mechanics and their generation
- Manipulate, visualize and analyze speech signals and use various processing methods
- Apply various decomposition techniques and modifiy the speech signals.
- Analyze speech and audio signals in time domain and frequency domain.
- Apply various algorithms for speech and audio processing and synthesizing.
- Characterize and justify various speech processing techniques for various applications.

ECCY016 NETWORK SECURITY

L	T	P	C
3	0	0	3

OBJECTIVES:

The student will be able to,

- Understand security concepts, Ethics in Network Security.
- Understand security threats, and the security services and mechanisms to counter them.
- Ability to analyze performance of various cryptographic and cryptanalytic algorithms.
- Gain knowledge about the role of Firewalls and Intrusion Detection Systems.

MODULE I SYMMETRIC CIPHERS (TECHNIQUES AND STANDARDS) –I 09

Introduction – Services, Mechanisms and Attacks, OSI security Architecture, Model for network Security; Classical Encryption Techniques- Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Machines, Stegnography; Block Ciphers and Data Encryption Standard Simplified DES, Block Cipher Principles, Data Encryption Standard, Strength of DES, Differential and Linear Crypt Analysis, Block Cipher Design Principles, Block Cipher Modes of Operation.

MODULE II SYMMETRIC CIPHERS (TECHNIQUES AND STANDARDS) – II 09

Advanced Encryption Standard- Evaluation Criteria for AES, AES Cipher; Contemporary Symmetric Ciphers- Triple DES, Blowfish, RC5, Characteristics of Advanced Symmetric Block Ciphers, RC4 Stream Cipher; Confidentiality using Symmetric Encryption- Placement of Encryption Function, Traffic Confidentiality, Key Distribution, and Random Number Generation.

MODULE III PUBLIC-KEY ENCRYPTION AND HASH FUNCTIONS 09

Public Key Cryptography and RSA- Principles of Public Key Cryptosystems, RSA Algorithm; Key Management and other public key cryptosystems- Key Management, Diffie-Hellman Key Exchange, Elliptic Curve arithmetic, Elliptic Curve Cryptography; Message Authentication and Hash Functions Authentication Requirements, Authentication Functions, Message Authentication Codes, Hash Functions and MACs; Hash Algorithms- MD5 Message Digest Algorithm; Secure Hash Algorithm, RIPEMD 160, HMAC; Digital Signatures and Authentication

Protocols - Digital Signatures, Authentication Protocols, Digital Signature Standards.

MODULE IV NETWORK SECURITY PRACTICE 09

Authentication Applications- Kerberos, X.509 Authentication Service; Electronic Mail Security- Pretty Good Privacy, S/MIME; IP Security- IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations; Web Security- Web Security Considerations, Secure Sockets Layer and Transport Layer Security, Secure Electronic Transaction.

MODULE V SYSTEM SECURITY 09

Intruders- Intruder Detection, Password Management; Malicious Software-Virus and Related Threats, Virus Counter Measures; Firewalls- Firewall Design Principles, Trusted Systems.

Total Hours : 45

REFERENCES:

1. William Stallings, “Cryptography and Network Security”, 3rd edition.Prentice Hall of India, New Delhi, 2004.
2. William Stallings, “Network Security Essentials”, 2rd edition.Prentice Hall of India, New Delhi, 2004.
3. Charlie Kaufman , “Network Security: Private Communication in Public World”, 2nd edition. Prentice Hall of India, New Delhi, 2004.

OUTCOMES:

On completion of the course the student will be able ,

- To identify common network security vulnerabilities/attacks; explain the foundations of network security;
- To identify the appropriate procedures required to secure networks;
- To evaluate the risks and threats to networked computers;
- To demonstrate detailed knowledge of the role of encryption to protect data;
- Get knowledge on development of security policies, standards and practices.
- To determine firewall requirements, and configure a firewall.

MACY081 SIGNAL PROCESSING TECHNIQUES

L	T	P	C
3	1	0	4

OBJECTIVES:

- To impart knowledge on various mathematical transforms for signal processing applications.

MODULE I LAPLACE TRANSFORMATION FOR CONTINUOUS TIME SIGNALS 06+03

Analog and digital signals - Periodic and aperiodic signals – Spectrum estimation for bandwidth requirement – Laplace Transform – Spectrum estimation – Frequency filtering for spectrum modification – Inverse Laplace Transform – Modified spectrum to get filtered signal.

MODULE II Z -TRANSFORM FOR DISCRETE TIME SIGNALS 12+03

Sampling of continuous time signals for discrete time signals – Nyquist sampling rate - Need for discrete signals – Quantization for digital signal – Z-Transform – Spectrum estimation of discrete signals – Digital filters for spectrum modification – Inverse Z-Transform – Modified spectrum to get filtered signal – Impulse response of digital systems - Bilinear Transform for analog to digital conversion.

MODULE III DISCRETE FOURIER TRANSFORM FOR DISCRETE TIME SIGNALS 09+03

Discrete Fourier Transform – Comparison with Z-Transform – Discrete signals for spectrum estimation – Digital filters for spectrum modification – Inverse Discrete Fourier Transform to get filtered signals – Fast Fourier Transform with decimation in either time or frequency

MODULE IV DISCRETE COSINE TRANSFORM FOR DISCRETE TIME SIGNALS 09+03

One dimensional and two dimensional discrete Cosine transforms – comparison with discrete Fourier transform – image processing applications like filtering & compression – two dimensional transform implementation using successive one dimensional transform – application in JPEG standards – zig zag scanning of transform coefficients – inverse discrete Cosine transform – expansion of compressed images – calculation of compression parameters of CF,RMSE,PSNR &CQ.

MODULE V DISCRETE WAVELET TRANSFORM FOR DISCRETE TIME SIGNALS 09+03

Wavelet – Haar wavelet – one dimensional forward discrete wavelet transform – comparison with discrete Cosine transform - two dimensional transform implementation using successive one dimensional transform – Image processing applications like filtering & compression - application in JPEG 2000 standards – zig zag scanning of transform coefficients – inverse discrete wavelet transform – expansion of compressed images – calculation of compression parameters of CF, RMSE, PSNR & CQ.

L – 45; T – 15; Total Hours– 60

REFERENCES:

1. Joel L.Schiff ,“ The Laplace Transform: Theory and Applications” – Springer – 1999.
2. Alexander D. Poularikas ,”The Transforms and Applications Handbook” Chapter 6 on Z- Transforms - Boca Raton : CRC Press LLC - 2000.
3. D.Sundararajan,” The Discrete Fourier Transform: Theory,” Algorithm and Applications – World Scientific Publishers – 2001.
4. K.Rao and P.Yip ,” Discrete Cosine Transform – Elsevier ,”– 1990.
5. D.Sundararajan ,” Discrete Wavelet Transform: A Signal Processing Approach ,”Wiley – 2015.

OUTCOMES:

On completion of the course, the student will be able to apply

- Laplace transform for analog signal analysis.
- Z Transform for discrete signal analysis.
- Discrete Fourier Transform for discrete signal analysis.
- Discrete Cosine Transform for discrete signal analysis.
- Discrete Wavelet Transform for discrete signal analysis.
- The methods to calculate compression parameters.

ECCY050 MEMS SYSTEM DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

The objective of the course is to

- Provide the basic of MEMS device fabrication
- Fulfill the need of electronic engineer who wants to create MEMS devices
- Introduce the concepts of MEMS Electronic Sensors, Optical and RF system

MODULE I INTRODUCTION TO MEMS 09

MEMS and Microsystems, Miniaturization, Typical products, Micro sensors, Micro actuation, MEMS with micro actuators, Micro accelerometers and Micro fluidics, MEMS materials, Micro fabrication.

MODULE II MECHANICS FOR MEMS DESIGN 09

Elasticity, Stress, strain and material properties, Bending of thin plates, Spring configurations, torsional deflection, Mechanical vibration, Resonance, Thermo mechanics - actuators, force and response time, Fracture and thin film mechanics.

MODULE III ELECTRO STATIC DESIGN 09

Electrostatics: basic theory, electro static instability. Surface tension, gap and finger pull up, Electro static actuators, Comb generators, gap closers, rotary motors, inch worms, Electromagnetic actuators. bistable actuators

MODULE IV CIRCUIT AND SYSTEM ISSUES 09

Electronic Interfaces, Feedback systems, Noise , Circuit and system issues, Case studies - Capacitive accelerometer, Peizo electric pressure sensor, Modelling of MEMS systems, CAD for MEMS.

MODULE V INTRODUCTION TO OPTICAL AND RF MEMS 09

Optical MEMS - System design basics - Gaussian optics, matrix operations, resolution. Case studies, MEMS scanners and retinal scanning display, Digital Micro mirror devices. RF MEMS - design basics, case study - Capacitive RF MEMS switch, performance issues.

L:45 Total Hours:45

REFERENCES:

1. Stephen Santuria," Microsystems Design", Kluwer publishers, 2000
2. NadimMaluf," An introduction to Micro electro mechanical system design", Artech House, 2000.
3. Mohamed Gad-el-Hak, editor," The MEMS Handbook", CRC press Baco Raton, 2000.
4. Tai Ran Hsu," MEMS & Micro systems Design and Manufacture" Tata McGraw Hill, New Delhi, 2002.

OUTCOMES:

At the end of the course students will be able to

- Describe the process of MEMS fabrication
- Describe the mechanisms followed to design MEMS devices
- Elucidate the methods to make electrostatic MEMS sensors
- Elucidate the methods to make MEMS based accelerometers
- Describe the MEMS based RF Switches
- Discuss the MEMS based optical scanners and sensors

PROFESSIONAL ELECTIVE (SEMESTER 3) (7/6 CREDITS)

EICY130	FAULT TOLERANT CONTROL	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide knowledge on the method of fault detection and diagnosis.
- To expose redundancy concept for fault detection and isolation.
- To impart knowledge on formulation, implementation of residual generators.
- To acquaint with the design of directional residual for parametric fault.
- To provide knowledge on various intelligent techniques for fault diagnosis and control.

MODULE I INTRODUCTION 09

Introduction-Scope - Approaches to fault detection and diagnosis:-Model free methods and Model based methods -Introduction to Random variables - Distribution Bivariated distribution-Multivariate distribution-Normal distribution - Maximum likelihood distribution-Hypothesis testing.

MODULE II ANALYTICAL REDUNDANCY CONCEPT 09

Additive faults and disturbance-Multiplicative faults and disturbance –Residual generation-Detection property-Isolation property Computational of Residual generation-Specification and implementation.

MODULE III PARITY EQUATION IMPLEMENTATION OF RESIDUAL GENERATOR 09

Parity equation formulation Implementation of single residual-Implementation with input output relation-Fault system matrix Design for structure residual - Structural definition-Canonical structures-Handling disturbance-Residual structure for multiple faults.

MODULE IV DESIGN FOR DIRECTIONAL RESIDUAL 09

Design for directional residual-Directional specifications-Parity equation - Linearly dependent columns Residual generation for parametric faults - Representation of parametric fault-Design for parametric fault and model errors-Robustness in residual generation-Perfect decoupling from disturbance.

MODULE V ADVANCE TOPICS 09

Fault diagnosis using Kalman filtering-Fault diagnosis using principle component

analysis - Fault diagnosis using ANN and Fuzzy clustering Case study: Aircraft fault detection - FTC Requirements IEC-61511-1, Guidance IEC-61511-2 & Methods IEC-61511-3.

Total hours: 45

REFERENCES:

1. Janos.J.Gertler, “Fault detection and diagnosis in engineering system second edition, Marcel Dekker, 1998.
2. Rami S.Mangoubi, “Robust Estimation and Failure detection”, Springer-Verlag London, 1998.

OUTCOMES:

At the end of the course the student will be able to:

- Compare the different approaches used infault detection and diagnosis
- Analyze the various types of fault isolation methods.
- Formulate parity equation implementation of residual generators and design of residual structure for single and multiple faults.
- design directional residual for parametric faults
- Carry out Fault diagnosis using Kalman filtering and principle component analysis

EICY131 ROBOTICS AND AUTOMATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide in depth knowledge about Robotic design, hardware and its programming
- To train the students to take up industrial applications and learn using high level languages like C,C++, Embedded C and micro processor programming.
- To provide basic knowledge in the architecture and local control unit of embedded systems for robotics and
- To give adequate knowledge about interfacing of drivers for Robert movement.
- To impart skill in developing Robot design like object detection, pick and place and line follower and path recognination and following.

MODULE I INTRODUCTION AND ROBOT KINEMATICS 09

Basic concepts of Robots and automation-classification-specifications-Application-Notation-Direct Kinematics-Co-ordinate frames-rotations-Homogeneous coordinates-The Arm equation-Kinematic analysis of a typical Robot -Inverse Kinematics -Tool configuration-Inverse kinematics of a typical Robot -Workspace analysis and trajectory planning-Work envelope of different robots-The pick and place operation

MODULE II DYNAMIC OF ROBOTS 09

Continuous path motion-interpolated motion-Straight line motion-Tool configuration Jacobian matrix and manipulator Jacobian-Manipulator Dynamics- -Kinetic of potential energy-Energized forces- Lagrange's Equation -Euler Dynamic model.

MODULE III ROBOT CONTROL 06

The control problem-state equation-Single axis PID control-PD gravity control-Computed torque control-Variable Structure control-Impedance control.

MODULE IV ROBOT VISION & MICRO ROBOTICS 12

Fundamentals of Robot applications-Robot vision –Image representation-Template-matching-polyhedral objects-Shape analysis- Segmentation – Iterative processing -Robot cell design-Types of applications-material handling applications-Machine loading and unloading-spot welding-arc welding-spray

painting-Micro Robotics and MEMS- Fabrication technology for micro robotics, Stability issues in legged robots, under actuated manipulators.

MODULE V MOBILE ROBOTS AND CONTROL ISSUES 09

Industrial automation-General layout-general configuration of an automated flow line-conveyor systems - major features – types - Roller, State wheel, Belt, Chain and overhead trolley-Inspection station with feedback loops to up steam workstations-shop floor control-3 phases-order scheduling.

Total hours: 45

REFERENCES:

1. Saeed B.Niku, “Introduction to robotics- Analysis, Systems, Application” Prentice Hall of India Pvt. Ltd., 2008.
2. Koren, “Robotics for Engineers”, McGraw Hill International Company. Tokyo 2005.
3. Vokotravotic, “Introduction to Robotics”, Springer, 1985.
4. K.S.Fu, R.C.Gonzally, C.S.G. Lee, “Robotics Control, Sensing, Vision and Intelligent”, Mcgraw Hill Book Company,1997.
5. Robort J.Schilling, “Fundamentals of robotics- Analysis and Control, Prentice Hall of India Pvt. Ltd., 2002.

OUTCOMES:

At the end of the course, the student will be able to

- Analyze the hardware components of processors, sub components and its programming languages used for it.
- Develop programs for the use of Robot in industrial applications for applications like fixing car parts, cleaning, welding and adjustment of load in correct coordinates.
- Analyze the different embedded architecture and interfaces of Robotic parts for movement.
- Design and develop Robotic motion control and data acquisition system for given application.
- Analyze the various coding techniques used in process industries.

EICY 132 INSTRUMENTATION IN POWER PLANT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To have an idea about different methods of Power Generation, with a particular emphasis on thermal power Generation.
- Should aware about the various measurements involved in power generation plants.
- To Impact knowledge about the different types of analysers used in power plant
- Should aware about the different types of controls and control loops.
- The student should know the methods of monitoring different parameters like speed, vibration of turbines and their control.

MODULE I INTRODUCTION 07

Brief Survey of power generation – Hydro, thermal, Instrumentation in power generation, thermal power plants – block diagram, details of boiler process, co-generation.

MODULE II MEASUREMENTS IN POWER PLANTS 08

Full Measurement – review of temperature and pressure measurement of steam, water flow measurement, review of recording and indicating instruments in power stations, water level of gauge for Boiler drum, gas analysis meter smoke instruments, dust monitor – measurement of Impurities in feed water, Instrument maintenance aspects.

MODULE III BOILER CONTROL - I 08

Boiler control – combustion of Fuels (gaseous liquid and solid), excess air, combustion chemistry and products of combustion, requirement for excess combustion, air-circulation of efficiency of Boiler, steam temperature control systems – super heaters and de-super heaters

MODULE IVBOILER CONTROL - II 08

Feed water supply and Boiler water circulation systems – Drum level control systems – boiler draft systems – measurement and control of furnace draft – measurement and control of combustion – draft and air flow control related functions. Interlodes in Boiler start up.

MODULE V ANALYSERS – FLUE GAS ANALYSIS 07

Combustion control for liquid and gaseous fuel Boilers coal or solid fuel, pulverized coal fired boilers, flue gas oxygen analyser, pH meter. Pollution monitoring instruments, dissolved oxygen analyser silica analyser and conductivity meter.

MODULE VI TURBINE MONITORING 07

Speed, vibration, shell temperature monitoring and control, lubricant oil temperature control – L.P. Heater, H.P. Heater, condenser Hot Well Control, Interlocks in turbine operation.

Total hours: 45

REFERENCE BOOKS:

1. S.M. Elonka and A.L. Kohal, 'Standard Boiler Operations', Tata McGraw Hill, New Delhi, 1994.
2. R.K.Jain, 'Mechanical and Industrial Measurements', Khanna Publishers, New Delhi, 1995.
3. E.Al. Wakil, 'Power Plant Engineering', Tata McGraw Hill, 1984

OUTCOMES:

At the end of the course, the students will be able to

- Know the different methods of Power Generation in operation and maintenance of power generation in a core industry
- Shall learn different parameters like speed, vibration of turbines and their control
- Optimise power plant using control loops effectively
- Know various parameters measured in Power Plant
- Learn about different analytical instruments used

EICY133	INSTRUMENTATION IN PETROCHEMICAL INDUSTRY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- The students should know with raw material pertaining to making of petroleum process
- They should know about various operations
- To learn the measurement, automation and control system in respect of petrochemical industry
- Should accustomed to computer application in petrochemical industry
- To learn about major petroleum products

MODULE I COMPOSITION OF PETROLEUM 08

Brief review of petroleum, its formation and composition of crude oil, exploration recovery techniques.

MODULE II OPERATION IN PETROLEUM INDUSTRY 08

Characterizsation of crude oil, Pretreatment of crude, removal of moisture, salts etc; General refinery setup and functions of various units, refinery flow diagram, equipment and tank farm layout.

MODULE III TYPES OF REFINERIES AND DISTILLATION 08

Types of refineries such as simple intermediate and complex, Pre-flashing distillation principles, atmospheric distillation, coloum types, vacuum distillation, pressure distillation methane deri.

MODULE IV MAJOR PETROLEUM PRODUCTS 07

Major petroleum products like LPG, Gasoline, Industrial Solvents, Haptha, Kerosene, Aviation turbine fuel, High speed diesel, Furnace oil, Lubricants, Bitumen, base oil molecular re-building process e.g. Gasto liquid Process, methane derivatives, acetylene derivatives ethylene derivatives, propylene derivatives.

MODULE V MEASUREMETNS AND CONTROL LOOPS IN PETROCHEMICAL INDUSTRY 09

Parameters to be measured in Petrochemical Industry, Selection of Instruments, Intrinsic safety Instruments, Control of distillation column, Control of Catalytic Crackers, Control of Vinyl Chloride and PVC production.

MODULE VI **05**

Statistical information Indian Petroleum and Petrochemical / Industry, future trends and developments.

Total hours: 45

REFERENCE BOOKS:

1. Austin G.T. Shreeves, Chemical Process Industries, McGraw Hill International student edition, Singapore, 1985.
2. Liptak B.G. Instrumentation in Process Industries, Chilton Book Company, 1994.

OUTCOMES:

At the end of the course, the students will be able to

- Introduce the concept of different measurement techniques and control systems in Petrochemical Industry
- adopt computer control in petrochemical industry
- Find out Fault and repairing of Instruments
- Understood good knowledge about process
- Understanding area classification

PROFESSIONAL ELECTIVE FROM OTHER DEPARTMENT

ECCY025	WIRELESS COMMUNICATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce current wireless systems and spectrum allocation
- To explain general ray tracing models and path loss models
- To impart knowledge on wireless channels and capacity
- To introduce MIMO systems, multiuser system, OFDM and broadband modulation
- To impart knowledge on multiuser systems .

MODULE I INTRODUCTION 09

Current wireless systems, Wireless spectrum and allocation to existing systems, radio propagation models, path loss calculation, ray tracing methods, empirical path loss models, discrete time and space time statistical channel models.

MODULE II CAPACITY AND DIVERSITYOF WIRELESS CHANNELS 09

Capacity in AWGN, capacity of flat fading channels, capacity of frequency selective fading channels. Receiver Diversity& Transmitter Diversity techniques.

MODULE III MULTIPLE ANTENNA SYSTEMS 09

Narrow band MIMO model, MIMO channel capacity, MIMO Diversity and beam forming, diversity multiplexing tradeoff, space time modulation and coding, Smart antennas.

MODULE IV MULTI CARRIER MODULATION 09

Data transmission using multiple carriers, Multi carrier modulation with overlapping subchannels. Mitigation of subcarrier fading, Discrete implementation of multicarrier systems, OFDM, PAPR.

MODULE V SPREAD SPECTRUM AND MULTI USER SYSTEMS 09

Spread spectrum principle – DSSS – FHSS , multiuser DSSS – spreading codes, downlink and uplink channels , multicarrier CDMA system and multi user FHSS systems. Multiuser channels - uplink and downlink channel capacity – Multiuser detection .

Total Hours: 45

REFERENCES:

1. Andrea Goldsmith," Wireless Communication" , Cambridge Univ. Press, 2006.
2. Andreas F.Molisch, "Wireless Communications" 2nd Edition, Wiley publications, 2014
3. Theodore S.Rappaport., "Wireless Communications", 2nd Edition, Pearson Education, 2002.
4. Yong SooCho , "MIMO – OFDM wireless communications with MATLAB", IEEE press, John Wiley publications, 2010.

OUTCOMES:

On completion of this course, student will be able to

- Describe ray tracing models and path loss models
- Characterize wireless channels and describe channel models
- Discuss MIMO narrow band model and transmission techniques with multiple antennas.
- Explain multi carrier modulation schemes
- Explore on broadband modulation and multiuser systems
- Discuss on wireless communication techniques

ECCY011 MEDICAL IMAGE PROCESSING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To explain fundamental concepts of digital image processing
- Design and implement algorithms that perform basic image pre-processing
- To interpret medical images through various multimodal imaging sources
- To describe idea on image representation,analysis, classification, reconstruction, registration and visualization of medical images.

MODULE I IMAGE FUNDAMENTALS 09

Image perception, MTF of the visual system, Image fidelity criteria, Image model, Image sampling and quantization – two dimensional sampling theory, Image quantization, Optimum mean square quantizer, Image transforms – 2D-DFT and other transforms.

MODULE II IMAGE PREPROCESSING 09

Image enhancement, point operation, Histogram modeling, spatial operations, Transform operations, Image restoration, Image degradation model, Inverse and Weiner filtering. Image Compression, Spatial and Transform methods.

MODULE III MEDICAL IMAGE RECONSTRUCTION 09

Mathematical preliminaries and basic reconstruction methods, Imagereconstruction in CT scanners, MRI, functional MRI, Ultra sound imaging, 3DUltra sound imaging Nuclear Medicine Imaging Modalities-SPECT, PET,Molecular Imaging.

MODULE IV IMAGE ANALYSIS AND CLASSIFICATION 09

Image segmentation: pixel based, edge based, region based, segmentation. Image representation and analysis, Feature extraction and representation, Statistical, Shape, Texture, feature and image classification: Statistical, Rulebased, Neural Network approaches.

MODULE V IMAGE REGISTRATIONS AND VISUALIZATION 09

Rigid body visualization: Principal axis registration, Interactive principal axisregistration, Feature based registration, Elastic deformation based registration,Image visualization: 2D display methods, 3D display methods, virtual realitybased interactive visualization.

Total Hours : 45

REFERENCES:

1. AtamP.Dhawan, “Medical Image Analysis”, Wiley Interscience Publication,NJ, USA 2003.
2. R.C.Gonzalez and R.E.Woods, “Digital Image Processing”, Second Edition,Pearson Education, 2002.
3. Anil. K. Jain, “Fundamentals of Digital Image Processing”, Pearson education,Indian Reprint 2003.
4. Alfred Horowitz, “MRI Physics for Radiologists – A Visual Approach”, Secondedition Springer Verlag Network, 1991.
5. KavyanNajarian and Robert Splerstor, “Biomedical signals and Imageprocessing”, CRC, Taylor and Francis, New York, 2006.
6. John L.Semmlow, “Biosignal and Biomedical Image Processing Matlab Basedapplications”, Marcel Dekker Inc., New York, 2004.
7. Jerry L. Prince and Jonathan M.Links, “Medical Imaging Signals and Systems”, Pearson Education Inc. 2006.

OUTCOMES:

On completion of the course the student will be able to

- Explain the fundamental concepts of digital image processing
- Recognize & apply suitable image enhancement,compression and restoration techniques.
- Compare various imaging sources(i.e.,MRI,CT,SPECTetc)
- Solve Mathematical Preliminaries for image Reconstruction
- Describe various techniques for image analysis and classification
- Use appropriate image registration technique for various applications

ECCY026 WIRELESS SENSOR NETWORKS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To make the students list the Wireless Sensor Network Architecture and its Applications
- To explain the physical layer design,
- To describe the MAC protocols and time synchronization algorithms
- To discuss various routing protocols, localization algorithms used for sensor network.
- To explain basics of sensor network programming and Internet of Things

MODULE I NODE ARCHITECTURE 07

Introduction to sensor network – Application – Difference between Adhoc and Sensor Network - Node architecture - Hardware components overview - Energy consumption of Sensor nodes - Operating Systems and Execution Environment - some examples of Sensor nodes.

MODULE II NETWORK ARCHITECTURE 07

Sensor Network Scenarios – Optimization goals- Design Principles –Gateway Concepts–Wireless Channel fundamentals - Physical layer and transceiver design considerations in Wireless Sensor Network

MODULE III MAC PROTOCOLS & TIME SYNCHRONIZATION 10

Fundamentals of MAC Protocols – Low duty cycle protocols – Contention based Protocols – schedule based protocols – IEEE 802.15.4 MAC – Address and name management in wireless sensor network. Need for time synchronization

MODULE IV LOCALIZATION & ROUTING PROTOCOLS 12

Properties of localization and positioning procedures – Range based Localization – Range free Localization Routing Metrics – Data Centric Routing– Proactive Routing - On Demand Routing – Hierarchical Routing – QoS based Routing Protocols

MODULE V SENSOR NETWORK PROGRAMMING and IoT 09

Challenges in sensor network programming – Node Centric programming – Dynamic programming – Sensor Network Simulators - Internet of Things (IoT): overview, Applications, potential & challenges, and architecture.

Total Hours : 45

REFERENCES:

1. Holger Karl and Andreas Willig, “Protocols and Architectures for Wireless Sensor Networks”, John Wiley and Sons, 2012.
2. WaltenegusDargie and Christian Poellabauer, “Fundamentals of Wireless Sensor Networks – Theory and Practice”, John Wiley and Sons, First edition, 2010.
3. G.Anastasi, Marco Conti, Mario Di Francesco and Andrea Passarella, “Energy Conservation in Wireless Sensor Networks: A Survey”, Adhoc Networks, Vol.7, No.3 May 2009, Elsevier Publications, pp.537-568.
4. “Adrian McEWen and Hakim Cassimalli, “Designing the Internet of Things” Wiley publications, November 2013.

OUTCOMES:

At the end of the course students will be able to

- Describe Wireless Sensor Network Architecture and its Applications
- Explain the physical layer design
- Compare the various MAC protocols and illustrate time synchronization algorithms
- Distinguish various routing protocols, localization algorithms used for sensor network.
- To describe the basics of sensor network programming and Internet of Things
- Analyze various Sensor Network Simulators

EEC 6128	EMBEDDED AND ADVANCED CONTROL OF ELECTRICAL DRIVES	L	T	P	C
		3	0	2	4

OBJECTIVES:

- The objective of this course is to introduce embedded application design for Electrical Drives.
- To provide practical experience with microcontroller systems
- Introduces Mikro C compiler for 16 series PICs.
- Demonstrates the use of the PIC Microcontrollers for Electrical Drives.

MODULE I PIC16F8XX- MICROCONTROLLERS 04

Device Overview- Features and Function- Core SFRs- I/O Ports- Timers-CCP MODULEs- Serial Communication MODULEs- Analog MODULEs - Internal oscillator - External oscillator in LP, XT or HS, RC and RCIO modes – EEPROM – Watch Dog Timer- Black-out and Brown-out Resets.

MODULE II MIKRO C COMPILER 05

Mikro C Compiler reference- Valid C Characters- Variables- Constants- Types- Increment and decrement - structure-Operators and expressions-Loops- Conditionals-micro C Libraries- ADC, CAN, CANSPI, EEPROM, Ethernet, PWM, Keypad, LCD, SPI Ethernet, RS485,USART and Trigonometric Libraries - Preprocessor- Statements.

MODULE III MIKRO C BUILDING APPLICATIONS 05

Mikro C IDE : Code Editor- Code Explorer – Debugger – Error Window – Statistics – Integrated Tools - Building applications :Projects – Source Files :Search Paths – Managing Source Files – Compilation : Output Files – Assembly View – Error Messages.- Flashing Software : Overview of PICkit2.

MODULE IV ALGORITHM AND PROGRAMMING IN MIKROC 20

Digital realization of error amplifier, limiter and Proportional-Integral-Derivative (PID) controller - PID algorithm - Source codes in Mikro C: ADC and PWM – SVPWM – Unipolar and Bipolar SPWM – Phase Angle Control with Zero Crossing Detection.

MODULE V MICROCONTROLLER COMMUNICATION 06

PIC to PIC Communication using UART - Communication with RS232 Serial Bus - Interfacing EEPROM -I²C Communication with PIC Microcontroller - Interfacing lcd and Temperature sensors - ZigBee communication between PICs.

MODULE VI CLOSED LOOP CONTROL OF ELECTRIC DRIVES 20

Closed Loop Control of the Plant Model - Hardware and Software Implementation using PIC Microcontrollers: Speed control of Chopper fed separately excited DC Motor – AC Motor Control Using TRIAC Phase Controller, SPWM and SVPWM inverter fed induction motor - Stepper Motor Interfacing – Servo Motor control.

Total Hours: 60

REFERENCES:

1. John Main, “PIC Microcontroller C”, 2006-2007 Edition, 2007.
2. Mikro C- Compiler for PIC Microchip controllers- mikro Electronik, 2012.
3. Martin P. Bates,” Programming 8-bit PIC Microcontrollers in C: With Interactive Hardware Simulation.
4. Tim Wilmshurst “Designing Embedded Systems with PIC Microcontrollers- Principles and applications”
5. Martin P. Bates,” PIC Microcontrollers –An Introduction” Newnes,2011.
6. Dogan Ibrahim, “Advanced PIC Microcontroller Projects in C: From USB to RTOS”, Elsevier Ltd, 2008.
7. Han-Way Huang, Leo Chartrand, "PIC Microcontroller: An Introduction to Software & Hardware Interfacing", Delmar Cengage Learning, 2004.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Work on different projects making use of the PIC microcontroller
- Implement external interfaces in various embedded system projects by using various interfacing techniques.
- Enable the student to design software to interact with real-world systems
- Design and develop both the hardware and software microcontroller based Electric Drive systems.
- Develop and demonstrate how to accomplish a given task using Embedded “C” language on a microcontroller.
- Demonstrate a working knowledge of the necessary steps and methods used to interface a microcontroller system to devices such as motors, sensors, etc.

EEC 6235 SOLID STATE AC AND DC DRIVES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the stable steady-state operation and transient dynamics of a motor-load system.
- To study and analyze the operation of the converter / chopper fed dc drive and to solve simple Problems.
- To study and understand the operation of both classical and modern induction motor drives.
- To understand the differences between synchronous motor drive and induction motor drive and to learn the basics of permanent magnet synchronous motor drives with converter.
- To analyze and design the current and speed controllers for a closed loop solid-state DC and AC motor drive and simulation using a software package

MODULE I FUNDAMENTAL OF DC AND AC MOTOR 06

Components of electrical Drives-electric machines, power converter, controllers-dynamics of electric drive - torque equation - equivalent values of drive parameters - components of load torques types of load - four quadrant operation of a motor– steady state stability– load equalization – classes of motor duty - determination of motor rating.

MODULE II SENSORS FOR DRIVES 06

Hall Effect Sensors – Mechanical SWensors for speed and angular positions – Absolute Encoders – Incremental Encoders – Resolvers

MODULE III CLOSED LOOP CONTROL POD DC AND AC DRIVES 09

Transient analysis of separately excited motor – converter control of dc motors – analysis of separately excited & series motor with 1 - phase and 3 - phase converters – dual converter – analysis of chopper controlled dc drives – converter ratings and closed loop control – transfer function of self, separately excited DC motors – linear transfer function model of power converters – sensing and feeds back elements – current and speed loops, P, PI and PID controllers – response comparison – simulation of converter and chopper fed DC drive.

MODULE IV SCALAR METHODS FOR IM DRIVES FROM STATOR SIDE 09

Stator voltage control of induction motor–torque-slip characteristics-operation with different types of loads – operation with unbalanced source voltages and single

phasing – analysis of induction motor fed from non - sinusoidal voltage supply – stator frequency control - variable frequency operation – V/F control, controlled current and controlled slip operation – effect of harmonics and control of harmonics

MODULE V SCALAR METHODS FOR IM DRIVES FROM ROTOR SIDE 08

PWM inverter drives – multiquadrant drives – rotor resistance control – slip torque characteristic – torque equations, constant torque operation – slip power recovery scheme – torque equation – torque slip characteristics – power factor – methods of improving power factor – limited sub synchronous speed operation – super synchronous speed operation.

MODULE VI SYNCHRONOUS MOTOR DRIVES 07

Principle of synchronous motor control – Introduction to CSI Single phase and three phase CSI – CSI fed synchronous machines – adjustable frequency operation of synchronous motors –voltage source inverter drive with open loop control – self controlled synchronous motor with electronic commutation – self controlled synchronous motor drive using load commutated thyristor inverter.

Total Hours: 45

REFERENCES:

1. R. Krishnan, Electrical Motor Drives, PHI 2003.
2. G.K.Dubey, Powersemiconductor controlled drives, Prentice Hall- 2000.
3. G.K.Dubey, Fundamentals of Electrical Drives, Narosa-1999.
4. A. Nasar, Boldea , Electrical Drives, Second Edition, CRCPress-2006.
5. M. A. ElSharkawi , Fundamentals of Electrical Drives , Thomson Learning - 2000. 49
6. Vedam Subrahmaniam, Electric Drives, TMH-2000.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following: Analyse the system considering the steady state and dynamic characteristics.

- Abilty to design a closed loop control of AC and DC drives.
- Talent in selection of motor for various application.
- Software knowledge in matlab , for drive application.
- Modeling AC,DC machines with appropriate loads
- Design a system with suitable parameters to control a drive system.

EECY047	SPECIAL ELECTRICAL MACHINES AND CONTROLLERS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart knowledge on Construction, principle of operation and performance of switched reluctance motors.
- To understand the Construction, principle of operation and performance of SM.
- To impart knowledge on Construction, principle of operation and performance of AC commutator motors.
- To study about the Construction, principle of operation and performance of permanent magnet brushless D.C. motors and PMSM.
- To impart knowledge on Construction, principle of operation and performance of linear motors.
- To learn the softwares Magnet AND ANSYS for performance analysis of motor.

MODULE I SWITCHED RELUCTANCE MOTORS 07

Constructional features - principle of operation - Torque equation - Power controllers Characteristics and control - Microprocessor based controller.

MODULE II STEPPING MOTORS 07

Constructional features, principle of operation-modes of excitation torque, production in Variable Reluctance (VR) stepping motor- dynamic characteristics, Drive systems - circuit for open loop control- closed loop control of stepping motor.

MODULE III AC COMMUTATOR MOTORS 07

Principle of operation – Equivalent circuit – Phasor diagram – Performance of Repulsion motor and Universal motor.

MODULE IV PERMANENT MAGNET MOTORS 07

Principle of operation – types – magnetic circuit analysis – EMF and Torque equations – Power Controllers – Motor characteristics and control of PMSM and BLDC motors.

MODULE V LINEAR MOTORS 07

Linear Induction motor (LIM) classification – construction – Principle of operation –

Concept of current sheet – goodness factor – DC Linear motor (DCLM) types – circuit equation , DCLM control applications ,Linear Synchronous motor(LSM) – Types - Performance equations – Applications.

MODULE VI CASE STUDY 10

Modeling and simulation – Switched Reluctance Machines – Permanent magnet BLDC Motor – PMSM – MAGNET 6.0, ANSYS software.

Total Hours: 45

REFERENCES:

1. Taylor E O, “The performance and design of AC Commutator motors”, Sir Issac Pitman & Sons, London, 1998.
2. Kenjo T, “Stepping Motors and their Microprocessor Controls”, Clarendon Press London, 1984.
3. Miller T J E, “Brushless Permanent Magnet and Reluctance Motor Drives”, Clarendon Press, Oxford, 1989.
4. Naser A and Boldea L,”Linear Electric Motors: Theory Design and Practical Applications”, Prentice Hall Inc., New Jersey 1987.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

- Talent in selection of motor for various application
- A thorough understanding of various special electric machines and their applications.
- Able to analyse any electric machine.
- Ability to model small power rating of motor for real time application
- Software knowledge in Magnet, ANSYS for electrical application.
- Able to present the rudiments of linear machines.

GENERAL ELECTIVES

GECY101 PROJECT MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

The objectives of the course would be to make the students

- Learn to evaluate and choose an optimal project and build a project profile.
- Attain knowledge on risk identification and risk analysis
- Gain insight into a project plan and components
- Familiar with various gamut of technical analysis for effective project implementation
- Learn to apply project management techniques to manage resources.

MODULE I INTRODUCTION & PROJECT INITIATION 09

Introduction to project and project management - projects in contemporary organization – The project life cycle - project initiation - project evaluation methods & techniques - project selection criteria - project profile.

MODULE II RISK ANALYSIS 09

Sources of risk: project specific - competitive - industry specific - market and international risk – perspectives of risk – risk analysis: sensitivity analysis - scenario analysis - breakeven analysis - simulation analysis - decision tree analysis – managing/mitigating risk – project selection under risk.

MODULE III PROJECT PLANNING & IMPLEMENTATION 09

Project planning – importance – functions - areas of planning - project objectives and policies - steps in planning process - WBS – capital requirements - budgeting and cost estimation - feasibility analysis - creation of project plan – project implementation: pre-requisites - forms of project organization

MODULE IV TECHNICAL ANALYSIS 09

Technical analysis for manufacturing/construction/infrastructure projects – process/technology - materials and inputs - product mix - plant capacity – plant location and site selection – plant layout - machinery and equipment – structures

and civil works – schedule of project implementation – technical analysis for software projects.

MODULE V PROJECT MANAGEMENT TECHNIQUES 09

Project scheduling - network construction – estimation of project completion time – identification of critical path - PERT & CPM – crashing of project network - complexity of project scheduling with limited resources - resource allocation - resource leveling – resource smoothing – overview of project management software.

Total Hours: 45

REFERENCES:

1. Projects: Planning, Analysis, Financing, Implementation and Review, Prasanna Chandra, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2004.
2. Project Management and Control, Narendra Singh, Himalaya Publishing, New Delhi, 2015.
3. A Management Guide to PERT/CPM, Jerome, D. Weist and Ferdinand K. Levy, Prentice Hall of India, New Delhi, 1994.

OUTCOMES:

On successfully completing this course, the student will be able to:

- Evaluate & select a project as well as develop a project profile.
- Identify various risks associated with the project and manage it effectively.
- Prepare a detailed project plan addressing its components.
- Perform technical analysis for effective project implementation
- Apply project management techniques for maximizing resource utilization.

GECY102 SOCIETY, TECHNOLGY & SUSTAINABILITY

L	T	P	C
3	0	0	3

OBJECTIVES:

- Aware of new technologies through advances in Science and Engineering.
- To make them realise the profound impact on society.
- Understand the ethical issues raised by technological changes and its effect on society.
- To introduce students a broad range of perspectives on the adoption and use of technologies.
- To make them realize the need of sustainability in the context of emerging technologies.

MODULE I TECHNOLOGY AND ITS IMPACTS 09

Origin and evolution of technologies – Nature of technology- Innovation – Historical Perspective of technology – Sources of technological change - Co-evolution of technology and economy – Scientific knowledge and technological advance – Science and Engineering aspects of Technology – Impact on the Society – Social and Ethical Issues associated with technological change – Social and environmental consequences - Impact of technological change on human life – Technology and responsibility – Technology and social justice.

MODULE II TECHNOLOGY AND ITS ADVANCEMENT 09

Sociological aspects of technology – Ethics and technology – Technology and responsibility – International Economics, Globalisation and Human Rights – Sustainability and Technology – Population and environment - Technology, Energy and Environment – Organisations and technological change.

MODULE III SOCIETY AND TECHNOLOGY 09

Impact of technologies on contemporary society – Role of society in fostering the development of technology – Response to the adaption and use of technology – Impact of technology on developer and consumers – Technological change and globalisation.

MODULE IV IMPACT OF A SPECIFIC TECHNOLOGY ON HUMAN WELFARE 09

Impact of the following technologies on Human life – Medical and Biomedical – Genetics Technology – Electronics and Communications – Electronic media Technology – Information Systems Technology – Nanotechnology – Space Technology and Energy Technology.

MODULE V THE IMPORTANCE OF SUSTAINABILITY 09

Sustainability – A brief history – Concepts and contexts for sustainability – Ecological imbalance and biodiversity loss – Climate change – Population explosion. Industrial ecology – systems approach to sustainability – Green engineering and technology- sustainable design- sustainable manufacturing- Green consumer movements – Environmental ethics – Sustainability of the planet Earth – Future planning for sustainability.

Total Hours: 45

REFERENCES:

1. Volti Rudi, “Society and Technology Change”, 6th Edition, Worth publishers Inc, USA, 2009.
2. Arthur W.A, “The nature of Technology: What it is and how it evolves”, Free Press, NY, USA, 2009.
3. Winston M and Edelbach R, “Society, Ethics and Technology”, 3rd Edition, San Francisco, USA, 2005.
4. Martin A.A Abraham, “Sustainability Science and Engineering: Defining Principles”, Elsevier Inc, USA, 2006.
5. R.V.G.Menon, “Technology and Society”, Pearson Education, India, 2011.

OUTCOMES:

At the end of this course, the students will be able to

- Understand the benefits of modern technology for the well-being of human life.
- Connect sustainability concepts and technology to the real world challenges.
- Find pathway for sustainable society.

GECY103 ARTIFICIAL INTELLIGENCE

L	T	P	C
3	0	0	3

OBJECTIVES:

- Expose the history and foundations of artificial intelligence.
- Showcase the complexity of working on real time problems underlying the need for intelligent approaches.
- Illustrate how heuristic approaches provide a good solution mechanism.
- Provide the mechanisms for simple knowledge representation and reasoning.
- Highlight the complexity in working with uncertain knowledge.
- Discuss the current and future applications of artificial intelligence.

MODULE I HISTORY AND FOUNDATIONS 08

History – Scope – Influence from life – Impact of computing domains - Agents in environments - Knowledge representation – Dimensions of Complexity – Sample application domains – Agent structure.

MODULE II SEARCH 10

Problem solving as search – State spaces – Uninformed Search – Heuristic search – Advanced search – Constraint satisfaction - Applications.

MODULE III KNOWLEDGE REPRESENTATION AND REASONING 10

Foundations of knowledge representation and reasoning, representing and reasoning about objects, relations, events, actions, time, and space predicate logic, situation calculus, description logics, reasoning with defaults, reasoning about knowledge, sample applications.

MODULE IV REPRESENTING AND REASONING WITH UNCERTAIN KNOWLEDGE 08

Probability, connection to logic, independence, Bayes rule, Bayesian networks, probabilistic inference, sample applications.

MODULE V CASE STUDY AND FUTURE APPLICATIONS 09

Design of a game/Solution for problem in student's domain. Natural Language processing, Robotics, Vehicular automation – Scale, Complexity, Behaviour – Controversies.

Theory: 45

TEXT BOOK:

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall, Third Edition, 2010.
2. David Poole, Alan Mackworth, Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010.
3. Nils J. Nilsson, The Quest for Artificial Intelligence, Cambridge University Press, Online edition, 2013.
4. Keith Frankish, William M. Ramsey (eds) The Cambridge Handbook of Artificial Intelligence, Cambridge University Press, 2014.

OUTCOMES:

Students who complete this course will be able to

- Discuss the history, current applications, future challenges and the controversies in artificial intelligence.
- Apply principle of AI in the design of an agent and model its actions.
- Design a heuristic algorithm for search problems.
- Analyze and represent the fact using logic for a given scenario
- Represent uncertainty using probabilistic models
- Develop a simple game or solution using artificial intelligence techniques.

GECY104 GREEN COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To focus on the necessity of green computing technology.
- To expose to various issues with information technology and sustainability.
- To attain knowledge on the technologies for enabling green cloud computing.
- To elaborate on the energy consumption issues
- To illustrate a Green and Virtual Data Center
- To develop into a Green IT Technologist.

MODULE I INTRODUCTION 08

Trends and Reasons to Go Green - IT Data Center Economic and Ecological Sustainment - The Growing Green Gap: Misdirected Messaging, Opportunities for Action - IT Data Center “Green” Myths and Realities - PCFE Trends, Issues, Drivers, and Related Factors - Green Computing and Your Reputation- Green Computing and Saving Money- Green Computing and the Environment

MODULE II CONSUMPTION ISSUES 10

Minimizing power usage – Cooling - Electric Power and Cooling Challenges - Electrical – Power -Supply and Demand Distribution - Determining Energy Usage - From Energy Avoidance to Efficiency - Energy Efficiency Incentives, Rebates, and Alternative Energy Sources - PCFE and Environmental Health and Safety Standards- Energy-exposed instruction sets- Power management in power-aware real-time systems.

MODULE III NEXT-GENERATION VIRTUAL DATA CENTERS 09

Data Center Virtualization - Virtualization beyond Consolidation - Enabling Transparency - Components of a Virtual Data Center - Datacenter Design and Redesign - Greening the Information Systems - Staying Green- Building a Green Device Portfolio- Green Servers and Data Centers- Saving Energy

MODULE IV TECHNOLOGIES FOR ENABLING GREEN AND VIRTUAL DATA CENTERS 08

Highly Effective Data Center Facilities and Habitats for Technology - Data Center Electrical Power and Energy Management - HVAC, Smoke and Fire Suppression - Data Center Location - Virtual Data Centers Today and Tomorrow - Cloud Computing, Out-Sourced, and Managed Services.

MODULE V SERVERS AND FUTURE TRENDS OF GREEN COMPUTING 10

Server Issues and Challenges - Fundamentals of Physical Servers - Types, Categories, and Tiers of Servers - Clusters and Grids - Implementing a Green and Virtual Data Center - PCFE and Green Areas of Opportunity- 12 Green Computer Companies- What's in Green computer science-Green off the Grid aimed for data center energy evolution-Green Grid Consortium- Green Applications- Green Computing Making Great Impact On Research

Theory: 45

REFERENCES:

1. Bud E. Smith,"Green Computing Tools and Techniques for Saving Energy, Money, and Resources", Taylor & Francis Group, CRC Press, ISBN-13: 978-1-4665-0340-3, 2014.
2. Jason Harris, "Green Computing and Green IT Best Practices, On Regulations and Industry Initiatives, Virtualization and power management, materials recycling and Tele commuting, Emereo Publishing .ISBN-13: 978-1-9215-2344-1,2014.
3. Ishfaq Ahmed & Sanjay Ranka, "Handbook of Energy Aware and Green Computing", CRC Press, ISBN: 978-1-4665-0116-4, 2013.
4. Kawahara, Takayuki, Mizuno, "Green Computing with Emerging Memory", Springer Publications, ISBN:978-1-4614-0811-6, 2012
5. Greg Schulz, "The Green and Virtual Data Center", CRC Press, ISBN-13:978-1-4200-8666-9, 2009.
6. Marty Poniatowski, "Foundation of Green IT: Consolidation, Virtualization, Efficiency, and ROI in the Data Center", Printice Hall, ISBN: 9780-1-3704-375-0, 2009.

OUTCOMES:

Students who complete this course will be able to

- Demonstrate issues relating to a range of available technologies, systems and practices to support green computing.
- Select appropriate technologies that are aimed to reduce energy consumption.
- Address design issues needed to achieve an organizations' green computing objectives.
- Analyze the functionality of Data Centers.
- Critically evaluate technologies and the environmental impact of computing resources for a given scenario.
- Compare the impact of Green Computing with other computing techniques.

GECY105 GAMING DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To master event-based programming
- To learn resource management as it relates to rendering time, including level-of-detail and culling.
- To become familiar with the various components in a game or game engine.
- To explore leading open source game engine components.
- To become familiar of game physics.
- To be compatible with game animation.

MODULE I INTRODUCTION 09

Magic Words – What Skills Does a Game Designer Need? – The Most Important Skill -The Five Kinds of Listening-The Secret of the Gifted.

MODULE II THE DESIGNER CREATES AN EXPERIENCE 09

The Game Is Not the Experience -Is This Unique to Games? -Three Practical Approaches to Chasing Rainbows -Introspection: Powers, Perils, and Practice -Dissect Your Feelings -Defeating Heisenberg -Essential Experience.

MODULE III THE EXPERIENCE IN THE PLAYER MIND AND GAME MECHANICS 08

Modeling – Focus -Empathy – Imagination – Motivation – Space – Objects, Attributes, and States – Actions – Rules.

MODULE IV GAMES THROUGH AN INTERFACE 09

Breaking it Down – The Loop of Interaction – Channels of Information – Other Interface.

MODULE V BALANCED GAME MECHANICS 10

Balance – The Twelve Most Common Types of Game Balance – Game Balancing Methodologies - Balancing Game Economies.

Theory: 45

REFERENCES:

1. Jesse Schell, "The Art of Game Design: A Book of Lenses", Second Edition 2nd Edition ISBN-10: 1466598646, 2014.
2. Ashok Kumar, Jim Etheredge, Aaron Boudreaux, “Algorithmic and Architectural Gaming Design: Implementation and Development", 1st edition, Idea Group, U.S ISBN-10: 1466616342, 2012.
3. Katie Salen Tekinba, Melissa Gresalfi, Kylie Peppler, Rafi Santo, "Gaming the System - Designing with Gamestar Mechanic" MIT Press , ISBN-10: 026202781X, 2014.
4. James M. Van Verth, Lars M. Bishop "Essential Mathematics for Games and Interactive Applications", Third Edition,A K Peters/CRC Press, ISBN-10: 1482250926, 2015.

OUTCOMES:

Students who complete this course will be able to

- Realize the basic history and genres of games
- Demonstrate an understanding of the overall game design process
- Explain the design tradeoffs inherent in game design
- Design and implement basic levels, models, and scripts for games
- Describe the mathematics and algorithms needed for game programming
- Design and implement a complete three-dimensional video game

GECY106 SOCIAL COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To create original social applications, critically applying appropriate theories and effective practices in a reflective and creative manner.
- To critically analyze social software in terms of its technical, social, legal, ethical, and functional features or affordances.
- To encourage the development of effective communities through the design, use, and management of social software.
- To give students with a base of knowledge and advances for them to critically examine existing social computing services.
- To plan and execute a small-scale research project in social computing in a systematic fashion.
- To become familiar with the concept of computational thinking.

MODULE I BASIC CONCEPTS 09

Networks and Relations: Relations and Attributes, Analysis of Network Data, Interpretation of network data -New Social Learning – Four Changes that Shift Work - Development of Social Network Analysis: Sociometric analysis and graph theory, Interpersonal Configurations and Cliques – Analysing Relational Data.

MODULE II SOCIAL LINK 09

Individual Actors, Social Exchange Theory, Social Forces, Graph Structure, Agent Optimization Strategies in Networks – Hierarchy of Social Link Motivation- Social Context.

MODULE III SOCIAL MEDIA 08

Trends in Computing – Motivations for Social Computing – Social Media: Social relationships, Mobility and Social context – Human Computation – Computational Models- Business use of social Media.

MODULE IV SOCIAL INFORMATION FILTERING 09

Mobile Location Sharing – Location based social media analysis – Social Sharing and Social Filtering – Automated recommender Systems – Traditional and Social Recommender Systems.

MODULE V SOCIAL NETWORK STRATEGY 10

Application of Topic Models – Opinions and Sentiments – Recommendation Systems – Language Dnamics and influence in online communities – Psychometric analysis – Case Study: Social Network Strategies for surviving the zombie apocalypse.

Theory: 45

REFERENCES:

1. Tony Bingham, Marcia Conner, “The New Social Learning, 2nd Edition: Connect. Collaborate. Work”, 2nd Edition, ATD Press, ISBN-10:1-56286-996-5, 2015.
2. Nick Crossley, Elisa Bellotti, Gemma Edwards, Martin G Everett, Johan Koskinen, Mark Tranmer, “Social Network Analysis for Ego-Nets”, SAGE Publication, 2015.
3. Zafarani, Abbasi and Liu, Social Media Mining: An Introduction, Cambridge University Press, 2014.
4. Christina Prell, “Social Network Analysis: History, Theory and Methodology”, 1st Edition, SAGE Publications Ltd, 2012.
5. John Scott, “Social Network Analysis”, Third Edition, SAGE Publication, 2013.
6. Jennifer Golbeck, “Analyzing the Social Web”, Elsevier Publication, 2013.
7. Huan Liu, John Salerno, Michael J. Young, “Social computing and Behavioral Modeling”, Springer Publication, 2009.

OUTCOMES:

Students who complete this course will be able to

- Realize the range of social computing applications and concepts.
- Analyze data left after in social media.

- Recognize and apply the concepts of computational models underlying social computing.
- Take out simple forms of social diagnostics, involving network and language models, applying existing analytic tools on social information.
- Evaluate emerging social computing applications, concepts, and techniques in terms of key principles.
- Design and prototype new social computing systems.

GECY107 SOFT COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To become familiar with AI and neural networks that can learn from available examples and generalize to form appropriate rules for inferencing systems.
- To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience.
- To provide the mathematical background for carrying out the optimization associated with neural network learning.
- To familiarize with genetic algorithms and other random search procedures useful while seeking global optimum in self-learning situations.
- To introduce case studies utilizing the above and illustrate the intelligent behavior of programs based on soft computing.

MODULE I INTRODUCTION 09

Introduction of soft computing, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing. Artificial Intelligence : Introduction, Various types of production systems, characteristics of production systems, breadth first search, depth first search techniques, other Search Techniques like hill Climbing, Best first Search, A* algorithm, AO* Algorithms and various types of control strategies. Knowledge representation issues, Prepositional and predicate logic, monotonic and non-monotonic reasoning, forward Reasoning, backward reasoning.

MODULE II INTRODUCTION TO NEURAL NETWROK 09

Structure and Function of a single neuron: Biological neuron, artificial neuron, definition of ANN, Taxonomy of neural net, Difference between ANN and human brain, characteristics and applications of ANN, single layer network, Perceptron training algorithm, Linear separability, Widrow & Hebb"s learning rule/Delta rule, ADALINE, MADALINE, AI v/s ANN. Introduction of MLP, different activation functions, Error back propagation algorithm, derivation of BPA, momentum, limitation, characteristics and application of EBPA.

MODULE III FUZZY LOGIC 09

Fuzzy set theory, Fuzzy set versus crisp set, crisp relation & fuzzy relations,

Fuzzy systems: crisp logic, fuzzy logic, introduction & features of membership functions, Fuzzy rule base system: fuzzy propositions, formation, decomposition & aggregation of fuzzy rules, fuzzy reasoning, fuzzy inference systems, fuzzy decision making & Applications of fuzzy logic.

MODULE IV GENETIC ALGORITHM 09

Fundamentals, basic concepts, working principle, encoding, fitness function, reproduction, Genetic modeling: Inheritance operator, cross over, inversion & deletion, mutation operator, Bitwise operator, Generational Cycle, Convergence of GA, Applications & advances in GA, Differences & similarities between GA & other traditional methods.

MODULE V APPLICATION OF COMPUTATIONAL INTELLIGENCE 09

Printed Character Recognition – Inverse Kinematics Problems – Automobile Fuel Efficiency Prediction – Soft Computing for Color Recipe Prediction.

Total Hours: 45

REFERENCES:

1. Jyh-shing Roger Jang, Chuen - Tsai Sun, Eiji Mizutani, “Neuro- Fuzzy and Soft Computing”, Prentice-Hall of India, 2003.
2. S.Rajasekaran & G.A. Vijayalakshmi Pai, “Neural Networks, Fuzzy Logic & Genetic Algorithms, Synthesis & applications”, PHI Publication, 2002.
3. S.N. Sivanandam & S.N. Deepa, “Principles of Soft Computing”, Wiley Publications, 2007.
4. N.K.Bose, “Neural Network Fundamentals with Graphs, Algorithms, and Applications” TMH, 1996.
5. Klir & Yuan, “Fuzzy sets & Fuzzy Logic: Theory & Application”, Prentice Hall of India Pub, 1995.
6. Kosko: “Neural Network & Fuzzy System”, PHI Publication, 1992.

OUTCOMES:

On completion of the programme students will be able to:

- Learn about soft computing techniques and their applications
- Analyze various neural network architectures and able to Understand perceptrons model

- Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
- Apply genetic algorithms to combinatorial optimization problems.
- Evaluate and compare solutions by various soft computing approaches for a given problem.

GECY108 EMBEDED SYSTEM PROGRAMMING

L	T	P	C
3	0	0	3

OBJECTIVES:

- This course provides an introduction to the design of embedded computing systems including their hardware and software architectures.
- Entire software development lifecycle and examine the various issues involved in developing software for embedded systems.
- To analyze the I/O programming and Embedded C coding techniques
- This course will equip students with the software development skills necessary for practitioners in the embedded systems field.

MODULE I INTRODUCTION OF EMBEDDED SYSTEM 09

Embedded computing - characteristics and challenges - embedded system design process-Overview of Processors and hardware units in an embedded system-Compiling, Linking and locating – downloading and debugging –Emulators and simulators processor – External peripherals – Memory testing – Flash Memory.

MODULE II SOFTWARE TECHNOLOGY 09

Software Architectures, Software development Tools, Software Development Process Life Cycle and its Model, Software Analysis, Design and Maintenance.

MODULE III INPUT/OUTPUT PROGRAMMING 09

I/O Instructions, Synchronization, Transfer Rate & Latency, Polled Waiting Loops, Interrupt – Driven I/O, Writing ISR in Assembly and C, Non Maskable and Software Interrupts

MODULE IV DATA REPRESENTATION IN EMBEDDED SYSTEMS 09

Data representation ,Twos complement, Fixed point and Floating Point Number Formats ,Manipulating Bits in -Memory, I/O Ports, Low level programming in C ,Primitive data types , Arrays, Functions ,Recursive Functions, Pointers, Structures & Unions ,Dynamic Memory Allocation ,File handling ,Linked lists, Queues, Stacks.

MODULE V EMBEDDED C 09

Embedded Systems programming in C – Binding & Running Embedded C program in Keil IDE – Dissecting the program -Building the hardware. Basic techniques for

reading & writing from I/O port pins – switch bounce - LED Interfacing using Embedded C.

Total Hours: 45

REFERENCES:

1. Marilyn Wolf, "Computers as components ", Elsevier, 2012.
2. Qing Li and Carolyn Yao, "Real-Time Concepts for Embedded Systems", CMP Books, 2003.
3. Daniel W. Lewis, "Fundamentals of embedded software where C and assembly meet", Pearson Education
4. Michael Bass, "Programming Embedded Systems in C and C++", Oreilly, 2003.

OUTCOMES:

On completion of this course the student will be able to

- Design the software and hardware components in embedded system
- Describe the software technology
- Use interrupt in effective manner
- Use keil IDE for programming
- Program using embedded C for specific microcontroller
- Design the embedded projects

GECY109 PRINCIPLES OF SUSTAINABLE DEVELOPMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge in the concepts and dimensions of sustainable development.
- To gain knowledge on the framework for achieving sustainability.

MODULE I CONCEPT OF SUSTAINABLE DEVELOPMENT 09

Environment and Development - Population poverty and Pollution –Global and Local environmental issues –Resource Degradation- Greenhouse gases- Desertification-industrialization –Social insecurity, Globalization and environment. History and emergence of the concept of sustainable development-Objectives of Sustainable Development.

MODULE II COMPONENTS AND DIMENSIONS OF SUSTAINABLE DEVELOPMENT 09

Components of Sustainability –Complexity of growth and equity – Social economic and environmental dimensions of sustainable development – Environment- Biodiversity- Natural -Resources- Ecosystem integrity- Clean air and water- Carrying capacity- Equity, Quality of Life, Prevention, Precaution-Preservation and Public Participation Structural and functional linking of developmental dimensions.

MODULE III FRAMEWORK FOR ACHIEVING SUSTAINABILITY 09

Operational guidelines- interconnected prerequisites for sustainable development Empowerment of Women, children, Youth, Indigenous People, Non-Governmental Organizations Local Authorities, Business and industry-Science and Technology for sustainable development- performance indicators of sustainability and assessment mechanism- Constraints and barriers for sustainable development.

MODULE IV SUSTAINABLE DEVELOPMENT OF SOCIO ECONOMIC SYSTEMS 09

Demographic dynamics of sustainability – Policies for socio-economic development -Strategies for implementing eco-development programmes Sustainable development through trade –Economic growth –Action plan for implementing sustainable development –Urbanization and sustainable Cities – Sustainable Energy and Agriculture –sustainable livelihoods.

MODULE V SUSTAINABLE DEVELOPMENT AND INTERNATIONAL RESPONSE 09

Role of developed countries in the development of developing countries – international summits – Stockholm to Johannesburg – Rio principles – Agenda-Conventions – Agreements – Tokyo Declaration – Doubling statement – Tran boundary issues integrated approach for resources protection and management

Total Hours: 45

REFERENCES:

1. Sayer J. and Campbell, B., The Science of Sustainable Development: Local Livelihoods and the Global environment - Biological conservation restoration & Sustainability, Cambridge university Press, London, 2003.
2. M.K. Ghosh Roy. and Timberlake, Sustainable Development, Ane Books Pvt. Ltd, 2011.
3. Mackenthun K.M., Concepts in Environmental Management, Lewis Publications London,1999.
4. APJ Abdul Kalam and Srijan Pal Singh, Target 3 Billion: Innovative Solutions Towards Sustainable Development, Penguin India, 2011

OUTCOMES:

At the end of the course the student will be able to

- Describe the concepts of sustainable development
- Define the components and dimensions of sustainable development
- Outline the Frame work for achieving sustainability.
- State the policies and strategies for implementing sustainable development for Socio economic programmes.
- Examine the role of developed countries in sustainable development.

GECY110	QUANTITATIVE TECHNIQUES IN MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVE:

To impart knowledge on

- operations research
- production management
- financial management
- decision theory and managerial economics

MODULE I OPERATIONS RESEARCH 09

Introduction to Operations research-Linear programming-Graphical and Simplex Methods, Duality and Post-Optimality Analysis-Transportation and Assignment Problems

MODULE II PRODUCTION MANAGEMENT 09

Inventory control, EOQ, Quantity Discounts, Safety Stock-Replacement Theory-PERT and CPM-Simulation Models-Quality Control.

MODULE III FINANCIAL MANAGEMENT 09

Working Capital Management-Compound Interest and Present Value methods-Discounted Cash Flow Techniques-Capital Budgeting.

MODULE IV DECISION THEORY 09

Decision Theory-Decision Rules-Decision making under conditions of certainity, risk and uncertainity-Decision trees-Utility Theory.

MODULE V MANAGERIAL ECONOMICS 09

Cost concepts-Break-even -Analysis-Pricing techniques-Game Theory applications.

Total Hours: 45

REFERENCES:

1. Vohra, N.D. , Quantitative Techniques in Management, Tata McGraw Hill Co., Ltd, New Delhi, 2009.

2. Seehroeder, R.G., Operations Management, McGraw Hill, USA, 2002.

3. Levin, R.I, Rubin, D.S., and Stinsonm J., Quantitative Approaches to Management, McGraw Hill Book Co., 2008.

4. Frank Harrison, E., The Managerial Decision Making Process, Houghton Miffin Co. Boston, 2005.

5. Hamdy A. Taha, Operations Research- An Introduction, Prentice Hall, 2002.

OUTCOME:

At the end of the course, the students will be able to

- Apply the concepts of operations research for various applications
- Create models for inventory control in production management
- Compute the cash flow for a project
- Choose a project using decision theory based on the risk criterion.
- Apply the concepts of managerial economics in construction management

GECY111 PROGRAMMING USING MATLAB & SIMULINK

L	T	P	C
1	0	2	2

OBJECTIVES:

The aim of this course is to:

- Teach students how to mathematically model engineering systems
- Teach students how to use computer tools to solve the resulting mathematical models. The computer tool used is MATLAB and the focus will be on developing and solving models of problems encountered in engineering fields

MODULE I INTRODUCTION MATLAB DATA PRESENTATION 03+06

Vectors, Matrices -Vector/Matrix Operations & Manipulation- Functions vs scripts-Making clear and compelling plots-Solving systems of linear equations numerically and symbolically- Least squares regression -Curve fitting.

MODULE II MATLAB PLOT FUNCTION 03+06

Introduction- Plot Function – Animation- 3D Plots-Customizing Plots – Plot Applications- Saving &Painting Plots.

MODULE III ROOT FINDING AND COMPUTER REPRESENTATION OF NUMBERS 03+06

Linearization and solving non-linear systems of equations- The Newton-Rapson method- Integers and rational numbers in different bases- Floating point numbers-Round off and errors in basic arithmetic-Significant digits when reporting results

MODULE IV ORDINARY DIFFERENTIAL EQUATIONS 03+06

Numerical integration and solving 1^{st} order, ordinary differential equations (Euler's method and Runge-Kutta) – Use of ODE function in MATLAB

MODULE V NON-LINEAR DIFFERENTIAL EQUATIONS 03+06

Converting 2^{nd} order and higher ODEs to systems of 1^{st} order ODEs- Solving systems of ODEs via Euler's method and Runge-Kutta) – Solving single and systems of non-linear differential equations by linearization-Use of the function ODE in MATLAB to solve differential equations

MODULE VI INTRODUCTION OF SIMULINK 03+06

Simulink & its relations to MATLAB – Modeling a Electrical Circuit- Modeling a fourth order differential equations- Modeling the solution of three equations with three unknowns- Representing a model as a subsystem-Simulink demos.

Total Hours: 45

REFERENCE:

1. Griffiths D V and Smith I M, Numerical Methods for Engineers, Blackwell, 1991.
2. Laurene Fausett, Applied Numerical Analysis Using MATLAB, Pearson 2008.
3. Moin P, Fundamentals of Engineering Numerical Analysis, Cambridge University Press, 2001.
4. Wilson HB, Turcotte LH, Advanced mathematics and mechanics applications using MATLAB. CRC Press, 1997
5. Ke Chen, Peter Giblin and Alan Irving, Mathematical Exploration with MATLAB, Cambridge University Press, 1999.

OUTCOMES:

At the end of this unit students will be able to:

- Use Matlab as a convenient tool for solving a broad range of practical problems in engineering from simple models to real examples.
- Write programs using first principles without automatic use of built-in ones.
- Write programs for solving linear and nonlinear systems, including those arising from boundary value problems and integral equations, and for root-finding and interpolation, including piecewise approximations.
- Be fluent in exploring Matlab's capabilities, such as using matrices as the fundamental data-storage unit, array manipulation, control flow, script and function m-files, function handles, graphical output.
- Make use of Maltab visual capabilities for all engineering applications.
- An ability to identify, formulate, and solve engineering problems. This will be accomplished by using MATLAB to simulate the solution to various problems in engineering fields

GECY112 JAVA PROGRAMMING

L	T	P	C
2	0	0	2

OBJECTIVES:

- To learn the fundamentals of Java programming such as data types, variables and arrays.
- To study the syntax and necessity of decision making and iterative statements.
- To create a class and invoke the methods.
- To instigate programming in overloading of methods.
- To emphasize the concept of packages.
- To learn the exception handling routines.

MODULE I INTRODUCTION TO JAVA PROGRAMMING 15

History and Evolution of Java – Overview of Java – Data types, variables and arrays – Operators – Control statements.

MODULE II METHODS AND CLASSES 15

Class fundamentals – Declaring objects – Methods – Constructors – Garbage collection – Overloading methods – Constructor overloading – Access control – Inheritance – Packages - Exception handling.

Total Hours: 30

REFERENCES:

1. Herbert Schildt, Java The Complete Reference, 9th Edition, Oracle Press, 2014, ISBN: 978007180855-2.
2. Nicholas S. Williams, Professional Java for Web Applications: Featuring WebSockets, Spring Framework, JPA Hibernate and Spring Security (WROX), John Wiley & Sons, 2014, ISBN:978111865651-8.
3. E Balagurusamy, Programming with Java, 5th Edition,Tata Mcgraw Hill,2014.
4. Yashavant Kanetka**,** Let Us Java, 2nd Edition, BPB Publications, 2012**.**

OUTCOMES:

Students to complete this course will be able to

- Implement basic Java programming.
- Create a class and invoke methods for real world problems.
- Construct simple overloading of methods programs.
- Implement various types of inheritance concepts.
- Describe the access control mechanism.

GECY113 PYTHON PROGRAMMING

L	T	P	C
2	0	0	2

OBJECTIVES:

- To learn the list and records of python programming.
- To study the control statements and string functions of python.
- To instigate the fundamental python programming.
- To emphasize GUI in python.
- To integrate python with embedded systems.
- To implement programs in python.

MODULE I INTRODUCTION TO PYTHON PROGRAMMING 15

Installation and environment set up – syntax used in python – variable types – operators – Loops – decision making – string functions - formatted files - GUI basics.

MODULE II EMBEDDED PROGRAMMING USING PYTHON 15

Web interface – system tools – script execution context - Motion-triggered LEDs-Python-arduino prototyping-storing and plotting arduino data-Remote home monitoring system.

Total Hours : 30

REFERENCES:

1. Nick Goddard, “Python Programming”, 2nd edition, ISBN: 1533337772, 2016.
2. Pratik Desai, “Python Programming for Arduino”, 1st edition, Packt publishing, 2015, ISBN: 9781783285938.
3. Mark Lutz, Learning Python: Powerful Object-Oriented Programming, 5th Edition, O'Reilly Media, 2013.

4. Richard H. Barnett, Sarah Cox, Larry O'Cull, “Embedded C Programming and the Atmel AVR”, 2nd edition, 2006.

5. Michael Barr, Anthony Massa, “Programming Embedded Systems”, 2nd Edition, O'Reilly Media, 2006.

OUTCOMES:

Students to complete this course will be able to

- Implement date and time function programming using python.
- Write formatted file programming.
- Construct simple python programs.
- Create web interface using python programming
- Develop embedded system with python programming.
- Build arduino prototype using python programming.

GECY114 INTELLECTUAL PROPERTY RIGHTS (IPR)

L	T	P	C
1	0	0	1

OBJECTIVES:

- To study about Intellectual property rights and its need
- To explore the patent procedure and related issues

MODULE I INTRODUCTION 07

Introduction and the need for intellectual property right (IPR) – IPR in India – Genesis and Development – IPR in abroad – Important examples of IPR – Copyrights, Trademarks, Patents, Designs, Utility Models, Trade Secrets and Geographical Indications – Industrial Designs

MODULE II PATENT 08

Concept of Patent – Product / Process Patents & Terminology – Duration of Patents – Law and Policy Consideration Elements of Patentability –- Patentable Subject Matter – Procedure for Filing of Patent Application and types of Applications – Procedure for Opposition – Revocation of Patents – Working of Patents- Patent Agent – Qualification and Registration Procedure – Patent databases and information system – Preparation of patent documents – Process for examination of patent application- Patent infringement – Recent developments in patent system

Total Hours: 15

REFERENCES

1. B.L.Wadehra; Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India 2000
2. Ajit Parulekar and Sarita D' Souza, Indian Patents Law – Legal & Business Implications; Macmillan India ltd , 2006
3. P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi, 2010.
4. E. T. Lokganathan, Intellectual Property Rights (IPRs): TRIPS Agreement & Indian Laws Hardcover, 2012
5. Alka Chawla, P N Bhagwati , Law of Copyright Comparative Perspectives 1st Edition, LexisNexis, 2013
6. V. K. Ahuja, Law Relating to Intellectual Property Rights 2nd Edition, LexisNexis, 2nd Edition, 2013

7. Deborah E. Bouchoux, Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets, 2015
8. Jatindra Kumar Das, Law of Copyright, PHI Learning, 2015

COURSE OUTCOMES:

Students should be able to

- Identify the various types of intellectual property and their value
- Apply the procedure to file a patent and to deal the related issues
- Search and extract relevant information from various intellectual database

REGULATIONS, CURRICULAM AND SYLLABUS

M. TECH.
INFORMATION TECHNOLOGY

(As approved by the 9th Academic Council)

JULY 2016

B.S.ABDUR RAHMAN
UNIVERSITY
B.S.ABDUR RAHMAN INSTITUTE OF SCIENCE & TECHNOLOGY
(Estd.u/s 3 of the UGC Act, 1956)

(FORMERLY B.S.ABDUR RAHMAN CRESCENT ENGINEERING COLLEGE)
Seethakathi Estate, G.S.T. Road, Vandalur, Chennai - 600 048.

VISION AND MISSION OF THE DEPARTMENT OF INFORMATION TECHNOLOGY

VISION

To be leader in providing quality education and training in the field of Information Technology at Undergraduate and Postgraduate levels and undertake Research activities thereby contributing to the progress of the country.

MISSION

- To impart quality education and include professionalism to suit the needs of the industries and society.
- To involve graduates in undertaking need based Research activities and disseminate the knowledge to develop entrepreneur skills.
- To improve the professionalism through extension activities, industrial visits and in-plant training.
- To improve communication effectively both in documentation and presentation.
- To create awareness of social & economic responsibilities ethically.

PROGRAMME EDUCATIONAL OBJECTIVES AND PROGRAMME OUTCOMES

M.Tech. (Information Technology)

PROGRAMME EDUCATIONAL OBJECTIVES:

- To impart broad spectrum of knowledge and skill in the analysis, design, implementation and testing of software systems.
- To focus on need based research in different domains relevant to Information Technology and carry out research projects of national and social relevance.
- To provide problem solving capability through IT tools and techniques with adequate hands on experience to meet industry/ societal needs.
- To develop communication, problem solving, team spirit and leadership skills for a successful professional career.

PROGRAMME OUTCOMES:

On completion of the programme students will be able to :

- Analyze, design, test and implement software systems required for IT industry.
- Apply relevant tools and techniques to solve software problems and undertake research activities.
- Prepare necessary software documentation and present with effective communication skills.
- Manage, organize and lead a team of highly competent Information technologists.

CURRICULUM & SYLLABI FOR
M. Tech (Information Technology)

CURRICULUM

Sl. No.	Course Code	Course Title	L	T	P	C
		SEMESTER I				
1	ITC6101	Computer Forensics and Information Security	**3**	**0**	**0**	**3**
2	CSC6101	Advanced Computer Architecture	**3**	**1**	**0**	**4**
3	MAC6181	Applied Algebra and Discrete Algorithms	**3**	**1**	**0**	**4**
4	ITC6102	Advanced Data Structures	**3**	**0**	**2**	**4**
5	CSC6103	Computer Networks and Management	**2**	**0**	**2**	**3**
6	ITC6103	Software Development Methodologies	**2**	**0**	**0**	**2**
7	ITC6104	Industry Oriented Case Study	**0**	**0**	**2**	**1**
						21
		SEMESTER II				
1	ITC6201	Cloud Computing Technologies	**3**	**0**	**0**	**3**
2	GEC6201	Research Methodology for Engineers	**3**	**0**	**0**	**3**
3		Professional Electives #	**9**	**0**	**0**	**9**
4	ITC6202	Mobile Application Development	**1**	**0**	**2**	**2**
5	ITC6203	Software Development and Testing Lab	**0**	**0**	**2**	**1**
						18
		SEMESTER III				
1	ITC7101	Project - Phase I	**0**	**0**	**12**	**6***
2	ITC7102	Internet of Things	**3**	**0**	**0**	**3**
3		Professional Electives ##	**9**	**0**	**0**	**9**
4		General Elective###	**3**	**0**	**0**	**3**
						15
		SEMESTER IV				
1	ITC7101	Project Phase II	**0**	**0**	**36**	**18**
						6+18=24
		Total				**78**

***** Credits for Project Work – Phase I to be accounted along with Project Work – Phase II in IV Semester

\# Student has to take a minimum of 9 credits from the list of II semester Professional Electives.

\## Student has to take a minimum of 9 credits from the list of III semester Professional Electives.

\### Student has to take a minimum of 3 credits from the list of General Electives.

PROFESSIONAL ELECTIVE

Sl. No.	Course Code	Course Title	L	T	P	C
		SEMESTER II				
1	ITCY201	Multicore Programming	**3**	**0**	**0**	**3**
2	ITCY202	Software Requirements Management	**3**	**0**	**0**	**3**
3	ITCY203	Social Network Analysis	**3**	**0**	**0**	**3**
4	ITCY204	Multimedia Technology & Applications	**3**	**0**	**0**	**3**
5	ITCY205	Distributed Systems	**3**	**0**	**0**	**3**
6	ITCY206	IT Infrastructure Management	**3**	**0**	**0**	**3**
7	ITCY207	Applied Cryptography	**3**	**0**	**0**	**3**
8	ITCY208	Video Processing	**3**	**0**	**0**	**3**
9	ITCY209	High Speed Networks	**3**	**0**	**0**	**3**
10	CSCY01	Mobile Computing	**3**	**0**	**0**	**3**
11	CSCY10	Advanced Databases	**3**	**0**	**0**	**3**
12	CSCY54	Service Oriented Architecture	**3**	**0**	**0**	**3**
13	ITCY210	Virtualization Techniques	**2**	**0**	**0**	**2**
14	ITCY211	Programming with Hadoop	**0**	**0**	**2**	**1**
		SEMESTER III				
1	ITCY101	Machine Learning	**3**	**0**	**0**	**3**
2	ITCY102	Wireless Networks	**3**	**0**	**0**	**3**
3	ITCY103	Enterprise Resource Planning	**3**	**0**	**0**	**3**
4	ITCY104	Web Design & Management	**3**	**0**	**0**	**3**
5	ITCY105	Design Patterns	**3**	**0**	**0**	**3**
6	ITCY106	Data Warehousing and Data Mining	**3**	**0**	**0**	**3**
7	ITCY107	Wireless Mobile Communication	**3**	**0**	**0**	**3**
8	ITCY108	Software Metrics	**3**	**0**	**0**	**3**
9	ITCY109	Security in Big Data	**3**	**0**	**0**	**3**
10	ITCY110	Multimedia Communication and Networks	**3**	**0**	**0**	**3**
11	ITCY111	Adhoc and Sensor Networks	**3**	**0**	**0**	**3**
12	ITCY112	Ontology and Semantic Web	**3**	**0**	**0**	**3**
13	ITCY113	Software Project Management	**3**	**0**	**0**	**3**
14	ECCY001	Digital Image Processing	**3**	**0**	**0**	**3**
15	ITCY114	Human Computer Interface	**2**	**0**	**0**	**2**
16	ITCY115	Data Science Analytics	**2**	**0**	**0**	**2**

Sl. No.	Course Code	Course Title	L	T	P	C
17	ITCY116	Big Data Analytics Tool	**1**	**0**	**0**	**1**
18	ITCY117	Green Technology	**1**	**0**	**0**	**1**

GENERAL ELECTIVES FOR M.TECH PROGRAMMES

Sl. No.	Course Code	Course Title	L	T	P	C
1	GECY101	Project management	**3**	**0**	**0**	**3**
2	GECY102	Society, Technology & Sustainability	**3**	**0**	**0**	**3**
3	GECY103	Artificial Intelligence	**3**	**0**	**0**	**3**
4	GECY104	Green Computing	**3**	**0**	**0**	**3**
5	GECY105	Gaming Design	**3**	**0**	**0**	**3**
6	GECY106	Social Computing	**3**	**0**	**0**	**3**
7	GECY107	Soft Computing	**3**	**0**	**0**	**3**
8	GECY108	Embedded System Programming	**3**	**0**	**0**	**3**
9	GECY109	Principles of Sustainable Development	**3**	**0**	**0**	**3**
10	GECY110	Quantitative Techniques in Management	**3**	**0**	**0**	**3**
11	GECY111	Programming using MATLAB & SIMULINK	**1**	**0**	**2**	**2**
12	GECY112	JAVA Programming	**2**	**0**	**0**	**2**
13	GECY113	PYTHON Programming	**2**	**0**	**0**	**2**
14	GECY114	Intellectual Property Rights	**1**	**0**	**0**	**1**

SEMESTER I

ITC6101	COMPUTER FORENSICS AND INFORMATION SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To have a fundamental understanding of security techniques.
- To apply appropriate skills and knowledge to identify and solve security issues in network.
- To apply theoretical and practical knowledge to provide security for operating systems and database.
- To understand the basics of computer forensics.
- To apply theoretical and practical knowledge in computer forensics for investigation.

MODULE I CRYPTOGRAPHY 09

Security problem in computing – Elementary Cryptography – Symmetric Key Encryption Public Key Encryption – Uses of Encryption.

MODULE II PROGRAM & NETWORK SECURITY 09

Security Programs – Non-malicious program Errors – Virus and other Malicious Code – Targeted Malicious Code – Control against program threats - Threats in Networks – Network Security Controls – firewalls – Intrusion Detection Systems – Secure E-Mail.

MODULE III OPERATING SYSTEM AND DATABASE 09

Memory and Address Protection – File Protection Mechanisms – User Authentication – Trusted Operating Systems – Designing Trusted Operating Systems - Database Security Requirements – Multilevel Databases and Multilevel Security.

MODULE IV INTRODUCTION TO COMPUTER FORENSICS 09

History of Forensics – Computer Forensic Flaws and Risks – Rules of Computer Forensics – Legal issues – Digital Forensic Principles – Digital Environments – Digital Forensic Methodologies - Forensics Software and Hardware tools.

MODULE V AN OVERVIEW OF COMPUTER FORENSICS INVESTIGATION 09

Router Forensics and Network Forensics – An overview of Routers – Hacking Routers – Investigating Routers – Investigating Wireless Attacks – Basics of wireless – Wireless Penetration Testing – Direct Connections to Wireless Access Point – Wireless Connect to a Wireless Access Point.

Total Hours : 45

REFERENCES:

1. Charles B. Pfleeger, Shari Lawrence Pfleeger, Fourth Edition, “Security in Computing”, Pearson Education, 2006.
2. William Stallings, “Cryptography and Network Security – Principles and Practices”, Sixth Edition, Pearson Education 2013.
3. Anthony Reyes, Jack Wiles, “Cybercrime and Digital Forenscis”, Elseiver Publications, 2007.
4. John Sammons, “The Basics of Digital Forensics”, Elesvier 2012.
5. Linda Volonins, Reynalds Anzaldua, “Computer Forensics for dummies”, Wiley Publishing 2008.

OUTCOMES:

On completion of the course students will be able to :

- Have a fundamental understanding of cryptographic techniques.
- Display their competence in choosing securing mechanisms to protect the
- networks from threats.
- Apply security techniques to protect operating systems and databases.
- Have a fundamental understanding of computer forensics.
- Perform computer forensic investigation in an organization.

CSC6101 ADVANCED COMPUTER ARCHITECTURE

L	T	P	C
3	1	0	4

OBJECTIVES :

- To understand the functional requirements and their role in the system design
- To understand the various parameters that contribute to the performance of a computer system and the technology of achieving the best performance through these parameters
- To acquire essential knowledge to measure or predict system performance
- To understand how the memory hierarchy and optimization contribute to the performance of the system
- To understand the approaches in designing a new system through Instruction level parallel processing and to improve the Performance overcoming the hazards-meeting the functionality.
- To understand the data level parallel processing and Vector Processing for performance

MODULE I FUNDAMENTALS OF COMPUTER DESIGN 09+04

Functional Requirements and architecture - Measuring and reporting performance - Quantitative principles of computer design - Classifying instruction set architecture - Operands and operations for media and signal processing –Graphic processing - Encoding an instruction set - Example architecture - MIPS and TM32.

MODULE II MEMORY HIERARCHY DESIGN 09+03

Memory Hierarchy - Cache performance - Reducing cache miss penalty and miss rate - Reducing hit time - Main memory and performance - Memory technology and optimization-Virtual memory and Virtual Machine and protection.

MODULE III INSTRUCTION LEVEL PARALLELISM 09+03

Concepts of ILP - Pipelining and hazards –Compiler techniques for exposing ILP-Dynamic scheduling - Dynamic hardware prediction - Multiple issues - Hardware based speculation - Limitations of ILP - Case studies: lP6 Micro architecture. Compiler techniques for exposing ILP - Static branch prediction - Static multiple issues: VLIW - Advanced compiler support –Hardware VS software speculation.– Case study: Intel core i7 and ARM Cortex-A8

MODULE IV DATA-LEVEL PARALLELISM 09+02

Vector Architecture - SIMD Instruction Set Extensions for Multimedia - Graphic Processing Units- Detecting and Enhancing Loop Level Parallelism - Mobile verses Server GPUs - Case Studies

MODULE V THREAD LEVEL PARALLELISM 09+03

Centralized Symmetric and shared memory Multiprocessor architectures - Performance issues - Distributed Shared Memory architecture- Directory based architecture-Synchronization - Cache Coherence and memory consistency - Trends in processor design- Need for multi-core processor – difference between multiprocessor and multicore processor- Thread level processing – Simultaneous multi-threading.

Total Hours : 60

REFERENCES :

1. John L. Hennessey and David A. Patterson," Computer Architecture: A Quantitative Approach", Morgan Kaufmann / Elsevier, 5th Edition, 2012.
2. David A. Patterson and John L. Hennessy,Computer Organization and Design – The Hardware / Software Interface, 4th Edition, Morgan Kaufmann, Elsevier, 2009.
3. D.Sima, T. Fountain and P. Kacsuk, "Advanced Computer Architectures: A Design Space Approach", Addison Wesley, 2000.
4. Vincent P. Heuring and Harry F. Jordan, "Computer System Design and Architecture", Addison Wesley, 2nd Edition, 2004.
5. B.Govindarajalu, “Computer Architecture and Organization”, Tata McGraw Hill Education Pvt. Ltd., 2010.

OUTCOMES :

Students who complete this course will be able to

- Suggest the requirements for a new instruction set, to meet the functional requirement and to contribute to performance.
- To test the performance of a computer system
- To analyze changes in performance with various configurations and Memory Hierarchy
- Analyze code for instruction level Parallel Processing and modify the code for out of order execution for better performance
- Modify the code to exploit SIMD architecture and improve the performance of the system.

- Analyze how multi-threading in multiple processors and multi-core processors will share the resources for performance.

MAC6181	APPLIED ALGEBRA AND DISCRETE ALGORITHMS	L	T	P	C
		3	1	0	4

OBJECTIVES :

The aim of this course is to

- Make the students familiarize on the concepts of mathematical induction and codes.
- Motivate the students to solve problems applying techniques of logic.
- To have a knowledge on the concepts of Formal languages and Automata theory.
- Familiarize students with basics of graph theory.
- Train the students in applying the basic concepts of Cryptography.

MODULE I INTEGERS, COMPUTER ALGEBRA AND CODES 09+03

Integers – computer algebra versus numerical analysis – sums and products – mathematical induction – Binary, Hexadecimal, ASCII, Morse, Braille, Two out of Five and Hollerith Codes.

MODULE II LOGIC 09+03

Propositional logic – logical connectives – truth tables – normal forms (conjunctive and disjunctive) – solving word problems - predicate logic - universal and existential quantifiers - proof techniques – direct and indirect – proof by contradiction – applications.

MODULE III MODELING, COMPUTATION AND LANGUAGES 09+03

Finite state machines - deterministic and non-deterministic finite state machines - classes of grammars - phrase structure grammar - context sensitive - context-free - regular grammars - formal languages - ambiguity - Turing machines.

MODULE IV GRAPH THEORY 09+03

Multigraphs - applications of graph theory - classes of graphs - subgraphs and morphisms - Hamilton circuits – planar graphs – shortest paths and spanning.

MODULE V CIPHERS 09+03

Cryptography - cryptanalysis - substitution and permutation ciphers – block cipher – the playfair cipher – unbreakable ciphers – applications.

Total Hours : 60

TEXT BOOKS:

1. Hopcraft, J. E, R. Motwani and Ullman, J. D, 'Introduction to Automata theory, Languages and Computation', Narosa publishing House, 4th edition 2006.
2. Kenneth H. Rosen, "Discrete Mathematics and its Applications", 7th edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2015.
3. J.P. Tremblay and R. Manohar, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill, 1997.

REFERENCES:

1. JurajHromkovic, Theoretical Computer Science: Introduction to Automata, Computability, Complexity, Algorithmics, Randomization, Communication and Cryptography, Springer, 2003.
2. Darel W. Hardy, Fred Richman, Carol L. Walker, Applied Algebra: Codes, Ciphers and Discrete Algorithms, Second Edition (Discrete Mathematics and Its Applications), CRC Press, Newyork, 2009.
3. David Gries and Fred B. Schneider, A Logical Approach to Discrete Math, Springer, 3rdEdition, 1993.

OUTCOMES :

At the end of the course students will be able to

- Authenticate the correctness of the a given statement using mathematical induction.
- Test and analyze the logic of a program.
- Apply the concept of finite state machines and to generate languages.
- Analyze the types of graphs solve problems using the concepts of graph theory.
- Apply encryption and decryption techniques to send messages securely.

ITC6102 ADVANCED DATA STRUCTURES

L	T	P	C
3	0	2	4

OBJECTIVES:

- Introduce the student to the concept of data structures through abstract data structures including lists, stacks, queues, sets/maps, trees, and graphs.
- To introduce the fundamental concept of data structures and to emphasize the importance of data structures.
- To choose the appropriate data structure for a specified application.
- Solve problems using data structures such as linear lists, stacks, queues, hash tables, binary trees, heaps, binary search trees, and graphs and writing programs for these solutions.

MODULE I LISTS, STACKS & QUEUES 09

Abstract Data Types - The List ADT – Implementation of List - The Stack ADT – Stack Model - Implementation of Stacks – Applications - The Queue ADT – Queue Model - Array Implementation of Queues – Applications of Queues.

MODULE II TREES 10

Preliminaries – Binary Trees – Expression Trees - Binary Search Trees – AVL Trees – Splay Trees – Tree Traversals - B trees.

MODULE III HASHING & HEAPS 08

General idea of Hashing – Hash function – Separate Chaining – Hash Tables without Linked lists – Rehashing - Binary Heap – Applications of Priority Queues – d-Heaps.

MODULE IV SORTING & THE DISJOINT SETS CLASS 07

Insertion Sort – Shell Sort – Heap Sort – Merge Sort – Quick Sort – The Disjoint Sets Class – Equivalence Relations – The Dynamic Equivalence Problem – Basic Data Structure – Path Compression.

MODULE V ADVANCED DATA STRUCTURES: GRAPHS & TREES 11

Graphs - Definitions – Topological Sort – Shortest Path Algorithm – Network Flow Problems – Minimum Spanning Tree – Trees - Sets – Maps - Top Down Splay Trees – Red Black Trees – Treaps.

Total Hours : 45

REFERENCES:

1. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C++”, 4th Ed., Addison Wesley, 2012.
2. Horowitz, Sahni, Anderson-Freed, “Fundamentals of Data Structures in C”, 2nd edition, Universities Press, 2008.
3. Narasimha Karumanchi, “Data Structures And Algorithms Made Easy”, CareerMonk Publications, 2014.

OUTCOMES:

On completion of the course students will be able to :

- Discuss the abstract properties of various data structures such as lists, stacks and queues.
- Demonstrate the working of different types of trees.
- Outline the concepts of hashing and heaps.
- Explain the various sorting techniques and assess the working of disjoint sets class.
- Assess the different techniques employed by various types of graphs and trees.

CSC6103	COMPUTER NETWORKS AND MANAGEMENT	L	T	P	C
		2	0	2	3

OBJECTIVES :

Outline the basic concepts of computer networks

- Illustrate the operations of network traffic, congestion, controlling and Queuing delay models
- Compare different mechanism for Quality of Service and Internet protocols
- Describe the concept and architecture of Network Management
- Showcase the different network management protocols like SNMP and RMON
- Identify various network tools to simulate the working of connection oriented and connectionless networks.

MODULE I INTRODUCTION TO COMPUTER NETWORKS 09

Introduction – Reliable Transmission via Redundancy – Reliable transmission by retransmission - Routing and addressing – Link Layer Protocols and Technologies – Quality of Service overview

MODULE II TRANSMISSION CONTROL PROTOCOL (TCP) AND SWITCHING AND QUEUING DELAY MODELS 09

Introduction to UDP and TCP – User Datagram Protocol (UDP) – TCP and Reliable Byte Stream Service – Congestion Control – Fairness – Recent TCP Versions – TCP Wireless Links - Packet Switching in Routers - Queuing Model – Networks of Queues

MODULE III MECHANISMS FOR QUALITY OF SERVICE AND INTERNET PROTOCOLS 09

Queue Scheduling – Policing – Active Queue Management – MPLS - Internet Protocol Version (IPV6) – Routing Protocols – Address Translation Protocols – Domain Name System (DNS) – Network Management Protocols – Network Tools

MODULE IV NETWORK MANAGEMENT AND SNMP 09

Network Management : goals , Organization and Functions – Network Management Architecture and organization – Network Management perspective – NMS platform – Current Status & future of Network Management – SNMP V1 Network Management- Basic Foundation standards, Models and languages – Organization and information Models - Communication and functional Models – SNMP V2 – SNPV3

MODULE V RMON, NETWORK MANAGEMENT TOOLS AND APPLICATIONS 09

Remote Monitoring – RMON SMI & MIB –RMON1-RMON2-ATM Remote Monitoring – A Case Study of Internet Traffic using RMON – Network Management Tools, Systems and Engineering –System utilities for Management – Network Statistics Measurement Systems – MIB Engineering – NMS Design – Network Management Applications

Total Hours : 45

REFERENCES :

1. Ivan Marsic , “Computer Networks Performance and Quality of Service” , Rutgers University, New Brunswick, New Jersey, 1st edition, FREE PDF, ISBN-10: N/A and ISBN-13-N/A, http://www.ece.rutgers.edu/~marsic/books/CN/ ,2013.
2. Mani Subramanian “Network Management : Principles and Practice “,2nd edition, Pearson Edition, ISBN-13: 978-8131734049, ISBN-10: 8131734048, 2010.
3. Olivier Bonaventure **,“Computer Networking : Principles, Protocols and Practice”**
4. By Creative Commons Attribution (CC BY) ISBN: 978-1-365-18583-0, 2011.
5. Larry Peterson and Bruce S Davis “Computer Networks :A System Approach” 5th
6. Edition , Elsevier , 2014,ISBN-13: 978-0123850591, ISBN-10: 0123850592, 2014.
7. Douglas E Comer, “Internetworking with TCP/IP, Principles, Protocols and Architecture” 6th Edition, PHI,ISBN-13: 978-0136085300, ISBN-10: 013608530X, 2014.

OUTCOMES :

Students who complete this course will be able to

- Describe the network services, protocols and architectures
- Identify the different congestion control techniques
- Develop effective communication mechanisms using techniques like connection establishment, queuing theory, recovery Etc.
- Apply SNMP and RMON for Managing Network.
- Access MIBS from devices using SNMP on a workstation
- Analyze and interpret the data provided by an NMS and take suitable actions

ITC6103	SOFTWARE DEVELOPMENT METHODOLOGIES	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To learn various software process model
- To understand the analysis and design concept
- To learn how to improve the software development process

MODULE I SOFTWARE PROCESS MODELS 10

Software Life Span Models – Software Technologies – Software Models – Specialized Process Models – The Unified Process – Agile Development – Software Processes – Team Iterative Processes – Initial Development – Final Stages

MODULE II SOFTWARE REQUIREMENTS ANALYSIS & DESIGN 10

Unified Modeling Language – Object Oriented Analysis Process: Identifying Classes – Object Analysis: Classification – Identifying Object Relationships, Attributes and Methods – Designing Classes – Design Pattern

MODULE III SOFTWARE PROCESS IMPROVEMENT 10

Testing Conventional Applications – Testing Web Applications – Software Process Improvement – Emerging Trends in Software Engineering

Total Hours : 30

REFERENCES:

1. Roger S. Pressman, “software engineering” 7th edition, Mc Graw Hill Education, 2014
2. Vaclav Rajlich, “Software Engineering: The Current Practice”, CRC Press, 2012
3. Ali Bahrami, "Object Oriented Systems Development", Tata McGraw-Hill, 1999.

OUTCOMES:

On completion of the course students will be able to:

- Choose most appropriate software process model
- Analyze the given requirements and prepare the design document
- Outline the different methods for software process improvement

ITC6104	INDUSTRY ORIENTED CASE STUDY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To give students the experience of writing an industry oriented case study that meets the technical requirements of a research journal.
- To impress upon the student an understanding of research issues in industries and importance of research in education.
- To give students the experience of evaluating new and current knowledge.

COURSE DESCRIPTION:

In this course the student will prepare a written case study. The selection of an appropriate case, a thorough review of the elements of a case study report, how to review the appropriate literature for the reference section, and the systematic construction of the report will be covered in a combination of lecture and self study format. It is expected that the case study will meet the technical requirements for consideration to publish in a research journal. This industry oriented case study course is intended to give the student hands-on experience writing a case study report coupled with an appreciation of the importance, necessity and benefits of case study reporting to their professional experience.

INDUSTRY ORIENTED CASE STUDY:

- Introduction to the Industry Oriented Case Study Research Report - **Objectives**
- Literature survey on research issues in industries - **Strategic research and analysis**
- Writing research proposal – Case study for research issue in Industry - **Approach**
- Review of a Case Study Research Report – **Deliverables & Impacts**
- Presentation on Case Study Report

REFERENCES:

1. https://www.griffith.edu.au/__data/assets/pdf_file/0020/320177/writing-a-case-study.pdf
2. http://www.martin-flatin.org/papers/ecows2004.pdf
3. http://www.tcs.com/resources/case_studies/Pages/default.aspx
4. http://www.tcs.com/research/Pages/TCS-IoT-Offerings-Platform.aspx
5. http://www.tcs.com/resources/white_papers/Pages/default.aspx

6. http://www.tcs.com/resources/case_studies/pages/tcs_on-demand_watermarking_system_studio.aspx

OUTCOMES:

On completion of the course students will be able to:

- Perform a literature review.
- Develop the intervention and outcomes components of the case study report.
- Construct a case study report with various sections.
- Recognize the importance of ethics in the conduct of research in industries.
- Prepare properly a formatted reference.
- Choose an appropriate journal for submission of case study work.

SEMESTER II

ITC6201	CLOUD COMPUTING TECHNOLOGIES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To gain understanding of the basic concepts of cloud computing.
- To learn various types of cloud services, technologies and service providers.
- To know the design challenges of cloud infrastructure.
- To have knowledge about different programming models and cloud software.
- To understand the privacy and security issues in cloud environments.

MODULE I CLOUD COMPUTING BASICS 08

Introduction to Cloud Computing – Cloud computing reference model- Essential Characteristics - Benefits and challenges of cloud computing- Cloud Delivery Models - Deployment models -Cloud computing vendors

MODULE II CLOUD COMPUTING TECHNOLOGY 10

Virtualization-Types of virtualization-Virtualization and cloud computing- Client- thin, thick, mobile clients- Cloud Providers and Consumers-Various Cloud Services- Accessing the Cloud- Frameworks- AJAX, Python- Web Hosting Services- Web Applications- Web API's and Web Browsers.

MODULE III CLOUD INFRASTRUCTURE 09

Architectural Design of Compute and Storage Clouds – Layered Cloud Architecture Development– Design Challenges - Inter Cloud Resource Management – Resource Provisioning and Platform Deployment – Global Exchange of Cloud Resources.

MODULE IV PROGRAMMING MODEL 10

Map Reduce programming model - Map reduce and extensions - Relational operations – Parallel Efficiency of Map Reduce- Cloud File Systems - GFS and HDFS –Cloud platforms in Industry – Google App Engine, Amazon AWS- Cloud Software Environments -Eucalyptus, Open Nebula.

MODULE V SECURITY IN CLOUD 08

Cloud security fundamentals- Privacy and Security in cloud - Software-as-a-Service Security Risk Management – Security Monitoring – Security Architecture Design –

Data Security – Application Security – Virtual Machine Security.

Total Hours: 45

REFERENCES:

1. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, “Cloud Computing: A Practical Approach “ , McGraw-Hill, 2010.
2. John W.Rittinghouse and James F.Ransome, “Cloud Computing: Implementation, Management, and Security”, CRC Press, 2010.
3. George Reese, “Cloud Application Architectures: Building Applications and Infrastructure in the Cloud” O'Reilly, 2009.
4. Rajkumar Buyya, James Broberg, Andrzej Goscinski, “Cloud Computing Principles and Paradigms” John Wiley & Sons, Inc Publications, 2011
5. Rajkumar Buyya, Christian Vecchiola, S.Thamarai Selvi, “Mastering Cloud Computing”, McGraw-Hill Education Private Ltd.,2013
6. Tim Malhar, S.Kumaraswammy, Shahed Latif , ” Cloud Security & Privacy”, O’Reilly media , 2009.

OUTCOMES:

On completion of the course students will be able to:

- Articulate the main concepts, key technologies, strengths and limitations of cloud computing
- Identify the architecture, infrastructure and delivery models of cloud computing
- Discuss the cloud technologies including virtualization and web based technologies.
- Explain the cloud file systems and their applications in industry.
- Explain the core issues of cloud computing such as security, privacy and interoperability

GEC6201	RESEARCH METHODOLOGY FOR ENGINEERS	L	T	P	C
		3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To provide a perspective on research to the scholars
- To educate on the research conceptions for designing the research
- To impart knowledge on statistical techniques for hypothesis construction
- To gain knowledge on methods of data analysis and interpretation
- To learn about the effective communication of research finding

MODULE I RESEARCH PROBLEM 07

Research – objectives – types, Research process, Solving engineering problems, Identification of research topic, Formulation of research problem, Literature survey and review.

MODULE II HYPOTHESIS FORMULATION 08

Research design – meaning and need – basic concepts, Different research designs, Experimental design – principle – important experimental designs, Design of experimental setup, Mathematical modeling, Simulation – validation and experimentation, Dimensional analysis and similitude.

MODULE III STATISTICAL TECHNIQUES 12

Statistics in research – concept of probability – popular distributions –Hypothesis testing- sample design- Design of experiments – factorial designs -– orthogonal arrays- ANOM - ANOVA - Multivariate analysis - Use of optimization techniques – traditional methods – evolutionary optimization techniques –Transportation model.

MODULE IV STATISTICAL ANALYSIS OF DATA 10

Research Data analysis – interpretation of results – correlation with scientific facts- Accuracy and precision – error analysis, limitations - Curve fitting, Correlation and regression.

MODULE V RESEARCH REPORT 08

Purpose of written report – audience, synopsis writing, preparing papers for International journals, Thesis writing – organization of contents – style of writing – graphs and charts – referencing, Oral presentation and defence, Ethics in research, Patenting, Intellectual Property Rights.

Total Hours: 45

REFERENCES:

1. Ganesan R., Research Methodology for Engineers, MJP Publishers, Chennai, 2011.
2. Ernest O., Doebelin, Engineering Experimentation: planning, execution, reporting, McGraw Hill International edition, 1995.
3. George E. Dieter., Engineering Design, McGraw Hill – International edition, 2000.
4. Madhav S. Phadke, Quality Engineering using Robust Design, Printice Hall, Englewood Cliffs, New Jersey, 1989.
5. Kothari C.R., Research Methodology – Methods and Techniques, New Age International (P) Ltd, New Delhi, 2003.
6. Kalyanmoy Deb., “Genetic Algorithms for optimization”, KanGAL report, No.2001002.
7. Holeman, J.P., Experimental methods for Engineers, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 2007.
8. Govt. of India, Intellectual Property Laws; Acts, Rules & Regulations, Universal Law Publishing Co. Pvt. Ltd., New Delhi 2010.
9. University of New South Wales, “How to write a Ph.D. Thesis” Sydney, Australia, Science @ Unsw.
10. Shannon. R.E., System Simulation: the art and science, Printice Hall Inc, Englewood Cliffs, N.J.1995.
11. Scheffer. R.L. and James T. Mc Clave, Probability and Statistics for Engineers, PWS – Kent Publishers Co., Boston, USA, 1990.

COURSE OUTCOMES:

Students should be able to

- Formulate the research problem
- Design and Analyse the research methodology
- Construct and optimize the research hypothesis
- Analyse and interpret the data
- Report the research findings

ITC6202 MOBILE APPLICATION DEVELOPMENT

L	T	P	C
1	0	2	2

OBJECTIVES:

- To know the importance of mobile applications.
- To learn the fundamentals of Android application development.
- To learn the fundamentals of iOS application development.
- To develop simple mobile applications using Android and iOS.

THEORETICAL STUDY

ANDROID APPLICATION DEVELOPMENT **07**

Android Basics - Android Architecture - Application Framework - The Manifest file - Libraries – Developing - Managing Virtual Devices - Building and Running – Debugging – Testing - Building Blocks - Application Components - Content Providers - Broadcast Receiver - Processes and Threads - Data storage - SQLite Databases - Localization - User Interface.

iOS APPLICATION DEVELOPMENT **08**

iOS Basics - iOS Architecture - Integrated development Tools - Objective C - Frame work and Libraries - Project templates - Resource & Application Settings - Views & Controls - Debugging & Running - Building Block Approach - Application Life cycle - MVC – Pattern - View - Data Management - Core Data - Application Storage - External Storage - Memory Management - UI Design - Design Tools - Interface Builders - Story board - View Controllers - Drawing model – Windows - Event Handling - View data Source and delegates.

LABORATORY PRACTICE **30**

- Developing Simple Android Applications (2 exercises)
- Developing Simple iOS Applications (2 exercises)
- Mobile application development in Android and iOS. (Students can select their own problem to develop an Application)

  Sample applications
  - Scientific calculator
  - Home Automation
  - Live Chat

- Currency converter
- To do list
- Games

Total Hours : 45

REFERENCES:

1. Frank Ableson.W, Robi Sen, Chris King, Enrique Ortiz, “Android in Action”, Dreamtech Press, 2012.
2. DiMarzio. J.F. “Android: A Programmer’s Guide”, McGraw Hill, 2008.
3. Rob Napier, Mugunth kumar, “iOS 7 Programming”, Wiley, 2014.
4. Erica Sadun, “The iOS 5 Developer’s Cookbook”, Pearson, Third Edition, 2012.

OUTCOMES:

On completion of the course students will be able to :

- Describe the limitations and challenges of working in a mobile and wireless environment as well as the commercial and research opportunities presented by these technologies.
- Apply the different types of application models/architectures used to develop mobile software applications.
- Describe the components and structure of a mobile development frameworks (Android SDK and Eclipse Android Development Tools (ADT)) and learn how and when to apply the different components to develop a working system.
- Work within the capabilities and limitations of a range of mobile computing devices.
- Design, implement and deploy mobile applications using an appropriate software development environment.

ITC6203	SOFTWARE DEVELOPMENT AND TESTING LAB	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To practice software engineering concepts using automated tools.
- To practice object oriented system development methodologies.

List of Sample Exercises

1. Health Insurance Management System
2. Mobile Recharging System
3. Tour Management System
4. Conference Management System
5. E-Banking System

Develop the following for the above applications using Object Oriented System Development Methodologies:

1.

Total Hours : 30

OUTCOMES:

On completion of the course students will be able to :

- Develop any software in a systematic manner.
- To test software using automated tools.

SEMESTER III

ITC7102	INTERNET OF THINGS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the basics of Internet of things.
- Utilize IoT features and create applications based on IoT protocols.
- To discuss the features of cloud of things and web of things.
- Outline the embedded prototyping and design and apply the use of Devices in IoT Technology.
- To explain Real World IoT Design and compile the same.

MODULE I INTRODUCTION 10

Definitions and Functional Requirements –Motivation – Architecture - Web 3.0 View of IoT– Ubiquitous IoT Applications – Four Pillars of IoT – DNA of IoT - The Toolkit Approach for End-user Participation in the Internet of Things. Middleware for IoT: Overview – Communication middleware for IoT.

MODULE II IOT PROTOCOLS 09

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus – KNX – ZigBee Architecture – Network layer – APS layer.

MODULE III CLOUD OF THINGS 08

Cloud of Things: Grid/SOA and Cloud Computing – Cloud Middleware – Cloud Standards – Cloud Providers and Systems – Mobile Cloud Computing – The Cloud of Things Architecture **–** Web of Things - Web of Things versus Internet of Things – Two Pillars of the Web – Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence.

MODULE IV DESIGN PRINCIPLES OF CONNECTED DEVICES 09

Technology for design –Privacy in storing data – Internet principles for connected devices-Prototypes and production –Changing embedded platform - open source

versus closed source- prototyping embedded devices – Electronics- Sensors – Actuators – Arduino – Raspberry PI – Beagle Bone Black – Electric Imp.

MODULE V PROTOTYPING ONLINE COMPONENTS AND EMBEDDED CODING 09

Sketch – Iterate and Explore – Preparation of physical prototype – Getting started with API – Writing New API - Writing New API – Real Time Reactions – Other Protocols - Techniques for Writing Embedded code –Memory Management – Performance and Battery Life – Libraries and Debugging.

Total Hours : 45

REFERENCES:

1. The Internet of Things in the Cloud: A Middleware Perspective - Honbo Zhou – CRC Press –2012
2. Architecting the Internet of Things - Dieter Uckelmann; Mark Harrison; Florian Michahelles-(Eds.) – Springer – 2011.
3. Designing internet of things –Adrian McEwen & Hakim Cassimally – Jhon Wiley and sons – 2014.
4. Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Key applications and Protocols”, Wiley, 2012.

OUTCOMES:

On completion of the course students will be able to :

- Identify and design the new models for market strategic interaction
- Analyze various protocols for IoT
- Analyze and compare Cloud of things and Web of things
- Design a middleware for IoT
- Analyze and design different models for embedded devices.

PROFESSIONAL ELECTIVES
SEMESTER II

ITCY201	MULTICORE PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the recent trends in the field of Computer Architecture and identify performance related parameters.
- To appreciate the need for parallel processing.
- To expose the students to the problems related to multiprocessing
- To expose the students to warehouse-scale and embedded architectures
- To understand the different types of multicore architectures.

MODULE I FUNDAMENTALS OF QUANTITATIVE DESIGN & ANALYSIS 09

Classes of Computers – Trends in Technology, Power, Energy and Cost – Dependability – Measuring, Reporting and Summarizing Performance – Quantitative Principles of Computer Design – Classes of Parallelism - ILP, DLP, TLP and RLP - Multithreading - SMT and CMP Architectures – Limitations of Single Core Processors - The Multicore era – Case Studies of Multicore Architectures.

MODULE II DLP IN VECTOR, SIMD AND GPU ARCHITECTURES 09

Vector Architecture - SIMD Instruction Set Extensions for Multimedia – Graphics Processing Units - Detecting and Enhancing Loop Level Parallelism - Case Studies.

MODULE III TLP AND MULTIPROCESSORS 09

Symmetric and Distributed Shared Memory Architectures – Cache Coherence Issues -performance Issues – Synchronization Issues – Models of Memory Consistency – Interconnection Networks – Buses, Crossbar and Multi-stage Interconnection Networks.

MODULE IV RLP AND DLP IN WAREHOUSE-SCALE ARCHITECTURES 09

Programming Models and Workloads for Warehouse-Scale Computers – Architectures for Warehouse-Scale Computing – Physical Infrastructure and Costs – Cloud Computing – Case Studies.

MODULE V ARCHITECTURES FOR EMBEDDED SYSTEMS 09

Features and Requirements of Embedded Systems – Signal Processing and Embedded Applications – The Digital Signal Processor – Embedded Multiprocessors - Case Studies.

Total Hours : 45

REFERENCES:

1. John L. Hennessey and David A. Patterson, “Computer Architecture – A Quantitative Approach”, Morgan Kaufmann / Elsevier, 5th edition, 2012.
2. Shameem Akhter and Jason Roberts, “Multi-core Programming”, Intel Press, 2006.
3. Michael J Quinn, “Parallel programming in C with MPI and OpenMP”, Tata McGraw Hill, 2003.
4. Wesley Petersen and Peter Arbenz, “Introduction to Parallel Computing”, Oxford University Press, 2004.

OUTCOMES:

On completion of the course students will be able to :

- Identify the limitations of Instruction-level parallelism and the need for multi-core
- architectures.
- Analyze the salient features of different multicore architectures and how they exploit
- Parallelism.
- Critically analyze the different types of inter connection networks.
- Discuss the architecture of GPUs, warehouse-scale computers and embedded processors
- Solve the issues related to multiprocessing and suggest solutions.

ITCY202 SOFTWARE REQUIREMENTS MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To overview about the requirements engineering.
- To learn requirements elicitation technique.
- To study about analyzing the requirements.
- To develop requirements specification document.
- To learn requirement validation technique.

MODULE I REQUIREMENTS ENGINEERING OVERVIEW 09

Introduction to Requirements Managements – Requirements and Software Life Cycle – Requirements from Customer's Perspective - .Good Practice for Requirements Engineering – The Business Analyst

MODULE II REQUIREMENTS ELICITATION 09

Establishing the Business Requirements – Finding the Voice of the User – Requirements Elicitation – Interviewing – Requirements Workshop – Brainstorming and Idea Reduction – Storyboarding

MODULE III REQUIREMENTS ANALYSIS 09

Identification of Functional and Non Functional Requirements – Understanding User Requirements - The Five Steps in Problem Analysis – Business Modeling – A Use Case Primer – Organizing Requirements Information

MODULE IV REQUIREMENTS DEVELOPMENT 09

The Vision Document – Establishing Project Scope – Playing by the Rules – Documenting the Requirements – Writing Excellent Documents – A Picture is worth 1024 Words – Specifying Data Requirements -

MODULE V REQUIREMENTS VALIDATION & MANAGEMENT 09

Risk Reduction Through Prototyping – Setting Requirements Priorities – Validating Requirements – Requirements Management Practice – Change Happens – Tools for Requirements Engineering

Total Hours : 45

REFERENCES:

1. Karl Eugene Wiegers, “Software Requirements”, Microsoft Press, 2013.
2. Dean Leffingwell, Don Widrig, “Managing Software Requirements,: A Use Case Approach”, Second Edition Addison Wesley, 2003.
3. Ian Sommerville, Pete Sawyer, “Requirements Engineering: A Good Practice Guide”, John Wiley and sons, 2009.
4. Ian Graham, “Requirements Engineering and Rapid Development”, Addison Wesley, 1998.

OUTCOMES:

On completion of the course students will be able to :

- Outline the fundamental concepts of requirements engineering
- Elucidate the complete software requirements
- Analyze the software requirements
- Prepare a Software Requirements Specification document
- Validate the software requirements

ITCY203 SOCIAL NETWORK ANALYSIS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the components of the social network
- To model and visualize the social network.
- To mine the users in the social network..
- To understand the evolution of the social network.
- To mine the interest of the user.

MODULE I INTRODUCTION 09

Introduction to Web – Limitations of current Web – Development of Semantic Web – Emergence of the Social Web – Statistical properties of Social Networks – Network analysis – Development of Social Network Analysis – key concepts and measures in network analysis – Discussion networks – Blogs and online communities – Web – based networks.

MODULE II MODELING AND VISUALIZATION 09

Visualizing Online Social Networks – A Taxonomy of Visualizations – Graph Representation – Centrality Clustering – Node-Edge Diagrams – Visualizing Social Networks with Matrix-Based representations – Node-link Diagrams – Hybrid Representations – Modeling and aggregating social network data – Random walks and their applications – Use of Hadoop and Map Reduce – Ontological representation of social individuals and relationships.

MODULE III INVESTIGATION 09

Aggregating and reasoning with social network data, Advanced Representations – Extracting evolution of Web community from a series b Archive – Detecting Communities in Social Networks – Evaluating Communities – Core Methods for Community Dtection & Mining – Applications of Community Mining Algorithms – Node Classification in Social Networks.

MODULE IV EVOLUTION 9

Evolution in Social Networks – Framework – Tracing Smoothly Evolving Communities – Models and Algorithms for Social Influence Analysis – Inflence Related Statistics – Social Similarity and Influence – Influence Maximization in Viral Marketing – Algorithms and Systems for Expert Location in Social Networks – Expert Location without Graph Constraints – with Score propagation – Expert Team Formation – Link Prediction in Social Networks – Feature based Link

Prediction – Bayesian Probablistic Models – Probablistic Relational Models.

MODULE V LAWS AND ACTS 09

Text Mining in Social Networks – Opinion extraction – Sentiment classification and clustering – Temporal sentiment analysis – Irony detection in opinion mining – Wish analysis – Product review mining – Review Classification – Tracking sentiments towards topics over time.

Total Hours : 45

REFERENCES:

1. Charu C. Aggarwal, “Social Network Dta Analytics”, Springer, 2011.
2. Peter Mika, “Social Networks and the Semantic Web”, Springer, First Edition, 2007.
3. Borko Furht, “Handbook of Social Network Technologies and Applications”, Springer, First Edition, 2010.
4. Guandong Xu, Yanchun Zhang and Lin Li, “Web Mining and Social Networking – Techniques and applications”, Springer, First Edition, 2011.
5. Giles, Mark Smith, John Yen, “ Advances in Social Network Mining and Analysis”, Springer 2010.
6. Ajith Abraham, Aboul Ella Hassanien, Vaclav Snasel, “Computational Social Network Analysis: Trends, Tools and Research Advances”, Springer, 2009.

OUTCOMES:

Upon completion of the course, the student will be able to

- Work on the internal components of the social network.
- Model and visualize the social network.
- Mine the behavior of the users in the social network.
- Predict the possible next outcome of the social network.
- Mine the opinion of the user.

ITCY204	MULTIMEDIA TECHNOLOGY AND APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce students to various multimedia elements along with the theoretical underpinnings and to expose them to integration of these elements.
- Gives the technological knowledge necessary for creating multimedia content for the web, video, DVD and cellular phones, 2D and 3D graphics, sound and programming.
- Provides an insight into digital technologies, media authoring, storage and distribution tools.
- Keep up with the current development of contemporary systems of multimedia technology.

MODULE I MULTIMEDIA COMPONENTS 09

Introduction to Multimedia: Multimedia Elements - Multimedia System Architecture - Evolving technologies for Multimedia - Defining objects for Multimedia systems - Multimedia Data interface standards - Multimedia Databases.

MODULE II MULTIMEDIA COMPONENTS 09

Overview of Text and Character representations - Audio: Basic Concepts - Data acquisition and digitization - Audio Formats - Image : Image Representation Formats and compression techniques - Color Schemes - Video : Analogue and Digital Video - Recording Formats and Standards - Transmission of Video Signals - Video Capture - Video compression techniques.

MODULE III DOCUMENT ARCHITECTURE & CONTENT MANAGEMENT 09

Content Management: Content Design and Development - General Design Principles - Hypertext Concepts - Open Document Architecture (ODA) - Multimedia and Hypermedia Coding Expert Group (MHEG) - Standard Generalized Markup Language (SGML) - Document Type Definition (DTD) - Hypertext Markup Language (HTML) in Web Publishing.

MODULE IV MULTIMEDIA NETWORKS 09

- Multimedia Networks: Basics of Multimedia Networks - Multimedia Network Communications and Applications - Quality of Multimedia Data Transmission - Multimedia over IP - Multimedia over ATM Networks - Transport of MPEG-4 - Media-on-Demand (MOD).

MODULE V APPLICATIONS 09

Multimedia in the Real World: Video conferencing - Virtual reality - Interactive video - video on demand - Training and Education - Kiosks - Image Processing - The Multimedia Office - Multimedia in the Home - Case Study: Application for Industrial - Educational and Medical Domains.

Total Hours : 45

REFERENCES:

1. Ralf Steinmetz and Klara Nahrstedt, “Multimedia:Computing, Communications and Applications”, Prentice - Hall, India. 2008.
2. Vaughan T, Multimedia, Tata McGraw Hill, Seventh Edition ,2008
3. Ze-Nian Li and Mark S. Drew, Fundamentals of Multimedia, Pearson Education, 2008.
4. Andleigh P.K., Thakrar K., Multimedia Systems Design (PHI).2003.

OUTCOMES:

On completion of the course students will be able to :

- Outline and critically analyze the different elements of multimedia systems
- Apply and demonstrate the features of text, audio, images, video and active contents of multimedia elements.
- Outline the concepts of document architecture and develop user friendly web pages using HTML and DTD.
- Discuss the multimedia network communications and applications.
- Apply the various applications of multimedia.

ITCY205 DISTRIBUTED SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the importance of communication in distributed environment and the actual implementation of various communication mechanisms.
- To study how a distributed operating system works and how it differs from the single processor OS.
- To learn how to manage the resources in a distributed environment.
- To learn how to make a distributed systems fault tolerant.
- To study how the above-mentioned techniques have been used in actual, real-life distributed systems.

MODULE I COMMUNICATION IN DISTRIBUTED ENVIRONMENT 09

Introduction - Client - Server Paradigm - Threads in distributed Systems - Remote Procedure Call - Remote Object Invocation - Message-Oriented Communication - Unicasting - Group Communication - Reliable and Unreliable Multicasting.

MODULE II DISTRIBUTED OPERATING SYSTEMS 09

Issues in Distributed Operating System - Lamport's Logical clock - Vector Clock - Causal Ordering - Global States - Election Algorithms - Distributed Mutual Exclusion - Distributed Transaction - Distribute Deadlock

MODULE III DISTRIBUTED SHARED MEMORY 09

Introduction - Data - Centric Consistency Models - Client - Centric Consistency Models - Distribution Protocols - Consistency Protocols - IVY - Munin - Atomic Transaction.

MODULE IV FAULT TOLERENCE & DISTRIBUTED FILE SYSTEM 09

Introduction to fault Tolerance - Distributed Commit Protocol - Distributed File System Architecture - Issues in Distributed File Systems - Sun NFS

MODULE V CASE STUDIES 09

Distributed Object - Based System - CORBA - COM - Distributed Coordination Based System – JINI - Distributed Web Based System - Google.

Total Hours : 45

REFERENCES:

1. A.S. Tanenbaum, M. Van Steen, “Distributed Systems: Principles and Paradigms”, Pearson Education, 2004.
2. George Coulouris, Jean Dollimore, Tim Kindberg, “Distributed Systems Concepts and Design”, Third Edition, Pearson Education Asia, 2002.
3. Mukesh Singhal, “Advanced Concepts in Operating Systems”, McGraw Hill Series in Computer Science, 1994.
4. M.L.Liu, “Distributed Computing Principles and Applications”, Pearson Addison Wesley, 2004.

OUTCOMES:

On completion of the course students will be able to :

- On completion of the programme students will be able to :
- Identify the communication issues in the distributed systems and how it can be used in remote procedure calls, remote objects and message-oriented communication.
- Analyze the principles of distributed operating systems through various algorithms.
- Select suitable consistency model for distributed shared memory.
- Predict the faults and find the solutions in distributed systems.
- Create the distributed file system architecture for real world needs.
- Compare and demonstrate various case studies in distributed systems.

ITCY206 IT INFRASTRUCTURE AND MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To familiarize with overview of IT infrastructure management.
- To analyze IT service management with different architectures
- To discuss and practice about storage, backup and recovery in an organization.
- To utilize security techniques and patterns available in market.
- To explore recent trends and apply it in real time.

MODULE I INTRODUCTION 09

Introduction – Network basics – Computer basics - IT Infrastructure Management – Challenges in IT infrastructure – Design issues of IT organization and IT Infrastructure – Determining customer's requirement- IT Systems management Process – Systems Management Building Blocks-IT Service Management Process – Patterns for IT Systems Management –Information System design process – IT Infrastructure Library (ITIL).

MODULE II IT SERVICE MANAGEMENT 09

Service level management – Financial Management – IT service continuity Management – capacity Management – Availability Management – Configuration Management – Incident Management – Change Management – Release Management – IT service management architecture – Overview of ITSM Architecture – Technology Infrastructure – Physical facilities – Network – Hardware -Virtualization Platforms–ITIL Service Architecture - Service Lifecycles – IT-Service Lifecycle Overview – Setting Objectives – Utility and Warranty

MODULE III DATA STORAGE AND NETWORKING MANAGEMENT 09

Introduction to storage – Backup and Storage – Archive and Retrieve – Disaster Recovery – Space Management – Bare Machine Recovery (BMR) – Data Retention – Storage Devices – RAID – Fiber Channel SAN-Replication Technologies – Storage Virtualization – Backup and Recovery management- Back Architecture and Policies – Storage management – Capacity and Performance Management-Management protocols and Interfaces.

MODULE IV SECURITY MANAGEMENT 09

Introduction - Computer Security – Internet Security –Risk Management- CIA Classification-Countermeasures based on CIA-Cryptography-Hash functions-Theft of information- Identity Management- Installing malicious softwares- Intrusion

Detection -Social Engineering-Phishing and Bating –Security Patterns -Layered Security- Ethical Hacking - IPR – Privacy and law – Computer Forensics – Cyber Crimes.

MODULE V TRENDS IN IT INFRASTRUCTURE 09

Cloud Computing – The cloud Model – Deployment Models – Service Models – IaaS – PaaS – SaaS – DaaS – Green IT – Data Centers – Enhance efficiency of Data center – BYOD – Big Data – DFS – GFS – HDFS – Hadoop – Configuration and Scheduling– Global system for mobile communication using cloud- Case study of networking using emerging trends - Deployment using Cloud / Hadoop / Mobile communications.

Total Hours : 45

REFERENCES:

1. Prof Phalguni Gupta, Mr. Surya Prakash, IT Infrastructure and its Management , Tata McGraw Publications, New Delhi, 2010 .
2. Sjaak Laan,Infrastructure Architecture - Infrastructure Building Blocks and Concepts Second Edition, Lulu Press Inc, 2013.
3. Nigel Poulton, Data Storage Networking: Real World Skills for the CompTIA Storage+ Certification and Beyond , Sybex, Jhon Wiley and Sons, 2014.
4. Chris Britton, Peter Bye, IT Architectures and Middleware: Strategies for Building Large, Integrated Systems, 2nd Edition, Addison wesley, 2004.
5. Randy A. Steinberg, Architecting ITSM: A Reference of Configuration Items and Building Blocks for a Comprehensive IT Service Management Infrastructure, Trafford publishing, Novemenr 2014.
6. Lars Dibbern, IT Service Management using ITIL® and UML, 60CO Press, 2nd edition, 2016.
7. Clyde Bank Technology, ITIL For Beginners - The Complete Beginner's Guide To ITIL (ITIL, ITIL Foundation, ITIL Service Operation) ,ClydeBank media , 2011.

OUTCOMES:

On completion of the course students will be able to:

- To discuss the introduction of IT infrastructure management.
- To outline different service architectures and asses each one of them.
- To predict the storage techniques for different infrastructures.
- To utilize the security techniques and apply it in appropriate places.
- To analyze the recent trends in IT infrastructure and apply it in real time case study

ITCY207 APPLIED CRYPTOGRAPHY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the classical cryptographic algorithms.
- To study the block cipher and advanced encryption standard.
- To learn RSA cryptosystem and issues in key distribution.
- To analyze the identification and authentication mechanisms.
- To understand the various secret sharing schemes.

MODULE I CLASSICAL CRYPTOGRAPHY 09

The Shift Cipher, The Substitution Cipher, The Affine Cipher Cryptanalysis-Cryptanalysis of the Affine Cipher, Cryptanalysis of the Substitution Cipher, Cryptanalysis of the Vigenere Cipher, Shannon's Theory.

MODULE II BLOCK CIPHER AND THE ADVANCED ENCRYPTION STANDARD 09

Substitution - Permutation Networks, Linear Cryptanalysis, Differential Cryptanalysis, The Data Encryption Standard, The Advanced Encryption Standard, Modes of Operation, Cryptography Hash Function - Hash Function and Data Integrity, Security of Hash Function, Iterated Hash Functions, Message Authentication Codes.

MODULE III RSA CRYPTOSYSTEM AND FACTORING INTEGERS 09

Introduction to Public –key Cryptography, Number theory, The RSA Cryptosystem ,Other Attacks on RSA, The ElGamal Cryptosystem, Shanks' Algorithm, Finite Fields, Elliptic Curves over the Reels, Elliptical Curves Modulo a Prime, Signature Scheme –Digital Signature Algorithm.

MODULE IV IDENTIFICATION SCHEME AND ENTITY AUTHENTICATION 09

Challenge and Response in the Secret-key Setting, Challenge and Response in the Public key Setting, The Schnorr Identification Scheme, Key distribution-Diffie-Hellman Key, Predistribution, Unconditionaly Secure key Predistribution, Key Agreement Scheme Diffie-Hellman Key agreement, Public key infrastructure-PKI, Certificates, Trust Models.

MODULE V SECRET SHARING SCHEMES 09

The Shamir Threshold Scheme, Access Structure and General Secret key sharing, Information Rate and Construction of Efficient Schemes, Multicast Security and Copyright production - Multicast Security, Broadcast Encryption, Multicast Re-keying, Copyright Protection, Tracing illegally redistribution keys.

Total Hours : 45

REFERENCES:

1. Douglas R. Stinson, “Cryptography Theory and Practice”, Third Edition, Chapman & Hall / CRC, 2006.
2. Menezes A. J, Oorschot P, Vanstone S.A, “Handbook of Applied Cryptography” CRC Press, 1997.
3. William Stallings, “Cryptography and Network Security: Principles and Practices”, Third Edition, Pearson Education, 2006.
4. Wenbo Mao, “Modern Cryptography – Theory and Practice”, Pearson Education, First Edition, 2006.
5. Charles B. Pfleeger, Shari Lawrence Pfleeger, “Security in Computing”, Fourth Edition, Pearson Education, 2007.

OUTCOMES:

On completion of the course students will be able to :

- Apply the suitable substitution cipher algorithm for a real world problem.
- Compute the security of data using DES and AES.
- Use the RSA algorithm and factoring integers for secured data transfer.
- Analyze the challenges and responses in secret key distribution.
- Evaluate the secret sharing schemes as per the real world needs.

ITCY208 VIDEO PROCESSESING

L	T	P	C
3	0	0	3

OBJECTIVES:

- Implement video processing techniques in new applications.
- Demonstrate an understanding of both theoretical and applications-related problems of the video processing systems.
- Know basic features of MPEG-2, MPEG-4, and H.264 video compression standards.

MODULE I VIDEO ACQUISITION AND REPRESENTATION 09

Spatial Temporal Sampling –Sampling Structure Conversion – Interpolation – Colour spaces – video formats.

MODULE II MOTION ANALYSIS 09

2D and 3D Motion Estimation and Compensation –Optical Flow methods – Block based – Point correspondences Gradient based – Intensity matching – Feature matching – Frequency domain Motion estimation.

MODULE III MOTION ANALYSIS APPLICATIONS VIDEO OBJECTRACKING AND SEGMENTATION 09

Video Summarization, Video Surveillance, Video Watermarking, Video Mosaicing.– 2D and 3D motion tracking –blob tracking – kernel based – Control tracking – Feature matching– Video Segmentation – Mean Shift based –Video shot boundary detection.

MODULE IVVIDEO FILTERING 9

Motion Compensation – Noise Filtering – Enhancement and Restoration – Video Stabilization and Super Resolution.

MODULE V VIDEO CODING REPRESENTATION AND VIDEO STANDARDS 09

MPEG 1, MPEG 2, MPEG 4, MPEG7, H.261, H.263, H.264. Video compression – Interframe Compression – 3D Waveform based – Motion Compensation.

Total Hours : 45

REFERENCES:

1. Handbook of Image and Video processing – Al Bovik (Alan C Bovik),Academic Press, Second Edition, 2005.
2. Digital Image Sequence Processing, Compression, and Analysis –Todd R. Reed, CRC Press, 2004.
3. H.264 and MPEG4 Video Compression: Video Coding for Next Generation Multimedia – Iain E. G. Richardson, Wiley, 2003
4. Digital Video Processing – A Murat Takalp, Prentice Hall, 1995.

OUTCOMES:

On completion of the course students will be able to :

- Solve practical problems with some basic image and video signal processing techniques.
- Analyze the 2D and 3D motion estimation and feature matching
- Evaluate the performance of video object segmentation and tracking methods
- Apply filtering and analyze the enhancement and restoration of video processing
- Design simple systems for realizing some multimedia applications with some basic video processing techniques.

ITCY209 HIGH SPEED NETWORKS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To get an introduction about ATM and Frame relay.
- To provide an up-to-date sur vey of developments in High Speed Networks.
- To enable the students to know techniques involved to support real-time traffic and congestion control.
- To provide the different levels of Quality of Service (QoS) to different applications.
- Students will be able to design high speed networks with Quality of Services.

MODULE I HIGH SPEED NETWORKS 09

Frame Relay Networks - Asynchronous transfer mode - ATM Protocol Architecture, ATM logical Connection, ATM Cell - ATM Service Categories - AAL. High Speed LAN's: Fast Ethernet, Gigabit Ethernet, Fibre Channel - Wireless LAN's: applications, requirements - Architecture of 802.11.

MODULE II CONGESTION AND TRAFFIC MANAGEMENT 09

Queuing Analysis- Queuing Models - Single Server Queues - Effects of Congestion - Congestion Control - Traffic Management - Congestion Control in Packet Switching Networks - Frame Relay Congestion Control.

MODULE III TCP AND ATM CONGESTION CONTROL 09

TCP Flow control - TCP Congestion Control - Retransmission - Timer Management -Exponential RTO backoff - KARN's Algorithm - Window management - Performance of TCP over ATM. Traffic and Congestion control in ATM - Requirements - Attributes - Traffic Management Frame work, Traffic Control - ABR traffic Management - ABR rate control, RM cell formats, ABR Capacity allocations - GFR traffic management.

MODULE IV INTEGRATED AND DIFFERENTIATED SERVICES 09

Integrated Services Architecture - Approach, Components, Services- Queuing Discipline, FQ, PS, BRFQ, GPS, WFQ - Random Early Detection, Differentiated Services.

MODULE V PROTOCOLS FOR QOS SUPPORT 09

RSVP - Goals & Characteristics, Data Flow, RSVP operations, Protocol Mechanisms - Multiprotocol Label Switching - Operations, Label Stacking, Protocol details - RTP - Protocol Architecture, Data Transfer Protocol, RTCP.

Total Hours : 45

REFERENCES:

1. IrvanPepelnjk, Jim Guichard and Jeff Apcar, 'MPLS and VPN architecture', Cisco Press, Volume 1 and 2, 2003.
2. William Stallings, 'High Speed Networks And Internet', Pearson Education, Second Edition, 2002.
3. Warland&PravinVaraiya, 'High Performance Communication Networks', Jean Harcourt Asia Pvt. Ltd., II Edition, 2001.

OUTCOMES:

On completion of the course students will be able to :

- Define the various high-speed networking technologies and their design issues.
- Manage projects involving any of the high-speed networking technologies.
- Design high speed networks with quality of service (QoS).
- Apply techniques involved to support real-time traffic and congestion control.
- Apply the concept learnt in this course to optimize and troubleshoot high-speed network.

CSCY01 MOBILE COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES :

- To discuss about advanced learning in the field of wireless communication.
- To elaborate upon the basic concepts and principles in mobile computing.
- To expose the students to the concepts of wireless devices.
- To explain the structure and components for Mobile IP and Mobility Management
- To create awareness about various operating systems available for mobile computing
- To discuss various issues related to security of mobile computing environment

MODULE I INTRODUCTION 15

Mobile Computing- Networks- Application and Services supporting - Developing Mobile Computing Applications-Security in Mobile Computing Mobile Computing Architecture-GSM-Wireless Internet- Wireless Vehicular Networks-Architecture-Vehicular Applications-Standards-Challenges

MODULE II APPLICATION DEVELOPMENT 15

Three tier architecture -Model View Controller Architecture -Memory Management –Information Access Devices –PDAs and Smart Phones –Smart Cards and Embedded Controls –J2ME –Programming for CLDC –GUI in MIDP –Application Development ON Android and iPhone

.

Total Hours : 30

REFERENCES :

1. Asoke K Talukder, Nuno M. Garcia, Jayateertha G. M, “Convergence Through All-IP Networks”, Pan Stanford, ISBN: 978-9814364638, 2013.
2. Asoke K Talukder, HasanHasan Ahmed and Roopa R Yavagal, “Mobile Computing Technology, Applications and Service Creation”, 2nd Edition, Tata McGraw-Hill Education Private Limited, ISBN: 978-0070707313, 2011.

OUTCOMES :

Students who complete this course will be able to

- Acquire capability to work with heterogeneous networks.
- Apply the knowledge of various mobile operating systems like Android to develop mobile computing applications.
- Develop mobile computing applications by analyzing their requirements.
- Identify the security algorithms to be used for mobile computing environment.
- Analyze business practices in mobile computing applications and their technical feasibility.
- Comparatively evaluate deployment platforms for mobile computing applications.

CSCY10 ADVANCED DATABASES

L	T	P	C
3	0	0	3

OBJECTIVES :

- To comprehend the different issues involved in the design and implementation of a database system
- To analyze the physical and logical database designs, database modeling, relational and object oriented models.
- To describe the techniques involved in the design of distributed databases.
- To recognize the various database techniques used in cloud and big data applications.
- To develop an understanding of emerging DBMS for various applications

MODULE I ADVANCED SQL QUERIES AND DATABASE TUNING 08

Relational model conformity and Integrity- Advanced SQL programming- Query optimization- Concurrency control and Transaction management- Database performance tuning-Distributed relational systems -Security issues in Databases.

MODULE II THE EXTENDED ENTITY RELATIONSHIP MODEL AND OBJECT MODEL 09

The ER model-Motivation for complex data types-User defined abstract data types and structured types- Subclasses- Super classes- Inheritance-Specialization and Generalization-Constraints and characteristics of specialization and Generalization-Relationship types of degree higher than two.

MODULE III DISTRIBUTED DATABASES 10

Distributed Systems- Parallel Databases: I/O Parallelism -Inter and Intra Query Parallelism -Inter and Intra operation Parallelism- Design of Parallel Systems. Distributed Database Concepts- Distributed Data Storage -Distributed Transactions -Commit Protocols - Concurrency Control -Distributed Query Processing - Case Studies.

MODULE IV INTRODUCTION TO CLOUD DATABASES AND BIG DATA 09

Cloud Based Databases: Data Storage Systems on the Cloud- Cloud Storage Architectures-Cloud Data Models- Query Languages- Introduction to Big Data-Storage-Analysis. Batch computing models for Big Data computing- Key-value storage systems -- Scalable prediction models - Distributed file systems - Scalable data analytics-- Data models – Real time data stream analytics.

MODULE V EMERGING DATABASE MANAGEMENT SYSTEM TECHNOLOGIES 09

Object Oriented database concepts-Object Relational database concepts-Active database concepts; Temporal database concepts-Spatial database concepts and architecture- Deductive databases and Query processing- Mobile Databases-Geographic Information Systems. Multimedia Databases; Multidatabases- Native XML databases (NXD)-Genome Data management.

Total Hours : 45

REFERENCES :

1. Henry F Korth, Abraham Silberschatz, S. Sudharshan, “Database System Concepts”, Fifth Edition, McGraw Hill, 2011.
2. Jeff Hoffer, Ramesh Venkataraman, HeikkiTopi, “Modern Database Management Systems”, Pearson Education Limited, 12th edition, 2016.
3. Thomas Cannolly and Carolyn Begg, “Database Systems, A Practical Approach to Design, Implementation and Management”, 6th edition, Pearson Education, 2014.
4. Carlos Coronel and Steven Morris, “Database Systems: Design, Implementation, & Management”, Cengage Learning, 12th edition, 2016.

OUTCOMES :

Students who complete this course will be able to

- Define the terminology, features, classifications, and characteristics in database systems.
- Illustrate the design strategies, query processing techniques and algorithms for advanced databases.
- Analyze an information storage problem and derive at an appropriate data model for the problem.
- Assess the Database techniques for designing intelligent information retrieval system for any application.
- Describe the database techniques used in Cloud and Big data environment.
- Appraise the emerging technologies in Databases and propose suitable model for any given application

CSCY54 SERVICE ORIENTED ARCHITECTURE

L	T	P	C
3	0	0	3

OBJECTIVES :

- To establish the fundamentals and issues relating to Service Oriented Architecture.
- To bring out the importance of service orientation and web services.
- To teach appropriate tools as technique on how to build the Service Oriented Architecture with web services.
- To gain knowledge of basic principles of Service-Oriented Architecture and apply these concepts to develop a sample application
- To assess emerging and proposed standards for the main components of Web services architectures.
- To become skilled at standards related to Web services: Web Services Description Language (WSDL), Simple Object Access Protocol (SOAP), and Universal Description, Discovery and Integration (UDDI).

MODULE I INTRODUCTION 09

Basic definition - Fundamentals of SOA - Characteristics about SOA-Benefits and pitfalls of SOA. Evolution of SOA - Web service and primitive SOA - The extension of SOA - Web service extension.

MODULE II WEB SERVICE AND CONTEMPORARY SOA 09

Message Exchange Pattern- Service Activity- Coordination- Atomic Transaction- Business Activity- Orchestration – Choreography- Addressing Reliable Messaging- Correlation and Policies- Meta data Exchange- Security Notification and Eventing.

MODULE III PRINCIPLES OF SERVICE ORIENTATION 09

Principles of service orientation -Building SOA-Planning and Analysis- SOA delivery strategies -Service Oriented Analysis Introduction -Service Modeling of Service Oriented Analysis.

MODULE IV SERVICE ORIENTED DESIGN 09

Introduction to service oriented design - WSDL related XML Schema language - WSDL Language Basics - SOAP Language Basics - Service interface design tools - Steps to composing SOA - Consideration for choosing service layers - SOA extension - Service design and business process design.

MODULE V WEB SERVICE EXTENSION AND SOA PLATFORM 09

WS Addressing language Basics - WS Reliable Messaging language Basics- policy Language Basics- WS Metadata Exchange Language Basics- WS security Language Basics -SOA Platform basics- SOA Support in J2EE, SOA Support in .NET- Case Studies.

Total Hours : 45

REFERENCES :

1. Thomas Erl, “Service Oriented Architecture, Concepts, Technology and Design”, Pearson Education, 2009. ISBN-13: 007-6092038498
2. Thomas Erl, “Service Oriented Architecture, Design Patterns”, Prentice Hall, 2009: ISBN-13: 978-0-13-613516-6
3. Shankar Kambhampaty, “Service Oriented Architecture for Enterprise Architecture for Enterprise Application”, 1st Edition, Wiley Publication, 2008.

OUTCOMES :

- Students who complete this course will be able to
- Relate web services with service oriented architecture.
- Analyze the issues related to SOA.
- Apply the tools and technique for Service Oriented Architecture.
- Develop service design using WSDL and XML schema languages.
- Choose appropriate SOA extensions for a particular design
- Assess SOA platform supported by J2EE and .NET.

ITCY210 VIRTUALIZATION TECHNIQUES

L	T	P	C
2	0	0	2

OBJECTIVES:

- To understand the concept of virtualization and how to apply virtualization for server consolidation.
- To impart knowledge on software defined networks (SDN), network and storage virtualization
- To understand applications and virtual devices in virtual machines.

MODULE I VIRTUALIZATION & SERVER CONSOLIDATION 10

Understanding Virtualization - Virtualization Advantages - Virtual Machine Basics - Creating and Working with Virtual Machines - System Virtual Machines - Hypervisor - Hardware Virtualization - Sever Virtualization - Business cases for Sever Virtualization - Uses of Virtual Server Consolidation - Selecting Server Virtualization Platform.

MODULE II NETWORK & STORAGE VIRTUALIZATION 11

Networking for a Virtual Machine – SDN Software Stack – Data-Plane Verification – Testing and Debugging - Network Virtualization - Design of Scalable Enterprise Networks - WAN Virtualization – VLANs - Classical Storage Model - SNIA Shared Storage Model - Host based Architecture - Configuring VM Storage Options - Tuning Practices for VM Storage.

MODULE III DEVICES AND APPLICATIONS IN VIRTUAL MACHINES 09

Using Virtual Machine Tools - Understanding Virtual Devices-Configuring a CD/ DVD Drive -Configuring a Sound Card - Configuring USB Devices - Configuring Graphic Displays - Configuring Other Devices - Deploying Applications in a Virtual Environment - Understanding Virtual Appliances and vApps.

Total Hours : 30

REFERENCES:

1. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.
2. Kumar Reddy, Victor Moreno, “Network virtualization”, Cisco Press, July, 2006.
3. Thomas D.Nadeau and Ken Gray, “SDN: Software Defined Networks”, O’Relly Publications, Kindle Edition, 2013.

4. Chris Wolf, Erick M. Halter, “Virtualization: From the Desktop to the Enterprise”, A Press 2005.

OUTCOMES:

On completion of the course students will be able to:

- Discuss virtualization and analyze types of server virtualization & consolidation.
- Outline network virtualization, SDN paradigm and storage architecture to manage devices and applications in virtual machines.
- Configure and deploy applications in virtual machines.

ITCY211	PROGRAMMING WITH HADOOP	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To make the students familiar with Hadoop distributed file system and can learn how to configure Hadoop.
- To create single node and multinode using Hadoop and to learn programming using Map Reduce paradigm.
- To provide a complete knowledge about Hadoop echo system with key components like Pig, Hive and Sqoop.
- To analyze NOSQL concepts and compare it with RDBMS.
- To explore NoSQL database MongoDB with its basic features.

LIST OF EXERCISES:

1. Introduction to HDFS and Hadoop Ecosystem. Configuration and Installation of Hadoop 1.0 Single node with Name node and Data node.
2. Configuration of Hadoop 1.0 with SSH key for security for Name and Data Node with Demo of Pseudo distributed Node and Case Study of Multinode set up.
3. Study of Map reduce Java API. Simple programs in Map Reduce paradigm with java concepts.
4. Working on Input functions, mapper & reducer functions. Simple program for text extraction and title extraction.
5. Program for searching key word and extract it from the given text paragraph.
6. Program for extracting link from a HTML page using Map and Reduce.
7. Implementation of Pig using Hadoop Ecosystem for processing structured Data.
8. Implementation of Sqoop for transferring schema format to NOSQL format.
9. Implementation and configuration of Hive in Hadoop ecosystem for querying.
10. Installation of Mongo DB and practicing CURD operations in MongoDB.Connecting MongoDB with Hadoop.

OUTCOMES:

On completion of the course students will be able to:

- Demonstrate single node and multinode Hadoop 1.0 with installation and configuration.
- Compute simple programs in Hadoop using Map reduce Paradigm.

- Analyze Hadoop Ecosystem using simple components like Pig, Hive and Sqoop.
- Create SQL and NOSQL Databases and compare processing of data in both.

PROFESSIONAL ELECTIVES
SEMESTER III

ITCY101	MACHINE LEARNING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the machine learning theory
- To implement learning models
- To implement distance based clustering techniques
- To build tree and rule based models
- To apply reinforcement learning techniques

MODULE I FOUNDATIONS OF LEARNING 09

Components of learning–learning models-geometric models-probabilistic models - logic models –grouping and grading –learning versus design –types of learning – supervised –unsupervised –reinforcement –theory of learning –feasibility of learning –error and noise –training versus testing–theory of generalization - generalization bound –approximation-generalization tradeoff–bias and variance – learning curve

MODULE II LINEAR MODELS 09

Linear classification –univariate linear regression –multivariate linear regression – regularized regression –Logistic regression –perceptrons –multilayer neural networks –learning neural networks structures –support vector machines –soft margin SVM –going beyond linearity –generalization and overfitting –regularization –validation

MODULE III DISTANCE BASED MODELS 09

Nearest neighbor models –K-means –clustering around medoids–silhouttes – hierarchical clustering –k-d trees –locality sensitive hashing –non-parametric regression –ensemble learning –bagging and random forests –boosting –meta learning.

MODULE IV TREE AND RULE MODELS 09

Decision trees –learning decision trees –ranking and probability estimation trees – regression trees –clustering trees –learning ordered rule lists –learning unordered

rule lists –descriptive rule learning –association rule mining –first-order rule learning.

MODULE V REINFORCEMENT LEARNING 09

Passive reinforcement learning –direct utility estimation –adaptive dynamic programming –temporal-difference learning –active reinforcement learning – exploration –learning an action-utility function –Generalization in reinforcement learning –policy search –applications in game playing–applications in robot control.

Total Hours : 45

REFERENCES:

1. Y. S. Abu-Mostafa, M. Magdon-Ismail, and H.-T. Lin, “Learning from Data”, AMLBook Publishers, 2012.
2. P. Flach, “Machine Learning: The art and science of algorithms that make sense of data”, Cambridge University Press, 2012.
3. K. P. Murphy, “Machine Learning: A probabilistic perspective”, MIT Press, 2012.
4. C. M. Bishop, “Pattern Recognition and Machine Learning”, Springer, 2007.
5. D. Barber, “Bayesian Reasoning and Machine Learning”, Cambridge University Press, 2012.
6. M. Mohri, A. Rostamizadeh, and A. Talwalkar, “Foundations of Machine Learning”, MIT Press, 2012.
7. T. M. Mitchell, “Machine Learning”, McGraw Hill, 1997.
8. S. Russel and P. Norvig, “Artificial Intelligence: A Modern Approach”, Third Edition, Prentice Hall, 2009.

OUTCOMES:

On completion of the course students will be able to:

- Explain theory underlying machine learning
- Construct algorithms to learning models
- Implement data clustering algorithms
- Construct algorithms to learn tree and rule-based models
- Apply reinforcement learning techniques

ITCY102 WIRELESS NETWORKS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn fundamentals of wireless communication.
- To understand the various components of wireless Internet.
- To learn the issues of Ad hoc wireless network and wireless sensor networks.
- To understand the applications of sensor networks.
- To study an awareness of trends and developments in wireless networks.

MODULE I **09**

Introduction, fundamentals of WLAN -technical issues, network architecture, IEEE 802.11- physical layer, Mac layer mechanism, CSMA/CA, Bluetooth-specification, transport layer, middleware protocol group, Bluetooth profiles, WLL -generic WLL architecture, technologies, broadband wireless access, IEEE 802.16 -differences between IEEE 802.11 and 802.16,physical layer, data link layer.

MODULE II **09**

Introduction -wireless internet, address mobility, inefficiency of transport layer and application layer protocol, mobile IP - simultaneous binding, route optimization, mobile IP variations, handoffs, IPv6 advancements, IP for wireless domain, security in mobile IP, TCP in wireless domain - TCP over wireless , TCPs - traditional, snoop, indirect, mobile, transaction- oriented, impact of mobility.

MODULE III **09**

Introduction, issues in ad-hoc Wireless Networks, Designing a MAC Protocol for adhoc Wireless Networks, Classification of MAC Protocols, Designing a routing protocol for adhoc Wireless Networks, Classification of routing Protocols- Table – Driven, On-demand and Hybrid routing Protocols, ad-hoc wireless internet.

MODULE IV **09**

Introduction - applications of sensor network, comparisons with MANET, issues and design challenges, architecture - layered and clustered , data dissemination, data gathering, Mac protocols, location discovery, quality of sensor network - coverage and exposure, zigbee standard.

MODULE V **09**

UWB radio communication- operation of UWB systems, comparisons with other technologies, major issues, advantages and disadvantages, Wi-Fi systems-service provider models, issues, interoperability of Wi-Fi and WWAN, multimode 802.11 - IEEE 802.11a/b/g - software radio-based multimode system, meghadoot architecture -802.11 phone, fundamentals of UMTS.

Total Hours : 45

REFERENCES:

1. C.Siva Ram Murthy and B.S. Manoj, “Ad-hoc wireless networks-architecture and protocols”, Pearson education, 2nd, 2005.
2. Jochen Schiller, 'Mobile Communication', Pearson education, 2nd edition 2005.
3. Wlliam Stallings, 'Wireless Communication and Networks', Prentice Hall, 2nd edition,2005

OUTCOMES:

On completion of the course students will be able to:

- Identify the basic concept of wireless networks;
- Identify and fix the vulnerabilities in different types of wireless networks as MANETS and WSN.
- Demonstrate knowledge of protocols used in wireless communications
- Classify network protocols, ad hoc and sensor networks, wireless MANs, LANs and PANs;
- Design, deploy and manage wireless local area networks.

ITCY103 ENTERPRISE RESOURCE PLANNING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To build an understanding of the fundamental business processes used to runcompanies with a focus on supply chain processes.
- To expose the students to the implementation issues and future trends
- associated with ERP
- To provide hands on exposure to a live ERP system, achieving an intermediate level of comfort using SAP ERP enterprise software.
- To learn how to effectively analyze information from an ERP system to make business decisions

MODULE I INTRODUCTION TO ERP 09

Overview - Benefits of ERP - ERP and Related Technologies – Business Process Reengineering - Data Warehousing - Data Mining - On-line Analytical Processing - Supply Chain Management.

MODULE II ERP IMPLEMENTATION 09

Implementation Life Cycle - Implementation Methodology - Hidden Costs - Organizing Implementation - Vendors, Consultants and Users - Contracts - IT91 Project Management and Monitoring.

MODULE III BUSINESS MODULES 09

Business Modules in an ERP Package - Finance - Manufacturing – Human Resource - Plant Maintenance - Materials Management - Quality Management- Sales and Distribution.

MODULE IV ERP MARKET 09

ERP Market Place - SAP AG - PeopleSoft - Baan Company - JD Edwards World Solutions Company - Oracle Corporation - QAD - System Software Associates.

MODULE V ERP - PRESENT AND FUTURE 09

Turbo Charge the ERP System - EIA - ERP and E-Commerce - ERP and Internet - Future Directions in ERP

Total Hours : 45

REFERENCES:

1. Alexis Leon, Enterprise Resource Planning, second edition, Tata McGraw-Hill, 2008.
2. Alexis Leon, ERP demystified, second Edition Tata McGraw-Hill, 2006.
3. Jagan Nathan Vaman, ERP in Practice, Tata McGraw-Hill, 2008
4. Vinod Kumar Grag and N.K. Venkitakrishnan, ERP- Concepts and Practice, Prentice Hall of India,2 nd edition, 2006.

OUTCOMES:

On completion of the course students will be able to:

- Apply the process modeling techniques in one or more modeling environments.
- Know and be able to apply key technical terminology different ERP products and development methods.
- Understand key differences between the major ERP applications (such as SAP R/3, and Oracle/PeopleSoft/Sibel) and issues specific to these applications their configuration and management.
- Synthesize prior theoretical and experiential knowledge in IT development and project management with the current literature on Enterprise System development.
- Be able to evaluate the progress of an ongoing ERP implementation project.

ITCY104 WEB DESIGN AND MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To familiarize the web page authoring fundamentals.
- To explore the web languages using client side script.
- To demonstrate and configure web servers and discuss about services.
- To design the website with different designing methodology.
- To publish the website by applying design technologies.

MODULE I WEB PAGE AUTHORING FUNDAMENTALS 09

Introduction to Web Site Development -Markup Language and Site Development Essentials-XHTML Coding - Elements -Hyperlinks -Tables -Web Forms -Image Techniques -Frames -GUI HTML 5 Editors- Introduction to Networking -TCP/IP Suite and Internet Addressing.

MODULE II WEB LANGUAGES **09**

JavaScript Introduction -Functions, Methods and Events -Program Flow -Object Model - Browser Objects -Language Objects -Interactive Forms -Cookies and JavaScript Security -Client-Side JavaScript Getting Started with Perl- Intro-Arrays - Matching and Substitution -Subroutines –References-Packages –Modules-J query - Bootstrap - Angular Java Script.

MODULE III SERVICES, SERVERS, INTEGRITY **09**

Web servers - IIS & Apache -Windows 2000 DNS Server -Configuring DNS in Windows NT –NetBIOS -Managing WINS -Introduction to FTP -Virtual FTP Servers -FTP Access -Telnet -Xinetd -Web Applications -Perl and E-Commerce Web Servers -Web Servers and Gateways Web Server and Gateway Overview - Streaming Media Servers -Configuring a News Server -Optimizing Servers- Introduction to Security -SSL -Proxy Servers -Introduction to Fault Tolerance - Disaster Assessment and Recovery

MODULE IV DESIGN METHODOLOGY **09**

Overview of Web Design Concepts -Web Project Management Fundamentals - Web Page Layout and Elements -Web Site Usability and Accessibility -Navigation Concepts -Web Graphics -Multimedia and The Web -Ethical and Legal Issues in Web Development -XML and XHTML -Web Page Structure - Tables and Framesets -Cascading Style Sheets -Site Content and Metadata -JSON.

MODULE V DESIGN TECHNOLOGY **09**

Development with Macromedia Dream weaver 10 - Advanced Features -Image Editing with Macromedia Fireworks -Multimedia with Macromedia Flash 11 - Timeline, Layers, Symbols and Buttons - Tweens - Movie Clips - Action script, Masks and Practical Uses -JavaScript and DHTML Fundamentals -Plus-ins and Java Applets -HTTP Servers and Web Applications -Databases -Web Site Publishing and Maintenance.

Total Hours : 45

REFERENCES:

1. L.Mohler, Flash 8 Graphics, 'Animation and Interactivity by James', Onword Press, Thomson Learning, 2006.
2. H. M. Deitel, P. J. Deitel and T. R. Nieto– How to program', PHI/Pearson Education Asia, November 2011.
3. William Stallings, 'Data and Computer Communications', Pearson, 2007
4. Jason Hunter and William Crawford, 'Java Servlet Programming', O'Reilly Pub1999.
5. Anders Miller, Michael Schwartzbach, 'An Introduction to XML and Web Technologies', Addison Wesley, 2006.

OUTCOMES:

On completion of the course students will be able to:

- Discuss the web authoring fundamentals.
- Demonstrate web languages and implement client side scripting.
- Configure web servers and evaluate services.
- Design the website by using specific methodologies.
- Publish the website by applying design technologies.

ITCY105 DESIGN PATTERNS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To explore the overview of patterns, prototyping and testing.
- To familiarize with different kinds of design patterns.
- To analyze the use of pattern algorithms in software engineering.
- To use the patterns in real world applications with the help of case study.
- To apply case study examples in UML.

MODULE I INTRODUCTION 09

History and origin of patterns – Applying Design Patterns - Prototyping - Testing.

MODULE II DESIGN PATTERNS 09

Kinds of pattern - Quality and elements - patterns and rules - Creativity and patterns – Creational patterns – Structural Patterns – Behavioral Patterns - Factory Patterns.

MODULE III FRAMEWORKS 09

State and Strategy of Patterns, Singleton, Composite, Functions and the Command Patterns, Adaptor, Proxy Patterns, Decorator Pattern – Pattern Frameworks and Algorithms.

MODULE IV CATALOGS 09

Pattern catalogs and writing patterns, Patterns and Case Study.

MODULE V ADVANCED PATTERNS 09

Anti-patterns - Case studies in UML and CORBA, Pattern Community.

Total Hours : 45

REFERENCES:

1. Eric Gamma, Richard Helm, Ralph Johnson, John Vissides, Grady Booch, “Design Patterns: Elements of Reusable Object-Oriented Software”, 2002.
2. James W-Cooper, “Java Design Patterns – A Tutorial”, Addison Wesley 2000.
3. Craig Larman, ‘Applying UML and Patterns: “An Introduction to Object-Oriented Analysis and Design’, and the Unified Process”, 2nd edition, Prentice Hall, 2001.

4. Thomas Mowbray and Raphel Malveaux, “CORBA and Design Patterns”, John Wiley, 1997.
5. William J Brown et al. “Anti-Patterns: Refactoring Software, Architectures and Projects in Crisis”, John Wiley, 1998.

OUTCOMES

On completion of the course students will be able to:

- Discuss the overview of design patterns in software engineering.
- Use different kinds of patterns and its features.
- Compare frameworks and patterns and compute pattern algorithm.
- Apply pattern catalogs and practice case study.
- Use patterns in UML.

ITCY106 DATA WAREHOUSING AND DATA MINING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the concepts of data warehousing architecture and implementation.
- To study the data mining principles and techniques.
- To learn to use association rule mining for handling large data sets.
- To know the concepts of classification for the retrieval process.
- To understand the clustering techniques for different methods.
- To identify business applications and trends in data mining.

MODULE I DATA WAREHOUSE & BUSINESS ANALYSIS 09

Data Warehousing - Operational Database Systems vs. Data Warehouses - Data Warehouse Architecture-Components - Multidimensional Data Model - Schemas for Multidimensional Databases - OLAP Operations - Indexing – OLAP Queries & Tools.

MODULE II DATA MINING & DATA PREPROCESSING 09

Introduction to KDD process - Knowledge Discovery from Databases - Classifications of Data Mining Systems - Need for Data Preprocessing - Data Cleaning - Data Integration and Transformation - Data Reduction - Data Discretization - Data Generalization and Concept Hierarchy Generation.

MODULE III ASSOCIATION RULE MINING 09

Association Rule Mining - Mining Frequent Item sets with and without Candidate Generation - Mining Various Kinds of Association Rules - Single and Multi-Level Association Rules from Transaction Databases - Correlation Analysis - Constraint Based Association Mining - Advanced Association Rule Techniques

MODULE IV CLASSIFICATION & PREDICITION 09

Classification vs. Prediction - Data preparation for Classification and Prediction - Classification by Decision Tree Introduction - Bayesian Classification - Rule Based Classification - Classification by Back Propagation - Support Vector Machines - Associative Classification - Lazy Learners - Other Classification Methods - Prediction - Evaluating the Accuracy of a Classifier or Predictor - Ensemble Methods - Model Section.

MODULE V CLUSTERING & TRENDS IN DATA MINING 09

Cluster Analysis - Types of Data in Cluster Analysis - Categorization of Major Clustering Methods - Partitioning Methods - Hierarchical methods - Density-Based Methods - Grid-Based Methods - Model-Based Clustering Methods - Clustering High-Dimensional Data - Constraint- Based Cluster Analysis - Outlier Analysis – Data Mining Applications.

Total Hours : 45

REFERENCES:

1. Jiawei Han and Micheline Kamber, “Data Mining Concepts and Techniques” Second Edition, Elsevier, Reprinted 2008.
2. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, “Introduction to Data Mining”,Pearson Education, 2007.
3. Alex Bezon, Stephen J.Smith, 'Data Warehousing, Data Mining & OLAP', McGraw-Hill Edition, 2001.
4. Paulraj Ponniah, 'Data Warehousing Fundamentals', John Wiley & Sons, New Delhi, 2012.

OUTCOMES:

On completion of the course students will be able to:

- Analyze the concepts of data warehousing and architecture.
- Discuss data mining principles and techniques and preprocess the data for mining applications.
- Apply association rules for mining the data.
- Outline appropriate classification and prediction methods.
- Discuss clustering methods for high-dimensional data and analyze data mining applications on modern organization.

ITCY107 WIRELESS & MOBILE COMMUNICATION

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the different cellular systems and their advancements from one generation to other.
- To know the different basic propagation mechanisms.
- To have a knowledge about designing a mobile system.
- To recognize various multipath propagation models
- To study the various mobile modulation and demodulation techniques.
- To realize how to alleviate fading effects, and multiple access techniques

MODULE I INTRODUCTION TO MOBILE COMMUNICATION SYSTEMS 09

Evolution of Mobile Radio Communications – Present Day mobile communication – Fundamental Techniques – How a mobile call is made? – Modern Mobile communication systems – 1G, 2G, 3G, Beyond 3G – Wireless Transmission Protocols.

MODULE II MOBILE SYSTEM DESIGN FUNDAMENTALS AND RADIO WAVE PROPAGATION 09

What is a cell? – Frequency reuse – Channel assignment strategies – Handoff strategies – Interference and system capacity – Trunking and Grade of service – Improving coverage and capacity in cellular systems – Free Space Propagation Model – The Three Basic Propagation Mechanisms: Reflection , Diffraction and Scattering – Link Budget Design – Outdoor Propagation Models – Indoor Propagation Models.

MODULE III WAVE PROPAGATION AND FADING 09

Multipath Propagation – Multipath and Small Scale Fading – Types of Small Scale Fading – Multipath Channel Parameters – Statistical Models for Multipath Propagation – Simulations of Clarke and Ganes Fading Model.

MODULE IV MOBILE MODULATION TECHNIQUES 09

Amplitude Modulation – Angle Modulation – Digital Modulation – Line coding – Pulse Shaping Techniques – Linear Modulation Techniques – Spread Spectrum Modulation Techniques – Modulation Performance in Fading and Multipath Channels.

MODULE V TECHNIQUES TO ALLEVIATE FADING EFFECTS AND MULTIPLE ACCESS TECHNIQUES 09

Equalization: – Linear and Non-linear Equalization – Algorithms for Adaptive Equalization Diversity: Polarization Diversity, Frequency Diversity, Time Diversity – Channel Coding: Fundamentals, Block Codes, Convolutional Codes, Coding Gain – Multiple Access Techniques: FDMA, TDMA, SSMA, SDMA.

Total Hours : 45

REFERENCES:

1. Theodore S. Rappaport, " Wireless Communications Principles and Practice", Second Edition, Pearson, 2010.
2. Andreas F.Molich, "Wireless Communications", Second Edition, John Wiley, 2011.
3. Jorge L.OleneWA, "Guide to Wireless Communications", Third Edition, Cengage Learning, 2014.
4. Cory Beard and William Stallings, "Wireless Communication Networks and Systems", First Edition, Pearson, 2015.
5. Nishith Tripathi and Jeffrey H. Reed , "Cellular Communications: A Comprehensive and Practical Guide", Wiley, 2014.

OUTCOMES:

On completion of the course students will be able to:

- Explain the fundamentals of cellular radio system design and increase the coverage capacity.
- Discuss various multipath propagation models and different types of fading.
- Demonstrate various mobile transmitter and receiver techniques.
- Apply various techniques to mitigate fading effects.
- Compare and contradict various multiple access techniques.

ITCY108 SOFTWARE METRICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To be aware of Core metrics for product, quality, process.
- To familiarize with the concepts of Software quality and tools for quality metrics.
- To learn more about software reliability.
- To understand important concepts of complexity metrics and OO metrics.
- To analyze and identify metrics for software project.

MODULE I MEASUREMENTS THEORY 09

Fundamentals of measurement - Measurements in Software Engineering - Scope of Software metrics - measurements theory - Goal based framework - Software Measurement validation.

MODULE II DATA COLLECTION AND ANALYSIS 09

Empirical investigation - Planning experiments - Software metrics data Collection - Analysis methods - statistical methods.

MODULE III PRODUCTS METRICS 09

Measurement of internet product attributes - size and structure - External product attributes - measurement of quality.

MODULE IV QUALITY METRICS 09

Software quality metrics - Product quality - Process quality - metrics forsoftware maintenance - Case studies of Metrics program - Motorola - Hp and IBM.

MODULE V MANAGEMENT METRICS 09

Quality management models - Rayleigh Model - Problem Tracking report (PTR)model - Reliability growth model - model evaluation - Orthogonal classification.

Total Hours : 45

REFERENCES:

1. Norman E - Fentar and Share Lawrence Pflieger, 'Software metrics', International Thomson Computer Press, 2013.
2. Norman Fenton, James Bieman, “Software Metrics: A Rigorous and Practical Approach“, 3rd edition, CRC Press, 2015

3. Stephen H.Kan, 'Metric and models in software quality engineering', 2nd edition, Addison Wesley 2003
4. William A. Florac and Areitor D. Carletow, 'Measuring Software Process', Addison - Wesley, 1999.

OUTCOMES:

On completion of the course students will be able to:

- Explain the concept of measurement theory
- Collect the data to measure metrics and analyze the metrics
- Identify the software product metrics
- Outline the software quality metrics
- Develop the software management metrics

ITCY109 SECURITY IN BIG DATA

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce security problem in computing and cryptography, and uses of
- Encryption.
- To explore about program security, non-malicious code and control against
- Program threats.
- To analyze the XML Encryption and security.
- To identify security challenges in distributed system and analyze various policies and guidelines to meet the challenges for securing data.
- To discuss the security in analytics and to identify secure provisioning in Hadoop.
- To demonstrate the security in various components of hadoop eco system.

MODULE I DATA SECURITY OVERVIEW - CRYPTOGRAPHY 09

Security problem in computing- Elementary Cryptography-Symmetric Key Encryption –Public Key Encryption-Uses of Encryption.

MODULE II DATA SECURITY -PROGRAM AND XML SECURITY 09

Security Programs-Non-Malicious program errors-Virus and other Malicious Code-Targeted Malicious Code-Control against program threats. Security Overview in XML – Canonicalization-XML security framework- XML encryption-XML Digital Signature.

MODULE III SECURITY IN DISTRIBUTED SYSTEMS 09

Security in DFS -Threat Categories – Unauthorized access-Risk assessment-Vulnerabilities – System Architecture- Operating environment – Network security – Network segmentation-Intrusion detection and prevention – Operating system security-Kerberos – Workflow-Identity theft –Authentication and Authorization.

MODULE IV DATA SECURITY IN BIGDATA ANALYTICS 09

Introduction to security in analytics –Data for security analytics -Security analytics process –Incident response and Intrusion Detection – Security and Text Mining – Simulations and Security process-Access Analytics.

MODULE V HADOOP SECURITY 09

Overview of Hadoop security – Hadoop components and Ecosystem – Authentication – Provisioning of Hadoop users – Hadoop users to group mapping- Mapping Kerberos principles to usernames – HDFS authorization-Map reduce and yarn authorization – Oozie authorization – Hbase authorization – Data protection in Hadoop- Case Study in Hadoop security.

Total Hours : 45

REFERENCES:

1. Charles B, Pfleeger, Shari LawerencePfleeger, Third Edition, “Security in Computing”, Pearson Education, 2003.
2. Frank P.Coyle, “XML, Web Services and the Data Reveloution”, Pearson Education, 2002.
3. Mark Talabis , Robert McPherson , Inez Miyamoto , Jason Martin Information Security Analytics: Finding Security Insights, Patterns, and Anomalies in Big Data, Syngress, Elseveir, 2015.
4. Ben Spivey Joey Echeverria,Hadoop Security: Protecting Your Big Data Platform ,!st Edition, Orielly, 2015.
5. Tim Mather, SubraKumaraswamy, and ShahedLatif “Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance”, O’Reilly Media Inc, 2009.

OUTCOMES:

On completion of the course students will be able to:

- To explain basics of Security problems in Big data and Hadoop.
- To compare XML Security with program security with pros and cons.
- To outline the security challenges in bigdata and the standards which are used to meet the
- Challenges.
- To analyze security in various Hadoop components and apply it to case study.
- To utilize the security techniques and apply it in a real time project.

ITCY110	MULTIMEDIA COMMUNICATION AND NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basics concepts of multimedia communications.
- To study the technical issues and system solutions for providing multimedia communications on the Internet.
- To understand the Multimedia Communication Models
- To explore real-time multimedia network applications.

MODULE I IP NETWORKS 09

Open Data Network Model – Narrow Waist Model of the Internet - Success and Limitations of the Internet – Suggested Improvements for IP and TCP – Significance of UDP in modern Communication – Network level Solutions – End to End Solutions - Best Effort service model – Scheduling and Dropping policies for Best Effort Service model

MODULE II ADVANCED ROUTING 09

Intra AS routing – Inter AS routing – Router Architecture – Switch Fabric – Active Queue Management – Head of Line blocking – Transition from IPv4 to IPv6 – Multicasting – Abstraction of Multicast groups – Group Management – IGMP – Group Shared Multicast Tree – Source based Multicast Tree – Multicast routing in Internet – DVMRP and MOSPF – PIM – Sparse mode and Dense mode

MODULE III GUARANTEED SERVICE MODEL 09

Best Effort service model – Scheduling and Dropping policies – Network Performance Parameters – Quality of Service and metrics – WFQ and its variants – Random Early Detection – QoS aware Routing – Admission Control – Resource Reservation – RSVP - Traffic Shaping Algorithms – Caching – Laissez Faire Approach - Possible Architectures - An Overview of QoS Architectures

MODULE IV MULTIMEDIA COMMUNICATION 09

Stream characteristics for Continuous media – Temporal Relationship – Object Stream Interactions, Media Levity, Media Synchronization – Models for Temporal Specifications - Streaming of Audio and Video – Jitter – Fixed playout and Adaptive playout – Recovering from packet loss – RTSP –– Multimedia Communication Standards – RTP/RTCP – SIP and H.263

MODULE V WIRELESS MULTIMEDIA COMMUNICATION 09

End to End QoS provisioning in Wireless Multimedia Networks – Adaptive Framework – MAC layer QoS enhancements in Wireless Networks – A Hybrid MAC protocol for Multimedia Traffic – Call Admission Control in Wireless Multimedia Networks – A Global QoS Management for Wireless Networks.

Total Hours : 45

REFERENCES:

1. Jean Warland and Pravin Vareya, 'High Performance Networks', Morgan Kauffman Publishers, 2002
2. Mahbub Hassan and Raj Jain, 'High Performance TCP/IP Networking', Pearson Education, 2004.
3. William Stallings, 'High Speed Networks: Performance and Quality of Service', 2nd Edition, Pearson Education, 2002.
4. Nalin K Sharda, 'Multimedia Information Networking', Prentice Hall of India, 1999
5. Aura Ganz, Zvi Ganz and Kitti Wongthawaravat, 'Multimedia Wireless Networks: Technologies, Standards and QoS', Prentice Hall, 2003.
6. Ellen Kayata Wesel, 'Wireless Multimedia Communications: Networking Video, Voice and Data', Addision Wesley, 1998

OUTCOMES:

On completion of the course students will be able to:

- Outline the current state-of-the-art developments in Internet technologies for multimedia communications and deploy the right multimedia communication models
- Identify different routing techniques
- Discuss the guaranteed service model
- Solve the security threats in the multimedia networks
- Apply QoS to multimedia network communication

ITCY111 AD-HOC AND SENSOR NETWORKS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the issues related with MAC protocols Ad-Hoc and wireless sensor networks.
- To discuss the various routing protocols used in Ad-Hoc and wireless sensor networks.
- Knowledge of sensor networks and their characteristics. This includes design of MAC layer protocols.
- To introduce the concept of QOS.
- To provide an overview of the various Mesh networks and the issues in them.

MODULE I AD-HOC MAC 09

Introduction – Issues in Ad-Hoc Wireless Networks. MAC Protocols – Issues, Classifications of MAC protocols, Multi channel MAC & Power control MAC protocol.

MODULE II AD-HOC NETWORK ROUTING & TCP 09

Issues – Classifications of routing protocols – Hierarchical and Power aware. Multicast routing – Classifications, Tree based, Mesh based. Ad Hoc Transport Layer Issues. TCP Over Ad Hoc – Feedback based, TCP with explicit link, TCP-BuS, Ad Hoc TCP, and Split TCP.

MODULE III WSN –MAC 09

Introduction – Sensor Network Architecture, Data dissemination, Gathering. MAC Protocols – self-organizing, Hybrid TDMA/FDMA and CSMA based MAC.

MODULE IV WSN ROUTING, LOCALIZATION & QOS 09

Issues in WSN routing – OLSR, AODV. Localization – Indoor and Sensor Network Localization. QoS in WSN.

MODULE V MESH NETWORKS 09

Necessity for Mesh Networks – MAC enhancements – IEEE 802.11s Architecture – Opportunistic routing – Self configuration and Auto configuration – Capacity Models – Fairness – Heterogeneous Mesh Networks – Vehicular Mesh Networks.

Total Hours : 45

REFERENCES:

1. C.Siva Ram Murthy and B.Smanoj, " Ad Hoc Wireless Networks – Architectures and Protocols", Pearson Education, 2004.
2. Feng Zhao and Leonidas Guibas, "Wireless Sensor Networks", Morgan Kaufman Publishers, 2004.
3. C.K.Toh, "Ad Hoc Mobile Wireless Networks", Pearson Education, 2002. Thomas Krag and Sebastin Buettrich, "Wireless Mesh Networking", O'Reilly Publishers, 2007.

OUTCOMES:

On completion of the course students will be able to:

- Explain the concept of Ad-Hoc and wireless sensor networks.
- Identify the design issues related with MAC protocols in Ad-Hoc and wireless sensor networks.
- Understand and explain issues related with routing protocols in Ad-Hoc and wireless sensor networks.
- Understand the necessity of various Mesh Networks.
- Understand the limitations of wireless sensor networks and the workarounds needed to develop real-life applications

ITCY112 ONTOLOGY AND SEMANTIC WEB

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce semantic web and ontology architectures.
- To familiarize with the languages for semantic web and ontologies.
- To analyze the use of ontology in semantic web.
- To demonstrate the use of tools for ontology.
- To apply the ontology and semantic web in real time applications.

MODULE I INTRODUCTION 0**8**

Components – Types – Ontological Commitments – Ontological Categories – Philosophical Background -Sample - Knowledge Representation Ontologies – Top Level Ontologies – Linguistic Ontologies – Domain Ontologies – Semantic Web – Need – Foundation – Layers – Architecture.

MODULE II LANGUAGES FOR SEMANTIC WEB AND ONTOLOGIES 12

Web Documents in XML – RDF - Schema – Web Resource Description using RDF- RDF Properties – Topic Maps and RDF – Overview – Syntax Structure – Semantics – Pragmatics - Traditional Ontology Languages – LOOM- OKBC – OCML – Flogic Ontology Markup Languages – SHOE – OIL - DAML + OIL- OWL.

MODULE III ONTOLOGY LEARNING FOR SEMANTIC WEB 12

Taxonomy for Ontology Learning – Layered Approach – Phases of Ontology Learning – Importing and Processing Ontologies and Documents – Ontology Learning Algorithms - Evaluation.

MODULE IV ONTOLOGY MANAGEMENT AND TOOLS 08

Overview – need for management – development process – target ontology – ontology mapping – skills management system – ontological class – constraints – issues. Volution – Development of Tools and Tool Suites – Ontology Merge Tools – Ontology based Annotation Tools.

MODULE V APPLICATIONS 05

Web Services – Semantic Web Services - Case Study for specific domain – Security issues – current trends.

Total Hours : 45

REFERENCES:

1. Asuncion Gomez-Perez, Oscar Corcho, Mariano Fernandez-Lopez "Ontological Engineering: with examples from the areas of Knowledge Management, e- Commerce and the Semantic Web" Springer, 2004
2. Grigoris Antoniou, Frank van Harmelen, "A Semantic Web Primer (Cooperative Information Systems)", The MIT Press, 2004
3. Alexander Maedche, "Ontology Learning for the Semantic Web", Springer; 1 edition, 2002
4. John Davies, Dieter Fensel, Frank Van Harmelen, "Towards the Semantic Web: Ontology – Driven Knowledge Management", John Wiley & Sons Ltd., 2003.
5. John Davies (Editor), Rudi Studer (Co-Editor), Paul Warren (Co-Editor) "Semantic Web Technologies: Trends and Research in Ontology-based Systems"Wiley Publications, Jul 2006
6. Dieter Fensel (Editor), Wolfgang Wahlster, Henry Lieberman, James Hendler, "Spinning the Semantic Web: Bringing the World Wide Web to Its Full Potential",The MIT Press, 2002.
7. Michael C. Daconta, Leo J. Obrst, Kevin T. Smith, "The Semantic Web: A Guide to the Future of XML, Web Services, and Knowledge Management", Wiley, 2003.
8. Steffen Staab (Editor), Rudi Studer, "Handbook on Ontologies (International Handbooks on Information Systems)", Springer 1st edition, 2004.
9. Dean Allemang (Author), James Hendler (Author) "Semantic Web for the Working Ontologist: Effective Modeling in RDFS and OWL" (Paperback), Morgan Kaufmann, 2008.

OUTCOMES:

On completion of the course students will be able to:

- Outline the architectures of semantic web and ontology.
- Utilize the languages used for ontology and semantic web.
- Analyze the use of ontology in semantic web.
- Use tools for ontology and semantic web.
- Apply the semantic web and ontology in web services.

ITCY113 SOFTWARE PROJECT MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn the basic concepts of software project management and software estimation methods.
- To know the software cost estimation methods.
- To learn how to allocate resources for software projects.
- To learn how to manage a project
- To manage peoples

MODULE I PROJECT MANAGEMENT CONCEPT 09

Evolution of Software Economics – Improving Software Economics – Life-Cycle Phases – Manage People – Implement Process – Leverage Tools – Utilize Measurements

MODULE II SOFTWARE ESTIMATION & COSTING 10

Form Vision - Algorithmic Cost Estimation Process, Function Points, SLIM (Software Life cycle Management), COCOMO II(Constructive Cost Model) – Estimating Web Application Development – Organize Resources – Sketch Schedule – Write Plan.

MODULE III RISK MANAGEMENT 07

Risk Definition – Risk Categories – Risk Assessment (Identification / Analysis / Prioritization) – Risk Control (Planning / Resolution / Monitoring) – Failure Mode and Effects Analysis (FMEA)

MODULE IV SOFTWARE PROJECT MANAGEMENT 10

Monitor Project – Engineer a Great Product – Deliver System – Assess Project – Managing Global Software Projects

MODULE V PEOPLE MANAGEMENT 09

PCMM – Team Management – Motivating Software Engineers Working in Virtual Teams Across Glob – Agile Project management

Total Hours : 45

REFERENCES:

1. Günther Ruhe, Claes Wohlin, “Software Project Management in a Changing World, Springer-Verlag, 2014
2. Bob Hughes,Mike Cotterell,Rajib Mall, “Software Project Management “, 5th edition, Tata McGraw-Hill Education Pvt. 2011
3. Roger S. Pressman, “software engineering” 7th edition, Mc Graw Hill Education, 2014
4. Royce, W. “Software Project management: A Unified Framework”, Addison-Wesley, 1998.
5. Joel Henry, “Software Project Management: A Real-World Guide To Success”, Pearson Education, 2004

OUTCOMES:

On completion of the course students will be able to :

- Explain the software project management concepts
- Estimate the cost and prepare project plan document.
- Identify and analyze risks.
- Express how to manage projects
- Lead a team and manage the people

ECCY001 DIGITAL IMAGE PROCESSING

L	T	P	C
3	0	0	3

OBJECTIVES:

- Describe and explain basic principles of digital image processing;
- Design and implement algorithms that perform basic image processing
- Design and implement algorithms for advanced image analysis
- Assess the performance of image processing algorithms and systems.

MODULE I DIGITAL IMAGE FUNDAMENTALS 09

Elements of digital image processing systems, Basics of visual perception, Psycho, visual model, Color image fundamentals, Brightness, contrast, hue, saturation, GB,HSI models, Image sampling & quantization.

MODULE II IMAGE TRANSFORMS 09

2D discrete transforms, DFT, DCT, WHT, KLT, DWT, Simulation of 2D transform by 1D transform.

MODULE III IMAGE ENHANCEMENT, RESTORATION, SEGMENTATION & RECOGNITION 12

Histogram modification and specification techniques, Noise distributions, Low and High Pass filters, Color image enhancement, Image degradation model – Unconstrained and constrained restoration, Geometric transformations, Spatial transformations, Gray level interpolation, Image Segmentation & its types, Pattern and Pattern classes.

MODULE IV IMAGE COMPRESSION 08

Need for image compression, Vector Quantization, Run Length Encoding, Shiftcodes, Block Truncation Coding, DCT and Wavelet Transform coding, Simulation of basic concepts.

MODULE V IMAGE PROCESSING APPLICATIONS 07

Biometric identification, Satellite image processing, Industrial machine vision application, Neural Networks in image processing, Medical image processing and Motion Analysis, Augmented\Virtual reality.

Total Hours : 45

REFERENCES:

1. Rafael C. Gonzalez, Richard E.Woods, Digital Image Processing, Pearson
2. Education, Inc., Second Edition, 2004
3. Anil K. Jain, Fundamentals of Digital Image Processing, Prentice Hall of India, 2002.
4. David Salomon : Data Compression The Complete Reference, Springer Verlag New York Inc., 2nd Edition, 2001
5. Rafael C. Gonzalez, Richard E.Woods, Steven Eddins, Digital Image Processing using MATLAB, Pearson Education, Inc., 2004.
6. William K.Pratt, Digital Image Processing, John Wiley, NewYork, 2002
7. G.W.Awcock & R.Thomas,Applied Image Processing,Mc Graw-Hill Inc,1996
8. Sonka,Hlavac,Boyle,Digital Image Processing and Computer Vision, Cengage Learning, India, 2008 Edition
9. Madhuri A.Joshi, Digital Image Processing-An Algorithmic approach, Prentice Hall of India, 2008

OUTCOMES:

At the completion of the course, students will be able to

- Acquire the knowledge of fundamental concepts of a digital image processing system
- Analyze 2D signals in the frequency domain through the various transforms.
- Describe various techniques for image enhancement and restoration.
- Recognize and apply suitable image segmentation techniques
- Identify and use of appropriate image compression techniques.
- Implement concepts of image processing using simulation technique.
- Apply suitable image processing techniques for various applications

ITCY114 HUMAN COMPUTER INTERFACE

L	T	P	C
2	0	0	2

OBJECTIVES:

- To understand the concept of menus, windows, interfaces and business functions.
- To know the various characteristics and components of windows.
- To study about various problems in windows design with color, text, graphics.

MODULE I **10**

Introduction-Importance- Human -Computer interface - characteristics of graphics interface- web user interface- characteristic & principles. User interface design process- obstacles -human characteristics in design - Human interaction speed-business functions-requirement analysis- basic business functions- Human consideration in screen design

MODULE II **10**

Structures of menus -functions of menus -contents of menu -formatting - phrasing the menu - selecting menu choice-navigating menus -graphical menus-Windows: Characteristics –components -presentation styles -types-managements –organizations –operations -web systems

MODULE III **10**

Device-based controls:characteristics-Screen -based controls: operate control - text boxes-selection control-combination control-custom control-presentation control-Text for web pages – Icons -Image -Multimedia –coloring- Windows layout-test: prototypes - kinds of tests – retest.

Total Hours: 30

REFERENCES:

1. Wilbent. O. Galitz ,"The Essential Guide to User Interface Design", John Wiley& Sons, 2001.
2. Alan Cooper, "The Essential of User Interface Design", Wiley – Dream Tech Ltd., 2002.
3. Sharp, Rogers, Preece, "Interaction Design", Wiley India, 2007.
4. Ben Sheiderman, "Design the User Interface", Pearson Education, 1998.

OUTCOMES:

On completion of the course students will be able to:

- Identify design elements from analysis of existing interfaces
- Use HCI concepts and principles to design and implement user interfaces for new applications
- Practical experience in iterative, user-centered design of graphical user interfaces and evaluate interface designs

ITCY115 DATA SCIENCE AND ANALYTICS

L	T	P	C
2	0	0	2

OBJECTIVES

- To explore the fundamental concepts of big data analytics.
- To learn the life cycle of data analytics
- To analyze the big data using intelligent techniques.

MODULE I INTRODUCTION TO BIG DATA 10

Introduction to BigData Platform – Analyst perspective on data repository-BI versus Data science- Current Analytical architecture- Drivers of Big Data- Emerging Big Data Ecosystem and a New Approach to Analytics- Examples of Big Data .

MODULE II DATA ANALYTICS LIFECYCLE 10

Data Analytics Lifecycle Overview- Key Roles for a Successful Analytics Project- Discovery- Data Preparation- Model Planning – Model Building – Communicate Results- Operationalize- Case Study: Global Innovation Network and Analysis (GINA).

MODULE III DATA ANALYTIC METHODS 10

Introduction to R 64- R Graphical User Interfaces- Data Import and Export- Attribute and Data Types- Descriptive Statistics – Descriptive Statistics- Exploratory Data Analysis – Visualization Before Analysis 8- Dirty Data – Visualizing a Single Variable- Examining Multiple Variables- Statistical Methods for Evaluation- Hypothesis Testing.

Total Hours-30

REFERENCES:

1. “Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data”, EMC Education Services, Wiley, 2015
2. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data”, McGrawHill Publishing, 2012.
3. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012.
4. PeteWarden, “Big Data Glossary”, O’Reilly, 2011.

OUTCOMES

On completion of the course students will be able to:

- Explain the fundamentals of various big data analytics techniques.
- Deploy a structured lifecycle approach to data analytics problems
- Apply appropriate analytic techniques and methods for analyzing big data

ITCY116 BIG DATA ANALYTICS TOOLS

L	T	P	C
1	0	0	1

OBJECTIVES

- To understand the basics concepts of text analysis methods.
- To know the framework applications on big data tools.

MODULE I ADVANCED ANALYTICAL THEORY AND METHODS-TEXT ANALYSIS **08**

Text Analysis Steps- A Text Analysis Example- Collecting Raw Text- Representing Text- Term Frequency—Inverse Document Frequency (TFIDF)- Categorizing Documents by Topics- Determining Sentiments- Gaining Insights-exercises.

MODULE II TECHNOLOGY AND TOOLS **07**

Analytics for Unstructured Data - Use Cases - MapReduce - Apache Hadoop - The Hadoop Ecosystem – Hive – HBase –Flume- Mahout – Apache Spark- SOLR-NoSQL.

Total Hours- 15

REFERENCES:

1. “Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data”, EMC Education Services, Wiley, 2015
2. Tom White “ Hadoop: The Definitive Guide” Third Edition, O’reilly Media, 2012.
3. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012.

OUTCOMES

On completion of the course students will be able to:

- Design efficient algorithms for mining the data from large volumes.
- Explore on Big Data applications Using Pig and Hive.

ITCY117 GREEN TECHNOLOGY

L	T	P	C
1	0	0	1

OBJECTIVES:

- To acquire knowledge to adopt green computing practices to minimize negative impacts on the environment.
- To learn to minimize energy consumption.
- To examine technology for energy management in real-time systems.

MODULE I GREEN IT FUNDAMENTALS, ASSETS & MODELING 07

Green IT Fundamentals: Business, IT, Environment - Green IT Strategies: Drivers, Dimensions, Goals - Green Assets: Buildings, Data Centers, Networks, and Devices - Green Business Process Management: Modeling, Optimization, and Collaboration – Green Enterprise Architecture - Green Information Systems: Design and Development Models – Power management in power-aware real time systems – Green Applications.

MODULE II GREEN IT FRAMEWORK & GREEN COMPLIANCE 08

Data center virtualization – Implementing Green Data Center – Saving energy – Enabling transparency, Telecommuting, Teleconferencing and Teleporting – Going paperless - Materials recycling – Green Data center – Green Grid framework – Green Compliance: Protocols, Standards, and Audits – Emergent Carbon Issues: Technologies and Future.

Total Hours : 15

REFERENCES:

1. Bud E. Smith,"Green Computing Tools and Techniques for Saving Energy, Money, and Resources", Taylor & Francis Group, CRC Press, ISBN-13: 978-1-4665-0340-3, 2014.
2. Jason Harris, "Green Computing and Green IT Best Practices, On Regulations and Industry Initiatives, Virtualization and power management, materials recycling and Tele commuting , Emereo Publishing .ISBN-13: 978-1-9215-2344-1,2014.
3. Ishfaq Ahmed & Sanjay Ranka, "Handbook of Energy Aware and Green Computing", CRC Press, ISBN: 978-1-4665-0116-4, 2013.
4. Greg Schulz, "The Green and Virtual Data Center", CRC Press, ISBN-13:978-1-4200-8666-9, 2009.

5. Marty Poniatowski, “Foundation of Green IT: Consolidation, Virtualization, Efficiency, and ROI in the Data Center”, Printice Hall, ISBN: 9780-1-3704-375-0, 2009.

OUTCOMES:

On completion of the course students will be able to:

- Discuss Green Computing concepts, assets and business process management.
- Outline Green data center framework, Green compliance in IT systems.

GENERAL ELECTIVES

GECY101 PROJECT MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

The objectives of the course would be to make the students

- Learn to evaluate and choose an optimal project and build a project profile.
- Attain knowledge on risk identification and risk analysis
- Gain insight into a project plan and components
- Familiar with various gamut of technical analysis for effective project implementation
- Learn to apply project management techniques to manage resources.

MODULE I INTRODUCTION & PROJECT INITIATION 09

Introduction to project and project management - projects in contemporary organization – The project life cycle - project initiation - project evaluation methods & techniques - project selection criteria - project profile.

MODULE II RISK ANALYSIS 09

Sources of risk: project specific - competitive - industry specific - market and international risk – perspectives of risk – risk analysis: sensitivity analysis - scenario analysis - breakeven analysis - simulation analysis - decision tree analysis – managing/mitigating risk – project selection under risk.

MODULE III PROJECT PLANNING & IMPLEMENTATION 09

Project planning – importance – functions - areas of planning - project objectives and policies - steps in planning process - WBS – capital requirements - budgeting and cost estimation - feasibility analysis - creation of project plan – project implementation: pre-requisites - forms of project organization

MODULE IV TECHNICAL ANALYSIS 09

Technical analysis for manufacturing/construction/infrastructure projects – process/technology - materials and inputs - product mix - plant capacity – plant location and site selection – plant layout - machinery and equipment – structures and civil works – schedule of project implementation – technical analysis for software projects.

MODULE V PROJECT MANAGEMENT TECHNIQUES 09

Project scheduling - network construction – estimation of project completion time – identification of critical path - PERT & CPM – crashing of project network - complexity of project scheduling with limited resources - resource allocation - resource leveling – resource smoothing – overview of project management software.

Total Hours: 45

REFERENCES:

1. Projects: Planning, Analysis, Financing, Implementation and Review, Prasanna Chandra, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2004.
2. Project Management and Control, Narendra Singh, Himalaya Publishing, New Delhi, 2015.
3. A Management Guide to PERT/CPM, Jerome, D. Weist and Ferdinand K. Levy, Prentice Hall of India, New Delhi, 1994.

OUTCOMES:

On successfully completing this course, the student will be able to:

- Evaluate & select a project as well as develop a project profile.
- Identify various risks associated with the project and manage it effectively.
- Prepare a detailed project plan addressing its components.
- Perform technical analysis for effective project implementation
- Apply project management techniques for maximizing resource utilization.

GECY102 SOCIETY, TECHNOLGY & SUSTAINABILITY

L	T	P	C
3	0	0	3

OBJECTIVES:

- Aware of new technologies through advances in Science and Engineering.
- To make them realise the profound impact on society.
- Understand the ethical issues raised by technological changes and its effect on society.
- To introduce students a broad range of perspectives on the adoption and use of technologies.
- To make them realize the need of sustainability in the context of emerging technologies.

MODULE I TECHNOLOGY AND ITS IMPACTS 09

Origin and evolution of technologies – Nature of technology- Innovation – Historical Perspective of technology – Sources of technological change - Co-evolution of technology and economy – Scientific knowledge and technological advance – Science and Engineering aspects of Technology – Impact on the Society – Social and Ethical Issues associated with technological change – Social and environmental consequences - Impact of technological change on human life – Technology and responsibility – Technology and social justice.

MODULE II TECHNOLOGY AND ITS ADVANCEMENT 09

Sociological aspects of technology – Ethics and technology – Technology and responsibility – International Economics, Globalisation and Human Rights – Sustainability and Technology – Population and environment - Technology, Energy and Environment – Organisations and technological change.

MODULE III SOCIETY AND TECHNOLOGY 09

Impact of technologies on contemporary society – Role of society in fostering the development of technology – Response to the adaption and use of technology – Impact of technology on developer and consumers – Technological change and globalisation.

MODULE IV IMPACT OF A SPECIFIC TECHNOLOGY ON HUMAN WELFARE 09

Impact of the following technologies on Human life – Medical and Biomedical – Genetics Technology – Electronics and Communications – Electronic media Technology – Information Systems Technology – Nanotechnology – Space

Technology and Energy Technology.

MODULE V THE IMPORTANCE OF SUSTAINABILITY 09

Sustainability – A brief history – Concepts and contexts for sustainability – Ecological imbalance and biodiversity loss – Climate change – Population explosion. Industrial ecology – systems approach to sustainability – Green engineering and technology- sustainable design- sustainable manufacturing- Green consumer movements – Environmental ethics – Sustainability of the planet Earth – Future planning for sustainability.

Total Hours: 45

REFERENCES:

1. Volti Rudi, “Society and Technology Change”, 6th Edition, Worth publishers Inc, USA, 2009.
2. Arthur W.A, “The nature of Technology: What it is and how it evolves”, Free Press, NY, USA, 2009.
3. Winston M and Edelbach R, “Society, Ethics and Technology”, 3rd Edition, San Francisco, USA, 2005.
4. Martin A.A Abraham, “Sustainability Science and Engineering: Defining Principles”, Elsevier Inc, USA, 2006.
5. R.V.G.Menon, “Technology and Society”, Pearson Education, India, 2011.

OUTCOMES:

At the end of this course, the students will be able to

- Understand the benefits of modern technology for the well-being of human life.
- Connect sustainability concepts and technology to the real world challenges.
- Find pathway for sustainable society.

GECY103 ARTIFICIAL INTELLIGENCE

L	T	P	C
3	0	0	3

OBJECTIVES:

- Expose the history and foundations of artificial intelligence.
- Showcase the complexity of working on real time problems underlying the need for intelligent approaches.
- Illustrate how heuristic approaches provide a good solution mechanism.
- Provide the mechanisms for simple knowledge representation and reasoning.
- Highlight the complexity in working with uncertain knowledge.
- Discuss the current and future applications of artificial intelligence.

MODULE I HISTORY AND FOUNDATIONS 08

History – Scope – Influence from life – Impact of computing domains - Agents in environments - Knowledge representation – Dimensions of Complexity – Sample application domains – Agent structure.

MODULE II SEARCH 10

Problem solving as search – State spaces – Uninformed Search – Heuristic search – Advanced search – Constraint satisfaction - Applications.

MODULE III KNOWLEDGE REPRESENTATION AND REASONING 10

Foundations of knowledge representation and reasoning, representing and reasoning about objects, relations, events, actions, time, and space predicate logic, situation calculus, description logics, reasoning with defaults, reasoning about knowledge, sample applications.

MODULE IV REPRESENTING AND REASONING WITH UNCERTAIN KNOWLEDGE 08

Probability, connection to logic, independence, Bayes rule, Bayesian networks, probabilistic inference, sample applications.

MODULE V CASE STUDY AND FUTURE APPLICATIONS 09

Design of a game/Solution for problem in student's domain. Natural Language processing, Robotics, Vehicular automation – Scale, Complexity, Behaviour – Controversies.

Theory: 45

TEXT BOOK:

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall, Third Edition, 2010.
2. David Poole, Alan Mackworth, Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010.
3. Nils J. Nilsson, The Quest for Artificial Intelligence, Cambridge University Press, Online edition, 2013.
4. Keith Frankish, William M. Ramsey (eds) The Cambridge Handbook of Artificial Intelligence, Cambridge University Press, 2014.

OUTCOMES:

Students who complete this course will be able to

- Discuss the history, current applications, future challenges and the controversies in artificial intelligence.
- Apply principle of AI in the design of an agent and model its actions.
- Design a heuristic algorithm for search problems.
- Analyze and represent the fact using logic for a given scenario
- Represent uncertainty using probabilistic models
- Develop a simple game or solution using artificial intelligence techniques.

GECY104 GREEN COMPUTING **L T P C**
3 0 0 3

OBJECTIVES:

- To focus on the necessity of green computing technology.
- To expose to various issues with information technology and sustainability.
- To attain knowledge on the technologies for enabling green cloud computing.
- To elaborate on the energy consumption issues
- To illustrate a Green and Virtual Data Center
- To develop into a Green IT Technologist.

MODULE I INTRODUCTION 08

Trends and Reasons to Go Green - IT Data Center Economic and Ecological Sustainment - The Growing Green Gap: Misdirected Messaging, Opportunities for Action - IT Data Center “Green” Myths and Realities - PCFE Trends, Issues, Drivers, and Related Factors - Green Computing and Your Reputation- Green Computing and Saving Money- Green Computing and the Environment

MODULE II CONSUMPTION ISSUES 10

Minimizing power usage – Cooling - Electric Power and Cooling Challenges - Electrical – Power -Supply and Demand Distribution - Determining Energy Usage - From Energy Avoidance to Efficiency - Energy Efficiency Incentives, Rebates, and Alternative Energy Sources - PCFE and Environmental Health and Safety Standards- Energy-exposed instruction sets- Power management in power-aware real-time systems.

MODULE III NEXT-GENERATION VIRTUAL DATA CENTERS 09

Data Center Virtualization - Virtualization beyond Consolidation - Enabling Transparency - Components of a Virtual Data Center - Datacenter Design and Redesign - Greening the Information Systems - Staying Green- Building a Green Device Portfolio- Green Servers and Data Centers- Saving Energy

MODULE IV TECHNOLOGIES FOR ENABLING GREEN AND VIRTUAL DATA CENTERS 08

Highly Effective Data Center Facilities and Habitats for Technology - Data Center Electrical Power and Energy Management - HVAC, Smoke and Fire Suppression

- Data Center Location - Virtual Data Centers Today and Tomorrow - Cloud Computing, Out-Sourced, and Managed Services.

MODULE V SERVERS AND FUTURE TRENDS OF GREEN COMPUTING 10

Server Issues and Challenges - Fundamentals of Physical Servers - Types, Categories, and Tiers of Servers - Clusters and Grids - Implementing a Green and Virtual Data Center - PCFE and Green Areas of Opportunity- 12 Green Computer Companies- What's in Green computer science-Green off the Grid aimed for data center energy evolution-Green Grid Consortium- Green Applications- Green Computing Making Great Impact On Research

Theory: 45

REFERENCES:

1. Bud E. Smith,"Green Computing Tools and Techniques for Saving Energy, Money, and Resources", Taylor & Francis Group, CRC Press, ISBN-13: 978-1-4665-0340-3, 2014.
2. Jason Harris, "Green Computing and Green IT Best Practices, On Regulations and Industry Initiatives, Virtualization and power management, materials recycling and Tele commuting, Emereo Publishing .ISBN-13: 978-1-9215-2344-1,2014.
3. Ishfaq Ahmed & Sanjay Ranka, "Handbook of Energy Aware and Green Computing", CRC Press, ISBN: 978-1-4665-0116-4, 2013.
4. Kawahara, Takayuki, Mizuno, "Green Computing with Emerging Memory", Springer Publications, ISBN:978-1-4614-0811-6, 2012
5. Greg Schulz, "The Green and Virtual Data Center", CRC Press, ISBN-13:978-1-4200-8666-9, 2009.
6. Marty Poniatowski, "Foundation of Green IT: Consolidation, Virtualization, Efficiency, and ROI in the Data Center", Printice Hall, ISBN: 9780-1-3704-375-0, 2009.

OUTCOMES:

Students who complete this course will be able to

- Demonstrate issues relating to a range of available technologies, systems and practices to support green computing.
- Select appropriate technologies that are aimed to reduce energy consumption.
- Address design issues needed to achieve an organizations' green

computing objectives.

- Analyze the functionality of Data Centers.
- Critically evaluate technologies and the environmental impact of computing resources for a given scenario.
- Compare the impact of Green Computing with other computing techniques.

GECY105 GAMING DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To master event-based programming
- To learn resource management as it relates to rendering time, including level-of-detail and culling.
- To become familiar with the various components in a game or game engine.
- To explore leading open source game engine components.
- To become familiar of game physics.
- To be compatible with game animation.

MODULE I INTRODUCTION 09

Magic Words – What Skills Does a Game Designer Need? – The Most Important Skill -The Five Kinds of Listening-The Secret of the Gifted.

MODULE II THE DESIGNER CREATES AN EXPERIENCE 09

The Game Is Not the Experience -Is This Unique to Games? -Three Practical Approaches to Chasing Rainbows -Introspection: Powers, Perils, and Practice -Dissect Your Feelings -Defeating Heisenberg -Essential Experience.

MODULE III THE EXPERIENCE IN THE PLAYER MIND AND GAME MECHANICS 08

Modeling – Focus -Empathy – Imagination – Motivation – Space – Objects, Attributes, and States – Actions – Rules.

MODULE IV GAMES THROUGH AN INTERFACE 09

Breaking it Down – The Loop of Interaction – Channels of Information – Other Interface.

MODULE V BALANCED GAME MECHANICS 10

Balance – The Twelve Most Common Types of Game Balance – Game Balancing Methodologies - Balancing Game Economies.

Theory: 45

REFERENCES:

1. Jesse Schell, "The Art of Game Design: A Book of Lenses", Second Edition 2nd Edition ISBN-10: 1466598646, 2014.
2. Ashok Kumar, Jim Etheredge, Aaron Boudreaux, “Algorithmic and Architectural Gaming Design: Implementation and Development", 1st edition, Idea Group, U.S ISBN-10: 1466616342, 2012.
3. Katie Salen Tekinba, Melissa Gresalfi, Kylie Peppler, Rafi Santo, "Gaming the System - Designing with Gamestar Mechanic" MIT Press , ISBN-10: 026202781X, 2014.
4. James M. Van Verth, Lars M. Bishop "Essential Mathematics for Games and Interactive Applications", Third Edition,A K Peters/CRC Press, ISBN-10: 1482250926, 2015.

OUTCOMES:

Students who complete this course will be able to

- Realize the basic history and genres of games
- Demonstrate an understanding of the overall game design process
- Explain the design tradeoffs inherent in game design
- Design and implement basic levels, models, and scripts for games
- Describe the mathematics and algorithms needed for game programming
- Design and implement a complete three-dimensional video game

GECY106 SOCIAL COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To create original social applications, critically applying appropriate theories and effective practices in a reflective and creative manner.
- To critically analyze social software in terms of its technical, social, legal, ethical, and functional features or affordances.
- To encourage the development of effective communities through the design, use, and management of social software.
- To give students with a base of knowledge and advances for them to critically examine existing social computing services.
- To plan and execute a small-scale research project in social computing in a systematic fashion.
- To become familiar with the concept of computational thinking.

MODULE I BASIC CONCEPTS 09

Networks and Relations: Relations and Attributes, Analysis of Network Data, Interpretation of network data -New Social Learning – Four Changes that Shift Work - Development of Social Network Analysis: Sociometric analysis and graph theory, Interpersonal Configurations and Cliques – Analysing Relational Data.

MODULE II SOCIAL LINK 09

Individual Actors, Social Exchange Theory, Social Forces, Graph Structure, Agent Optimization Strategies in Networks – Hierarchy of Social Link Motivation- Social Context.

MODULE III SOCIAL MEDIA 08

Trends in Computing – Motivations for Social Computing – Social Media: Social relationships, Mobility and Social context – Human Computation – Computational Models- Business use of social Media.

MODULE IV SOCIAL INFORMATION FILTERING 09

Mobile Location Sharing – Location based social media analysis – Social Sharing and Social Filtering – Automated recommender Systems – Traditional and Social Recommender Systems.

MODULE V SOCIAL NETWORK STRATEGY 10

Application of Topic Models – Opinions and Sentiments – Recommendation Systems – Language Dnamics and influence in online communities – Psychometric analysis – Case Study: Social Network Strategies for surviving the zombie apocalypse.

Theory: 45

REFERENCES:

1. Tony Bingham, Marcia Conner, “The New Social Learning, 2nd Edition: Connect. Collaborate. Work”, 2nd Edition, ATD Press, ISBN-10:1-56286-996-5, 2015.
2. Nick Crossley, Elisa Bellotti, Gemma Edwards, Martin G Everett, Johan Koskinen, Mark Tranmer, “Social Network Analysis for Ego-Nets”, SAGE Publication, 2015.
3. Zafarani, Abbasi and Liu, Social Media Mining: An Introduction, Cambridge University Press, 2014.
4. Christina Prell, “Social Network Analysis: History, Theory and Methodology”, 1st Edition, SAGE Publications Ltd, 2012.
5. John Scott, “Social Network Analysis”, Third Edition, SAGE Publication, 2013.
6. Jennifer Golbeck, “Analyzing the Social Web”, Elsevier Publication, 2013.
7. Huan Liu, John Salerno, Michael J. Young, “Social computing and Behavioral Modeling”, Springer Publication, 2009.

OUTCOMES:

Students who complete this course will be able to

- Realize the range of social computing applications and concepts.
- Analyze data left after in social media.
- Recognize and apply the concepts of computational models underlying social computing.
- Take out simple forms of social diagnostics, involving network and language models, applying existing analytic tools on social information.
- Evaluate emerging social computing applications, concepts, and techniques in terms of key principles.
- Design and prototype new social computing systems.

GECY107 SOFT COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To become familiar with AI and neural networks that can learn from available examples and generalize to form appropriate rules for inferencing systems.
- To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience.
- To provide the mathematical background for carrying out the optimization associated with neural network learning.
- To familiarize with genetic algorithms and other random search procedures useful while seeking global optimum in self-learning situations.
- To introduce case studies utilizing the above and illustrate the intelligent behavior of programs based on soft computing.

MODULE I INTRODUCTION 09

Introduction of soft computing, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing. Artificial Intelligence : Introduction, Various types of production systems, characteristics of production systems, breadth first search, depth first search techniques, other Search Techniques like hill Climbing, Best first Search, A* algorithm, AO* Algorithms and various types of control strategies. Knowledge representation issues, Prepositional and predicate logic, monotonic and non-monotonic reasoning, forward Reasoning, backward reasoning.

MODULE II INTRODUCTION TO NEURAL NETWROK 09

Structure and Function of a single neuron: Biological neuron, artificial neuron, definition of ANN, Taxonomy of neural net, Difference between ANN and human brain, characteristics and applications of ANN, single layer network, Perceptron training algorithm, Linear separability, Widrow & Hebb"s learning rule/Delta rule, ADALINE, MADALINE, AI v/s ANN. Introduction of MLP, different activation functions, Error back propagation algorithm, derivation of BPA, momentum, limitation, characteristics and application of EBPA.

MODULE III FUZZY LOGIC 09

Fuzzy set theory, Fuzzy set versus crisp set, crisp relation & fuzzy relations, Fuzzy systems: crisp logic, fuzzy logic, introduction & features of membership functions, Fuzzy rule base system: fuzzy propositions, formation, decomposition & aggregation of fuzzy rules, fuzzy reasoning, fuzzy inference

systems, fuzzy decision making & Applications of fuzzy logic.

MODULE IV GENETIC ALGORITHM 09

Fundamentals, basic concepts, working principle, encoding, fitness function, reproduction, Genetic modeling: Inheritance operator, cross over, inversion & deletion, mutation operator, Bitwise operator, Generational Cycle, Convergence of GA, Applications & advances in GA, Differences & similarities between GA & other traditional methods.

MODULE V APPLICATION OF COMPUTATIONAL INTELLIGENCE 09

Printed Character Recognition – Inverse Kinematics Problems – Automobile Fuel Efficiency Prediction – Soft Computing for Color Recipe Prediction.

Total Hours: 45

REFERENCES:

1. Jyh-shing Roger Jang, Chuen - Tsai Sun, Eiji Mizutani, “Neuro- Fuzzy and Soft Computing”, Prentice-Hall of India, 2003.
2. S.Rajasekaran & G.A. Vijayalakshmi Pai, “Neural Networks, Fuzzy Logic & Genetic Algorithms, Synthesis & applications”, PHI Publication, 2002.
3. S.N. Sivanandam & S.N. Deepa, “Principles of Soft Computing”, Wiley Publications, 2007.
4. N.K.Bose, “Neural Network Fundamentals with Graphs, Algorithms, and Applications” TMH, 1996.
5. Klir & Yuan, “Fuzzy sets & Fuzzy Logic: Theory & Application”, Prentice Hall of India Pub, 1995.
6. Kosko: “Neural Network & Fuzzy System”, PHI Publication, 1992.

OUTCOMES:

On completion of the programme students will be able to:

- Learn about soft computing techniques and their applications
- Analyze various neural network architectures and able to Understand perceptrons model
- Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
- Apply genetic algorithms to combinatorial optimization problems.
- Evaluate and compare solutions by various soft computing approaches for a given problem.

GECY108 EMBEDED SYSTEM PROGRAMMING

L	T	P	C
3	0	0	3

OBJECTIVES:

- This course provides an introduction to the design of embedded computing systems including their hardware and software architectures.
- Entire software development lifecycle and examine the various issues involved in developing software for embedded systems.
- To analyze the I/O programming and Embedded C coding techniques
- This course will equip students with the software development skills necessary for practitioners in the embedded systems field.

MODULE I INTRODUCTION OF EMBEDDED SYSTEM 09

Embedded computing - characteristics and challenges - embedded system design process-Overview of Processors and hardware units in an embedded system-Compiling, Linking and locating – downloading and debugging –Emulators and simulators processor – External peripherals – Memory testing – Flash Memory.

MODULE II SOFTWARE TECHNOLOGY 09

Software Architectures, Software development Tools, Software Development Process Life Cycle and its Model, Software Analysis, Design and Maintenance.

MODULE III INPUT/OUTPUT PROGRAMMING 09

I/O Instructions, Synchronization, Transfer Rate & Latency, Polled Waiting Loops, Interrupt – Driven I/O, Writing ISR in Assembly and C, Non Maskable and Software Interrupts

MODULE IV DATA REPRESENTATION IN EMBEDDED SYSTEMS 09

Data representation ,Twos complement, Fixed point and Floating Point Number Formats ,Manipulating Bits in -Memory, I/O Ports, Low level programming in C ,Primitive data types , Arrays, Functions ,Recursive Functions, Pointers, Structures & Unions ,Dynamic Memory Allocation ,File handling ,Linked lists, Queues, Stacks.

MODULE V EMBEDDED C 09

Embedded Systems programming in C – Binding & Running Embedded C program in Keil IDE – Dissecting the program -Building the hardware. Basic techniques for reading & writing from I/O port pins – switch bounce - LED Interfacing using Embedded C.

Total Hours: 45

REFERENCES:

1. Marilyn Wolf, "Computers as components ", Elsevier, 2012.
2. Qing Li and Carolyn Yao, "Real-Time Concepts for Embedded Systems", CMP Books, 2003.
3. Daniel W. Lewis, "Fundamentals of embedded software where C and assembly meet", Pearson Education
4. Michael Bass, "Programming Embedded Systems in C and C++", Oreilly, 2003.

OUTCOMES:

On completion of this course the student will be able to

- Design the software and hardware components in embedded system
- Describe the software technology
- Use interrupt in effective manner
- Use keil IDE for programming
- Program using embedded C for specific microcontroller
- Design the embedded projects

GECY109 PRINCIPLES OF SUSTAINABLE DEVELOPMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge in the concepts and dimensions of sustainable development.
- To gain knowledge on the framework for achieving sustainability.

MODULE I CONCEPT OF SUSTAINABLE DEVELOPMENT 09

Environment and Development - Population poverty and Pollution –Global and Local environmental issues –Resource Degradation- Greenhouse gases- Desertification-industrialization –Social insecurity, Globalization and environment. History and emergence of the concept of sustainable development-Objectives of Sustainable Development.

MODULE II COMPONENTS AND DIMENSIONS OF SUSTAINABLE DEVELOPMENT 09

Components of Sustainability –Complexity of growth and equity – Social economic and environmental dimensions of sustainable development – Environment- Biodiversity- Natural -Resources- Ecosystem integrity- Clean air and water- Carrying capacity- Equity, Quality of Life, Prevention, Precaution-Preservation and Public Participation Structural and functional linking of developmental dimensions.

MODULE III FRAMEWORK FOR ACHIEVING SUSTAINABILITY 09

Operational guidelines- interconnected prerequisites for sustainable development Empowerment of Women, children, Youth, Indigenous People, Non-Governmental Organizations Local Authorities, Business and industry-Science and Technology for sustainable development- performance indicators of sustainability and assessment mechanism- Constraints and barriers for sustainable development.

MODULE IV SUSTAINABLE DEVELOPMENT OF SOCIO ECONOMIC SYSTEMS 09

Demographic dynamics of sustainability – Policies for socio-economic development -Strategies for implementing eco-development programmes Sustainable development through trade –Economic growth –Action plan for implementing sustainable development –Urbanization and sustainable Cities – Sustainable Energy and Agriculture –sustainable livelihoods.

MODULE V SUSTAINABLE DEVELOPMENT AND INTERNATIONAL RESPONSE 09

Role of developed countries in the development of developing countries – international summits – Stockholm to Johannesburg – Rio principles – Agenda-Conventions – Agreements – Tokyo Declaration – Doubling statement – Tran boundary issues integrated approach for resources protection and management

Total Hours: 45

REFERENCES:

1. Sayer J. and Campbell, B., The Science of Sustainable Development: Local Livelihoods and the Global environment - Biological conservation restoration & Sustainability, Cambridge university Press, London, 2003.
2. M.K. Ghosh Roy. and Timberlake, Sustainable Development, Ane Books Pvt. Ltd, 2011.
3. Mackenthun K.M., Concepts in Environmental Management, Lewis Publications London,1999.
4. APJ Abdul Kalam and Srijan Pal Singh, Target 3 Billion: Innovative Solutions Towards Sustainable Development, Penguin India, 2011

OUTCOMES:

At the end of the course the student will be able to

- Describe the concepts of sustainable development
- Define the components and dimensions of sustainable development
- Outline the Frame work for achieving sustainability.
- State the policies and strategies for implementing sustainable development for Socio economic programmes.
- Examine the role of developed countries in sustainable development.

GECY110	QUANTITATIVE TECHNIQUES IN MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVE:

To impart knowledge on

- operations research
- production management
- financial management
- decision theory and managerial economics

MODULE I OPERATIONS RESEARCH 09

Introduction to Operations research-Linear programming-Graphical and Simplex Methods, Duality and Post-Optimality Analysis-Transportation and Assignment Problems

MODULE II PRODUCTION MANAGEMENT 09

Inventory control, EOQ, Quantity Discounts, Safety Stock-Replacement Theory-PERT and CPM-Simulation Models-Quality Control.

MODULE III FINANCIAL MANAGEMENT 09

Working Capital Management-Compound Interest and Present Value methods-Discounted Cash Flow Techniques-Capital Budgeting.

MODULE IV DECISION THEORY 09

Decision Theory-Decision Rules-Decision making under conditions of certainity, risk and uncertainity-Decision trees-Utility Theory.

MODULE V MANAGERIAL ECONOMICS 09

Cost concepts-Break-even -Analysis-Pricing techniques-Game Theory applications.

Total Hours: 45

REFERENCES:

1. Vohra, N.D. , Quantitative Techniques in Management, Tata McGraw Hill Co., Ltd, New Delhi, 2009.
2. Seehroeder, R.G., Operations Management, McGraw Hill, USA, 2002.
3. Levin, R.I, Rubin, D.S., and Stinsonm J., Quantitative Approaches to Management, McGraw Hill Book Co., 2008.

4. Frank Harrison, E., The Managerial Decision Making Process, Houghton Miffin Co. Boston, 2005.
5. Hamdy A. Taha, Operations Research- An Introduction, Prentice Hall, 2002.

OUTCOME:

At the end of the course, the students will be able to

- Apply the concepts of operations research for various applications
- Create models for inventory control in production management
- Compute the cash flow for a project
- Choose a project using decision theory based on the risk criterion.
- Apply the concepts of managerial economics in construction management

GECY111 PROGRAMMING USING MATLAB & SIMULINK

L	T	P	C
1	0	2	2

OBJECTIVES:

The aim of this course is to:

- Teach students how to mathematically model engineering systems
- Teach students how to use computer tools to solve the resulting mathematical models. The computer tool used is MATLAB and the focus will be on developing and solving models of problems encountered in engineering fields

MODULE I INTRODUCTION MATLAB DATA PRESENTATION 03+06

Vectors, Matrices -Vector/Matrix Operations & Manipulation- Functions vs scripts-Making clear and compelling plots-Solving systems of linear equations numerically and symbolically- Least squares regression -Curve fitting.

MODULE II MATLAB PLOT FUNCTION 03+06

Introduction- Plot Function – Animation- 3D Plots-Customizing Plots – Plot Applications- Saving &Painting Plots.

MODULE III ROOT FINDING AND COMPUTER REPRESENTATION OF NUMBERS 03+06

Linearization and solving non-linear systems of equations- The Newton-Rapson method- Integers and rational numbers in different bases- Floating point numbers-Round off and errors in basic arithmetic-Significant digits when reporting results

MODULE IV ORDINARY DIFFERENTIAL EQUATIONS 03+06

Numerical integration and solving 1st order, ordinary differential equations (Euler's method and Runge-Kutta) – Use of ODE function in MATLAB

MODULE V NON-LINEAR DIFFERENTIAL EQUATIONS 03+06

Converting 2nd order and higher ODEs to systems of 1st order ODEs- Solving systems of ODEs via Euler's method and Runge-Kutta) – Solving single and systems of non-linear differential equations by linearization-Use of the function ODE in MATLAB to solve differential equations

MODULE VI INTRODUCTION OF SIMULINK 03+06

Simulink & its relations to MATLAB – Modeling a Electrical Circuit- Modeling a fourth order differential equations- Modeling the solution of three equations with three unknowns- Representing a model as a subsystem-Simulink demos.

Total Hours: 45

REFERENCE:

1. Griffiths D V and Smith I M, Numerical Methods for Engineers, Blackwell, 1991.
2. Laurene Fausett, Applied Numerical Analysis Using MATLAB, Pearson 2008.
3. Moin P, Fundamentals of Engineering Numerical Analysis, Cambridge University Press, 2001.
4. Wilson HB, Turcotte LH, Advanced mathematics and mechanics applications using MATLAB. CRC Press, 1997
5. Ke Chen, Peter Giblin and Alan Irving, Mathematical Exploration with MATLAB, Cambridge University Press, 1999.

OUTCOMES:

At the end of this unit students will be able to:

- Use Matlab as a convenient tool for solving a broad range of practical problems in engineering from simple models to real examples.
- Write programs using first principles without automatic use of built-in ones.
- Write programs for solving linear and nonlinear systems, including those arising from boundary value problems and integral equations, and for root-finding and interpolation, including piecewise approximations.
- Be fluent in exploring Matlab's capabilities, such as using matrices as the fundamental data-storage unit, array manipulation, control flow, script and function m-files, function handles, graphical output.
- Make use of Maltab visual capabilities for all engineering applications.
- An ability to identify, formulate, and solve engineering problems. This will be accomplished by using MATLAB to simulate the solution to various problems in engineering fields

GECY112 JAVA PROGRAMMING

L	T	P	C
2	0	0	2

OBJECTIVES:

- To learn the fundamentals of Java programming such as data types, variables and arrays.
- To study the syntax and necessity of decision making and iterative statements.
- To create a class and invoke the methods.
- To instigate programming in overloading of methods.
- To emphasize the concept of packages.
- To learn the exception handling routines.

MODULE I INTRODUCTION TO JAVA PROGRAMMING 15

History and Evolution of Java – Overview of Java – Data types, variables and arrays – Operators – Control statements.

MODULE II METHODS AND CLASSES 15

Class fundamentals – Declaring objects – Methods – Constructors – Garbage collection – Overloading methods – Constructor overloading – Access control – Inheritance – Packages - Exception handling.

Total Hours: 30

REFERENCES:

1. Herbert Schildt, Java The Complete Reference, 9th Edition, Oracle Press, 2014, ISBN: 978007180855-2.
2. Nicholas S. Williams, Professional Java for Web Applications: Featuring WebSockets, Spring Framework, JPA Hibernate and Spring Security (WROX), John Wiley & Sons, 2014, ISBN:978111865651-8.
3. E Balagurusamy, Programming with Java, 5th Edition,Tata Mcgraw Hill,2014.
4. Yashavant Kanetka**,** Let Us Java, 2nd Edition, BPB Publications, 2012**.**

OUTCOMES:

Students to complete this course will be able to

- Implement basic Java programming.
- Create a class and invoke methods for real world problems.
- Construct simple overloading of methods programs.
- Implement various types of inheritance concepts.
- Describe the access control mechanism.

GECY113 PYTHON PROGRAMMING

L	T	P	C
2	0	0	2

OBJECTIVES:

- To learn the list and records of python programming.
- To study the control statements and string functions of python.
- To instigate the fundamental python programming.
- To emphasize GUI in python.
- To integrate python with embedded systems.
- To implement programs in python.

MODULE I INTRODUCTION TO PYTHON PROGRAMMING 15

Installation and environment set up – syntax used in python – variable types – operators – Loops – decision making – string functions - formatted files - GUI basics.

MODULE II EMBEDDED PROGRAMMING USING PYTHON 15

Web interface – system tools – script execution context - Motion-triggered LEDs-Python-arduino prototyping-storing and plotting arduino data-Remote home monitoring system.

Total Hours : 30

REFERENCES:

1. Nick Goddard, “Python Programming”, 2nd edition, ISBN: 1533337772, 2016.
2. Pratik Desai, “Python Programming for Arduino”, 1st edition, Packt publishing, 2015, ISBN: 9781783285938.
3. Mark Lutz, Learning Python: Powerful Object-Oriented Programming, 5th Edition, O'Reilly Media, 2013.
4. Richard H. Barnett, Sarah Cox, Larry O'Cull, “Embedded C Programming and the Atmel AVR”, 2nd edition, 2006.
5. Michael Barr, Anthony Massa, “Programming Embedded Systems”, 2nd Edition, O'Reilly Media, 2006.

OUTCOMES:

Students to complete this course will be able to

- Implement date and time function programming using python.
- Write formatted file programming.
- Construct simple python programs.
- Create web interface using python programming
- Develop embedded system with python programming.
- Build arduino prototype using python programming.

GECY114 INTELLECTUAL PROPERTY RIGHTS (IPR)

L	T	P	C
1	0	0	1

OBJECTIVES:

- To study about Intellectual property rights and its need
- To explore the patent procedure and related issues

MODULE I INTRODUCTION 07

Introduction and the need for intellectual property right (IPR) – IPR in India – Genesis and Development – IPR in abroad – Important examples of IPR – Copyrights, Trademarks, Patents, Designs, Utility Models, Trade Secrets and Geographical Indications – Industrial Designs

MODULE II PATENT 08

Concept of Patent – Product / Process Patents & Terminology – Duration of Patents – Law and Policy Consideration Elements of Patentability –- Patentable Subject Matter – Procedure for Filing of Patent Application and types of Applications – Procedure for Opposition – Revocation of Patents – Working of Patents- Patent Agent – Qualification and Registration Procedure – Patent databases and information system – Preparation of patent documents – Process for examination of patent application- Patent infringement – Recent developments in patent system

Total Hours: 15

REFERENCES

1. B.L.Wadehra; Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India 2000
2. Ajit Parulekar and Sarita D' Souza, Indian Patents Law – Legal & Business Implications; Macmillan India ltd , 2006
3. P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi, 2010.
4. E. T. Lokganathan, Intellectual Property Rights (IPRs): TRIPS Agreement & Indian Laws Hardcover, 2012
5. Alka Chawla, P N Bhagwati , Law of Copyright Comparative Perspectives 1st Edition, LexisNexis, 2013
6. V. K. Ahuja, Law Relating to Intellectual Property Rights 2nd Edition, LexisNexis, 2nd Edition, 2013

7. Deborah E. Bouchoux, Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets, 2015
8. Jatindra Kumar Das, Law of Copyright, PHI Learning, 2015

COURSE OUTCOMES:

Students should be able to

- Identify the various types of intellectual property and their value
- Apply the procedure to file a patent and to deal the related issues
- Search and extract relevant information from various intellectual database

REGULATIONS, CURRICULAM AND SYLLABUS

M. TECH. STRUCTURAL ENGINEERING

(As approved by the 9th Academic Council)

JULY 2016

B.S.ABDUR RAHMAN
UNIVERSITY
B.S.ABDUR RAHMAN INSTITUTE OF SCIENCE & TECHNOLOGY
(Estd.u/s 3 of the UGC Act, 1956)
(FORMERLY B.S.ABDUR RAHMAN CRESCENT ENGINEERING COLLEGE)
Seethakathi Estate, G.S.T. Road, Vandalur, Chennai - 600 048.

VISION & MISSION OF THE DEPARTMENT OF CIVIL ENGINEERING

VISION

To be a leading department for Education, Training and Research in Civil Engineering for a better future and overall socio-economic progress of the country in a sustainable manner.

MISSION

- To offer world class undergraduate, postgraduate and research programs of industrial and societal relevance in civil engineering.
- To nurture ethically strong civil engineers to address global challenges through quality education and application oriented research.
- To educate our students on design, construction, maintenance and advancements in civil engineering for providing solutions to the betterment of the society.
- To prepare competitive and responsible future citizens with good communication, leadership and managerial skills.
- To enrich and enhance the knowledge base for the best practices in various areas of civil & allied engineering through collaborations with Global Institutions of Excellence, Industries and Research organizations.
- To provide a healthy ambience for teaching, research, consultancy and extension activities.

PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES

M.TECH. (STRUCTURAL ENGINEERING)

PROGRAMME EDUCATIONAL OBJECTIVES

- To impart knowledge and develop analytical skills to design structural components and systems based on codal provisions and create an urge for lifelong learning.
- To impart skills in the usage of state of the art software tools for modeling and evaluation of structural systems.
- To improve the analytical skills of the graduates through supportive teaching tools and methodologies as solution providers.
- To develop research skills with full exposure to appropriate real time projects in the field of structural engineering.
- To educate graduates in the use of sustainable, cost effective construction materials and practices.
- To inculcate in students the ethical attitude, team work and effective communication skills.

PROGRAMME OUTCOMES

Structural Engineering Graduates will be able to

- Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- Identify, formulate, research literature, and analyses complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- Use research – based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.
- Create, select, and apply appropriate techniques, resources, and modern engineering including prediction and modelling to complex engineering

activities with an understanding of the limitations.

- Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES

- Analyse and design structural components & systems using appropriate software and standards.
- Apply engineering techniques and relevant software tools for solving structural engineering problems.
- Undertake real time projects and research in the field of structural engineering.

CURRICULUM & SYLLABI FOR M.TECH. (STRUCTURAL ENGINEERING)

CURRICULUM

Sl. No.	Course Code	Course Title	L	T	P	C
		SEMESTER I				
1	MAC6184	Probability, Matrix Theory and Linear Programming	**3**	**1**	**0**	**4**
2	CEC6101	Theory of Elasticity and Plasticity	**3**	**0**	**0**	**3**
3	CEC6102	Advanced Concrete Design	**3**	**1**	**0**	**4**
4	CEC6103	Structural Dynamics	**3**	**0**	**0**	**3**
5	CEC6104	Advanced Concrete Technology	**3**	**0**	**2**	**4**
6	CEC6105	Design of Substructures	**3**	**0**	**0**	**3**
						21
		SEMESTER II				
1	GEC6201	Research Methodology for Engineers	**3**	**0**	**0**	**3**
2	CEC6211	Finite Element Analysis in Structural Engineering	**3**	**0**	**0**	**3**
3	CEC6212	Advanced Steel Structures	**3**	**1**	**0**	**4**
4	CEC6213	Experimental Techniques and Instrumentation	**2**	**0**	**2**	**3**
5		Professional Electives #				**6**
6	CEC6214	Seminar	**0**	**0**	**2**	**1**
						20
		SEMESTER III				
1		General Elective###	**3**	**0**	**0**	**3**
2		Professional Electives##				**9**
3	CEC7101	Project Phase I***	**0**	**0**	**12**	**6**
4	CEC7102	Internship*/Mini Project**	**0**	**0**	**2**	**1**
						13
		SEMESTER IV				
1	CEC7101	Project Phase II	**0**	**0**	**36**	**18**
						6+18=24
		Total				**78**

Student has to take a minimum of 6 credits from even semester professional elective courses

Student has to take a minimum of 9 credits from odd semester professional elective courses

Student has to take a minimum of 3 credits from general elective courses

* 15 days of Industrial training will be undertaken by regular candidates during first year summer vacation and the credit will be awarded in the 3rd semester.

** Mini project will be taken by working Professionals only.

*** Credits for Project Work Phase I to be accounted along with Project Work Phase II in IV Semester

ELECTIVE

Sl. No.	Course Code	Course Title	L	T	P	C
		LIST OF ODD SEMESTER ELECTIVES				
1	CECY101	Design of Bridges	**3**	**0**	**0**	**3**
2	CECY102	Industrial Structures	**3**	**0**	**0**	**3**
3	CECY103	Maintenance and Rehabilitation of Structures	**3**	**0**	**0**	**3**
4	CECY104	Plates and Shells	**3**	**0**	**0**	**3**
5	CECY105	Stability of Structures	**3**	**0**	**0**	**3**
6	CECY106	Tall Structures	**3**	**0**	**0**	**3**
7	CECY107	Wind and Cyclone Effects on Structures	**3**	**0**	**0**	**3**
8	CECY108	Design of offshore Structures	**2**	**0**	**0**	**2**
9	CECY109	Design of Steel Concrete Composite Structures	**2**	**0**	**0**	**2**
10	CECY110	Case studies on Performance and Evaluation of Structures	**1**	**0**	**0**	**1**
		LIST OF EVEN SEMESTER ELECTIVES				
1	CECY201	Composite Materials	**3**	**0**	**0**	**3**
2	CECY202	Corrosion of Steel in Concrete	**3**	**0**	**0**	**3**
3	CECY203	Earthquake Engineering	**3**	**0**	**0**	**3**
4	CECY204	Fatigue & Fracture of Structures	**3**	**0**	**0**	**3**
5	CECY205	Matrix Methods of Structural Analysis	**3**	**0**	**0**	**3**
6	CECY206	Optimization in Structural Design	**3**	**0**	**0**	**3**
7	CECY207	Prestressed Concrete	**3**	**0**	**0**	**3**
8	CECY208	Soil - Structure Interaction	**3**	**0**	**0**	**3**
9	CECY224	Green Building and Energy Efficient Structures	**3**	**0**	**0**	**3**
10	CECY209	Computer Aided Analysis for Structures	**2**	**0**	**0**	**2**
11	CECY210	Prefabricated Structures	**2**	**0**	**0**	**2**
12	CECY211	Analysis of Structures using FEA software	**1**	**0**	**0**	**1**

GENERAL ELECTIVES FOR M.TECH PROGRAMMES

Sl. No.	Course Code	Course Title	L	T	P	C
1	GECY101	Project management	**3**	**0**	**0**	**3**
2	GECY102	Society, Technology & Sustainability	**3**	**0**	**0**	**3**
3	GECY103	Artificial Intelligence	**3**	**0**	**0**	**3**
4	GECY104	Green Computing	**3**	**0**	**0**	**3**
5	GECY105	Gaming Design	**3**	**0**	**0**	**3**
6	GECY106	Social Computing	**3**	**0**	**0**	**3**
7	GECY107	Soft Computing	**3**	**0**	**0**	**3**
8	GECY108	Embedded System Programming	**3**	**0**	**0**	**3**
9	GECY109	Principles of Sustainable Development	**3**	**0**	**0**	**3**
10	GECY110	Quantitative Techniques in Management	**3**	**0**	**0**	**3**
11	GECY111	Programming using MATLAB & SIMULINK	**1**	**0**	**2**	**2**
12	GECY112	JAVA Programming	**2**	**0**	**0**	**2**
13	GECY113	PYTHON Programming	**2**	**0**	**0**	**2**
14	GECY114	Intellectual Property Rights	**1**	**0**	**0**	**1**

SEMESTER – I

		L	T	P	C
MAC6184	**PROBABILITY, MATRIX THEORY AND LINEAR PROGRAMMING**	**3**	**1**	**0**	**4**

OBJECTIVE:

The aim of this course is to

- provide a comprehensive introduction to the probability distributions used in engineering.
- familiarize students with advanced matrix theory and variational problems.
- expose the students to Operations Research using concepts of linear programming.

MODULE I PROBABILITY DISTRIBUTIONS 10+03

Axioms of probability – addition and multiplication theorem – conditional probability – total probability – random variables - moments – moments generating functions and their properties- Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

MODULE II TWO DIMENSIONAL RANDOM VARIABLES 08+03

Joint distributions - marginal and conditional distributions - functions of random variables - covariance - correlation and regression - Central limit theorem.

MODULE III ADVANCED MATRIX THEORY 09+03

Matrix norms - singular value decomposition - QR algorithm - pseudo inverse - least square approximations.

MODULE IV LINEAR PROGRAMMING 10+03

Formation - graphical method - simplex method - Big-M method - Two Phase method - transportation and assignment problems.

MODULE V CALCULUS OF VARIATIONS 08+03

Variation and its properties – Euler's equation – functional dependant on first and higher order derivatives – functional dependant on functions of several independent variables – variational problems with moving boundaries – isoperimetric problems – Ritz and Kantorovich methods.

L – 45; T – 15; Total – 60

TEXT BOOKS:

1. S.M.Ross, “A First Course in Probability”, 9th edition, Pearson Education, 2013.
2. Lewis.D.W., “Matrix Theory”, Allied Publishers, Chennai, 1995.
3. Taha, H.A., “Operations Research - An Introduction ", 10th edition, Pearson Prentice Hall, 2016.
4. A.S. Gupta, “Calculus of variations with applications”, PHI Pvt. Ltd, New Delhi, 2011.

REFERENCES:

1. H. Cramer., “Random Variables and Probability Distributions”, Cambridge University Press (2004).
2. Roger A. Horn, Charles R. Johnson, “Matrix Analysis”, Cambridge University Press; 2nd edition (2012).
3. Robert.J.Vanderbei., “Linear Programming: Foundations and Extensions”, Springer US(2014).
4. David. J. Rader., “Deterministic Operations Research”, Wiley (2010).
5. Elsgolts, “Differential Equations and Calculus of Variations", University Press of the Pacific (2003).

OUTCOME:

At the end of the course students will be able to

- Solve problems using concept of standard, discrete and continuous distributions.
- Solve problems using one dimensional and two dimensional random variables.
- Find eigenvalues and eigen vectors of a higher order matrix.
- Solve problems of linear programming.
- Solve problems of calculus of variations by direct methods and using Euler’s formulae.

CEC6101 THEORY OF ELASTICITY AND PLASTICITY

L	T	P	C
3	0	0	3

OBJECTIVE:

- To impart knowledge on the general features of elastic systems and to analyze two-dimensional state of stresses and strains.
- To familarise the students to solve the torsion of non-circular cross-sections by various approaches.
- To understand the fundamental concepts to solve problems in structural members by various energy methods.
- To provide sufficient background on the theory of plasticity.

MODULE I ANALYSIS OF STRESS & STRAIN 09

Basic equations - stress and strain at a point - generalized Hookes law - plane stress and plane strain - equilibrium conditions - compatibility conditions.

MODULE II TWO DIMENSIONAL PROBLEMS 09

Two dimensional problems in Cartesian and polar coordinates - solution of two-dimensional problems with different loading conditions by using polynomials.

MODULE III TORSION OF PRISMATIC BARS 09

Torsion of non circular sections- St.Venants approach – Parndtl,s approach - methods of analysis - membrane analogy - torsion of thin rectangular section and hollow thin walled sections - bars with Elliptical Cross Section – torsion of thin walled and multiple cell closed sections.

MODULE IV ENERGY METHODS 09

Castiglianos theorem - principle of Virtual work - principle of stationary potential energy - principle of least work - Rayleighs method - Rayleigh-Ritz method- finite difference method - simple applications.

MODULE V PLASTICITY 09

Plastic deformation - mechanism - factors affecting plastic deformation - strain hardening - theory of plastic flow - concept of plastic potential - yield criteria - yield conditions - experimental evidence - geometric representation of yield criteria-plastic bending of beams and Plastic torsion

Total Hours : 45

REFERENCES:

1. Timoshenko and Goodier, Theory of Elasticity, 3rd Edition, McGraw Hill, 2010.
2. Sadhusingh, Theory of Elasticity, Khanna Publishers, New Delhi 2012
3. Kachanov L M, Fundamentals of the Theory of Plasticity, Dover Publications, 2013.

OUTCOME:

On successful completion of this course, students will be able to

- critically describe the mathematical and physical foundations of the continuum mechanics of solids, including deformation, stress measures and constitutive relations.
- solve the two dimensional problems in cartesian and polar coordinates
- apply the principles to evaluate the problems related to torsion of non-circular cross-sections.
- analyse the structural members by various energy methods
- describe the basic concepts on the theory of plasticity.

CEC6102 ADVANCED CONCRETE DESIGN

L	T	P	C
3	1	0	4

OBJECTIVE:

- To impart knowledge on the design of RCC beams under combined shear, torsion and bending, limit state of serviceability for structural members.
- To provide exposure on the design of slender columns, deep beams, yield line analysis and flat plates.
- To expand the knowledge in studying the inelastic response of reinforced concrete structural members.

MODULE I DESIGN OF BEAMS 09+03

Overall review on behaviour of RC beams in flexure and shear - behaviour and design of RCC beams under combined Shear, Torsion and Bending - serviceability limit states - computation of deflections and crack width as per codal provisions.

MODULE II DESIGN OF SLENDER COLUMNS 09+03

Behaviour of slender RCC Columns - failure modes - calculation of design moments for braced and unbraced columns - design of slender columns.

MODULE III DESIGN OF SPECIAL RC ELEMENTS 09+03

Design of RC walls – ordinary and shear walls - strut and tie method of analysis for corbels and deep beams

MODULE IV DESIGN OF FLAT SLABS AND PLATES 09+03

Yield line theory and Hillerberg method of design of slabs - design of flat slabs and flat plates according to BIS method - shear in flat slabs and flat plates - design of Grid floors

MODULE V INELASTIC BEHAVIOUR OF CONCRETE STRUCTURES 09+03

Inelastic behaviour of concrete beams - moment-rotation curves - moment redistribution - concept of Ductility – detailing for ductility – design of beams, columns for ductility - design of cast-in-situ joints in frames.

L – 45; T – 15; Total Hours - 60

REFERENCES:

1. Varghese, P.C. Advanced Reinforced Concrete Design, Prentice Hall of India, 2005.
2. Gambhir.M.L, Design of Reinforced Concrete Structures, Prentice Hall of India, 2012.
3. Subramanian. N, Design Of Reinforced Concrete Structures, Oxford University Press, 2013.
4. Varghese, P.C. Limit State Design of Reinforced Concrete, Prentice Hall of India, 2007.
5. Sinha.S.N., Reinforced Concrete Design, Tata-McGraw-Hill,1996.
6. Purushothaman, P, Reinforced Concrete Structural Elements: Behaviour Analysis and Design, Tata McGraw-Hill, 1986.
7. Park. R., & Paulay .T, Reinforced Concrete Structures, John Wiley & Sons, 2009.
8. Shah V.L., & Karve S.R, Limit state theory and Design of Reinforced Concrete, Structures Publications, Pune 2003.
9. Arthur H.Nilson, Design of Concrete Structures, Tata McGraw-Hill, 2003.
10. IS 456-2000, Plain and Reinforced Concrete - Code of Practice.
11. SP 16, Design Aids for IS 456-1978.
12. IS 13920- 1993- Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces — Code Of Practice.

OUTCOME:

On successful completion of these modules, students will be able to

- describe the behavior of reinforced concrete structural members and compute serviceability response of structural elements.
- employ the Indian code of practice for the design the slender RC columns.
- design the special structural elements such as RC walls, deep beams and corbels
- appropriately choose and design the two-way slab system for buildings.
- critically describe the inelastic behaviour of structures and ductile detailing of RC structures.

CEC6103 STRUCTURAL DYNAMICS

L	T	P	C
3	0	0	3

OBJECTIVE:

- To impart knowledge about theory of vibrations and vibration parameters to analyse the dynamic forces caused by an earthquake.
- To introduce the design of buildings for blast and impact forces as per BIS codes of practice.

MODULE I SINGLE DEGREE OF FREEDOM SYSTEMS 09

Formulation of equations of motion by different methods - free and forced vibrations, effect of damping.

MODULE II MULTI DEGREE OF FREEDOM SYSTEMS 09

Formulation of structure property matrices, eigen value problems, mode shapes and orthonormality of modes, approximate methods of extraction of eigen values.

MODULE III CONTINUOUS SYSTEMS 09

Modeling - free and forced vibration of bars and beams. Rayleigh –Ritz method –formulation using conservation of energy –formulation using virtual work

MODULE IV DIRECT INTEGRATION METHODS FOR DYNAMIC RESPONSE 09

Damping in MDOF systems - Nonlinear MDOF systems - Wilson Theta method, Newmark's beta method - step-by-step numerical integration techniques.

MODULE V DESIGN AGAINST BLAST AND IMPACT 09

Characteristics of internal and external blast - Impact and impulse loads - pressure distribution on buildings above ground due to external blast - underground explosion - design of buildings for blast and impact as per BIS codes of practice.

Total Hours : 45

REFERENCES:

1. Clough R.W, and Penzien J, Dynamics of Structures, Second Edition, McGraw-Hill International Edition, 1996.
2. Mario Paz, Structural Dynamics – Theory and Computations, Third Edition, CBS Publishers, 1990.

3. Roy R Craig, Structural Dynamics – An Introduction to Computer Methods, John Wiley and Sons, 2005.
4. Humar J. L., Dynamics of Structures, Prentice Hall, 1990.

OUTCOME:

At the end of the course, students will be able to

- develop the equation of motion for single degree of freedom
- analyze the dynamic response of multi degree of freedom systems
- analyze the free and forced vibration of bars and beams
- find the dynamic response of structures using numerical integration procedure
- design the buildings for blast and impact forces using BIS codes of practice.

CEC6104 ADVANCED CONCRETE TECHNOLOGY

L	T	P	C
3	0	2	4

OBJECTIVE:

- To impart sufficient knowledge to students about properties of various concrete constituent materials, mix design for different types of concrete, fresh and hardened properties of concrete.
- To provide students knowledge on durability properties of concrete and different types of special concretes.

MODULE I CONCRETE CONSTITUENT MATERIALS 09+06

Cement - Grades and types - properties and testing as per Indian standards. Fine aggregate - coarse aggregate - classification - properties - testing as per Indian standards. Water - quality, properties and requirements. Mineral admixtures - fly ash, silica fume, metakaoline, ground granulated blast furnace slag, rice husk ash, titanium dioxide. Chemical admixtures - Super plasticizers, water reducers, set accelerators, set retarders, air entraining agents, viscosity modifying agents, corrosion inhibiting admixtures - working mechanism and application areas.

MODULE II CONCRETE MIX DESIGN 09+06

Principles of concrete mix design- mix design for different types of concrete - control concrete, self compacting concrete, high performance concrete and ready mix concrete - Indian standards - ACI method - relevant standards. Design concrete mix for a desired application and subsequent validation.

MODULE III PROPERTIES OF FRESH AND HARDENED CONCRETE 09+06

Fresh concrete properties of control concrete, self compacting concrete and high performance concrete – workability related tests - slump, compaction factor, vee bee consistometer, flow test, L-box test, U-box test, V-funnel test, J-ring test. Hardened concrete properties – strength – modulus of elasticity – creep – shrinkage - bond strength.

MODULE IV DURABILITY PROPERTIES OF CONCRETE 09+06

Deteriorating mechanism : sulphate attack, alkali aggregate reaction, corrosion of steel rebar - mechanism, causes and consequences. Tests related to durability properties - water absorption, permeability, sorptivity, resistance to chemical attack, freeze and thaw resistance, accelerated corrosion test, RCPT test, half-cell potential test and macrocell corrosion test.

MODULE V SPECIAL CONCRETE 09+06

High performance concrete – fibre reinforced concrete – self compacting concrete - polymer concrete composites - light weight concrete – pervious concrete – ferrocement – shotcrete – coloured concrete – heavy density concrete.

L – 45; T – 30; Total Hours - 75

REFERENCES:

1. Nayak, N.V, and Jain, A.K, Handbook on Advanced Concrete Technology, Narosa Publishing House Pvt. Ltd., New Delhi, 2012.
2. Neville, A.M., Properties of Concrete, Fourth Edition, John Wiley & Sons, London, 1996.
3. Shetty, M.S., Concrete Technology, S. Chand and Company Ltd., New Delhi, 2003.
4. Santhakumar,A.R., Concrete Technology, Oxford University Press, New Delhi, 2007
5. Krishnaraju,N., Design of Concrete Mixes, CBS Publishers, New Delhi, 2007.
6. Mehta P.K., and Paulo J.M. Monteiro, Concrete: Microstructure, Properties, and Materials, McGraw-Hill Professional, USA, 2005.
7. Yoshihiko Ohama, Hand Book of Polymer-modified Concrete and Mortars – Properties and Process Technology, Noyes Publications, 1995.
8. BIS 10262 – 1999, “Recommended Guidelines for Concrete Mix Design”, Bureau of Indian Standards, New Delhi.
9. ACI Committee 211.1 – 1991, “ Standard Practice for Selecting Proportions for Normal, Heavy weight, and Mass concrete (Part – I)”, ACI Manual of Concrete Practice, 1994.
10. ACI Committee 549.1R – 2009, “Guide for the Design, Construction and Repair of Ferro Cement”, American Concrete Institute, USA.
11. BIS 383 – 1970, “Specification for Coarse and Fine Aggregates from Natural Sources for Concrete”, Bureau of Indian Standards, New Delhi.
12. BIS 516 – 1968, “Methods of Tests for Strength of Concrete”, Bureau of Indian Standards, New Delhi.
13. BIS 1199 – 1959, “Methods of Sampling and Analysis of Concrete”, Bureau of Indian Standards, New Delhi.
14. BIS 2386 (Part I & 3) - 1963, “Methods of Test for Aggregates for Concrete”, Bureau of Indian Standards, New Delhi.
15. BIS 4031 (Part 1-6) : 1996, “Method of Physical Tests for Hydraulic Cement”, Bureau of Indian Standards, New Delhi.

16. BIS 5816-1999, Splitting Tensile Strength of Concrete - Method of Test, Bureau of Indian Standards.
17. BIS 13311 - 1992, Non destructive testing of concrete - Method of test, Part -2 : Rebound Hammer, Bureau of Indian Standards.

OUTCOME:

On completion of these modules, students will be able to

- conduct tests to assess the properties of concrete constituent materials and its validation for the desired application.
- perform mix design for normal concrete, self compacting concrete and high performance concrete as per specified standards.
- conduct tests as per codal provisions to assess the fresh and hardened concrete properties.
- carryout durability studies on different types of concrete.
- suggest type of concrete based on application and durability requirements.

GEC6201	RESEARCH METHODOLOGY FOR ENGINEERS	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To provide a perspective on research to the scholars
- To educate on the research conceptions for designing the research
- To impart knowledge on statistical techniques for hypothesis construction
- To gain knowledge on methods of data analysis and interpretation
- To learn about the effective communication of research finding

MODULE I RESEARCH PROBLEM FORMULATION 07

The research problem – Sources of research problem – Information, how to deal with it – Criteria / characteristics of a good research problem – Errors in selecting a good research problem – Types of research – Nature and use of arguments.

MODULE II HYPOTHESIS FORMULATION 08

Research design – meaning and need – basic concepts, Different research designs, experimental design – principle – important experimental designs, Design of experimental setup, mathematical modeling, simulation – validation and experimentation, dimensional analysis and similitude.

MODULE III STATISTICAL TECHNIQUES 12

Statistics in research – concept of probability – popular distributions –hypothesis testing- sample design- design of experiments – factorial designs -– orthogonal arrays- ANOM - ANOVA - Multivariate analysis - use of optimization techniques – traditional methods – evolutionary optimization techniques –transportation model

MODULE IV STATISTICAL ANALYSIS OF DATA 10

Research Data analysis – interpretation of results – correlation with scientific facts- Accuracy and precision – error analysis, limitations - Curve fitting, Correlation and regression.

MODULE V RESEARCH REPORT 08

Purpose of written report – audience, synopsis writing, preparing papers for International journals, thesis writing – organization of contents – style of writing – graphs and charts – referencing, oral presentation and defence, ethics in research, Patenting, Intellectual Property Rights.

Total Hours: 45

REFERENCES:

1. Ganesan R., Research Methodology for Engineers, MJP Publishers, Chennai, 2011.
2. Ernest O., Doebelin, Engineering Experimentation: planning, execution, reporting, McGraw Hill International edition, 1995.
3. George E. Dieter., Engineering Design, McGraw Hill – International edition, 2000.
4. Madhav S. Phadke, Quality Engineering using Robust Design, Printice Hall, Englewood Cliffs, New Jersey, 1989.
5. Kothari C.R., Research Methodology – Methods and Techniques, New Age International (P) Ltd, New Delhi, 2003.
6. Kalyanmoy Deb., “Genetic Algorithms for optimization”, KanGAL report, No.2001002.
7. Holeman, J.P., Experimental methods for Engineers, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 2007.
8. Govt. of India, Intellectual Property Laws; Acts, Rules & Regulations, Universal Law Publishing Co. Pvt. Ltd., New Delhi 2010.
9. University of New South Wales, “How to write a Ph.D. Thesis” Sydney, Australia, Science @ Unsw.
10. Shannon. R.E., System Simulation: the art and science, Printice Hall Inc, Englewood Cliffs, N.J.1995.
11. Scheffer. R.L. and James T. Mc Clave, Probability and Statistics for Engineers, PWS – Kent Publishers Co., Boston, USA, 1990.

OUTCOME:

Students who complete this course will be able to

- identify the research problem.
- become capable of analyzing the data using mathematical techniques.
- learn to apply the statistical concepts in research.
- demonstrate the different research methods applicable to a specific problem.

CEC6105 DESIGN OF SUBSTRUCTURES

L	T	P	C
3	0	0	3

OBJECTIVE:

- To familiarize the students with various site investigation programme, geotechnical terminology and important concepts for design of shallow and deep foundations.
- To help the students to utilize their knowledge in soil mechanics and to perform various types of engineering calculations
- To perform the geotechnical engineering design functions for shallow and deep foundations.

MODULE I SUB SURFACE EXPLORATION 08

Engineering properties of soil - Purpose of soil exploration- Programme and Procedures – Interpretation of bore logs, soil data and exploration reports.

MODULE II SHALLOW FOUNDATIONS 10

Types of foundations and their specific applications – depth of foundation – bearing capacity and settlement estimates – structural design of isolated, strip, rectangular and trapezoidal and combined footings – strap – balanced footings – raft foundation – Approximate flexible method of raft design - Compensated foundations.

MODULE III DEEP FOUNDATIONS 09

Types of piles and their applications - load capacity - settlements - group action - design of piles and pile caps.

MODULE IV FOUNDATIONS FOR BRIDGES AND OTHER MISCELLANEOUS STRUCTURES 09

Drilled shaft foundations and caissons for bridges - foundations for towers – chimneys – silos.

MODULE V MACHINE FOUNDATIONS 09

Types - general requirements and design criteria - general analysis of machine foundations-soil system - stiffness and damping parameters - tests for design parameters - guidelines for design of reciprocating engines, impact type machines, rotary type machines, framed foundations.

Total Hours : 45

REFERENCES:

1. Tomlinson, M.J. and Boorman. R., Foundation Design and Construction, ELBS Longman, 6th edition, 2013.
2. Nayak, N.V., Foundation Design manual for Practicing Engineers, Dhanpat Rai and Sons, 2012.
3. Winterkorn H.F, and Fang H.Y., Foundation Engineering Hand Book, Van Nostrard – Reinhold, 1991.
4. Brain J. Bell and M.J. Smith, Reinforced Concrete Foundations, George Godwin Ltd., 1981.
5. Braja M. Das, Principles of Foundations Engineering, Thomson Asia (P) Ltd., 2012.
6. Bowels J. E., Foundation Analysis and Design, Mc Graw-Hill International Book Co., 1996.

OUTCOME:

At the end of the course students will be able to

- interpret subsurface information to report soil properties.
- Determine bearing capacity and design shallow foundations for various types of structures.
- Recommend a suitable type of pile foundation and determine the load carrying capacity of pile foundations.
- Design foundations for bridges
- Design a suitable type of machine foundation for a machine,

CEC6211	FINITE ELEMENT ANALYSIS IN STRUCTURAL ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To introduce the fundamental concepts of finite element method, specifically the conception of an idea that involved in the finite element analysis of a structure.
- To incorporate overview of matrix techniques and plane stress and plane strain concepts.
- To expose the finite element software to analyse the structural members

MODULE I CONCEPTS OF FINITE ELEMENT METHOD 09

General description of the finite element method – overview of matrix techniques - basic equations from solid mechanics - variational formulation - approximate methods – Rayleigh Ritz, Weighted residual (Galerkin) and finite difference methods.

MODULE II PLANE STRESS AND PLANE STRAIN 09

The concept of an element - derivation of Elemental Equations – assembly - imposition of boundary Conditions - solution of the equations – basic functions and shape functions – one dimensional elements - two dimensional problems in plane stress and plain strain.

MODULE III AXISYMMETRIC STRESS ANALYSIS AND 3D STRESS ANALYSIS 09

Axisymmetric problems - triangular and quadrilateral Elements - natural coordinates - isoparametric formulation - numerical Integration - plate bending and shell elements - brick elements - Higher Order Elements.

MODULE IV MESHING AND SOLUTION PROBLEMS 09

Pre and post processor interpretations - p and h methods of refinement - iil conditioned elements - discretisation errors – patch test - auto and adaptive mesh generation techniques - error evaluation - finite element programming and FEA Software – ANSYS.

MODULE V NONLINEAR AND VIBRATION PROBLEMS 09

Material and geometric non-linearity - consistent system matrices – dynamic condensation - eigen value extraction - modal methods – integration methods - application to thermal analysis.

Total Hours : 45

REFERENCES:

1. Seshu, P., Text Book of Finite Element Analysis, Prentice-Hall of India Pvt. Ltd., New Delhi, 2007.
2. Reddy, J.N., An Introduction to the Finite Element Method, McGraw-Hill International Editions (Engineering Mechanics Series), 1993.
3. Chandrupatla & Belagundu, Introduction to Finite Elements in Engineering,
4. Edition, Prentice-Hall of India, Eastern Economy Editions, 2000.
5. David V. Hutton Fundamentals of Finite Element Analysis, Tata McGraw-Hill Edition, 2005.
6. Cook Robert. D., Plesha, Michael. E & Witt, Robert.J. Concepts and Applications of Finite Element Analysis, Wiley Students Edition, 2004.

OUTCOME:

On the successful completion of these modules, students will be able to

- solve the boundary value problems using approximate methods.
- derive and elemental equations and shape function for one and two dimensional elements.
- form the isparametric functions for various elements.
- perform the mesh refinement and error evaluation for various elements.
- model and analyse 2D and 3D systems using finite element software.

CEC6212 ADVANCED STEEL STRUCTURES

L	T	P	C
3	1	0	4

OBJECTIVE:

- To impart sufficient knowledge to students on various codal provisions for steel structural design.
- To offer knowledge to analyse and design different types of bolted and welded connections; industrial structural members; cold formed structural elements; and special structures such as chimney etc.
- To give exposure to students on plastic analysis of structures.

MODULE I BEHAVIOUR AND DESIGN OF CONNECTIONS 09+03

Types of connection - importance - codal provisions as per IS: 800 - behaviour and design of bracket connection - unsiffened and stiffened seated connections – framed connections - connections for force and moment transmission – tee stub and end plate connections - stiffeners and other reinforcement.

MODULE II ANALYSIS AND DESIGN OF INDUSTRIAL BUILDINGS 09+03

Review of loads on structures - dead, live wind and seismic loads as per standards - requirements of industrial buildings - structural framing - braced frames & unbraced frames - analysis and design of Industrial building components such as roof truss, rafter bracing, purlin, eave girder, stanchions, gable column and bents - analysis and design of gable frames - design of moment resisting base plates.

MODULE III ANALYSIS AND DESIGN OF COLD–FORMED STEEL STRUCTURES 12+05

Types of cross sections – concepts of local buckling and effective width – codal provisions as per IS : 801 - analysis and design of unstiffened and stiffened compression elements - design of webs of beams - design of flexural members - economic design for beam strength - concept of lateral buckling of beams - concept of lateral bucking and bracing requirement – concept of shear lag and flange curling - design of compression members - design of wall studs and connection details.

MODULE IV ANALYSIS AND DESIGN OF SPECIAL STRUCTURES 09+03

Design of self supporting chimney (lined and unlined) - codal provisions of IS 6533 - stresses due to wind and earthquake forces – design of base plate, anchor bolts

and foundation - check for deflection - design for dynamic effects - wind effects on chimney - gust factor Method - design of guyed chimneys.

MODULE V PLASTIC ANALYSIS OF STRUCTURES 06+01

Introduction - concepts of plastic design - shape factor - redistribution of moments - plastic collapse load - conditions of plastic analysis - methods of plastic analysis - plastic design of portal frames – problems. Connections - requirement - design of straight and haunched connections.

L-45; T-15; Total Hours :60

REFERENCES:

1. Dayaratnam, P., Design of Steel Structures, Wheeler Publishing, 1990.
2. Teaching Resource for Structural Steel Design, INSDAG, Kolkatta, 2010.
3. Rhodes, J, Design of Cold-Formed Steel Members, Elsevier Science Publishers, 1991.
4. Ramchandra, S., Design of Steel Structures, Vol.-II, Standard Publications, New Delhi, 2010.
5. Salmon, C.G., and Johnson, J.E., Steel Structures-Design and Behaviour, Harper and Row, 1980 73.
6. Subramanian N, Steel Structures - Design and practice, Oxford University Press, 2011.
7. BIS : 800-2007, Indian standard code of practice for general construction in steel , Bureau of Indian Standards.
8. BIS 801 : 1975 - Indian standard code of practice for use of cold-formed light gauge steel structural members in general building construction, Bureau of Indian Standards.
9. SP 6 (1) -1964 – Hand book for structural Engineers, 1. Structural Steel Sections, Indian Standards Institution.
10. SP 6 (5) -1980 – Hand book for structural Engineers, 5. Cold formed, Light-gauge steel structures, Bureau of Indian Standards.
11. BIS 6533 (Part 1) **:** 1989**,** Design and construction of steel chimney - Code of practice, Part I Mechanical Aspect, Bureau of Indian Standards.
12. BIS 6533 (Part 2) **:** 1989**,** Design and construction of steel chimney - Code of practice, Part 2 Structural Aspect, Bureau of Indian Standards.
13. BIS 6533 **:** 1971**,** Code of practice for design and construction of steel chimney, Bureau of Indian Standards.

OUTCOME:

At the end of course work, students will be able to

- design connections for the expected shear force and bending moment
- design components of industrial building such as roof truss, purlins, columns, bracing based on application requirement.
- analyse and design cold formed flexural members, compression members and wall studs.
- design self supporting and guyed chimney for the various loading conditions.
- describe the concepts of plastic design, methods of plastic analysis and plastic collapse mechanism.

and materials. Direct model analysis - theory of similitude for modeling - Buckingham Pi theorem for analysis. Testing large scale structures – wind tunnel.

L-30; P- 30; Total Hours - 60

REFERENCES:

1. Dally J. W. and Riley W.F., Experimental stress Analysis, McGraw-Hill, Inc. New York, 1991.
2. Srinath L.S. et al., Experimental Stress Analysis, Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 1984.
3. Rangan C.S. et al., Instrumentation – Devices and Systems, Tata McGraw-Hill Publishing Co., Ltd., New Delhi, 1983.
4. Sadhu Singh, Experimental Stress Analysis, Khanna Publishers, New Delhi, 1996.
5. Renganathan S, Transducer Engineering, Allied Publishers Limited, Chennai, 1999.

OUTCOME:

At the end of course work, students will be able to

- employ load cell, sensitive dial gauges and LVDT for different application areas and interpret the results.
- measure static and dynamic strain using electrical resistance strain gauges by understanding principles of rosette analysis.
- acquire load-deflection and load-strain behaviour using data acquisition systems.
- employ NDT techniques such as rebound hammer, UPV test, half-cell potential technique and interpret the test results.
- describe the importance of model analysis in predicting structural behaviour of large scale structures.

CEC6214	SEMINAR	L	T	P	C
		0	0	2	1

GENERAL GUIDELINES:

- Seminar is an important component of learning where the student gets acquainted with preparing and presentation of a technical report.
- The students are advised to collect peer reviewed journal papers relevant to their proposed project work and prepare a report in consultation with a faculty having expertise in that field.
- Presentation schedules will be prepared by the course faculty in line with the academic calendar.
- The students shall be required to present a technical report in PPT and submit a relevant report.
- At the end of each presentation, the class students are encouraged to ask questions to clarify their queries and finally the course faculty give his/her comments to improve the quality in subsequent presentations.
- The marks will be awarded based on technical content, report preparation and presentation skills and in depth knowledge of the student in the subject.
- The marks awarded shall be intimated to the students at the completion of one cycle of presentation by all the students and communicated to the Class Advisor in the specified format.
- Each student shall be given at least two opportunities to exhibit his/her presentation skills.

LIST OF ODD SEMESTER PROFESSIONAL ELECTIVES

CECY101 DESIGN OF BRIDGES

L	T	P	C
3	0	0	3

OBJECTIVE:

- To impart students knowledge on classification of bridges & investigation procedures, IRC specification for road bridges and load distribution theories.
- To offer knowledge on design of short span bridges, design of T-Beam and slab bridges, prestressed concrete bridges and plate girder bridges.
- To give exposure to design principles of continuous, box girder and balanced cantilever bridges, types of bearings and design of sub structures.

MODULE I SHORT SPAN BRIDGES 12

Classification - investigation and planning - choice of type - I.R.C. specifications for road bridges - standard live loads - other forces acting on bridges - general design considerations - load distribution theories - analysis and design of slab culverts. Design of T-beam and slab bridges - deck slab - cantilever slab - longitudinal girder - cross girder- end beams.

MODULE II LONG SPAN GIRDER BRIDGES 09

Design principles of continuous bridges - box girder bridges - balanced cantilever bridges.

MODULE III PRESTRESSED CONCRETE BRIDGES 08

Types of prestressed concrete bridges - types of prestressing - typical cross section detailing - over view of design principles of prestressed concrete - design of post-tensioned prestressed concrete slab bridge deck - design of post-tensioned prestressed concrete T-beam and slab bridge deck.

MODULE IV PLATE GIRDER BRIDGES 08

Types of plate girder bridges - design principles - codal provisions and loading standards - design of plate girder bridges - intermediate stiffeners - end bearing stiffeners.

MODULE V BEARINGS, SUBSTRUCTURE AND FOUNDATION FOR BRIDGES 08

Bridge bearings – types - design principles – design of steel rocker roller bearing. Design of pile cap and pier - foundation – types – construction procedure - design of well foundation – design of pile foundation.

Total Hours : 45

REFERENCES:

1. Johnson Victor D., "Essentials of Bridge Engineering", Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, 2008.
2. Raina V.K. "Concrete Bridge Practice" , Tata McGraw Hill Publishing Company, New Delhi, 1994.
3. Krishnaraju, N., "Design of Bridges" Oxford and IBH Publishing Co., New Delhi, 2010.
4. Bakht, B. and Jaegar, L.G., "Bridge Analysis simplified", McGraw Hill Publishing Compny, New Delhi, 1985.
5. Ponnuswamy, S., "Bridge Engineering", Tata McGraw Hill Publishing Company, New Delhi, 1989.
6. Petros P. Xanthakos, " Theory and Design of Bridges", .John Wiley & Sons, 2007.
7. Edwin H.Gaylord Jr., Charles N.Gaylord, James, E.,Stallmeyer "Design of Steel Structures", McGraw Hill International Editions, 1992

OUTCOME:

At the end of course work, students will be able to

- design slab culverts and T-beam bridge superstructure for the IRC loading conditions.
- design post tensioned prestressed T-beam bridge superstructure for the IRC loading.
- design steel plate girder bridge superstructure based on IRS loading conditions.
- design steel rocker cum roller bearing and substructure for pile foundation and well foundation as per IRC.
- describe the design principles of continuous bridges, box girder and balanced cantilever bridges for its use in real time conditions.

CECY102 INDUSTRIAL STRUCTURES

L	T	P	C
3	0	0	3

OBJECTIVE:

- To provide relevant knowledge on functional requirements of industrial buildings and to design various industrial building components.
- To design various special structures and transmission line towers.

MODULE I GENERAL 09

Classification of industries and industrial structures – general requirements of various industries – engineering, textiles, chemicals etc, - planning and layout of buildings and components.

MODULE II FUNCTIONAL REQUIREMENTS 09

Lighting – illumination levels – characteristics of good lighting – principles of day lighting design – artificial lighting – ventilation – natural and mechanical ventilation – evaporate cooling design – measurement – contaminant control – installation and operation - acoustics – fire safety – guidelines from factories act.

MODULE III INDUSTRIAL BUILDINGS 09

Industrial building frames - analysis of industrial bents – design of gable frames - industrial roofs - crane girders - machine foundations

MODULE IV SPECIAL STRUCTURES 09

Design of corbels and nibs - analysis and design of bunkers and silos – design of chimneys –– design of cooling towers

MODULE V POWER TRANSMISSION STRUCTURES 09

Tower configuration and bracings – loads acting on towers – analysis and design of lattice towers – transmission line towers – tower foundations

Total Hours : 45

REFERENCES:

1. SP 32: 1986, Handbook on Functional Requirements of Industrial buildings.
2. Manohar S.N., Tall Chimneys; Design and Construction, Tata McGraw Hill, 1985.
3. Santhakumar A.R. and Murthy S.S, Transmission Line Structures, McGraw-Hill, 1990.

4. Krishna Raju, Advanced Concrete Structures, McGraw Hill, New Delhi, 2000.
5. Ramchandra, Design of Steel Structures, Vol . I & II Standard Book House,
6. New Delhi, 1996.
7. Dayaratnam P., Design of Steel Structures, Wheeler and Co., New Delhi,
8. 1999.

OUTCOME:

Upon successful completion of the course, students will be able to

- plan for general requirements in an industry and prepare a layout on buildings and structural components for various industries
- make an appropriate lighting & ventilation and identify a suitable measures to control fire as per factories act in an industrial structure.
- design an industrial building with bents along with crane girder; describe suitable foundations for the various types of machines/equipment in an industry.
- analyse and design a rc structure such as corbels, bunkers, silos, chimneys and cooling towers in an industry.
- identify suitable tower configurations for power transmission, analyse and design a lattice tower with suitable foundations.

CECY103	MAINTENANCE AND REHABILITATION OF STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To impart students sound knowledge on various causes of failures, detailed assessment procedure for evaluating a distressed structure, materials available for effecting repair and techniques for effective rehabilitation.
- To offer knowledge to students on rehabilitation of real time distressed structures through case studies.

MODULE I CAUSES FOR FAILURES 09

Effects due to climate, temperature, chemicals, wear and erosion - design and construction errors- corrosion – mechanism, causes, consequences and remedial measures - effect of cover thickness and cracking on durability of concrete.

MODULE II MAINTENANCE AND ASSESSMENT PROCEDURE 09

Definition : maintenance, repair and rehabilitation - facets of maintenance - importance of maintenance- assessment procedure for evaluating a damaged structure - various aspects of inspection - destructive and non–destructive testing techniques.

MODULE III MATERIALS FOR REPAIR 09

Special concretes and mortar - concrete chemicals - elements for accelerated strength gain - expansive cement - polymer concrete composites - ferro cement - fibre reinforced concrete- fibre reinforced polymer composites - micro concrete. methods of corrosion protection - corrosion inhibitors - protective coating materials for rebar and concrete - corrosion resistant steel - cathodic protection.

MODULE IV TECHNIQUES FOR REPAIR 09

Rust converters and polymer coating for rebars during repair - repair mortar for cracks - bonding agents - epoxy injection - guniting and shotcrete - FRP and ferro cement jacketing - vacuum concreting - bonding plates - overlays - protective coatings - shoring and underpinning technique.

MODULE V REHABILITTION OF STRUCTURES - CASE STUDIES 09

Case studies on repairs to overcome low member strength - deflection - cracking - chemical attack - damage due to wear - leakage - fire - marine exposure and

corrosion- engineered demolition techniques for dilapidated structures - case study.

Total Hours : 45

REFERENCES:

1. Santha Kumar A.R., Concrete Technology, Oxford University Press, 2007.
2. Shetty M.S., Concrete Technology – Theory and Practice, S. Chand & Company Limited, 2008.
3. Orchard D.F., Concrete Technology -Vol. I - Properties of Materials, Wiley Publishers, 2010.
4. Yoshihiko Ohama, Hand Book of Polymer – Modified Concrete and Mortars, Noyes Publications, 1995.
5. Philip H. Perkins, Repair, Protection and Waterproofing of Concrete Structures, Elsevier Applied Science Publishers, 1986.
6. Ransom W.H., Building Failures - Diagnosis and Avoidnce, E.& F.N. Spon Publishers, 1987.
7. Michael T. Kubal, Waterproofing the Building Envelope, Mc-Graw Hill Inc., 1993.

OUTCOME:

At the end of course work students will be able to

- Specify the various causes for distress in reinforced concrete structures.
- Conduct systematic condition assessment of damaged structures using conventional and non-destructive testing methods.
- Suggest suitable materials for repair based on damage level, deterioration mechanism and durability requirements of the distressed structures.
- Recommend repair techniques for rehabilitation of damaged structural elements based on deterioration level, serviceability and durability requirements.
- Specify rehabilitation procedure for fire affected, corrosion affected and other structurally distressed members and engineered demolition techniques

CECY104 PLATES AND SHELLS

L	T	P	C
3	0	0	3

OBJECTIVE:

- To impart knowledge on the behavior of thin and thick plates in cartesian and polar coordinates.
- To understand the behaviour of reinforced concrete plate and shell elements at material level, element level and system level.

MODULE I THIN AND THICK PLATES 09

Plate equation and behaviour of thin plates in cartesian- polar coordinates- isotropic and orthotropic plates- bending and twisting of plates.

MODULE II ANALYSIS & DESIGN OF PLATES 10

Navier's solution and energy method, rectangular, circular plates with various end conditions - design steps - minimum thickness and reinforcements as per I.S. specifications for R.C. folded plates.

MODULE III BEHAVIOUR OF SHELLS 08

Shell behaviour, shell surfaces and characteristics, classifications of shells, equilibrium equations in curvilinear coordinates, force displacement relations.

MODULE IV ANALYSIS OF SHELLS 08

Membrane analysis and bending theory of shells of revolution, cylindrical shells under different loads, shallow shells, solutions of typical problems.

MODULE V DESIGN OF SHELLS 10

Design of spherical, conical, paraboloid, ellipsoid, cylindrical hyperbolic paraboloid, northlight shells.

Total Hours : 45

REFERENCES:

1. Timoshenko.S & S.W. Krieger, Theory of Plates & Shells, McGraw Hill & Co., New York, 1990.
2. Ramaswamy.G.S, Design and Construction of Concrete Shell Roofs, CBS Publishers, 1986.
3. Varadhan K., and Baskar, K, Analysis of Plates (Theory & Problems),Naraosa Publishing House,1999

4. Bairagi N.K, Plate Analysis, Khanna Publishers, 1981.
5. Reddy, J.N., Mechanics of Laminated Composites Plates and Shells, CRC Publishers, 2nd Edition, 2003.
6. Philip L Gould, Analysis of Shells and Plates, Prentice Hall, 1998.

OUTCOME:

Upon successful completion of this course, students will be able to

- describe the behaviour of thin and thick plates.
- solve and establish classical solutions for various types of plates.
- illustrate the characteristics on different types of shells and develop equilibrium equations and force displacement relations.
- analyse the various types of shells under different loading conditions
- design the various types of shells structures.

CECY105 STABILITY OF STRUCTURES

L	T	P	C
3	0	0	3

OBJECTIVE:

- To impart students sufficient knowledge about basic concepts of elastic structural stability, analytical approaches to stability and analysis of inelastic buckling of columns.
- To give exposure on the stability analysis of beam columns and frames using FEM and other methods and analysis of buckling of beams and thin plates.

MODULE I STABILITY OF COLUMNS 09

Concepts of elastic structural stability- analytical approaches to stability - characteristics of stability analysis- elastic buckling of columns- equilibrium; energy and imperfection approaches – non-prismatic columns- built up columns- orthogonality of buckling modes- effect of shear on buckling load - large deflection theory.

MODULE II METHODS OF ANALYSIS AND IN ELASTIC BUCKLING 09

Approximate methods – rayleigh and galerkin methods – numerical methods – finite difference and finite element - analysis of columns – experimental study of column behaviour – south well plot - column curves - derivation of column design formula - effective length of columns - inelastic behaviour- tangent modulus and double modulus theory

MODULE III BEAM COLUMNS AND FRAMES 09

Beam column behaviour- standard cases- continuous columns and beam columns – column on elastic foundation – buckling of frames – single storey portal frames with and without side sway – classical and stiffness methods – approximate evaluation of critical loads in multistoried frames – use of wood’s charts.

MODULE IV BUCKLING OF BEAMS 09

Lateral buckling of beams – energy method- application to symmetric and simply symmetric I beams – simply supported and cantilever beams - narrow rectangular cross sections- – numerical solutions – torsional buckling – uniform and non uniform torsion on open cross section - flexural torsional buckling – equilibrium and energy approach.

MODULE V BUCKLING OF THIN PLATES 09

Isotropic rectangular plates - governing differential equations - simply supported on all edges – use of energy methods – plates with stiffeners – numerical techniques.

Total Hours : 45

REFERENCES:

1. Ashwini Kumar, Stability of Structures, Allied Publishers Ltd, 1998.
2. NGR Iyengar, Structural Stability of Columns and Plates, Affiliated East-West Press Pvt. Ltd, 2007.
3. Stephen P. Timoshenko and Gere Theory of Elastic Stability, McGraw-Hill Company, 2000.
4. Allen, H.G and Bulson, P.S., Background to Buckling, McGraw-Hill Book Company,1980.
5. Gambhir, M.L, *Stability* Analysis and Design of *Structures*, Springer, 2004.
6. Chai H Yoo, Sung Lee, Stability of Structures - Principles and Applications, Elsevier, 2011.

OUTCOME:

At the end of the course work, the students will be able to

- describe the basic concepts of elastic structural stability and identify suitable analytical approaches to stability of structures.
- analyse the inelastic buckling of structures by various approximate methods.
- Illustrate the buckling behaviour of various structural components and evaluate under critical loading conditions.
- develop stability analysis by different approaches for various types of beams.
- establish differential equations for thin plates under different edge conditions.

CECY106 TALL STRUCTURES

L	T	P	C
3	0	0	3

OBJECTIVE:

- To understand the problems associated with large heights of structures with respect to different loads.
- To gain knowledge on the behaviour, analysis and design of various structural systems.
- To impart knowledge on stability of tall buildings and also on dynamic analysis of wind and earthquake loadings.

MODULE I DESIGN CRITERIA & LOADING 09

General - factors affecting growth, height and structural form - design philosophy - loading - gravity loading - wind loading - earthquake loading - combinations of loading - strength and stability - stiffness and drift limitations - human comfort criteria- creep effects - shrinkage effects - temperature effects - fire - foundation settlement - soil-structure interaction

MODULE II STRUCTURAL FORMS 09

Structural forms – braced frame, rigid frame, infilled frame, shear wall structures, wall- frame structures, framed tube structures, outrigger braced structures, space structures, hybrid structures, R.C.floor systems - one-way slab on beams and girders - two-way flat slab - two-way flat plate - waffle flat slabs - two-way slab and beam - steel framing floor systems - one-way beam system - two-way beam system - three-way beam system - composite steel - concrete floor systems.

MODULE III MODELING, BEHAVIOUR & ANALYSIS OF STRUCTURAL SYSTEMS 09

Modeling for analysis - assumptions - modeling for approximate analyses - modeling for accurate analysis - reduction technique. types, behaviour and analysis methods of braced frames - behaviour and analysis of rigid frame structures - behaviour, analysis & design of infilled frame structures - behaviour and analysis of shear wall, coupled shear wall and wall-frame structures - behaviour of tubular structures, core structures and outrigger-braced structures

MODULE IV STABILITY OF TALL BUILDINGS 09

Overall buckling analysis of frames (approximate methods) - overall buckling analysis of wall frames - second order effects of gravity loading - translational -

torsional instability - out-of-plumb effects - effects of foundation rotation - creep and shrinkage effects - temperature effects.

MODULE V DYNAMIC ANALYSIS 09

Response to wind loading - along-wind response - across-wind response - estimation of natural frequencies & damping - types of excitation - design to minimise dynamic response - response to earthquake motions - response to ground accelerations - response spectrum analysis - estimation of natural frequencies and damping - human response to building motions.

Total Hours : 45

REFERENCES:

1. Bryan Stafford Smith and Alex Coull, Tall building Structures, Analysis Design, John Wiley and Sons, Inc. 1991.
2. Taranath B.S, Structural Analysis and Design of Tall Buildings McGraw Hill Book Co., 2010.
3. Lin .Y. and Burry D. Stotes, Structural Concepts and Systems for Architects and Engineers, John Wiley, 1994.
4. Lynn.S. Beedle, Advances in Tall Buildings, CBS Publishers and Distributors, 1996
5. Lawson T V, Wind Effects on Buildings, Applied Science Publishers, 1980.

OUTCOME

On successful completion of these modules, students will be

- compute the different types of loading acting on tall structures and identify the different factors affecting the tall structures.
- classify and use appropriate types of structural systems in tall structures.
- construct modeling using various analysis techniques and describe its behaviour for various structural systems.
- manipulate the second order effects of gravity loading, translational and torsional instability in the analysis of tall structures
- analyze the response of wind and seismic motions on tall structures.

CECY107	WIND AND CYCLONE EFFECTS ON STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To impart sufficient knowledge on the concepts of wind effects on structures.
- To familiarise on the modeling and designing the structures for wind and cyclone effects as per the codal recommendations.

MODULE I INTRODUCTION 09

Types of wind – characteristics of wind – wind velocity, method of measurement, variation of speed with height, shape factor, aspect ratio, drag effects - dynamic nature of wind – pressure and suctions - spectral studies, gust factor.

MODULE II WIND TUNNEL STUDIES 09

Wind tunnel studies- types of tunnels, prediction of acceleration – load combination factors – wind tunnel data analysis – calculation of period and damping value for wind design - modeling requirements – interpretation of results-aero dynamic and aero-elastic models

MODULE III WIND EFFECTS ON STRUCTURES 09

Classification of structures - rigid structures, flexible structures - static and dynamic effects on tall buildings - chimneys.

MODULE IV DESIGN OF STRUCTURES FOR WIND LOAD 09

Design principles for wind loading on structures as per IS and NBC codal provisions – design of tall buildings – chimneys – transmission towers – industrial sheds.

MODULE V CYCLONE EFFECTS ON STRUCTURES 09

Cyclone effect on low rise structures – sloped roof structures - tall buildings -effect of cyclone on claddings and design of cladding as per codal provisions in cladding design –procedure and modeling of cladding.

Total Hours : 45

REFERENCES:

1. Cook., N.J., The Designer's Guide to Wind Loading of Building Structures, Butterworths, 1989.
2. Kolousek., et.al., Wind Effects on Civil Engineering Structures, Elsevier Publications, 1994.

3. Lawson T.V., Wind Effects on Building Vol. I and II, Applied Science Publishers, London, 1980.

OUTCOME:

On successful completion of this course, students will have the ability to

- describe the concepts on the wind effects on structures.
- perform the wind tunnel studies, analyse and compute the various parameters for wind design.
- critically describe the behavior of various types of structures due to wind loading.
- Employ the standards for the design of various structures due to wind loading.
- Describe and perform the design of structures against cyclone.

CECY109 DESIGN OF OFFSHORE STRUCTURES

L	T	P	C
2	0	0	2

OBJECTIVE:

- To impart knowledge on wave generalized process and wave theories.
- To understand the forces on offshore structure.
- To expand the idea on foundation and structural modeling and familiarize with foundation analysis on offshore structures
- To design of offshore structures with failure probability

MODULE I WAVE THEORIES 06

Wave generation process-small- finite amplitude and nonlinear wave theories.

MODULE II FORCES OF OFFSHORE STRUCTURES 06

Wind forces- wave forces on small bodies and large bodies current forces and use of morison equation.

MODULE III OFFSHORE SOIL AND STRUCTURE MODELLING 06

Different types of offshore structures- foundation modeling- fixed jacket platform structural modeling.

MODULE IV ANALYSIS OF OFFSHORE STRUCTURES 06

Static method of analysis-foundation analysis and dynamics of offshore structures.

MODULE V DESIGN OF OFFSHORE STRUCTURES 06

Design of platforms –helipads- Jacket tower- analysis and design of mooring cables and pipe lines.

Total Hours : 30

REFERENCES:

1. Cakrabarti, S.K. Hydrodynamics of Offshore Structures, Computational Mechanics Publications, 1987.
2. Dawson.T.H., Offshore Structural Engineering, Prentice Hall Inc Englewood Cliffs, N.J. 1983
3. Brebia, C.A and Walker, S., Dynamic Analysis of Offshore Structures, New Butterworths, U.K. 1979.

4. API, Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms, American Petroleum Institute Publication, RP2A, Dalls, Tex, 2000.
5. Reddy, D.V. and Arockiasamy, M., Offshore Structures, Vol.1 and Vol.2, Krieger Publishing Company, Florida, 1991

OUTCOME:

On completion of this course students will be able to

- determine the constants involved in the wave theories.
- solve various types of forces due to ocean waves.
- describe the foundation for offshore structures.
- perform and analyze the dynamics of offshore structures.
- design offshore structures like platform, helipads, jackets, towers etc.,

CECY110	DESIGN OF STEEL CONCRETE COMPOSITE STRUCTURES	L	T	P	C
		2	0	0	2

OBJECTIVE:

- To introduce the behaviour of composite beams, columns and connections.
- To understand the behaviour and design concepts of composite box girder bridges and composite trusses.

MODULE I CONCEPTS OF STEEL CONCRETE COMPOSITE CONSTRUCTION 07

Introduction to steel-concrete composite construction - theory of composite structures - introduction to steel-concrete - steel sandwich construction.

MODULE II DESIGN OF COMPOSITE MEMBERS 08

Behaviour of composite beams - columns - design of composite beams - steel - concrete composite columns - design of composite trusses

MODULE III DESIGN OF CONNECTIONS 08

Types of connections - design of connections in the composite structures - shear connections - design of connections in composite trusses.

MODULE IV COMPOSITE BOX GRIDER BRIDGERS 07

Introduction - behaviour of box girder bridges - design concepts.

Total Hours : 30

REFERENCES:

1. Johnson R.P., Composite Structures of Steel and Concrete, Blackwell Scientific Publications (Second Edition), UK, 2005.
2. Owens, G.W. and Knowels. P., Steel Designers Manual (Fifth edition), Steel Concrete Institute (UK), Oxford Blackwell Scientific Publications, 1992.
3. Course Notes, Institute of Steel Development and Growth (INSDAG), Kolkatta,.

OUTCOME:

At the end of the course, students will be able to

- Describe the composite structures using various theories.
- design the composite beams and columns.
- analyse and design the connections in composite structures.
- design composite box girder bridges.

CECY111	CASE STUDIES ON PERFORMANCE AND EVALUATION OF STRUCTURES	L	T	P	C
		1	0	0	1

OBJECTIVE:

- To impart knowledge on the various causes of deterioration of structures
- To expand the knowledge on repair, retrofit and strengthening of structures through case studies.

MODULE I CASE STUDIES ON PERFORMANCE OF STRUCTURES 07

Durability assessment of structures - seismic performance of configuration of buildings – seismic performance of concrete, steel and composite structures- blast and wind resistant structures

MODULE II CASE STUDIES ON REPAIR AND REHABILITATION OF STRUCTURES 08

Degradation of concrete structures in marine environment - durability problems on heritage structures - structural appraisal and evaluation of fire damaged structures- engineered demolition techniques for dilapidated structures – retrofit on non-engineered buildings - strengthening of concrete and steel structures.

Total Hours : 15

OUTCOME:

On successful completion of these modules, students will be able to

- identify different types of damages and repair strategies on structures
- apply the suitable repair and rehabilitation techniques to evaluate the performance of structures.

LIST OF EVEN SEMESTER PROFESSIONAL ELECTIVES

CECY201	COMPOSITE MATERIALS	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To impart sufficient knowledge about classification and characteristics of composite materials used in structures.
- To develop an understanding on analysis of laminated composites, netting analysis, manufacturing and fabrication processes of fibres.

MODULE I CLASSIFICATION AND CHARACTERISTICS OF COMPOSITE MATERIALS 09

Need for the composite materials – types of composite materials and their use in structures.

MODULE II BASIC CONCEPTS 09

Hooke's law for orthotropic and anisotropic materials – micromechanics and macro mechanics – lamina stress-strain relations referred and principal material directions and arbitrary axes.

MODULE III ANALYSIS OF LAMINATED COMPOSITES 09

Governing equations for anisotropic and orthotropic plates – angle-ply and cross-ply laminates – static, dynamic and stability analysis for simpler cases of composite plates – interlaminar stresses

MODULE IV FAILURE THEORY 09

Netting analysis – failure criteria – sandwich construction.

MODULE V MANUFACTURING AND FABRICATION PROCESSES 09

Manufacturing of glass – boron and carbon fibres – open mould and closed mould processes.

Total Hours : 45

REFERENCES:

1. Jones R.M., Mechanics of composite materials, CRC Press, 1998.
2. Lubin G, Handbook on Fibre glass and advanced plastic composites, Van
3. Nostrand Co., New York, 1989.

4. Agarwal B.D and L.J.Broutman, Analysis and performance of fiber composites, John-wiley and sons, 1980.
5. Calcote L.R, Analysis of limited structures, Van Nostrand Reinhold Co., 1989.

OUTCOME:

On successful completion of these modules, students will be able to

- classify the composite materials and their use in structures.
- identify the priniciple material direction and arbitrary axes
- apply the various theories for analysis of laminated composites
- perform netting analysis in sandwich construction
- analyse, manufacture and fabricate the composite materials.

CECY202 CORROSION OF STEEL IN CONCRETE

L	T	P	C
3	0	0	3

OBJECTIVE:

- To impart students sound knowledge on mechanism of corrosion of steel in concrete, its causes, consequences and control measures.
- To offer students knowledge on codal provisions for enhancing durability and corrosion rate measurement in distressed structures including rehabilitation techniques.

MODULE I CORROSION MECHANISM 09

Corrosion mechanism – black rust - pits - stray current - bacterial corrosion- causes of corrosion – carbonation - chloride attack - influence of concrete cover- corrosion damage – damage in conventionally reinforced concrete and prestressed concrete - stress corrosion cracking - hydrogen embrittlement- cost of corrosion - worldwide scenario.

MODULE II CORROSION CONTROL IN REINFORCED CEMENT CONCRETE09

Control of carbonation - control of chlorides - high performance concrete- corrosion inhibitors – anodic, cathodic and mixed Inhibitors-protective coatings to steel rebars – fusion bonded epoxy coating, galvanization, cement polymer composite coating, inhibited cement slurry coating and anticorrosive polymer cementious coatings - stainless steel reinforcement - sealers and membranes - cathodic protection.

MODULE III CONDITION EVALUATION AND CORROSION RATE MEASUREMENT 09

Preliminary survey - visual Inspection - detailed survey - delamination, - cover - half cell potential measurements - carbonation depth measurement - chloride determination and resistivity measurement - corrosion rate measurement – linear polarization resistance techniques - impedance studies - macrocell techniques - potential-time behavior studies and accelerated corrosion studies.

Module IVREHABILITATION TECHNIQUES 09

Physical and chemical rehabilitation techniques - concrete removal and surface preparation - patches - coatings and sealers - membranes and barriers - encasement and overlays - sprayed concrete - corrosion inhibitors -

electrochemical repair techniques – basic principles – cathodic protection - chloride removal and realkalization

MODULE V CODAL REQUIREMENTS FOR DURABILITY 09

Indian standard codal requirements for enhancing durability of R.C.C. structures - Indian and ASTM codal provisions for coated rebars - galvanized reinforcement - corrosion inhibitors - bond strength test.

Total Hours : 45

REFERENCES:

1. Arnon Bentur, Sidney Diamond and Neal S. Berke, Steel Corrosion in Concrete – Fundamentals and Civil Engineering Practice, E & FN SPON Publications, Madras,1997.
2. John P.Broomfield, Corrosion of steel in concrete - Understanding, investigation and repair, E & FN SPON Publications, Madras,1997.
3. Mars G. Fontana, Corrosion Engineering Mc-Graw Hill Publishers, New Delhi, 2001.
4. Philip H. Perkins, Repair, Protection and Waterproofing of Concrete Structures, Elsevier Applied Science Publishers, London, 1986.

OUTCOME:

At the end of course work, students will be able to

- describe the corrosion mechanism of steel in concrete including its causes and consequences.
- suggest active and passive measures to control corrosion of steel rebars in concrete environment.
- perform condition evaluation studies on corrosion damaged structures by employing conventional and electrochemical corrosion rate measurement techniques.
- recommend physical and chemical rehabilitation techniques based on serviceability needs.
- specify standards to conduct performance evaluation tests on coated rebars and corrosion inhibitors.

CECY203 EARTHQUAKE ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVE:

- To provide the basic understanding on the theory of vibrations.
- To introduce the phenomena of earthquakes and its measurements, factors that affect the design of structures in seismic areas.
- To impart knowledge on the fundamentals of load calculation, various structural systems, design and detailing aspects of structures subject to earthquake loading.
- To provide insight knowledge on the seismic retrofitting techniques of structures.

MODULE I THEORY OF VIBRATIONS 09

Concepts of vibrations – response of the system – simple harmonic motion – damped and undamped -free and forced vibration- natural frequencies and modes shapes.

MODULE II ENGINEERING SEISMOLOGY 09

Earthquake characterizations – causes of earthquake - types of earthquake – seismic waves – magnitude and intensity – measurement of earthquake – seismic zones – architectural features – indian seismic codes– liquefaction of soil - indian and world seismicity

MODULE III SEISMIC BEHAVIOUR OF STRUCTURES 09

Seismic design philosophy – earthquake resistant design of RC members – beams – columns – beam column joints – slabs – staircases – shear wall – seismic coefficient – load combinations - response spectrum method - steel frames – steel panel zones – bracing members–connection design and joint behavior.

MODULE IV DUCTILE DETAILING 09

IS 13920 codal provisions for detailing – beams – columns – beam column joints – footing – staircases – shear wall – special confining reinforcements.

MODULE V SEISMIC RETROFITTING OF STRUCTURES 09

Base isolation – seismic dampers – retrofitting and strengthening of structural members.

Total Hours : 45

REFERENCES:

1. Duggal S.K., Earthquake Resistant Design of Structures. Oxford university press, 2007.
2. Paulay.T and Priestly. M.N.J., Aseismic Design of Reinforced Concrete and Masonry Building, John Wiley and Sons, 1991.
3. Anil K.Chopra, Dynamics of Structures Theory and Applications to Earthquake Engineering Prentice Hall of India (P) Ltd., New Delhi 1996.
4. Allen R.T., Edwards S.C., Repair of Concrete Structures, Blackie and Sons, U.K. 1992.
5. Paulay,T. and Priestly, M.N.J., “Aseismic Design of Reinforced Concrete and Masonry Building”, John Wiley and Sons, 1991.

OUTCOME:

At the end of this course, students will be able to

- evaluate the natural frequencies and modes shapes for structures.
- identify the types of seismic waves and measure the magnitude of earthquake.
- perform seismic analysis of structures using various methods.
- describe and design the ductile detailing for structures.
- suggest retrofitting and strengthening methods for structural members.

CECY204 FATIGUE & FRACTURE OF STRUCTURES

L	T	P	C
3	0	0	3

OBJECTIVE:

- To impart knowledge on the behaviour on fatigue and damage tolerance problems in structures.
- To provide in-depth knowledge on the stress distribution and energy theories related to fatigue load.

MODULE I INTRODUCTION TO FATIGUE 09

Loads – cyclic loads – high cycle fatigue – low cycle fatigue- stress-life approach: S-N curve – size effect – loading effect – surface , plating, thermal and mechanical –temperature – environment.

MODULE II STRAIN-LIFE APPROACH 09

Introduction – material behaviour – monotonic stress-strain behaviour, basic definition – true and engineering stress-strain relationship, cyclic stress-strain behaviour, cyclic strain hardening and softening, cyclic stress-strain curve determination, stress-strain power law relation.

MODULE III FATIGUE LIFE CALCULATION 09

Prediction of fatigue life using S-N and miner's approach – general calculation of equivalent stress range, stresses to be considered, S-N curves and joint classifications, – prediction of crack propagation– general, constant amplitude loading, variable amplitude loading, geometric functions and crack growth integrals– general, load calculation, stress calculation, probability of failure – design formats – general, allowable stresses, allowable cumulative damage ratio, comments on the design formats

MODULE IV STRESS DISTRIBUTION & ENERGY THEORIES 09

Stress distribution at discontinuities – stress concentration factors – cracks linear elastic fracture mechanics, stress intensity factor – monotonic and cyclic loads - fracture toughness – energy theories – J-integral; crack growth studies: fatigue crack growth -constant amplitude loading – variable amplitude loading – crack growth models –remaining life-prediction – residual strength evaluation – plastic collapse condition, yield condition, remaining life approach

MODULE V FRACTURE OF CONCRETE STRUCTURES 09

Fracture mechanics approach for concrete – limitations – non-linear fracture models with tension softening – fracture energy – size effect – remaining life prediction – residual strength evaluation.

Total Hours : 45

REFERENCES:

1. Prashanth Kumar, Elements of Fracture Mechanics, Tata McGraw-Hill Education, 2009.
2. Shah S P, Stuart E. Swartz, Ouyang C, Fracture Mechanics of Concrete: Applications of Fracture Mechanics to Concrete, Rock and Other Quasi-Brittle Materials. John Wiley & Sons, 1995.
3. Madhava Rao A G, Appa Rao T.V.S.R, Fatigue and Fracture in Steel and Concrete Structures, Taylor & Francis, 1992.
4. George C. Sih, A. Ditomasso, Fracture mechanics of concrete: Structural application and numerical calculation, Springer Science & Business Media, 2012.
5. ncrete, CRC Press, 1992.
6. ACI 215R-74, Considerations for Design of Concrete Structures Subjected to Fatigue Loading, ACI Committee.

OUTCOME:

On successful completion of these modules, students will able to

- develop S-N curve for structures failed due to fatigue loading.
- apply strain-life approach to calculate fatigue damage.
- calculate fatigue life of structures.
- apply various theories and fracture models related to fatigue response of structures.
- describe and compute fracture energy of concrete structures

CECY205	MATRIX METHODS OF STRUCTURAL ANALYSIS	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To understand the difference between matrix based flexibility and stiffness approaches in structural analysis.
- To impart knowledge to compute deflections and forces in statically determinate and indeterminate structures using matrix methods.
- To provide an in-depth analytical knowledge on the physical interpretation of stiffness matrices to assemble stiffness matrices.

MODULE I FUNDAMENTAL CONCEPTS AND TRANSFORMATION 09

Introduction – forces and displacement measurements – principle of superposition – methods of structural analysis – betti's Law – stiffness and flexibility matrices of the elements - indeterminate structures – transformation of system force to element forces – element flexibility to system flexibility – system displacement to element displacement – transformation of forces and displacement in general – normal and orthogonal transformation.

MODULE II FLEXIBILITY METHOD 10

Choice of redundant – ill and well-conditioned equations – automatic choice of redundant – rank technique – transformation of one set of redundant to another set – thermal expansion – lack of fit – application to pin jointed plane truss – continuous beams - frames and grids.

MODULE III STIFFNESS METHOD 10

Development of stiffness method – analogy between flexibility and stiffness – analysis due to thermal expansion, lack of fit – application to pin-jointed plane and space trusses – continuous beams – frames and grids – problem solving.

MODULE IV MATRIX DISPLACEMENT METHODS - SPECIAL TOPICS 8

Static condensation technique – substructure technique - transfer matrix method – symmetry & anti symmetry of structures – reanalysis technique.

MODULE V DIRECT STIFFNESS METHOD 08

Discrete system – direct stiffness approach – application to two and three dimensional pin-jointed trusses - plane frames – grids – three dimensional space frames.

Total Hours : 45

REFERENCES:

1. Mcguire and Gallagher, R.H, Matrix Structural Analysis, John Wiley, 2001.
2. Rajasekaran S and Sankarasubramanian G, Computational Structural Mechanics, Prentice Hall of India, 2001.
3. Beaufait, F.W., Computer Methods of Structural Analysis Analysis, Prentice Hall, 1970.
4. Holzer, S.M., Computational Analysis of Structures, Elsevier Science Publishing Co., Inc, 1988.
5. Meek J. L., Computer methods in structural Analysis, Taylor and Francis, 1991.
6. Nelsm J.K., Nelson K James and Mc Cormac J C., Structural analysis using Classical and Matrix methods, John Wiley &sons, 2002.
7. Kanchi M. B., Matrix methods of Structural analysis, New Age International, 1993.

OUTCOME:

On successful completion of these modules, students will be able to

- transform the different kinds of matrices.
- apply the matrix flexibility method for planar trusses, beams, and frames.
- compute reactions, internal forces and deflections for planar trusses, beams, and frames using matrix stiffness method.
- analyze the matrix displacement method for symmetry and anti-symmetry of structures using various techniques.
- extend the direct stiffness method for three dimensional framed structure.

CECY206 OPTIMIZATION IN STRUCTURAL DESIGN

L	T	P	C
3	0	0	3

OBJECTIVE:

- To impart sufficient knowledge on basic concepts of optimization and classical methods.
- To give detailed overview of queuing theory, exposure to various optimization techniques for design of structural elements and linear programming methods for plastic design.

MODULE I BASIC CONCEPTS IN OPTIMIZATION 09

Basic concepts of minimum weight - minimum cost design - objective function – constraints - classical methods.

MODULE II QUEUING THEORY 09

Queuing model - poisson and exponential distributions - queues with combined arrivals and departures - random and series queues

MODULE III OPTIMIZATION TECHNIQUES AND ALGORITHMS 09

Linear programming - integer programming - quadratic programming - dynamic programming and geometric programming methods for optimal design of structural elements.

MODULE IV COMPUTER SEARCH METHODS 09

Linear programming methods for plastic design of frames - computer search methods for univariate and multivariate minimization.

MODULE V OPTIMIZATION THEOREMS 09

Optimization by structural theorems – Maxwell - mitchell and heyman's Theorems for trusses and frames - fully stresses - design with deflection constraints-optimality criterion methods.

Total Hours : 45

REFERENCES:

1. Quang Liang, Q., Performance-based Optimization of Structures: Theory and Applications, Taylor & Francis, 2005.
2. Ratan Prakash Agarwal, Ravi P. Agarwal, Recent Trends in Optimization theory and applications, World Scientific, 1995.

3. Iyengar. N.G.R and Gupta.S.K, Structural Design Optimisation, Affiliated East West Press Ltd, New Delhi, 1997
4. Richard Bronson, Operation Research, Schaum's Outline Series, McGraw-Hill Book Co., Singapore, 1983.

OUTCOME:

At the end of the course work, students will be able to

- describe the various basic concepts in optimization.
- perform the queuing theory in structural analysis.
- execute different optimization techniques for the design of structural elements.
- appropriately use the computer search methods for the analysis of structures.
- describe the various optimization theorems for the analyzing of structures.

CECY207 PRESTRESSED CONCRETE

L	T	P	C
3	0	0	3

OBJECTIVE:

- To understand the behaviour and performance of prestressed concrete structures.
- To impart knowledge to analyze and design prestressed concrete flexural and shear members.
- To expand knowledge to design the prestressed concrete structures such as circular prestressing, composite construction members.

MODULE I BASIC CONCEPTS & ANALYSIS OF STRESSES 09

Basic concepts – advantages of PSC – materials required – systems and methods of prestressing – analysis of sections – stress concept – strength concept – load balancing concept –stresses in tendons - losses of prestress –deflections of prestressed concrete members - factors influencing deflections –effect on tendon profile on deflections - short term and long term deflections as per codal provisions.

MODULE II DESIGN OF PSC MEMBERS 09

Flexural strength – simplified procedures as per codes – shear and principal stresses – ultimate shear resistance of PSC members - design of shear reinforcement – behaviour under torsion – modes of failure - design for torsion, shear and bending - design of PSC sections for flexure - transmission of prestress in pre-tensioned members –bond and transmission length – end zone reinforcement – anchorage zone stresses - stress distribution - design of anchorage zone reinforcement.

MODULE III STATICALLY INDETERMINATE STRUCTURES 09

Analysis of indeterminate structures – continuous beams – concept of concordance and linear transformations.

MODULE IV DESIGN OF TENSION AND COMPRESSION MEMBERS 09

Design of tension members - application in the design of prestressed concrete pipes and cylindrical water tanks - design of compression members with and without flexure - application in the design piles

MODULE V DESIGN OF COMPOSITE MEMBERS 09

Composite beams - analysis and design, ultimate strength - their applications - partial prestressing - its advantages and applications.

Total Hours : 45

REFERENCES:

1. Krishna Raju, N., Prestressed concrete, Tata McGraw Hill Company, New Delhi, 2012.
2. Rajagopal, N, Prestressed concrete, Second Edition, Narosa Publications, New Delhi, 2007.
3. Lin.T.Y., Design of Prestressed Concrete Structures, John Wiley and Sons
4. Inc, 2000.
5. Sinha, N.C, & S.K.Roy, Fundamentals of Prestressed Concrete, S.Chand & Co, New Delhi, 2000.
6. Ramaswamy G.S., Modern Prestressed Concrete Design, Arnold Heinimen, New Delhi, 1990.
7. IS 1343-1980, Code of Practice for Prestressed concrete
8. IS 3370 (Part –IV) – 1967, Design Tables, Code of Practice for Concrete Structures for the Storage of Liquids.
9. IS 456-2000, Code of Practice for Plain and Reinforced Concrete.
10. SP 16, Design Aids for IS 456-1978.

OUTCOME:

On successful completion of the course, students will be able to

- apply the principles for analyzing the prestressed concrete structures; evaluate the short and long term losses and deflection for PSC members
- establish appropriate approaches to calculate the design strength for flexure, shear & torsion and design the PSC members.
- analyse the indeterminate PSC structures
- apply the principles and techniques for the design of circular prestressing and demonstrate the various structures such as poles, piles.
- analyse and design the composite structural members.

CECY208 SOIL -STRUCTURE INTERACTION

L	T	P	C
3	0	0	3

OBJECTIVE:

- To provide graduate students and practicing engineers with the fundamental concepts and theory of dynamic soil-structure interaction(SSI), with special focus on analysis, influence of SSI in the design parameters.
- To expose the students to various design charts.

MODULE I SOIL- FOUNDATION INTERACTION 09

Introduction to soil-foundation interaction problems – soil behaviour, foundation behaviour, interface behaviour-scope of soil foundation interaction analysis-soil response models-winkler, elastic continuum, two parameter elastic models - elastic plastic behaviour-time dependent behaviour

MODULE II BEAM ON ELASTIC FOUNDATION- SOIL MODELS 09

Infinite beam - two parameters - isotropic elastic half-space - analysis of beams of finite length - classification of finite beams in relation to their stiffness.

MODULE III PLATE ON ELASTIC MEDIUM 09

Infinite plate- winkler - two parameters - isotropic elastic medium -thin and thick plates - analysis of finite plates - rectangular and circular plates -numerical analysis of finite plates -simple solutions.

MODULE IV ELASTIC ANALYSIS OF PILE 09

Elastic analysis of single pile-theoretical solutions for settlement and load distributions - analysis of pile group, interaction analysis - load distribution in groups with rigid cap.

MODULE V LATERALLY LOADED PILE 09

Load deflection prediction for laterally loaded piles - sub grade reaction and elastic analysis - interaction analysis - pile raft system - solutions through influence charts

Total Hours : 45

REFERENCES:

1. Selvadurai, A.P.S., Elastic Analysis of Soil Foundation Interaction, Elsevier, 1979.
2. Poulos, H.G., and Davis, E.H., Pile Foundation - Analysis and Design, John Wiley, 1980.

3. Scott, R.F., Foundation Analysis, Prentice Hall, 1981.
4. Structure-Soil Interaction - State of Art Report, Institution of Structural Engineers, 1978.
5. ACI 336, Suggested Analysis and Design Procedures for combined footings and Mats, American Concrete Institute, Delhi, 1988

OUTCOME:

At the end of this course the students will be able to

- analyse the soil foundation interaction using soil response models.
- perform elastic analysis of foundation and consider soil structure interaction in design.
- perform the numerical analysis of finite plates
- perform the interaction analysis of pile group
- predict the load deflection behavior for laterally loaded piles

CECY224	GREEN BUILDING AND ENERGY EFFICIENT STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVE:

To impart the knowledge on

- Design of energy efficient buildings
- Thermal performance of building sections by providing a mix of passive solar design strategies
- Usage of materials with low embodied energy to increase the thermal comfort

MODULE I INTRODUCTION 09

Energy required for building construction - heat transfer – measuring conduction – thermal storage – measurement of radiation – the green house effect – psychrometry chart – measuring latent and sensible heat - thermal comfort – site planning and development – temperature – humidity – wind – optimum site location sun protection – types of shading devices – conservation – heating and cooling loads - IGBC's rating systems - sustainable sights - water efficiency - energy efficiency - materials and resources - indoor environmental quality.

MODULE II PASSIVE SOLAR HEATING AND COOLING 09

General principles of passive solar heating – key design elements - direct gain trombe walls - water walls - convective air loops – concepts – case studies – general principles of passive cooling – ventilation – predicting ventilation in building-window ventilation calculations - radiation – evaporation and dehumidification –mass effect – load control – air filtration and odour removal – heat recovery in large buildings

MODULE III DAYLIGHTING AND ELECTRICAL LIGHTING 09

Materials- components and details - insulation – optical materials – radiant barriers glazing materials - day lighting – sources and concepts – building design strategies – case studies – electric lighting –light distribution – electric lighting control for day lighted buildings – illumination requirement – components of daylight factor – recommended daylight factors – day lighting analysis – supplementary artificial lighting design

MODULE IV HEAT CONTROL AND VENTILATION 09

Requirements – heat transmission through building sections – thermal performance of building sections – orientation of buildings – building characteristics for various climates – thermal design of buildings influence of design parameters – mechanical controls – examples - ventilation – requirements – minimum standards for ventilation – ventilation design – energy conservation in ventilating systems – design for natural ventilation.

MODULE V DESIGN FOR CLIMATIC ZONES 09

Energy efficiency – an overview of design concepts and architectural interventions – energy efficient buildings for various zones – cold and cloudy – cold and sunny – composite – hot and dry – moderate – warm and humid – case studies of residences, office buildings and other buildings in each zones – energy audit – certification.

Total Hours: 45

REFERENCES:

1. Moore F., Environmental Control system, Mc Graw Hill Inc., 1994.
2. Brown, GZ Sun, Wind and Light: Architectural design strategies, John Wiley,2013.
3. Cook. J, Award –Winning passive Solar Design, Mc-Graw Hill, 1984.

OUTCOME:

At the end of the course, the students will be able to

- identify the required energy for building construction.
- design and analyse the passive solar cooling and heating techniques.
- identify the required amount of daylight and electrical lighting for a building.
- analyse the ventilation and thermal design of a building.
- design a specific type of building for a special climatic zones.

CECY209	COMPUTER AIDED ANALYSIS FOR STRUCTURES	L	T	P	C
		2	0	0	2

OBJECTIVE:

- To impart required knowledge about modeling of curves and surfaces and solid modeling
- To familiarise on the use of typical software packages and computer methods of analysis such as FEM and computer aided design of steel and RC structural elements.
- To provide exposure on computer aided project scheduling such as CPM and PERT applications.
- To understand the concepts on the knowledge based expert systems and principles of neural network.

MODULE I COMPUTER GRAPHICS 06

Graphic primitives - transformations - basics of 2-D drafting - modeling of curves and surfaces – solid modeling - graphic standards - drafting software packages and usage.

MODULE II STRUCTURAL ANALYSIS 06

Computer methods of structural analysis - finite element programming - analysis through application packages.

MODULE III STRUCTURAL DESIGN 06

Computer aided design of steel and RC structural elements - detailed drawing - bill of materials.

MODULE IV OPTIMIZATION 06

Linear programming - simplex algorithm - post-optimality analysis - project scheduling - CPM and PERT applications - genetic algorithm and applications.

MODULE V EXPERT SYSTEMS 06

Introduction - heuristic search - knowledge based expert systems - architecture and applications of KBES - expert system shells - principles of neural network.

Total Hours : 30

REFERENCES:

1. Krishnamoorthy, C.S.,and Rajeev, S.,Computer Aided Design, Narosa Publishing House, New Delhi, 1991.
2. Ian M. Smith, D. V. Griffiths Programming the Finite Element Method, John Wiley & Sons, 2005.
3. Harrison,H.B., Structural Analysis and Design Vol. I & II, Pergamon Press, 1991.
4. Richard Forsyth (Ed.), Expert System Principles and Case studies,
5. Chapman & Hall , 1989.

OUTCOME:

At the end of course, students will be able to

- apply the drafting techniques with the use of software packages
- analyse the structural members through FEA software packages.
- design the steel and RC structural elements using computer aided analysis packages.
- apply various optimization techniques in project management systems
- describe and apply the expert systems for the analysis of structural members.

CECY210 PREFABRICATED STRUCTURES

L	T	P	C
2	0	0	2

OBJECTIVE:

- To impart required knowledge about the behavior of prefabricated RC structures
- To understand the concepts in the construction of prefabricated structural components for industrial buildings

MODULE I DESIGN PRINCIPLES 06

General civil engineering requirements, specific requirements for planning and layout of prefabrication plant. IS code specifications- modular co-ordination, standardization, disuniting of prefabricates, production, transportation, erection, stages of loading and code provisions, safety factors, material properties, deflection control, lateral load resistance, location and types of shear walls.

MODULE II REINFORCED CONCRETE 06

Prefabricated structures - long wall and cross-wall large panel buildings, one way and two way prefabricated slabs, framed buildings with partial and curtain walls - connections – beam to column and column to column.

MODULE III FLOORS, STAIRS AND ROOFS 06

Types of floor slabs, analysis and design example of cored and panel types and two-way systems, staircase slab design, types of roof slabs and insulation requirements, description of joints, their behaviour and reinforcement requirements, deflection control for short term and long term loads, ultimate strength calculations in shear and flexure.

MODULE IV WALLS 06

Types of wall panels, blocks and large panels, curtain, partition and load bearing walls, load transfer from floor to wall panels, vertical loads, eccentricity and stability of wall panels, design curves, types of wall joints, their behaviour and design, leak prevention, joint sealants, sandwich wall panels, approximate design of shear walls.

MODULE V INDUSTRIAL BUILDINGS AND SHELL ROOFS 06

Components of single-storey industrial sheds with crane gantry systems, R.C. roof trusses, roof panels, corbels and columns, wind bracing design - cylindrical, folded

plate and hyper-prefabricated shells, erection and jointing, joint design, hand book based design.

Total Hours : 30

REFERENCES:

1. Koncz.T., Manual of Precast Concrete Construction, Vol.I II and III & IV Bauverlag, GMBH, 1971.
2. Laszlo Mokk, Prefabricated Concrete for Industrial and Public Structures, Akademiai Kiado, Budapest, 2007.
3. Lewicki.B, Building with Large Prefabricates, Elsevier Publishing Company, Amsterdam/ London/New York, 1998.
4. Structural Design Manual, Precast Concrete Connection Details, Society for the Studies in the use of Precase Concrete, Netherland Betor Verlag, 2009.
5. Warszawski, A., Industrialization and Robotics in Building - A managerial approach, Harper and Row, 1990.

OUTCOME:

Upon successful completion of this course, students will be able to

- apply the design principles used to construct prefabricated structures.
- create a panel and framed buildings with their connections of prefabricated RC structures.
- Classify the types of floors, stairs and roofs and describe their behaviour of structures.
- Critically describe the various of types wall panels of prefabricated structures.
- Construct a prefabricated structural components for industrial buildings.

CECY211	ANALYSIS OF STRUCTURES USING FEA SOFTWARE	L	T	P	C
		1	0	0	1

OBJECTIVE:

- To expand the knowledge on the preparation of structural design and drawings for concrete and steel structures using STAAD Pro software.
- To impart knowledge on the various structural systems and general behavior of structures using ETABS.
- To provide a practical training to analyse the various types of structures using ANSYS.

MODULE I ANALYSIS OF STRUCTURES USING STAAD PRO SOFTWARE 05

Analysis and design of beams subjected to various loading systems - analysis of plane and space frames - design of foundation for the structure

MODULE II ANALYSIS OF STRUCTURES USING ETABS SOFTWARE 05

Working with analytical model view - introducing grid system - object based meshing tools - creating building and applying gravity, wind and seismic loads - buckling analysis - p-delta analysis - generating live mode shapes

MODULE III ANALYSIS OF STRUCTURES USING ANSYS SOFTWARE 05

Introduction to ANSYS - problem formulation– pre & post - processing - plane pin-jointed truss – redundant truss - cantilever beam - simply supported and continuous beam with different types of loads – dynamic analysis of a beam and frame.

Total Hours : 15

REFERENCES:

1. Krishna Raju N, Structural Design & Drawing (Reinforced Concrete & Steel), Universities Press, 2004.
2. ETABS, Three Dimensional Analysis and Design of Building Systems, Computers and structures, 2003.
3. Sivakumar Naganathan, Learn Yourself Staad.Pro V8i, Lap Lambert Academic Publishing GmbH KG, 2012.

4. Srinivas P, Sambana K C, Datti Rajesh Kumar, Finite Element Analysis using Ansys 11.0, PHI Learning Pvt. Ltd., 2010.
5. Revathy J, Gajalakshmi P and Vinu S.K, Manual for Analysis of Structures Using FEA Software, 2016.

OUTCOME:

On successful completion of these modules, students will be able to

- analyse and design steel /concrete structural components and prepare relevant structural drawings as per I.S Specifications using STAAD Pro software.
- design and analyze high rise buildings using ETABS software .
- analyse the non-linear behaviour of structures using ANSYS software.

GENERAL ELECTIVES

GECY101 PROJECT MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

The objectives of the course would be to make the students

- Learn to evaluate and choose an optimal project and build a project profile.
- Attain knowledge on risk identification and risk analysis
- Gain insight into a project plan and components
- Familiar with various gamut of technical analysis for effective project implementation
- Learn to apply project management techniques to manage resources.

MODULE I INTRODUCTION & PROJECT INITIATION 09

Introduction to project and project management - projects in contemporary organization – The project life cycle - project initiation - project evaluation methods & techniques - project selection criteria - project profile.

MODULE II RISK ANALYSIS 09

Sources of risk: project specific - competitive - industry specific - market and international risk – perspectives of risk – risk analysis: sensitivity analysis - scenario analysis - breakeven analysis - simulation analysis - decision tree analysis – managing/mitigating risk – project selection under risk.

MODULE III PROJECT PLANNING & IMPLEMENTATION 09

Project planning – importance – functions - areas of planning - project objectives and policies - steps in planning process - WBS – capital requirements - budgeting and cost estimation - feasibility analysis - creation of project plan – project implementation: pre-requisites - forms of project organization

MODULE IV TECHNICAL ANALYSIS 09

Technical analysis for manufacturing/construction/infrastructure projects – process/technology - materials and inputs - product mix - plant capacity – plant location and site selection – plant layout - machinery and equipment – structures and civil works – schedule of project implementation – technical analysis for software projects.

MODULE V PROJECT MANAGEMENT TECHNIQUES 09

Project scheduling - network construction – estimation of project completion time – identification of critical path - PERT & CPM – crashing of project network - complexity of project scheduling with limited resources - resource allocation - resource leveling – resource smoothing – overview of project management software.

Total Hours: 45

REFERENCES:

1. Projects: Planning, Analysis, Financing, Implementation and Review, Prasanna Chandra, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2004.
2. Project Management and Control, Narendra Singh, Himalaya Publishing, New Delhi, 2015.
3. A Management Guide to PERT/CPM, Jerome, D. Weist and Ferdinand K. Levy, Prentice Hall of India, New Delhi, 1994.

OUTCOMES:

On successfully completing this course, the student will be able to:

- Evaluate & select a project as well as develop a project profile.
- Identify various risks associated with the project and manage it effectively.
- Prepare a detailed project plan addressing its components.
- Perform technical analysis for effective project implementation
- Apply project management techniques for maximizing resource utilization.

GECY102 SOCIETY, TECHNOLGY & SUSTAINABILITY

L	T	P	C
3	0	0	3

OBJECTIVES:

- Aware of new technologies through advances in Science and Engineering.
- To make them realise the profound impact on society.
- Understand the ethical issues raised by technological changes and its effect on society.
- To introduce students a broad range of perspectives on the adoption and use of technologies.
- To make them realize the need of sustainability in the context of emerging technologies.

MODULE I TECHNOLOGY AND ITS IMPACTS 09

Origin and evolution of technologies – Nature of technology- Innovation – Historical Perspective of technology – Sources of technological change - Co-evolution of technology and economy – Scientific knowledge and technological advance – Science and Engineering aspects of Technology – Impact on the Society – Social and Ethical Issues associated with technological change – Social and environmental consequences - Impact of technological change on human life – Technology and responsibility – Technology and social justice.

MODULE II TECHNOLOGY AND ITS ADVANCEMENT 09

Sociological aspects of technology – Ethics and technology – Technology and responsibility – International Economics, Globalisation and Human Rights – Sustainability and Technology – Population and environment - Technology, Energy and Environment – Organisations and technological change.

MODULE III SOCIETY AND TECHNOLOGY 09

Impact of technologies on contemporary society – Role of society in fostering the development of technology – Response to the adaption and use of technology – Impact of technology on developer and consumers – Technological change and globalisation.

MODULE IV IMPACT OF A SPECIFIC TECHNOLOGY ON HUMAN WELFARE 09

Impact of the following technologies on Human life – Medical and Biomedical – Genetics Technology – Electronics and Communications – Electronic media Technology – Information Systems Technology – Nanotechnology – Space

Technology and Energy Technology.

MODULE V THE IMPORTANCE OF SUSTAINABILITY 09

Sustainability – A brief history – Concepts and contexts for sustainability – Ecological imbalance and biodiversity loss – Climate change – Population explosion. Industrial ecology – systems approach to sustainability – Green engineering and technology- sustainable design- sustainable manufacturing- Green consumer movements – Environmental ethics – Sustainability of the planet Earth – Future planning for sustainability.

Total Hours: 45

REFERENCES:

1. Volti Rudi, “Society and Technology Change”, 6th Edition, Worth publishers Inc, USA, 2009.
2. Arthur W.A, “The nature of Technology: What it is and how it evolves”, Free Press, NY, USA, 2009.
3. Winston M and Edelbach R, “Society, Ethics and Technology”, 3rd Edition, San Francisco, USA, 2005.
4. Martin A.A Abraham, “Sustainability Science and Engineering: Defining Principles”, Elsevier Inc, USA, 2006.
5. R.V.G.Menon, “Technology and Society”, Pearson Education, India, 2011.

OUTCOMES:

At the end of this course, the students will be able to

- Understand the benefits of modern technology for the well-being of human life.
- Connect sustainability concepts and technology to the real world challenges.
- Find pathway for sustainable society.

GECY103 ARTIFICIAL INTELLIGENCE

L	T	P	C
3	0	0	3

OBJECTIVES:

- Expose the history and foundations of artificial intelligence.
- Showcase the complexity of working on real time problems underlying the need for intelligent approaches.
- Illustrate how heuristic approaches provide a good solution mechanism.
- Provide the mechanisms for simple knowledge representation and reasoning.
- Highlight the complexity in working with uncertain knowledge.
- Discuss the current and future applications of artificial intelligence.

MODULE I HISTORY AND FOUNDATIONS 08

History – Scope – Influence from life – Impact of computing domains - Agents in environments - Knowledge representation – Dimensions of Complexity – Sample application domains – Agent structure.

MODULE II SEARCH 10

Problem solving as search – State spaces – Uninformed Search – Heuristic search – Advanced search – Constraint satisfaction - Applications.

MODULE III KNOWLEDGE REPRESENTATION AND REASONING 10

Foundations of knowledge representation and reasoning, representing and reasoning about objects, relations, events, actions, time, and space predicate logic, situation calculus, description logics, reasoning with defaults, reasoning about knowledge, sample applications.

MODULE IV REPRESENTING AND REASONING WITH UNCERTAIN KNOWLEDGE 08

Probability, connection to logic, independence, Bayes rule, Bayesian networks, probabilistic inference, sample applications.

MODULE V CASE STUDY AND FUTURE APPLICATIONS 09

Design of a game/Solution for problem in student's domain. Natural Language processing, Robotics, Vehicular automation – Scale, Complexity, Behaviour – Controversies.

Theory: 45

TEXT BOOK:

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall, Third Edition, 2010.
2. David Poole, Alan Mackworth, Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010.
3. Nils J. Nilsson, The Quest for Artificial Intelligence, Cambridge University Press, Online edition, 2013.
4. Keith Frankish, William M. Ramsey (eds) The Cambridge Handbook of Artificial Intelligence, Cambridge University Press, 2014.

OUTCOMES:

Students who complete this course will be able to

- Discuss the history, current applications, future challenges and the controversies in artificial intelligence.
- Apply principle of AI in the design of an agent and model its actions.
- Design a heuristic algorithm for search problems.
- Analyze and represent the fact using logic for a given scenario
- Represent uncertainty using probabilistic models
- Develop a simple game or solution using artificial intelligence techniques.

GECY104 GREEN COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To focus on the necessity of green computing technology.
- To expose to various issues with information technology and sustainability.
- To attain knowledge on the technologies for enabling green cloud computing.
- To elaborate on the energy consumption issues
- To illustrate a Green and Virtual Data Center
- To develop into a Green IT Technologist.

MODULE I INTRODUCTION 08

Trends and Reasons to Go Green - IT Data Center Economic and Ecological Sustainment - The Growing Green Gap: Misdirected Messaging, Opportunities for Action - IT Data Center “Green” Myths and Realities - PCFE Trends, Issues, Drivers, and Related Factors - Green Computing and Your Reputation- Green Computing and Saving Money- Green Computing and the Environment

MODULE II CONSUMPTION ISSUES 10

Minimizing power usage – Cooling - Electric Power and Cooling Challenges - Electrical – Power -Supply and Demand Distribution - Determining Energy Usage - From Energy Avoidance to Efficiency - Energy Efficiency Incentives, Rebates, and Alternative Energy Sources - PCFE and Environmental Health and Safety Standards- Energy-exposed instruction sets- Power management in power-aware real-time systems.

MODULE III NEXT-GENERATION VIRTUAL DATA CENTERS 09

Data Center Virtualization - Virtualization beyond Consolidation - Enabling Transparency - Components of a Virtual Data Center - Datacenter Design and Redesign - Greening the Information Systems - Staying Green- Building a Green Device Portfolio- Green Servers and Data Centers- Saving Energy

MODULE IV TECHNOLOGIES FOR ENABLING GREEN AND VIRTUAL DATA CENTERS 08

Highly Effective Data Center Facilities and Habitats for Technology - Data Center Electrical Power and Energy Management - HVAC, Smoke and Fire Suppression

- Data Center Location - Virtual Data Centers Today and Tomorrow - Cloud Computing, Out-Sourced, and Managed Services.

MODULE V SERVERS AND FUTURE TRENDS OF GREEN COMPUTING 10

Server Issues and Challenges - Fundamentals of Physical Servers - Types, Categories, and Tiers of Servers - Clusters and Grids - Implementing a Green and Virtual Data Center - PCFE and Green Areas of Opportunity- 12 Green Computer Companies- What's in Green computer science-Green off the Grid aimed for data center energy evolution-Green Grid Consortium- Green Applications- Green Computing Making Great Impact On Research

Theory: 45

REFERENCES:

1. Bud E. Smith,"Green Computing Tools and Techniques for Saving Energy, Money, and Resources", Taylor & Francis Group, CRC Press, ISBN-13: 978-1-4665-0340-3, 2014.
2. Jason Harris, "Green Computing and Green IT Best Practices, On Regulations and Industry Initiatives, Virtualization and power management, materials recycling and Tele commuting, Emereo Publishing .ISBN-13: 978-1-9215-2344-1,2014.
3. Ishfaq Ahmed & Sanjay Ranka, "Handbook of Energy Aware and Green Computing", CRC Press, ISBN: 978-1-4665-0116-4, 2013.
4. Kawahara, Takayuki, Mizuno, "Green Computing with Emerging Memory", Springer Publications, ISBN:978-1-4614-0811-6, 2012
5. Greg Schulz, "The Green and Virtual Data Center", CRC Press, ISBN-13:978-1-4200-8666-9, 2009.
6. Marty Poniatowski, "Foundation of Green IT: Consolidation, Virtualization, Efficiency, and ROI in the Data Center", Printice Hall, ISBN: 9780-1-3704-375-0, 2009.

OUTCOMES:

Students who complete this course will be able to

- Demonstrate issues relating to a range of available technologies, systems and practices to support green computing.
- Select appropriate technologies that are aimed to reduce energy consumption.
- Address design issues needed to achieve an organizations' green

computing objectives.

- Analyze the functionality of Data Centers.
- Critically evaluate technologies and the environmental impact of computing resources for a given scenario.
- Compare the impact of Green Computing with other computing techniques.

GECY105 GAMING DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To master event-based programming
- To learn resource management as it relates to rendering time, including level-of-detail and culling.
- To become familiar with the various components in a game or game engine.
- To explore leading open source game engine components.
- To become familiar of game physics.
- To be compatible with game animation.

MODULE I INTRODUCTION 09

Magic Words – What Skills Does a Game Designer Need? – The Most Important Skill -The Five Kinds of Listening-The Secret of the Gifted.

MODULE II THE DESIGNER CREATES AN EXPERIENCE 09

The Game Is Not the Experience -Is This Unique to Games? -Three Practical Approaches to Chasing Rainbows -Introspection: Powers, Perils, and Practice -Dissect Your Feelings -Defeating Heisenberg -Essential Experience.

MODULE III THE EXPERIENCE IN THE PLAYER MIND AND GAME MECHANICS 08

Modeling – Focus -Empathy – Imagination – Motivation – Space – Objects, Attributes, and States – Actions – Rules.

MODULE IV GAMES THROUGH AN INTERFACE 09

Breaking it Down – The Loop of Interaction – Channels of Information – Other Interface.

MODULE V BALANCED GAME MECHANICS 10

Balance – The Twelve Most Common Types of Game Balance – Game Balancing Methodologies - Balancing Game Economies.

Theory: 45

REFERENCES:

1. Jesse Schell, "The Art of Game Design: A Book of Lenses", Second Edition 2nd Edition ISBN-10: 1466598646, 2014.
2. Ashok Kumar, Jim Etheredge, Aaron Boudreaux, “Algorithmic and Architectural Gaming Design: Implementation and Development", 1st edition, Idea Group, U.S ISBN-10: 1466616342, 2012.
3. Katie Salen Tekinba, Melissa Gresalfi, Kylie Peppler, Rafi Santo, "Gaming the System - Designing with Gamestar Mechanic" MIT Press , ISBN-10: 026202781X, 2014.
4. James M. Van Verth, Lars M. Bishop "Essential Mathematics for Games and Interactive Applications", Third Edition,A K Peters/CRC Press, ISBN-10: 1482250926, 2015.

OUTCOMES:

Students who complete this course will be able to

- Realize the basic history and genres of games
- Demonstrate an understanding of the overall game design process
- Explain the design tradeoffs inherent in game design
- Design and implement basic levels, models, and scripts for games
- Describe the mathematics and algorithms needed for game programming
- Design and implement a complete three-dimensional video game

GECY106 SOCIAL COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To create original social applications, critically applying appropriate theories and effective practices in a reflective and creative manner.
- To critically analyze social software in terms of its technical, social, legal, ethical, and functional features or affordances.
- To encourage the development of effective communities through the design, use, and management of social software.
- To give students with a base of knowledge and advances for them to critically examine existing social computing services.
- To plan and execute a small-scale research project in social computing in a systematic fashion.
- To become familiar with the concept of computational thinking.

MODULE I BASIC CONCEPTS 09

Networks and Relations: Relations and Attributes, Analysis of Network Data, Interpretation of network data -New Social Learning – Four Changes that Shift Work - Development of Social Network Analysis: Sociometric analysis and graph theory, Interpersonal Configurations and Cliques – Analysing Relational Data.

MODULE II SOCIAL LINK 09

Individual Actors, Social Exchange Theory, Social Forces, Graph Structure, Agent Optimization Strategies in Networks – Hierarchy of Social Link Motivation- Social Context.

MODULE III SOCIAL MEDIA 08

Trends in Computing – Motivations for Social Computing – Social Media: Social relationships, Mobility and Social context – Human Computation – Computational Models- Business use of social Media.

MODULE IV SOCIAL INFORMATION FILTERING 09

Mobile Location Sharing – Location based social media analysis – Social Sharing and Social Filtering – Automated recommender Systems – Traditional and Social Recommender Systems.

MODULE V SOCIAL NETWORK STRATEGY 10

Application of Topic Models – Opinions and Sentiments – Recommendation Systems – Language Dnamics and influence in online communities – Psychometric analysis – Case Study: Social Network Strategies for surviving the zombie apocalypse.

Theory: 45

REFERENCES:

1. Tony Bingham, Marcia Conner, “The New Social Learning, 2nd Edition: Connect. Collaborate. Work”, 2nd Edition, ATD Press, ISBN-10:1-56286-996-5, 2015.
2. Nick Crossley, Elisa Bellotti, Gemma Edwards, Martin G Everett, Johan Koskinen, Mark Tranmer, “Social Network Analysis for Ego-Nets”, SAGE Publication, 2015.
3. Zafarani, Abbasi and Liu, Social Media Mining: An Introduction, Cambridge University Press, 2014.
4. Christina Prell, “Social Network Analysis: History, Theory and Methodology”, 1st Edition, SAGE Publications Ltd, 2012.
5. John Scott, “Social Network Analysis”, Third Edition, SAGE Publication, 2013.
6. Jennifer Golbeck, “Analyzing the Social Web”, Elsevier Publication, 2013.
7. Huan Liu, John Salerno, Michael J. Young, “Social computing and Behavioral Modeling”, Springer Publication, 2009.

OUTCOMES:

Students who complete this course will be able to

- Realize the range of social computing applications and concepts.
- Analyze data left after in social media.
- Recognize and apply the concepts of computational models underlying social computing.
- Take out simple forms of social diagnostics, involving network and language models, applying existing analytic tools on social information.
- Evaluate emerging social computing applications, concepts, and techniques in terms of key principles.
- Design and prototype new social computing systems.

GECY107 SOFT COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To become familiar with AI and neural networks that can learn from available examples and generalize to form appropriate rules for inferencing systems.
- To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience.
- To provide the mathematical background for carrying out the optimization associated with neural network learning.
- To familiarize with genetic algorithms and other random search procedures useful while seeking global optimum in self-learning situations.
- To introduce case studies utilizing the above and illustrate the intelligent behavior of programs based on soft computing.

MODULE I INTRODUCTION 09

Introduction of soft computing, soft computing vs. hard computing, various types of soft computing techniques, applications of soft computing. Artificial Intelligence : Introduction, Various types of production systems, characteristics of production systems, breadth first search, depth first search techniques, other Search Techniques like hill Climbing, Best first Search, A* algorithm, AO* Algorithms and various types of control strategies. Knowledge representation issues, Prepositional and predicate logic, monotonic and non-monotonic reasoning, forward Reasoning, backward reasoning.

MODULE II INTRODUCTION TO NEURAL NETWROK 09

Structure and Function of a single neuron: Biological neuron, artificial neuron, definition of ANN, Taxonomy of neural net, Difference between ANN and human brain, characteristics and applications of ANN, single layer network, Perceptron training algorithm, Linear separability, Widrow & Hebb"s learning rule/Delta rule, ADALINE, MADALINE, AI v/s ANN. Introduction of MLP, different activation functions, Error back propagation algorithm, derivation of BPA, momentum, limitation, characteristics and application of EBPA.

MODULE III FUZZY LOGIC 09

Fuzzy set theory, Fuzzy set versus crisp set, crisp relation & fuzzy relations, Fuzzy systems: crisp logic, fuzzy logic, introduction & features of membership functions, Fuzzy rule base system: fuzzy propositions, formation, decomposition & aggregation of fuzzy rules, fuzzy reasoning, fuzzy inference

systems, fuzzy decision making & Applications of fuzzy logic.

MODULE IV GENETIC ALGORITHM 09

Fundamentals, basic concepts, working principle, encoding, fitness function, reproduction, Genetic modeling: Inheritance operator, cross over, inversion & deletion, mutation operator, Bitwise operator, Generational Cycle, Convergence of GA, Applications & advances in GA, Differences & similarities between GA & other traditional methods.

MODULE V APPLICATION OF COMPUTATIONAL INTELLIGENCE 09

Printed Character Recognition – Inverse Kinematics Problems – Automobile Fuel Efficiency Prediction – Soft Computing for Color Recipe Prediction.

Total Hours: 45

REFERENCES:

1. Jyh-shing Roger Jang, Chuen - Tsai Sun, Eiji Mizutani, “Neuro- Fuzzy and Soft Computing”, Prentice-Hall of India, 2003.
2. S.Rajasekaran & G.A. Vijayalakshmi Pai, “Neural Networks, Fuzzy Logic & Genetic Algorithms, Synthesis & applications”, PHI Publication, 2002.
3. S.N. Sivanandam & S.N. Deepa, “Principles of Soft Computing”, Wiley Publications, 2007.
4. N.K.Bose, “Neural Network Fundamentals with Graphs, Algorithms, and Applications” TMH, 1996.
5. Klir & Yuan, “Fuzzy sets & Fuzzy Logic: Theory & Application”, Prentice Hall of India Pub, 1995.
6. Kosko: “Neural Network & Fuzzy System”, PHI Publication, 1992.

OUTCOMES:

On completion of the programme students will be able to:

- Learn about soft computing techniques and their applications
- Analyze various neural network architectures and able to Understand perceptrons model
- Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
- Apply genetic algorithms to combinatorial optimization problems.
- Evaluate and compare solutions by various soft computing approaches for a given problem.

GECY108 EMBEDED SYSTEM PROGRAMMING

L	T	P	C
3	0	0	3

OBJECTIVES:

- This course provides an introduction to the design of embedded computing systems including their hardware and software architectures.
- Entire software development lifecycle and examine the various issues involved in developing software for embedded systems.
- To analyze the I/O programming and Embedded C coding techniques
- This course will equip students with the software development skills necessary for practitioners in the embedded systems field.

MODULE I INTRODUCTION OF EMBEDDED SYSTEM 09

Embedded computing - characteristics and challenges - embedded system design process-Overview of Processors and hardware units in an embedded system-Compiling, Linking and locating – downloading and debugging –Emulators and simulators processor – External peripherals – Memory testing – Flash Memory.

MODULE II SOFTWARE TECHNOLOGY 09

Software Architectures, Software development Tools, Software Development Process Life Cycle and its Model, Software Analysis, Design and Maintenance.

MODULE III INPUT/OUTPUT PROGRAMMING 09

I/O Instructions, Synchronization, Transfer Rate & Latency, Polled Waiting Loops, Interrupt – Driven I/O, Writing ISR in Assembly and C, Non Maskable and Software Interrupts

MODULE IV DATA REPRESENTATION IN EMBEDDED SYSTEMS 09

Data representation ,Twos complement, Fixed point and Floating Point Number Formats ,Manipulating Bits in -Memory, I/O Ports, Low level programming in C ,Primitive data types , Arrays, Functions ,Recursive Functions, Pointers, Structures & Unions ,Dynamic Memory Allocation ,File handling ,Linked lists, Queues, Stacks.

MODULE V EMBEDDED C 09

Embedded Systems programming in C – Binding & Running Embedded C program in Keil IDE – Dissecting the program -Building the hardware. Basic techniques for reading & writing from I/O port pins – switch bounce - LED Interfacing using Embedded C.

Total Hours: 45

REFERENCES:

1. Marilyn Wolf, "Computers as components ", Elsevier, 2012.
2. Qing Li and Carolyn Yao, "Real-Time Concepts for Embedded Systems", CMP Books, 2003.
3. Daniel W. Lewis, "Fundamentals of embedded software where C and assembly meet", Pearson Education
4. Michael Bass, "Programming Embedded Systems in C and C++", Oreilly, 2003.

OUTCOMES:

On completion of this course the student will be able to

- Design the software and hardware components in embedded system
- Describe the software technology
- Use interrupt in effective manner
- Use keil IDE for programming
- Program using embedded C for specific microcontroller
- Design the embedded projects

GECY109 PRINCIPLES OF SUSTAINABLE DEVELOPMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge in the concepts and dimensions of sustainable development.
- To gain knowledge on the framework for achieving sustainability.

MODULE I CONCEPT OF SUSTAINABLE DEVELOPMENT 09

Environment and Development - Population poverty and Pollution –Global and Local environmental issues –Resource Degradation- Greenhouse gases- Desertification-industrialization –Social insecurity, Globalization and environment. History and emergence of the concept of sustainable development-Objectives of Sustainable Development.

MODULE II COMPONENTS AND DIMENSIONS OF SUSTAINABLE DEVELOPMENT 09

Components of Sustainability –Complexity of growth and equity – Social economic and environmental dimensions of sustainable development – Environment- Biodiversity- Natural -Resources- Ecosystem integrity- Clean air and water- Carrying capacity- Equity, Quality of Life, Prevention, Precaution-Preservation and Public Participation Structural and functional linking of developmental dimensions.

MODULE III FRAMEWORK FOR ACHIEVING SUSTAINABILITY 09

Operational guidelines- interconnected prerequisites for sustainable development Empowerment of Women, children, Youth, Indigenous People, Non-Governmental Organizations Local Authorities, Business and industry-Science and Technology for sustainable development- performance indicators of sustainability and assessment mechanism- Constraints and barriers for sustainable development.

MODULE IV SUSTAINABLE DEVELOPMENT OF SOCIO ECONOMIC SYSTEMS 09

Demographic dynamics of sustainability – Policies for socio-economic development -Strategies for implementing eco-development programmes Sustainable development through trade –Economic growth –Action plan for implementing sustainable development –Urbanization and sustainable Cities – Sustainable Energy and Agriculture –sustainable livelihoods.

MODULE V SUSTAINABLE DEVELOPMENT AND INTERNATIONAL RESPONSE 09

Role of developed countries in the development of developing countries – international summits – Stockholm to Johannesburg – Rio principles – Agenda-Conventions – Agreements – Tokyo Declaration – Doubling statement – Tran boundary issues integrated approach for resources protection and management

Total Hours: 45

REFERENCES:

1. Sayer J. and Campbell, B., The Science of Sustainable Development: Local Livelihoods and the Global environment - Biological conservation restoration & Sustainability, Cambridge university Press, London, 2003.
2. M.K. Ghosh Roy. and Timberlake, Sustainable Development, Ane Books Pvt. Ltd, 2011.
3. Mackenthun K.M., Concepts in Environmental Management, Lewis Publications London,1999.
4. APJ Abdul Kalam and Srijan Pal Singh, Target 3 Billion: Innovative Solutions Towards Sustainable Development, Penguin India, 2011

OUTCOMES:

At the end of the course the student will be able to

- Describe the concepts of sustainable development
- Define the components and dimensions of sustainable development
- Outline the Frame work for achieving sustainability.
- State the policies and strategies for implementing sustainable development for Socio economic programmes.
- Examine the role of developed countries in sustainable development.

GECY110	QUANTITATIVE TECHNIQUES IN MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVE:

To impart knowledge on

- operations research
- production management
- financial management
- decision theory and managerial economics

MODULE I OPERATIONS RESEARCH 09

Introduction to Operations research-Linear programming-Graphical and Simplex Methods, Duality and Post-Optimality Analysis-Transportation and Assignment Problems

MODULE II PRODUCTION MANAGEMENT 09

Inventory control, EOQ, Quantity Discounts, Safety Stock-Replacement Theory-PERT and CPM-Simulation Models-Quality Control.

MODULE III FINANCIAL MANAGEMENT 09

Working Capital Management-Compound Interest and Present Value methods-Discounted Cash Flow Techniques-Capital Budgeting.

MODULE IV DECISION THEORY 09

Decision Theory-Decision Rules-Decision making under conditions of certainity, risk and uncertainity-Decision trees-Utility Theory.

MODULE V MANAGERIAL ECONOMICS 09

Cost concepts-Break-even -Analysis-Pricing techniques-Game Theory applications.

Total Hours: 45

REFERENCES:

1. Vohra, N.D. , Quantitative Techniques in Management, Tata McGraw Hill Co., Ltd, New Delhi, 2009.
2. Seehroeder, R.G., Operations Management, McGraw Hill, USA, 2002.
3. Levin, R.I, Rubin, D.S., and Stinsonm J., Quantitative Approaches to Management, McGraw Hill Book Co., 2008.

4. Frank Harrison, E., The Managerial Decision Making Process, Houghton Miffin Co. Boston, 2005.
5. Hamdy A. Taha, Operations Research- An Introduction, Prentice Hall, 2002.

OUTCOME:

At the end of the course, the students will be able to

- Apply the concepts of operations research for various applications
- Create models for inventory control in production management
- Compute the cash flow for a project
- Choose a project using decision theory based on the risk criterion.
- Apply the concepts of managerial economics in construction management

GECY111 PROGRAMMING USING MATLAB & SIMULINK

L	T	P	C
1	0	2	2

OBJECTIVES:

The aim of this course is to:

- Teach students how to mathematically model engineering systems
- Teach students how to use computer tools to solve the resulting mathematical models. The computer tool used is MATLAB and the focus will be on developing and solving models of problems encountered in engineering fields

MODULE I INTRODUCTION MATLAB DATA PRESENTATION 03+06

Vectors, Matrices -Vector/Matrix Operations & Manipulation- Functions vs scripts-Making clear and compelling plots-Solving systems of linear equations numerically and symbolically- Least squares regression -Curve fitting.

MODULE II MATLAB PLOT FUNCTION 03+06

Introduction- Plot Function – Animation- 3D Plots-Customizing Plots – Plot Applications- Saving &Painting Plots.

MODULE III ROOT FINDING AND COMPUTER REPRESENTATION OF NUMBERS 03+06

Linearization and solving non-linear systems of equations- The Newton-Rapson method- Integers and rational numbers in different bases- Floating point numbers-Round off and errors in basic arithmetic-Significant digits when reporting results

MODULE IV ORDINARY DIFFERENTIAL EQUATIONS 03+06

Numerical integration and solving 1^{st} order, ordinary differential equations (Euler's method and Runge-Kutta) – Use of ODE function in MATLAB

MODULE V NON-LINEAR DIFFERENTIAL EQUATIONS 03+06

Converting 2^{nd} order and higher ODEs to systems of 1^{st} order ODEs- Solving systems of ODEs via Euler's method and Runge-Kutta) – Solving single and systems of non-linear differential equations by linearization-Use of the function ODE in MATLAB to solve differential equations

MODULE VI INTRODUCTION OF SIMULINK 03+06

Simulink & its relations to MATLAB – Modeling a Electrical Circuit- Modeling a fourth order differential equations- Modeling the solution of three equations with three unknowns- Representing a model as a subsystem-Simulink demos.

Total Hours: 45

REFERENCE:

1. Griffiths D V and Smith I M, Numerical Methods for Engineers, Blackwell, 1991.
2. Laurene Fausett, Applied Numerical Analysis Using MATLAB, Pearson 2008.
3. Moin P, Fundamentals of Engineering Numerical Analysis, Cambridge University Press, 2001.
4. Wilson HB, Turcotte LH, Advanced mathematics and mechanics applications using MATLAB. CRC Press, 1997
5. Ke Chen, Peter Giblin and Alan Irving, Mathematical Exploration with MATLAB, Cambridge University Press, 1999.

OUTCOMES:

At the end of this unit students will be able to:

- Use Matlab as a convenient tool for solving a broad range of practical problems in engineering from simple models to real examples.
- Write programs using first principles without automatic use of built-in ones.
- Write programs for solving linear and nonlinear systems, including those arising from boundary value problems and integral equations, and for root-finding and interpolation, including piecewise approximations.
- Be fluent in exploring Matlab's capabilities, such as using matrices as the fundamental data-storage unit, array manipulation, control flow, script and function m-files, function handles, graphical output.
- Make use of Maltab visual capabilities for all engineering applications.
- An ability to identify, formulate, and solve engineering problems. This will be accomplished by using MATLAB to simulate the solution to various problems in engineering fields

GECY112 JAVA PROGRAMMING

L	T	P	C
2	0	0	2

OBJECTIVES:

- To learn the fundamentals of Java programming such as data types, variables and arrays.
- To study the syntax and necessity of decision making and iterative statements.
- To create a class and invoke the methods.
- To instigate programming in overloading of methods.
- To emphasize the concept of packages.
- To learn the exception handling routines.

MODULE I INTRODUCTION TO JAVA PROGRAMMING 15

History and Evolution of Java – Overview of Java – Data types, variables and arrays – Operators – Control statements.

MODULE II METHODS AND CLASSES 15

Class fundamentals – Declaring objects – Methods – Constructors – Garbage collection – Overloading methods – Constructor overloading – Access control – Inheritance – Packages - Exception handling.

Total Hours: 30

REFERENCES:

1. Herbert Schildt, Java The Complete Reference, 9th Edition, Oracle Press, 2014, ISBN: 978007180855-2.
2. Nicholas S. Williams, Professional Java for Web Applications: Featuring WebSockets, Spring Framework, JPA Hibernate and Spring Security (WROX), John Wiley & Sons, 2014, ISBN:978111865651-8.
3. E Balagurusamy, Programming with Java, 5th Edition,Tata Mcgraw Hill,2014.
4. Yashavant Kanetka**,** Let Us Java, 2nd Edition, BPB Publications, 2012**.**

OUTCOMES:

Students to complete this course will be able to

- Implement basic Java programming.
- Create a class and invoke methods for real world problems.
- Construct simple overloading of methods programs.
- Implement various types of inheritance concepts.
- Describe the access control mechanism.

GECY113 PYTHON PROGRAMMING

L	T	P	C
2	0	0	2

OBJECTIVES:

- To learn the list and records of python programming.
- To study the control statements and string functions of python.
- To instigate the fundamental python programming.
- To emphasize GUI in python.
- To integrate python with embedded systems.
- To implement programs in python.

MODULE I INTRODUCTION TO PYTHON PROGRAMMING 15

Installation and environment set up – syntax used in python – variable types – operators – Loops – decision making – string functions - formatted files - GUI basics.

MODULE II EMBEDDED PROGRAMMING USING PYTHON 15

Web interface – system tools – script execution context - Motion-triggered LEDs-Python-arduino prototyping-storing and plotting arduino data-Remote home monitoring system.

Total Hours : 30

REFERENCES:

1. Nick Goddard, “Python Programming”, 2nd edition, ISBN: 1533337772, 2016.
2. Pratik Desai, “Python Programming for Arduino”, 1st edition, Packt publishing, 2015, ISBN: 9781783285938.
3. Mark Lutz, Learning Python: Powerful Object-Oriented Programming, 5th Edition, O'Reilly Media, 2013.
4. Richard H. Barnett, Sarah Cox, Larry O'Cull, “Embedded C Programming and the Atmel AVR”, 2nd edition, 2006.
5. Michael Barr, Anthony Massa, “Programming Embedded Systems”, 2nd Edition, O'Reilly Media, 2006.

OUTCOMES:

Students to complete this course will be able to

- Implement date and time function programming using python.
- Write formatted file programming.
- Construct simple python programs.
- Create web interface using python programming
- Develop embedded system with python programming.
- Build arduino prototype using python programming.

GECY114 INTELLECTUAL PROPERTY RIGHTS (IPR)

L	T	P	C
1	0	0	1

OBJECTIVES:

- To study about Intellectual property rights and its need
- To explore the patent procedure and related issues

MODULE I INTRODUCTION 07

Introduction and the need for intellectual property right (IPR) – IPR in India – Genesis and Development – IPR in abroad – Important examples of IPR – Copyrights, Trademarks, Patents, Designs, Utility Models, Trade Secrets and Geographical Indications – Industrial Designs

MODULE II PATENT 08

Concept of Patent – Product / Process Patents & Terminology – Duration of Patents – Law and Policy Consideration Elements of Patentability –- Patentable Subject Matter – Procedure for Filing of Patent Application and types of Applications – Procedure for Opposition – Revocation of Patents – Working of Patents- Patent Agent – Qualification and Registration Procedure – Patent databases and information system – Preparation of patent documents – Process for examination of patent application- Patent infringement – Recent developments in patent system

Total Hours: 15

REFERENCES

1. B.L.Wadehra; Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India 2000
2. Ajit Parulekar and Sarita D' Souza, Indian Patents Law – Legal & Business Implications; Macmillan India ltd , 2006
3. P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi, 2010.
4. E. T. Lokganathan, Intellectual Property Rights (IPRs): TRIPS Agreement & Indian Laws Hardcover, 2012
5. Alka Chawla, P N Bhagwati , Law of Copyright Comparative Perspectives 1st Edition, LexisNexis, 2013
6. V. K. Ahuja, Law Relating to Intellectual Property Rights 2nd Edition, LexisNexis, 2nd Edition, 2013

7. Deborah E. Bouchoux, Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets, 2015
8. Jatindra Kumar Das, Law of Copyright, PHI Learning, 2015

COURSE OUTCOMES:

Students should be able to

- Identify the various types of intellectual property and their value
- Apply the procedure to file a patent and to deal the related issues
- Search and extract relevant information from various intellectual database

REGULATIONS, CURRICULUM AND SYLLABI

M.Sc.
ACTUARIAL SCIENCE

(As approved by the 9th Academic Council)

JULY 2016

B.S.ABDUR RAHMAN
UNIVERSITY
B.S. ABDUR RAHMAN INSTITUTE OF SCIENCE & TECHNOLOGY
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(FORMERLY B.S. ABDUR RAHMAN CRESCENT ENGINEERING COLLEGE)
Rated with A Grade by National Assessment and Accreditation Council
Seethakathi Estate, G.S.T. Road, Vandalur, Chennai - 600 048
www.bsauniv.ac.in

VISION AND MISSION OF THE DEPARTMENT OF ACTUARIAL SCIENCE

VISION

To be a leader in providing quality education and to carryout research in the field of Mathematics and its application in Science, Engineering and Technology

MISSION

- To provide quality education in higher mathematics through well designed programs
- To provide quality mathematical foundation for all science and engineering programs
- To offer programs in specialized areas such as Actuarial Science to meet the needs of Insurance and other Industries
- To undertake fundamental, applied and interdisciplinary research

PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES

M. Sc. (Actuarial Science)

PROGRAMME EDUCATIONAL OBJECTIVES:

- To provide opportunities of higher studies in the professional area of Actuarial Science.
- To impart knowledge on various theoretical and practical aspects of Actuarial Science.
- To enable the students to apply their newly gained knowledge and skills in their workplace.
- To develop independent learning skills and transferable skills among the students.
- To help the students extend and develop their career plan and pursue their own professional development.
- To provide the students with a structured programme of study covering all Core Actuarial Science subject contents.
- To contribute to the education of academics, allowing the University to play an active role in the production of advanced studies in the areas of the Master in Actuarial Science.

PROGRAMME OUTCOMES:

On Completion of the Programme, the students will be able to

- understand the fundamental probability tools for quantitatively assessing risk and demonstrate an ability to apply these tools to problems encountered in Actuarial Science.
- use the fundamental concepts of Financial Mathematics and demonstrate an ability to use those concepts to calculate present and accumulated values for various streams of cash flows as a basis for future use.
- demonstrate an understanding of the financial instruments, including derivatives, and the concept of no–arbitrage as it relates to financial mathematics.
- understand the theoretical bases of certain Actuarial Models and Life Contingent models and can apply those models to insurance and other financial risks.
- understand the frequency and severity models and an ability to carry out the steps involved in the modeling process in solving Actuarial Science problems.

- demonstrate the ability to summarize and communicate, orally and in writing, Actuarial problems and the ability to communicate solutions to Actuarial problems to specialized and non-specialized audiences, and,
- demonstrate highest standards of Actuarial ethical conduct and Professional Actuarial behavior, critical, interpersonal and communication skills as well as a commitment to life-long learning.

CURRICULUM & SYLLABI FOR
M. Sc. (Actuarial Science)
(Four Semesters / Full Time)

Curriculum

Sl. No.	Course Code	Course Title	L	T	P	C
		SEMESTER I				
1	MAC 6101	Fundamentals of Financial Mathematics	**3**	**1**	**0**	**4**
2	MAC 6102	Probability and Distributions	**3**	**1**	**0**	**4**
3	MAC 6103	Business Economics	**2**	**1**	**0**	**3**
4	MAC 6104	Financial reporting and Accounting	**2**	**1**	**0**	**3**
5	MAC 6105	Principles of Insurance	**2**	**0**	**0**	**2**
6	MAC 6106	R Programming	**0**	**0**	**4**	**2**
		Total	**12**	**4**	**4**	**18**
		SEMESTER II				
1	MAC 6201	Applications of Financial Mathematics	**3**	**1**	**0**	**4**
2	MAC 6202	Fundamentals of Life Contingencies	**3**	**1**	**0**	**4**
3	MAC 6203	Descriptive Statistical Methods in Actuarial Science	**3**	**1**	**0**	**4**
4	MAC 6204	Stochastic Models	**2**	**1**	**0**	**3**
5	MAC 6205	Mathematical Statistics	**3**	**1**	**0**	**4**
6	ENC 6281	Communication Skills	**1**	**0**	**2**	**2**
7	MAC 6206	Actuarial Computational Laboratory (MS-EXCEL)	**0**	**0**	**4**	**2**
		Total	**15**	**5**	**6**	**23**
		SEMESTER III				
1	MAC 7101	Applications of Life Contingencies	**3**	**1**	**0**	**4**
2	MAC 7102	Financial Economics	**3**	**1**	**0**	**4**
3	MAC 7103	Applied Statistical Methods in Actuarial Science	**3**	**1**	**0**	**4**
4	MAC 7104	Survival Models	**2**	**1**	**0**	**3**
5	MAC 7105	Actuarial Computational Laboratory (SPSS)	**0**	**0**	**4**	**2**
6		Elective – I	**3**	**0**	**0**	**3**
7		Elective- II	**3**	**0**	**0**	**3**
8	MAC7201	Project Phase-I	**0**	**0**	**8**	**4***
		Total	**17**	**4**	**12**	**23**

Sl. No.	Course Code	Course Title	L	T	P	C
		SEMESTER IV				
1	MAC 7201	Project Phase – II	**0**	**0**	**24**	**12***
		Total	**0**	**0**	**24**	**16**

* Credits for Project Work Phase I to be accounted along with Project Work Phase II in IV Semester

LIST OF ELECTIVES

Sl. No.	Course Code	Course Title	L	T	P	C
		SEMESTER I				
1	MACY001	Financial Management of Life Office	3	0	0	3
2	MACY002	Islamic Investments	3	0	0	3
3	MACY003	Corporate Finance	3	0	0	3
		SEMESTER II				
1	MACY004	Financial Markets	3	0	0	3
2	MACY005	Islamic Asset and Fund Management	3	0	0	3
3	MACY006	Portfolio and Credit Risk Management	3	0	0	3

Total Credit (18+23+23+16) = 80

SEMESTER I

MAC 6101 FUNDAMENTALS OF FINANCIAL MATHEMATICS

L	T	P	C
3	1	0	4

OBJECTIVE:

- The aim of this course is to provide basic grounding in basic financial mathematics like simple interest, compound interest and their simple applications to calculate accumulate value, present value and loan calculation.

MODULE I CASH FLOW MODEL 07+02

Cash flow model: Cash flow process, outflows-Cash flow model for a zero coupon bond – Time value of money – Simple and Compound interest problems-Present value and Simple discount- Investing over a period.

MODULE II INTEREST RATES 07+02

Interest rates: Nominal and effective rate of interest. Accumulation factors- Principle of consistency- The force of interest- Present values- The basic compound interest functions- Interest payable monthly.

MODULE III REAL AND MONEY INTEREST RATES 07+02

Real and money interest rates: Definition- Deflationary conditions- Usefulness. Discounting and accumulating: Present value of continuous cash flows- Valuing cashflows- Interest income.

MODULE IV Level ANNUITIES 08+03

Level annuities: Present values and Accumulations -Payments made in arrear- Payments made in advance- Continuously payable annuities- Annuities payable monthly- Non-integer values- Perpetuities.

MODULE V DEFERRED AND INCREASING ANNUITIES 08+03

Deferred and increasing annuities: Deferred annuities- Varying annuities- Decreasing payments- Irregular payments- Sudden changes in interest rates- Simple and Compound increasing annuities.

MODULE VI LOAN SCHEDULES 08+03

Equations of value: Uncertain payment or receipt- Loan schedules- Calculation of capital outstanding- Calculation of interest and capital elements- Installments payable more frequently than annually- Consumer credit: flat rates and APRs.

L: 45, T: 15, Total: 60

REFERENCES:

1. Mark S. Joshi, “The concepts and practice of Mathematical Finance”, Cambridge University Press, 2nd Edition (2008).
2. Paul Wilmott, Sam Howison, and Jeff Dewynne “The Mathematics of Financial derivatives” Cambridge University press, 1995.
3. S.M. Ross “An Introduction to Mathematical finance” Cambridge University Press.
4. J J McCutcheon and Dr W F Scott, “An Introduction to the Mathematics of Finance” Heinemann, 1986.
5. Bowers, Newton L et al. “Actuarial mathematics” – 2nd ed. – Society of Actuaries, 1997.
6. Butcher, M V; Nesbitt, Cecil J. “Mathematics of compound interest”. Ulrich's Books, 1971.
7. Ingersoll, Jonathan E. Rowman & Littlefield, “Theory of financial decision making” 1987.
8. Kellison, Stephen G. “The theory of interest”.2nd ed. Irwin, 1991.

OUTCOME:

On completion of the course the students will be able to

- describe how to use a generalised cash-flow model to describe financial transactions
- describe how to take into account the time value of money using the concepts of compound interest and discounting.
- show how interest rates or discount rates may be expressed in terms of different time periods.
- demonstrate a knowledge and understanding of real and money interest rates.
- calculate the present value and the accumulated value of a stream of equal or unequal payments using specified rates of interest and the net present value at a real rate of interest, assuming a constant rate of inflation.
- define and use the more important compound interest functions, including annuities certain.
- describe how a loan may be repaid by regular installments of interest and capital.

MAC 6102 PROBABILITY AND DISTRIBUTIONS

L	T	P	C
3	1	0	4

OBJECTIVE:

- The aim of this subject is to provide grounding in the aspects of Basic probability, Random variables, probability distributions, joint distribution that are of relevance to actuarial work.

MODULE I BASIC PROBABILITY 09+03

Types of data- Frequency distributions-Bar chart- Histogram- Stem and leaf diagram- Dotplot / Lineplot- Cumulative frequency curves- Boxplot- Location- Spread. Set theory, Venn diagrams, Basics of probability- The addition and multiplication rule – Conditional Probability- and Total probability – Baye's Theorem.

MODULE II RANDOM VARIABLES 06+02

Random Variables and Expectation of a random variable – Moment inequalities (Tchebyshev, Markov, Jensen)- Continuous random variables Functions of a random variable

MODULE III PROBABILITY DISTRIBUTIONS 09+03

Discrete distributions- Uniform, Bernoulli, Binomial, Geometric, Negative binomial, Hypergeometric and Poisson distribution. Continuous distributions- Uniform, Gamma, exponential, chi-square, Beta, Normal distribution, Lognormal distribution, t-distribution, F-distribution. Deriving the Poisson process, Random number simulation.

MODULE IV GENERATING FUNCTIONS 06+02

Probability generating functions, Moment generating functions, Cumulant generating functions, Linear functions

MODULE V JOINT DISTRIBUTIONS 07+02

Joint distributions- Expectations of functions of two variables- Convolutions- Using generating functions to derive distributions of linear combinations of independent random variables.

MODULE VI CONDITIONAL EXPECTATION AND LAW OF LARGE NUMBERS 08+03

Conditional expectation and Conditional variance - Compound distributions- Functions of vector random variables. Weak and strong law of large numbers - Central Limit Theorems - Normal approximations. The continuity correction,

L: 45, T: 15, Total: 60

REFERENCES:

1. Miller, I.; Miller, M.; [Freund, J. E.], “Mathematical statistics”, 7th ed. Prentice Hall International, 1999
2. S.C Gupta,V.K Kapoor, ”Fundamentals of mathematical statistics “, Sultan chand and sons , New Delhi.
3. S.C Gupta,V.K Kapoor, ”Fundamentals of Applied statistics “, Sultan chand and sons , New Delhi.
4. Dekking, F.M., Kraaikamp, C., Lopuhaä, H.P., Meester, L.E. “A Modern Introduction to Probability and Statistics” Springer text series, 2nd Edition
5. Chin Long chiang “ Statistical Methods of Analysis “ World Scientific Books, 2003

OUTCOME:

On completion of the course the students will be able to

- summarize the main features of a data set (exploratory data analysis).
- explain the concepts of probability.
- explain the concepts of random variable, probability distribution, distribution function, expected value, variance and higher moments, and calculate expected values and probabilities associated with the distributions of random variables.
- define a probability generating function, a moment generating function, a cumulant generating function and cumulants, derive them in simple cases, and use them to evaluate moments.
- explain the concepts of independence, jointly distributed random variables and conditional distributions, and use generating functions to establish the distribution of linear combinations of independent random variables.
- state the central limit theorem, and apply it.

MAC 6103 BUSINESS ECONOMICS

L	T	P	C
2	1	0	3

OBJECTIVE:

- The aim of the Business Economics subject is to provide a grounding in the fundamental concepts of economics as they affect the operation of insurance and other financial systems, both from the point of view of individuals and their requirements for financial security, and from the point of view of financial institutions and their ability to provide products that meet customer needs.

MODULE I ECONOMIC CONCEPTS 05+03

Economic concepts- the macroeconomic Environment- microeconomics choices- Demand and supply- Price and output determination- Business in a competitive market Elasticity and uncertainty- Price elasticity of demand- The time dimension of market adjustment-Consumer demand and uncertainty- Marginal utility theory- Demand under conditions of risk and uncertainty- utility and insurance.

MODULE II PRODUCTION AND COSTS 05+02

Production and costs- Costs in the short run and long run- Revenue and profit maximization- Perfect competition and monopoly- Comparing monopoly with perfect competition- contestable markets-Imperfect competition- Monopolistic competition- Oligopoly- Collusive oligopoly- Non-collusive oligopoly.

MODULE III PRODUCTS, MARKETING AND ADVERTISING 05+03

Products, marketing and advertising- Growth strategy and globalization- Growth and profitability- Constraints on growth- Alternative growth strategies- Internal and External growth- Globalization-Pricing strategies- Pricing and market structure- Price discrimination- Multiple product pricing.

MODULE IV GOVERNMENT INTERVENTION IN MARKETS 05+02

Government intervention in markets- objectives- Types of market failure- Types of government intervention- Government and the firm- Competition policy- Policies towards R&D- Supply-side policy- Market-orientation- Industrial policy.

MODULE V INTERNATIONAL TRADE 05+03

International trade- Trading patterns- advantages- The world trading system and the WTO-Balance of payments and exchange rates- The balance of payments account- Fixed versus floating exchange rates- Business activity, unemployment and Inflation- Keynesian model- The “disappearance” of the Phillips curve- Business cycles.

MODULE VI THE MACROECONOMIC ENVIRONMENT 05+02

The macroeconomic environment- objectives- The circular flow of income- The measurement and determination of national income- Economic growth- The AD-AS model Money and interest rates- The financial system- The supply and demand of money- Equilibrium in the money market- The effect of a change in the money supply- Demand-side macroeconomic policy- Fiscal policy- Monetary policy- The supply-side problem.

L: 30, T: 15, Total: 45

REFERENCES:

1. Sloman, John; Hinde, Kevin. "Economics for business"- 4th ed.- Prentice Hall, 2007. ISBN: 9780273709084. [No: 38420]
2. Frederik Mishkin " Economics of Money banking and Financial Markets ", Prentice Hall, July , 2009

OUTCOME:

On completion of the course the students will be able to

- discuss the interaction between supply and demand in the provision of a product and the way in which equilibrium market prices are determined, define elasticity of demand and supply and discuss the effects on a market of different levels of elasticity.
- describe how profit maximizing firms make short run and long run production choices. Describe what is meant by different sorts of competition, or lack of it, and discuss the practical effect on supply and demand.
- define what is meant by GDP, GNP and net national product, show how these concepts may be useful in describing the economy and in making comparisons between countries, and discuss their limitations.
- describe how the propensity to save or to consume by the private sector or the corporate sector affects the economy. describe and discuss the impact of fiscal and monetary policy and other forms of government intervention on different aspects of the economy, and in particular on financial markets.
- discuss the role of exchange rates and international trade in the economy and the meaning of the term balance of payments.
- describe the major factors affecting the rate of inflation, the level of interest rates, the exchange rate, the level of unemployment, and the rate of economic growth in the economy of an industrialized country.

MAC 6104 FINANCIAL REPORTING AND ACCOUNTING

L	T	P	C
2	1	0	3

OBJECTIVE:

- The aim of this subject is to provide a basic understanding of corporate finance including knowledge of the instruments used by companies to raise finance and manage financial risk.
- To provide the ability to interpret the accounts and financial statements of companies and financial institutions.

MODULE I THE KEY PRINCIPLES OF FINANCE 05+03

The key principles of finance- Finance and the real resources of an organisation-Business objectives- The maximisation of shareholder wealth- Company ownership- Types of business entity - Types of medium-term company finance- Types of short-term company finance- Taxation- Personal taxation- Corporation tax- Capital gains Tax- Double taxation relief.

MODULE II FINANCIAL INSTRUMENTS 05+03

Financial instruments- Debenture - Unsecured loan stocks- Subordinated debt- Eurobond loan capital- Share capital-Convertible- Warrants- Use of derivatives- Financial futures- Options- Interest rates and currency swaps- Issue of shares- Obtaining stock exchange quotation- Rights issues- Scrip issues.

MODULE III INTRODUCTION TO ACCOUNTS 05+02

Introduction to accounts- Users- regulation- requirements- Accounting Standards Board- The auditors' report- Accounting concepts- The main accounts- balance sheet- income statement- cash flow statement- Statement of changes in equity- Notes to the accounts.

MODULE IV GENERATING ACCOUNTS 05+02

Depreciation- purpose of depreciation- straight line basis -reducing balance method- Generating accounts -The trial balance- Constructing financial statements.

MODULE V GROUP ACCOUNTS 05+02

Group accounts and insurance company accounts- Subsidiary companies- Consolidated balance sheets- Goodwill on consolidation- Minority interests- Associated companies.

MODULE VI INTERPRETATION OF ACCOUNTS 05+03

Interpretation of accounts- security of loan capital - Income cover and income priority percentages- Asset cover and asset priority percentages- Gearing-shareholder analysis-

Ratios involving share information- Profitability ratios- Liquidity ratios- Efficiency ratios- Limitations in the interpretation of accounts.

L: 30, T: 15, Total: 45

REFERENCES:

1. Anne Britton, Chris waterston " Financial Accounting", Pearson Education,2009
2. Barry Elliott, Jamie Elliott "Financial Accounting and reporting", Trans-Atlantic publications, 2005.
3. Lawrence Revsine "Financial Reporting and Analysis", Mc Graw Hill, 2008.
4. Samuels, J M; Brayshaw, R E; Craner, J M. "Financial statement analysis in Europe" -Chapman & Hall, 1995.
5. Brigham, Eugene F; Houston, Joel F. "Fundamentals of financial management" 9th Edition - Harcourt Brace, 2000.
6. Brett, M. "How to read the financial pages", 2nd Edition-Random House Business Books, 2003.
7. Holmes, Geoffrey; Sugden, Alan; Gee, Paul. – "Interpreting company reports and accounts"- 8th Edition - Pearson Education, 2002.
8. Brealey, Richard A; Myers, Stewart C. – "Principles of corporate finance" - 7th Edition -McGraw-Hill, 2003.

OUTCOMES:

On completion of the course the students will be able to

- demonstrate a knowledge and understanding of the principal terms which is used in investment and asset management.
- demonstrate an awareness of the key principles of finance and basic principles of personal and corporate taxation.
- describe the structure of a joint stock company and the different methods by which it may be financed.
- demonstrate a knowledge and understanding of the characteristics of the principal forms of financial instrument issued or used by companies and the ways in which they may be issued.
- describe the basic construction of accounts of different types and the role and principal features of the accounts of a company.
- interpret the accounts of a company or a group of companies and discuss the limitations of such interpretation and show how financial techniques can be used in the assessment of capital investment projects.

MAC 6105 PRINCIPLES OF INSURANCE

L	T	P	C
2	0	0	2

OBJECTIVE:

- The objective of the paper Principles of Insurance is to give introduction about the various types of insurable risk, principle of insurance, insurance products and markets with a brief history of Insurance.

MODULE I THE CONCEPT OF RISK 05

The concept of risk- kinds and classification of risk – assessment – transfer- risk appraisal-risk selection- underwriting risk appraisal – Mortality tables- physical and moral hazards- representations- warranties- conditions.

MODULE II THE BUSINESS OF INSURANCE 05

The business of insurance-risk managed by individuals- risk managed by insurers-premium fixing- reinsurance and its important-role of insurance in economic development-the insurance market-role of-intermediaries-specialists-regulator.

MODULE III INSURANCE CUSTOMERS 05

Insurance customers-types of customers-customer mindset and customer satisfaction-importance of ethical behavior-History of insurance- History of insurance in India.

MODULE IV BASIC PRINCIPLES OF INSURANCE 05

Basic principles of Insurance – Utmost good faith- Insurable Interest- Material facts-Economic principles of Insurance- Sharing – Subrogation – contribution –Legal principles of Insurance –Actuarial principles.

MODULE V INSURANCE TERMINOLOGY, LIFE INSURANCE 05

Insurance terminology-terms that are specific to life insurance-traditional product offered by life insurance companies-features of MODULE linked policies-features of annuities and group policies.

MODULE VI INSURANCE TERMINOLOGY, GENERAL INSURANCE 05

Insurance terminology-terms that are specific to general insurance- product offered by non-life insurance companies-fire insurance-marine insurance-various product under miscellaneous category.

L: 30, T: 0, Total: 30

REFERENCES:

1. Neelam C Gulati “Principles of Insurance Management”, Excel Books, New Delhi.
2. Harriett E Jones “Principles of Insurance “FLMI Insurance Education Program. Life Management Institute LOMA, (Dec 1995).
3. Robert I Mehr “Principles of Insurance” Richar D Irwin edition,(8th edition, 1985).
4. Ben G Baldwin “The New Life Insurance Investment Advisor” 2nd Edition. Mc Graw Hill.

OUTCOME:

On completion of the course students will be able to

- describe the basic principle of insurance.
- identify different kind of insurable risk.
- demonstrate the insurance terminology.
- describe the history of insurance.
- plan new products based market need.

MAC 6106 R PROGRAMMING

L	T	P	C
0	0	4	2

R: A Language and Environment for Statistical Computing

OBJECTIVE:

- The objective of the R-Programming is to give the basic knowledge of a system for statistical computation and graphics.

PROBLEMS FROM THE FOLLOWING TOPICS

1. Introduction and preliminaries
2. Simple manipulations; numbers and vectors
3. Objects, their modes and attributes
4. Ordered and unordered factors
5. Arrays and matrices
6. Lists and data frames
7. Reading data from files
8. Probability distributions
9. Grouping, loops and conditional execution
10. Writing own functions
11. Statistical models in R

OUTCOME:

On completion of the course the students will be able to use the statistical procedures. Among these are:

- linear and generalized linear models.
- nonlinear regression models.
- time series analysis.
- classical parametric and nonparametric tests.
- clustering and smoothing.

SEMESTER II

MAC 6201 APPLICATIONS OF FINANCIAL MATHEMATICS

L	T	P	C
3	1	0	4

OBJECTIVE:

- The aim of this course is to provide advance knowledge on financial mathematics like project evaluation, calculation of bond price in tax environment, Investment decision, and calculation of forward price and idea of stochastic interest rate model.

MODULE I PROJECT APPRAISAL 08+02

Project appraisal- Accumulated value- Net present values-Internal rate of return-Comparison of two investment projects-Different interest rates for lending and borrowing-payback periods-Measurement of investment performance-Money-weighted rate of return-Time-weighted rate of return-Linked internal rate of return.

MODULE II INVESTMENTS 07+02

Investments-Fixed interest borrowings- government bonds-Government bills-Characteristics of corporate debt-Debentures-Unsecured loan stocks-Eurobonds-Certificates of deposit-Shares and other equity-type borrowing-Property-Derivatives-Futures-Options-Swaps.

MODULE III ELEMENTARY COMPOUND INTEREST PROBLEMS 08+03

Elementary compound interest problems-Fixed interest securities-Calculating the price-Calculating yields-The effect of the term to redemption on the yield-Optional redemption dates-Deferred income tax-Uncertain income securities-Equities-Property-Real rates of interest-Inflation adjusted cash flows-Calculating real yields using an inflation index-Index-linked bonds-Capital gains tax.

MODULE IV ARBITRAGE AND FORWARD CONTRACTS 07+02

Arbitrage and forward contracts-The “No Arbitrage” assumption-Why do we assume “No Arbitrage”?-Forward contracts-Calculating the forward price for a security with no income-Calculating the forward price for a security with fixed cash income-Calculating the forward price for a security with known dividend yield-Hedging-The value of a forward contract.

MODULE V TERM STRUCTURE OF INTEREST RATES 08+03

Term structure of interest rates-Discrete time-spot rates-forward rates-Continuous time-spot rates-forward rates-Instantaneous forward rates-Theories of the term structure of interest rates-Yields to maturity-Pay yields-Duration, convexity and immunization.

MODULE VI STOCHASTIC INTEREST RATE MODELS 07+03

Stochastic interest rate models-Simple models-Preliminary remarks-Fixed interest rate model-Varying interest rate model-Log-normal distribution

L: 45, T: 15, Total: 60

REFERENCES:

1. Mark S. Joshi, “The concepts and practice of Mathematical Finance”, Cambridge University Press, 2nd Edition (2008).
2. Paul Wilmott, Sam Howison, and Jeff Dewynne “The Mathematics of Financial derivatives” Cambridge University press, 1995.
3. S.M. Ross “An Introduction to Mathematical finance” Cambridge University Press..
4. J J McCutcheon and Dr W F Scott, “An Introduction to the Mathematics of Finance Heinemann”,1986.
5. Bowers, Newton L et al. “Actuarial mathematics” – 2nd ed. – Society of Actuaries, 1997.
6. Butcher, M V; Nesbitt, Cecil J. “Mathematics of compound interest”. Ulrich's Books, 1971.
7. Ingersoll, Jonathan E. Rowman & Littlefield, “Theory of financial decision making” 1987.
8. Kellison, Stephen G. “The theory of interest”.2nd ed. Irwin, 1991.

OUTCOME:

On completion of the course the students will be able to

- show how discounted cash flow techniques can be used in investment project appraisal.
- describe the investment and risk characteristics of the following types of asset available for investment purposes.
- calculate the delivery price and the value of a forward contract using arbitrage free pricing methods.
- show an understanding of the term structure of interest rates.
- show an understanding of simple stochastic interest models for investment returns.

MAC 6202 FUNDAMENTALS OF LIFE CONTINGENCIES

L	T	P	C
3	1	0	4

OBJECTIVE:

- The aim of the Life Contingencies subject is to provide grounding in the mathematical techniques which can be used to model and value cash flows dependent on death, survival, or other uncertain risks and also help to calculate premium and reserve for the insurance company.

MODULE I THE LIFE TABLE 07+02

The life table-Constructing a life table-Using the life table-The pattern of human mortality-Life table functions at non-integer ages-uniform distribution of deaths (UDD)- constant force of mortality (CFM)-The general pattern of mortality-Select mortality-Constructing select and ultimate life tables-Evaluation of assurances and annuities-Premium conversion equations-Variance of benefits-Expected present values of annuities payable m times each year.

MODULE II LIFE ASSURANCE CONTRACTS 08+03

Life assurance contracts: Pricing of life insurance contracts, Whole life assurance contracts, Term assurance contracts, Pure endowment contracts, Endowment assurance contracts, Critical illness assurance contracts, Deferred assurance benefits, Mean and Variance of the present value random variable Claim acceleration approximation.

MODULE III LIFE ANNUITY CONTRACTS 08+03

Life annuity contracts: Whole life annuities payable annually in arrears, Whole life annuities payable annually in advance, Temporary annuities payable annually in arrear, Temporary annuities payable annually in advance, Deferred annuities, Deferred annuities-due, Continuous annuities, Immediate annuity, Mean and Variance of the present value random variable approximations.

MODULE IV NET PREMIUMS AND RESERVES 08+03

Net premiums and reserves-The basis-The net premium-The insurer’s loss random variable-Reserves- Prospective reserve-Retrospective reserves-Conditions for equality of prospective and retrospective reserves-Net premium reserves-Recursive calculation of reserves-Mortality profit-Death strain at risk (DSAR)-Expected death strain (EDS) for a single policy-Actual death strain (ADS) for a single policy-Mortality profit.

MODULE V WITH-PROFIT POLICIES 07+02

Variable benefits and with-profit policies-Variable payments-Payments varying at a constant compound rate-Payments changing by a constant monetary amount-With-profit

contracts-Types of bonus-Calculating net premiums and net premium reserves for with-profit contracts- Accumulating with-profits contracts.

MODULE VI GROSS PREMIUMS AND RESERVES 07+02

Gross premiums and reserves for fixed and variable benefit contracts-Types of expenses incurred in writing a life insurance contract-The influence of inflation on expenses-Gross future loss random variable for standard contracts- Determining gross premiums using the equivalence principle-Gross premium reserves-Equality of gross premium prospective and retrospective reserves.

L: 45, T: 15, Total: 60

REFERENCES:

1. B H Smith “Contingencies of Value”, Harvard University Press, 1988.
2. Alistair Neil “Life Contingencies”, Butterworth-Heinemann Ltd; illustrated edition (1977).
3. Griffith Davis “Table of Life Contingencies”, Longman & Co, 1825: University of California Library.
4. Micheal M Parmenter, “Theory of Interest and Life contingencies with Pension”, 3rd Edition.
5. Bowers, Newton L et al. – “Actuarial mathematics”. 2nd Edition – Society of Actuaries, 1997.
6. Benjamin, Bernard; Pollard, John H. – “The analysis of mortality and other actuarial statistics” 3rd Edition – Faculty and Institute of Actuaries, 1993.
7. Gerber, Hans U. – “Life insurance mathematics” 3rd Edition– Springer. Swiss Association of Actuaries, 1997.
8. Booth, Philip Metal. “Modern actuarial theory and practice”– Chapman & Hall,1999.

OUTCOME:

On completion of the course the students will be able to

- define simple assurance and annuity contracts, and develop formulae for the means and variances of the present values of the payments under thesecontracts, assuming constant deterministic interest.
- describe practical methods of evaluating expected values and variances of the simple contracts defined in objective.
- describe and calculate, using ultimate or select mortality, net premiums and net premium reserves of simple insurance contracts.
- describe the calculation, using ultimate or select mortality, of net premiums and net premium reserves for increasing and decreasing benefits and annuities.
- describe the calculation of gross premiums and reserves of assurance and annuity contracts.

MAC 6203 DESCRIPTIVE STATISTICAL METHODS IN ACTUARIAL SCIENCE

L	T	P	C
3	1	0	4

OBJECTIVE:

- The objective of this subject is to provide grounding in Decision theory, Bayesian statistics, Loss distributions, Reinsurance, and Credibility theory which have particular relevance to General Insurance.

MODULE I DECISION THEORY 06+02

Decision theory-Zero-sum two-player games-Domination- the Minimax criterion-Randomised Strategies-Statistical games-Decision criteria-The Bayes criterion.

MODULE II BAYESIAN STATISTICS 06+02

Bayesian statistics-Bayes' Theorem- Prior and posterior distributions- Conjugate priors-Improper prior distributions-The loss function-Quadratic loss-Absolute error loss-All-or-nothing loss.

MODULE III LOSS DISTRIBUTIONS 07+02

Loss distributions- MGFs and basic loss distributions- exponential-gamma-normal-Pareto and generalised Pareto distributions- lognormal distribution-Weibull distribution- The Burr distribution-Estimation-The method of moments-Maximum Likelihood Estimation-Goodness-of-fit-tests-Mixture distributions.

MODULE IV REINSURANCE 08+03

Reinsurance- Reinsurance arrangements- Excess of loss reinsurance – the insurer-Excess of loss reinsurance – the reinsurer-Proportional reinsurance-Particular distributions-Lognormal distribution-Normal distribution-Inflation-Estimation-Policy excess.

MODULE V CREDIBILITY THEORY 09+03

Credibility theory-Credibility-The credibility premium formula-The credibility factor-Bayesian credibility-The Poisson/gamma model-The normal/normal model-Bayesian approach to credibility. Empirical Bayes credibility theory - EBCT Model to estimate risk premium - EBCT Model to estimate claim frequency

MODULE VI RISK MODELS 09+03

Risk models-General features of a product -Insurable interest- Insurable risk- types of cover and types of product-Products liability-Property damage-Financial loss-Fixed benefits-Models for short term insurance contracts-The collective risk model- Aggregate

claim distributions under proportional and excess of loss reinsurance-The individual risk model-Parameter variability/uncertainty.

L: 45, T: 15, Total: 60

REFERENCES:

1. Dobson, Annette J. – "An introduction to statistical modeling"- Chapman & Hall, 1983.
2. Hossack, Ian B; Pollard, John H; Zehnwirth, Benjamin. "Introductory statistics with applications in general insurance"- 2nd ed. - Cambridge University Press, 1999.
3. Klugman, Stuart A; Panjer, Harry H; Willmot, Gordon E; Venter, Gary G. "Loss models: from data to decisions"- John Wiley & Sons, 1998.
4. Daykin, Chris D; Pentikainen, Teivo; Pesonen, Martti. "Practical risk theory for actuaries" - Chapman & Hall, 1994.
5. Critian P Robert "Monte Carlo Statistical Methods", 2nd Edition, Springer- Verlag.
6. George W Snedecor "Statistical Methods", 8th Edition, Iowa State University Press.
7. G.S. Maddala C.R Rao" Statistical methods in Finance", Jan 1996, Elsevier Science and technology.
8. Philip J Boland "Statistical and Probabilistic Methods in Actuary Science", Chapman & Hall Press, 2007.

OUTCOME:

On completion of the course the students will be able to

- explain the concepts of decision theory and apply them.
- calculate probabilities and moments of loss distributions both with and without limits and risk-sharing arrangements.
- construct risk models involving frequency and severity distributions and calculate the moment generating function and the moments for the risk models both with and without simple reinsurance arrangements.
- explain the fundamental concepts of bayesian statistics and use these concepts to calculate bayesian estimators.
- describe the fundamental concepts of rating and apply them to simple experience rating systems.
- Construct risk models involving frequency and severity distributions and calculate the moment generating function and the moments for the risk models both with and without simple reinsurance arrangements.

MAC 6204 STOCHASTIC MODELS

L	T	P	C
2	1	0	3

OBJECTIVE:

- The objective of this subject is to provide grounding in actuarial modeling, stochastic processes, Markov chains and its application in framing NCD, HSD models.

MODULE I PRINCIPLES OF ACTUARIAL MODELING 05+02

Principles of actuarial modelling-Models-Modelling - the benefits and limitations-Stochastic and deterministic models-Discrete and continuous state spaces and time sets-Suitability of a model-Short-term and long-term properties of a model-Analysing the output of a model-Sensitivity testing-Communication of the results.

MODULE II STOCHASTIC PROCESSES 05+02

Stochastic processes-Types of stochastic processes-Defining a stochastic process-Sample paths-Stationarity-Increments-The Markov property-Filtrations-White noise-General random walk-Poisson process-Compound Poisson process.

MODULE III MARKOV CHAINS 05+03

Markov chains-The Chapman-Kolmogorov equations-Time-homogeneous Markov chains-No Claims Discount policy-Simple random walk on Z = {... − 2, − 1, 0,1, 2, ...} and {0,1, 2, ... , b}-A model of accident proneness-The long-term distribution of a Markov chain-The stationary probability distribution-Estimating transition probabilities-Assessing the fit-Simulation.

MODULE IV TWO-STATE MARKOV MODEL 05+02

The two-state Markov model-Assumptions underlying the model-Comparison with other models-Probabilities-Statistics-Joint density function-The maximum likelihood estimators-The distribution of $\bar{\mu}$.

MODULE V TIME-HOMOGENEOUS MARKOV JUMP PROCESSES 05+03

Time-homogeneous Markov jump processes: Poisson process- Chapman-Kolmogorov equations- transition matrix- Transition rates- health-sickness-death model- Kolmogorov's forward and backward differential equations- Holding times and occupancy probabilities- Expected time to reach state k starting from state i- Jump chain- Two-decrement model- MLE.

MODULE VI TIME-INHOMOGENEOUS MARKOV JUMP PROCESSES 05+03

Time-inhomogeneous Markov jump processes: Chapman-Kolmogorov equations- Transition rates- Kolmogorov's forward and backward differential equations- Occupancy probabilities- Residual holding times- Integrated form of the Kolmogorov forward and backward equations-Applications.

L: 30, T: 15, Total: 45

REFERENCES:

1. Brzezniak, Zdzislaw; Zastawniak, Tomasz. "Basic stochastic processes; A course through exercises"- Springer, 1998.
2. Hickman, James C. "Introduction to actuarial modeling" – North American Actuarial Journal (1997) 1(3) 1-5.
3. Kulkarni, Vidyadhar G. "Modeling, analysis, design, and control of stochastic systems" – Springer, 1999.
4. Grimmett, Geoffrey; Stirzaker, David. – "Probability and random processes" – 3rd ed. – Oxford University Press, 2001.
5. Bowers, Newton L; Gerber, Hans U; Hickman, James C; Jones, Donald A; Nesbitt, Cecil J. – "Actuarial mathematics"-2nd ed. - Society of Actuaries, 1997.
6. Haberman, Steven; Pitacco, Ermanno." Actuarial models for disability insurance"– Chapman & Hall, 1999.
7. Vlamidir I Rotar "Actuarial Models" Chapman & Hall, 2006.
8. A.C. Davison "Statistical models "Cambridge University Press, 2008.

OUTCOME:

On completion of the course the students will be able to

- describe the principles of actuarial modeling.
- describe the general principles of stochastic processes, and their classification into different types.
- define and apply markov chain.
- define and apply markov process.
- Solve insurance related problem based on markov chain.

MAC 6205 MATHEMATICAL STATISTICS

L	T	P	C
3	1	0	4

OBJECTIVE:

- The aim of the Mathematical Statistics subject is to provide grounding in Advance Probability and in particular sampling, Hypothesis testing, correlation-regression and Analysis of variance that are of relevance to actuarial work.

MODULE I SAMPLING 07+02

Types of Sampling - Moments of the sample mean and variance, Sampling distributions for the normal, t-test, F-test.

MODULE II POINT ESTIMATION 07+02

Point estimation - method of moments- method of maximum likelihood- one and two parameter cases-Incomplete samples, Unbiasedness- Mean square error- Asymptotic distribution of MLEs.

MODULE III CONFIDENCE INTERVALS 08+03

Confidence intervals in general, Derivation of confidence intervals, Confidence intervals for the normal distribution, Confidence intervals for binomial & Poisson, Confidence intervals for two-sample problems, Paired data

MODULE IV HYPOTHESIS TESTING 08+03

Hypothesis testing- Hypotheses, test statistics, decisions and errors- Classical testing, significance and p-values- Basic tests — single samples- two independent samples- paired data- Tests and confidence intervals- Chi square test.

MODULE V CORRELATION AND REGRESSION 08+03

Correlation and regression- Scatter plots- Correlation- linear correlation- Regression- Regression line- deriving the least squares estimates- Bivariate data- Correlation analysis- Regression analysis- The multiple linear regression model-

MODULE VI ANALYSIS OF VARIANCE 07+02

Analysis of variance- One-way analysis of variances- Estimation of the parameters- Partitioning the variability-Examining the treatment means- Confidence intervals for a single treatment mean and pair of treatment means.

L: 45, T: 15, Total: 60

REFERENCES:

1. Mathematical statistics. Miller, I.; Miller, M.; [Freund, J. E.] 7th ed. Prentice Hall International, 1999.
2. Dekking, F.M., Kraaikamp, C., Lopuhaä, H.P., Meester, L.E. “A Modern Introduction to Probability and Statistics” Springer, 2nd Edition.
3. Chin Long chiang “Statistical Methods of Analysis “World Scientific Books, 2003.

OUTCOME:

On completion of the course the students will be able to

- explain the concepts of random sampling, statistical inference and sampling distribution, and state and use basic sampling distributions.
- Describe the main methods of estimation and the main properties of estimators, and apply them.
- Construct confidence intervals for unknown parameters and Test hypotheses.
- Investigate linear relationships between variables using correlation analysis and regression analysis.
- Explain the concepts of analysis of variance and use them.

ENC 6281 COMMUNICATION SKILLS

L	T	P	C
1	0	2	2

OBJECTIVE:

- To orient students in communication skills.
- To train students making effective presentations and discussion various topics.
- To develop active listening skills among students.
- To encourage them to read important documents by using the sub – skills of reading.
- To train them to write project reports with confidence.

MODULE I INTRODUCTION TO LANGUAGE SKILLS 02

Orientation to communication skills - Introduction to business vocabulary - Integration of grammatical elements in business English

MODULE II SPEAKING IN FORMAL AND INFORMAL SCENARIO 02

Orientation to presentation skills – Introducing one-self - Presentation skills -Talking on a familiar topic.(JAM) - Making presentations - Getting into conversations- Role play

MODULE III ACTIVE LISTENING 02

Listening to basic conversations - Listening for specific information - Note-taking and developing points

MODULE IV READING COMPREHENSION 02

Introduction to reading skills & sub – skills - Developing comprehension skills - Reading circulars and important notices - Reading advertisement and responding

MODULE V WRITING SKILLS 02

Writing a letter of application & resume - Writing a brochure - Writing a report to a periodical - eg.newspaper.

MODULE VI INTEGRATION OF SKILLS 02

Implications of communication skills in work life - Discussion on current topics- newspaper items, current issues - Reading a newspaper article - Report writing - Project proposal and report.

L: 12, P: 18, Total: 30

REFERENCES:

1. Byrne, D “Teaching Oral Skill”, London: Longman. (1975).

2. Byrne, D. Teaching Writing,, London: Longman. (1975).
3. Grellet, F “Developing Reading Skills”, Cambridge University Skills.UK. (1981).
4. Ur,P. “Teaching Listening Comprehension”, Cambridge University Press.UK. (1984).
5. Anderson, K., Maclean, J. & Lynch, T “Study speaking”, A Course in Spoken English for Academic Purposes. Cambridge University Press, UK. (2004).
6. Withrow, J., Brookes, G.& Cummings, M.C. “Inspired to write. Reading and Tasks to Develop Writing Skills”, Cambridge University Press, U.K (2004).

OUTCOME:

On completion of the course the students will be able to

- communicate effectively.
- present their ideas with confidence.
- listen and respond effectively.
- read all types of documents effectively.
- write project reports.

MAC 6206	ACTUARIAL COMPUTATIONAL LABORATORY (MS-EXCEL)	L	T	P	C
		0	0	4	2

OBJECTIVE:

- The objective of this laboratory is to provide grounding in Microsoft Excel so that they can perform the actuarial calculation in an effective way.

Review: Custom Toolbar/Custom Menu Bar-Paste Options/Paste List/Paste Special-Managing Comments/Protect Worksheet-Create Lists/Data Form-Custom Sort/Auto Filters/Subtotals-Labels in Formulas-IF/AND/OR Conditions-Pivot Table-V Lookup-H Lookup.

PROBLEMS FROM THE FOLLOWING TOPICS

- Presenting data in tables and charts
- Numerical descriptive measures
- Basic probability
- Some important discrete probability distributions
- The normal distribution and other continuous distributions
- Sampling and sampling distributions
- Confidence interval estimation
- Fundamentals of hypothesis testing
- Simple linear regression
- Introduction to multiple regression

REFERENCES:

1. D.M. Levine, D.F.Stephan, T.C. Krehbiel, M.L. Berenson. “Statistics for Managers Using
2. Microsoft Excel” 5th Edition, Pearson Education Ltd., 2008.

OUTCOME:

On completion of the course the students will be able to

- entering data.
- calculating a set of data.
- displaying the data in a meaningful way.
- Sharing data so that other can understand.
- formatting cells for the need.
- using functions and formulae and inserting charts and graphs.

SEMESTER III

MAC 7101 APPLICATIONS OF LIFE CONTINGENCIES

L	T	P	C
3	1	0	4

OBJECTIVE:

- The objective of the subject is to give the basic knowledge of different types of insurance contract involving two life's, Idea of Pension Scheme and ULIP policies.

MODULE I SIMPLE ANNUITIES AND ASSURANCES INVOLVING TWO LIVES 08+03

Simple annuities and assurances involving two lives-Random variables to describe joint life functions-Determining simple probabilities involving two lives-Determining present values involving two lives-Contingent and reversionary benefits-Contingent probabilities of death-Present values of contingent assurances-Present values of reversionary annuities-Present values of functions with specified terms- Expected present value of annuities payable m times a year-Premium conversion relationships.

MODULE II PROFIT TESTING 07+02

Profit testing-Unit-linked contracts-Evaluating expected cashflows for various contract types-profit tests for annual premium contracts-Determining premiums using a profit test.

MODULE III DETERMINING RESERVES USING PROFIT TESTING 07+02

Determining reserves using profit testing-Pricing and reserving bases-Determining reserves for a unit-linked policy using cashflow techniques-Determining reserves for a conventional policy using cashflow techniques-Effect of pricing and reserving bases on a profit test.

MODULE IV COMPETING RISKS 08+03

Competing risks**-**Multiple state modelling-Valuing benefits that are contingent upon competing risks-Multiple decrement tables-Multiple decrement service table for pensions calculations-Updating a service table-How to obtain multiple decrement table rates under the assumption of uniformity in the single decrement tables-Consistency with the multiple state approach.

MODULE V PENSION FUNDS 08+03

Pension funds**-**Salary scales-Salary-related pensions benefits and contributions-Expected cashflows generated by pensions benefits and contributions-Using commutation functions to value salary related benefits and contributions-Valuing health and care insurance benefits using multiple decrement tables-Non-life contingencies.

MODULE VI MORTALITY, SELECTION AND STANDARDIZATION 07+02

Mortality, selection and standardization-Principal factors contributing to variation in mortality and morbidity-Selection-Selection in life assurance and pensions business-different mortality tables for different classes of lives-Crude mortality rate-Directly standardised mortality rate-Indirectly standardised mortality rate-Standardised mortality ratio.

L: 45, T: 15, Total: 60

REFERENCES:

1. B H Smith “Contingencies of Value “Harvard University Press, 1988.
2. Alistair Neil “Life Contingencies”, Butterworth-Heinemann Ltd; illustrated edition (1977).
3. Griffith Davis “Table of Life Contingencies”, Longman &Co, 1825: University of California Library.
4. Micheal M Parmenter, ‘theory of Interest and Life contingencies with Pension”, 3rd edition.
5. Bowers, Newton L *et al*. – “Actuarial mathematics”. 2nd ed. – Society of Actuaries, 1997.
6. Benjamin, Bernard; Pollard, John H. – “The analysis of mortality and other actuarial statistics” 3rd ed. – Faculty and Institute of Actuaries, 1993.
7. Gerber, Hans U. – “Life insurance mathematics” 3rd ed. – Springer. Swiss Association of Actuaries, 1997.
8. Booth, Philip M *et al*. “Modern actuarial theory and practice”– Chapman & Hall, 1999.

OUTCOME:

On completion of the course the students will be able to

- define and use straightforward functions involving two lives.
- describe methods which can be used to model cash flows contingent upon competing risks.
- describe the technique of discounted emerging costs, for use in pricing, reserving, and assessing profitability.
- describe the principal forms of heterogeneity within a population and the ways in which selection can occur.

MAC 7102 FINANCIAL ECONOMICS

L	T	P	C
3	1	0	4

OBJECTIVE:

- The objective of the Financial Economics subject is to provide basic grounding in Financial Economics such as efficient market hypothesis, Measures of investment risk, Utility theory and portfolio theory with Brownian motion- Martingales which help them to understand the economic environment and value the security price in different situation.

MODULE I INTRODUCTION TO FINANCIAL ECONOMICS 07+02

Introduction to financial economics- Economic models- Mathematical models- Efficient market hypothesis- The three forms of the efficient markets hypothesis- The evidence for or against each form of the efficient markets hypothesis- Informational efficiency- Volatility tests.

MODULE II CONSUMER CHOICE THEORY 08+03

Consumer choice theory- Utility theory- The expression of economic characteristics in terms of utility functions- Measuring risk aversion-Construction of utility functions-Stochastic dominance-Relationship between dominance concepts and utility theory.

MODULE III MEASURES OF INVESTMENT RISK 07+02

Measures of investment risk- Measures of risk-Variance of return-Semi-variance of return-Shortfall probabilities-Value at risk-Tail value at risk (TailVar) and expected shortfall-Relationship between risk measures and utility functions.

MODULE IV PORTFOLIO THEORY 08+03

Portfolio theory-Lagrangian function-Benefits of diversification-Models of asset returns-Multifactor models- Macroeconomic factor models-Fundamental factor models-Statistical factor models-Construction of models- The single-index model- The capital asset pricing model (CAPM)-Limitations of CAPM-Arbitrage pricing theory.

MODULE V BROWNIAN MOTION AND MARTINGALES 08+03

Introduction to Brownian motion- standard Brownian motion- Properties of Brownian motion- Geometric Brownian motion- Martingales- Martingales in discrete time-Martingales in continuous time.

MODULE VI STOCHASTIC CALCULUS 07+02

Stochastic calculus- The Ito Integral- Ito's lemma- Stochastic differential equations- Diffusion and Ito process models- The Ornstein-Uhlenbeck process.

L: 45, T: 15, Total: 60

REFERENCES:

1. Baxter, Martin & Andrew Rennie, Financial calculus; "An introduction to derivative pricing" Cambridge University Press, 1996.
2. Panjer, Harry H (ed), "Financial economics: with applications to investments, insurance and pensions", The Actuarial Foundation, 1998.
3. Elton, Edwin J, Martin J Gruber, Stephen J Brown, & William N Goetzmann, "Modern portfolio theory and investment analysis" (6th edition), John Wiley, 2003.
4. Hull, John C, "Options, futures and other derivatives" (5th edition), Prentice Hall, 2002.

OUTCOME:

On completion of the course the students will be able to

- discuss the various forms of the efficient markets hypothesis and discuss the evidence for and against the hypothesis.
- discuss the advantages and disadvantages of different measures of investment risk.
- describe and discuss the assumptions of mean-variance portfolio theory and its principal results.
- describe and discuss the properties of single and multifactor models of asset returns.
- describe asset pricing models, discussing the principal results and assumptions and limitations of such models.
- define and apply the main concepts of Brownian motion, Martingales, and Ito integral.

MAC 7103 APPLIED STATISTICAL METHODS IN ACTUARIAL SCIENCE

L	T	P	C
3	1	0	4

OBJECTIVE:

- The objective of this subject is to provide grounding in Risk models, Ruin theory, Run-off triangles and Time series which have particular relevance to fix the premium and calculation of reserve in General Insurance.

MODULE I RUIN THEORY 07+02

Ruin theory-Basic concepts-The surplus process-The probability of ruin in continuous time-The probability of ruin in discrete time-Probability of ruin in the short term-Premium security loadings-Reinsurance.

MODULE II GENERALISED LINEAR MODELS 07+02

Generalised linear models-Exponential families-Normal distribution-Poisson distribution-Binomial distribution-Gamma distribution-Link functions and linear predictors-Deviance of model fitting-Residuals analysis and assessment of model fit.

MODULE III RUN-OFF TRIANGLES 08+03

Run-off triangles-Projections using development factors-Run-off patterns-The chain ladder method-Model checking-Other methods of deriving development factors-Adjusting for inflation-The inflation adjusted chain ladder method-The average cost per claim method-Loss ratios-The Bornhuetter-Ferguson method.

MODULE IV TIME SERIES I 08+03

Time series-Properties of a univariate time series-Stationary random series-Main linear models of time series- Autoregressive process (AR)- Moving average process (MA)-Autoregressive moving average process (ARMA)- ARIMA Model

MODULE V TIME SERIES II 08+03

Compensating for trend and seasonality-Identification of MA(q) and AR(p) models- Box-Jenkins method-Forecasting-Multivariate time series models- Bilinear models-Threshold autoregressive models-Random coefficient autoregressive models-Autoregressive models with conditional heteroscedasticity.

MODULE V MONTE CARLO SIMULATION 07+02

Monte Carlo simulation-Generation of pseudo-random numbers using a computer-Inverse transform method-Inverse transform method for discrete variates-Acceptance-

rejection method-Generating normal variates-Numerical evaluation of derivatives-Comparative simulations, performance evaluation.

L: 45, T: 15, Total: 60

REFERENCES:

1. Dobson, Annette J. – "An introduction to statistical modeling"- Chapman & Hall, 1983.
2. Hossack, Ian B; Pollard, John H; Zehnwirth, Benjamin. "Introductory statistics with applications in general insurance"- 2nd ed. - Cambridge University Press, 1999.
3. Klugman, Stuart A; Panjer, Harry H; Willmot, Gordon E; Venter, Gary G. "Loss models: from data to decisions"- John Wiley & Sons, 1998.
4. Daykin, Chris D; Pentikainen, Teivo; Pesonen, Martti. "Practical risk theory for actuaries" - Chapman & Hall, 1994.
5. Critian P Robert "Monte Carlo Statistical Methods", 2nd Edition, Springer- Verlag.
6. George W Snedecor " Statistical Methods", 8th Edition, Iowa State University Press,
7. G.S. Maddala C.R Rao" Statistical methods in Finance", Jan 1996, Elsevier Science and technology.
8. Philip J Boland "Statistical and Probabilistic Methods in Actuary Science", Chapman & Hall Press, 2007.

OUTCOME:

On completion of the course the students will be able to

- Explain the concept of ruin for a risk model.
- describe and apply techniques for analyzing a delay (or run-off) triangle and projecting the ultimate position.
- explain the fundamental concepts of a generalized linear model (glm), and describe how a glm may apply.
- define and apply the main concepts underlying the analysis of time series models.
- explain the concepts of "monte carlo" simulation using a series of pseudorandom numbers.

MAC 7104 SURVIVAL MODELS

L	T	P	C
2	1	0	3

OBJECTIVE:

- The objective of the Survival Models subject is to provide grounding in survival models such as Estimating the lifetime distribution function, calculating crude mortality rate and testing for best feet which will help the Insurance companies to model the premium rates.

MODULE I SURVIVAL MODELS AND THE LIFE TABLE 05+02

Survival models and the life table-Future Lifetime-Probabilities of death and survival The force of mortality μ_x-Survival probabilities-The probability density function of T_x Initial rates and central rates of mortality-Complete and curtate expectation of life-Gompertz' and Makeham's laws-Calculating the parameter values-Survival probabilities.

MODULE II ESTIMATING THE LIFETIME DISTRIBUTION FUNCTION 05+03

Estimating the lifetime distribution function – the Kaplan-Meier and Nelson-Aalen models-Statistical Inference-Censoring mechanisms-The Kaplan-Meier (product-limit) estimator-Comparing lifetime distributions-The Nelson-Aalen estimate-Relationship between the Kaplan-Meier and Nelson-Aalen estimates.

MODULE III THE COX REGRESSION MODEL 05+02

The Cox regression model-Fully parametric models-Parametric models for the hazard function-Covariates-The Cox model-Estimating the regression parameters-The partial likelihood-Model fitting.

MODULE IV BINOMIAL-TYPE MODELS 05+03

Binomial-type models-The actuarial estimate-Central exposed to risk-Strengths and weakness of the binomial model-Poisson models- Estimating the underlying force of mortality- Comparison of multiple-state, binomial and Poisson models- Exposed to risk-Homogeneity-The principle of correspondence-Exact calculation of E_x^c-Census approximations to E_x^c-Different definitions of age.

MODULE V GRADUATION AND STATISTICAL TESTS 05+03

Graduation and statistical tests-The need for graduation-Reasons for graduation-Desirable features of a graduation-Testing the smoothness of a graduation- Statistical tests of a mortality experience-Chi square (χ^2) test-Standardised deviations test-Signs test-Cumulative deviations-Grouping of signs test-Serial correlations test-Testing actual versus expected rates.

MODULE VI METHODS OF GRADUATION 05+02

Methods of graduation-Graduation by parametric formula-Graduation by reference to a standard table-Graphical graduation-Comparison of different methods- Statistical tests of a graduation- The effect of duplicate policies.

L: 30, T: 15, Total: 45

REFERENCES:

1. Vlamidir I Rotar “Actuarial Models” Chapman & Hall, 2006.
2. Elke Korn, Ralf Korn “Monte Carlo Simulation of financial and Actuarial model” Chapman & Hall, (Feb 2010).
3. Dick London “Survival models and their estimation “ACTEX Publication. 1998.
4. A.C. Davison “Statistical models “Cambridge University Press, 2008.
5. Regina C Elandt Johnson “Survival models and data Analysis”, Wiley, Inter science, 1999.

OUTCOME:

On completion of the course the students will be able to

- explain the concept of survival models and estimation for lifetime distributions.
- derive maximum likelihood estimators for the transition intensities in models of transfers between states with piecewise constant transition intensities.
- describe the binomial model of mortality, derive a maximum likelihood estimator for the probability of death and compare the binomial model with the multiple state models.
- describe how to estimate transition intensities depending on age, exactly or using the census approximation and test crude estimates for consistency with a standard table or a set of graduated estimates, and describe the process of graduation.

MAC 7105	ACTUARIAL COMPUTATIONAL LABORATORY (SPSS)	L	T	P	C
		0	0	4	2

OBJECTIVE:

- The aim of the SPSS lab is to provide the practical knowledge of the various Actuarial aspects

[S P S S (STATISTICAL PACKAGE FOR SOCIAL SCIENCES)]

- Data Analysis
- Basic Data Analysis and graphs
- Regression Analysis
- Sampling (Normal, F, Students- t, chi-square distributions)
- Analysis of Variance (One way, Two Way, Latin square, factorial Methods)
- Contingency tables
- Risk Analysis Using Monte-Carlo Method
- Insurance Claims Severity and frequency

REFERENCES:

1. George A. Morgan, Nancy L. Leech, Gene W. Gloeckner, Karen C. Barrett: SPSS *for Introductory Statistics: Use and Interpretation,* (Second Edition), Lawrence Erlbaum Associates Publishers, New Jersey, 2004.

OUTCOME:

- Will have the thorough knowledge SPSS and they can use this idea to calculate premium and reserve using similar software which is widely used in actuarial evaluation process in industries.

LIST OF ELECTIVES
SEMESTER I

MACY 001 FINANCIAL MANAGEMENT OF LIFE OFFICE

L	T	P	C
3	0	0	3

OBJECTIVE:

- The objective of the subject is to provide the basic idea about the financial management of companies in particular Life insurance companies.

MODULE I ETHIC OF FINANCIAL MANAGEMENT 07

Financial Management development - scientific management - Management Vs Administration, Ethics in management – Social responsibilities of managers-roles & responsibilities – duties.

MODULE II ROLE OF ACTUARY 08

Role of Actuary : Investment policy – Product pricing and design Control cycle Profit testing- Model office and uses – Analysis of surplus - marketing- underwriting and reinsurance policies- reserving – profit distribution – sales policy – Surrender and transfer policy.

MODULE III LIABILITY AND FISCAL RESPONSIBILITY 08

Liability and fiscal responsibility – Budgeting - Financial ledgers – Accounts expenditure requests – Petty cash - Limited purchase orders (LPO) - Direct pay/cheque request – Journal vouchers – funding opportunities – Resources and services.

MODULE IV ASSET TYPES OF LIFE COMPANIES 07

Reversionary and terminal bonuses- Solvency for a life insurance company – Mechanical and model based solvency margins – fair values of life insurance liabilities.

MODULE V REVERSIONARY AND TERMINAL BONUSES 08

Asset types of life companies - Insurer’s liabilities - surplus on portfolio of insurance - Nonprofit premiums- owner ship of surplus and types of bonus system – Asset shares and uses.

MODULE VI RESERVING 07

Mismatching reserves- capital requirements for life office – lognormal and Willkie models of equity returns - asset/liability investigation.

L: 45, T: 0, Total: 45

REFERENCES:

1. Peter J Booth " Modern actuary theory and practice " 2nd Edition (2004)CRC Press.
2. http://www.ma.hw.ac.uk/~niall/lopcourse/
3. J David Cummins "Financial management of Life Insurance Companies", June 1993, Huebner International.

OUTCOME:

On completion of the course the students will be able to

- explain the role of actuary and their work.
- explain what are the asset and liabilities of an insurance companies.
- differentiate the different type of bonuses.
- explain why insurance companies need to keep reserve.

MACY 002 ISLAMIC INVESTMENTS

L	T	P	C
3	0	0	3

OBJECTIVE:

- The objective of the subject is to provide the basic idea about Islamic investment in insurance sector and how it differs from other investment.

MODULE I ISLAMIC INVESTMENT AND GLOBAL TRENDS 08

Innovation, globalization and diversification- strengths and resilience of the Islamic banking sector- Growth and development of Islamic capital market.

MODULE II ISLAMIC LAW 07

Objectives and Sources of Islamic law – principle of business contracts in Islamic law- Islamic banking Models.

MODULE III ISLAMIC DERIVATIVES 08

Hedging and Islamic derivatives – Islamic Bonds (Sukuk) – Islamic Fund Management – Islamic Structured products- risk management for Islamic funds, derivatives, structured products.

MODULE IV ISLAMIC INSURANCE 08

Islamic Insurance (Takaful): Introduction–Takaful models and Mechanism – Reinsurance (Re takaful) – Concerns in the provision of Takaful – Business models – retailing.

MODULE V JURISPRUDENCE AND ARBITRAGE 07

Jurisprudence and Arbitrage – Sale based Islamic Finance – Derivatives like sales – Partnership and Equity Investment.

MODULE VI ISLAMIC ASSET MANAGEMENT 07

Islamic Asset management: Screening criteria for Islamic Equity funds- Islamic Indexes- Equities- Sukuk – Private equity investment – Investing in real estate and leasing funds.

L: 45, T: 0, Total: 45

REFERENCES

1. Munawar Iqbal “A Guide to Islamic Finance “Risk Books ,UK, 2007.
2. Mahmoud A El-Gamal “Inslamic Finance: Law, Economics and Practice” Cambridge university Press, 2008.
3. Sohail Jaffar “Islamic Asset management” Euromoney books, London, 2006.
4. Michael Mahlknecht “Islamic capital markets and risk management” Risk Books UK 2007.

5. Aly Khorshid “Islamic Insurance” Routledge Curzon, London, 2004.
6. Sohail Jaffar “Islamic Insurance” Euromoney books, London, 2006.

OUTCOME:

On completion of the course the students will be able to

- describe the fundamental concept of islamic law
- use islamic derivatives to reduce the risk in investment
- demonstrate the concept of islamic asset management

MACY 003 CORPORATE FINANCE

L	T	P	C
3	0	0	3

OBJECTIVE:

- The objective of the subject is to provide the basic idea about corporate finance and Capital project appraisal.

MODULE I FINANCIAL INSTITUTIONS 08

Government agencies- The Stock Exchange- The roles of the Stock Exchange- Derivatives exchanges- Institutional investors- Investment banks- Clearing banks- Building societies- Investment trusts- Unit trusts- Open-ended investment companies (OEICs)- Investment management companies- Self-administered pension schemes- Life insurance companies- General insurance companies.

MODULE II USE OF DERIVATIVES 07

Financial futures- Types of futures- Uses of financial futures- Forwards- Options- Types of options- Uses of options- Interest rate and currency swaps- Types of swaps- Uses of swaps.

MODULE III WEIGHTED AVERAGE COST OF CAPITAL 08

Importance and definetion of WACC- Theoretical background- The traditional view- Modigliani and Miller- Cost of equity- The capital asset pricing model (CAPM) and risk- Specific risk- Systematic risk- Beta as a measure of systematic risk- Adjusting beta for gearing- Measuring beta- Cost of debt- calculation of WACC.

MODULE IV CAPITAL STRUCTURE AND DIVIDEND POLICY 07

Components of capital structure- aims of the financial manager- Theoretical background to the gearing decision- Factors affecting the gearing decision- Fundamentals of dividend policy- Factors influencing the decision on dividend policy- Other methods of reward- Scrip or stock dividends- Share buybacks.

MODULE V CAPITAL PROJECT APPRAISAL I 08

capital project- Initial appraisal- Evaluation of cashflows- Methods of project evaluation- Net present value (NPV)- Internal rate of return (IRR)- Annual capital charge- Shareholder value approach- Payback period- Nominal returns- Strategic fit- Opportunity cost- Hurdle rates- Receipts/costs ratio- Results of the evaluation- Simulations.

MODULE VI CAPITAL PROJECT APPRAISAL II 07

Choice of discount rate- Risk analysis – an overview- Identification of risks- Analysis of risks- Obtaining a distribution of NPVs in practice- Risk mitigation- investment submission.

L: 45, T: 0, Total: 45

REFERENCES:

1. S A Ross, Wester Field, Jaffe “Corporate Finance” 8th Edition , Mc Graw Hill, 2008.
2. Interpreting company reports and accounts. Holmes, G.; Sugden, A.; Gee, P. 10th ed. 336 pages. FT Prentice Hall, 2008. ISBN: 978-0273711414.
3. S.R Vishwanath “Corporate Finance Theory and Practice”, Sage Publications (ca), 2007.
4. Principles of corporate finance (Global edition). Brealey, R. A.; Myers, S. C.; Allen, F. 10th ed. McGraw-Hill, 2010. ISBN: 978-0071314176.
5. IIBF “International Corporate Finance”, Macmillan (I) Publishing , Delhi,2007.

OUTCOME:

On completion of the course the students will be able to

- explain the basic concepts of corporate finance.
- explain the various financial institutions and its purpose.
- identify the components and factors of capital structure.
- identify the factors and important of didivent policies.
- interpret the accounts of a company or a group of companies and discuss the limitations of such interpretation and show how financial techniques can be used in the assessment of capital investment projects.

SEMESTER II

MACY 004 FINANCIAL MARKETS

L	T	P	C
3	0	0	3

OBJECTIVE:

The objective of the subject is to provide the basic idea about the production, investment, risk process and market treading in financial market.

MODULE I FACTS OF FINANCIAL MARKETS 07

Facts of financial markets – time variation and business cycle – equity premiums – consumption models

MODULE II INTEREST RATE MODEL 08

The rate of interest - liquidity preference theory- structure of interest rates- Market segmentation theory- Forward interest rates and yield curve.

MODULE III PRODUCTION, INVESTMENT AND GENERAL EQUILIBRIUM 08

Production, investment and general equilibrium – labour income - Idiosyncratic risk – challenges for the future.

MODULE IV FINANCIAL RISK PROCESSES 07

Financial risk processes- risk measurement – team structure dynamics – financial risk management.

MODULE V SCIENCE OF MARKET TRADING 07

Science of Market trading: Signals and indicators – trending, oscillator, vertex indicators – various time frames- wavelet analysis – trading systems.

MODULE VI ISLAMIC FINANCE 08

Islamic banking and finance: Socio economic responses – resilience and stability – current developments – Islamic structured products – Islamic capital markets- trust and wealth managements.

L: 45, T: 0, Total: 45

REFERENCES:

1. John H Cochrane " Financial markets and the real economy ", Now Publishers, Oct 2005
2. Don K Mak " The science of financial market trading ", World Scientific, 2003

3. Keith Pilbeam “Finance and Financial Markets” 2nd Edition, Palgrave Macmillan
4. Lloyd B Thomas “ Money banking and Financial Markets “, 1997, Student Gd edition, Mc Graw hill
5. Stepeh G Cecchetti “Money banking and Financial Markets “, 1st edition, 2005, Mc Graw hill
6. Natalie Schoon “Islamic banking and Finance” Spiramus Press Ltd., Jan, 2009.

OUTCOME:

On completion of the course the students will be able to

- explain the basic concept of financial market.
- demonstrate the concept of financial risk management.
- explain the treading procedure in financial market.
- explain the importance of Islamic finance.

MACY 005 ISLAMIC ASSET AND FUND MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVE:

- The objective of the subject is to provide the basic idea about the Islamic asset and fund management.

MODULE I THE CAPITAL MARKET 07

The Capital Market: Functions and Objective – Risk return principle in Islam: Cost of Capital – Shariah Principles for Capital Market.

MODULE II ISLAMIC STOCKS AND WEALTH MANAGEMENT 08

Islamic Stocks and Wealth Management- Equity shares and funds- Business and Structure of Islamic enterprise: Indebtedness- Earnings from impermissible activities.

MODULE III SHARIAH SCREENING IN ISLAM 07

Norms for Shariah screening in Islam- Dow Jones Islamic investment criteria – Norms used in India, Pakistan and Middle East.

MODULE IV ISLAMIC SCREENING NORMS 07

Critical assessment of Islamic Screening norms- Suitability of Market cap – Purification and Zakah.

MODULE V ESTATE AND PROJECT FINANCING 08

Islamic Real Estate and Project financing – Characteristics of Real Estate – Islamic REITS & REMFs – Islamic MODULE Trusts and Mudaraba Certificates.

MODULE VI ISLAMIC BANKING 08

Islamic Banking – Introduction: Riba – Modern Islamic Banking – Largest Islamic banks- Principles of Islamic Banking.

L: 45, T: 0, Total: 45

REFERENCES

1. Munawar Iqbal “A Guide to Islamic Finance “Risk Books ,UK, 2007.
2. Mahmoud A El-Gamal “Inslamic Finance: Law, Economics and Practice” Cambridge university Press, 2008.
3. Sohail Jaffar “Islamic Asset management” Euromoney books, London, 2006.
4. Michael Mahlknecht “Islamic capital markets and risk management” Risk Books UK 2007.

5. Aly Khorshid “Islamic Insurance“ Routledge Curzon, London, 2004.
6. Sohail Jaffar “Islamic Insurance” Euromoney books, London, 2006.

OUTCOME:

On completion of the course the students will be able to

- explain the concept of capital market.
- demonstrate the concept of Islamic stocks and wealth management.
- explain the concept of real estate and project financing.
- explain the idea of Islamic banking .

MACY 006 PORTFOLIO AND CREDIT RISK MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVE:

- The objective of the subject is to provide the basic idea about portfolio theory and credit risk management.

MODULE I VALUATION OF DERIVATIVE SECURITIES 08

Arbitrage-European options-American options-Factors affecting option price-Pricing forward contracts-Bounds for option prices-Put-call parity.

MODULE II THE BINOMIAL MODEL 08

The one-period model-Two-period binomial tree-n-period binomial tree-Recombining binomial trees-Calibrating binomial models-state price deflator approach

MODULE III BLACK-SCHOLES OPTION PRICING FORMULA 07

Assumptions of Black-Scholes model-The Black-Scholes model- Black-Scholes model for dividend-paying shares

MODULE IV THE 5-STEP METHOD IN DISCRETE & CONTINUOUS TIME 08

Tradeable assets-Self-financing strategies-Replicating strategies and complete markets-Cameron-Martin-Girsanov theorem-martingale representation theorem-Diffusion models-The martingale approach (the 5-step method)- The 5-step approach with dividends

MODULE V THE TERM STRUCTURE OF INTEREST RATES 07

Relationships between interest rates and bond prices-The risk-neutral approach to pricing-The state price deflator approach to pricing-Models for the term structure of interest rates

MODULE VI CREDIT RISK 07

Credit events and recovery rates- Structural models- Reduced-form models- Intensity-based models- The Merton model- Two-state models for credit ratings- The Jarrow-Lando-Turnbull (JLT) model

L: 45, T: 0, Total: 45

REFERENCES:

1. Andrew Kimble “Credit Risk: From Transaction of Portfolio Management”, Nov, 2003, Butterworth Heinemann.
2. Andrew Fight “Credit riskManagement”, 2007, Elsevier India Private Limited.

3. Ludwig B chincarini “Quantitative Equity Portfolio Management “, 2006, Mc Graw Hill.
4. Greg N Gregoriou, Critisian Hoppe “The Handbook of Credit Portfoilo .Management”, 2008, Mc Graw Hill.

OUTCOME

On completion of the course the students will be able to

- Demonstrate a knowledge and understanding of the properties of option prices, valuation methods and hedging techniques.
- Show how to use binomial trees and lattices in valuing options and solve simple examples.
- Show how to use the Black-Scholes model in valuing options and solve simple examples.
- Demonstrate a knowledge and understanding of models of the term structure of interest rates.
- Demonstrate a knowledge and understanding of simple models for credit risk.

REGULATIONS, CURRICULUM AND SYLLABI

M.Sc.
CHEMISTRY

(As approved by the 9th Academic Council)

JULY 2016

B.S.ABDUR RAHMAN
UNIVERSITY
B.S. ABDUR RAHMAN INSTITUTE OF SCIENCE & TECHNOLOGY
(Estd. u/s 3 of the UGC Act, 1956)
(FORMERLY B.S. ABDUR RAHMAN CRESCENT ENGINEERING COLLEGE)
Rated with A Grade by National Assessment and Accreditation Council
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VISION AND MISSION OF THE DEPARTMENT OF CHEMISTRY

VISION

MISSION

CURRICULUM & SYLLABI FOR
M. Sc. (Chemistry)
(Four Semesters / Full Time)

Curriculum

Sl. No.	Course Code	Course Title	L	T	P	C
		SEMESTER I				
1	CHC6101	Organic Chemistry	**3**	**0**	**0**	**3**
2	CHC6102	Thermodynamics and Electrochemistry	**3**	**0**	**0**	**3**
3	CHC6103	Inorganic Chemistry	**3**	**0**	**0**	**3**
4	CHC6104	Analytical Chemistry	**3**	**0**	**2**	**4**
5		Elective				**3***
6	CHC6105	Organic Chemistry Practical	**0**	**0**	**4**	**2**
7	CHC6106	Inorganic Chemistry Practical -I	**0**	**0**	**4**	**2**
8	CHC6107	Physical Chemistry Practical - I	**0**	**0**	**4**	**2**
9	CHC6108	Seminar		**2**		**1**
		Total				**23**
		SEMESTER II				
1	GEC6202	Research Methodology	**3**	**0**	**0**	**3**
2	CHC6201	Synthetic Organic Chemistry	**3**	**2**	**0**	**4**
3	CHC6202	Quantum Chemistry	**3**	**1**	**0**	**4**
4	CHC6203	Coordination Chemistry	**3**	**0**	**0**	**3**
5		Elective	**3**	**1**	**0**	**4**
6	CHC6204	Synthetic Organic Chemistry Practical	**0**	**0**	**4**	**2**
7	CHC6205	Inorganic Chemistry Practical-II	**0**	**0**	**4**	**2**
8	CHC6206	Physical Chemistry Practical -II	**0**	**0**	**4**	**2**
		Total				**24**
		SEMESTER III				
1	CHC7101	Advanced Organic Chemistry	**3**	**0**	**0**	**3**
2	CHC7102	Physical Chemistry	**3**	**0**	**0**	**3**
3	CHC7103	Advanced Inorganic Chemistry	**3**	**0**	**0**	**3**
4		Elective				**11****
5	CHC7104	Internship (during summer vacation)				**1**
6	CHC7201	Project Phase -1				**2*****
		Total				**21**

Sl. No.	Course Code	Course Title	L	T	P	C
		SEMESTER IV				
1	CHC 7201	Project Phase – II	**0**	**0**	**0**	**10**
		Total				**12*** **

Total credits =80

* Elective should be chosen with credit not less than 3

** Elective should be chosen with total credit not less than 11

*** Credit for Project Phase – I is incorporated in phase -II

LIST OF ELECTIVES

Sl. No.	Course Code	Course Title	L	T	P	C
		Basic Chemistry				
1	CHCY001	Green chemistry	**3**	**0**	**2**	**4**
2	CHCY002	Molecular spectroscopy	**3**	**2**	**0**	**4**
3	CHCY003	Photophysics and photochemistry	**3**	**0**	**0**	**3**
4	CHCY004	Photochemistry	**3**	**0**	**0**	**3**
		Medicinal ,Pharmaceutical and Biological Chemistry				
1	CHCY005	Biochemistry	**3**	**0**	**2**	**4**
2	CHCY006	Pharmaceutical Technology	**3**	**0**	**0**	**3**
3	CHCY007	GMP, Quality Assurance and Validation	**3**	**0**	**0**	**3**
4	CHCY008	Medicinal and Pharmaceutical Chemistry	**3**	**0**	**0**	**3**
		Materials and Technology				
1	CHCY009	Polymer Chemistry	**3**	**0**	**2**	**4**
2	CHCY010	Nanotechnology	**3**	**0**	**2**	**4**
3	CHCY011	Electrical Properties of Polymeric Materials	**3**	**0**	**0**	**3**
4	CHCY012	Polymer Structure and Property Relationship	**3**	**0**	**0**	**3**
5	CHCY013	Concepts and Techniques in Catalysis	**3**	**0**	**0**	**3**
6	CHCY014	Polymer Technology	**3**	**0**	**0**	**3**
7	CHCY015	Inorganic Chemical Technology	**3**	**0**	**0**	**3**
8	CHCY016	Organic Chemical Technology	**3**	**0**	**0**	**3**
9	CHCY017	Chlor-alkali Technology	**3**	**0**	**0**	**3**
10	CHCY018	Module Operations and module Processes	**3**	**0**	**0**	**3**

Sl. No.	Course Code	Course Title	L	T	P	C
		Energy ,Water and Environment				
1	CHCY019	Water and Waste Water Treatment	**3**	**0**	**0**	**3**
2	CHCY020	Solid Waste Management and Air Pollution	**3**	**0**	**0**	**3**
3	CHCY021	Industrial Electrochemistry	**3**	**0**	**0**	**3**
4	CHCY022	Corrosion and Corrosion Control	**3**	**0**	**0**	**3**
5	CHCY023	Electrochemical Protection Systems	**3**	**0**	**0**	**3**
6	CHCY024	Metal Coating Technology	**3**	**0**	**0**	**3**
7	CHCY025	Protective Coatings	**3**	**0**	**0**	**3**
8	CHCY026	Fuel Cells and Applications	**3**	**0**	**0**	**3**
9	CHCY027	Advanced Batteries and Systems	**3**	**0**	**0**	**3**
10	CHCY028	Electrochemical Material Science	**3**	**0**	**0**	**3**
11	CHCY029	Electrochemical Energy Conversion and Storage	**3**	**0**	**0**	**3**
12	CHCY030	Solar energy	**3**	**0**	**0**	**3**

SEMESTER I

CHC6101 ORGANIC CHEMISTRY

L	T	P	C
3	0	0	3

OBJECTIVES:

To make the student conversant with

- The basic concepts in stereochemistry.
- Reactive intermediates in organic reactions
- Mechanism of nucleophilic substitution reaction
- concepts of aromaticity and aromatic electrophilic substitution reaction
- mechanism of addition reaction
- mechanism of elimination reactions

MODULE I STEREOCHEMISTRY I 09

Introduction to molecular symmetry and point groups – optical isomerism – conditions for optical activity – Newmann, Sawhorse and Fisher projection formulae – Interconversion – concept of chirality – R,S-nomenclature - geometrical isomerism – E,Z nomenclature – determination of configuration of geometrical isomers using physical and chemical methods - optical activity of biphenyls, allenes and spiranes, cyclophanes, helical chirality - ANSA compounds.

MODULE II REACTIVE INTERMEDIATES & REACTION MECHANISM 09

Formation and stability of carbonium ions, norbornyl cation and other non-classical carbocations and classical carbocations, Bredt's rule - carbanions, carbenes, nitrenes, free radicals, arynes, ylides - methods of generation and reactivity and applications - Kinetic and nonkinetic methods to determine the reaction mechanism: Thermodynamic and Kinetic controlled reactions Non-kinetic methods -Kinetic methods – methods of determining mechanism

MODULE III NUCLEOPHILIC SUBSTITUTIONS 09

S_N1, S_N2, Neighboring group participation and S_Ni, S_NAr mechanisms – effects of substrate, attacking nucleophile, leaving group and solvent – stereochemistry of nucleophilic substitution reactions – substitutions at carbonyl, bridgehead, vinylic and allylic carbons, Ambident nucleophiles - O versus C alkylation – activated aromatic nucleophilic substitution

MODULE IV AROMATICITY and AROMATIC ELECTROPHILIC SUBSTITUTION REACTIONS 09

Aromaticity – concept – Huckel and Craig rules – Aromatic and anti aromatic compounds

– benzenoid, non-benzenoid and homo aromatic compounds – anti-aromaticity - Annulenes – Aromaticity in cyclopentadienyl anion, tropolone, ferrocenes, fullerenes, azulenes, fulvenes, azirines, heteroaromatic systems and charged ring systems – NMR and aromaticity - Reactions of aryl diazonium salts – aromatic electrophilic substitution reactions and mechanisms.

MODULE V ADDITION AND ELIMINATION REACTIONS 09

Addition to carbon-carbon and carbon-hetero multiple bonds – electrophilic, nucleophilic and free radical additions – stereochemistry of addition to carbon-carbon multiple bonds – orientation and reactivity, addition to conjugated systems and orientation – addition to α,β-unsaturated carbonyl groups – E1, E2 and $E1_{CB}$ mechanisms – stereochemistry of E2 elimination – competition between elimination and substitution reactions – orientation effects in elimination reactions – effects of substrate structures, attacking base, leaving group and medium on E1 and E2 reactions – pyrolytic eliminations - Chugaev and Cope eliminations – Peterson's and Julia elimination.

Total Hours: 45

REFERENCES:

1. Michael B. Smith and Jerry March, Advanced Organic Chemistry, Reactions, Mechanisms and Structure 7th Edition, Wiley Intersciences, New York, 2009.
2. Francis A. Carey and Richard J. Sundberg, Advanced Organic Chemistry, Part A – Structure and Mechanisms, 5th Edition, Springer, 2007.
3. Francis A. Carey and Richard J. Sundberg, Advanced Organic Chemistry, Part B: Reactions and Synthesis, 5th Edition, Springer, 2007.
4. Morrison R.T., Boyd R.N. and Battacharjee S.K., Organic Chemistry, 7th Edition, Pearsons, 2007.
5. Eliel E.L. and Wilen S.H., Stereochemistry of Organic Compounds, John Wiley India, 2009.
6. Nasipuri D., Stereochemistry of Organic Compounds, 2nd Edition, Wiley Eastern Ltd., 1991.
7. Kalsi P.S., Stereochemistry of Organic Compounds, Wiley Eastern Ltd., New Delhi, 1992.
8. Peter Sykes, Guidebook to Mechanism in Organic Chemistry, Orient Longman, 2005.

OUTCOMES:

The students will be able to

- assign stereochemical configuration
- Distinguish the different types of organic reaction intermediates

- Postulate the mechanism of nucleophilic substitution reaction
- recognize the aromaticity and aromatic electrophilic substitution reaction
- suggest the mechanism of addition reaction
- depict the mechanism of elimination reactions

CHC6102 THERMODYNAMICS AND ELECTROCHEMISTRY

L	T	P	C
3	0	0	3

OBJECTIVES:

To make the student conversant with

- laws of chemical thermodynamics
- applications of Vant Hoff's equation in chemical thermodynamics
- application of partition function
- applications of onsager reciprocal relation
- various models of electrical double layer
- applications of Butler-Volmer equation and Tafel equation

MODULE I CHEMICAL THERMODYNAMICS-1 09

First law of thermodynamics – Joule-Thomson effect – thermochemistry – standard enthalpy changes – standard enthalpies of formation – second law of thermodynamics – free energy and work function – Maxwell relations – third law of thermodynamics – evaluation of absolute entropies of solids, liquids and gases.

MODULE II CHEMICAL THERMODYNAMICS-2 09

Clausius-Clapeyron equation - determination of partial molar quantities - thermodynamic aspects of extract ion of metals- reduction of oxides and sulphides - Ellingham diagram and its significances - partial molar properties – chemical potential – vant Hoff's equation – Gibbs-Duhem equation.

MODULE III STATISTICAL THERMODYNAMICS 09

Objectives of statistical thermodynamics – probability – microstates and macrostates for distinguishable and indistinguishable particles – permutation and combinations – Maxwell-Boltzmann statistics – third law of thermodynamics and exception to this law – use of partition function for obtaining thermodynamic functions.

MODULE IV NON-EQUILIBRIUM THERMODYNAMICS 09

Steady state – conservation of energy and mass – entropy production and entropy flow in open system – fluxes and forces – transformation of properties of rates and affinity – microscopic reversibility and Onsager reciprocal relation – thermokinetic effect – irreversible thermodynamics for non-linear regime.

MODULE V ELECTROCHEMISTRY 09

Ion-solvent and ion-ion interactions, ion transport in solutions – electrochemical cells electrical double layer – various models – electrocapillary phenomena – electrokinetic phenomena – electro osmosis – streaming potential and electrophoresis – Tiselius

apparatus – kinetics of electrode processes – Butler-Volmer equation - Tafel equation.

Total Hours: 45

REFERENCES:

1. Atkins P., and Paula J.D., Physical Chemistry, 7th Edition, Oxford University Press, London, 2002.
2. Alberty P.A. and Silbey R.U., Physical Chemistry, 1st Edition, John Wiley and Sons Inc., 1995.
3. Castellan G.W., Physical Chemistry, 3rd Edition, Narosa Publishing House, 2004.
4. Kuriacose J.C. and Rajaram J., Thermodynamics for Students of Chemistry, 3rd Edition, S. Chand and Co., New Delhi, 2001.
5. Crow D.R., Principles and Application of Electrochemistry, Chapman and Hall, 1988.

OUTCOMES:

The students will be able to comprehend the

- laws of chemical thermodynamics
- applications vant Hoff's equation in chemical thermodynamics
- application of partition function
- applications of onsager reciprocal relation and microscopic reversibility
- various models of electrical double layer
- applications of Butler-Volmer equation and Tafel equation

CHC6103 INORGANIC CHEMISTRY

L	T	P	C
3	0	0	3

OBJECTIVES:

To make the student conversant with

- Periodic properties of elements ,
- Bonding in inorganic molecules
- Molecular orbital theory for diatomic and poly atomic molecules
- Types of non-valence forces,
- Concepts of non-aqueous solvents,
- Types of crystal structure.

MODULE I ATOMIC STRUCTURE 09

Modern views on atomic structure – Wave equation – hydrogen atom and poly electron atoms, electronic configuration and term symbols, periodic properties of elements – atomic size, ionization energy, electron affinity, electro negativity, covalent and ionic radii and magnetic properties.

MODULE II COVALENT BOND 09

Valence bond theory – hybridization and resonance – diatomic and polyatomic systems - VSEPR theory - molecular orbital theory – LCAO approximation for diatomic and polyatomic systems.

MODULE III IONIC AND NON-VALENCE FORCES 09

vander waals' forces – hydrogen bond – clathrates, metallic bond – free electron theory of metals, ionic solids – lattice energy – Born-Haber cycle.

MODULE IV AQUEOUS AND NON-AQUEOUS CHEMISTRY 09

Acid-base concepts, HSAB theory, super acids, non-aqueous solvents – reactions in liquid ammonia, sulphuric acid, aprotic solvents - molten salts - electrode potentials and applications in inorganic systems.

MODULE V CRYSTAL STRUCUTRE 09

Radius ratio – structures of AX, AX_2, A_2X_3, ABX_3 and A_2BX_4 type solids – layer structure – cadmium iodide - covalent solids – diamond and graphite - Polymorphism and X-Ray Diffraction.

Total Hours: 45

REFERENCES:

1. Cotton F.A., Wilkinson G. and Gaus P.L., Basic Inorganic Chemistry, 3rd Edition, John Wiley and New York, 2003.
2. Atkins P.W., Overton T., Rourke, J., Weller, M. and Armstrong, F. Shriver and Atkins inorganic chemistry, 4th edition, Oxford University Press, 2006.
3. Huheey J.E., Keiter E.A. and Keiter R.L., Inorganic Chemistry, 4th Edition, Addision Wesley Publication, London, 1993.
4. Jolly W.L., Modern Inorganic Chemistry, 2nd Edition, McGraw – Hill, Inc., 1991.
5. Lee J.D., Concise Inorganic Chemistry, 5th Edition, Blackwell Science, 2003.

OUTCOMES:

Students will be able to

- Demonstrate the basic principles of periodicity.
- Demonstrate VSEPR theory.
- Depict the molecular orbital diagram for diatomic and polyatomic systems.
- Recognize the different non valence forces and their influence on the physical & chemical properties
- Demonstrate the basic principles of acid – base chemistry in non aqueous solvents.
- Acquire the knowledge of structure of different types of solids and their diffraction pattern.

CHC6104 ANALYTICAL CHEMISTRY

L	T	P	C
3	0	2	4

OBJECTIVES:

To make the student

- identify the right analytical method for a given sample and information required
- state the principles and applications of different wet chemical methods
- study the principles, instrumentation and applications of spectroscopic methods
- describe the principles, instrumentation and applications of electro analytical techniques
- state the principles and instrumentation of different separation techniques
- describe the different thermal analytical methods and their applications

MODULE I QUANTITATIVE ANALYSIS 09

Volumetric analysis – neutralization, precipitation, complexometric and redox titrations - Gravimetric analysis – volatilization and precipitation methods - Types of error – evaluation of analytical data - estimation of Na/K/Ca by flame photometer

MODULE II SEPARATION TECHNIQUES 09

Chromatography – paper, column, TLC, GC, HPLC and GPC techniques – ion exchange techniques – Capillary electrophoresis – principle, instrumentation and applications- gel electrophoresis.

MODULE III INTRODUCTION TO MOLECULAR SPECTROSCOPY 09

Molecular spectroscopy: Colorimetric analysis- , principle and applications UV, Visible, IR absorption - Fluorescence, phosphorescence and chemiluminescence methods - Atomic absorption and atomic fluorescence spectroscopy - Emission spectroscopy, flame photometry and ICP-AES principle, instrumentation and analytical applications.

MODULE IV ELECTROANALYTICAL TECHNIQUES 09

Conductometry and high frequency titrations - potentiometry, pH-metry and ion-selective electrodes - coulometry – voltammetry - polarography, amperometric titrations and anodic stripping voltammetry - principle, practice and applications.

MODULE V THERMAL METHODS OF ANALYSIS 09

Thermal analytical techniques – TGA, DTA, DSC,.DEA (dielectric thermal analysis) TOA (thermo optical analysis) Temperature-programmed Desorption/ Reduction/ Oxidation/ Sulfidation (TPD / TPR / TPO / TPS), – principle, instrumentation and applications

Total Hours: 45

REFERENCES:

1. Skoog D.A., West D.M., Holler F.J. and Crouch S.R., Fundamentals of Analytical Chemistry, 8th Edition, Thomson Brooks/Cole Publication., Singapore, 2004.
2. Willard H.H., Merritt L.L., Dean J.A. and Settle F.A., Instrumental Methods of Analysis, 7th Edition, CBS Publication, New Delhi Reprint, 2004.
3. Skoog D.A., Holler F.J. and Nieman T.A., Principles of Instrumental Analysis, 5th Edition, Harcourt College Publication., Singapore, 1998.
4. Christian G.D., Analytical Chemistry, 6th Edition, John Wiley, Singapore, 2003.
5. Fifield F.W. and Kealey D., Principles and Practice of Analytical Chemistry, 5th Edition, Blackwell Publication, London, 2000.
6. Settle F. (Editor), Handbook of Instrumental Techniques for Analytical Chemistry, Pearson Education, Singapore, 2004.

OUTCOMES:

The student will be able to

- Identify the proper method and do the various chemical analysis
- isolate the compounds in a mixture by chromatographic techniques
- interpret the spectral data like UV-Visible, IR, apply electro analytical techniques
- interpret the thermal analysis data

CHC6105 ORGANIC CHEMISTRY PRACTICAL

L	T	P	C
0	0	4	2

OBJECTIVES:

To make the student conversant with

- Separation of two component mixture
- analyze the functional groups present in simple organic compounds.
- Purification techniques of organic solvents and reagents

LIST OF EXPERIMENTS:

1. Qualitative analysis of simple organic compounds
2. Separation of organic compounds with two component mixtures and its qualitative analysis.
3. Purification of organic solvents and reagents - Purification of liquids by distillation – Purification of solids by recrystallization – Determination of melting point – Determination of boiling point by capillary method.

Total Hours: 60

REFERENCES:

1. A.I. Vogel, Vogel's Textbook of Practical Organic Chemistry, 5th Edition, Prentice Hall, 2008.
2. V.K Ahluwalia, R. Agarwal Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press, 2000.

OUTCOMES:

At the end of the course, the student will be able to

- Separate the different component mixtures of simple organic compounds.
- Analyze the functional groups present in simple organic compounds
- Purify the organic compounds by using recrystallisation and distillation techniques

CHC6106 INORGANIC CHEMISTRY PRACTICAL-I

L	T	P	C
0	0	4	2

OBJECTIVES:

The students will be trained

- the purification process such as distillation, extraction, etc.
- to identify individual common and rare cations present in the given mixture
- to estimate the chloride ions present in water
- to estimate the various ions by titrimetry
- to estimate the ions such as iron, cobalt, nickel, chromium and manganese and spectral techniques

LIST OF EXPERIMENTS:

1. Water distillation and solvent extraction
2. Semi-micro qualitative analysis: Analysis and identification of two common and two rare cations in a mixture including spot test confirmation
3. Estimation of chloride in water by Mohr's method
4. Complexometric tirtrations: Estimation of Ca^{2+}, Mg^{2+}, $Mn^{2+}$and Zn^{2+}
5. Spectrophotometric analysis of iron, cobalt, nickel, chromium and manganese

Total Hours: 60

REFERENCES:

1. Monograph on Green Chemistry Laboratory Experiments, Green Chemistry Task Force Committee, Department of Science and technology, India.
2. Rakesh K. Sharma, Indu Tucker Sidhwani and Mihir K. Chaudhuri, Green Chemistry Experiments: A Monograph, I K International Publishing House; 1st Edition, 2012.
3. J. Mendham, R.C. Denney, M.J.K. Thomas David and J. Barnes, Vogel's Quantitative Chemical Analysis, 6th Edition, Prentice Hall, 2000.
4. V.V. Ramanujam, Inorganic Semimicro Qualitative Analysis; 3rd Edition, The National Publishing Company, Chennai, 1974.
5. Mukhopadhyay R and Chatterjee P, Advanced Practical Chemistry, Books & Allied (P) Ltd., 2007.
6. Dinesh Sharma, A Handbook of Analytical Inorganic Chemistry, International Scientific Publishing Academy, India, 2005.

OUTCOMES:

The students will be able to

- Distill water and other organic solvents
- Analyze the common and rare cations present in the given mixture
- Estimate the ions present in the sample by titrimetry
- Estimate the ions such as iron, cobalt, nickel, chromium and manganese present in the sample by spectral methods

CHC6107 PHYSICAL CHEMISTRY PRACTICAL- I

L	T	P	C
0	0	4	2

OBJECTIVES:

To make the students trained to

- Determine the equivalent conductance of strong electrolytes
- Verify the Ostwald dilution law
- do conductometric titrations
- Determine the rate constant of first and second order reactions
- Verify Beer –Lambert law
- Determine the molecular weight of a polymer

LIST OF EXPERIMENTS:

1. Equivalent conductance of strong electrolytes and verification of Debye Huckel Onsager equation
2. Verification of Ostwald dilution law using weak acid and determination of its dissociation constant
3. Conductometric titrations: acid-base and precipitation titrations
4. Determination of rate constant
5. Saponification of oils and fats
6. Temperature dependence of solubility of benzoic acid in water and DMSO
7. Determination of activity coefficients of an electrolyte at different molalities
8. Verification of Beer-Lambert equation
9. Determination of molecular weight of a polymer by viscometry

Total Hours: 60

REFERENCES:

1. V.D. Athawale, Experimental Physical Chemistry, New Age International, 2007.
2. B.D. Khosla, Senior Practical Physical Chemistry, R. Chand and Co., New Delhi, 2007.
3. B. Viswanathan and P.S. Raghavan, Practical Physical Chemistry, Viva Books Pvt. Ltd., 2005.
4. D.R. Satiya, Practical Chemistry, 2nd Edition, Allied Publishers, Madras, 1991.
5. D.P. Shoemaker and C.W. Garland, Experiments in Physical Chemistry, McGraw Hill, London, 1962.

OUTCOMES:

The students will be able to

- Determine the equivalent conductance of strong electrolytes
- Verify the Ostwald dilution law
- do conductometric titrations
- Determine the rate constant of first and second order reactions
- Verify Beer –Lambert law
- Determine the molecular weight of a polymer

SEMESTER II

CHC6202	RESEARCH METHODOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

The students will be trained to

- Select and Define a research problem
- Describe the Methodology of Research
- Acquire good laboratory practices
- Operate the software for Programming techniques
- Analyze and Interpret the Results
- Demonstrate the Plagiarism check by turtin

MODULE I RESEARCH METHODOLOGY- AN INTRODUCTION 09

Research: Objectives, Motivation and types - Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Criteria of Good Research, Problems Encountered by Researchers - Introduction to ethics, scientific conduct and misconduct, Misconduct and why it occurs, Fabrication, Authorship issues, The investigation and punishment of scientific misconduct.

MODULE II GOOD LABORATORY PRACTICES AND SAFETY 09

Introduction: History, definition, Principles, Good Laboratory Practices (GLP) and its application GLP training: Resources, Rules, Characterization, Documentation, quality assurance, Resources, Facilities: building and equipment, Personnel, GLP and FDA, Stepwise implementation of GLP and compliance monitoring. Safety Symbols, Science Safety Rules- Dress Code, First Aid, Heating and Fire Safety

MODULE III PROGRAMMING TECHNIQUES 09

Data analysis using Excel, Origin and Sigma plot Analyzing the chemical data and drawing chemical structures using Chemdraw and Chemsketch. Basics of C and C++ programme – MATLAB – Numerical Methods – Ordinary Differential Equation – Partial Differential Equation – Runge Kutta Method.

MODULE IV INTERPRETATION OF RESULTS AND ANALYSIS 09

Importance and scientific methodology in recording results, importance of negative results, different ways of recording, industrial requirement, artifacts versus true results, types of analysis (analytical, objective, subjective) and cross verification, correlation with

published results, discussion, outcome as new idea, hypothesis, concept, theory, model etc.

Conceptions of error of measurement, true score theory and generalisability theory. Measures of central tendency or averages – mean median and mode. Measures of dispersion – range, variance, and standard deviation: The normal distribution and the normal probability curve.

MODULE V SCIENTIFIC WRITING, TECHNICAL PUBLICATION AND RESEARCH PROPOSAL 09

Different types of scientific and technical publications in the area of research, and their specifications, Ways to protect intellectual property – Patents, technical writing skills, definition and importance of impact factor and citation index - assignment in technical writing, The research problem, finding related literature, computer generated references sources and the research project, model research proposal. Plagiarism checking by Turtin -demonstration

Total Hours: 45

REFERENCES:

1. Essentials of Research Design and Methodology Geoffrey R. Marczyk, David DeMatteo, David Festinger, 2005 John Wiley & Sons Publishers, Inc
2. Biochemical Calculations: How to Solve Mathematical Problems in General Biochemistry, 2nd Edition, Irwin H. Segel, 1976 John Wiley & Sons Publishers, Inc
3. Guide to Publishing a Scientific paper, Ann M. Korner, 2004, Bioscript Press.
4. P Laake, H B Benestad, B R Olsen. Research Methodology in the medical and biological sciences. Academic Press, 2007.
5. R Arora. Encyclopaedia of Research Methodology in Biological Sciences. Anmol Publishing, 2004.
6. Kothari C.R., Research Methodology, Methods and Techniques, Wiley Eastern Ltd., NewDelhi, 1991.
7. Coghill M. and Gardson L.R., The ACS Style Guide Effective Communication of Scientific Information, 3rd Edn., Oxford University Press, 2006.
8. Willa Y. Garner, Maureen S. Barge, James, P, Good Laboratory Practice Standards: Applications for Field and Laboratory Studies (ACS Professional References Book).

OUTCOMES:

At the end of this course, the students should be able to:

- recognize the basic concepts of research and its methodologies
- Identify appropriate research topics
- Select and define appropriate research problem and parameters
- Prepare a project proposal (to undertake a project)
- Organize and conduct research (advanced project) in a more appropriate manner
- Write a research report and thesis

CHC6201 SYNTHETIC ORGANIC CHEMISTRY

L	T	P	C
3	2	0	4

OBJECTIVES:

To impart

- Knowledge of the increasingly important role played by organic and transition metals reagents and catalysts with their corresponding proposed reaction mechanisms.
- Knowledge for rational mechanism-based design of synthetic strategies for new and novel organic reactions.

MODULE I STEREOCHEMISTRY II 09

Conformational analysis and reactivity of cyclic and acyclic systems – topicity – prochirality - enantiotopic and diastereotopic atoms, groups and faces –asymmetric synthesis - stereoselective, stereospecific reactions - enantioselective synthesis - optical purity and enantiomeric excess - Cram's rule – Prelog's rule – Fehn Anns model - methods of resolution – kinetic, dynamic kinetic resolution - Sharpless epoxidation

MODULE II MOLECULAR REARRANGEMENTS 09

General mechanistic considerations, nature of migration, migratory aptitude - nucleophilic, electrophilic and free radical rearrangements – Wagner-Meerwein, Demyanov, Favorskii, Fritsch-Butternberg - Wiechell, Neber, Hofmann, Curtius, Beckmann, Schmidt, Lossen, Wolff, Baeyer – Villiger, Stevens, Wittig, Chapman, Wallach, Orton, Bamberger, Pummerer and Von Ritchter rearrangements.

MODULE III REAGENTS IN ORGANIC SYNTHESIS 09

Synthesis and application of - Diborane, $LiAlH_4$, $NaBH_4$, DIBAH, Bu_3SnH, SeO_2, NBS, DCC, PCC, Swern, Dess Martin, DDQ, LDA, Gilman's reagent, phase transfer catalysts, Wittig, Tebbe, Wilkinson's catalysts, Palladium and copper catalysts in coupling (Suzuki, Heck), Low valent titanium(McMurry), Co(Salen) complex (Jacobsen), BINAL(H), BINAP, Grubb and Schrock catalyst (Olefin Metathesis).

MODULE IV MULTISTEP SYNTHESIS 09

Strategies for synthetic analysis and planning – functional group introduction, removal and interconversion - activating groups – protection and deprotection of hydroxyl, amino, carbonyl and carboxylic acid groups - retrosynthetic analysis, synthons and synthetic equivalent groups - C-C, C=C, C-O bond forming reactions – linear and convergent synthesis - control of stereochemistry – reactive umpolung - analysis and synthesis of a few target molecules.

MODULE V APPLICATIONS OF ORGANIC SPECTROSCOPY 09

Structure determination of organic compounds - introduction to NMR spectroscopy-interpretation of molecular structure by ^{1}H, ^{13}C and Mass spectroscopic techniques.

Total Hours: 45

REFERENCES:

1. Jerry March, Advanced Organic Chemistry, 4th Edition, Wiley-Interscience, New York, 2007.
2. Morrison R.T., Boyd R.N. and S. K. Battacharjee Organic Chemistry, 7th Edition, Pearsons, 2007.
3. Lowry T.H. and Richardson K.S., Mechanism and Theory in Organic Chemistry, 2nd Edition, Harper and Row Publishers, 1981.
4. Michael B. Smith and Jerry March, Advanced Organic Chemistry, Reactions, Mechanisms and Structure 7th Edition, Wiley Intersciences, New York, 2009.
5. Finar I.L., Organic Chemistry, Volume II, 5th Edition, ELBS Longmann Group Ltd., London, 1980.
6. Stuart G. Warren, Organic Synthesis: The Disconnection Approach Wiley India, 2009.
7. Achesen R.M., Chemistry of Heterocyclic Compounds, Wiley Eastern, 1973.
8. Francis A. Carey and Richard J. Sundberg, Advanced Organic Chemistry, Part A – Structure and Mechanisms, 5th Edition, Springer, 2007.
9. Francis A. Carey and Richard J. Sundberg, Advanced Organic Chemistry, Part B: Reactions and Synthesis, 5th Edition, Springer, 2007.

OUTCOMES:

The student will

- acquire the skills for correct stereo chemical assignment and interpretation in the cases of complex organic molecules.
- be equipped as a more competent synthetic organic chemist due to being capable of correct mechanistic approach and design of a synthesis.

CHC6202 QUANTUM CHEMISTRY

L	T	P	C
3	1	0	4

OBJECTIVES:

To make the student

- understand the origin of classical mechanics and the background of quantum mechanics
- derive and use of Schrodinger equation to simple systems
- able to construct the molecular orbital for molecules
- gain the basics of quantum statistics and how it is applied to systems of chemical interest
- learn the concepts symmetry elements and operations, able to assign the point group of molecules

MODULE I INTRODUCTION TO QUANTUM CHEMISTRY 09

Review of essential mathematical concepts. General introduction to classical and quantum mechanics. Classical mechanics: black body radiation, photo electric effect, heat capacity of solids and inadequacy of classical mechanics. Quantum mechanics: historical background, principles and postulates. Operators and their properties. Eigen value – Eigen functions.

MODULE II SOLUTIONS OF SCHRODINGER EQUATION AND APPROXIMATE METHODS 09

Schrodinger equation, Discussion of solutions of the Schrodinger equation to few systems: particle in a box, the rigid rotor, the harmonic oscillators and the hydrogen atom. Approximate methods: The variation theorem, linear variation principle. Perturbation theory (introductory concept, degenerate and non-degenerate). Application of variation methods to the helium atom. Concept of Hartree Fock/SCF methods.

MODULE III QUANTUM AND PHOTOCHEMISTRY OF MOLECULES 09

Born Oppenheimer approximation; VB and MO theory; Applications to $H2^+$ and H2 molecules. MO treatment of homo- and hetero nuclear diatomic molecules. Hukel molecular orbital theory and its application to ethylene, butadiene, benzene and cyclic systems.

Photochemistry: Law of photochemistry, Jablonski diagram, quantum yield, excimer and exciplex and quenching, Stern-Volmer relation, Photo induced electron and energy transfer, FRET (concept only); Measurement of fluorescence, phosphorescence and lifetime (introductory concept), chemiluminescence – fluorescence based sensors and imaging applications.

MODULE IV QUANTUM STATISTICS 09

Recapitulation of classical statistics and partition function, relationship between partition and thermodynamic functions, thermodynamic probability, derive the expression for translational, rotational, vibrational and electronic partition functions and its simple application to mono atomic gases (ortho-para hydrogen) and solids, Compare and distinguish between Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics. Applications of Bose-Einstein and Fermi-Dirac statistics.

MODULE V MOLECULAR SYMMETRY AND GROUP THEORY 09

Symmetry elements and symmetry operations – types of groups- group postulates - classification of point groups- Schoenflies symbol –matrix representation of symmetry operations and point groups, representation of point group, reducible and irreducible representations, the great orthogonal theorem – character table, construction of character table for C_{2v} and C_{3v} groups- symmetry adopted linear combinations (SALCs), assignments of point groups and geometry of various molecules- applications of group theory.

Total Hours: 45

REFERENCES:

1. McQuarrie D.A., Quantum Chemistry, First Edition, University Science Books, Mill Valley, California, 2003.
2. Levine I.N., Quantum Chemistry, Fifth Edition, Pearson Education, 2000.
3. Hanna M.W., Quantum Mechanics in Chemistry, Third Edition, Addition Wesley, London, 1981.
4. Prasad R. K., Quantum Chemistry, Fourth Edition, New Age International Publishers, 2008.
5. Chandra A. K., Introductory to Quantum Chemistry, Fourth Edition, Tata McGraw Hill Education Private Ltd.
6. C.L. Tien., J.H.Lienhard., Statistical thermodynamics, Revised Printing Edition, Hemisphere Publishing Corporation, Oxford.
7. N.M. Laurendeau, Statistical Thermodynamics, fundamentals and applications, 2005, Oxford University Press, Oxford.
8. Albert Cotton F., Chemical Applications of Group Theory, Third Edition, Wiley India Pvt Ltd.
9. P.K.Bhattacharya, Group theory and its Chemical Applications, 2nd Edn, Himalaya Publications, India.2012
10. A. Vincent., Molecular Symmetry and Group theory, A programmed introduction to chemical applications, 2nd Edition, Wiley,.2001

OUTCOMES:

The student will gain:

- Basic aspects of quantum chemistry of atoms and molecules
- Importance of quantum chemistry and how to apply this knowledge to atomic and molecular structure
- Able to understand clearly the microscopic and inner details of chemical reactions in chemistry point of view
- In depth knowledge and understanding of photochemical reactions
- Assign the symmetry elements and point group of molecules/ion/complexes
- Indentify the symmetry in molecules and explain the character table of C_{2v} and C_{3v} point groups

CHC6203 CO-ORDINATION CHEMISTRY

L	T	P	C
3	0	0	3

OBJECTIVES:

To make the students conversant with the

- Nomenclature and isomerism of coordination compounds
- Bonding theories of coordination compounds
- Spectra of coordination compounds
- Magnetic properties of coordination compounds
- Various reactions of coordination compounds
- Chemistry of lanthanides and actinides

MODULE I COORDINATION COMPOUNDS 09

Nomenclature, structure and stability – geometry and isomerism - absolute configuration – ORD and CD spectra - stability of complexes – thermodynamic aspects, successive and overall formation constants – experimental methods.

MODULE II THEORIES OF METAL- LIGAND BOND 09

Valence bond theory – hybridization - crystal field theory – crystal field splitting, crystal field stabilization energy – thermodynamic and structural implications, Jahn Teller effects, ligand field theory - molecular orbital theory – pi bonding.

MODULE III SPECTRA OF CO-ORDINATION COMPOUNDS 09

Free ion terms, transformation in crystal field, energy diagrams in weak and strong field cases – Tanabe – Sugano diagrams, selection rules - magnetic properties – Van Vleck equation, magnetic susceptibility – experimental methods - ESR spectra of transition metal ions.

MODULE IV REACTIONS OF CO-ORDINATION COMPOUNDS 09

Inert and labile complexes - substitution reactions in square-planar and octahedral complexes - electron transfer reactions - photochemical reactions.

MODULE V COMPARATIVE CHEMISTRY OF OXIDATION STATES OF d AND f BLOCK ELEMENTS 09

Lanthanides-occurrence, isolation, lanthanide contraction, oxidation states, spectral and magnetic properties, co-ordination complexes, actinides, comparative chemistry with transition metals and lanthanides.

Total Hours: 45

REFERENCES:

1. Cotton F.A., Wikinson G. and Gaus P., Basic Inorganic Chemistry, 3rd Edition, John Wiley and Sons, 2003.
2. Shriver D.F. and Atkins P.W., Inorganic Chemistry, 3rd Edition, (ELBS), Oxford University Press, Oxford, 2004.
3. Huheey J.E., Keiter E.A. and Keiter R.L., Inorganic Chemistry, 4th Edition, Addison Wesley Publication, London, 1993.
4. Cotton F.A., Wikinson G., Murillo C.A. and Bochmann M., Advanced Inorganic Chemistry, 6th Edition, John Wiley and Sons, New York, 2003.
5. Jolly W.L., Modern Inorganic Chemistry, 2nd Edition, McGraw Hill Inc., 1991.
6. Meissler G.L. and Tarr D.A., Inorganic Chemistry, 3rd Edition, Pearson Education, Singapore, 2004.

OUTCOMES:

Students will be able to

- Write the nomenclature of a coordination complex
- Find the number of isomers possible for coordination compound
- illustrate an understanding of the principles of theories of metal-ligand bond.
- demonstrate an understanding of spectra of coordination compounds.
- analyze the spectra of transition metal ions.
- analyze Tanabe – Sugano diagrams.
- interpret the stability of complexes.
- understand the substitution reactions in transition metal complexes.
- demonstrate an understanding of chemistry of ‘d’ and ‘f’ block elements.
- analyze and compare the transition metals and lanthanides

CHC6204	SYNTHETIC ORGANIC CHEMISTRY PRACTICAL	L	T	P	C
		0	0	4	2

OBJECTIVES:

To make the students

- Identify organic compounds by TLC technique and purify them by column chromatography.
- expertise in multi step synthesis of organic compounds.

LIST OF EXPERIMENTS:

1. Identification and purification of organic compounds by thin layer and column chromatographic techniques.
2. Single step and multistep synthesis of organic compounds - isolation and characterization of the products by various spectroscopic techniques.

Total Hours: 60

REFERENCES:

1. A.I. Vogel, Vogel's Textbook of Practical Organic Chemistry (4th Edition), Longmann group, 2008.
2. N.S. Gnanapragasam, G. Ramamurthy, Organic Chemistry – Lab manual, S. Viswanathan Co. Pvt. Ltd., 1998.
3. V.K. Ahluwalia S Dhingra Comprehensive Practical Organic Chemistry: Qualitative Analysis, University Press, 2000.
4. Robert M. Silverstein, Francis X. Webster, David Kiemle, Spectrometric Identification of Organic Compounds, 7th Edition, Wiley, 2005.
5. Kemp W., Organic Spectroscopy, 3rd Edition, ELBS, McMillan, London, 1991.

OUTCOMES:

The students will be able to

- Independently perform multi step organic synthesis.
- Identify the synthesized compounds by TLC and purify it by column chromatography.

CHC6205 INORGANIC CHEMISTRY PRACTICAL-II

L	T	P	C
0	0	4	2

OBJECTIVES:

The students will be trained to

- estimate the metal components present in alloys
- prepare different complexes
- characterize the complexes by spectral techniques
- synthesis of green reagents

LIST OF EXPERIMENTS:

1. Estimation of alloys by gravimetry and titrimetry: brass (Cu & Zn), bronze (Cu & Sn) and ferro nickel (Fe & Ni)
2. Complex preparation and characterisation by UV-Visible and FT-IR spectroscopic techniques
   - (i) Preparation of 1-acetyl ferrocene
   - (ii) Preparation of bis(acetylacetanato)copper(II)
   - (iii) Preparation of tris(acetylacetanato)iron(III)
   - (iv) Preparation of tris(acetylacetanato)manganese(III)
   - (v) Solvent free and one pot synthesis of phthalocyanine complex of copper(II)
   - (vi) Synthesis of tetrabutyl ammonium tribromide (TBATBP) - A green reagent and its application

Total Hours: 60

REFERENCES:

1. Monograph on Green Chemistry Laboratory Experiments, Green Chemistry Task Force Committee, Department of Science and technology, India.
2. Rakesh K. Sharma, Indu Tucker Sidhwani and Mihir K. Chaudhuri, Green Chemistry Experiments: A Monograph, I K International Publishing House; 1st Edition, 2012.
3. J. Mendham, R.C. Denney, M.J.K. Thomas David and J. Barnes, Vogel's Quantitative Chemical Analysis, 6th Edition, Prentice Hall, 2000.
4. V.V. Ramanujam, Inorganic Semimicro Qualitative Analysis; 3rd Edition, The National Publishing Company, Chennai, 1974.
5. Mukhopadhyay R and Chatterjee P, Advanced Practical Chemistry, Books & Allied (P) Ltd., 2007.
6. Dinesh Sharma, A Handbook of Analytical Inorganic Chemistry, International Scientific Publishing Academy, India, 2005.

OUTCOMES:

The students will be able to

- estimate the various metal ions present in alloys by titrimetry and gravimetry
- prepare different complexes
- characterize the complexes by spectral techniques
- synthesis green reagents

CHC6206 PHYSICAL CHEMISTRY PRACTICAL- II

L	T	P	C
0	0	4	2

OBJECTIVES:

To make the students

- expertise in the applied concepts of volumetric titrations, electrochemistry, phase equilibrium, adsorption, etc.
- draw structures and graph using softwares and prepare reports

LIST OF EXPERIMENTS:

1. EMF measurement
2. Potentiometric titrations
3. Acid base titration by pH metry
4. Redox and precipitation titrations
5. Determination of CST in phenol-water system
6. Determination of activity coefficients of an electrolyte at different molalities
7. Determination of sucrose content in cane sugar by polarimetry
8. Determination of DEp of a redox system by cyclic voltametry
9. Verification of Freundlich isotherm - Adsorption of acetic acid, oxalic acid on activated carbon
10. Experiments on electroplating and electroless plating.
11. Uses of computer packages: Microsoft (word, excel and powerpoint), origin, chemsketch and chemdraw

Total Hours: 60

REFERENCES:

1. V.D. Athawale, Experimental Physical Chemistry, New Age International, 2007.
2. B.D. Khosla, Senior Practical Physical Chemistry, R. Chand and Co., New Delhi, 2007.
3. B. Viswanathan and P.S. Raghavan, Practical Physical Chemistry, Viva Books Pvt. Ltd., 2005.
4. D.R. Satiya, Practical Chemistry, 2nd Edition, Allied Publishers, Madras, 1991.
5. D.P. Shoemaker and C.W. Garland, Experiments in Physical Chemistry, McGraw Hill, London, 1962.

OUTCOMES:

The students will be able to

- determine the EMF of any cell
- measure the adsorption capacity of various materials

- draw the phase diagram for 2 and 3 component systems and analyze it
- draw chemical structures using chemsketch and chemdraw
- draw graphs using excel and origin software
- prepare the final dissertation report using MS word by themselves

SEMESTER III

CHC7101 ADVANCED ORGANIC CHEMISTRY

L	T	P	C
3	0	0	3

OBJECTIVES:

To make the students conversant with

- the structure and synthesis of various natural compounds.
- all major types of organic name reaction with mechanisms.
- all types of pericyclic and photochemicals reactions with its applications.

MODULE I CARBOHYDRATES, PROTEINS, NUCLEIC ACIDS 09

Monosaccharides – classification – cyclic structure of monosaccharides – mutarotation – epimers – glycals - glycosides – Ferrier rearrangement – anomers – Hudson rules – derivatives of monosaccharides – Vitamin C - disaccharides – trisaccharides – polysaccharides – nucleic acids : amino acids – classification – peptides - proteins – classification - structure .

MODULE II NAME REACTIONS 09

Stork enamine, Birch reduction - Aldol, Claisen, Benzoin, Stobbe condensations - Michael addition, Mannich reaction, Wittig, Robinson annulation, Dieckmann, Shapiro, Koenigs-Knorr, Polonowski, Hofmann-Loffler, Reformatsky, Darzen's, Simmons-Smith, Gattermann-Koch, Mitsunobu reaction, Buchwald and Hartwig.

MODULE III ORGANIC PHOTOCHEMISTRY 09

Thermal vs photochemical reactions – n-pi* and pi-pi* transitions - allowed and forbidden transitions – Jablonski Diagram - fluorescence and phosphorescence – internal conversion and intersystem crossing -– sensitization, quenching and quantum efficiency – photochemical reaction of ketones – Norrish type I and II, Paterno-Buchi and Barton reactions - photochemical oxidation and reduction, photochemical reactions of olefins - cis-trans isomerisation, di-pi-methane and Fries rearrangements.

MODULE IV PERICYCLIC REACTIONS 09

Definition – electrocyclic, cycloaddition, sigmatropic, chelotropic and ene reactions - Woodward-Hoffmann rules – Frontier orbital, Mobius-Huckel and orbital symmetry correlation approaches - Stereospecificity and regiospecificity of pericyclic reactions – pericyclic reactions in organic synthesis – Diels-Alder reaction, 1,3-dipolar cycloaddition, Claisen, Cope, Aza cope.

MODULE V HETEROCYCLES, ALKALOIDS, TERPENOIDS AND STEROIDS 09

Nomenclature of condensed heterocycles - Synthesis and reactivity of indoles, quinolines, isoquinolines, benzopyran, chromones, coumarins - Alkaloids – classification - synthesis of cocaine and atropine - terpenoids - Classification – isoprene rule – stereochemistry and synthesis of car-3-ene, menthol, zingiberene – Steroids – classification – structure and stereochemistry of cholesterol, synthesis of cortisone, estrone.

Total Hours: 45

REFERENCES:

1. Jerry March, Advanced Organic Chemistry: Reactions, Mechanisms and Structure, 4th Edition, Wiley Inter Science, New York, 2007.
2. Fleming I., Frontier Orbital and Organic Chemical Reactions, Wiley, 1976.
3. Graham Solomons T.W., Organic Chemistry, Volume I and II, 5th Edition, John Wiley and Sons, New York, 1992.
4. Finar I.L., Organic Chemistry, Volume II, 5th Edition, ELBS Longman Group Ltd., London, 1975.
5. Sankararaman S., Pericyclic reactions – a Textbook: Reactions, Applications and Theory, Wiley-VCH, 2005.
6. Francis A. Carey and Richard J. Sundberg, Advanced Organic Chemistry, Part A – Structure and Mechanisms, 5th Edition, Springer, 2007.
7. Francis A. Carey and Richard J. Sundberg, Advanced Organic Chemistry, Part B: Reactions and Synthesis, 5th Edition, Springer, 2007.

OUTCOMES:

The student will

- acquire the skill of relating all the biomolecules /natural products and propose synthetic routes.
- be skilled in photochemical and pericyclic reaction mechanism.

CHC7102 PHYSICAL CHEMISTRY

L	T	P	C
3	0	0	3

OBJECTIVES:

To make the student learn

- the basic aspects of both experimental and theoretical chemical kinetics
- derive rate expressions for acid-base catalytic systems and enzyme catalysed systems
- Different type of phase equilibria
- write mechanisms for reactions catalysed by transition metal complexes
- relate the catalytic activity of heterogeneous catalysts to their physicochemical properties
- learn the principle and instrumentation of surface characterization techniques

MODULE I KINETICS 09

Methods of determining rate laws – reversible, consecutive and competing reactions – Vant Hoff's rule, Collision theory, *Bodenstein's* Theory, theory of absolute reaction rates – transmission coefficient – thermodynamic formulation of reaction rates – kinetics – classical treatment – principle of microscopic reversibility - photochemical kinetics, – fast reactions – luminescence and energy transformations –study of kinetics by stopped flow techniques – flash photolysis.

MODULE II MECHANISM OF SOLUTION PHASE REACTION 09

Lindeman's theory – Hinshelwood, Kassel and Slater treatments, reaction rates in solution – effect of dielectric constant and ionic strength – kinetic isotope effect – linear free energy relationships – Hammett equation – Taft equation

MODULE III PHASE EQUILBRIA 09

Two component systems – classification – solid-gas (dehydration and rehydration of $CuSO_4$, $5H_2O$), solid-liquid systems – benzene-picric acid system, salt-water system fractional distillation – three component systems involving liquid-liquid equilibria.

MODULE IV CATALYSIS 09

Acid-base catalysis – general scheme – Arrhenius complex – Vant Hoff's complex – specific and general catalysis – catalytic constants – Bronsted relationship – Hammett acidity functions – mechanism of acid-base catalysed reaction – catalysis by transition metal ions and their complexes – supported transition metal complexes as catalysts – enzyme catalysis – theory and applications.

MODULE V SURFACE PHENOMENA AND HETEROGENEOUS CATALYSIS 09

Diffusion – adsorption – surface reaction – various adsorption isotherms – determination of surface area – pore volume and pore size – thermodynamics of interfaces – solid catalysts – metal-metal oxides – geometric factor – electronic factor - zeolites – phase transfer catalysis – colloidal electrolytes – reactions on surfaces – surface characterization techniques – ESCA, AES and SIMS.

Total Hours: 45

REFERENCES:

1. Laidler K.J., Chemical Kinetics, Harper and Row, New Delhi, 1987.
2. Rajaram J. and Kuriacose J.C., Kinetics and Mechanism of Chemical Transformation, Mcmillan India Ltd., 1993.
3. Kuriacose J.C. and Rajaram J., Thermodynamics for Students of Chemistry, 3rd Edition, Shoban Lal Nagin Chand and Co., 1999.
4. Nash L.K. and Addison, Elements of Statistical Thermodynamics, Wiley Publication Co., 1971.
5. Gupta M.C., Statistical Thermodynamics, Wiley Eastern, New Delhi, 1990.
6. Sears F.W. and Salinger G.L., Thermodynamics, Kinetic theory and Statistical Thermodynamics, 3rd Edition, Narosa Publishing House, New Delhi, 1998.
7. Rohatgi, Mukharjii K.K., Fundamentals of Photochemistry- Wiley Eastern

OUTCOMES:

The student will be acquainted with

- differential rate laws, integrated rate laws, temperature dependence of reaction rates,
- Derivation of rate law for the complex reactions such as parallel ,reversible and consecutive reactions
- the knowledge of phase equilibria for various systems
- different types of catalysts and catalyzed reactions
- Basic analytical techniques to analyze the catalyst

CHC7103 ADVANCED INORGANIC CHEMISTRY

L	T	P	C
3	0	0	3

OBJECTIVES:

To make the student conversant with the

- structure and bonding of organometallic compounds
- catalytic reactions of organometallic compounds
- role of metals and non-metals inside the living organisms
- molecular polyhedra in inorganic solids
- inorganic solid state
- basics of photochemistry

MODULE I ORGANOMETALLIC COMPOUNDS 09

18 electron rule: metal carbonyls, metal nitrosyls, metal alkyl and aryl complexes - preparation, structure, bonding, stereochemical non-rigidity.

MODULE II METAL CARBON PI COMPLEXES 09

Metal-alkene, alkyne and allyl complexes, cyclopentadiene and benzene complexes – preparation, structure and bonding - catalysis by organometallic compounds – hydrogenation, hydroformylation, stereoregular polymerization – Wacker process.

MODULE III BIO-INORGANIC CHEMISTRY 09

Metals and non-metals in biological systems - metal ion transport - oxygen carriers – haemoglobin, myoglobin - metallo-enzymes – carboxypeptidase-A, carbonic anhydrase, vitamin B_{12}, nitrogenase - electron transfer and redox systems - photosynthesis.

MODULE IV BONDING AND MOLECULAR POLYHEDRA IN INORGANIC SOLIDS 09

Boranes, borazines, silicates, phosphorous-nitrogen, sulphur-nitrogen compounds, metal clusters - inert gas compounds.

MODULE V INORGANIC SOLID STATE AND PHOTOCHEMISTRY 09

Preparation of non-molecular solids - band theory of solids - defects and non-stoichiometry, electrical and magnetic properties, superconductivity, amorphous solids, nonsolids - photochemistry – photophysical processes, spontaneous and stimulated emission of radiation, chemical actinometry, solar energy conversion and applications.

Total Hours: 45

REFERENCES:

1. Cotton F.A., Wilkinson G. and Gaus P., Basic Inorganic Chemistry, 3rd Edition, John Wiley and Sons, 2003.
2. Shriver D.F., Atkins P.W. and Langford C.H., Inorganic Chemistry, 2nd Edition, Oxford University Press (ELBS), Oxford, 1994.
3. Huheey J.E., Keiter E.A. and Keiter R.L., Inorganic Chemistry, 4th Edition, Addison Wesley Publication, London, 1993.
4. Cotton F.A., Wilkinson G., Murillo C.A., Bochmann M., Advanced Inorganic Chemistry, 6th Edition, John Wiley and Sons, New York, 2003.
5. Jolly W.L., Modern Inorganic Chemistry, 2nd Edition, McGraw-Hill, Inc., 1991.

OUTCOMES:

Students will be able to

- demonstrate basic principles of organometallic compounds.
- illustrate reactivity and stereochemistry of organometallic compounds.
- demonstrate the basic principles of bioinorganic chemistry.
- demonstrate the bonding in inorganic polyhedral solids.
- illustrate the basic principles of inorganic solid state.
- learn the basic principles of photochemistry
- illustrate the basic principles of band theory of solids.

LIST OF ELECTIVES

BASIC CHEMISTRY

CHCY001 GREEN CHEMISTRY	L	T	P	C
	3	0	2	4

OBJECTIVES:

To make the students conversant with the

- principle and advantages of green chemistry.
- principle and uses of microwave as a green technology.
- Applications of ionic liquids and phase transfer catalyst
- Application of supported catalysts and bio catalyst for green synthesis
- various alternative reagents and chemicals for green synthesis.

MODULE-I INTRODUCTION TO GREEN CHEMISTRY 09

Green chemistry-relevance and goals, Anastas' twelve principles of green chemistry - Tools of green chemistry: alternative starting materials, reagents, catalysts, solvents and processes with suitable examples.

MODULE-II MICROWAVE ASSISTED ORGANIC SYNTHESIS (MAOS) 09

Microwave activation – advantage of microwave exposure – specific effects of microwave – Neat reactions – solid supports reactions _ Functional group transformations – condensations reactions – oxidations – reductions reactions – multi-component reactions.

MODULE III IONIC LIQUIDS AND PHASE TRANSFER CATALYSIS 09

Introduction – synthesis of ionic liquids – physical properties – applications in alkylation – hydroformylations – epoxidations – synthesis of ethers – Friedel-craft reactions – Diels-Alder reactions – Knoevenegal condensations – Wittig reactions – Phase transfer catalyst - Synthesis – applications.

MODULE IV SUPPORTED CATALYSTS AND BIO-CATALYSTS FOR GREEN CHEMISTRY 09

Introduction – the concept of atom economy – supported metal catalysts – mesoporous silicas –the use of Biocatalysts for green chemistry - modified bio catalysts – fermentations and biotransformations – fine chemicals by microbial fermentations – vitamins and amino acids – Baker's yeast mediated biotransformations – Bio-catalyst mediated Baeyer-Villiger reactions – Microbial polyester synthesis.

MODULE V ALTERNATIVE SYNTHESIS, REAGENTS AND REACTION CONDITIONS 09

Photochemical alternative to Friedel-crafts reactions - Dimethyl carbonate as a methylating agent – the design and applications of green oxidants – super critical carbon dioxide for synthetic chemistry.

Total Hours: 45

REFERENCES:

1. Green Chemistry – Environmentally benign reactions – V. K. Ahluwalia. Ane Books India (Publisher). (2006).
2. Green Chemistry – Designing Chemistry for the Environment – edited by Paul T. Anastas & Tracy C. Williamson. Second Edition, (1998).
3. Green Chemistry – Frontiers in benign chemical synthesis and processes- edited by Paul T. Anastas & Tracy C. Williamson. Oxford University Press, (1998).
4. Green Chemistry – Environment friendly alternatives- edited by Rashmi Sanghi & M. M. Srivastava, Narora Publishing House, (2003).

OUTCOMES:

The students will demonstrate the

- principles and advantages of green chemistry.
- principles and uses of microwave as a green technology.
- Applications of ionic liquids and phase transfer catalyst
- Supported catalysts and bio catalyst for green synthesis
- various alternative reagents and chemicals for green synthesis

CHCY002 MOLECULAR SPECTROSCOPY

L	T	P	C
3	0	2	4

OBJECTIVES:

To make the students

- learn molecular spectroscopy as an important tool to understanding molecular structure and its characteristics.
- acquire a basic idea of different electromagnetic regions and instrumentation of various modern spectrometers
- demonstrate an understanding of the rotational, vibrational and electronic spectroscopy of diatomic and polyatomic molecules
- acquire the skill to determine the functional groups present in unknown molecules using vibrational (IR) spectra and to calculate maximum (λmaximum) absorption of molecules in Electronic (UV-Visible) region using Woodward-Fischer rule
- learn the magnetic properties of electrons and nucleus of atoms and free radicals, using spin angular momentum with the help of nuclear magnetic resonance and electron spin resonance spectra
- identify the unknown molecular formula of fragmented metastable ions of organic Compounds
- learn hyperfine interactions of nuclei present in a molecule

MODULE I ELECTROMAGNETIC RADIATION AND ROTATIONAL SPECTROSCOPY 09

Characterization of electromagnetic radiation – regions of the spectrum – basic elements of practical spectroscopy – enhancement of spectra – Applications of group theory – Microwave spectroscopy – rotational spectra of molecules – applications.

MODULE II INFRA-RED & RAMAN SPECTROSCOPY 09

Infra-red spectroscopy – harmonic and unharmonic vibrations – dissociation energy of diatomics – vibrating rotator – PQR branches in IR spectra – Fermi resonance – Raman spectroscopy – mutual exclusion principle.

MODULE III ELECTRONIC SPECTROSCOPY 09

Electronic spectra of diatomic molecules: Born Oppenheimer approximation,Franck-Condon principle, selection rules, intensity of electronic transition, vibronic coupling, types of electronic transition - UV-Visible spectroscopy –solvent effects – Woodward-Fischer rule to conjugated dienes.

MODULE IV SPIN RESONANCE SPECTROSCOPY 09

Proton magnetic resonance spectroscopy – relaxation processes – chemical shift – coupling – ^{13}C NMR spectra – Electron spin resonance spectroscopy – hyperfine interactions.

MODULE V MASS SPECTROMETRY 09

Reactions of ions in gas phase – effect of isotopes – nitrogen rule –determination of molecular formula – fragmentations and rearrangements –metastable ions – fragmentation of organic compounds. Application of Massspectroscopy with GC.

Total Hours: 45

REFERENCES:

1. Banwell C.N. and McCash E.M., Fundamentals of Molecular Spectroscopy, 4th Edition, Tata McGraw Hill, New Delhi, 1995.
2. Kemp W., Organic Spectroscopy, 3rd Edition, ELBS, McMillan, London, 1991.
3. Drago R., Physical Methods for Chemists, Saunders, Philadelphia, 1992.
4. Williams D.H. and Fleming I., Spectroscopic Methods in Organic Chemistry, 4th Edition, McGraw Hill, New York, 1989.
5. Pasto D., Johnson C. and Miller M., Experiments and Techniques in Organic Chemistry Prentice-Hall Inc., New Jersey, 1992.
6. Pavia D.L., Lampman G.M. and Kriz G.S., Introduction to Spectroscopy, 3rd Edition, Brooks/Cole Publication, Singapore, 2001.
7. Robert M. Silverstein, Francis X. Webster, David Kiemle, Spectrometric Identification of Organic Compounds, 7th Edition, Wiley, 2005.

OUTCOMES:

The students will be able to

- gain the theoretical knowledge of the various spectroscopic methods on the basis of the examples from the science and industry.
- become familiar with modern spectrometers and methods, which are applied in industrial and scientific laboratories in the field of synthesis and structural determination.

CHCY003 PHOTOPHYSICS AND PHOTOCHEMISTRY

L	T	P	C
3	0	0	3

OBJECTIVES:

To make the students conversant with the

- basic laws of photophysics and photochemistry.
- principle and instrumentation of different types of spectrofluorimeter.
- Basics of fluorescence spectroscopy
- Different types of photochemical reactions
- Applications of solar energy materials.

MODULE I BASICS OF PHOTOPHYSICS AND PHOTOCHEMISTRY: **09**

Basic laws, Einstein Laws – absorption, Fundamentals of absorption- absorption coefficients, electronic transitions. Excited state energy relaxations – Jablonski diagram, Radiative and non-radiative relaxations, fluorescence, phosphorescence, Lifetime and quantum yield, Stokes Shift, Kasha's rule.

MODULE II INSTRUMENTATION TECHNIQUES: 09

Spectrophotometer, light Sources, photochemical quauntum yield and intensity measurements, detectors-PMT, Diode-array. Spectrofluorimeter – Steady state and Time-resolved fluorimeter. Study using time resolved techniques – pump-probe methods and instrumentation: Lasers-nanosecond, picosecond and femtosecond. Measurement of – Triplet quantum yield and Time resolved absorption spectrum. Fluorescence standards – lifetime and quantum yield.

MODULE III FLUORESCENCE SPECTROSCOPY: **09**

Quenching of fluorescence, fluorescence lifetime, fluorescence quantum yield-method of determination, Rotation diffusion, Time resolved anisotropy, environmental influence on fluorescence properties and photo-bleaching. Solvent effect-Lippert equation, excited state acidity constants, Fluorescence analysis of excited state reactions. Ultrafast solvation dynamics.

MODULE IV PHOTOCHEMICAL REACTIONS: **09**

Norrish type reactions. Paterno-Büchi Reaction. Quenching by excitation transfer (Förster and Dexter), electron transfer, excited state complex formation, heavy atoms and paramagnetic effects, Proton transfer, addition reactions, elimination reactions, photoisomerisation, photosensitisation, Distance dependence of electron transfer (superexchange). Electron transfer to metals and semiconductors.

MODULE V APPLICATIONS: SOLAR ENERGY MATERIALS: **09**

Photovoltaic cells – 1st,2nd, 3rd generation cells - Organic Solar Cells-Single Layer, Double layer, Bulk heterojunction, DSSC, Tandem structured – Fabrication, Key Processes and issues – Materials – Low molecular weight – Polymeric – Donor-acceptor polymeric systems – Devices- Characteristics.

Total Hors:

OUTCOMES:

After completing the course the student should be able to

- describe and explain common photochemical and photophysical processes and mechanisms with suitable theoretical models, and apply established experimental methods for the investigation of these processes
- describe the interaction of excited states with their surroundings and analyse photoinduced electron transfer and excitation energy transfer with quantitative models
- describe the structure and function of photosynthetic reaction centres, and explain the function of photosynthetic antenna systems
- describe photoinduced processes in semiconductors and at molecule-semiconductor interfaces, and explain how these can be used for photophysical energy conversion and in photocatalysis
- describe and explain the impact and applications of photochemistry

REFERENCES::

1. Principles of Fluorescence Spectroscopy by Joesph R. Lakowicz
2. Fundamentals of photochemistry by k. k. Rohatgi-Mukherjee
3. Modern molecular Photochemistry of Organic molecules by N. J. Turro

OUTCOMES:

The students will acquainted with the

- basic laws of photophysics and photochemistry.
- principle and instrumentation of different types of spectrofluorimeter.
- Basics of fluorescence spectroscopy
- Different types of photochemical reactions
- Applications of solar energy materials.

CHCY004 PHOTOCHEMISTRY

L	T	P	C
3	0	0	3

OBJECTIVES:

To make the students conversant with the

- Principles and concepts of photochemistry.
- Measurement of fluorescence and phosphorescence
- Different types of photochemical reactions
- Different types of photochemical reactions
- Applications of solar energy materials.

MODULE I PRINCIPLES AND CONCEPTS

An overview of: Laws of photochemistry, Beer-Lambert law, electronic energy levels, atomic and molecular term symbols, singlet-triplet state, intensity and strength of electronic transition, selection rules for electronic transition, Jablonski diagram and photophysical processes, Franck-Condon principle.

Excited state lifetime, steady state and time resolved emission, factors affecting excited state energy: solvent effect, TICT.

Excited state kinetics, quantum yield expressions, excimer and exciplex, kinetics of luminescence quenching: static and dynamic, Stern-Volmer analysis, deviation from Stern-Volmer kinetics. Photoinduced electron transfer rates, free energy dependence of electron transfer on rate, Photoinduced energy transfer, FRET, rate and efficiency calculation of FRET.

MODULE II METHODS

Measurement of fluorescence and phosphorescence and lifetimes. Introduction to time-resolved techniques for absorption and emission measurements, detection and kinetics of reactive intermediates. Examples of low temperature matrix isolation of reactive intermediates.

MODULE III REACTIONS

Photochemistry of alkene, cis-trans isomerization, photocycloaddition reactions of alkene, photochemical electrocyclic and sigmatropic reactions, di-pi-methane rearrangment, electron transfer mediated reactions of alkene. Photochemistry of carbonyl compounds, Norrish type I and type II reactions, enone and dienone cycloadditions. Photochemistry of aromatic systems, electron transfer and nucleophilic substitution reactions. Photochemistry of nitro, azo and diazo compounds. Photochemistry involving molecular oxygen, generation and reactions of singlet oxygen. Photo-fragmentation reactions (Barton, Hofmann-Loffler-Freytag)

MODULE IV REACTIONS IN AROMATIC COMPOUNDS

Photochemistry of aromatic systems, electron transfer and nucleophilic substitution reactions. Photochemistry of nitro, azo and diazo compounds. Photochemistry involving molecular oxygen, generation and reactions of singlet oxygen. Photo-fragmentation reactions (Barton, Hofmann-Loffler-Freytag)

MODULE V APPLICATIONS

Fluorescence based sensors – examples of molecular and supramolecular systems. Conversion of solar energy to chemical and other forms of energies, solar photovoltaic cell, basic principle and design of the cell.

Total Hors:

REFERENCES:

1. Fundamental of Photochemistry, K. K. Rohatgi-Mukherjee, New Age International (P) Ltd., New Delhi, 1986.
2. Principles of Fluorescence Spectroscopy, 3rd Ed., J. R. Lakowicz, Springer, New York, 2006.
3. Fundamentals of Photoinduced Electron Transfer, G. J. Kavarnos, VCH publishers Inc., New York, 1993.
4. Molecular Fluorescence: Principles and Applications, B. Valeur, Wiley-VCH Verlag GmbH, Weinheim, 2002.
5. Modern Molecular Photochemistry of Organic Molecules, N. J. Turro, V. Ramamurthy, J. C. Scaiano, University Science, Books, CA, 2010.
6. Photochemical Synthesis, I. Ninomiya, T. Naito, Academic Press, New York, 1989.

OUTCOMES:

To make the students acquainted with the

- Principles and concepts of photochemistry.
- Measurement of fluorescence and phosphorescence
- Different types of photochemical reactions
- Different types of photochemical reactions
- Applications of solar energy materials.

MEDICINAL, PHARMACEUTICAL AND BIOLOGICAL CHEMISTRY

CHCY005 BIOCHEMISTRY	L	T	P	C
	3	0	2	4

OBJECTIVES:

The student are trained about

- Mechanism of enzymes and coenzymes.
- Carbohydrate metabolism
- Lipid metabolism and biological oxidation.
- Biochemistry of amino acids
- Biochemistry of proteins

MODULE I ENZYMES AND COENZYMES 08

Enzymes: Nomenclature, enzymes-kinetics and mechanism of action, mechanism of inhibition of enzymes and isoenzymes in chemical diagnosis. Co-enzymes: Vitamins as co-enzymes and their significance - Metals as co-enzymes and their significance.

MODULE II CARBOHYDRATE METABOLISM 08

Glycolysis, gluconeogenesis and glycogenolysis - metabolism of galactose and galactosemia - role of sugar nucleotides in biosynthesis and pentose phosphate pathway - citric acid cycle, significance, reactions and energetics of the cycle.

MODULE III LIPID METABOLISM AND BIOLOGICAL OXIDATION 08

Oxidation of fatty acids-oxidation and energetics, biosynthesis of ketone bodies and their utilization, biosynthesis of saturated and unsaturated fatty acids, regulation of lipid metabolism, essential fatty acids. The respiratory chain, its role in energy capture and control, energetics of oxidative phosphorylation, mechanism of oxidative phosphorylation.

MODULE IV BIOCHEMISTRY OF AMINOACIDS 08

Biosynthesis of amino acids, catabolism of amino acids and conversion of amino acids to specialized products, biosynthesis of purine and pyrimidine - formation of deoxyribonucleotides.

Biosynthesis of RNA, DNA replication, carcinogensis and DNA repair mechanism.

MODULE V BIOCHEMISTRY OF PROTEINS 08

Genetic code and protein synthesis, components of protein synthesis, inhibition of protein synthesis. Regulation of gene expression (Prokaryote and Eukaryote).

PRACTICAL **20**

1. Preparation of standard buffers (citrate, phosphate and carbonate) and measurement of pH.
2. Titration curve for amino acids.
3. Separation of amino acids by chromatography.
4. The separation of lipids by TLC.
5. Quantitative estimation of amino acids.
6. The determination of glucose by means of the enzyme glucose oxidase.
7. Enzymatic hydrolysis of glycogen by α and β-amylase.
8. Effects of temperature on the activity of α- amylase.
9. Estimation of cholesterol in Blood.
10. Estimation of Glucose in blood and urine.
11. Estimation of Urea in blood.
12. Estimation of ketone bodies in blood.
13. Qualitative analysis of inorganic as well as organic constituents of Urine.

Total Hours:

REFERENCES:

1. Conn E.E. and Stumph P.K., Outline of Biochemistry, John Wiley and Sons, New York.
2. Nelson D.L. and Cox M.M., Lehninger Principles of Biochemistry, Macmillan Worth Publishers.
3. Stryer L., Biochemistry, W.H., Freeman and Company, San Francisco.
4. Harrow B. and Mazur A., Text book of Biochemistry, W.B. Saunders Co., Philadephia.
5. Harpers Review of Biochemistry, Lange Medical Publication.
6. Jayaraman J., Laboratory Manual in Biochemistry, Wiley Eastern Limited.
7. Plummer David J., An Introduction to Practical Biochemistry, McGraw Hill, New Delhi.
8. Singh S.P., Practical Manual to Biochemistry, CBS Publisher, New Delhi.

OUTCOMES:

The students are acquainted with the

- Mechanism of enzymes and coenzymes.
- Carbohydrate metabolism
- Lipid metabolism and biological oxidation.
- Biochemistry of amino acids
- Biochemistry of proteins
- Different types of textile mat

CHCY007 PHARMACEUTICAL TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

To make the student learn about the

- pre formulation studies
- additives used in formulations
- evaluation of drug and packaging
- cosmetic preparations

MODULE I PRE-FORMULATION STUDIES 09

Study of physical properties of drug like physical form, particle size, shape, density, wetting, dielectric constant, solubility, dissolution and organoleptic properties and their effect on formulation, stability and bioavailability – Drug delivery types and methods including nano-delivery system.

MODULE II LIQUID DOSAGE FORMS 09

Introduction, types of additives used in formulations, vehicles, stabilizers, preservatives, suspending agents, emulsifying agents, solubilizers, colors, flavours and others, manufacturing packaging and evaluation of clear liquids, suspensions and emulsions.

MODULE III SEMISOLID DOSAGE FORMS 09

Definitions, types, mechanisms of drug penetration, factors influencing penetration, semisolid bases and their selection, general formulation of semisolids, clear gels and manufacturing procedure, evaluation and packaging.

MODULE IV SUPPOSITORIES 09

Ideal requirements, bases, manufacturing procedure, packaging and evaluation.
Pharmaceutical Aerosols: Definition, propellants, general formulation, manufacturing and packaging methods, pharmaceutical applications.

MODULE V COSMETOLOGY AND COSMETIC PREPARATIONS 09

Structure of skin, formulation of cold cream, vanishing cream, cleansing cream, all purpose cream, protective cream, antiperspirants, deodorant, face powder - Hair structure, Shampoos, Conditioner, Shaving and after shaving products, Dentrifice and Mouthwash, Lipstick, Nail lacquer.

Total Hours: 45

REFERENCES:

1. Remington's Pharmaceutical Sciences, Volume I and Volume II, Mack Publishing Co., USA.
2. Cooper J.W., and Gunn G., Tutorial Pharmacy, Petman Books Ltd., London.
3. Lachman L., Lieberman H.A, Kanig J.L, Theory and Practice of Industrial Pharmacy, Lea and Febiger, Philadelphia, USA.
4. Ansel H.C., Introduction to Pharmaceutical Dosage Forms, Lea and Febiger, Philadelphia, USA.
5. R.L. Juliano, Drug Delivery Systems, Oxford University Press, Oxford.
6. Harrys Cosmetology.
7. Balsam and Sagarin, Cosmetics: Science and Technology.
8. Thomssen E.G., Modern Cosmetics, Universal Publishing Corporation.
9. Mittal B.M. and Saha R.N., A Handbook of Cosmetics, Vallabh Prakashan.

OUTCOMES:

The students will be familiar with the

- pre formulation studies
- additives used in formulations
- evaluation of drug and packaging
- preparations of cosmetic

CHCY007 GMP, QUALITY ASSURANCE and VALIDATION

L	T	P	C
3	0	0	3

OBJECTIVES:

To make the student learn about the

- good manufacturing practices
- documentation, quality management and control
- Validation methods
- IPQC problems
- Sampling and operating characteristics curves

MODULE I GOOD MANUFACTURING PRACTICE 09

Requirements of GMP, CGMP1, GLP, USFDA, WHO guidelines and ISO 9000 series.

MODULE II DOCUMENTATION AND 09

Documentation - Protocols, Forms and maintenance of records in Pharmaceutical industry - Preparation of documents for new drug approval and export registration.

MODULE III QUALITY ASSURANCE 09

Basic concept of C, Quality assurance systems, Sources and control of quality variation - raw materials, containers, closures, personnel, environment etc.

MODULE IV VALIDATION 09

Concepts in validation, validation of manufacturing and analytical equipment, Process validation in manufacturing dosage formulations, applications of process validation.

MODULE V QUALITY CONTROL 09

In process quality control tests, IPQC problems in pharmaceutical industries - Sampling plans, Sampling and operating characteristics curves.

Total Hours:

REFERENCES:

1. Willing, Tuckerman and Hitchings, Good Manufacturing Practices for Pharmaceuticals.
2. OPPI, Quality Assurance.
3. Loftus and Nash, Pharmaceutical Process Validation.
4. Florey, Analytical Profile of Drugs (All volumes).
5. Indian Pharmacopoeia.
6. MODULEed States Pharmacopoeia.

7. British Pharmacopoeia.
8. Garfield, Quality Assurance Principles for Analytical Laboratories.

OUTCOMES:

The student will be able to demonstrate the

- good manufacturing practices
- documentation, quality management and control
- Validation methods
- IPQC problems
- Sampling and operating characteristics curves

CHCY008 MEDICINAL AND PHARMACEUTICAL CHEMISTRY

L	T	P	C
3	0	0	3

OBJECTIVES:

To make the student to learn

- The basic factors governing drug design
- The synthesis and drug action of anti-malarial, anti-bacterial and anti-tuberculosis drugs, etc.

MODULE I INTRODUCTION TO DRUG DESIGN 09

Factors governing drug design – advantages – types of drug – literature survey for preparation of drugs – characterization and structural elucidation of drugs using different spectral methods.

MODULE II ANALGESICS, ANTIHISTAMINES AND ANTIMALARIALS 09

Analgesics – narcotic analgesics – morphine analogues – synthesis of codeine – synthetic narcotic analgesics –– antipyretic analgeics – salicyclic acid analogues –– para amino phenol derivatives – Antihistamines-structure, synthesis, activity promethazine, chlorpheneraminemaleate - Antimalerials – classification- structure, synthesis, drug action - quinine-4-amino and 8-amino quinolines – chloroquine.

MODULE III ANTIBIOTICS AND ANTIBACTERIALS 09

Synthesis and mode of action -Antibiotics – pencillin, D-pencillamine, semisythetic pencillin – chloramphenicol streptomycin, tetracyclines, cephalosporins,-Antibacterials – norfloxacin, ciprofloxacin, clotrimazole,

MODULE IV ANTIHYPERTENSIVE, Anti-Infectives and Antivirals 09

Synthesis and drug action - Antihypertensive drugs-methyldopa - antiseptics and disinfectants: benzalkonium chloride - anthelmintics: mebendazole - antivirals: amantadine, acyclovir.

MODULE V STEROIDS AND RELATED DRUGS 09

Introduction, classification, nomenclature and stereochemistry - (A) Androgens - testosterone (B) Estrogens and progestational agents – progesterone, estradiol, (C) Adrenocorticoids – prednisolone, dexamethasone- prostaglandins: misoprostol,

Total Hours: 45

REFERENCES:

1. J. B. Stenlake, Medicinal and Pharmaceutical Chemistry, Volume 1, Viva /b S Publication, 1979.
2. A. Berger, Medicinal Chemistry, Wiley Interscience, New York, Volume 1 and 2, 1990.
3. Bentely and Driver's Textbook of Pharmaceutical Chemistry, Oxford University Press, 1985.
4. David A. Williams, David A. Williams A, William O. Foye, Thomas L. Lemke, Foye's Principles of Medicinal Chemistry, Wolter Kluwer, 2008.
5. J. B. Stenlake, The Chemical Basis of Drug Action Volume 2, Viva /b S Publication, 1979.

OUTCOMES:

The student will be familiar with

- The drug design,
- The functions of various drugs
- the drug action and uses

MATERIALS AND TECHNOLOGY

CHCY009	POLYMER CHEMISTRY	L	T	P	C
		3	0	2	4

OBJECTIVES:

To make the student conversant with the

- basic concepts of polymers, molecular weight and its distribution
- kinetics and mechanism of Addition, Coordination and Condensation polymerization
- various polymerization techniques
- various testing methods for mechanical, thermal and electrical properties
- preparation, properties and applications of polymeric materials.

MODULE I BASIC CONCEPTS OF POLYMERS 09

Basic concepts of polymers – classification of polymers: source, structure, processing behavior, composition and structure, mechanism, application – copolymer: types – terpolymer: Definition - nomenclature of polymers - tacticity – crystalline and amorphous polymers - thermal transitions – Molecular weight of polymer – number, weight and viscosity average molecular weights – molecular weight distribution (problems)

MODULE II KINETICS AND MECHANISM OF POLYMERISATION REACTIONS 09

Kinetics and mechanism of addition polymerization: free radical, cationic and anionic polymerizations – Trommsdroff effect – living polymers – Ziegler-Natta catalysts – coordination polymerization – Kinetics of polycondensation reactions – copolymer equation-Reactivity ratio and copolymerization behavior.

MODULE III POLYMERISATION TECHNIQUES 09

Polymerisation techniques – homogenous and heterogeneous polymerization – bulk, solution, suspension and emulsion polymerization – merits and demerits – interfacial, and melt polycondensation

MODULE IV POLYMER TESTING AND ANALYSIS 09

Mechanical properties : tensile strength, Flexural strength, Compressive strength, Izod impact, Rockwell hardness – thermal properties : TGA and DSC - electrical properties: dielectric constant, dissipation factor, and dielectric strength – molecular weight: determination by GPC and viscometry.

MODULE V POLYMERIC MATERIALS 09

Preparation, properties and applications – thermoplastics : LDPE, HDPE, PVC, PTFE, PET and Nylons – thermosets : phenolic resins, epoxy resins, unsaturated polyesters and polyurethanes – polymer blends and alloys – reinforced plastics.

Total Hours:

REFERENCES:

1. Billmeyer F.N., Text Book of Polymer Science, 3rd Edition, John Wiley and Sons, New York, 1994.
2. George Odian, Principles of Polymerisation, 3rd Edition, McGraw Hill Book Company, New York, 1991.
3. Young R.S., Introduction to Polymers, Chapman and Hall Ltd., London, 1981.
4. P. J. Flory., Principles of Polymer Chemistry, Cornell Press (recent edition).
5. Vishu shah., Handbook of plastics testing and failure analysis, John Wiley and Sons, New Jersey, 2007.
6. I.M. Ward and D.W. Hadley, An Introduction to the Mechanical Properties of Solid Polymers, John Wiley and Sons, Chichester, England, 1993.
7. C.C. Ku and R. Liepins, Electrical Properties of Polymers, Hanser Publications, Munich, 1987.
8. Jacqueline I., Kroschwitz, Concise Encyclopedia of Polymer Science and Engineering, John Wiley and Sons, New York, 1998.
9. Michael L. Berins, Plastics Engineering Hand Book, 5th Edition, Chapman and Hall, New York, 1991.
10. Gowarikar V.R., Viswanathan N.V and Jayadev Sreedhar, Polymer Science, Wiley Eastern Limited, Madras, 1981.

OUTCOMES:

The student will be able to

- classify various polymers, calculate molecular weight of polymers, explain the theory of crystallinity and thermal transitions.
- derive the rate equations and explain the mechanism of polymerization reactions
- compare and contrast the various polymerization techniques with its merits and demerits.
- analyze and test the polymers for the mechanical, thermal and electrical properties
- summarize the preparation, properties and applications of different polymeric materials

CHCY010 NANOTECHNOLOGY

L	T	P	C
3	0	2	4

OBJECTIVES:

To make the students conversant with the

- definition and significance of nanoscale materials and their properties
- different methods of preparation of nanomaterials
- various tools for characterizing nanomaterials
- applications and impacts of nanotechnology

MODULE I INTRODUCTION OF NANOMATERIALS 12

Definition of nano - significance of the nanoscale - nanomaterials - Classification - nanoscale in one dimension -thin films, layers and surfaces - nanoscale in two dimensions - carbon nanotubes- inorganic nanotubes, nanowires, biopolymers- nanoscale in three dimensions – nanoparticles, fullerenes, carbon 60, dendrimers, quantum dots; Nanomachines and Devices. Properties of nanomaterials: Size and shape dependent optical (quantum confinement in semiconductors), electronic, emission, transport, photonic, refractive index, dielectric, mechanical, magnetic, catalytic and photocatalytic, non-linear optical properties.

MODULE II PREPARATION OF NANOMATERIALS 15

Methods of preparation of nanomaterials, top-down approach and bottom-up: Mechanical milling, laser ablation, electrodeposition, sputtering and microwave plasma synthesis, inert gas condensation - Chemical reduction and oxidation, hydrothermal, micelles, sol-gel processes, photolysis, radiolysis and metallo-organic chemical vapour deposition.

MODULE III CHARACTERIZATION TECHNIQUES 12

Structural Characterization: Atomic Force Microscopy (AFM): Contact and Tapping Mode – Scanning Electron microscopy (SEM), Transmission electron microscopy (TEM), and Powder XRD. Chemical Characterization: Optical spectroscopy, X-ray Photoelectron spectroscopy (XPS). Physical properties: Melting point, Lattice constant. Electrical and magnetic characterization: Mechanical properties- Nanoindentation and nanotribology.
Introduction to advanced Scanning Probe Microscopy - Electrostatic Force Microscopy (EFM) - Magnetic Force Microscopy (MFM) - Scanning Thermal Microscopy (SThM), Scanning Tunnelling Mode (STM), Piezoelectric force microscopy (PFM), Scanning Capacitance Microscopy (SCM).

MODULE IV APPLICATIONS AND ENVIRONMENTAL IMPACTS 11

Current applications - sunscreens and cosmetic, composites, clays, coatings and surfaces, tougher and harder cutting tools. Short-term Applications – Paints, remediation,

fuel cells, displays, batteries, fuel additives, catalysts. Long - term Applications - lubricants, magnetic materials, medical implants machinable ceramics, water purification, military battle suits. Biomedical applications – Photodynamic therapy in targeted drugs, biosensors, quantum dot technology in cancer treatment, nanoparticles as a drug carrier. Environmental Impacts: toxicological health effects, relevant parameters in nanoparticle toxicology, integrated concept of risk assessment of nanoparticles

MODULE V CARBON NANOSTRUCTURES 15

History – Carbon nanotubes, carbon clusters, production methods - arc method, laser method, chemical vapour deposition, purification methods- gas phase, liquid phase, intercalation, - dispersion - fuctionalization -chopping, oxidation, and “wrapping” of CNTs. Properties of carbon nanotubes: Electrical conductivity, strength and elasticity, thermal conductivity and expansion, field emission, high aspect ratio, highly absorbent.

Applications of carbon nanostructures - field emission, conductive or reinforced plastics, energy storage, conductive adhesives and connectors, molecular electronics, thermal materials, structural composites, fibers and fabrics, catalyst support, CNT ceramics, biomedical applications, air, water and gas filtration.

Total Hours: 60

REFERENCES:

1. Pradeep T., Nano: The Essentials Understanding Nanoscience and Nanotechnology, Tata McGraw-Hill, New Delhi, 2007.
2. Mark Ratner and Daniel Ratner, Nano Technology, Pearson Education, New Delhi, 2003.
3. Tlusty J, Machining Processes and Equipment, 2nd Edition, Prentice Hall, 2000. Viswanathan B., Nano Materials
4. Nanobiotechnology by Subbiah balagi, MJP Publishers, India (2010)

OUTCOMES:

The students will be able to

- differentiate the nanomaterials based on their dimensions
- acquire knowledge of various synthetic methods and characterization techniques
- select the appropriate nanomaterials for specific applications

CHCY011	ELECTRICAL PROPERTIES OF POLYMERIC MATERIALS	L	T	P	C
		3	0	0	3

OBJECTIVES:

To make the student to learn

- The blend morphology
- Effect of structural features
- Resistivity, thermal behavior and electrical behavior of polymeric materials

MODULE I POLYMER BLENDS 09

Introduction – equilibrium phase – polymer behaviour – effect of polymer structure, polymer – polymer interaction – special structural effects – blend morphology – chemical reactions – properties – miscible blends – immiscible blends – toughened polymers - Commercial blends – applications.

MODULE II RESISTIVITY 09

General features – polymer as wide band gap insulators – theories –trapping – carrier injection – effects of structural features – effects of additives.

MODULE III DIELECTRIC BEHAVIOUR 09

Mechanism of laws – relaxation – non-polar polymers – amorphous dipolar polymers – crystalline dipolar polymers – effects of structures, additives and impurities – testing of degradation in polymers.

MODULE IV THERMAL PROPERTIES 09

Specification of thermal evaluation and classification of electrical insulation – determination of resistivity – relating resistance of solid insulating materials – relating resistance of insulating materials to breakdown by surface discharges – artificial pollution tests of HV insulator – AC, DC.

MODULE V BREAKDOWN TESTING ANALYSIS 09

Breakdown test methods – statistical analysis – graphical techniques – numerical techniques.

Total Hours:

REFERENCES:

1. J. Kreschurity, concise Encyclopedia of polymer Science and Engineering, John Wiley and Sons, New York, 1990.
2. M.E. Balrd, Electrical Properties of Polymeric Materials, The Plastic Institute,

London.
3. A. Bradwell (Editor), Electrical Insulation, Peter Peregrinus Ltd., 1983.
4. Tiller Shugg W., A Handbook of Electrical and Electronic Materials, Van Nostrand Reinhold, New York, 1986.
5. L.A. Dissado and J.C. Fothergil, Electrical Degradation and Breakdown in Polymers, Peter Perenguins Ltd., London, 1992.

OUTCOMES:

The student will be familiar with the electrical behavior of polymeric materials

CHCY012 POLYMER STRUCTURE AND PROPERTY RELATIONSHIP

L	T	P	C
3	0	0	3

OBJECTIVES:

To make the student to learn the

- structure of polymers
- various properties of polymers

MODULE I STRUCTURE OF POLYMERS 09

Linear, branched, cross linked, and network polymers - homochain and hetero atomic chain polymers - Copolymers - Linear and cyclic arrangement - Prediction of polymer properties, group contribution techniques, topological techniques - Volumetric properties - molar volume, density, vanderWaals volume - Coefficient of linear thermal expansion and volumetric thermal expansion - Pressure volume temperature (PVT) relationship.

MODULE II MECHANICAL PROPERTIES 09

Stress-strain properties of polymers - Effect of polymer structure on modulus of elasticity, tensile strength, flexural strength, impact strength, yield strength, fracture toughness - Crazing in glassy polymers - Ductile brittle transition - Effect of additives on mechanical properties of polymers - Creep, stress relaxation and fatigue.

MODULE III THERMODYNAMIC AND TRANSITION PROPERTIES 09

Transition temperature in polymers, glass transition (Tg), melt transition (Tm), relationship between Tg and Tm - other transitions like β-transitions, upper and lower glass transition temperatures - Prediction of Tg and Tm of polymers by group contributions. Calorimetric properties - Heat capacity, specific heat, latent heat of crystallization and fusion, enthalpy and entropy - Calculation of heat capacities of polymers.

MODULE IV ELECTRICAL AND OPTICAL PROPERTIES 09

Effect of polymer structure on dielectric constant, power factor, dissipation factor, and loss factor - effect of frequency of voltage and temperature on dielectric properties - Prediction of molar polarization and effective dipole moment - Effect of …additives on electrical properties of polymers - Optical properties - Effect of polymer structure on optical properties - clarity, transparency, haze, transmittance, reflectance, and gloss - Prediction of refractive indices of polymers by group contributions.

MODULE V CHEMICAL PROPERTIES 09

Cohesive energy, cohesive energy density, solubility parameter, determination of solubility parameter of polymers - Prediction of solubility parameter - Effect of polymer structure on solubility in solvents and oils - Influence of structure in prediction of flame

retardancy, water repellency - Chemical resistance of polymers - Polymer toxicity.

Total Hours: 45

REFERENCES:

1. D.W. vanKrevelen and P.J. Hoftyzen, Properties of Polymer, 3rd Edition, Elsevier Scientific Publishing Company Amsterdam, Oxford New York, 1990.
2. J.E. Mark (Editor), AIP, Physical Properties of Polymers Hand Book, Williston, 1996.
3. D.A. Seanor, (Editor), Electrical Properties of Polymers, Academic press, New York, 1982.
4. Jozef Bicerano, Prediction of Polymer Properties, 2nd Edition, Marcel Dekker Inc. New York, 1995.
5. J.M. Margolis (Editor), Engineering Thermoplastics Properties and Applications, Marcel Dekker, New York 1985.
6. R.J. Samuels, Structured Polymer Properties, John Wiley and Sons, New York, 1974.
7. I.M. Ward and D.W. Hadley, An Introduction to the Mechanical Properties of Solid Polymers, John Wiley and Sons, Chichester, England, 1993.
8. C.C. Ku and R. Liepins, Electrical Properties of Polymers, Hanser Publications, Munich, 1987.
9. F. Bueche, Physical Properties of Polymers, Wiley, New York, 1962.
10. J. Mort and G. Pfister, (Editor), Electronic Properties of Polymers, Wiley Interscience, New York, 1982.

OUTCOMES:

At the end of the course, the students will be familiar with the

- structure of polymers
- effect of polymer structure on the properties such as mechanical, electrical and optical properties

CHCY013 CONCEPTS AND TECHNIQUES IN CATALYSIS

L	T	P	C
3	0	0	3

OBJECTIVES:

The objectives of this course is to

- impart the basic concepts involved in catalytic processes.
- learn the different preparation methods of catalysts such as by precipitation, impregnation, mixing method, ion-exchange, etc.
- develop a knowledge in the physic-chemical and spectral characterization methods for catalytic materials.
- evaluate the catalysts using different catalytic reactors
- use different types catalysts for various organic reactions in detail.

MODULE I CONCEPTS OF CATALYSIS 09

acid-base catalysis – catalysis by transition metal ions and their complexes – supported transition metal complexes as catalysts – catalysis by enzymes – phase transfer catalysis - photocatalysis – adsorption – chemisorption on metals, metal oxides and semiconductors - kinetics of unimolecular and bimolecular surface reactions - Contact time - WHSV - time on stream - Catalyst deactivation and regeneration

MODULE II HETEROGENEOUS CATALYSTS AND THEIR SYNTHESIS 09

Metals, metal oxides, mixed metal oxides, supported metals, spinels, perovskites, super acids, hydrotalcites, zeolites and zeotypes (small, medium, large), shape selective catalysts, mesoporous materials (SBA, MCM, KIT, AlPOs)

Hydrothermal synthesis, sol-gel process, impregnation method, ion-exchange method - MODULE operations in catalyst manufacture - drying, calcination, spray drying

MODULE III CATALYSTS CHARACTERIZATION 09

Diffuse Reflectance Infrared Fourier Transform Spectroscopy (DRIFT), Diffuse Reflectance UV-Visible Spectroscopy (DRSUV), X-ray Powder Diffraction (XRD), Brunauer-Emmett-Teller (BET) Surface Area Analysis, Barrett-Joyner-Halenda (BJH) Pore Size and Volume AnalysisMagic Angle Spinning Nuclear Magnetic Resonance (MAS NMR) (^{209}Si, ^{27}Al, ^{31}P), Auger Electron Spectroscopy (AES), Scanning Electron Microscopy and Energy Dispersive Spectroscopy (SEM/EDAX), Electron Probe Micro-Analyzer (EPMA), Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP-AES), X-ray Photoelectron Spectroscopy (XPS), Extended X-ray Absorption Fine Structure Spectroscopy (EXAFS), Transmission Electron Microscopy (TEM), Electron Spin Resonance Spectroscopy (ESR).

MODULE IV CATALYTIC REACTORS 09

Integral and fixed bed reactors - differential reactors - stirred flow reactors - microcatalytic reactors of pulse type - static reactors – high pressure reactors - reaction monitoring by GC and GC-MS

MODULE V CATALYTIC REACTIONS 09

Catalytic asymmetric synthesis - C-C, C-H bond formation, oxidation - acid catalysed isomerisation - heterogeneous hydrogenation, dehydrogenation, cyclo dehydrogenation, oxidation - Homogeneous catalysis by transition metal complexes - metathesis of olefins - synthetic fuels

Total Hours: 45

REFERENCES:

1. J. Rajaram and J.C. Kuriacose, Kinetics and Mechanisms of Chemical Transformations, Macmillan Publishers India Limited, 2000.
2. John Meurig Thomas and W. John Thomas, Principles and Practice of Heterogeneous Catalysis, Wiley, 1997.
3. Herman Pines, The Chemistry of Catalytic Hydrocarbon Conversions, Academic Press, 1981.
4. J.W. Niemantsverdriet, Spectroscopy in Catalysis, 2nd Edition, John Wiley and Sons, 2008.
5. 2Gadi Rothenberg, Catalysis: Concepts and Green Applications, WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim, 2008.
6. B. Viswanathan, S. Sivasanker and A.V. Ramaswamy (Editors), Catalysis: Principles and Applications, Narosa Publishing House, 2002.
7. Julian R.H. Ross, Heterogeneous Catalysis: Fundamentals and Applications, Elsevier, 2011.
8. Gerhard Ertl, Handbook of Heterogeneous Catalysis, 2nd Edition, Volume 6, Wiley-VCH-Verlag, 2008.
9. Charles N. Satterfield, Heterogeneous Catalysis in Practice, McGraw-Hill, 1980.
10. Jens Hagen, Industrial Catalysis: A Practical Approach, 2nd Edition, Wiley, 2006.
11. Jens Weitkamp, Lothar Puppe (Editors), Catalysis and Zeolites: Fundamentals and Applications, Springer, 1999.
12. R.A. Sheldon and Herman van Bekkum (Editors), Fine Chemicals through Heterogeneous Catalysis, John Wiley and Sons, 2008.
13. Michel Che and Jacques C. Védrine (Editors), Characterization of Solid Materials and Heterogeneous Catalysts: From Structure to Surface Reactivity, John Wiley and Sons, 2012.

OUTCOMES:

At the end of the course, the students will be able to

- Distinguish different types of catalyzed and uncatalysed reactions, homogeneous and heterogeneous catalyzed reactions
- Synthesize the catalysts by different methods
- Adopt the suitable characterization techniques and interpret the data
- Carry out reactions with different type of reactors
- Perform different reactions with the prepared catalysts and choose a catalyst for a particular reaction

CHCY014 POLYMER TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

To make the student to learn about

- Classification of polymeric materials.
- the process of elastomers
- different types of moulding
- characterization of polymers
- effect of structure on polymer properties

MODULE I POLYMERIC MATERIALS 09

Introduction – classification – thermoplastics – cellulose derivatives – LDPE, HDPE, PVC, PMMA, PTFE, PET and Nylons – thermosetting resins – phenolic resins, epoxy resins, silicones and polyurethanes – polymer blends and alloys – reinforced plastics.

MODULE II ELASTOMERS 09

Natural rubber – processing – vulcanization – synthetic rubber – SBR, neoprene, butyl and thiocol rubbers – thermoplastic elastomers – high performance polymers – polythers – PEEK, polysulphones and polyimides.

MODULE III MOULDING TECHNIQUES 09

Moulding constituents – functions – moulding techniques – compression – injection – extrusion – blow moulding – thermoforming – Vacuum forming – pultrusion – casting – calendaring – RIM – lamination.

MODULE IV CHARACTERISATION AND TESTING 09

Characterisation of polymers by IR and NMR – Thermal properties by TGA and DSC – Testing tensile strength, Izod impact, Compressive strength, Rockwell hardness, Vicot softening point – Test for electrical resistance, dielectric constant, dissipation factor, arc resistance and dielectric strength – water absorption.

MODULE V POLYMER PROPERTIES 09

Effect of structure on mechanical, chemical, thermal, electrical and optical properties.

Total Hours: 45

REFERENCES:

1. Michael L. Berins, Plastics Engineering Hand Book, 5th Edition, Chapman and Hall, New York, 1991.

2. Jacqueline I., Kroschwitz, Concise Encyclopedia of Polymer Science and Engineering, John Wiley and Sons, New York, 1998.
3. Iyson R.W., Specialty Polymers, Blackie Academic and Professional, London, 1992.
4. Maurice Morton, Rubber Technology, van Nostrand, Reinhold, New York, 1987.

OUTCOMES:

The students will be familiar with the

- classification of polymeric materials.
- the process of elastomers
- different types of moulding
- characterization of polymers
- effect of structure on polymer rproperties

CHCY015 INORGANIC CHEMICAL TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

To make the student to learn about the

- fuel and industrial gases
- chemicals used in fertilizers and glass industries
- principles of metallurgic processes

MODULE I FUEL AND INDUSTRIAL GASES 09

Fuel and industrial gases – production and uses of producer gas, water gas, coke oven gas, acetylene, natural gas and LPG: Liquefaction of gases – noble gases, carbon dioxide, hydrogen, oxygen, nitrogen.

MODULE II HEAVY CHEMICALS 09

Chloralkali industry – soda ash, caustic soda and chlorine. Chemicals from sea – sodium chrloride, magnesium chloride and bromine.

MODULE III ACIDS AND FERTILIZERS 09

Sulphur and sulphuric acid – nitric acid – ammonia – nitrogenous fertilizers – phosphorous – phosphoric acid – phosphatic fertilizers – potassic fertilizers.

MODULE IV SILICATE INDUSTRIES 09

Silicate industries – refractories – abrasives – ceramics – glass – cement, lime and gypsum.

MODULE VPRINCIPLES OF METALLURGICAL PROCESSES 09

Principles of Metallurgical Processes – ore benefication- pyrometallurgy, hydrometallurgy, powder metallurgy and electrometallurgy - Explosives and propellants – nuclear materials.

Total Hours: 45

REFERENCES:

1. B. Norris Shreve and Joseph A. Brink, Chemical Process Industries, McGraw Hill, Kogakusha Ltd., 1991.
2. M. Gopala Rao and Marshall Sitty (Editors), Dryden's Outlines of Chemical Technology, Affiliated East West Press Pvt. Ltd., 1992.
3. B.K. Sharma, Industrial Chemistry, GOEL Publishing House, 1991.
4. James A. Kent (Editors), Riegel's Industry Chemistry, Asia Publishing House, 1989.

OUTCOMES:

The student will be familiar with the

- use of caustic soda, sodium chloride
- N,P and K fertilizers
- Ceramics, glass, etc.
- Powder and extractive metallurgy

CHCY016 ORGANIC CHEMICAL TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

To make the student to learn about the

- industrial organic synthesis
- pharmaceuticals, pesticides and dyes

MODULE I BASIC PRINCIPLES OF CHEMICAL TECHNOLOGY 09

Classification of chemical technological processes – chemical equilibrium in technological processes – rates of technological processes – designing and modeling chemical technological processes and reactors.

MODULE II INDUSTRIAL ORGANIC SYNTHESIS 09

Raw materials – manufacture of methyl alcohol, ethyl alcohol, ethylene, 1,3-butadiene, acetylene, ethyl benzene, cumene, linear alkyl benzenes and alkyl phenols.

MODULE III SYNTHETIC ORGANIC CHEMICALS 09

Chemicals derived from ethylene – polyethylene, ethylene oxide, ethylene dichloride chlorinated hydrocarbons – chemicals derived from propylene – isopropyl alcohol, polypropylene, acrylontrile, propylene oxide – oxidation of butane – esters – maleic anhydride – acetone – ethyl methyl ketone – disphenol – DDT – aniline.

MODULE IV PHARMACEUTICALS AND PESTICIDES 09

Introduction – manufacture – aspirin, Phenobarbital, penicillin, malathion, parathion and naled.

MODULE V DYES 09

Classification – raw materials – intermediates – manufacture – azodyes – triphenylmethane dyes – xanthene dyes. Indigoid and thioindigoid dyes, sulphur dyes, phthalcoanines – optical brighteners.

Total Hours: 45

REFERENCES:

1. P.H. Groggins, MODULE Processes in Organic Synthesis, McGraw Hill Book Co., Kogakusha, 1984.
2. Peter Wiseman, An Introduction to Industrial Organic Chemistry, 2nd Edition, Applied Science Publishers Ltd., London, 1979.
3. J.A. Kent, Reigel's Hand Book of Industrial Chemistry, 7th Edition, vanNostrand Reinhold Co., New York, 1974.

OUTCOMES:

The student will be familiar with the

- industrial organic processes with enes, alcohols, esters, ketones, etc.
- Manufacture of aspirin, penicillin xanthenes dyes, etc.

CHCY017 CHLOR-ALKALI TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

To make the student to learn about the

- Electrode materials
- Membrane cells
- Process control and instrumentation

MODULE I ELECTODES 09

Anodes, cathodes and separators for chlor-alkali production: graphite, metal anodes, steel cathodes, coated cathodes, asbestos diaphragms, Improved diaphragms, cation exchange membranes - different types - preparation-characteristics.

MODULE II DIAPHRAGM CELL PROCESS 09

Diaphragm cell process, different cell designs, deposition of diaphragm, mercury cell process - different cell designs, reasons for hydrogen evolution in the primary cells, denuder vertical and horizontal types, design aspects.

MODULE III MEMBRANE CELL PROCESS 09

Membrane cell process, different designs of membrane cell, monopolar and bipolar cells - conversion of mercury and diaphragm cells to membrane cells - factors affecting the performance of the membrane cells.

MODULE IV MODULE operations 09

MODULE operations in chlor-alkali industry, salt washing, saturation - brine dechlorination - primary brine purification - secondary brine purification, caustic concentration - separation of salt from diaphragm cell liquor, handling of hydrogen, chlorine and caustic, chlorine liquefaction.

MODULE V ENERGY CONSERVATION IN CHLOR-ALKALI INDUSTRY 09

Energy conservation in chlor-alkali industry, chlorine utilization - materials of construction - electrode protection devices - environmental pollution and its control - analytical techniques - process control and instrumentation - safety aspects.

Total Hours: 45

REFERENCES:

1. Ullmann’s Encyclopedia of Industrial Chemistry, Volume 6, 1986.
2. Krik and Othmer, Encyclopedia of Chemical Technology, 4th Edition, 1991.

3. N.M. Prout and J.S. Moorhouse, Modern Chlor-Alkali Technology, Volume IV, Elsevier Applied Science, London, 1990.
4. T. Wellington, Modern Chlor-Alkali Technology, Volume V, Elsevier Science, Essex, 1992.

OUTCOMES:

The students will be familiar with the

- anode, cathode and membrane cells
- MODULE operations in chlor-alakli industry and instrumentation

CHCY018 MODULE OPERATIONS AND MODULE PROCESSES

L	T	P	C
3	0	0	3

OBJECTIVES:

To make the student conversant with

- Chemical engineering concepts
- Fouriers law and HETP concepts
- Laws of crushing and types of Crushers

MODULE I BASIC CONCEPTS 09

Stoichiometric principle – material and energy balances - Combustion, Theoretical air for combustion, Flue gas analysis - water treatment - environmental protection.

MODULE II HEAT AND MASS TRANSFER 09

Modes of Heat Transfer - Fourier's law – simple numerical problems on conduction – natural and forced convection – heat transfer equipment – Drying, Distillation – vapour-liquid equilibria – distillation methods – continuous rectification of binary systems.

MODULE III MASS TRANSFER OPERATIONS 09

Adsorption and adsorption principle – equilibrium relationships – methods of calculation – various types of equipment - Extraction and Leaching – liquid extraction – ternary diagram – selection of solvent and equipment – method of calculation of co-current and counter-current extraction operations - Crystallization – types of crystallization equipment – material and energy balances.

MODULE IV MECHANICAL OPERATIONS 09

Laws of crushing – closed and open circuit grinding – various types of crushers and grinders – settling, floatation and filtration concepts.

MODULE V MODULE PROCESSES 09

Nitration, sulphonation, halogenation, esterification, amination, saponification and hydrogenation – role of the above MODULE processes in such industries as petroleum, drugs, pharmaceuticals and organic synthesis.

Total Hours: 45

REFERENCES:

1. Groggins P.H., MODULE Processes in Organic Synthesis, McGraw Hill Book Co., Kogakusha, 5th Edition, 2007.
2. McCabe W.L., Smith J.C. and Harriot P., MODULE Operations of Chemical

Engineering, 6th Edition, McGraw Hill Book Co. 2001.
3. Perry J.H., Handbook of Chemical Engineers, McGraw Hill Book Co., 2006.
4. Badger W.I. and Banchero I.T., Introduction to Chemical Engineering, McGraw Hill Book Co. Inc., Kogakusha, 1988.

OUTCOMES:

The students will be familiar with

- Bernoullis equation & its applications and
- demonstrate the role of MODULE processes in various industries.

ENERGY, WATER AND ENVIRONMENT

CHCY019	WATER AND WASTEWATER TREATMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

To make the student to learn about the

- Quality standard for drinking water
- Industrial water treatment methods
- Waste Water analysis and treatment
- Adsorption and oxidation process

MODULE I REQUIREMENTS OF WATER AND PRELIMINARY TREATMENT 09

Requirements of water – quality standards for drinking water – object of water treatment – conventional treatment – turbidity removal – cause of turbidity – coagulation – common coagulants – theory of coagulation – mixing basins – flocculation – principle and design of flocculators – sedimentation – settling tanks – settling velocity – surface loading rate – efficiency of settling tanks – sludge removal mechanism.

MODULE II INDUSTRIAL WATER TREATMENT 09

Filtration – size and shape characteristics of filtering media – sand filters – hydraulics of filtration – design considerations – radial, upflow, high rate and multimedia filters – pressure filter - Water softening – lime soda, zeolite and demineralization processes – industrial water treatment for boilers.

MODULE III TREATMENT METHODS 09

Taste and odour control – absorption – activated carbon treatment – removal of colour – iron and manganese removal – aeration, oxidation, ion exchange and other methods – effects of fluorides – fluoridation and defluoridation – desalination – corrosion prevention and control – factors influencing corrosion – Langelier index – corrosion control measures.

MODULE IV WASTEWATER TREATMENT 09

Wastewater treatment – pre and primary treatment – equalization neutralization – screening and grid removal – sedimentation – oil separation gas stripping of volatile organics – biological oxidation – lagoons and stabilization basins – aerated lagoons – activated sludge process – trickling filtration – anaerobic decomposition.

MODULE V ADSORPTION AND OXIDATION PROCESSES 09

Chemical process – adsorption – theory of adsorption – ion exchange process – chemical

oxidation – advanced oxidation process – sludge handling and disposal – miscellaneous treatment processes.

Total Hours: 45

REFERENCES:

1. W. Wesley Eckenfelder, Jr., Industrial Water Pollution Control, 2nd Edition, McGraw Hill Inc., 1989.
2. Metcalf and Eddy, Waste Water Engineering, 3rd Edition, McGraw Hill Inc., 1991.
3. C.S. Rao, Environmental Pollution Control Engineering, Wiley Eastern Ltd., 1994.
4. S.P. Mahajan, Pollution Control in Process Industries, Tata McGraw Hill Publishing Company Ltd., 1994.
5. Howard S. Peavy, Donald R. Rowe and George Tchobanoglous, Environmental Engineering, McGraw Hill Inc., 1985.

OUTCOMES:

The student will be familiar with the

- quality requirement of water,
- analysis and treatment methods.

CHCY020	SOLID WASTE MANAGEMENT AND AIR POLLUTION	L	T	P	C
		3	0	0	3

OBJECTIVES:

To make the student to learn about the

- Solid waste collection and disposal
- Air quality and air pollution control
- Energy recovery

MODULE I SOLID WASTE 09

Solid waste – definition – characteristics – perspectives – types of solid waste – sources – properties of solid waste – physical and chemical composition – changes in composition – solid waste management – materials flow – reduction in raw materials usages and solid waste quantities – reuse of solid waste materials.

MODULE II SOLID WASTE COLLECTION AND DISPOSAL 09

Solid waste generation – on-site handling, storage and processing – collection of solid waste – transfer and transport – processing techniques – ultimate disposal.

MODULE III ENERGY RECOVERY 09

Energy recovery – processing techniques – materials recovery systems – recovery of biological conversion products and thermal conversion products – materials and energy recovery system.

MODULE IV AIR POLLUTION 09

Air pollution – global implication of air pollution – MODULEs of measurement – sources of pollutants – classification of pollutants – meteorology and natural purification processes – influence of meteorological phenomena on air quality – effects on man and vegetation - Effects of pollutants on human beings, animals, vegetation, buildings and materials.

MODULE V ANALYSIS AND CONTROL DEVICES 09

Sampling and analysis – particulars and gaseous pollutants – methods for monitoring air pollutants – air quality control devices for particulate and gaseous contaminants – major polluting industries – measures to check industrial pollution.

Total Hours: 45

REFERENCES:

1. Howard S. Revay, Donald R. Rowe and George Technobanoglous, Environmental Engineering, McGraw Hill Inc., 1985.

2. Gilbut M. Masters, Introduction to Environmental Engineering and Science, Prentice-Hall of India Pvt. Ltd., 1991.
3. S.K. Garg, Sewage Disposal and Air Pollution Engineering, Khanna Publishers, 1990.
4. V.P. Kudesia, Air Pollution, Pragati Prakashan Publishers, 1992.
5. M.N. Rao and H.V.N. Rao, Air Pollution, Tata McGraw Hill Publishing Company Ltd., 1994.

OUTCOMES:

The students will be familiar with the types of

- solid waste, collection and disposal
- air pollutants and control measures

CHCY021 INDUSTRIAL ELECTROCHEMISTRY

L	T	P	C
3	0	0	3

OBJECTIVES:

To make the student to learn about the

- basics of electrolysis
- electrometallurgy
- metal refining
- electrosynthesis
- industrial electrochemical process

MODULE I CHLORALKALI INDUSTRY 09

General concepts of brine electrolysis – modern technological developments – chlorine cell technologies – mercury and diaphragm cell – membrane – cell.

MODULE II ELECTROMETALLURGY 09

Metal extraction and refining – electrowinning – aluminium extraction – manufacture of sodium, lithium and magnesium – hydrometallurgical processes – electrorefining – aqueous and molten salt electrorefining.

MODULE III METAL FINISHING 09

Pretreatment – conversion coatings – phosphating – types, methods, properties and influencing factors – evaluation and testing – applications – anodizing – principle and applications - electroplating – objectives, theory and method – electroplating of nickel – electroless plating – galvanizing – tinning.

MODULE IV ELECTROSYNTHESIS 09

Electrolytic preparation of inorganic compounds – fluorine – peracids and their salts – $KMnO_4$ – $K_2Cr_2O_7$ - Organic electrosynthesis – hydromerisation of acrylonitrile – Monsanto process – manufacture of ethylene glycol – electrolysis of organic compounds with the use of ion – exchange membranes.

MODULE V INDUSTRIAL ELECTROCHEMICAL PROCESSES 09

Water treatment and environmental protection – metal ion removal and metal recovery – electro-filtration of particulates from gases – electrodialysis – desalination – electroflotation.

Total Hours: 45

REFERENCES:

1. P.H. Rieger, Electrochemistry, Prentice Hall, Inc., New York, 1987.
2. D. Fletcher, Industrial Electrochemistry, Chapman and Hall, London, 1982.
3. J. Bockris and A.K.M. Reddy, Modern Electrochemistry, Volume II, Mac Donold, London, 1970.
4. C. Rajagopal and K. Vasu, Conversion Coatings, 1st Edition, Tata McGraw Hill, New Delhi, 2000.

OUTCOMES:

The student will be familiar with the

- electrowinning,
- electrorefining,
- electrochemical metal finishing,
- electrosynthesis
- electrodialysis.

CHCY022 CORROSION AND CORROSION CONTROL

L	T	P	C
3	0	0	3

OBJECTIVES:

To make the student conversant with the

- Causes and theories of corrosion
- Different types of corrosion
- Basic concepts to prevent corrosion and testing of corrosion by various diagrams.
- Factors influencing corrosion
- Control of corrosion using various methods.

MODULE I CORROSION 09

Causes and effects of corrosion – theories of corrosion – oxidation – direct atmospheric effect – electrochemical corrosion – hydrogen evolution – presence and absence of oxygen – corrosion by gaseous reduction.

MODULE II FORMS OF CORROSION 09

Galvanic bimetal corrosion – differential aeration corrosion – concentration cell corrosion – erosion corrosion – pitting corrosion – underground soil corrosion – intergranular corrosion – stress corrosion – seasonal cracking of alloys – caustic embrittlement – corrosion fatigue.

MODULE III CORROSION TESTING 09

Rate of corrosion – calculation of ΔG and other related thermodynamic parameters – potential measurement – electrochemical series – redox reactions – EMF measurement and corrosion current – anodic and cathodic behaviour of metals – passivity – testing of virgin metals – alloy – Pourbaix and Evans diagrams.

MODULE IV FACTORS INFLUENCING CORROSION 09

Nature of metal – over voltage – areas of anodic/cathodic – purity of metal – physical state of metals – passive nature of metal – solubility – volatility of corrosion products – corroding environment – influence of pH – ions – formations of cells – polarization of electrodes.

MODULE V CORROSION CONTROL 09

Design – selection of materials – pure metals and alloys – annealing – elimination of galvanic action – cathodic protection – sacrificial anodic protection – impressed current cathodic protection – modification of environment – deaeration – dehumidification – inhibitors – protective coatings – preparation of materials for coating – metallic and non-

metallic – organic coatings – special paints – varnish, enamel and lacquers.

Total Hours: 45

REFERENCES:

1. M.G. Fontana and N.G. Green, Corrosion Engineering, McGraw Hill Book Company, New York, 1984.
2. J.H. Brophy, R.M. Rose and J. Walf, The Structure and Properties of Materials, Wiley Inter Science Inc., New York, 1984.
3. B.T. Kelly, Irradiation Diamagneto Solids, Pergamon Press, New York, 1992.
4. D.R. Cross, Principles and Applications of Electrochemistry, Chapman and Hall, UK, 1988.

OUTCOMES:

Students will become familiar with the

- basic concepts of corrosion,
- factors which influence the corrosion
- mechanism of corrosion
- control of corrosion in real situation.

CHCY023 ELECTROCHEMICAL PROTECTION SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

To make the student to learn about the

- cathodic protection
- Sacrificial anode system
- Impressed current cathodic protection
- Design of Anodic and cathodic protection

MODULE I CATHODIC PROTECTION 09

Fundamental aspects, Definition of cathodic protection using Evans diagram and Pourbaix diagram, Derivation of protective potential for steel protective potentials of different metals. Criteria for cathodic protection, half cells used in cathodic protection potential measuring devices, rectifiers, zero current ammeter, automatic control MODULEs, holiday detectors.

MODULE II SACRIFICIAL ANODE SYSTEM 09

Principle of sacrificial anodes, required properties of galvanic anodes, anode life, current output. Advantages and limitations of sacrificial anodes-shape - and size of anodes, inserts, back-fills: Magnesium anode-electrochemical properties, current density, anode consumption, composition field of application. Aluminium anode - electrochemical properties, composition, field of application - Zinc alloy anodes - electrochemical properties, composition, field of application.

MODULE III IMPRESSED CURRENT CATHODIC PROTECTION 09

Principle of impressed current system - DC power sources, cables, advantages and limitation, required properties of impressed current anode. Consumable anodes, Scrap steel, Aluminum -properties consumption - field of application. Permanent anodes, Graphite, High Silicon Iron, magnetite, platinum and platinum alloys platinised titanium, platinised Niobium, platinised tantalum, Metal oxide anodes lead alloy anode, properties, composition, consumption, field of application. Back fills for impressed current anodes.

MODULE IV DESIGN OF CATHODIC PROTECTION 09

Cathodic protection to buried structures - Field data, soil resistivity, pH determination redox potential measurement, potential measurement, long line current survey, coating resistance, current drainage survey - Designing of sacrificial anode system, designing of impressed current system - Designing of CP to buried pipe line, ship hull and storage tank.

MODULE V DESIGN OF ANODIC PROTECTION 09

Anodic protection: Principles of anodic protection-description of electrochemical passivity, characteristics of anodic polarisation curves, the passive metal layer and mechanism of iron passivity, passivity breakdown. Equipments for anodic protection-characteristics of cathodes, platinum clad cathode, Hastelloy - cathodes, stainless steel cathode. Reference electrodes-calomel half cell, silver/silver chloride half cell, mercury/mercury sulphate half cell, metal oxide and metals as reference electrodes. Design, operation and maintenance of anodic protection system. Establishing electrochemical parameters, operation and maintenance applications.

Total Hours: 45

REFERENCES:

1. John H. Morgan, Cathodic Protection, New Age International, 2nd Edition, 1987.
2. Glen, L. Riggs, Anodic Protection, Kluwer Academic Publication, 1981.

OUTCOMES:

The students will be familiar with the

- cathodic protection
- Sacrificial anode system
- Impressed current cathodic protection
- Design of Anodic and cathodic protection

CHCY024 METAL COATING TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

To make the student to know about

- the different surface coating methods to preserve the metal surface
- different methods of coating
- electron beam coating

MODULE I SURFACE CHEMISTRY OF ALLOYS 09

Basic physical chemistry, surface chemistry, pretreatment principle - technology and control of electro deposition systems such as alloy plating, electrolysis, composites and non aqueous.

MODULE II METHODS OF COATING I 09

Hot dip coatings - principle, surface preparation, methods, applications, Diffusion coatings - Principle - Cementation - Cladding - case hardening - structures.

MODULE III Methods of coating II 09

Chemical vapor deposition - classification-techniques, metal organic type, plasma assisted, layer assisted, applications.

MODULE IV Methods of coating III 09

Sputtering techniques, methods, applications, plasma treatments, nitriding, carbonizing, boriding, titanizing methods and applications.

MODULE V LASER ALLOY AND ELECTRON BEAM COATING 09

Laser alloying - sources, variables, methods, applications, Electron beam coating - evaporation materials, methods, applications.

Total Hours: 45

REFERENCES:

1. T.S. Sudarsan, Surface Modification Technologies, Marcel Dekker Inc., 1989
2. D.R. Gabe, Principles of Metal Surfaces Treatment and Protection, Pergmon Press 1972.

OUTCOMES:

The student will be familiar with the

- pretreatment methods before coating
- Galvanizing and tinning and cladding
- Chemical vapour deposition
- Sputtering and laser alloying methods to preserve the metal surface.

CHCY025 PROTECTIVE COATINGS

L	T	P	C
3	0	0	3

OBJECTIVES:

To make the student to learn the

- organic and inorganic coatings to protect the surface.
- Electroplating
- Evaluation of paints
- Special paints
- Inorganic coating materials

MODULE I PIGMENTS AND RESINS 09

Pigments and additives used in paints - properties and functions - Inorganic, organic and metallic pigments - Extenders - Driers. Natural resins - chemistry and properties - shellac Rosin, rubber oils used for surface coatings - preparation and properties of synthetic resins - alkyds - phenolic - vinyls - amino resins - acrylics - epoxies - urethanes - silicones. Formulation of paints and rheological characteristics - Importance of pigment volume concentration, volume solids etc., water based paints, composition and properties - factors affecting water solubility.

MODULE II ELECTROPLATING 09

Surface preparation for paint applications, methods of surface preparation - methods of application of paints brushing - roller coating - compressed air spraying - airless spraying - electrostatic spraying - Electrodeposition of Paints and Electropolymerization Electrokinetic phenomena involved in electrodeposition fundamental principle, formulation of bath - anodic and cathodic deposition - advantages over conventional methods.

MODULE III TESTING AND EVALUATION OF PAINTS 09

Testing and evaluation of liquid paints and coatings - specific gravity - viscosity - time of grind - thickness - hardness, abrasion - flexibility - electrochemical and accelerated tests - field exposure tests - paint film defects - identification and remedial measures.

MODULE IV PAINTS FOR FUNCTIONAL APPLICATIONS 09

Paints for automobiles - aircrafts - marine paints (ships) chemical resistant coatings - Paints for pipe line, paints for various substrates other than metals - paints for concrete - wood - plastic - powder coatings - basic and application principle.

MODULE V INORGANIC COATINGS 09

Conversion coatings - phosphating, chromating of ferrous and non-ferrous metals - ceramic coatings.

Total Hours: 45

REFERENCES:

1. John Williams, Organic Coating Technology Payne, Volume I and II, Henry Fleming Sons Inc., New York London, 1961.
2. Gosta Wranglen, An Introduction to Corrosion and Protection Of Metals, Institute for Metals Kgdd, Stockholm, 1972.
3. Charles G. Munger, Corrosion Prevention by Organic Coating, NACE 1984.
4. H.W. Chatfield, (Editor)s, The Science of Surface Coating, Published: Ernest Benn Limited London, 1962.
5. Willibald Machu, Hand Book of Electropainting Technology, Electrochemical Publication Limited 1978.

OUTCOMES:

The students will be familiar with the

- Surface preparation methods
- Different types of paints, their constituents and fictions
- Constituents and functions of paints
- Inorganic coating methods

CHCY026 FUEL CELLS AND APPLICATIONS

L	T	P	C
3	0	0	3

OBJECTIVES:

The primary objective of the course is make the student conversant with

- classification and types of fuel cell
- outline components of fuel cells
- performance for fuel cells
- hydrogen storage and production
- the applications of fuel cells

MODULE I INTRODUCTION AND TYPES OF FUEL CELLS 09

Introduction - definition - history - difference between batteries and fuel cells - chemistry of fuel cells - classification of fuel cell (based on temperature and electrolyte) – types of fuel cell: polymer electrolyte membrane or proton exchange membrane fuel cell (PEMFC), direct methanol fuel cell (DMFC), alkaline fuel cell (AFC), phosphoric acid fuel cell (PAFC), molten carbonate fuel cell (MCFC) and solid oxide fuel cells (SOFC).

MODULE II FUEL CELL COMPONENTS 09

Membrane electrode assembly components : membranes and ionomers , fuel cell electrodes and gas diffusion layer, fuel cell electrocatalysts - bi-polar plates, humidifiers and cooling plates - fuel cell stack

MODULE III FUEL CELLS PERFORMANCE AND APPLICATIONS 09

Thermodynamics of fuel cells - electrochemical kinetics of fuel cells - Fuel cell efficiency - performance characteristics:, voltage efficiency - effect of voltage with current density for low and high temperature fuel cells- causes for voltage losses- introduction to fuel cycle analysis

MODULE IV PRODUCTION AND STORAGE OF HYDROGEN FUEL 09

Hydrogen as energy source -its merit as a fuel - hydrogen storage: compressed hydrogen, liquid hydrogen, metal hydrides, carbon fibers – hydrogen production : steam reforming, partial oxidation, coal gasification/thermal reforming, fuel cell technology based on bio-mass.

MODULE V FUEL CELL APPLICATIONS

Automotive applications – road map to market – automotive industry and the environment – distributed power generation – grid-connect applications – non-grid connect applications – residential power – portable power – combined heat and power

Total Hours: 45

REFERENCES:

1. R.H. Thring (Editor), Fuel Cells for Automotive Applications, Professional Engineering Publishing UK, 2004.
2. Gregor Hoogers (Editor), Fuel Cell Technology Handbook, SAE International, CRC Press, 2003.
3. Vladimir S. Bagotsky, Fuel Cells: Problems and Solutions, 2nd Edition, John Wiley and Sons, 2012.
4. B. Viswanathan and M. Aulice Scibioh, Fuel Cells: Principles and Applications, Taylor and Francis Group, 2007.
5. Supramaniam Srinivasan, From Fundamentals to Applications, Springer, 2006.
6. Prospects for Hydrogen and Fuel Cells, International Energy Agency, OECD Publishing, 2005.

OUTCOMES:

The student will be able to

- classify fuel cells and elaborate the different types of fuel cells.
- explain the various components of the fuel cells
- calculate the open circuit voltage, efficiency and voltage losses, explain fuel cycle analysis and prove the laws of thermodynamics for fuel cell.
- describe the various methods for production and storage of hydrogen.
- list out the applications of fuel cells.

CHCY027 ADVANCED BATTERIES AND SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

The students will be trained about the

- different types of batteries
- design and operation of different types of batteries

MODULE I **09**

Advanced Ni-MH Batteries: Introduction to Ni-MH batteries, overview of Ni MH, Improvement in hydrogen storage alloys, improvement in Cathode materials, improvement in separator and cell design.

MODULE II **09**

Advanced Li-ion Batteries: Lithium-ion battery, The Principle carbonaceous anode materials, cathode material Electrolyte, separator.

MODULE III **09**

Advanced Cathode materials for Lithium Batteries: The intercalative reactions, relationships between performance requirements and materials characteristics D stability, capacity, voltage, energy, power, cycle life, shelf life.

MODULE IV **09**

Li/polymer Batteries: Polymer cathode for Li battery, Polymer Cathode in SPE, conductivity, ion transport mechanisms, plasticized electrolytes.

MODULE V **09**

Ultra capacitors: Double layer, Metal Oxide, conducting polymers energy and power densities, voltage limitation and self discharge.

Total Hours: 45

REFERENCES:

1. Energy Storage Systems for Electronics Edited by Tetsuya Osaka, Department of Applied Chemistry, Wasuda University, Tokyo, Japan and Madhav Dutta, Intel Corporation, Hillsboro, USA.
2. M. Barak, Electrochemical Power Sources, IEEE Series, Peter Peregrinus Ltd.
3. Lindar D., Handbook on Batteries and Fuel Cells, McGraw Book Co., New York, 1955.

OUTCOMES:

The student will have

- A thorough understanding about batteries and their components
- Understand the working up of the batteries

CHCY028 ELECTROCHEMICAL MATERIAL SCIENCE

L	T	P	C
3	0	0	3

OBJECTIVES:

To make the student to learn about the

- Different types of semiconductors
- Preparation and properties of the semiconductors
- Application in photovoltaic cells

MODULE I SEMICONDUCTORS 09

Semiconductors, n-type and p-type semiconductors, conductivity of semiconductors, applications, of semiconductors, Photo conductivity, Photo conducting materials, electronic transitions in photoconductors, trapping and recombination, general mechanism of photoconductivity, life-time of majority carriers, preparation of CdS photoconductors by the sintering technique, ohmic contacts, fabrication of photo conductive cells and their applications.

MODULE II METHODS OF PREPARATION 09

Thin films of semiconductors, methods of preparation: vacuum evaporation, sputtering, molecular beam epitaxy, hot wall epitaxy, chemical bath deposition, spray pyrolysis, electrodeposition, liquid phase epitaxy, chemical vapor deposition, structural, electrical and optical characterization, mechanical properties of thin films, effect of grain boundaries.

MODULE III LUMINESCENCE 09

Luminescence, various types of luminescence (definitions only) model of luminescence in sulphide phosphors, applications, basic aspects of superconductivity, super conducting materials, high temperature, super conducting materials, method of preparation and applications.

MODULE IV PHOTOVOLTAICS 09

Basic of photovoltaics, homo and heterojunctions, preparation of single crystals and polycrystalline silicon solar cells, Metal-Insulator-Metal and semiconductors - Insulator-semiconductors solar cells, photovoltaic measurements - I-V characteristics, spectral response and capacitance measurements.

MODULE V SOLAR CELLS AND PEC CELLS 09

Preparation of CdS/CU_2S solar cells by screen printing technique and their characteristics, amorphous Si solar cells GaAs solar cells, Semiconductors electrolyte interface. Photoelectrochemical (PEC) cells for conversion of light energy to electrical

energy, PEC cells based on CdSe Si and GaAs and their output characteristics, Estimation of flat band potential from Mott-Schottky plots.

Total Hours: 45

REFERENCES:

1. B.S. Saxena, R.C. Gupta and P.N. Saxena, Fundamentals of Solid State Physics, Pragati Prakashan Educational Publishers, Meerut, 2001.
2. K.L. Chopra and I. Kaur, Thin Film Devices and their Applications, Plenum Press, New York, 1983.
3. A.C. Rose D. Innes and E.H. Rhoderick, Introduction to Superconductivity, Robert Maxwell Publishers, 1988.
4. Photoelectrochemical Solar Cell, Edited By K.S.V. Santhanam and M. Sharon, Elsevier Science Publishers, BV New York 1988.
5. C. Hu and R.M. White, Solar Cells, McGraw Hill Book Company, New Delhi, 1983
6. R.K. Kotnala and N.P. Singh, Essentials of Solar Cells, Allied Publishers Pvt. Ltd., Chennai, 1992
7. A.F. Fahrenbruch and R.H. Bube, Fundamentals of Solar Cells, Academic Press, London 1983.
8. W.E. Hatified and J.H. Miller (Editors), High Temperature Superconducting Materials, Marcel Dekker, New York 1988.

OUTCOMES:

The students will be familiar with

- p & n type semiconductors
- luminescence and photovoltaic properties of semiconductors
- application in solar cells.

CHCY029	ELECTROCHEMICAL ENERGY CONVERSION AND STORAGE	L	T	P	C
		3	0	0	3

OBJECTIVES:

To make the student to learn about the

- electrochemical cells and their types
- factors affecting battery performance
- application of batteries
- testing in fuel cells

MODULE I FUNDAMENTALS 09

EMF, Reversible cells, Reversible electrodes, relationship between electrical energy and energy content of a cell, force energy changes and EMF in cells, relationship between the energy changes accompanying a cell reaction and concentration of the reactants, effect of sulphuric acid concentration on EMF in the lead acid battery, effect of cell temperature in lead acid battery, derivation of number of electrons involved in a cell reactions, thermodynamic calculation of the capacity of a battery, calculation of the capacity of a battery, calculation of operating parameters for a lead acid battery from calorimetric measurements, calculations of energy density of cells, heating effects in batteries, spontaneous reaction in electrochemical cells, pressure development in sealed batteries.

MODULE II FACTORS AFFECTING BATTERY PERFORMANCE 09

Factors affecting battery capacity, voltage level current drain of discharge, types of discharge continuous, intermittent, constant current, constant load, constant power, temperature of battery during discharge, service life, voltage regulation, changing voltage, effect of all design, battery age and storage condition, effect of battery design.

MODULE III SELECTION AND APPLICATION OF BATTERIES 09

Major consideration in selecting a battery, battery applications, comparative features and performance characteristics, characteristics of batteries for portable equipment, cost effectiveness, other comparison of performance criteria for battery selection D probable equipment.

MODULE IV TESTING AND EVALUATION 09

Evaluation of active masses, Porosity - mercury porosity meter, liquid absorption method, Surface area measurement - BET method (nitrogen absorption), internal resistance of cells - D.C. methods, polarization elimination method - I.E. polarization and flash current method A.C. methods, A.C. impedance method, testing of storage batteries - capacity test for retention of charge, vibration test, life test, efficiency test, leakage test for sealed

cells, testing of separators, HRD at normal and low temperature.

MODULE V FUEL CELLS AND SUPER CAPACITOR 09

Introduction, Types of Fuel cells, figure of merit, electro catalysts for hydrogen oxidation and oxygen reduction, electrochemical double layer capacitors, ruthenium oxide as capacitor electrode, manual capacitors with proton conducting solid polymer electrolytes.

Total Hours: 45

REFERENCES:

1. Barak, Electrochemical Power sources, IEEE Series, Peter Peregrinus Ltd., Steverage, UK 1980, 1997.
2. N. Corey Cahoon and George W. Heise, Primary Battery (Volume I and II), John Wiley New York, 1971 and 1976 London.
3. Linden D. Hand Book on Batteries and Fuel Cell, McGraw Hill Book Co., New York 1955.
4. J.P. Gabano, Lithium Batteries, Academic Press, London, 1983
5. T.R. Crompton, Batteries Reference Book, Batterworths, London.
6. G.W. Vinal, Storage Batteries, John Wiley, New York 1955.

OUTCOMES:

The students will be familiar with

- electrochemical cells and their types
- factors affecting battery performance
- application of batteries
- testing in fuel cells

CHCY030 SOLAR ENERGY

L	T	P	C
3	0	0	3

OBJECTIVES:

The students will be conversant with the

- sustainable energy conversion proceses
- fundamentals of solar cells
- solar electrical energy conversion
- nanomaterials as photovoltaics
- different types of solar cells

MODULE I INTRODUCTIONS TO SUSTAINABLE ENERGY CONVERSION PROCESSES

Photovoltaic, Photothermal, Photoelectrochemical, Biofuel, Wind Power, and Geothermal Systems. Insolation vs. world energy demand, Current energy consumption from different sources, Renewable Energy Resources; Utilization, Storage, and Economic limitations Solar energy: Thermonuclear energy source, Planck's Law, Thermal radiation fundamentals, Solar Radiation Table: extraterrestrial and terrestrial radiations; Solar constant, Air Mass, Spectral Irradiance, Mean annual irradiance on horizontal surface across the world, Radiation on an inclined surface: direct, reflected, and diffused radiations, Global solar radiation data.

MODULE II SOLAR CELL FUNDAMENTALS 15

Photovoltaic effect - Principle of direct solar energy conversion into electricity in a solar cell. Semiconductor properties, energy levels, basic equations. Solar cell, p-n junction, structure.

MODULE III SOLAR ELECTRICAL ENERGY CONVERSION 15

Solar photovoltaic energy conversion - Principles - Physics and operation of solar cells. Classification of solar PV systems, Solar cell energy conversion efficiency, I-V characteristics, effect of variation of solar insolation and temperature, losses. Solar PV power plants.

MODULE IV NANOMATERIALS FOR PHOTOVOLTAICS 09

Photochemical solar cells, PV panels with nanostructures. Phase compositions on nanoscale microstructures – role of nanostructures and materials – nanomaterials in solar photovoltaic technology- band gap engineering and optical engineering - tandem structures - quantum well and quantum dot solar cells - photo-thermal cells – organic solar cells. Performance and reliability of nanomaterials based solar cells.

MODULE V MODULE III SOLAR CELLS

Formation of a pn – junction - Space charge and internal field - Quasi - Fermi levels - The Shockley diode equation - Structure of a solar cell - The solar cell equation - Fill factor and maximum power - Various electron - hole-pair recombination mechanisms - Crystalline silicon solar cells - Thin film solar cells: CIGS, Cite and a – silicon - Tandem solar cells - Dye - sensitized solar cells - Organic solar cells. Thin film solar cells, Amorphous silicon (a-Si) solar cells, Cadmium Telluride (Cd-Te) Solar cells, Cu(InGa)Se2 solar cells, Dye-sensitized solar cells, Organic and polymer solar cells. Photoelectrochemical hydrogen production, photoelectrochemical cells, solar-to-hydrogen efficiency; Hydrogen storage, hydrogen economy, Electrochemical Storage of energy, Current developments in energy storage.

Total Hours:

REFERENCES:

1. PhotoeTotal Hoursectrochemical Solar Cell, Edited By K.S.V. Santhanam and M. Sharon, Elsevier Science Publishers, BV New York 1988.
2. C. Hu and R.M. White, Solar Cells, McGraw Hill Book Company, New Delhi, 1983
3. R.K. Kotnala and N.P. Singh, Essentials of Solar Cells, Allied Publishers Pvt. Ltd., Chennai, 1992
4. A.F. Fahrenbruch and R.H. Bube, Fundamentals of Solar Cells, Academic Press, London 1983.

OUTCOMES:

The students will be acquainted with the

- sustainable energy conversion processes
- fundamentals of solar cells
- solar electrical energy conversion
- nanomaterials as photovoltaics
- different types of solar cells

REGULATIONS, CURRICULUM AND SYLLABI

M.Sc.
PHYSICS

(As approved by the 9th Academic Council)

JULY 2016

B.S.ABDUR RAHMAN
UNIVERSITY
B.S. ABDUR RAHMAN INSTITUTE OF SCIENCE & TECHNOLOGY
(Estd. u/s 3 of the UGC Act, 1956)
(FORMERLY B.S. ABDUR RAHMAN CRESCENT ENGINEERING COLLEGE)
Rated with A Grade by National Assessment and Accreditation Council
Seethakathi Estate, G.S.T. Road, Vandalur, Chennai - 600 048
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VISION AND MISSION OF THE DEPARTMENT OF PHYSICS

VISION

To be a leader in providing quality higher education through well designed programs and undertake research in Physical Sciences and related interdisciplinary areas.

MISSION

- To provide quality education in the field of Physical Sciences through well designed programs.
- To provide necessary knowledge in Physical Sciences required for all programs in science and engineering.
- To offer quality programs in advanced and applied physical sciences.
- To undertake fundamental, applied and interdisciplinary research in emerging areas.

PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES

M. Sc. (Physics)

PROGRAMME EDUCATIONAL OBJECTIVES:

- To identify, formulate, analyze and optimize variety of problems related to various fields of Physics through basic knowledge and to apply the skills and knowledge acquired during the UG studies.
- To acquire knowledge of fundamental laws and principles in wide areas of Physics along with their applications so as to develop strong student competencies in Physics and its applications in a technology-rich, interactive environment.
- To prepare for the successful pursuit of Post Graduate studies and shall have abilities to engage in life-long learning in various fields of Physics and General Science.
- To understand the challenges of a dynamically and globalised changing world adapting their skills through continuous learning and self-improvement.
- To work effectively in bringing interdisciplinary ideas related to diverse environmental skills to excel in technical careers and thrive in Post Graduate and research studies using scientific principles and applications of Physical Science.
- To become effective researcher who will be able to provide lucid summation of the scientific literature on a given topic of study.
- To develop their skills to plan, execute and report the results of extended computational techniques, experimental and theoretical Physics based projects in a research environment.
- To inculcate the sense of ethics, professionalism and effective communication skills amongst graduates improve their workplaces, communities and the society through professional and personal responsibilities and activities of their work.
- To prepare the students to successfully compete for employment and to offer a wide range of experience in research methods, data analysis to meet the industrial needs.

PROGRAMME OUTCOMES:

After the completion of PG programme, graduates will be able to

- Design and conduct experiments, as well as to analyze and interpret data.
- Function on interdisciplinary teams with professional and ethical responsibility.
- Use the modern techniques, skills and sophisticated equipment necessary for research.

- Apply knowledge and skill in the design and development of Electronics circuits to cater to the needs of Electronic Industry.
- Become professionally trained in the area of optical communication, lasers, nonlinear circuits, materials development and characterization including nanomaterials.
- Demonstrate highest standards of actuarial ethical conduct and professional actuarial behavior, critical, interpersonal and communication skills as well as a commitment to life-long learning.
- Successfully compete for employment in the field of Teaching, Research and Industries.

CURRICULUM & SYLLABI FOR
M. Sc. (Physics)
(Four Semesters / Full Time)

Curriculum

Sl. No.	Course Code	Course Title	L	T	P	C
		SEMESTER I				
1	PHC6101	Classical Mechanics and Relativity	4	0	0	4
2	PHC6102	Mathematical Physics	3	1	0	4
3	PHC6103	Solid state Physics	3	0	0	3
4	PHC6104	Physics of semiconductor devices	3	0	0	3
5		Elective – I	3	0	0	3
6		Elective – II	3	0	0	3
7	PHC6105	Materials Science lab	0	0	4	2
8	PHC6106	Semiconductor devices and circuits lab	0	0	4	2
					Total	**24**
		SEMESTER II				
1	PHC6201	Quantum Mechanics	3	0	0	3
2	PHC6202	Thermodynamics and Statistical Physics	4	0	0	4
3	PHC6203	Atomic Physics and Molecular Spectroscopy	4	0	0	4
4	GEC6202	Research Methodology	3	0	0	3
5		Elective – III	3	0	0	3
6		Elective – IV	3	0	0	3
7	PHC6204	Thermal Physics lab	0	0	4	2
8	PHC6205	Mini project – I			2	1
					Total	**23**
		SEMESTER III				
1	PHC7101	Digital Electronics and Microprocessors	4	0	0	4
2	PHC7102	Electromagnetic Theory & Electrodynamics	3	1	0	4
3	PHC7103	Nuclear and Particle Physics	3	0	0	3
4		Elective – V	3	0	0	3
5		Elective – VI	3	0	0	3
6	PHC7104	Advanced Electronics Lab	0	0	4	2
7	PHC7105	Advanced optics lab	0	0	4	2
8	PHC7106	Seminar			2	1
9	PHC7201	Project phase – I			4	2*
					Total	**24**

Sl. No.	Course Code	Course Title	L	T	P	C
		SEMESTER IV				
1	PHC7201	Project Phase – II			20	10
			Total		**10+2=12**	
			Total number of credits			**81**

*Note: Credit will be awarded along with phase-II

LIST OF ELECTIVES

Sl. No.	Course Code	Course Title	L	T	P	C
		SEMESTER I				
1	PHCY101	Crystal Growth Techniques	3	0	0	3
2	PHCY102	Materials processing	3	0	0	3
3	PHCY103	Characterization of materials	3	0	0	3
4	PHCY104	Functional materials and structures	3	0	0	3
5	PHCY105	Advanced Optics & Laser Technology	3	0	0	3
6	PHCY106	Nonlinear optics	3	0	0	3
7	PHCY107	Optical Fiber communication	3	0	0	3
8	PHCY108	Optical computing	3	0	0	3
		SEMESTER II				
1	PHCY201	Electro-Optic materials and devices	3	0	0	3
2	PHCY202	Ferroelectric materials and devices	3	0	0	3
3	PHCY203	Structure and properties of alloys	3	0	0	3
4	PHCY204	Photonic materials and devices	3	0	0	3
5	PHCY205	Numerical methods and programming	3	0	0	3
6	PHCY206	Ultrasonics and Non-Destructive Testing	3	0	0	3
7	PHCY207	Optoelectronics and its devices	3	0	0	3
8	PHCY208	Biophotonics	3	0	0	3
		SEMESTER III				
1	PHCY111	Mathematical methods for nonlinear science	3	0	0	3
2	PHCY112	Measurements and Instrumentation	3	0	0	3
3	PHCY113	Biomedical Instrumentation	3	0	0	3
4	PHCY114	Radiation Physics	3	0	0	3
5	PHCY115	Laser spectroscopy and its applications	3	0	0	3
6	PHCY116	Nanophotonics	3	0	0	3
7	PHCY117	Nanoscience and Technology	3	0	0	3
8	PHCY118	Thin film science and technology	3	0	0	3
9	PHCY119	Corrosion science and technology	3	0	0	3
10	PHCY120	Biomaterials	3	0	0	3

SEMESTER I

PHC6101 CLASSICAL MECHANICS AND RELATIVITY

L	T	P	C
4	0	0	4

OBJECTIVES:

- To understand the basic concepts in Classical Mechanics
- To train in the Lagrangian and the Hamiltonian formalisms
- To understand the dynamics of Rigid body and small oscillations
- To solve real world problems including problems from Nonlinear dynamics
- To lay foundations for further studies in Relativistic Physics and Engineering

MODULE I FUNDAMENTAL PRINCIPLES AND LAGRANGIAN FORMULATION 12

Conservation of linear momentum – Energy – Angular momentum – Degree of freedom – Constraints – Generalised coordinates- Principle of Virtual work- D'Alembert's Principle – Lagrange's equations of motion – conservative and Non-conservative forces- Applications : L-C circuit – one dimensional harmonic oscillator. Central force and motion in a plane – Equation of motion under central force and first integrals-Differential equation for an orbit – Inverse square law of force- Kepler's laws of planetary motion and their deduction-Virial theorem.

MODULE II HAMILTONIAN FORMULATION 12

Hamiltonian function - Physical significance-Hamilton's canonical equations of motion - Applications :simple pendulum – Motion of a particle in a central force field- charged particle in an electromagnetic field- Hamilton's variational principle- proof-Derivation of Lagrange's equations-Principle of Least Action – its deduction- Canonical Transformations-Generating function-Poisson's and Lagrange's brackets-properties-relation between them- The Hamilton – Jacobi equation – Kepler's problem -solution by Hamilton – Jacobi method - Action and angle variables.

MODULE III RIGID BODY DYNAMICS AND SMALL OSCILLATIONS 12

Independent coordinates- Euler's angles – Components of Angular velocity in terms of Euler's angles –Angular momentum of a rigid body –Moments and products of inertia-Euler's equations of motion for a rigid body. Theory of small oscillations-frequencies of free vibration and normal coordinates-two coupled harmonic oscillators-vibrations of a linear triatomic molecule.

MODULE IV RELATIVISTIC MECHANICS 12

Basic postulates of special theory of relativity – variation of mass with velocity– Relativistic energy – Mass- energy relation – Force in relativistic mechanics – The Lagrangian and Hamiltonian of a particle in relativistic mechanics - Minkowski space and Lorentz transformations – four vectors.

MODULE V NONLINEAR DYNAMICS 12

Dynamical systems – mathematical implications of nonlinearity – definition and effects of nonlinearity – Linear vs Nonlinear oscillators – classification of equilibrium points – Logistic map- stability analysis – Period doubling – definition of chaos- initial conditions – KdV equations -solitary waves & solitons : Linear waves and Non Linear Waves.

Total Hours: 60

REFERENCES:

1. Goldstein. H, Classical Mechanics, Third edition, Dorling Kindersley (India) Pvt. Ltd, Delhi, 2008.
2. Upadhyaya. J.C., Classical Mechanics, Himalaya Publishing House, 2010.
3. Marion and Thorntron, Classical Dynamics of Particles and Systems, Fifth Edition, Holt Rinehart & Winston, 2012.
4. Panat. P.V, Classical Mechanics, Narosa Publishing Home, New Delhi, 2008.
5. Rana. N.C and Joag.P.S, Classical Mechanics, Tata Mc-Graw Hill Publishing Company Limited, New Delhi, 2004.
6. M.Lakshmanan and S.Rajasekar, Nonlinear dynamics: Integrability, Chaos and Spatio-temporal patterns, Springer-Verlag, 2003.
7. Steven H.Strogatz, Nonlinear Dynamics and Chaos: With Applications to Physics, Biology, Chemistry, and Engineering (Studies in Nonlinearity) 2nd Edition, 2015.
8. Tamás Tél, Márton Gruiz, Chaotic Dynamics: An Introduction Based on Classical Mechanics, Cambridge University Press, 2006

OUTCOMES:

At the end of the course, the students will be able to

- Explain the basic concepts in Classical Mechanics and Relativistic Mechanics.
- Solve real world problems.
- Apply theorems relating to the nonlinear bodies to analyze the various aspects of dynamics and oscillations of bodies.

PHC6102 MATHEMATICAL PHYSICS

L	T	P	C
3	1	0	4

OBJECTIVES:

- To understand the basic concepts in Mathematical Physics
- To have an overall knowledge about the use of mathematical methods such as Vectors, Matrices, Tensors, Fourier transform, Green function and Group Theory in physics
- To develop expertise in mathematical techniques that are required to solve problems in Physics

MODULE I VECTORS AND MATRICES 12

Vector analysis: Gradient – Divergence – Curl – vector spaces – linear dependence and independence of vectors - second order derivatives Gauss's theorem - Stoke's theorem - Green's theorem – Curvilinear coordinates-spherical polar-cylindrical coordinates.Matrices: Orthogonal and Unitary Matrices, Matrix diagonalization, eigen values and eigen vectors.

MODULE II SECOND ORDER LINEAR DIFFERENTIAL EQUATIONS SPECIAL FUNCTIONS 12

Physical Legendre, Bessel and Laguerre differential equations –series solutions-generating functions-recurrence relations- Sturm Liouville theorem - Orthogonality of eigen function. Hyper geometric functions – generating functions.

MODULE III COMPLEX VARIABLES 12

Functions of complex variables – single and many valued functions- analytic functions –Cauchy – Riemann equations –conjugate functions – complex line integrals-Cauchy's integral theorem-integral formula – Taylor and Laurent expansions –zeros and singularities – residues –Cauchy's Residue theorem and its applications for evaluation of integrals.

MODULE IV FOURIER TRANSFORM AND GREEN FUNCTIONS 12

Fourier Transform: Fourier transform – sine and cosine transform – properties Faultung's theorem- application in heat conduction and spectroscopy. Laplace transforms – Inverse transforms – Linearity and Shifting theorems. Linear spaces – Basis-change of basis – Inner product space – Schmidt's orthogonalisation procedure – Schwartz's inequality – Hilbert spaces - properties. Green's function: Definition and construction – symmetry properties - expression for Green's functions in terms of Eigen functions - Green's functions for simple and second order operator.

MODULE V TENSORS AND GROUP THEORY 12

Tensor analysis : Cartesian tensors – law of transformation of first and second order tensors- addition, subtraction and multiplication (inner and outer product) of tensors –rank ,covariant, contravariant and mixed tensors- symmetric and antisymmetric tensors- Quotient law. Group Theory: Basic definitions- subgroups- permutation groups-Cyclic groups - cosets - Normal Subgroups-Isomorphism - Homomorphsim-Rotation groups - Reducible – Irreducible representations – Applications.

Total Hours: 60

REFERENCES:

1. G.B. Arfken, H.J.Weber and F.E. Harris, Mathematical Methods for Physicists, Seventh Edition, Academic Press, 2012
2. S.Andrilli and D.Hecker, Elementary Linear Algebra,Academic Press, 2006
3. Chattopadhyay. P.K, Mathematical Physics, 3rd Edition, New Academic Science, 2014.
4. Joshi. A. W, Matrices and Tensors in Physics, 3rd edition, Wiley Eastern Ltd., New Delhi, 1995.
5. Gupta. B. D., Mathematical Physics, 4th edition, Vikas Publishing House Pvt Limited, 2007.
6. Murray Spiegel, Schaum's Outline of Advanced Mathematics for Engineers and Scientists, Schaum's Outline Series, McGraw-Hill, 2009.

OUTCOMES:

At the end of the course, the students will be able to

- explain basic concepts in Mathematical Physics
- solve differential equations that are appearing in Physical science
- solve problems in other courses such as Classical Mechanics, Quantum Mechanics, etc.,

PHC6103 SOLID STATE PHYSICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce crystal structure, band theory and lattice vibrations
- To have comprehensive idea on properties of materials
- To provide a sound knowledge of macroscopic properties derived from microscopic considerations

MODULE I CRYSTAL STRUCTURE AND BINDING 09

General Description of Crystal Structures – Bravais lattices- Cubic Structures, NaCl, CsCl, Diamond, Zincblende, HCP structures- Miller Indices- interplanar distance(derivation) - The Reciprocal Lattice - defects and dislocations-Quasi crystals - Force between atoms-cohesive energy –bonding in solids - binding energy of ionic crystals(derivation)-Madelung constant – Born Haber cycle.

MODULE II TRANSPORT PROPERTIES AND BAND THEORY OF SOLIDS 09

Free electron theory (Sommerfeld theory) – electronic specific heat- electrical and thermal conductivity of metals – Wiedemann Franz law (derivation)- Hall effect and Thermoelectric power - Effective mass and concept of hole- electron motion in periodic potential – Bloch’s theorem - band theory of solids -construction of Brillouin zone - Fermi surface in metals – characteristics of Fermi surface- De Haas van Alphen effect - Kronig Penney model (derivation).

MODULE III PHONONS : CRYATAL VIBRATIONS AND THERMAL PROPERTIES 08

Vibrations of crystals with monoatomic lattice(derivation) - Vibrations of crystals with diatomic lattice (derivation)– optical and acoustical modes – number of normal modes of vibrations in a band-Phonon momentum- inelastic scattering of photons by phonons – Debye's theory of lattice specific heat(derivation) - anharmonic effects.

MODULE IV MAGNETIC AND DIELECTRIC PROPERTIES 10

Types of magnetic materials –Diamagnetism – Langevin's theory(derivation)- Paramagnetism – Hund’s rules – rare earth ions-iron group ions-crystal field splitting- Pauli paramagnetism- Ferromagnetism – domain theory- Curie-Weiss law (derivation)- antiferromagnetism-ferrites. Polarization and polarizability- types of polarization (qualitative) and dependence on frequency and temperature-local electric field in an atom- Clausius Mossotti relation(derivation) - Piezo, pyro and ferroelectric properties of crystals.

MODULE V SUPERCONDUCTIVITY AND OPTICAL PROPERTIES 09

Properties of superconductor – critical magnetic field – Meissner effect (derivation) – Type I and Type II super conductors – superfluidity - entropy and heat capacity –energy gap-quantum tunneling - London equations (derivation) – coherence length - BCS theory – RVB - AC and DC Josephson effect – SQUID. Traps – Excitons – coloration of crystals - types of colour centers - Luminescence: fluorescence and phosphorescence– activators - Emission and absorption spectra – Efficiency of phosphor.

Total Hours: 45

REFERENCES:

1. Kittel. C, Introduction to Solid State Physics, 8th edition, Wiley Eastern, New Delhi, 2004.
2. Pillai. S.O, Solid State Physics, New Age International, New Delhi, 2009.
3. Blakemore. J. S, Solid State Physics, 2nd edition, Cambridge University Press, Cambridge, 1985.
4. Philip Hofmann, Solid State Physics, 1st edition, Wiley-VCH Publishers, 2011.
5. Wahab. A, Solid State Physics: Structure and Properties of Materials , Alpha Science International Ltd; 2nd Revised edition, 2005
6. Raghavan.V, Materials science and Engineering: a first course, PHI Learning 5th Ed, 2004
7. Kashab S.O, Principles of Electrical Engineering Materials and Devices, McGraw Hill Int National publishers, 2000

OUTCOMES:

At the end of the course, the students will be able to illustrate the

- basic concepts on properties of materials in solid state physics.
- phenomenon of superconductivity and its properties.
- different techniques used for synthesis and fabrication of nanomaterials.
- properties of solids with relevant theoretical knowledge
- knowledge for specialization in condensed matter physics

PHC6104 PHYSICS OF SEMICONDUCTOR DEVICES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the fundamentals of physics of semiconducting materials
- To construct and study the operations of semiconductor devices in the family of diodes and transistors under different operating conditions
- To expose to circuit design of different types of amplifiers, oscillators and IC fabrication
- To understand and analyze complex practical circuits and to have strong basic knowledge to design electronic circuits.

MODULE I SEMICONDUCTOR DIODES 09

Semiconductors: N and P type, mass action law - continuity equation –
PN junction diode under forward and reverse bias – Band structure – Einstein's diode equation – Zener diode - Varactor diode – Schottky diode – Tunnel diode – Gunn diode – Optoelectronic diodes – LED,LASER diode and photo diode.

MODULE II SPECIAL DEVICES 09

BJT construction and characteristics – biasing circuits – current components - JFET-structure and working –V-I Characteristics – pinch off voltage derivation –Depletion and Enhancement type MOSFFT – UJT – SCR–DIAC, TRIAC - applications.

MODULE III AMPLIFIERS 09

BJT single stage amplifier - FET single stage amplifier – small signal analysis - Operational amplifier - inverting and non-inverting amplifier – instrumentation amplifier – voltage follower –comparator - integrating and differential circuits – log & antilog amplifiers –active filters : lowpass, high pass, band pass & band rejection filters-solving simultaneous and differential equations.

MODULE IV OSCILLATORS and CONVERTORS 09

Colpitt's oscillator – Hartley oscillator - Wien bridge, phase shift oscillators - – triangular, sawtooth and square wave generators-Schmitt's trigger – sample and hold circuits – phase locked loops. Basic D to A conversion and A to D conversion.

MODULE V IC FABRICATION AND IC TIMER 09

Basic monolithic ICs – epitaxial growth – masking – etching impurity diffusion fabricating monolithic resistors, diodes, transistors and capacitors – circuit layout – contacts and inter connections – charge coupled device –555 timer – description of the functional diagram

– mono stable operation – applications of mono shots – astable operation and pulse generation.

Total Hours: 45

REFERENCES:

1. Floyd L, Electronic Devices, Pearson Education, 8th edition, New York, 2009.
2. Milman.J and Halkias.C.C, Electronic devices and circuits, Tata McGraw Hill, 1991.
3. Roy Choudhary. D, Linear Integrated Circuits, 3rd edition, New Academic
4. Science Ltd, 2010.
5. Mottershead, A., Electronic Devices and Circuits - An Introduction, Prentice
6. SM.Sze, Semiconductor devices – Physics and Technology, 2nd Ed, John Wiley 2002.
7. Doneld A Neaman, Semiconductor physics and devices, 3rd Ed, Tata McGraw Hill, 2002.
8. S. Salivahanan, N.Suresh Kumar and A.Vallavaraj, Electronic devices and circuits, Tata McGraw Hill, Third Edition, 2012.

OUTCOMES:

At the end of the course, the students will be able to explore the

- Fundamentals of working of semiconductor diodes and special devices
- Applications of electronic devices in amplifier and oscillator circuits.

PHC6105 MATERIALS SCIENCE LAB

L	T	P	C
0	0	4	2

OBJECTIVES:

- To make the student understand the basics of materials science.
- To enable the student to explore the concepts involved in various instrumentation techniques
- To make the student understand the basic concepts of electronic band structures and some applications
- To allow the student to understand the fundamentals of nonlinear optics.

LIST OF EXPERMENTS

(ANY TEN)

1. Crystal growth – Constant temperature bath
    a. Solubility Test
    b. Metastable zone width
    c. Slow evaporation technique
2. Determination of susceptibility of liquid using Quinckie's method.
3. Determination of type of semiconductor by Hall Effect method.
4. Determination of Conductivity of a material using four probe method.
5. Determination of dielectric constant of material using LCR meter.
6. Determination of Young's Modulus using Flexural vibration
7. Determination of Band structure and Density of States (DOS)
8. Determination of magnetic properties using density functional theory (DFT).
9. Study of Nonlinear behaviors – Numerical simulation
10. Determination of Velocity and Compressibility of ultrasonic waves in liquid
11. Characteristics of solar cell
12. Comparative study of Compound pendulum and Torsion pendulum
13. Determination of Magnetic moment using materials modelling.
14. Measurement of Line intensities in Iron Arc Spectrum by spectrograph
15. Basic programing using UNIX and C++.

OUTCOMES:

At the end of the course, the students will be able to

- demonstrate experiments related to Materials Science
- obtain electronic band structure through computational methods and investigate materials properties

PHC6106 SEMICONDUCTOR DEVICES AND CIRCUITS LAB

L	T	P	C
0	0	4	2

OBJECTIVES:

- To make the student understand the basics of electronics.
- To enable the student to explore the concepts involved in the oscillators
- To make the student understand the basic concepts in IC's and digital devices
- To allow the student to understand the fundamentals of multivibrators

LIST OF EXPERMENTS

(ANY TEN)

1. Characteristics of PN Junction diode and Zener diode. Design of clipper and clamper circuits.
2. Input and Output characteristics of BJT in CB and CE configurations and comparison.
3. Characteristics of JFET and MOSFET
4. UJT and SCR characteristics
5. Characteristics of photodiode and photo transistor.
6. Design of single stage amplifier using BJT and JFET for small signal applications and comparison.
7. Design of Colpitt's and Hartley oscillators using BJT for a given frequency
8. Design of Wien bridge and Phase shift oscillators using OPAMP.
9. Schmitt's trigger: Triangular, sawtooth and square wave generators.
10. Design of Adder, Subtractor, Multiplier, Differentiator and Integrator circuits using OPAMP
11. Construction of Astable, Monostable and Bistable multivibrators using BJT / OPAMP.
12. Construction of Dual power supply.
13. Design of A / D and D / A convertors.
14. Design of modulation and demodulation circuits.

OUTCOMES:

At the end of the course, the student will be able to

- classify the characteristics of semiconductor devices
- design amplifier, oscillator and other circuits using OP AMP

SEMESTER II

PHC6201 QUANTUM MECHANICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To study the basic concepts of quantum mechanics.
- To understand the different approximation methods used in quantum mechanics.

MODULE I BASIC FORMULATION 09

Postulates of quantum mechanics - Schrodinger time independent and dependent equations– physical Interpretation of wave function Ψ - expectation values - Ehrenfest theorem-Basic postulates - Operators: Definition and properties- Eigen values and Eigen functions - self adjoint operators – Parity operator- uncertainty principle. (Statement and Proof) - Quantum pictures: Schroedinger, Heisenberg and Interaction.

MODULE II EXACTLY SOLVABLE SYSTEMS 09

One dimensional linear harmonic oscillator – solutions to a square well potential – rigid rotator -Particle in a central potential – Particle in a periodic potential - Central forces and reduction of two body problem – Particle in a spherical well – Hydrogen atom.

MODULE III APPROXIMATION METHODS 09

Equations in various orders of time independent perturbation theory for non- degenerate case: first and second order– Stark effect – Zeeman effect- Application to ground state of Helium atom – time dependent perturbation theory– harmonic perturbation (Fermi-Golden Rule) - Adiabatic, Sudden Approximation perturbation.

MODULE IV ANGULAR MOMENTUM 09

Commutation rules for angular momentum operators – eigen values and eigen functions of L2 and Lz – Ladder operators - raising and lowering operators- eigen states and eigen values of J2 and Jz - addition of angular momentum - Clebsch Gordan coefficients - Symmetry and anti symmetry of wave functions - Pauli's spin matrices.

MODULE V RELATIVISTIC QUANTUM MECHANICS 09

Klein Gordon equation – probability and current densities – Dirac's equation for free particles – Dirac matrices- covariant form of Dirac's equation - Spin of Dirac's particle- Interpretation of negative energy states - Magnetic moment of an electron due to spin - Energy values in a coulomb potential.

Total Hours: 45

REFERENCES:

1. Merzbacker E., Quantum mechanics, Wiley Publishers, 4th Edition, 1991.
2. Satya Prakash, Quantum Mechanics, Sultan Chand Publishers, New Delhi, 2004.
3. V. Devanathan, Quantum Mechanics, Alpha Science, 2005
4. S. Rajasekar, R. Velusamy, Quantum Mechanics I: The Fundamentals, CRC Press, 2014.
5. Sl Gupta, Kumar V, Hv Sharma, Quantum Mechanics, Jai Prakash Nath Publications
6. P M Mathews, K.Venkatesan ,Text Book of Quantum Mechanics, 2nd Ed, Tata McGraw-Hill Education

OUTCOMES:

At the end of the course, the students will be able to

- Comphrend the basics of quantum mechanics and to apply it in different branches of Physics
- Undertake applied research in quantum mechanics

PHC6202 THERMODYNAMICS AND STATISTICAL PHYSICS

L	T	P	C
4	0	0	4

OBJECTIVES:

- To understand the concepts of thermodynamics
- To know the fundamentals of statistical physics
- To understand the quantum laws governing particles

MODULE I REVIEW OF THERMODYNAMICS 12

Energy and first law of thermodynamics – entropy and second law of thermodynamics – Nernst heat theorem and third law of thermodynamics Enthalpy – consequences of Nernst heat theorem – heat capacity and specific heat – Maxwell's thermodynamic relations and potentials - Gibb's - Helmholtz relations - thermodynamic equilibria.

MODULE II STATISTICAL DESCRIPTION OF SYSTEM OF PARTICLES 12

Statistical formulation of a state system – calculation of pressure using time independent scenario-phase space – density distribution in phase space – Liouville's theorem-equation of motion and Liouville's theorem – ensembles-types and ensemble average-equal apriori probability – statistical equilibrium– isolated system – system in contact with heat reservoir - calculation of meanvalues in a canonical ensemble and connection with thermo dynamics.

MODULE III SIMPLE APPLICATIONS OF THERMODYNAMICS 12

Concept of partition function – their properties- ideal monatomic Gas - calculation of thermo dynamic quantities – Gibb's paradox- equipartition theorem – proof – simple application - Harmonic oscillator- characteristics of crystalline solids – specific heat by Einstein model- Debye's modification.

MODULE IV QUANTUM STATISTICS OF IDEAL GASES 12

Identical particles- symmetry requirements – formulation of statistical problems – quantum distribution functions from partition function: Photon, Fermi-Dirac and Bose – Einstein statistics- chemical potential – Bose- Einstein condensation.

MODULE V PHASE TRANSITIONS 12

General remarks on phase transitions- First and Second order – non ideal gas – calculation of partition function for low densities – equation of state and Virial coefficients-derivation of Vander Wall's equation – spin – spin interaction – one dimensional model – Weiss molecular field approximation.

Total Hours: 60

REFERENCES:

1. Frederick Reif, Fundamentals of statistical and thermal physics, McGraw-Hill, 2008.
2. Agarwal B.K. and Eisner M, Statistical Mechanics, 2nd Edition, New Age International, New Delhi, 1998.
3. Sears F.W and Salinger G.L, Thermodynamics, kinetic theory and statistical thermodynamics, Narosa publishing House, 1998.
4. Huang. K, Statistical Mechanics, Wiley Eastern Ltd., 2nd Edition, New Delhi, 1987.
5. Bhattacharjee J.K, Statistical Mechanics: An Introductory Text, Allied Publication, New Delhi, 1996.

OUTCOMES:

At the end of the course, the students will be able to explain the

- Fundamentals of thermodynamic systems
- Various statistical laws governing the particles
- the physics of thermodynamics applied in solids

PHC6203 ATOMIC PHYSICS AND MOLECULAR SPECTROSCOPY

L	T	P	C
4	0	0	4

OBJECTIVES:

- To have a basic knowledge of modern atomic and molecular physics
- To understand different spectroscopic studies on matter on the basis of quantum mechanics
- To master the experimental and theoretical methods in atomic and molecular spectroscopy

MODULE I ATOMIC AND MOLECULAR STRUCTURE 12

Atomic models: Vector atom model – Pauli's exclusion principle –Heisenberg's uncertainty principle – Types of spectra - Equation of motion of matters waves – operators - momentum and energy operators - eigen functions and eigen values –– Many electron atoms – coupling schemes – Spin orbit interaction -energy levels – Spin functions of two and three electrons - Central field approximation: Thomas Fermi statistical model –– Paschen back effect – Covalent bond - Hybridization: sp, sp2, sp3 - molecular orbital theory –Heitler London theory of Hydrogen ion and Helium molecule.

MODULE II INFRARED AND MICROWAVE SPECTROSCOPY 12

Characteristic features of pure rotation – vibration – rotation and vibration of a diatomic molecule – theory – evaluation of molecular constants – IR spectra of polyatomic molecules – experimental techniques of IR – Dipole moment studies – molecular structure determination. Microwave spectra of polyatomic molecules – experimental techniques of microwave spectroscopy – inversion spectrum of ammonia – Maser principles – Ammonia Maser– applications of Masers.

MODULE III RAMAN SPECTROSCOPY 12

Semi classical treatment of emission and absorption of radiation – emission and absorption coefficients – spontaneous and induced emission of radiation – polarisability – Rayleigh scattering – Raman effect – basic principles of Raman scattering – vibrational and rotational Raman spectra – Experimental techniques of Raman Spectroscopy- – molecular structure studies – Laser as a Raman source.

MODULE IV NMR AND ESR SPECTROSCOPY 12

NMR spectroscopy Basic principles- classical and quantum mechanical techniques - Bloch equations- spin- spin and spin- lattice relaxation times-experimental technique - single coil and double coil methods- pulse method-high resolution method. ESR spectroscopy- basic principles- ESR spectrometer- Nuclear interaction and hyperfine structure- Relaxation effects- 'g' factor- biological applications.

MODULE V NQR AND MOSSBAUER SPECTROSCOPY 12

NQR spectroscopy- basic principles- quadrupole Hamiltonian- Nuclear quadrupole energy levels- for axial and non axial symmetry- NQR spectrometer-chemical bonding-molecular structure and molecular symmetry studies. Mossbauer spectroscopy-principle experimental arrangement - chemical shift-quadrupole splitting-applications.

Total Hours: 60

REFERENCES:

1. Sune Svanberg, Atomic and Molecular spectroscopy, 3rd Edition, Springer Publishers, 2012.
2. Jain V. K., Introduction to Atomic And Molecular Spectroscopy, Alpha Science Intl Publishers, 2007.
3. Colin N. Banwell and Elaine M. McCash, Fundamentals of Molecular spectroscopy, McGraw-Hill College, 1994.
4. G.Aruldhas, Molecular structure and Spectrocopy, 2nd Ed., PHI learning Pvt.Ltd. 2014.
5. R.Gopalan, P.S.Subramanian and K.Rengarajan, Elements of Analytical Chemistry,Sultan Chand & sons, 2011
6. Jeanne L. McHale, Molecular spectroscopy, Prentice Hall, 1994.

OUTCOMES:

At the end of the course, the students will be able to

- explain the basic ideas about the various energy levels in matter and the concepts of spectroscopy
- Compare different spectroscopic studies
- carry out theoretical and experimental studies on molecular spectroscopy with focus on structure and dynamics of atoms and molecules

GEC6202 RESEARCH METHODOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To inculcate the importance and the process of research methodology
- To train the students to define a research problem and to collect data
- To guide in the analysis and interpretation of results

MODULE I RESEARCH METHODOLOGY-AN INTRODUCTION 09

Research: Objectives, Motivation and types - Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Criteria of Good Research, Problems Encountered by Researchers - Introduction to ethics, scientific conduct and misconduct, Misconduct and why it occurs, Fabrication, Authorship issues, The investigation and punishment of scientific misconduct.

MODULE II GOOD LABORATORY PRACTICES AND SAFETY 09

Introduction: History, definition, Principles, Good Laboratory Practices (GLP) and its application GLP training: Resources, Rules, Characterization, Documentation, quality assurance, Resources, Facilities: building and equipment, Personnel, GLP and FDA, Stepwise implementation of GLP and compliance monitoring. Safety Symbols, Science Safety Rules- Dress Code, First Aid, Heating and Fire Safety

MODULE III PROGRAMMING TECHNIQUES 09

FORTRAN-77 - C and C++ programme – MATLAB – Numerical Methods – Ordinary Differential Equation – Partial Differential Equation – Runge Kutta Method.

MODULE IV INTERPRETATION OF RESULTS AND ANALYSIS 09

Importance and scientific methodology in recording results, importance of negative results, different ways of recording, industrial requirement, artifacts versus true results, types of analysis (analytical, objective, subjective) and cross verification, correlation with published results, discussion, outcome as new idea, hypothesis, concept, theory, model etc. Data analysis using Excel, Origin and Sigma plot Analyzing the chemical data and drawing chemical structures using Chemdraw and Chemsketch. Conceptions of error of measurement, true score theory and generalisability theory. Measures of central tendency or averages – mean median and mode. Measures of dispersion – range, variance, and standard deviation: The normal distribution and the normal probability curve.

MODULE V SCIENTIFIC WRITING, TECHNICAL PUBLICATION AND RESEARCH PROPOSAL 09

Different types of scientific and technical publications in the area of research, and their specifications, Ways to protect intellectual property – Patents, technical writing skills, definition and importance of impact factor and citation index - assignment in technical writing, The research problem, finding related literature, computer generated references sources and the research project, model research proposal.

Total Hours: 45

REFERENCES:

1. Essentials of Research Design and Methodology Geoffrey R. Marczyk, David DeMatteo, David Festinger, John Wiley & Sons Publishers, Inc, 2005.
2. Biochemical Calculations: How to Solve Mathematical Problems in General Biochemistry, 2nd Edition, Irwin H. Segel, John Wiley & Sons Publishers, Inc, 1976
3. Guide to Publishing a Scientific paper, Ann M. Korner, Bioscript Press, 2004.
4. P Laake, H B Benestad, B R Olsen. Research Methodology in the medical and biological sciences. Academic Press, 2007.
5. R Arora. Encyclopaedia of Research Methodology in Biological Sciences. Anmol Publishing, 2004.
6. Kothari C.R., Research Methodology, Methods and Techniques, Wiley Eastern Ltd., NewDelhi, 1991.
7. Coghill M. and Gardson L.R., The ACS Style Guide Effective Communication of ScientificInformation, 3rd Edn., Oxford University Press, 2006.
8. Willa Y. Garner, Maureen S. Barge, James, P, Good Laboratory Practice Standards:Applications for Field and Laboratory Studies (ACS Professional References Book).

OUTCOMES:

At the end of this course, the students will be able to:

- select and define appropriate research problems
- analyze and interpret the results of the research problem
- prepare project proposals

PHC6204 THERMAL PHYSICS LAB

L	T	P	C
0	0	4	2

OBJECTIVES:

- To make the student familiarize with the basics of experimental physics .
- To enable the student to explore the concepts involved in the thermodynamics and heat
- To allow the student to apply the fundamentals of instruments involved in thermal process.

LIST OF EXPERMENTS

(ANY TEN)

1. Radiation from a black body: Stefan-Boltzmann Law
2. Thermal conductivity of good conductors by Forbe's method.
3. To determine the Coefficient of Thermal Conductivity of Copper by Searle's and Angstrom's method.
4. To determine the Coefficient of Thermal Conductivity of a bad conductor by Lee disc method.
5. To study the variation of Thermo-Emf of a Thermocouple with Difference of Temperature of its Two Junctions.
6. Measurement of Planck's constant using black body radiation.
7. Determination of Stefan's constant.
8. Specific heat of liquid – Newtons law of cooling
9. EMF of a thermocouple – Mirror galvanometer – Direct deflection method.
10. Verification of Newton's Law of cooling.
11. Thermal conductivity of a good conductor by Searle's method.
12. Temperature characteristics of thermistor.
13. Specific heat of liquid – Joule's Calorimeter
14. Thermal expansion by Fizeau's method (Coefficient of linear expansion of brass).
15. Determination of co-efficient of thermal conductivity of a single crystal.

OUTCOMES:

At the end of the course, the student will be able to

- have a thorough knowledge on the different experimental techniques in thermal physics.
- grasp the basic ideas involved in thermal experiments
- apply the concepts of physics and do the interpretation and acquire the result

SEMESTER III

PHC7101 DIGITAL ELECTRONIC AND MICROPROCESSORS

L	T	P	C
4	0	0	4

OBJECTIVES:

- To understand the concepts of microprocessors and microcontrollers.
- To comprehend the ideas about the digital electronics

MODULE I LOGIC GATES 12

Logic gates - block diagram - truth table - XOR gate - equivalent functions -combinational logic - half adder / subtractor - full adder / subtractor – De Morgan's laws-Boolean algebra - Karnaugh maps - max and min terms -encoders and decoders - multiplexers and demultiplexers.

MODULE II COUNTERS 12

Sequential logic – flip flops – sequential circuit analysis – state diagram – state equation – registers – counters – up down counters – timing sequences – the memory MODULE – Random Access Memory (RAM) – Magnetic core memory.

MODULE III INTRODUCTION TO MICROPROCESSOR 12

Common microprocessor characteristics - pin diagram and functions for generic microprocessor - microprocessor architecture - the intel 8085 microprocessor - the 8085 pin diagram and functions - 8085 architecture - different addressing modes - 8085 instruction set - arithmetic, logical and branch instructions - the 8085 stack, I/O and control instructions.

MODULE IV 8085 MICROPROCESSOR 12

Programming the 8085 microprocessor - 8 bit addition, subtraction, multiplication and division - looping programs - sum of data - maximum,
minimum values of the given array - ascending / descending - data transfer- 16 bit addition – relay generation – multiple precision arithmetic decimal arithmetic - subroutine programs - ASCII to decimal multiple precision addition subroutine.

MODULE V MICROPROCESSOR INTERFACING 12

Timing diagram - instruction cycle, machine cycle, R/W cycle – interfacing the microprocessor - interfacing with ROM - interfacing with RAM - I/O interfacing basics.

Total Hours: 60

REFERENCES:

1. Jain R. P, Digital Electronics and Microprocessors, First Edition, Tata – McGraw Hill, 1987.
2. Anokh Singh, A.k.Chhabra, Fundamental of Digital Electronics and Microprocessors, 2nd Edition, S. Chand Limited, 2005.
3. Anokh Singh, Chhabra A.k, Fundamental of Digital Electronics and its application, S. Chand Limited, 2005.
4. Sumit Kumar Singh, Fundamental of Digital Electronics and Microprocessors, Coronet Books Incorporated, 2008.
5. Jain, Modern Digital Electronics, 3rd Edition, Tata McGraw Hill, 2003.

OUTCOMES:

At the end of the course, the students will be able to illustrate

- the working of digital electronic devices.
- the concepts of working model of microprocessors and microcontrollers.

PHC7102 ELECTROMAGNETIC THEORY AND ELECTRODYNAMICS

L	T	P	C
3	1	0	4

OBJECTIVES:

- To know the principles of electrostatics and magnetostatics.
- To understand the basic concepts in electromagnetic wave and radiation.
- To study the laws governing the propagation of electromagnetic waves.
- To enable the student to explore the field of electrodynamics

MODULE I ELECTROSTATICS 12

Coulomb's law, Gauss's law and applications, Electrostatic potential – Laplace and Poisson's equation – Laplace equation in three dimensions - Boundary value problems and uniqueness theorem, Polarization and displacement vectors - Boundary conditions - Dielectric sphere in a uniform field – Molecular polarisability and electrical susceptibility – Electrostatic energy in the presence of dielectric – Multipole expansion.

MODULE II MAGNETOSTATICS 12

Biot-Savart Law and its Applications, Ampere's circuital Law – Applications – Magnetic vector and scalar potential - Magnetic moment, force and torque on a current distribution in an external field - Magnetostatic energy - Magnetic induction and magnetic field in macroscopic media - Boundary conditions.

MODULE III MAXWELL'S EQUATION 12

Faraday's laws of Induction - Maxwell's displacement current - Maxwell's equations – free space and linear isotropic media - Vector and scalar potentials - Gauge invariance - Wave equation in one dimension - Coulomb and Lorentz gauges - Energy and momentum of the field - Poynting's theorem - Lorentz force - Conservation laws for a system of charges and electromagnetic fields.

MODULE IV ELECTROMAGNETIC WAVES & INTERACTION WITH MATTER 12

Plane waves in non-conducting media - Linear and circular polarization, reflection and refraction at a plane interface- Fresnel's law, interference, coherence and diffraction - Waves in a conducting medium - Propagation in linear media – Reflection and transmission at Normal incidence – Reflection and Transmission at Oblique incidence – Laws of incidence and reflectance, Snell's law, Brewster law – Fresnel's equations.

MODULE V RELATIVISTIC AND QUANTUM ELECTRODYNAMICS 12

Four vectors - Lorentz transformation - invariance of Maxwell's equations under Lorentz transformation - invariance of D'Alembertian operator – invariance of Maxwell's field

equations in terms of four vector - Quantum Electrodynamics (QED) – Introduction - S-Matrix and its expansion. Ordering theorems, Feynman graph and Feynman rules - Application - Rutherford scattering and Compton scattering.

Total Hours: 60

REFERENCES:

1. David J.Griffith, Introduction to Electrodynamics, 4th Edition, Pearson New International Edition, New Delhi, 2014.
2. John David Jackson, Classical electrodynamics, 3rd edition, Wiley Eastern Ltd. (1999).
3. Gupta, Kumar, Singh, Electrodynamics, Pragati Prakashan (2001).
4. Capri A.Z. and Panat P.V., Introduction to Electrodynamics, Narosa Publishing House, 2010.
5. Satya Prakash, Electromagnetic theory and Electrodynamics, 10th edition, Kedar Nath and co., Meerut, 1999.
6. Matthew N.O, Sadiku, Elements of Electromagnetics, 3rd Ed. 2006

OUTCOMES:

At the end of the program, the students will

- Familiarize with the concepts of electrostatics, magnetostatics and electromagnetic theory.
- Apply Maxwell's equations to circuit theory.
- Gain knowledge on the propagation of electromagnetic waves.

PHC7103 NUCLEAR AND PARTICLE PHYSICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To acquire the knowledge of basic properties of nucleus.
- To have an idea on the nature of nuclear forces.
- To gain the knowledge on elementary particles.
- To introduce the concepts of radioactivity
- To get an insight into nuclear reactions

MODULE I NUCLEAR STRUCTURE 09

Basic properties: nuclear size-nuclear radius, nuclear structure, Rutherford's experiment - magnetic moments - systematics of stable nuclei - semi empirical mass formula of Weizsacker - nuclear stability - mass parabolas- liquid drop model- shell model.

MODULE II NUCLEAR FORCES 09

Ground state of deutron- magnetic dipole moment of deutron- charge independence of nuclear forces- exchange forces. Scattering Processes: The scattering problem-formulation- scattering amplitude- expression in terms of Green’s function- Born approximation and its validity- method of partial waves - phase shifts-low energy scattering- scattering length and effective range.

MODULE III RADIOACTIVITY 09

Alpha particle emission- Geiger Nuttal law- Gamow’s theory of alpha decay-fine structure of alpha spectra-beta decay- Neutrino hypothesis- Fermi’s theory of beta decay-Fermi and G.T.Slection rules- Non- Conservation of parity in gamma decay- Gamma emission-selections rules- transition probability-internal conversion- nuclear isomerism.

MODULE IV NUCLEAR REACTIONS 09

Energies of Nuclear reaction- level widths - cross sections- compound nucleusmodel-resonance scattering- Breit- Wigner one level formula- optical model- direct reactions-Stripping and pick- up reactions- Fission and fusion reactions- elementary ideas of fission reaction- theory of fission- elementary ideas of fusion- controlled thermonuclear reactions- ideas of nuclear reactors- plasma confinement- fusion power.

MODULE V ELEMENTARY PARTICLES 09

Classification of fundamental forces- isospin strangeness- GellMann Nishijima’s formula-quark model- SU (3) symmetry- CPT invariance in different interactions-parity non

conservation-k meson- complex and time reversal invariance- elementary ideas of gauge theory of strong and weak interactions – Higg's boson particle.

Total Hours: 45

REFERENCES:

1. Tayal D.C., Nuclear Physics, Himalaya Publishing House, 1997.
2. Khanna M.P., Introduction to Particle Physics, Prentice Hall of India, 2004.
3. Williams W. S. C., Nuclear and Particle Physics, Oxford University Press, 1991.
4. Brian Martin, Nuclear and Particle Physics: An Introduction, Wiley Publishers, 2011.
5. I. S. Hughes, Elementary Particles, Cambridge University Press.
6. Roy and Nigam, Nuclear Physics, Wiley.

OUTCOMES:

At the end of the course, the students will be able to

- explore the basic concepts of nucleus and its properties
- explore the basic ideas and comprehend concepts of Nuclear forces
- get an exposure of radioactivity concepts
- apply the concepts of quantum forces in nuclear reactions
- gain the knowledge on elementary particles.

PHC7104 ADVANCE ELECTRONICS LAB

L	T	P	C
0	0	4	2

OBJECTIVES:

- To understand basic analog circuit designs
- To know the working of amplifiers
- To study transistor biasing

LIST OF EXPERMENTS

(ANY TEN)

1. Combinational circuit (Half Adder, Hall - Subtractor, Full Adder and Full-Subtractor)
2. Design a BCD to Excess 3 code converter using combinational circuits.
3. Design a combinational circuit whose output is the 2’s complement of the input number.
4. To design and construct of a 4-bit parallel Binary Adder
5. To design and construct multiplexer and demultiplexer
6. To design and verify encoder and decoder
7. To Verification of Flip-Flop (JK, RS,T& D)
8. To verify the operation of a 4 bit shift register using IC 7495
9. To design and construct Synchronous Counter
10. To verify the operation of a ring counter
11. To verify the operation of a decade counter
12. Addition and subtraction of two numbers using 8085 Microprocessor.
13. Multiplication of 2 - 8 numbers using 8085 Microprocessor

OUTCOMES:

- Students can simulate building and test basic analog circuit
- Students can simulate building and test amplifier circuits
- Students can simulate building and test Transistor biasing

PHC7105 ADVANCED OPTICS LA

L	T	P	C
0	0	4	2

OBJECTIVES:

- To gain in-depth knowledge in the field of optics
- To apply the concepts learnt through laboratory in various applications to meet the epithetical needs of the society.

LIST OF EXPERMENTS

(ANY TEN)

1. Determination of wavelength of light using Michelson interferometer
2. Refractive index of a given liquid using Hollow prism method
3. Air – wedge experiment
4. Numerical aperture and acceptance angle of an optical fibre.
5. Particle size determination of different materials
6. Spectrometer experiment – determination of wavelength of prominent line of mercury spectrum.
7. Determination of Brewster angle using fibre optics
8. Fraunhoffer diffraction experiment
9. Fresnel diffraction experiment
10. Beam divergence of He - Ne laser semiconductor diode laser
11. Single mode fibre characteristics
12. Nonlinear optical studies using Pulsed Nd: YAG Laser
13. Demonstrate the principle of Rayleigh Scattering
14. Polarization experiments using polarimeter

OUTCOMES:

At the end of the course, the student will be able to

- have a thorough knowledge on the different experimental techniques in Advanced optics
- grasp the basic ideas involved in laser experiments
- apply the concepts of physics and do the interpretation on interference, diffraction, polarization experiment results

LIST OF ELECTIVES
SEMESTER I

PHCY101 CRYSTAL GROWTH TECHNIQUES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand and compare the various Crystal Growth techniques.
- To know the principle in the methods involved in the growth of crystal.

MODULE I CRYSTALLOGRAPHY 09

Symmetry elements, operations - translational symmetries - point groups - space groups - equivalent positions –close packed structures - voids - important crystal structures – Paulings rules - defects in crystals, – polymorphism and twinning - polarizing microscope and uses.

MODULE II CRYSTAL GROWTH THEORY & TECHNIQUES 09

Introduction to crystal growth - nucleation – Gibbs-Thomson equation - kinetic theory of nucleation – limitations of classical nucleation theory - homogeneous and heterogeneous nucleation – different shapes of nuclei – spherical, cap, cylindrical and orthorhombic, Bridgman technique - Czochralski methods - Verneuil technique - zone melting – gel growth – solution growth methods – low and high temperature solution growth methods – vapour growth.

MODULE III GROWTH FROM SOLUTIONS 09

Measurement of supersaturation – Low temperature solution growth – High temperature solution growth – Accelerated crucible rotation technique (ACRT) – Electrocrystallization – Crystal growth in gel – Growth of biological crystals – Hydrothermal technique – Sol-gel growth – Chemical bath deposition (CBD) – Photochemical deposition (PCD) – unidirectional growth of crystals from solution.

MODULE IV MELT GROWTH 09

Temperature measurement and control – Starting materials and purification – conservative and non-conservative process – Bridgman method – Czochralski method – Verneuil method – Zone melting – Skull melting – Fluid flow analysis in melt growth – theory and experiment.

MODULE V APPLICATIONS OF LINEAR AND NON-LINEAR CRYSTALS 09

Nonlinear Optics in Linear Photonic Crystals - Guided Modes in Photonic Crystals Slab. Photonic crystal optical circuitry - 1-D Quasi Phase Matching - Nonlinear Photonic Crystal

Analysis – Nonlinear photonic crystals – photonic crystal fibers – photonic crystal sensor - Materials: LiNbO3, Chalcogenide Glasses, etc., Wavelength Converters, etc.

Total Hours: 45

REFERENCES:

1. Brice J.C., Crystal Growth Processes, John Wiley and Sons, New York, 1987.
2. SanthanaRagavan P. and Ramasamy P., Crystal Growth Processes and Methods, KRU Publications, Kumbakonam, 2001.
3. Scheel, Hans J. and Fukuda, Crystal Growth Technology, Wiley publishers, 2003.
4. Hans J. Scheel and Peter Capper, Crystal Growth Technology: From Fundamentals and Simulation to Large-scale Production, Wiley publishers, 2008.

OUTCOME:

- At the end of the course, the students will be able to understand the various techniques involved in Crystal Growth.

PHCY102 MATERIALS PROCESSING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the basic concepts of physics of materials processing
- To provide knowledge of various material processing techniques.

MODULE I BASIC MANUFACTURING PROCESSES 09

Fundamental analysis of Manufacturing processes, casting, casting processes, forging, methods of forging, extrusion, rolling, spinning, turning, planning and shaping, milling, grinding.

MODULE II SURFACE TREATMENT PROCESSES 09

Necessity for surface modification, surface cladding, surface alloying, hard facing, shock hardening, conventional methods, carburizing, nitriding, cyaniding, advantages of laser surface treatment over conventional methods, typical laser variables used in surface alloying, laser cladding, experimental set up.

MODULE III WELDING PROCESSES 09

Various processes of welding, fusion welding, pressure welding, oxyacetylene welding, resistance welding, spot welding, thermite welding, projection welding, seam welding, butt welding, thermal effects of welding, effects on grain size and microstructure, internal stresses effect, corrosion effect, high energy beam welding, laser beam and electron beam welding, key hole effect.

MODULE IV MECHANICAL WORKING OF METALS 09

Hot working, cold working, normalizing, full annealing, tempering, theory of tempering, effect of tempering temperature on mechanical properties of carbon steels, different tempering process, deformation of metals, elastic deformation, plastic deformation, slip, twinning.

MODULE V POWDER METALLURGICAL PROCESS 09

Production of powders, powder mixing, compacting, types of presses, sintering, soaking, finishing process, limitations and advantages of powder metallurgy, applications, production of cemented carbide cutting tools, self-lubricating bearings, magnets, cermets, ultrasonic ceramic transducers.

Total Hours: 45

REFERENCES:

1. Rajan T.V, Sharma C.P and Ashok Sharma Heat treatment - Principles and Techniques, Prentice Hall of India Pvt. Ltd. New Delhi, 1995.
2. Muralidhara, M.K., Materials Science and Processes, Dhanpat Rai Publishing Co., New Delhi, 1998.
3. Rykalin, Uglov A, Kokona, A Laser and Electron beam material processing hand book, MIR Publishers, 1987.
4. Gupta, R.B. Materials Science and Processes, Satya Prakashan, New Delhi, 1995.

OUTCOMES:

At the end of the course the students will be able to

- illustrate the manufacturing process, surface treatment process, welding process and mechanical working of metals and powder metallurgical process.

PHCY103 CHARACTERISATON OF MATERIALS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To know the principle and working of various techniques involved in the characterization of materials.
- To learn to analyze data of these techniques

MODULE I THERMAL ANALYSIS 08

Introduction – thermogravimetric analysis (TGA) –instrumentation – determination of weight loss and decomposition products – differential thermal analysis (DTA)- cooling curves - differential scanning calorimetry (DSC) – instrumentation – specific heat capacity measurements – determination of thermomechanical parameters .

MODULE II MICROSCOPIC METHODS 12

Optical Microscopy: optical microscopy techniques – Bright field optical microscopy – Dark field optical microscopy – Dispersion staining microscopy - phase contrast microscopy -differential interference contrast microscopy - fluorescence microscopy - confocal microscopy - scanning probe microscopy (STM, AFM) - scanning new field optical microscopy - digital holographic microscopy - oil immersion objectives - quantitative metallography - image analyzer.

MODULE III ELECTRON MICROSCOPY AND OPTICAL CHARACTERISATION 08

SEM, EDAX, EPMA, TEM: working principle and Instrumentation – sample preparation – data collection, processing and analysis- Photoluminescence – light – matter interaction – instrumentation – electroluminescence – instrumentation – Applications.

MODULE IV ELECTRICAL METHODS 08

Two probe and four probe methods- van der Pauw method – Hall probe and measurement – scattering mechanism – C-V characteristics – Schottky barrier capacitance – impurity concentration – electrochemical C-V profiling – limitations.

MODULE V SPECTROSCOPY 09

Principles and instrumentation for UV-Vis-IR, FTIR spectroscopy, Raman spectroscopy, ESR, NMR, NQR, XPS, AES and SIMS-proton induced X-ray Emission spectroscopy (PIXE) –Rutherford Back Scattering (RBS) analysis-application.

Total Hours: 45

REFERENCES:

1. Stradling,R.A; Klipstain, P.C; Growth and Characterization of semiconductors, Adam Hilger, Bristol,1990.
2. Belk, J.A; Electron microscopy and microanalysis of crystalline materials, Applied Science Publishers, London, 1979.
3. Lawrence E.Murr, Electron and Ion microscopy and Microanalysis principles and Applications, Marcel Dekker Inc., New York, 1991
4. D.Kealey&P.J.Haines, Analytical Chemistry, Viva Books Private Limited, New Delhi 2002.
5. Hobart Hurd Willard, Lynne Lionel Merritt, Instrumental Methods of Analysis, 6th ed, CBS Publishers & Distributors, 1986.

OUTCOMES:

At the end of the course, the students will be able to

- illustrate various characterization techniques
- interpret data obtained through the characterization techniques

PHCY104 PHCY104

L	T	P	C
3	0	0	3

OBJECTIVES:

- To enable the students understand importance and structure of smart materials
- To make the students understand the applications of smart materials

MODULE I INTRODUCTION AND HISTORICAL PERSPECTIVE 09

Classes of materials and their usage – Intelligent /Smart materials – Evaluation of materials Science – Structural material – Functional materials – Poly functional materials – Generation of smart materials – Diverse areas of intelligent materials – Primitive functions of intelligent materials – Intelligent inherent in materials – Examples of intelligent materials, structural materials, Electrical materials, bio-compatible materials etc. – Intelligent biological materials – Biomimetics – Wolff's law – Technological applications of Intelligent materials.

MODULE II FUNCTIONAL MATERIALS AND STRUCTURAL SYSTEMS 09

The principal ingredients of smart materials – Thermal materials – Sensing technologies – Micro sensors – Intelligent systems – Hybrid smart materials – An algorithm for synthesizing a smart material – Passive sensory smart structures–Reactive actuator based smart structures – Active sensing and reactive smart structures – Smart skins – Aero elastic tailoring of airfoils – Synthesis of future smart systems.

MODULE III ELECTRO-RHEOLOGICAL (FLUIDS) FUNCTIONAL MATERIALS 09

Suspensions and electro-rheological fluids – Bingham-body model – Newtonian viscosity and non-Newtonian viscosity – Principal characteristics of electro rheological fluids – The electro-rheological phenomenon – Charge migration mechanism for the dispersed phase – Electro-rheological fluid domain – Electrorheological fluid actuators – Electro-rheological fluid design parameter – Applications of Electrorheological fluids.

MODULE IV PIEZOELECTRIC FUNCTIONAL MATERIALS 09

Background – Electrostriction – Pyro electricity – Piezoelectricity – Industrial piezoelectric materials – PZT – PVDF – PVDF film – Properties of commercial Piezoelectric materials – Properties of piezoelectric film (explanation) – Smart materials featuring piezoelectric elements – Smart composite laminate with embedded piezoelectric actuators – SAW filters.

MODULE V SHAPE – MEMORY (ALLOYS) FUNCTIONAL MATERIALS 09

Background on shape – Memory alloys (SMA) Nickel – Titanium alloy (Nitinol) – Materials characteristics of Nitinol – Martensitic transformations – Austenitic transformations –

Thermoelastic martensitic transformations – Cu based SMA, chiral materials – Applications of SMA – Continuum applications of SMA fastners – SMA fibers – reaction vessels, nuclear reactors, chemical plants, etc. – Micro robot actuated by SMA – SMA memorization process (Satellite antenna applications) SMA blood clot filter – Impediments to applications of SMA – SMA plastics – Primary molding – secondary molding – Potential applications of SMA plastics.

Total Hours: 45

REFERENCES:

1. M.V.Gandhi and B.S. Thompson, Smart Materials and Structures Chapman and Hall, London, First Edition, 1992
2. T.W. Deurig, K.N.Melton, D.Stockel and C.M.Wayman, Engineering aspects of Shape Memory alloys, Butterworth –Heinemann, 1990
3. C.A.Rogers, Smart Materials, Structures and Mathematical issues, TechnomicPublising Co., USA, 1989.

OUTCOMES:

At the end of the course the students will be able to

- illustrate structure and properties of smart materials and their applications in Science & Technology

PHCY105 ADVANCED OPTICS AND LASER TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To know the role of advanced optics in laser technology
- To understand the various mechanisms involving operation of laser.

MODULE I THEORY OF DIFFRACTION 09

Kirchoff's theorem – Fresnel – Kirchoff integral formula and its application to diffraction problems - Wave propagation in free space - Fraunhofer and Fresnel diffraction, Fraunhofer diffraction by a single slit, double slit, diffraction grating, circular aperture - Fresnel diffraction, Fresnel zones, Fresnel integrals.

MODULE II FOURIER OPTICS 09

Concept of spatial Frequencies, Impulse response and transfer functions-Fourier Transform properties of lens - spatial filtering - theory of imaging (Focused and non-focused) - Pupil functions - Abbe's principle.

MODULE III LASER SYSTEMS 09

Laser systems – General description-Laser structure-excitation mechanism-Different laser systems- He-Ne laser, Argon-ion laser, Nitrogen laser, Carbon-dioxide laser - Excimer laser - X-ray laser - Free electron laser, Nd:YAG; Nd:Glass, Alexandrite laser - Ti-Sapphire laser – Diode pumped solid state laser, Pulsed-CW dye laser.

MODULE IV Q-SWITCHING, MODE LOCKING AND COHERENCE OF LASER 09

Theory of Q-switching and experimental methods - cavity dumping -Theory of Mode locking and experimental methods - Spatial and Temporal coherence - Methods of detection and measurement of ultrashort pulses.

MODULE V LASER APPLICATIONS 09

Cooling and Trapping of Atoms, Principles of Doppler and Polarization Gradient Cooling, Qualitative Description of Ion Traps, Optical Traps and Magneto-Optical Traps, Evaporative Cooling and Bose Condensation. Medical applications - laser and tissue interaction – laser instrument of surgery.

Total Hours: 45

REFERENCES:

1. Born and Wolf, Principles of Optics, Cambridge University press, 1999.
2. Saleh and Tiech, Fundamentals of photonics, Wiley-Interscience Publishers, 2007.
3. Guenther. R.D., Modern Optics, John Wiley Publishers, 1990.
4. William T. Silfvast, Laser Fundamentals, Cambridge University press, 1996.
5. Robert Boyd. W, Non Linear Optics, 3rd edition, Academic Press, 2008.

OUTCOMES:

At the end of the course, the students will be able to

- illustrate the characteristics of the laser systems and various applicatons of laser systems.

PHCY106 NONLINEAR OPTICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To teach the students the principles of nonlinear optics and origin of optical nonlinearities.
- To analyze various types of nonlinearities in optics and its applications.

MODULE I INTRODUCTION TO NONLINEAR OPTICS 09

Wave propagation in an anisotropic crystal – Polarization response of materials to light – Harmonic generation – Second harmonic generation – Sum and difference frequency generation – Phase matching – Third harmonic generation – bistability – self focusing.

MODULE II NONLINEAR PROCESSES 09

Propagation of Electromagnetic Waves in Nonlinear medium, Self Focusing, Phase matching condition, Fiber Lasers, Stimulated Raman Scattering and Raman Lasers, CARS, Saturation and Two photon Absorptions.

MODULE III THIRD ORDER NONLINEARITIES 09

Two photon process – Theory and experiment – Three photon process Parametric generation of light – Oscillator – Amplifier – Stimulated Raman scattering – Intensity dependent refractive index optical Kerr effect – photorefractive, electron optic effects.

MODULE IV MULTIPHOTON PROCESSES 09

Electro-optic effects – Electro-optic modulators - Photorefractive effect - Two beam coupling in Photorefractive materials – Four wave mixing in Photorefractive materials.

MODULE V STIMULATED SCATTERING PROCESSES 09

Stimulated scattering processes – Stimulated Brillouin scattering – Phase conjugation – Spontaneous Raman effect – Stimulated Raman Scattering – Stokes – Anti-Stokes Coupling in SRS – Stimulated Rayleigh - Wing Scattering.

Total Hours: 45

REFERENCES:

1. Robert W. Boyd, “Non-linear Optics”, Academic Press, London, 5th Edition, 2008.
2. A.Yariv, Opto Electronics, Third Edition, John Wiley and Sons, New York,1990. (Unit II)
3. P.N.Butcher and D.Cotter, “The Elements of Nonlinear Optics”, Cambridge Univ. Press, New York, 1990. (Unit I & V)

OUTCOMES:

At the end of the course the students will able to

- explain the principles of nonlinear optics, different nonlinear phenomena and its applications.
- apply the knowledge for harmonic conversion and evaluate nonlinear susceptibility of materials.

PHCY107 OPTICAL FIBER COMMUNICATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the principles and technologies of fiber optic communication.
- To introduce the various optical fiber modes, configurations and various signal degradation factors associated with optical fiber.
- To study about various optical sources and optical detectors and their use in the optical communication system.

MODULE I FIBER OPTICS 08

Total internal reflection - Phase shift & attenuation during total internal reflection - Hybrid modes - cutoff frequencies - meridinal rays & skew rays - different types of fibers.

MODULE II TRANSMISSION CHARACTERISTICS OF OPTICAL FIBERS 08

Dispersion - Fiber attenuation, absorption loss & scattering loss measurement - Optical Time Domain Reflectometer (OTDR) and its uses - Interferometric method to measure fiber refractive index profile.

MODULE III OPTICAL FIBERS CABLES & CONNECTORS 08

Fiber materials - Fiber fabrication- fiber optic cables design - fiber connectors - fiber splices - Lensing schemes for coupling improvements.

MODULE IV METHODS OF MODULATION AND DETECTION 11

Advantages - Elements of an optical fiber communication system - and detectors for communication - Injection laser - Homojunction and Heterojunction lasers - Injection laser to fiber coupling - Fiber lasers - Surface Emitting, edge emitting and superluminescent LEDs - Optical Detectors - Pin photodiodes - Avalanche photodiodes - Multiplexers - wavelength division multiplexing - Electrooptic and Acoustooptic modulation - Coherent optical fiber communication system - ASK, FSK and PSK modulated waveforms - Basic coherent receiver model - heterodyne and homodyne detections.

MODULE V OPTICAL FIBER COMMUNICATION NETWORKS 10

Local Area Networks - Bus, ring and star topologies - optical fiber regenerative repeater - optical amplifiers - basic applications - Active and passive taps - Low speed industrial optical fiber networks - Integrated optical switches.

Total Hours - 45

REFERENCES:

1. Gerd Keiser, "Optical fiber Communications", McGraw Hill Inc. Company, Tokyo, 1995.
2. Allen H. Cherin, "An Introduction to Optical Fibers", Mc Graw Hill Inc., Tokyo, 1995.
3. John M. Senior, "Optical Fiber Communications", Prentice Hall International Ltd., London 1992.
4. Govind P. Agrawal, "Fiber Optic Communication Systems", John Wiley & Sons Inc., New York, 1997.

OUTCOME:

On completion of this course the student will be able to

- Design optimization of SM fibers, RI profile and cut-off wave length.
- explain the various optical source material (LED, LASER), fiber amplifiers and receivers.
- illustrate fiber slicing and connectors, noise effects on system performance, operational principles WDM and solutions.

PHCY108 OPTICAL COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the concepts of digital images and optical computation on digital images.
- To provide knowledge of advanced digital communications areas.
- To introduce the students to neural networks and on advanced memory techniques such as associative memory and artificial intelligence.

MODULE I DIGITAL IMAGE PROCESSING FUNDAMENTALS 05

Digital Image fundamentals - sampling and Quantization - Image Enhancement – Image Restoration – image filtering

MODULE II ANALOG OPTICAL COMPUTING 07

Optical Computing 4f - fourier system - Spatial filtering - Inverse filtering - Deblurring - Analog Optical Arithmetic - Halftone processing - Non-linearOptical processing - Matched filter - Joint transform correlation - Phase only filter - Amplitude-modulated recognition filters - Generalized correlation filter.

MODULE III DIGITAL LOGIC 14

Number Systems - Number representations - Codes - Arithmetic Operations - Logic elements and Operations - Basic Logic Operations - Logic function formulations - Boolean Algebra - Minimization of function using K-map - Universal Logic gates - Logic functions using Multiplexers - Threshold Logic - Combinational Logic- Binary Adders - Carry-Look Ahead adder - Arithmetic Logic Unit- Decoders and encoders - Sequential Logic -Flip-flops- Synchronous sequential circuits - Counters.

MODULE IV DIGITAL OPTICAL COMPUTING 14

Non-linear devices - Integrated Optics - Threshold Devices - Spatial Light Modulators - Theta Modulation Devices - Shadow casting and Symbolic substitution - Design Algorithm - POSC Logic operations - POSC Multiprocessor Parallel and Sequential ALU using POSC - POSC Image Processing - Symbolic Substitution- Optical Implementation-Limitations and Challenges - Optical Matrix Processing - Multiplication using Convolution - Matrix Operations - Cellular Logic Architecture - Programmable Logic Array.

MODULE V OPTICAL NEURAL NETWORKS 05

Neural Networks - Associative Memory - Optical Implementations - Interconnections - Artificial Intelligence.

Total Hours - 45

REFERENCES:

1. Mohammad A. Karim and Abdul A.S. Awwal, "Optical Computing - An Introduction", John Wiley & Sons, 2003.
2. Alistair D. McAulay, "Optical Computer Architectures", John Wiley & Sons, 1991.
3. Dror G. Fritelson, "Optical Computing", The MIT Press, 1988.
4. B.S. Wherrett and F.A.P. Tooley, "Optical Computing", Heriot-WattUniversity, Edinburgh, 1988..Henri H. Arsenault et al., "Optical Processing and Computing", Academic Press, London, 1989.
5. Morris Mano, "Fundamentals of Digital Logic Circuits", Prentice Hall, 2002.

OUTCOME:

At the end of the course, the student will be able to

- explain digital image fundamentals and various imaging techniques

SEMESTER II

PHCY201 ELECTRO-OPTIC MATERIALS AND DEVICES

L	T	P	C
3	0	0	3

OBJECTIVE:

- To make the students to understand the various electro optic materials and devices.

MODULE I PHYSICS OF LASER 09

Laser beam characteristics, Spontaneous and stimulated emission - Population inversion - Threshold condition - Gain profile – super-radiance Laser - Rate equation for 3 level and 4 level systems - conditions for CW and pulsed laser action. Methods of detection and measurement of ultrashort pulses.

MODULE II OPTICAL ACTIVITY OF CRYSTALS 09

Anisotropic media - index ellipsoid, propagation in uniaxial crystals, Birefringence, wave plates and compensators, optical activity.

MODULE III ELECTRO-OPTIC EFFECT 09

E-O effect in KDP E-O retardation, E-O modulation - longitudinal and transverse E-O effect in cubic crystals, E-O Q- switching (Experimental) Beam deflectors.

MODULE IV ACOUSTO-OPTIC AND ELASTO-OPTIC EFFECTS 09

Materials and devices based on these effects – modulators - SHG, mode locking and frequency mixing - materials and devices.

MODULE V NON LINEAR OPTICAL MATERIALS AND DEVICES 09

Origin of optical nonlinearities – second and third order optical non-linearities-Optical switching devices employing optical non-linearities -Photorefractive effect - Two beam coupling in Photorefractive materials – Four wave mixing in Photorefractive materials.

Total Hours: 45

REFERENCES:

1. Munn R W and Ironsid C N, "Non - Linear Optical Materials", Blackie Academic & Professional, Glassgow, 1993.
2. Kochner W, "Solid State Laser Engineering", Springer-Verlag, New York, 1976.
3. Yariv A, "Quantum Electronics", John Wiley & Sons, 1975.

4. Ivan P Kaminov, " Introduction to Electro-Optic Devices", Academic press, New York, 1974.

OUTCOMES:

At the end of the course the students will be able to explain

- electrooptic effect and Acoustooptic effect
- electro optics and Acousto-Optics devices.
- non linear optical materials and devices

PHCY202 FERROELECTRIC MATERIALS AND DEVICES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To enable the students understand the principles behind ferroelectric materials.
- To make the students understand materials, devices and applications.

MODULE I INTRODUCTION 09

Maxwell equations – Polarization – Macroscopic electric field – Local electric field at an atom – Dielectric constant and polarizability – Structural phase transitions – Classification of ferroelectric crystals – Displacive transitions – Soft optical phonons – Landau theory of the phase transition – Second order transition – First order transition – Antiferroelectricity – Ferroelectric domains – Piezoelectricity – Ferroelectricity – Optical ceramics.

MODULE II THEORY OF FERROELECTRICS 09

Ferroelectricity, piezoelectricity and pyroelectricity – definitions – classification of ferroelectrics – oxygen octahedral and order – disorder ferroelectronics. Characteristics of typical ferroelectrics, barium titanate, potassium dihydrogen phosphate and triglycine sulphate – applications of ferroelectrics. Theories of ferroelectrics – dipole theory – thermodynamic theory – first order and second order transitions – local field theory of $BeTiO_3$ – Slater's theory of KH_2PO_4 – ferroelectric domains.

MODULE III HIGH PERMITTIVITY DIELECTRICS 09

Ceramic capacitors. Chip capacitors. Hybrid substrate.Relaxor ferroelectrics – High permittivity – Diffuse phase transition – Dielectric relaxation -IK dielectric materials.

FERROELECTRIC MEMORY DEVICES: DRAM – Ferroelectric DRAM – Non- volatile ferroelectric memory – FRAM (inversion current type) – MFSFET

PYROELECTRIC DEVICES: Pyroelectric materials – pyroelectric effect – responsivity – figures of merit. Temperature / infrared light sensors, infrared image sensors.

MODULE IV PIEZOELECTRIC DEVICES 09

Piezoelectric materials and properties – Figures of Merit. - Single crystal – polycrystalline materials - relaxer ferroelectrics polymers – composites – Thin films. Pressure sensors, accelerometers, gyroscopes. Piezoelectric vibrators – piezoelectric resonance – equivalent circuits, ultrasonic transducers – Resonators/filters. Surface acoustic wave devices.Piezoelectric transformers.Piezoelectric actuators. Ultrasonic motors.

MODULE V ELECTRO-OPTIC DEVICES 09

Electro-optic effect, transparent electro-optic ceramics, bulk electro-optic devices. Wave-guide modulators.

COMPOSITES: Composite piezoelectric materials, connectivity, composite effects. PZT polymer composites.

Total Hours: 45

REFERENCES:

1. Kenji Uchino, “Ferroelectric Devices”, Marcel Dekker, INC, 2000.
2. Gerhard R, "Electrets", Vol 2, Laplacian Press, 2000.
3. Moulson A L and Herberh J M, "Electroceramics – Materials properties and Applications", Chapman & Hall, 2000.
4. Lines M E and Glass A M, "Principles and Applications of Ferroelectrics and Related Materials", Clarendon Press, 1977.
5. Jack C Burfoot, "Ferroelectrics – Introduction to the Physical Principles", D Van Nostrand Co., 1967.

OUTCOMES:

At the end of the course the students will be able to understand

- the principles of ferroelectric materials.
- ferroelectric materials, devices and applications

PHCY203 STRUCTURE AND PROPERTIES OF ALLOYS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To enable the students understand importance of phase diagrams and their relationship with properties of alloys
- To make the students understand the basic structure and property relationship of the alloy
- To make students to learn the application of the alloys with respect to their phase diagram and properties

MODULE I SOLID SOLUTIONS 09

Concept of solid solution - Solid solutions of Copper and Iron - Cu-Ni phase diagram - cast cupro nickel microstructures - Properties of annealed copper solid solution alloys - Soft magnetic alloys - Stainless steels.

MODULE II EUTECTIC ALLOYS 09

Pb-Sb phase diagram and microstructure - Pb-Sn phase diagram - Cu:O system - Ternary Pb-Sn-Sb phase diagram - Characteristic properties of eutectic system alloys - Applications of Pb-Sn and Pb-Sn-Sb alloys.

MODULE III CAST AND WROUGHT ALLOYS 09

Al-Si phase diagram - Al-Cu phase diagram -coherency theory of age hardneing - Microstructures – Cast aluminium alloy -properties-residual stresses and relaxation.

MODULE IV TWO PHASE ALLOYS 09

Cu-Zn phase diagram – Cu-Zn alloy structure - Cu-Sn and Cu-Al alloy systems and their microstructures - Properties of brasses, tin brasses and aluminium bronzes.

MODULE V IRON-CARBON ALLOYS 09

Fe-Fe3C phase diagram - Solubility of carbon in austenite and ferrite-terminology-Equilibrium and non equilibrium - Microstructures-properties of normalized steels - Grain size of steels - Engineering applications of low carbon steels and low alloy high strength steels.

Total Hours: 45

REFERENCES:

1. Structure and Properties of Alloys, R.M.Brick and Arthur Philips, MCGraw Hill Book Co. inc, New york, 1985.

2. Solid State Physics - Structure and properties of materials, M.A.Wahab, Narosa publishing house, New Delhi, 1999.
3. Heat Treatment - Principle and Techniques, T.V.Rajan, C.P.Sharma and Ashok Sharma, Prentice Hall of India pvt. Ltd., New Delhi, 1995.
4. Materials Science and Processes, M.K.Muralidhara, Dhanpat Rai publishing company, New Delhi, 1998.
5. Charlie Brooks, R,Heat Treatment, Structure and properties of non ferrous alloys, American Society for Metals, U.S.A, 1984.
6. William F Smith, “Structure and Properties of Engineering Alloys”, McGraw – Hill, 2nd Edition,1993
7. William D. Callister, David G. Rethwisch,“Materials Science and Engineering : AN Introduction” Wiley Publishing, 9th Edition, 2013.

OUTCOMES:

At the end of the course the students will be able to explain

- importance of phase diagrams and their relationship with properties of alloys
- basic structure and property relationship of the alloys
- applications of phase diagram and their importance

PHCY204 PHOTONIC MATERIALS AND DEVICES

L	T	P	C
3	0	0	3

OBJECTIVE:

- To impart knowledge on photonic devices by going over the fundamentals of semiconductor physics and optical processes in semiconductors.

MODULE I SEMICONDUCTING MATERIALS 07

Band gaps - density of states – materials - optical and electronic properties - carrier generation and recombination - mobility and diffusion - low dimensional structures - quantum wells - wires and dots - heterostructures.

MODULE II OPTICAL PROCESSES IN SEMICONDUCTORS 10

Electron-Hole formation and recombination – absorption in semiconductors – effect of electric field on absorption – absorption in quantum wells and the quantum-confined Stark effect – Kramer-Kroning relations – radiation in semiconductors – deep level transitions – auger recombination – Luminescence from quantum wells – measurement of absorption and luminescence spectra – time resolved photoluminescence.

MODULE III SEMICONDUCTOR DEVICE FABRICATION 10

Types of photonic materials –III-V compound-II-VI compounds-Wafer preparation-interface quality- interdiffusion and doping. Quantum wells and bandgap engineering (examples of structures).Post-growth processing-Photolithography-different methodologies – patterning - fabrication of semiconductor devices.

MODULE IV PHOTONIC DEVICES 10

Photodiodes: current-voltage equation – operation-spectral response of Ge and Si – quantum efficiency – response time – diffusion time – drift – capacitance of diodes, measurement - device configuration and efficiency – device performance.

MODULE V INSTRUMENTATION OF PHOTONIC MATERIALS 08

Measurements using lenses, monochromators, spectrometers, grating, mirrors, lock-in amplifiers – characterization of photodiodes, LEDs and laser diodes – modulation of lasers – rate equations.

Total Hours: 45

REFERENCES:

1. P. Bhattacharya, “Semiconductor optoelectronic devices”, Prentice-Hall India, New Delhi, 2003.

2. B.E.A. Saleh and M.C. Teich., “Fundamentals of photonics”, John Wiley., New York, 1991.
3. J. Singh, “Optoelectronics: An introduction to materials and devices”, Mc-Graw-Hill Co., New York, 1996.
4. S.O. Kasap, “Optoelectronics and photonics: Principles and practices”, Prentice-Hall, New York, 2001.
5. T.P. Pearsall, “Photonics essentials: An introduction to experiments”, Mc-Graw-Hill Professional, New York, 2002.
6. Ajoy Ghatak and K Thyagarajan, “An Introduction on Fibre Optics”, Cambridge University Press, 2012.

OUTCOMES:

At the end of the course, the students would be able to

- understand the properties of a photonic materials.
- fabricate photonic devices and its characterization techniques.

PHCY205 NUMERICAL METHODS AND PROGRAMMING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the basic numerical methods and programming.
- To have an idea to apply numerical methods into research areas.

MODULE I ERRORS AND THE MEASUREMENTS 09

Errors and their computations – General formula for errors – Errors of observation and measurement – Round of errors and Computer Arithmetic – Empirical formula – Graphical method – method of averages – Least square fitting – curve fitting – parabola, exponential – Algorithms and convergence.

MODULE II NUMERICAL SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS 09

The iteration method – the bisection method – the method of false position – Newton – Raphson method.SimultaneousLinear algebraic equations: Direct methods – Gauss elimination method – Gauss – Jordan method – Iterative method – Jacobi's method – Gauss Seidel iterative method.

MODULE III INTERPOLATION 09

Finite differences – Interpolation – Gregory – Newton forward interpolation of Newton's formula – Backward differences – Newton's Backward interpolation formula – central differences – Gauss's forward and backward formula – Stirling's formula – Divided differences – Newton's divided difference formula – Lagrange's interpolation formula.

MODULE IV NUMERICAL DIFFERENTIATION AND INTEGRATION 09

Introduction – Numerical differentiation – Errors in numerical differentiation – The cubic spline method – Maximum and Minimum values of a tabulated function – Numerical integration – Trapezoidal rule – simpson's rule – Extended Simpson's rule – Use of cubic splines – Romberg integration – Newton – Cotes Integration formulae – Euler – Maclaurin formula – Adaptive quadrature method – Gaussian integration.

MODULE V PROGRAMMING WITH C 09

Introduction to C programming-program control-logical compares-functions, variables and prototypes-C preprocessor- strings, arrays-pointers- standard input & output-structures, Unions-bitwise operators.

Total Hours: 45

REFERENCES:

1. Sastry, S.S., Introduction of Numerical Analysis, Fifth Edition, Prentice Hall of India, New Delhi, 2012.
2. Gerald C.F., Wheatley P.O., Applied Numerical Analysis, Seventh Edition, Addison – Wesley, Singapore, 2003.
3. Kandasamy, P., Thilakavthy, K and Gunavathy K., Numerical Methods, S.Chand and Co., New Delhi, 2006.
4. Grewal B.S., Grewal J.S., Numerical Methods in Engineering and Science, Khanna Publishers, New Delhi, 1999.
5. Balagurusamy, E, Programming in Ansi C, 4th Edition, Tata McGraw Hill, 2008.

OUTCOME:

- At the end of the course, the students will be able to understand the basic concepts of numerical methods and programming

PHCY206 ULTRASONIC AND NON-DESTRUCTIVE TESTING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce students with the recent advances in the field of ultrasonics and to equip them with the knowledge of different process for a better evaluation in complex geometries.
- To introduce the other NDT techniques like LPI to equip the students to understand the evaluation method

MODULE I FUNDAMENTALS OF ULTRASONIC WAVES 09

Nature of sound waves, wave propagation in metals– modes of sound wave generation – longitudinal waves, transverse waves, surface waves, lamb waves –Velocity, frequency and wavelength of ultrasonic waves – Ultrasonic pressure, intensity and impedance – Attenuation of ultrasonic waves – reflection, refraction and mode convection – Snell's law and critical angles – Fresnel and Fraunhofer effects – ultrasonic beam split – wave propagation in other engineering materials

MODULE II ULTRASONIC INSPECTION METHODS AND EQUIPMENT 09

Principle of pulse echo method, through transmission method, resonance method – Advantages, limitations – contact testing, immersion testing, couplants – Data presentation A, B and C scan displays, comparison of contact and immersion method. Pulse Echo instrumentation, controls and circuits, pulse generation, signal detection, display and recording methods, gates, alarms and attenuators, detectability of defects

MODULE III ULTRASONIC GUIDED WAVES 09

Types of guided waves – Generation of guided waves – Plate theory – Rayleigh-Lamb Equation, Guided waves in Plates, Pipes and rods – Wave structure analysis – Dispersion curves –Modes in guided waves – Air coupled ultrasonic guided waves – advantages and limitations – Applications, few case studies. Electro Magnetic Acoustic Transducer (EMAT)-Basic principles – types of coil and design – Generation and defect detection of guided waves using EMATS- - advantages and limitations – Applications- case studies

MODULE IV OPTICAL METHODS IN ULTRASONICS 9

Laser Ultrasonics – Laser fundamentals – types of lasers – bulk wave and lamb wave generation mechanisms – optical detection of ultrasound – measurement of in plane displacement and velocity – holographic NDT – recording and reconstruction of a hologram – Two wave mixing interferometry – Laser shearography – Applications (Laser ultrasonics for flaw detection and material characterization) – Case studies.

MODULE V LIQUID PENETRANT TESTING 09

Principles – types and properties of liquid penetrants – developers – advantages and limitations of various methods - Preparation of test materials – Application of penetrants to parts, removal of excess penetrants, post cleaning – Control and measurement of penetrant process variables – selection of penetrant method – solvent removable, water washable, post emulsifiable – Units and lighting for penetrant testing – Interpretation and evaluation of test results - dye penetrant process, applicable codes and standards.

Total Hours: 45

REFERENCE:

1. J. Krautkramer and H. Krautkramer, Ultrasonic Testing of Materials, Springer, 4th edition (1990).
2. B. Raj, C.V. Subramanian and T. Jayakumar, Non Destructive Testing of Welds, Woodhead Publishing, 1st edition (2000).
3. L. Schmerr and J. Song, Fundamentals of Ultrasonic Nondestructive Evaluation, Springer, 1998.
4. P. J. Shull, Nondestructive Evaluation: Theory, Techniques, and Applications, CRC Press, 1st edition (2002).
5. C.V.Subramanian, Practical Ultrasonics, Alpha Science International, (2006).
6. A.S. Birks and R.E. Green, Ultrasonic Testing, Nondestructive Handbook, Vol. 7, American Society for Nondestructive Testing, 2nd edition (1991).

OUTCOMES:

After successful completion of this course the student will be able to

- have a basic knowledge of ultrasonic testing and NDT, this enables them to perform inspection of samples.
- calibrate the instrument and evaluate the component for imperfections.
- differentiate various defect types and select the appropriate NDT methods for the specimen.
- document a written procedure paving the way for further training in specific techniques.

PHCY207 OPTO ELECTRONICS & ITS DEVICES

L	T	P	C
3	0	0	3

OBJECTIVE:

- To make the students learn the fundamentals of Photo-luminous-semiconductors, Optoelectronic devices, Optical modulators/detectors
- To make them understand the technology behind latest Display devices like LCD, Plasma and LED Panels.

MODULE I INTRODUCTION TO OPTOELECTRONIC MATERIALS 09

Energy bands in solids, Electrical conductivity, Semiconductors, carrier concentrations, Work function, Excess carrier in semiconductors, Junctions, , Metal-semiconductor junctions - Preparation of junctions wafer selection, Oxidation, lithography photolithography, doping, metalisation, terminals, packaging Metal - semiconductor junctions: energy-band relation, surface states and depletion layer, Schottky-effect current transport process – thermo ionic emission, tunneling, device structures.

MODULE II OPTOELECTRONIC DEVICES 09

Light-Emitting Diodes, Liquid crystal displays, Photo detectors, Photodiode materials, Phototransistor, Solar cells, Materials and design considerations, Thin film solar cells, amorphous silicon solar cells, Semiconductor Lasers, Optical processes in semiconductor lasers - LED – power and efficiency - double hetero LED - LED structure - LED characteristics - White LED – Applications.

MODULE III OPTICAL MODULATORS 09

Modulation of light – birefringence - electro optic effect - EO materials - Kerr modulators - scanning and switching - self electro optic devices - MO devices, AO devices - AO modulators.

MODULE IV OPTICAL DETECTORS 09

Photo detectors - thermal detectors – photoconductors – detectors - photon devices - PMT- photodiodes - photo transistors - noise characteristics - PIN diode - APD characteristics - APD design of detector arrays – CCD - Solar cells

MODULE V PHOTONIC DEVICES 09

Photo detectors : photoconductors – absorption coefficient, D.C. and A.C. conductors. Junction photo detectors – Photo voltaic effect: Photodiodes, PIN diodes, quantum efficiency and frequency response, noise, hetero junction diodes, avalanche diode, Solar

cells – basic principles, spectral response, efficiency, materials and cascaded solar cells, thin film solar cells, manufacturing and design characteristics.

Total Hours: 45

REFERENCES:

1. Wilson & J.F.B. Hawkes, “Optoelectronics – An Introduction”, Prentice Hall, India, 1996.
2. Bhattacharya, “Semiconductor optoelectronic devices”, Second Edn Pearson Education, Singapore, 2002.
3. J. M. Senior, “Optical fiber communication”, Prentice-Hall India, 1985.
4. J. Gowar, “Optical fiber communication systems”, Prentice–Hall, 1995.
5. J .Palais, “Introduction to optical electronics”, Prentice–Hall, 1988.
6. Jasprit Singh, “Semiconductor optoelectronics”, McGraw–Hill, Inc, 1995.R. P.
7. Khare, “Fiber optics and Optoelectronics”, Oxford University Press, 2004.

OUTCOME:

On completion of this course the student will explore

- the concepts of LED, Laser drive circuits.
- the modulation of light,birefringence,MO devices.
- the working of optical detectors and various optical devices.

PHCY208 BIOPHOTONICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To know the importance of spectroscopic studies in Biophotonics
- To understand the role of Biophotonic materials in applications.

MODULE I INTERACTION OF LIGHT WITH BIOLOGICAL SYSTEMS 09

Interaction of light with cells, tissues, nonlinear optical processes with intense laser beams, photo-induced effects in biological systems.

MODULE II IMAGING TECHNIQUES 09

Imaging techniques: Light microscopy, wide-field, laser scanning - confocal, multiphoton, fluorescence lifetime imaging, FRET imaging - Frequency-Domain lifetime imaging. Cellular Imaging - Imaging of soft and hard tissues and other biological structures.

MODULE III SINGLE MOLECULE SPECTROSCOPY 09

Single molecule spectroscopy: UV-VIS spectroscopy of biological systems, single molecule spectra and characteristics – IR and Raman spectroscopy and Surface Enhanced Raman Spectroscopy for single molecule applications.

MODULE IV OPTICAL FORCE SPECTROSCOPY 09

Optical Force Spectroscopy: Generation optical forces – Optical trapping and manipulation of single molecules and cells in optical confinement - Laser trapping and dissection for biological systems - single molecule biophysics, DNA protein interactions.

MODULE V BIOSENSORS 09

Biosensors, Principles- DNA based biosensors – Protein based biosensors – materials for biosensor applications- fabrication of biosensors.

Total Hours: 45

REFERENCES:

1. Prasad. P.N., Introduction to Biophotonics, John Wiley & Sons, 2003
2. Michael P. Sheetz, Laser Tweezers in Cell Biology (Methods in Cell Biology), Vol.55, Academic Press Publishers, 1997.
3. Ranier .W, Nanoelectronics and Information Technology, Wiley Publishers, 2012.
4. Drexler. K.E., Nanosystems: Molecular Machinery, Manufacturing, and Computation, Wiley Publishers, 1992.

OUTCOMES:

At the end of the course, the students will be able to illustrate

- the basic concepts about the Biophotonics
- the importance of use of spectroscopy in design of biophotonic devices.

SEMESTER III

PHCY111	MATHEMATICAL METHODS FOR NONLINEAR SCIENCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basic concepts of different mathematical methods useful for nonlinear sciences.
- To have a comprehensive idea on solitons and soliton equation.
- To understand the methods to solve Nonlinear Schrodinger type equations.

MODULE I FOURIER ANALYSIS AND OPTICS 08

Fourier series – Harmonic analysis – Fourier Transform and applications – Convolution Theorem – Sampling Theorem and applications – Fourier Optics – Holographic filters.

MODULE II DISCRETE FOURIER TRANSFORM 07

Discrete time signals – Discrete Fourier Transform – Butterfly algorithm – Fast Fourier Transform.

MODULE III DIFFERENTIAL EQUATIONS 10

Ordinary differential equations (ODEs) – Partial differential equations (PDEs) – Nonlinear ordinary differential equations – Nonlinear partial differential equations.

MODULE IV SOLITON EQUATIONS 10

Korteweg de Vries (K-dV) type equations – modified K-dV equation (MK-dV) – sine-Gordon m-Nonlinear Schrodinger type equations – Burger's equations.

MODULE V COHERENT STRUCTURES 10

Solitons – Generating soliton equations (AKNS method) – Inverse scattering method – Backlund transformation – Hirotabi linearization method – Painleve Analysis – Lax pair.

Total Hours: 45

REFERENCES:

1. L.A.Pipes, Applied mathematics for Engineers and Physicists, McGraw Hill book Co., 1980.
2. A.V.Oppenheim and R.W.Schafer, Digital Signal Processing, Printice Hall of India, 1995.
3. M.J.Ablowitz and H.Segur, Solitons and Inverse scattering Transform, Philadelphia, 1981.

4. J.M.T. Thomson and H.B.Stewart, Nonlinear Dynamics and Chaos, John Wiley and Sons, 1986.
5. M.Lakshmanan and S.Rajasekar, Nonlinear dynamics: Integrability, Chaos and Spatio-temporal patterns, Springer-Verlag, 2003.
6. Steven H.Strogatz, Nonlinear Dynamics and Chaos: With Applications to Physics, Biology, Chemistry, and Engineering (Studies in Nonlinearity) 2nd Edition, 2015.

OUTCOMES:

At the end of the course, the students will be able to

- use different mathematical methods to study problems in nonlinear sciences.
- apply various methods to solve ordinary differential equations, nonlinear schroedinger type equations.
- understand the concepts and applications of solitons.

PHCY112 MEASUREMENT AND INSTRUMENTATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To enable the students understand the importance of measurements.
- To make the students understand the principle behind instrumentation for measurement.

MODULE I PHYSICAL MEASUREMENT 07

Measurement – result of a measurement – uncertainty and experimental error– systematic error – random error – repeated measurements – data distribution functions; mathematical description, derivation and properties – propagation error – analysis of data – multi parameter experiments.

MODULE II TRANSDUCERS0 10

Classification of Transducers - Principle, construction and working of Thermistor - LVDT, Electrical strain gauges and capacitive transducers, Photoelectric transducer, Piezoelectric transducer - Measurement of non-electrical quantities - Strain, Displacement, temperature, Pressure, Magnetic fields, vibration, optical and particle detectors.

MODULE III BRIDGES AND RECORDERS 10

DC bridges - Wheatstone's bridge – Kelvin's bridge – double bridge –AC bridges – bridges for capacitance and inductance comparison – Wien bridge – Schering bridge – Maxwell's inductance bridge – Maxwell – Wein bridge - Hay bridge – Anderson bridge – De sauty bridge – Owen bridge - resonance bridge – types of detectors– strip chart recorders – X-Y recorders – digital data recording – recorder specifications.

MODULE IV INSTRUMENTATION ELECTRONICS 08

Op-amps – instrumentation amplifier – signal conditioning – filters – analog signal processing – high speed A/D conversion – D/A conversion – digital logic levels –digital instrumentation – frequency measurements – FFT –sampling time and analyzing – IEEE 488 interface bus – LabView (basics).

MODULE V ADVANCED MEASUREMENTS 10

Spectroscopic instrumentation –UV – Vis spectrometer IR spectroscopy – spectrometer design – refraction and diffraction –– dispersive elements – lasers – fiber optics – X-ray fluorescence: line spectra and fine structure – absorption and emission processes – X-

ray production – X-ray crystallography –neutron diffraction – TEM – SEM – atomic force and tunneling scanning microscope.

Total Hours: 45

REFERENCES:

1. M. Sayer and A. Mansingh, “Measurement, instrumentation and experiment design in physics and engineering”, Prentice-Hall India Pvt. Ltd., New Delhi,2000.
2. H.S. Kalsi, ‘Electronic instrumentation’, (2nd Edition), Tata McGraw Hill
1. Publication Co.Ltd., New Delhi, 2004.
2. R.F. Coughlin and F.F. Driscoll, “Operational amplifiers and linear integrated circuits”, Pearson Education, New Delhi, 2001.
3. E.O. Doebelin, “Measurement systems: Applications and design”, McGraw-Hill, New York, 2002.Rangan Sharma and Mani, “Instrumentation devices and systems”, Tata McGraw-Hill, New Delhi, 2000.

OUTCOMES:

At the end of the course, the students will be able to

- acquire the knowledge about the different errors occurring during measurement
- understand the principle behind the instrumentation for measurement.
- Identify the various transducers involved in measurement.

PHCY113 BIOMEDICAL INSTRUMENTATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the biomedical instrumentation techniques.
- To know the importance methods, instruments available for biomedical field.
- To analyze the biomedical instrumentation systems, and the application specific biomedical sensor and instrumentation design.

MODULE I HUMAN PHYSIOLOGICAL SYSTEMS 09

Cells and their structure – Nature of Cancer cells – Transport of ions through the cell membrane – Resting and action potentials – Bio-electric potentials – Nerve tissues and organs – Different systems of human body. Biopotential Electrodes and Transducers Design of Medical instruments – components of the biomedical instrument system – Electrodes – Transducers.

MODULE II BIOSIGNAL ACQUISITION 09

Physiological signal amplifiers – Isolation amplifiers – Medical preamplifier design – Bridge amplifiers – Line driving amplifier – Current amplifier – Chopper amplifier – Biosignal analysis – Signal recovery and data acquisition – Drift Compensation in operational amplifier – Pattern recognition – Physiological Assist Devices. Pacemakers – Pacemakers batteries – Artificial heart valves – Defibrillators – nerve and muscle stimulators Heart – Lung machine – Kidney machine.

MODULE III BIOPOTENTIAL RECORDERS 09

Characteristics of the recording system – Electrocardiography (ECG) – Electroencephalography (EEG) – Electromyography (EMG) – Electroethinogrphy (ERG) and Electroculography (EOG) – Recorders with high accuracy – recorders for OFF line analysis.

MODULE IV OPERATION THEATRE EQUIPMENT 09

Surgical diathermy- shortwave diathermy – Microwave diathermy – Ultrasonic disathermy – Therapeutic effect of heat – Range and area of irritation of different techniques – Ventilators – Anesthesia machine – Blood flowmeter – Cardiac Output measurements – Pulmonary function analyzers – Gas analyzers – Blood gas analyzers – Oximeters – Elements of intensive care monitoring.

MODULE V SPECIALISED MEDICAL EQUIPMENTS 09

Blood Cell counter – Electron microscope – Radiation detectors – Photometers and colorimeters – digital thermometer – audiometers – X-rays tube – X-ray machine – image

intensifiers – Angiography – Application of X-ray examination. Safety instrumentation: Radiation safety instrumentation – Physiological effects due to 50Hz current passage – Microshock and macroshock – electrical accident Hospitals – Devices to protect against electrical hazards – Hospitals architecture.

Total Hours: 45

REFERENCES:

1. Arumugam M., Biomedical Instrumentaion, Anurada Agencies Publishers, 1992.
2. Khandpur R.S., Handbook of Biomedical Instrumentation, Third Edition, Tata McGraw-Hill Education, 2014.
3. Shakti Chatterjee and Aubert Miller, Biomedical Instrumentation Systems, Cengage Learning Publisher, 2010.
4. Gromwell L., Fred J. Weibell, Erich A. Pfeiffer, Biomedical Instrumentation and Measurements, Second Edition, Prentice Hall, 1980.

OUTCOMES:

At the end of the course, the students will be able to understand

- different biomedical instruments involved in medicine field.
- the various methods available in the use of new modern techniques in biomedicine.

PHCY114 RADIATION PHYSICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the theory of electromagnetic radiation
- To know the difference between natural and artificial radioactivity
- To study the interaction of radiation with matter and its effects.

MODULE I ELECTROMAGNETIC RADIATION 09

Wave model – Quantum Model– visible light and fluorescence particulate radiation – inverse square law.

MODULE II NATURAL AND ARTIFICIAL RADIOACTIVITY 09

Radioactivity – General properties of alpha, beta and gamma rays – Laws Of radioactive disintegration – Radioactive decay constant – Half-life period – average life – Isotopes, Isobars, Isomers – Isotones and Isodiapheres – Natural radioactive series – Radioactive equilibrium –Radioactive decay - a particle decay – ß particle decay – Theory of beta decay – Gamma emission – Electron capture – Internal conversion – Nuclear isomerism – Artificial radioactivity - Nuclear reactions –a, p reaction - a, n reaction- Proton bombardment – deuteron bombardment- neutron bombardment – photo disintegration – Activation of nuclides - Elementary ideas of fission, fusion and nuclear reactors.

MODULE III RADIATION FACTORS 09

Quantities to describe a radiation beam - particle flux and fluence- Photon flux and fluence- cross section- linear and mass absorption coefficient-stopping power and LET Activity – Curie – Becquerel. Exposure and its measurements – Roentgen, Radiation absorbed Dose- Gray - kerma- kerma rate constant -Electronic equilibrium - relationship between kerma, exposure and absorbed dose – Relative biological effectiveness (RBE)-radiation weighting factors.

MODULE IV INTERACTION OF RADIATION WITH MATTER 09

Interaction of electromagnetic radiation with matter: Ionization – Photon beam exponential attenuation – Rayleigh scattering – Photoelectric effect – Compton effect - energy absorption – Pair production – Attenuation, energy transfer and mass energy absorption coefficients – Relative importance of various types of interactions.

MODULE V INTERACTION OF CHARGED PARTICLES WITH MATTER 09

Classical theory of inelastic collisions with atomic electrons – Energy loss per ion pair by primary and secondary ionization – Dependence of collision energy losses on the physical and chemical state of the absorber – Cerenkov radiation – Electron absorption process –

scattering excitation and ionization – Radiative collision – Bremmstrahlung – Range energy relation – Continuous slowing down approximation (CSDA) – straight ahead approximation and detour factors – transmission and depth dependence methods for determination of particle penetration - empirical relations between range and energy – Back scattering.

Total Hours: 45

REFERENCES:

1. Segre E., Experimental Nuclear Physics, Vol 3, John Wiley, 1959.
2. Theraja B.L., Modern Physics, S.Chand Company, 1995.
3. Faiz M Khan , The Physics of Radiation Therapy, Lippincott Williams & Wilkins Publishers, 2010.
4. Oliver R., Radiation Physics in Radiology, Blackwell Scientific Publication, 1974.
5. Frank Herbert Attix, Introduction to Radiological Physics and Radiation Dosimetry, Wiley-VCH Publishers, 1991.

OUTCOMES:

At the end of course, students will be able to understand

- concepts of electromagnetic radiation
- theory of artificial and natural radioactivity
- interaction of radiation with matter.

PHCY115 LASER SPECTROSCOPY AND ITS APPLICATIONS

L	T	P	C
3	0	0	3

OBJECTIVE:

- To endow the students with the knowledge of the fundamentals of spectroscopy and about different types of spectroscopy and applications of laser spectroscopy in various fields.
- To provide the information in a way that the student can learn about laser tissue interaction, photobiology and thermal and non-thermal applications of lasers and create awareness about the safety of lasers.

MODULE I TIME-RESOLVED SPECTROSCOPY 10

Generation of short optical pulses - generation of ultra short optical pulses - Measurement techniques for Optical Transcients: Transient - Digitizer - Boxcar - Delayed coincidence- Streak-camera & Pump-probe techniques. Basics of lifetime measurements - Methods of measuring radiative properties - linewidth measurements - ODR and LC - Beam foil techniques - Beam laser techniques - Time resolved spectroscopy with pulsed lasers - Phase- shift method and emission method - The hook method - Quantum-Beat spectroscopy.

MODULE II HIGH RESOLUTION SPECTROSCOPY 08

Spectroscopy on collimated atomic beams: Detection through fluorescence - detection by photoionization - detection by the recoil effect - detection by magnetic deflection. Saturation spectroscopy and related techniques -Doppler-free two-photon absorption - spectroscopy of trapped ions and atoms.

MODULE III APPLICATIONS OF LASER-SPECTROSCOPY 10

Diagnostics of combustion processes: Background - Laser-inducedfluorescence and related techniques - Raman spectroscopy - coherent anti- stokes Raman scattering - Velocity measurements. Laser remote sensing of the atmosphere: Optical heterodyne detection - long path absorption techniques - LIDAR techniques. Laser-induced fluorescence and Raman spectroscopy in liquids and solids: Hydrospheric remote sensing - monitoring of surface layers. Laser-induced chemical processes: Laser-induced chemistry - laser isotope separation - spectroscopic aspects of lasers in medicine.

MODULE IV PHOTOBIOLOGY AND MEDICAL LASERS 09

Study of biological functions - Microradiation of cells - optical properties of tissues (normal and diseased state) - Experimental methods to determine the reflectance, absorption, transmittance and emission properties of tissues - Laser systems in medicine and biology

- Nd: YAG, Ar ion, CO2, Excimer, N2, Gold Vapour laser - Beam delivery and measuring systems

MODULE V THERMAL APPLICATIONS 09

Surgical applications of lasers - Sterilization - hermostasis - Cancer Liver stomach gynecological surgeries - Performance evaluation - Lasers in Opthalmology - Dermatology and Dentistry - Cosmetic Surgery.

Total hours: 45

REFERENCES:

1. S. Svanberg, "Atomic and Molecular Spectroscopy", Springer Verlag, Germany, 1992.
2. J. R. Lakowicz, "Principles of Fluorescence Spectroscopy", Kluwer Academic/ Plenum Publishers, New York, 1999.
3. Z. Wang and H. Xia, "Molecular and Laser Spectroscopy", Springer Series in Chemical Physics, Vol.50, 1991.
4. S.S. Martellucci and A.N. Chester, "Laser Photobiology and Photomedicine", Plenum Press, New York, 1985.
5. R. Pratesi and C.A. Sacchi, "Lasers in Photomedicine and Photobiology", Springer verlag, West Germany, 1980.
6. Carruth JAS & AL Mckenzie, "Medical Lasers Science and Clinical Practice", Adam Hilger Ltd., Bristol, 1991.
7. T. Kaluylu and M. Tsukakoshi, "Laser Microradiation of cells", Harward Academic publishers, New York, 1990.

OUTCOME:

- At the end of the cousre the student will get knowledge in different types spectroscopy and applications of laser spectroscopy in various fields.
- At the end of the course the student will get knowledge in laser tissue interaction, photobiology and thermal and non-thermal applications of lasers and safety of lasers.

PHCY116 NANO PHOTONICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the concepts of Nano Photonics.
- To know the importance of photonics materials.
- To use the ideas of nano photonics and apply in research

MODULE I QUANTUM CONFINED MATERIALS 09

Quantum dots – optical transitions – absorption-inter-band transitions-quantum confinement intraband transitions-fluorescence / luminescence– photoluminescence / fluorescence optically excited emission – electroluminescence emission.

MODULE II PLASMONICS 09

Internal reflection and evanescent waves- plasmons and surface plasmon resonance (SPR)- Attenuated total reflection- Grating SPR coupling- Optical waveguide SPR coupling- SPR dependencies and materials- plasmonics and nanoparticles.

MODULE III NEW APPROACHES IN NANOPHOTONICS 09

Near-Field Optics- Aperture near-field optics- Apertureless near-field optics-Near-field scanning optical microscopy (NSOM or SNOM)- SNOM based detection of plasmonic energy transport- SNOM based visualization of waveguide structures- SNOM in nanolithography- SNOM based optical data storage and recovery.

MODULE IV ELECTRONIC& PHOTONIC MOLECULAR MATERIALS 9

Preparation –Electroluminescent Organic materials - Laser Diodes - Quantum well lasers:- Quantum cascade lasers- Cascade surface-emitting photonic crystal laser- Quantum dot lasers- Quantum wire lasers:- White LEDs - LEDs based on nanowires - LEDs based on nanotubes- LEDs based on nanorods High Efficiency Materials for OLEDs- High Efficiency Materials for OLEDs - Quantum well infrared photo detectors.

MODULE V ELEMENTS OF PLASMONICS 9

Introduction to Plasmonics, merging photonics and electronics at nanoscale dimensions, single photon transistor using surface plasmon, nanowire surface plasmons-interaction with matter, single emitter as saturable mirror, photon correlation, and integrated systems. All optical modulation by plasmonic excitation of quantum dots, Channel plasmon-polariton guiding by subwavelength metal grooves, Near-field photonics: surface plasmon polaritons and localized surface plasmons, Slow guided surface plasmons at telecom frequencies.

Total Hours: 45

REFERENCES:

1. Masuhara. H, Kawata. S and Tokunaga. F, Nano Biophotonics, Elsevier Science, 2007.
2. Saleh. B.E.A and Teich. A.C, Fundamentals of Photonics, John-Wiley & Sons, New York, 2007.
3. Ohtsu.M, Kobayashi.K, Kawazoe.T and Yatsui.T, Principles of Nanophotonics (Optics and Optoelectronics), University of Tokyo, Japan, 2003.
4. Joannopoulos.J.D, Meade. R.D and Winn. J.N, Photonic Crystals, Princeton University Press, Princeton, 1995.
5. Ranier. W, Nano Electronics and Information Technology, Wiley, 2003.

OUTCOMES:

At the end of the course, the students will be able to explain

- the concepts of nano photonics and its uses
- the importance of applications of Nano photonics in design of devices

PHCY117 NANOSCIENCE AND TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To give thorough knowledge of the general principles of physics, chemistry, electronics and biology that play a role on the nanometer scale.
- To get into Insight of the materials, fabrication and other experimental techniques that can be used on the nanoscale, as well as their limitations.
- To get in-depth knowledge of at least one specialisation area within the field of nanoscience and nanotechnology.
- To gain Sufficient scientific background to undertake research.

MODULE I NANOMATERIALS AND STRUCTURES 09

Nanomaterials and types: nanowires, nanotubes, fullerenes, quantum dots, nanocomposites – properties – Methods of preparation: top-down, bottom-up.

MODULE II CHARACTERIZATION TOOLS 09

Electron Microscopy Techniques – SEM, TEM, X ray methods – optical methods Fluorescence Microscopy – Atomic Force Microscopy, STM and SPM.

MODULE III NANOMAGNETISM 09

Mesoscopic magnetism – Magnetic measurements: miniature Hall detectors, integrated DC SQUID Microsusceptometry – magnetic recording technology, biological magnets.

MODULE IV NANOELECTRONICS AND INTEGRATED SYSTEMS 09

Basics of nanoelectronics – Single Electron Transistor – quantum computation – tools of micro-nanofabrication – nanolithography – quantum electronic devices – MEMS and NEMS – dynamics of NEMS – limits of integrated electronics.

MODULE V BIOMEDICAL APPLICATIONS OF NANOTECHNOLOGY 09

Biological structures and functions – drug delivery systems – organic-inorganic nanohybrids – inorganic carriers – nanofluidics.

Total Hours: 45

REFERENCES:

1. Jan Korvink and Andreas Greiner, Semiconductors for Micro and Nanotechnology – an Introduction for Engineers, Weinheim Cambridge: Wiley-VCH, 2001.
2. Murty B.S., Shankar P. & et al., Textbook of Nanoscience and Nanotechnology, Universities Press (India) Private Ltd., 2012.

3. Richard Booker and Earl Boysen, Nanotechlongy, Wiley Publishing, 2005.
4. Timp G (ed), Nanotechnology, AIP press, Springer, 1999.
5. Wilson M., Kannangara K., Smith G., Simmons M. and Raguse B., Nanotechnology: Basic Sciences and Energy Technologies, Overseas Press, 2005.

OUTCOMES:

At the end of the course, the students will be able to understand

- the basic concepts about the Nano materials
- the importance of use of nano materials in design and synthesis of novel materials.

PHCY118 THIN FILM SCIENCE AND TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To familiarize with preparation and properties of Thin films
- To understand the preparation and characterization of Thin films.
- To apply the knowledge of Thin film technology into applications.

MODULE I PREPARATION OF THIN FILMS 09

Kinetic aspects of gases in a vacuum chamber – classifications of vacuum ranges – production of vacuum - pressure measurement in vacuum systems– thin film (epitaxy) – definition – types of epitaxy. Different Growth Techniques: Liquid phase epitaxy – vapour phase epitaxy – molecular beam epitaxy – metal organic vapour phase epitaxy – sputtering (RF & DC) – pulsed laser deposition. Thickness Measurement: Microbalance technique – photometry-ellipsometry– interferometry.

MODULE II KINETICS OF THIN FILMS 09

Nucleation Kinetics: types of nucleation – kinetic theory of nucleation – energy formation of a nucleus – critical nucleation parameters; spherical and non spherical (cap, disc and cubic shaped) Growth Kinetics: Kinetics of binary (GaAs, InP, etc.), ternary (Al1-xGaxAs, Ga1-xInxP, InAs1-xPx, etc.) and quaternary (Ga1-xInxAs1 -yPy, etc.) semiconductors – derivation of growth rate and composition expressions.

MODULE III CHARACTERIZATION 09

X-ray diffraction – photoluminescence – UV-Vis-IR spectrophotometer – Atomic Force Microscope – Scanning Electron Microscope – Hall effect – Vibrational Sample Magnetometer – Secondary Ion Mass Spectrometry – X-ray Photoemission Spectroscopy.

MODULE IV PROPERTIES OF THIN FILMS 09

Dielectric properties – experimental technique for the determination of dielectric properties – optical properties – experimental technique for the determination of optical constants – mechanical properties – experimental technique for the determination of mechanical properties of thin films – magnetic and superconducting properties.

MODULE V APPLICATIONS 09

Optoelectronic devices: LED and Solar cell – Micro Electromechanical Systems (MEMS) – Fabrication of thin film capacitor – application of ferromagnetic thin films; data storage,

Giant Magnetoresistance (GMR) – sensors – fabrication and characterization of thin film transistor and FET – quantum dot - Cryptography.

Total Hours: 45

REFERENCES:

1. Goswami. A, Thin Film Fundamentals, New Age International (P) Limited, New Delhi, 1996.
2. AichaEishabini-Riad, Fred D. Barlow and ISHN, Thin film Technology Handbook, McGraw-Hill Professional Publishers, 1997.
3. Krishna Seshan, Handbook of Thin Film Deposition, William Andrew Publishers, 2012.
4. Donald Smith, Thin-Film Deposition: Principles and Practice, McGraw-Hill Professional Publishers, 1995.
5. K.L.Chopra, “Thin Film Phenomena”, Malabar : Robert E. Krieger Publishing Company, 1979.

OUTCOMES:

At the end of the course, the students will be able to understand

- the basic concepts about the thin film technology
- the importance of use of thin films in application and research.

PHCY119 CORROSION SCIENCE AND TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To enable the students understand principles behind corrosion science.
- To make the students understand various corrosion processes and engineering applications

MODULE I CORROSION PROCESSES 12

Basic principles of electrochemistry and aqueous corrosion processes - Electrochemical Thermodynamics and Electrode Potential - Electrochemical Kinetics of Corrosion Cathodic and anodic behavior - Faraday's Law - Nernst equation; standard potentials Pourbaix diagram - Tafel equations, corrosion rate - Evans diagram - pitting, crevice and exfoliation corrosion; influence of deposits and anaerobic conditions; corrosion control; high temperature oxidation and hot corrosion; corrosion/mechanical property interactions.

MODULE II INSTRUMENTAL TECHNIQUES 09

X-ray diffraction, TEM, SEM and EDX, WDX analysis, surface analysis by AES, XPS and SIMS, overview of other techniques.

MODULE III COATING MANUFACTURE 09

Electrodeposition; flame and plasma spraying; thermal, HV of detonation gun, gas dynamic spray, physicalvapour deposition; chemical vapour deposition; HIP surface treatments.

MODULE IV CORROSION IN SELECTED ENVIRONMENTS 07

Atmospheric Corrosion, Corrosion in Automobiles, Corrosion in Soils, Corrosion of Steel in Concrete, Corrosion in Water, Microbiologically Induced Corrosion, Corrosion in the Body, Corrosion in the Petroleum Industry, Corrosion in the Aircraft Industry, Corrosion in the Microelectronics Industry

MODULE V COATING APPLICATIONS 08

Abrasive, erosive and sliding wear.The interaction between wear and corrosion. Coating systems for corrosion and wear protection; new coating concepts including multi-layer structures, functionally gradient materials, intermetallic barrier coatings and thermal barrier coatings.

Total Hours: 45

REFERENCES:

1. D.A. Jones, Principles and Prevention of Corrosion, 2nd Edition, Macmillan Publishing Co., 1995.
2. J.O.M. Bockris, B.E. Conway, E. Yeager and White, Electrochemical Materials Science in Comprehensive Treatise of Electrochemistry, Volume 4, Plenum press, 2001.
3. M.G. Fontanna and N.D. Greene, Corrosion Engineering, McGraw-Hill publishing, 1978
4. I.M. Hutchings, Tribology: Friction and Wear of Engineering Materials, CRC press, Boca Raton, 1992 D.O. Sprowds, Corrosion Testing and Evaluation, Corrosion Metals Hand book, vol. 13, 1986.

OUTCOMES:

At the end of the course the students will be able to understand the

- corrosion process and analytical technique
- applications of coatings.
- coating manufacture technique and corrosion environment

PHCY120 BIOMATERIALS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To enable the students understand importance of and properties of Biomaterials
- To make the students understand applications of various biomaterials

MODULE I BIOLOGICAL PERFORMANCE OF MATERIALS 09

Biocompatibility- Introduction to the biological environment – Material response: swelling and leaching, corrosion and dissolution, deformation and failure, friction and wear – Host response: the inflammatory process - coagulation and hemolysis- approaches to thrombo- resistant materials development.

MODULE II ORTHOPAEDIC MATERIALS 09

Bone composition and properties - temporary fixation devices - joint replacement – Biomaterials used in bone and joint replacement: metals and alloys – Stainless steel, cobalt based alloys, titanium based materials – Ceramics: carbon, alumina, zirconia, bioactive calcium phosphates, bioglass and glass ceramics – polymers: PMMA, UHMWPE/HDPE, PTFE – Bone cement – Composites.

MODULE III CARDIOVASCULAR MATERIALS 09

Blood clotting – Blood rheology – Blood vessels – The heart – Aorta and valves – Geometry of blood circulation – The lungs - Vascular implants: vascular graft, cardiac valve prostheses, cardiac pacemakers – Blood substitutes – Extracorporeal blood circulation devices.

MODULE IV DENTAL MATERIALS 09

Teeth composition and mechanical properties – Impression materials – Bases, liners and varnishes for cavities – Fillings and restoration materials – Materials for oral and maxillofacial surgery – Dental cements and dental amalgams – Dental adhesives.

MODULE V MATERIALS IN OPTHALMOLOGY 09

Biomaterials in ophthalmology – Viscoelastic solutions, contact lenses, intraocular lens materials – Tissue grafts – Skin grafts – Connective tissue grafts – Suture materials – Tissue adhesives – Drug delivery: methods and materials – Selection, performance and adhesion of polymeric encapsulants for implantable sensors-biomemtic materials-Technology from nature.

Total Hours: 45

REFERENCES:

1. Sujata V. Bhat. Biomaterials, Narosa Publication House, New Delhi, 2002.
2. Jonathn Black. Biological Performance of Materials: Fundamentals of biocompatibility, Marcel Dekker Inc, New York, 1992.
3. D.F.Williams (editor). Materials Science and Technology: A comprehensive treatment, Volume 14. Medical and Dental Materials, VCH Publishers Inc, New York, 1992.
4. F.Silver and C.Doillon. Biocompatibility: Interactions of Biological and implantable materials. Volume I Polymers, VCH Publishers Inc, New York, 1989.
5. L.L.Hench and E.C.Ethridge. Biomaterials: An Interfacial Approach, Academic Press, 1982.
6. Joon Park, R. S. Lakes, Biomaterials. An Introduction, Springer, third edition, 2010. Springer

OUTCOMES:

At the end of the course the students will be able to explain the

- importance of and properties of biomaterial
- applications of various biomaterials

REGULATIONS, CURRICULUM AND SYLLABI

M.Sc.
BIOTECHNOLOGY

(As approved by the 9th Academic Council)

JULY 2016

B.S.ABDUR RAHMAN
UNIVERSITY
B.S. ABDUR RAHMAN INSTITUTE OF SCIENCE & TECHNOLOGY
(Estd. u/s 3 of the UGC Act, 1956)
(FORMERLY B.S. ABDUR RAHMAN CRESCENT ENGINEERING COLLEGE)
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VISION AND MISSION OF THE DEPARTMENT OF SCHOOL OF LIFE SCIENCES

VISION

To attain new heights in biotechnology research, shaping life sciences into a premier precision tool for the future for creation of wealth and ensuring social justice-specially for the welfare of the poor

MISSION

The mission of the School of Life Sciences is to maximize the benefits of biotechnology to the University, the nation and the globe by being an excellent quality, comprehensive, multidisciplinary school that supports, coordinates, disseminates and advances biotechnology in the areas of social welfare and entrepreneurship.

PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES

M. Sc. (Biotechnology)

PROGRAMME EDUCATIONAL OBJECTIVES:

The course aims to provide an advanced understanding of the core principles and topics of Biotechnology and their experimental basis, and to enable students to acquire a specialized knowledge and understanding of selected aspects by means of a lecture series and a research project. Hence, the main objectives of the program are:

- To provide an introduction to the basic concepts of Biotechnology and its recent advances.
- For the basic understanding, this course includes biochemistry, cell and molecular biology, animal and plant biochemistry, and immunology.
- Moreover, several laboratory courses given in the individual sections of the curriculum with detailed information on the importance of biotechnology in basic and applied research.
- Finally this course explains the advanced sections of biotechnology like recombinant DNA technology, nanobiotechnology, Pharmaceutical biotechnology, plant and animal biotechnology and bioinformatics.
- This course provides necessary theoretical and practical experience in all divisions of biotechnology to become an effective professional.
- To provide broad exposure to various societal, ethical and commercial issues in the various aspects of biotechnology.

PROGRAMME OUTCOMES:

After successfully completing this course, the student should be able to:

- Apply their knowledge of biotechnology into high end research.
- Advanced sections of like Immunology, boinformatics, nano-biotechnology will give broad information on applications and opportunities in the field of biotechnological research.
- Identify research and solve biochemistry, cell and molecular biology related problems related to the different types of animal and plant diseases.

CURRICULUM & SYLLABI FOR
M. Sc. (Biotechnology)
(Four Semesters / Full Time)
Curriculum

Sl. No.	Course Code	Course Title	L	T	P	C
		SEMESTER I				
1	LSC6101	Advanced Biochemistry	**4**	**0**	**0**	**4**
2	LSC6102	Cell and Molecular Biology	**4**	**0**	**0**	**4**
3	LSC6103	Genetic Engineering	**4**	**0**	**0**	**4**
4		Elective I	**3**	**0**	**0**	**3**
5		Elective II	**3**	**0**	**0**	**3**
6	LSC6104	Lab I (Biochemistry / Molecular Biology / Genetic Engineering)	**0**	**0**	**6**	**3**
		Total				**21**
		SEMESTER II				
1	GEC6202	Research Methodology	**3**	**0**	**0**	**3**
2	LSC6201	Immunology	**4**	**0**	**0**	**4**
3	LSC6202	Bioinformatics	**4**	**0**	**0**	**4**
4		Elective III	**3**	**0**	**0**	**3**
5		Elective IV	**3**	**0**	**0**	**3**
6	LSC6203	Lab II (Immunology / Bioinformatics)	**0**	**0**	**6**	**3**
7	LSC6204	Industrial Internship	**0**	**0**	**0**	**1**
8	LSC6205	Mini Project	**0**	**0**	**0**	**1**
		Total				***22***
		SEMESTER III				
1	LSC7101	Project Phase I	**0**	**0**	**2**	**2**
2	LSC7102	Plant and animal Biotechnology	**4**	**0**	**0**	**4**
3	LSC7103	Bioprocess Technology	**4**	**0**	**0**	**4**
4		Elective 5	**3**	**0**	**0**	**3**
5		Elective 6	**3**	**0**	**0**	**3**
6	LSC7104	Lab III (Plant and animal Biotechnology / Bioprocess Technology)	**0**	**0**	**6**	**3**
		Total				**17**
		SEMESTER IV				
1	LSC7101	Project Phase II	**0**	**0**	**36**	**18**
		Total			**2+18=20**	
		Total Credits				**80**

Note: Two credits earned in the Project Phase I will be added when the complete the Phase II project

LIST OF ELECTIVES

	Course Code	Course Title	L	T	P	C
		SEMESTER I				
1	LSCY101	Bio safety and Bioethics, Bio entrepreneurship and IPR	**3**	**0**	**0**	**3**
2	LSCY102	Microbiology	**3**	**0**	**0**	**3**
3	LSCY103	Food Process Technology	**3**	**0**	**0**	**3**
4	LSCY104	Analytical Methods	**3**	**0**	**0**	**3**
5	LSCY105	Environmental Biotechnology	**3**	**0**	**0**	**3**
6	LSCY106	SiRNA/RNA Interference	**3**	**0**	**0**	**3**
		SEMESTER II				
1	LSCY201	Recombinant DNA Technology	**3**	**0**	**0**	**3**
2	LSCY202	Advanced Instrumentation	**3**	**0**	**0**	**3**
3	LSCY203	Molecular Diagnostics	**3**	**0**	**0**	**3**
4	LSCY204	Omics	**3**	**0**	**0**	**3**
5	LSCY205	Biofuel and Bio energy	**3**	**0**	**0**	**3**
6	LSCY206	Molecular Farming	**3**	**0**	**0**	**3**
		SEMESTER III				
1	LSCY111	Biopharmaceuticals	**3**	**0**	**0**	**3**
2	LSCY112	Molecular and Immune Diagnostics	**3**	**0**	**0**	**3**
3	LSCY113	Tissue and Antibody Engineering	**3**	**0**	**0**	**3**
4	LSCY114	Bio nanotechnology	**3**	**0**	**0**	**3**
5	LSCY115	Protein Engineering	**3**	**0**	**0**	**3**
6	LSCY116	Stem Cell Technology	**3**	**0**	**0**	**3**

SEMESTER I

LSC6101 ADVANCED BIOCHEMISTRY

L	T	P	C
4	0	0	4

OBJECTIVES:

This course aims to develop in the students' mind a concept regarding

- The diversity of metabolic processes occurring in biological system.
- The effect of the structural and functional role of the enzymes governing the metabolic processes.
- Importance of the metabolic pathways in maintaining homeostasis in biological system.
- The clinical implications of the metabolic pathway.

MODULE I AMINO ACIDS & PROTEIN: STRUCTURE AND FUNCTIONS 05

Amino acids- Classification, structure and function, proteins- primary, secondary, tertiary and quaternary structure, Ramachandran plot, super secondary structures and helix loop.

MODULE II ENZYMOLOGY 10

Classification of enzymes. How do enzymes work: activation energy, substrate specificity. Enzyme-substrate interaction: Lock and Key mechanism and Induced Fit mechanism. Effect of temperature and pH on enzyme action. Enzyme Kinetics: Michaelis-Menten Equation, Km, Measurement of Km and Vmax (Lineweaver-Burk equation). Kinetics of multisubstrate reaction: Sequential reactions and ping-pong reactions. Enzyme inhibition: reversible (competitive, uncompetitive and mixed) and irreversible. Allosteric regulation of enzyme activity. Multienzyme complex and multifunctional enzymes.

MODULE III ENERGY PRODUCTION AND OXIDATIVE PHOSPHORYLATION 14

Introduction to metabolism: Anabolism, catabolism, metabolic pathways. Characteristics of metabolic pathways

Glycolysis: glycolytic pathway. Molecular mechanism of action of the glycolytic enzymes. Energetic of glycolysis. Glycolysis and cancer biology—Warburg Hypothesis and PET scanning. Fates of Pyruvate under anaerobic conditions: alcohol and lactic acid fermentation. Importance of lactic acid fermentation.

TCA Cycle: Formation of Acetyl CoA and reactions of citric acid cycle. Molecular mechanism of pyruvate dehydrogenase complex and enzymes involved in Kreb's cycle. Energetic of TCA cycle and substrate level phosphorylation.

Lipid metabolism: Hormonal regulation of the mobilization of triglycerides from adiposities. Transport of fatty acid into mitochondria. Beta oxidation of saturated fatty acid (both even and odd). Regulation. Energetic.

Electron Transport Chain: structure and function of Electron carriers: Complex I—V. Passage of electrons from complex I to IV. Mitchell's chemiosmotic hypothesis and proton gradient. Structure of complex V or ATP synthase, Catalytic sites of ATP synthesis. Mechanism of ATP generation by Boyer's binding change mechanism—rotational catalysis. Energetic of ATP synthesis and efficiency of ATP synthase.

MODULE IV METABOLIC INTERRELATIONSHIP 09

Starve-Fed cycle. Glucose homeostasis. Switching of metabolism of liver between starve and fed cycle. Metabolic relationship of tissues in various nutritional and hormonal states—insulin resistance, diabetes, exercise, pregnancy, lactation, stress, liver and renal diseases, alcohol consumption.

MODULE V REGULATORY MECHANISMS OF METABOLIC PATHWAYS 07

Feedback inhibition by allosteric modulation of enzymes. Covalent modifications of enzymes. Isozymes. Propetolytic cleavage. Regulationg the amount of enzyme—regulation gene expression in prokaryotes and eukaryotes.

Total Hours: 45

REFERENCES:

1. Nelson D.L, Cox M. M. Lehninger's Principle of Biochemistry. 5th Ed.,W. H. Freeman, 2008.
2. Biochemistry by Lubert Stryer 7th ed. W. H. Freeman & Company.
3. Textbook of Biochemistry with Clinical Correlations. 4th Ed. Thomas M. Devlin. Wiley-Liss publication. 1997.

OUTCOMES:

At the completion of the course the student will develop an understanding about the

- Various metabolic processes occurring in biological system and their role in governing homeostasis and normal physiology.
- The importance of enzymes as a regulatory molecule in metabolism.
- The interrelationship of metabolic pathways different physiological conditions.
- The role of liver in regulating metabolism.

LSC6102 CELL & MOLECULAR BIOLOGY

L	T	P	C
4	0	0	4

OBJECTIVES:

- To get overview of classes of cells and structural and function aspects of plasma membrane and cell organelle.
- To develop skill to understand molecular aspects of cell cycle and cell division.
- To get familiar with transcription and translation in details.
- To understand the signaling pathways in cell functioning

MODULE I INTRODUCTION TO CELL 08

Basic properties of cell, Different classes of cell: Prokaryotic, animal and plant cell.Plasma membrane- structure and function, Chemical composition of membranes, membrane lipids and proteins, fluid mosaic model, Transport across the membranes- diffusion, osmosis, facilitated diffusion,passive and active transport; membrane potential and nerve impulses.

MODULE II MEMBRANE TRANSPORT 07

Endoplasmic Reticulum, Golgi complex- glycosylation, Vesicle transport- COPI and COPII; Lysosomes-autophagy;Endocytic pathway- endocytosis and phagocytosis,transport of proteins into peroxisomes, mitochondria and chloroplast;

MODULE III ENERGY CONVERSION 10

Structure of mitochondria and organization of respiratory chain; Proton Pump and ATP generation in mitochondria; Structure of chloroplast and Photosynthesis, photorespiration; Genetic system of mitochondria and chloroplast.

MODULE IV BASIC GENETIC MECHANISMS 10

The structure and function of DNA, DNA packaging and Chromosomes, chromatin structure and function, DNA replication mechanisms, DNA damage and repair and homologous recombination and transposable elements, Telomeres, telomerase and end replication. Role of telomerase in aging and cancer.

MODULE V TRANSCRIPTION AND TRANSLATION 10

Transcription- Prokaryotic and eukaryotic Transcription- RNA polymerases- general and specific transcription factors- regulatory elements- mechanism of transcription, Transcription termination Post transcriptional modification- splicing- editing- nuclear export of mRNA- mRNA stability; Translation- Genetic code, Mechanism of initiation-elongation andtermination- Regulation of translation.

Total Hours: 45

REFERENCES

1. Molecular Biology of Cell by Alberts et.al. John Wiley & Sons, 6Ed, 2015
2. The Cell by Cooper. ASM Press, 4Ed, 2007
3. Cell and Molecular Biology by Karp. John Wiley & Sons, 7Ed, 2013
4. Lodish H. F.Cell and Molecular Biology. W.H. Freeman & Co Ltd, 7Ed, 2000.

OUTCOMES:

- On the completion of the above objectives student will be able to get the overview of classes of cells and structural and function aspects of plasma membrane and cell organelle. They can develop skill to understand molecular aspects of cell cycle, cell division, transcription and translation.

LSC6103 GENETIC ENGINEERING

L	T	P	C
4	0	0	4

OBJECTIVES:

- To learn about genetic engineering, principles involved in manipulating genes and DNA.
- To know about cloning strategies and expression systems.
- To acquire basic understanding of techniques in genetic engineering.

MODULE I BASICS CONCEPTS 09

DNA Structure and properties; Restriction Enzymes; DNA ligase, Klenow enzyme, T4 DNA polymerase, Polynucleotide kinase, Alkaline phosphatase; Cohesive and blunt end ligation; Linkers; Adaptors; Homopolymeric tailing; Labeling of DNA: Nick translation, Random priming, Radioactive and non-radioactive probes, Hybridization techniques: Northern, Southern and Colony hybridization, Fluorescence in situ hybridization; Chromatin Immunoprecipitation; DNA-Protein Interactions-Electromobility shift assay; DN a selfoot printing

MODULE II CLONING VECTORS 09

Plasmids; Bacteriophages; M13 mp vectors; PUC19 and Bluescript vectors, Phagemids; Lambda vectors; Insertion and Replacement vectors; Cosmids; Artificial chromosome vectors (YACs; BACs); Animal Virus derived vectors-SV-40; vaccinia/bacculo& retroviral vectors; Expression vectors; pMal; GST; pET-can be omitted vectors; Protein purification; His-tag; GST-tag; MBP-tag etc.; Intein-based vectors; Inclusion bodies; Methodologies to reduce formation of inclusion bodies; Baculovirus and pichia vectors system, Plant based vectors, Ti and Ri as vectors, Yeast vectors, Shuttle vectors. Criteria for selection of vectors.

MODULE III CLONING METHODOLOGIES 09

Insertion of Foreign DNA into Host Cells; Transformation; Transfection, Transduction, Construction of libraries; Isolation of mRNA and total RNA; cDNA and genomic libraries; cDNA and genomic cloning; Expression cloning; Jumping and hopping libraries; Southwestern and Far-western cloning; Protein-protein interactive cloning and Yeast two hybrid system; Phage display; Principles in maximizing gene expression. Methods to confirm cloning and reporter genes and proteins.

MODULE IV PCR AND ITS APPLICATIONS 09

Primer design; Fidelity of thermostable enzymes; DNA polymerases; Types of PCR – multiplex, nested, reverse transcriptase, real time PCR, touchdown PCR, hot start PCR, colony PCR, cloning of PCR products; Tvectors; Proof reading enzymes; PCR in gene

recombination; Deletion; addition; Overlap extension; and SOEing; Site specific mutagenesis; PCR in molecular diagnostics; Viral and bacterial detection; PCR based mutagenesis detection. Sequencing methods; Enzymatic DNA sequencing; Chemical sequencing of DNA; Automated DNA sequencing; RNA sequencing; Chemical Synthesis of oligonucleotides.

MODULE V APPLICATION OF GENETIC ENGINEERING 09

Gene silencing techniques; Introduction to siRNA; siRNA technology; Micro RNA; Construction of siRNA vectors; Principle and application of gene silencing; Gene knockouts and Gene Therapy; Creation of knock out mice; Disease model; Somatic and germ-line therapy- in vivo and ex-vivo; Suicide gene therapy; Gene replacement; Gene targeting; Transgenics; cDNA and intragenic arrays; Differential gene expression and protein array. Ethics in genetic engineering and global policy.

Total Hours:

TEXT / REFERENCES

1. S.B. Primrose, R.M. Twyman and R.W.Old; Principles of Gene Manipulation. 6th Edition, S.B.University Press, 2001.
2. J. Sambrook and D.W. Russel; Molecular Cloning: A Laboratory Manual, Vols 1-3, CSHL, 2001.
3. Brown TA, Genomes, 3rd ed. Garland Science 2006
4. Selected papers from scientific journals.
5. Desmond S. T. Nicholl An Introduction to Genetic Engineering Cambridge University Press 2008
6. Technical Literature from Stratagene, Promega, Novagen, New England Biolab etc.

OUTCOMES:

- On completion of the course the scholars will acquire knowledge on the concepts and terminology in genetic engineering.
- Students will be familiar with various cloning strategies in prokaryotes as well as in eukaryotes.
- Students will learn various techniques in genetic engineering.
- They will also get awareness about the social and ethical issues concerning cloning by genetic engineering

LSC6104	LAB I (BIOCHEMISTRY, MOLECULAR BIOLOGY AND GENETIC ENGINEERING)	L	T	P	C
		0	0	6	3

OBJECTIVES:

- To learn basic techniques in molecular biology
- To study and differentiate the electrochemical properties of nucleic acids
- To learn the preliminary methods in biochemistry by preparing buffer and adjusting pH.
- To estimate various biomolecules by biochemical assays

EXPERIMENTS:

1. Laboratory safety guidelines.
2. To determine an unknown protein concentration by plotting a standard graph of BSA using UV-Vis Spectrophotometer and validating the Beer- Lambert's Law.
3. Effect of temperature on enzyme activity.
4. Separation techniques for amino acids and sugar:
    a. paper chromatography
    b. thin layer chromatography.
5. Separation of proteins by native and SDS-PAGE.
6. Preparation of slides from onion root tip for mitosis
7. Isolation & Purification of genomic DNA from bacteria
8. Isolation & Purification of plasmid DNA
9. Isolation of RNA
10. Agarose gel electrophoresis of chromosomal & plasmid DNA
11. Restriction Digestion of chromosomal & plasmid DNA
12. Isolation of DNA fragment from agarose gel
13. Competent cell preparation
14. Transformation and Efficiency of competent cells
15. SDS PAGE
16. Polymerase Chain Reaction
17. Isolation of Genomic DNA from Plants

REFERENCES:

1. Michel R. G and Sambrook J. Molecular Coning- A laboratory manual. Cold spring harbor laboratory press, 2012.
2. Laboratory Exercises in Microbiology, Fifth Edition by Harley−Prescott, The McGraw−Hill Companies, 2002
3. Wilson K and Walker J, Principles and Techniques in Practical Biochemistry, 5th Ed., Cambridge University Press, 2000.
4. Holtzhauer M, Basic Methods for the Biochemical Lab, Springer, 2006.

Nigam, Lab Manual in Biochemistry: Immunology and Biotechnology, Tata McGraw-Hill Education, 2007.
5. Lab manual

OUTCOMES:

- On the completion of the above experiments students will be able to handle DNA samples and also to isolate, purify and visualize nucleic acid.
- On performing the above experiments students will be able to know and perform the routine biochemical assays.
- Students will be able to isolate culture and identify microbes and also to efficiently use light microscope.

SEMESTER II

GEC6202	RESEARCH METHODOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

MODULE I RESEARCH METHODOLOGY-AN INTRODUCTION 09

Meaning of Research, Objectives of Research, Motivation in Research, Types of Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Criteria of Good Research, Problems Encountered by Researchers. Ethics and scientific conduct, Introduction to ethics, scientific conduct and misconduct, Misconduct and why it occurs, Fabrication, Authorship issues, the investigation and punishment of scientific misconduct.

MODULE II GOOD LABORATORY PRACTICES AND SAFETY 09

Introduction: History, definition, Principles, Good Laboratory Practices (GLP) and its application GLP training: Resources, Rules, Characterization, Documentation, quality assurance, Resources, Facilities: building and equipment, Personnel, GLP and FDA, Stepwise implementation of GLP and compliance monitoring.

MODULE III LABORATORY SAFETY AND EXPERIMENTAL RESEARCH 09

Safety in the Biology Laboratory, Safety Symbols, Science Safety Rules- Dress Code, First Aid, Heating and Fire Safety, Using Chemicals and glassware's, Handling living organisms, handling human blood and some other body fluids and tissue, disposal of bio hazardous waste.Precision, accuracy, sensitivity and specificity; variables, experimental planning – general guidelines

MODULE IV INTERPRETATION OF RESULTS AND ANALYSIS: 09

Importance and scientific methodology in recording results, importance of negative results, different ways of recording, industrial requirement, artifacts versus true results, types of analysis (analytical, objective, subjective) and cross verification, correlation with published results, discussion, outcome as new idea, hypothesis, concept, theory, model etc. Data analysis using Excel, Origin and Sigma plot Analyzing the chemical data and drawing chemical structures using Chemdraw and Chemsketch. Conceptions of error of measurement, true score theory and generalisability theory. Measures of central tendency or averages – mean median and mode. Measures of dispersion – range, variance, and standard deviation: The normal distribution and the normal probability curve.

MODULE V SCIENTIFIC WRITING, TECHNICAL PUBLICATION AND RESEARCH PROPOSAL 09

Different types of scientific and technical publications in the area of research, and their specifications, Ways to protect intellectual property – Patents, technical writing skills, definition and importance of impact factor and citation index - assignment in technical writing, The research problem, finding related literature, computer generated references sources and the research project, model research proposal.

Total Hours: 45

TEXT BOOKS AND REFERENCES:

1. Essentials of Research Design and Methodology Geoffrey R. Marczyk, David DeMatteo, David Festinger, 2005 John Wiley & Sons Publishers, Inc
2. Biochemical Calculations: How to Solve Mathematical Problems in General Biochemistry, 2nd Edition, Irwin H. Segel, 1976 John Wiley & Sons Publishers, Inc
3. Guide to Publishing a Scientific paper, Ann M. Korner, 2004, Bioscript Press.
4. P Laake, H B Benestad, B R Olsen. Research Methodology in the medical and biological sciences. Academic Press, 2007.
5. R Arora. Encyclopaedia of Research Methodology in Biological Sciences. Anmol Publishing, 2004.
6. Kothari C.R., Research Methodology, Methods and Techniques, Wiley Eastern Ltd., New
7. Delhi, 1991.
8. Coghill M. and Gardson L.R., The ACS Style Guide Effective Communication of Scientific
9. Information, 3rd Edn., Oxford University Press, 2006.
10. Willa Y. Garner, Maureen S. Barge, James, P, Good Laboratory Practice Standards:
11. Applications for Field and Laboratory Studies (ACS Professional References Book).

OUTCOMES:

LSC6201 IMMUNOLOGY

L	T	P	C
4	0	0	4

OBJECTIVES:

- The course is aimed at introducing the science of immunology and detailed study of various types of immune systems and their classification structure and mechanism of immune activation**.**

MODULE I OVERVIEW OF IMMUNE SYSTEM 04

Innate, adaptive and Comparative ImmModule y, Immune dysfunction and its consequences, Cells & Tissues of Immune System: Hematopoisesis, Apoptosis and Necrosis, systemic function of Immune system, organs of immune systems, Lymphoid cells and organs Evolutionary comparision. Cytokines- Properties of Cytokines, Cytokine Receptors, Cytokine Antagonists, Cytokine Secretion by TH1 and TH2 Subsets, Cytokine-Related Diseases, Therapeutic Uses of Cytokines and Their Receptors, Cytokines in Hematopoiesis

MODULE II MOLECULAR IMMUNOLOGY 05

Immunogenicity Versus Antigenicity, Factors that influence immunogenicity, Epitopes, Haptens and the Study of Antigenicity, Pattern-Recognition Receptors, drugs allegies-when medicine become immunogens, Molecular structure of antibody, Obstacles to Antibody Sequencing, Immunoglobulin Fine Structure, Antibody-Mediated Effector Functions, Antibody Classes and Biological Activities, Antigenic Determinants on Immunoglobulins, The B-Cell Receptor, The Immunoglobulin Superfamily, Monoclonal Antibodies.

MODULE III ORGANIZATION AND EXPRESSION OF IMMUNOGLOBULIN GENES 09

Genetic Model Compatible with Ig Structure, Multigene Organization of Ig Genes, Variable-Region Gene Rearrangements, Mechanism of Variable-Region DNA Rearrangements, Generation of Antibody Diversity, Class Switching among Constant-Region Genes, Expression of Ig Genes, Synthesis, Assembly, and Secretion of Immunoglobulins, Regulation of Ig-Gene Transcription, Antibody Genes and Antibody Engineering

MODULE IV ANTIGEN PROCESSING AND PRESENTATION 09

General organization and inheritance of the major histocompatibility complex (MHC), MHC molecules and genes, detailed genomic map of MHC genes, cellular distribution of MHC molecules, regulation of MHC expression, MHC and immune responsiveness, MHC and disease susceptibility self-MHC restriction of T cells, role of antigen-presenting cells,

evidence for two processing and presentation pathways, endogenous antigens: the cytosolic pathway,exogenous antigens: the endocytic pathway presentation of nonpeptide antigens

MODULE V GENERATION OF T AND B CELL RESPONSE 09

T-Cell Receptor, Early Studies of the T-Cell Receptor and αβ andγΔ T-Cell Receptors: Structure and Roles, Organization and Rearrangement of TCR Genes, T-Cell Receptor Complex: TCR-CD3,T-Cell Accessory Membrane Molecules, Three-Dimensional Structures of TCR-Peptide-

MHC Complexes,Alloreactivity of T Cells, T-Cell Maturation and the Thymus,Thymic Selection of the T-Cell Repertoire,T_H-Cell Activation, T-Cell Differentiation, Cell Death and T-Cell Populations Peripheral γΔ T-Cells, B-Cell Maturation,B-Cell Activation and Proliferation, The Humoral Response, In Vivo Sites for Induction of Humoral Responses, Germinal Centers and Antigen-Induced B-Cell Differentiation, Regulation of B-Cell Development, Regulation of the Immune Effectors Response.

Total Hours: 45

REFERENCES:

1. Kuby, RA Goldsby, Thomas J. Kindt, Barbara, A. Osborne Immunology, 6th Edition, Freeman, 2002.
2. Brostoff J, Seaddin JK, Male D, Roitt IM., Clinical Immunology, 6th Edition, Gower Medical Publishing, 2002.
3. Janeway et al., Immunobiology, 4th Edition, Current Biology publications., 1999.
4. Paul, Fundamental of Immunology, 4th edition, Lippenco

OUTCOMES:

After completing the course students will:

- have a detailed understanding of Component of immModule y
- know antigen presentation on a detailed molecular level
- understand the concept immunology and the immune system .
- have a in depth knowledge of the cellular and molecular basis for autoimmune disease and allergies.
- have basic knowledge of tumor immunology and the development of novel recombinant antibodies for treatment of cancer and autoimmune disease

LSC6202 BIOINFORMATICS

L	T	P	C
4	0	0	4

OBJECTIVES:

- To understand the programming languages applied in computational biology.
- To understand the methods and applications for sequence analysis, Phylogenetics and Protein modelling.

MODULE I INTRODUCTION TO PROGRAMMINB LANGUAGE 09

Introduction –Programming languages – Problem solving Technique: Algorithm, Flowchart, Compiling, Testing and Debugging - Basic Perl Data Types, File handle and File Tests – Perl Modules – SQL.

MODULE II PROGRAMMING IN C, C++ AND OOPS 09

C language Introduction – Tokens – Keywords, Identifier, Variables, Constants, Operators – Structure of a 'C' program - Expression – Data types – Control Statement - C++ programming – Object Oriented Concept: Encapsulation, Inheritance, Polymorphism.

MODULE III COMPUTATIONAL BIOLOGY AND SEQUENCE ANALYSIS 09

Molecular sequences, Genome sequencing: pipeline and data, Next generation sequencing data, Biological databases: Protein and Nucleotide databases, Sequence Alignment, Dynamic Programming for computing edit distance and string similarity, Local and Global Alignment, Needleman Wunsch Algorithm, Smith Waterman Algorithm, BLAST family of programs, FASTA algorithm, Functional Annotation, Progressive and Iterative Methods for Multiple sequence alignment, Applications.

MODULE IV PHYLOGENETICS 09

Introduction to Phylogenetics, Distance and Character based methods for phylogenetic tree construction: UPGMA, Neighbour joining, Ultrametric and Min ultrametric trees, Parsimonous trees, Additive trees, Bootstrapping.

MODULE V PROTEIN STRUCTURE, MODELLING AND SIMULATIONS 09

Protein Structure Basics, Visualization, Prediction of Secondary Structure and Tertiary Structure, Homology Modeling, Structural Genomics, Molecular Docking principles and applications, Molecular dynamics simulations

Total Hours: 45

REFERENCES:

1. Dan Gusfield. Algorithms on Strings Trees and Sequences, Cambridge University Press.
2. David W. Mount Bioinformatics: Sequence and Genome Analysis, Cold Spring Harbor Laboratory Press, Second Edition, 2004.
3. Arthur M. Lesk, Introduction to Bioinformatics by Oxford University Press, 2008.
4. Tisdall, James, Beginning PERL for Bioinformatics, O'Reilley Publications, 2001.
5. Andrew R. Leach, Molecular Modeling Principles and Applications, Second Edition, Prentice Hall.
6. Baldi, P., Brunak, S. Bioinformatics: The Machine Learning Approach, 2nd ed., East West Press, 2003
7. Baxevanis A.D. and Oullette, B.F.F. A Practical Guide to the Analysis of Genes and Proteins, 2nd ed., John Wiley, 2002

OUTCOMES:

- At the end of this course, students will have been familiarized with language skills and their applications in analyzing Protein structure , sequence analysis which can be used in analyzing the binding effect of drugs on proteins.

LSC6203	LAB II (IMMUNOLOGY/ BIOINFORMATICS)	L	T	P	C
		0	0	6	3

OBJECTIVES:

- To acquire knowledge on immunological techniques
- To train in various techniques involving antigen and antibody reactions
- To get hands on experience on plasmid construction, mappings and analysis.
- To explore to various tools in bioinformatics.

LIST OF EXPERIMENTS:

1. Double diffusion, Immuno-electrophoresis and Radial Immuno diffusion.
2. Antibody titre by ELISA method.
3. ELISA for detection of antigens and antibodies-DOT ELISA
4. Blood group mapping
5. Preparation of antigens from pathogens and parasites
6. Slide and tube agglutination reaction
7. Plasmid Construction/Restriction Mapping
8. PCR Primer Designing
9. Sequence Retrieval and Format Conversion
10. Homology Search/ Multiple Sequence Alignment
11. Motif finding in DNA and Protein Sequences
12. Protein Secondary Structure Prediction
13. Accessing Data- Use FORMATTED, LIST and COLUMN input to read raw data files, Combine SAS data sets using the DATA step.
14. Creating Data Structures- Create temporary and permanent SAS data sets, Control with observations and variables in a SAS data set are processed and output Managing Data- Investigate SAS data libraries using base SAS utility procedures.
15. Generating Reports- Generate list reports using the PRINT and REPORT procedures, Generate HTML reports using ODS statements.
16. Handling Errors- Identify and resolve programming logic errors, syntax errors, data errors.

REFERENCES:

1. Rose et al., Manual of Clinical laboratory Immunology, 6th Ed ASM Publications, 2002.
2. Lefkovis and Pernis. Immunological methods. Academic Press, 1978.
3. Hudson L. and Hay F.C. Practical Immunology. Black Well publishers, 1989
4. Rashidi H, Buehler L. K. Bioinformatics Basics: Applications in Biological Science and Medicine. 2nd Ed., CRC Press, 2005.

5. Baxevanis A. D, Ouellette B. F. F. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins. 3nd edition Wiley, John & Sons, Incorporated, 2004.
6. Krawetz S. A, Womble D. D. Introduction to Bioinformatics: A Theoretical and Practical Approach. Humana press, 2003

OUTCOMES:

- Students could independently perform diagnostics assays involving antigen-antibody reaction. They also learn to perform the qualitative and quantitative analysis using antibody.
- Students will be familiar with various soft skills/tool used in understating modern biology. They will also be able to analyze and interpolate data starting from PCR primer designing to structure predictions.

SEMESTER III

LSC7102	PLANT AND ANIMAL BIOTECHNOLOGY	L	T	P	C
		4	0	0	4

OBJECTIVES:

- This course gives students about the fundamentals of totipotency, plant tissue and animal cell culture techniques for in vitro manipulations and transgenic technology. It also familiarizes them with the use of plants for production of biologically active therapeutic proteins. The students will get an idea about animal cell culture their preservation and stem cells.

MODULE I PLANT TISSUE CULTURE 09

Totipotency, organogenesis, somatic embryogenesis, artificial seed production, Micropropagation, somaclonal variation, Germplasm conservation and cryopreservation. Protoplast Culture and Somatic Hybridization Protoplast isolation- its culture and usage, Somatic hybridization and its applications.

MODULE II AGROBIOLOGY 09

Agrobacterium-plant interaction; Virulence; Ti and Ri plasmids; Opines and their significance; T-DNA transfer, Genetic Transformation Agrobacterium-mediated gene delivery, Direct gene transfer - PEG-mediated, electroporation, particle bombardment and alternative methods; Screenable and selectable markers, Characterization of transgenics, Gene targeting.

MODULE III MOLECULAR MAPPING & MARKER ASSISTED SELECTION (MAS) 09

Marker assisted selection for genes of agronomic importance, e.g. insect resistance, grain quality and grain yield, Molecular polymorphism, RFLP, RAPD, STS, AFLP, SNP markers; Construction of genetic and physical map, Gene mapping and cloning, strategies for Introducing Biotic and Abiotic Stress Resistance/Tolerance Bacterial resistance; Viral resistance; Fungal resistance; Insects and pathogens resistance; Herbicide resistance; Drought, salinity, thermal stress, flooding and submergence tolerance.

MODULE IV INTRODUCTION TO ANIMAL BIOTECHNOLOGY 09

Animal cell culture; media composition and growth conditions; Animal cell and tissue preservation; Anchorage and non-anchorage dependent cell culture; Kinetics of cell growth; Micro & macro-carrier culture; Hybridoma technology; Stem cell technology; Animal cloning; Transgenic animals

MODULE V PRESERVATION AND APPLICATION 09

Cryopreservation, IVF, Cell banking, Gene transfer technology in animals, Stem cells, Application,Disease, Management through biotechnology, Genetic councelling. Hybridomas, human hybridoma, commercial scale production of monoclonal antibodies.

Total Hours: 45

REFERENCES:

OUTCOMES:

- At the end of the course students will be able to understand the advantages of in vitro propagation of plants in various areas and methods used for production of transgenic plants with their applications in different areas. At the end the students will be able to learn about primary cell culture. They could assess the effect of factors and their role in cell functions.

LSC7103 BIOPROCESS TECHNOLOGY

L	T	P	C
4	0	0	4

OBJECTIVES:

- To learn about the History and scope of bioprocess technology.
- To understand the mechanism of enzyme reactions,
- To know about the Bioreactors

MODULE I INTRODUCTION 09

Types, cells, production strains, preservation- history, industrial applications,chemical technology vis-a-vis biotechnology, commercial evalution potential.

MODULE II ENZYMES 09

Mechanism of enzyme reactions, Michaelis Menten kinetics, enzyme inhibition, factors affecting rate, parameter estimations, growth characterstics of microbial cells, Monod model, batch culture.

MODULE III PHYSICAL FACTORS FOR BIOPROCESS 09

Agitation and mixing, transport in cells, transfer resistances, mass transfer coefficients, enhancement of oxygen transfer, heat transfer correlations, batch and continuous sterilisation.

MODULE IV BIOREACTORS 09

Ideal bioreactors, Batch, fed batch, CSTR, PFR, Multiphase bioreactors,packed bed, bubble column fluidized trickle bed, immobilization. Aseptic, septic and anaerobic fermentors.

MODULE V DOWN STREAM METHODS 09

Filtration, centrifugation, sedimentation, extraction, sorption, reverse osmosis, ultra filtration, electrophoresis, waste water treatment.

Total Hours: 45

REFERENCES:

1. Shuler M and Kargi F. Bioprocess Engineering. Prentice Hall (I) Ltd., 2002.
2. Doran P. M. Bioprocess Engineering Principles. Academic Press,1995
3. Bailey J. E and Ollis D. F. Biochemical Engineering fundamentals. 2nd Ed., McGraw-Hill 1986.

OUTCOMES:

- On Completion of the course the scholars will be able to determine the scope and features of bioprocess technology. Students will also be familiar with the downstream process and scaling -up and scaling down.

LSC7104	LAB III (PLANT AND ANIMAL BIOTECHNOLOGY/ BIOPROCESS TECHNOLOGY)	L	T	P	C
		0	0	6	3

OBJECTIVES:

- To establish animal cell line cultures
- To test drugs toxicity in the cultured cells
- To study cell morphology and also to perform different staining procedures to identify the active status of the cells.

EXPERIMENTS:

1. MTT assay
2. Morphological characterization of cell death
3. Acridine orange/Ethidium bromide staining
4. Biochemical characterization of cell death
5. Isolation of proteolytic organism from soil sample
6. Glucose assay by DNS method
7. Evaluations of enzyme kinetic parameters
8. Enzyme activity calculation
9. Determination of optimum pH for enzyme
10. Determination of optimum temperature for an enzyme
11. Enzyme immobilized by alginate gel method
12. Hydrolysis of starch by immobilized method
13. Effect of substrate concentration on biomass yield
14. Solvent extraction techniques for product recovery
15. Micropropagation of plant by leaf disc culture
16. Electroelution of insert DNA from agarose gel slice.
17. Molecular analysis of putative transformed plants by Polymerase Chain Reaction

REFERENCES:

1. Yadav P. R, Tyagi R. Biotechnology of Animal Tissues. Discovery Publishing House, 2006.
2. Freshney R. I, Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications, 6th Edition, John Wiley & Sons, Inc. 2010.
3. Freshney R. I, Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications. Wiley-Blackwell. 6th Edition, 2010.
4. Razdan M. K. Introduction to Plant Tissue Culture . Science Publishers, 2003
5. Laimer M, Rcker. W. Plant Tissue Culture. Springer, 2003.
6. Reinert J, Yeoman M. M. MacDonald P. Plant Cell and Tissue Culture: A Laboratory Manual. Springer. 2012

OUTCOMES:

- By performing the mentioned experiments students will be able to culture and maintain animal and plant cells/tissues. Students will also be able to screen drugs in the cultured animal cells.

LIST OF ELECTIVES

SEMESTER I

		L	T	P	C
LSCY101	**BIOSAFETY, BIOETHICS, BIOENTREPRENEURSHIP, INTELLECTUAL PROPERTY RIGHTS**	**3**	**0**	**0**	**3**

OBJECTIVES:

- Developing a good work ethics and laboratory working condition
- Understanding the importance of following and maintaining laboratory safety guidelines

MODULE I ETHICS IN BIOLOGY 09

The legal and socioeconomic impacts of biotechnology - Public education of the processes of biotechnology involved in generating new forms of life for informed decision making - Biosafety regulation and national and international guidelines - rDNA guidelines

MODULE II BIOSAFETY 09

Experimental protocol approvals - levels of containment - Environmental aspects of biotech applications - Use of genetically modified organisms and their resistance in environment - Special procedures for r-DNA based product production

MODULE III MARKETING 09

Assessment of market demand for potential product(s) of interest; Market conditions, segments; Prediction of market changes; Identifying needs of customers including gaps in the market, packaging the product; Market linkages, branding issues; Developing distribution channels; Pricing/Policies/Competition; Promotion/Advertising; Services Marketing

MODULE IV INTELLECTUAL PROPERTY RIGHTS 09

Intellectual property rights - TRIP International conventions patents and methods of application of patents - Legal implications - Biodiversity and farmers rights - Beneficial applications' and development of research focus to the need of the poor - Identification of directions for yield effect in agriculture, aquaculture Bioremediation etc.

MODULE V PATENT SYSTEM 09

Objectives of the patent system - basic principles and general requirements of patent law - biotechnological inventions and patent law - legal development - patentable subjects and protection in biotechnology - The patentability of microorganisms - IPR and WTO

regime - consumer protection and IPR - IPR and plant genetic resources - GATT and TRIPS.

Total Hours: 45

REFERENCES:

1. Beier,F.K.,Crespi,R.S. and Straus,J. *Biotechnology and Patent protection*-Oxford and IBH Publishing Co.New Delhi.
2. Sasson A, *Biotechnologies and Development*, UNESCO Publications.
3. Singh K, *Intellectual Property rights on Biotechnology*, BCIL,NewDelhi.

OUTCOMES:

- At the end of the course student will develop an idea about the importance of good laboratory practice in high quality research. They will also develop awareness about the basic fundamental safety measures that a researcher should follow in laboratory.

LSCY102 MICROBIOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To expose the fundamentals and scope of microbiology.
- To learn the classification of bacteria, Virus, Fungi & Protozoa
- Learn microbial culture and disease related to microbes.

MODULE I INTRODUCTION TO MICROBIOLOGY 09

History and scope of microbiology- Classification of microorganisms-bacteria, fungi, virus, alga, protozoa- sterilization techniques, disinfectant and antiseptic agents. Microscopy - types of microscopes and their applications-simple and compound, bright field, dark field, fluorescence, phase-contrast and electron microscopes.

MODULE II BACTERIOLOGY 09

Major groups of bacteria- Archaebacteria, Actinomycetes, chemoautotrophs, eubacteria, Pseudomonads, cyanobacteria, rickettsias, chlamydias and spirochetes- Bacterial cell-structure and functions of cellular components cell wall composition of Gram positive and Gram negative bacteria, sub-cellular organizations, flagella, capsule and spores-bacterial staining-antimicrobial agents-antibiotics, chemotherapeutic drugs-antibacterial agents-mode of action- antibiotic resistance.

MODULE III VIROLOGY 09

Classification, morphology and characteristics of virus, fungi and Protozoa. Structure of DNA and RNA viruses, viral replication, Bacteriophages- lysogeny and lytic cycle- virus like agents-satellites, viroids and prions, antiviral and antifungal drugs. Classification of Helminthic parasites- Life cycle of malarial and filarial parasites.

MODULE IV CULTURING OF MICROORGANISMS 08

Microbial culture, continuous and synchronous culture- composition of culture media - solid and liquid media, chemically defined media, complex and differential media- Effect of PH, temperature and radiation on microbial growth.

MODULE V MICROBES AND DISEASES 10

Major human diseases caused by bacterial, viral and fungal pathogens Diseases of the respiratory tract-diphtheria, tuberculosis, pneumonia, influenza, mumps- Diseases of the skin-systemic mycoses, candidiasis- herpes viral infections, chicken pox, zoster and small pox- Genito-urinary infections- Gonorrhea, syphilis, leptospirosis, and AIDS-trichomoniasis- Diseases of GITCholera, ETEC and EIEC infections- shigellosis-Typhoid- Hepatitis,

gasteroenteritis. Major human protozoan diseases-Malaria, Amebiasis, Toxoplasmiases.

Total Hours: 45

REFERENCES:

1. Prescott, Harley and Klein, Microbiology, 5th Edition- Publisher: mcgraw Hill science 2002.
2. Gerard J. T, Berdell R. F, Christine L. C, Microbiology: An Introduction, 8th Edition, Benjamin Cummings, 2004.
3. Kenneth J. R,George R, John C. S, Medical Microbiology: An Introduction to Infectious Diseases, mcgraw-Hill Professional, 2003.

OUTCOMES:

- On the completion of the above objectives student will be able to learn the fundamentals and scope of microbiology, classification of Protozoa, bacteria, Fungi Virus, microbial culture and diseases.

LSCY103 FOOD PROCESS TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To explore about food process and technology.
- To get overview of processing of various types of food
- To expose themselves to storage and handling of food and food products.

MODULE I STORAGE AND HANDLING OF CEREALS 09

Infestation control; Drying of grains, Processing of rice and rice products. Milling of wheat and production of wheat products, including flour and semolina. Milling of corn, barley, oat, coarse grains including sorghum, ragi and millets; Processing of tea, coffee and cocoa.

MODULE II FRESH FRUITS AND VEGETABLES 09

Preservation of fruits and vegetable by heat treatment. Production and preservation of fruits and vegetable juices, preservation of fruit juice by hurdle technology. Non-alcoholic beverages; Food Laws, food rules and standards, Statistical Quality Control; Various types of packaging.

MODULE III SEA FOOD 09

Commercial handling, storage and transport of raw fish; Average composition of fish; Freshness criteria and quality assessment of fish; Spoilage of Fish; Methods of Preservation of fish: Canning, Freezing, Drying, Salting, Smoking and Curing. Quality control of processed fish; Fish processing industries in India.

MODULE IV ANIMAL PRODUCT 09

Slaughtering technique of animal; Meat cuts and portions of meat, muscle; Color of meat; Post mortem changes of meat; Meat processing - curing and smoking; fermented meat products (meat sausages & sauces); Frozen meat & meat storage. Classification of poultry meat; Composition and nutritional value of poultry meat & eggs ; Processing of poultry meat and eggs; Spoilage and control; Byproduct utilization and future prospects; Poultry farms in India.

MODULE V DIARY PRODUCT 09

Composition of milk; Varieties of milk; Checks for purity of milk; Handling of fresh milk. Pasteurization of milk; HTST and UHT techniques; Packaging of milk; Fermentation of milk and fermented milk products. Manufacture of milk products like evaporated milk, powder milk, condensed milk, cream butter, cheese, yogurt, ice cream, ghee, baby food

and sweet meat. Quality control of milk and milk products; Milk plant hygiene and sanitation.

Total Hours: 45

REFERENCES

1. Principles of Food Science, Vol-I by Fennma Karrel
2. Modern Dairy Products, Lampert LH; 1970, Chemical Publishing Company.
3. Developments in Dairy Chemistry – Vol 1 & 2;
4. Processed Meats; Pearson AM & Gillett TA; 1996, CBS Publishers.
5. Meat; Cole DJA & Lawrie RA; 1975, AVI Pub.
6. Post Harvest Technology of cereal pulse and oil seeds by Chakraborty, AC
7. Egg and poultry meat processing; Stadelman WJ, Olson VM, Shemwell GA & Pasch S; 1988, Elliswood Ltd.
8. Preservation of Fruits & Vegetables by Girdhari Lal, Sidhapa and Tandon
9. Developments in Meat Science – I & II, Lawrie R; Applied Science Pub. Ltd.
10. Egg Science & Technology; Stadelman WJ & Cotterill OJ; 1973, AVI Pub.
11. Technology of Food Preservation by Desrosier Fish as Food; Vol 1 & 2; Bremner HA; 2002, CRC Press.
12. Fish & Fisheries of India; Jhingram VG; 1983, Hindustan Pub Corp.
13. Robinson RK; 1996; Modern Dairy Technology, Vol 1 & 2; Elsevier Applied Science Pub.
14. Milk & Milk Processing; Herrington BL; 1948, McGraw-Hill Book Company.
15. Fox PF; Applied Science Pub Ltd. Outlines of Dairy Chemistry, De S; Oxford.

OUTCOMES:

- On the completion of the above objectives student will have a sound knowledge on the various techniques involved in food processing, storage and handling of food and food products.

LSCY104 ANALYTICAL TECHNIQUES

L	T	P	C
3	0	0	3

OBJECTIVES

- The students will be exposed to basic concepts related with techniques and instrumentation widely used in Biotechnology.

MODULE I CALORIMETRY AND SPECTROSCOPY 09

Properties of electromagnetic radiations, interaction with matter. Ultraviolet spectroscopy: Origin of UV spectra, types of transition, chromophore & related terms, choice of solvent, instrumentation and applications Infra-red spectroscopy: Origin of infra-red spectra, modes of vibrations, instrumentation, sampling technique and applications; Nuclear magnetic resonance spectroscopy: Mass Spectroscopy: Origin, Instrumentation, types of ions produced, interpretation and applications of mass spectra GCMS, LCMS & MSMS.

MODULE II CENTRIFUGATION AND MICROSCOPY 09

Principle of centrifugation, rotors, different types of centrifuges, preparative and analytical centrifugation, ultra centrifugation. Optical microscopy, Bright field, Dark field, phase contrast and fluorescence microscopy. Electron microscopy: Transmission and scanning electron microscopy, Atomic force microscopy.

MODULE III ELECTROPHORESIS 09

General principle, support media. Agarose gels, polyacrylamide gels. SDS PAGE, 2D PAGE Pulsed field gel electrophoresis Iso-electric focusing Capillary electrophoresis

MODULE IV RADIOISOTOPE TECHNIQUES 09

Study of radioisotopes in biological samples, proportional and GM counter, scintillation counters, autoradiography, radio –immunoassay.

MODULE V CHROMATOGRAPHY 09

Introduction: Chromatography theory and practice. Paper chromatography. Thin layer chromatography. Ion exchange chromatography. Affinity chromatography. Partition chromatography. Adsorption chromatography. Introduction to gas chromatography and HPLC. Permeation.

Total Hours:

REFERENCES

1. Pierre C. ORD and CD in chemistry and biochemistry: An Introduction. Academic Press, 1972.
2. Paddock S. W. Confocal Microscopy methods & protocols.1st Ed., Human Press, 1999.
3. Murphy D. B. Fundamental of Light Microscopy & Electron Imaging. 1st Ed., Wiley-Liss, 2001.

OUTCOMES:

- At the end of the course, the students will have sufficient scientific understanding of the basic concepts in instrumentation used in Biotechnology.

LSCY105 ENVIRONMENTAL BIOTECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn the environment protection Act and Law related to environmental biotechnology
- To give basic idea on environmental sample analysis
- To understand the basic principles involved in waste water management
- To get the information on usage of Bioremediation-biotechnology
- To inform students about Biooxidation & microbial leaching

MODULE I INTRODUCTION TO ENVIRONMENTAL BIOTECHNOLOGY 09

Water, Soil and Air: their sources and effects. Removal of Specific Pollutants : Sources of Heavy Metal Pollution, Microbial Systems for Heavy Metal Accumulation, Biosorption & detoxification mechanisms. Environment protection Act: Environmental laws, Environmental policies, Environmental ethics. UN declaration. Environmental protection and conservation. Environmental Impact Assessment, Ecoplanning and Sustainable Development

MODULE II ENVIRONMENTAL SAMPLE ANALYSIS 09

Physicochemical and bacteriological analysis of soil and water, Problems associated with soil alkali soils, sodic soils, and solid waste, Fate of insecticides fungicides, pesticides in soil, use of genetically modified (insect- , pest- and pathogen resistant) plants. Ecotoxicology of soil pollutants, Municipal solid waste treatment strategies.

MODULE III WASTE WATER MANAGEMENT 09

Waste water constituents, Analysis and selection of flow rates and loadings, Process Selection, Physical unit operations, Chemical unit operations, Fundamentals of biological treatment, Role of biotechnology in water purification systems. Types and kinetics of biological treatment, Advanced waste water treatment, Biological Processes for Industrial and domestic effluent, Treatment, Aerobic Biological Treatment,Anaerobic Biological Treatment.

MODULE IV BIOREMEDIATION-09

Bioremediation-Biotechnology for clean environment, Biomaterials as substitutes for non-degradable materials, Metal microbe interactions: Heavy Metal Pollution and impact on environment, Microbial Systems for Heavy Metal Accumulation, Biosorption, molecular mechanisms of heavy metal tolerance Bioindicators and biosensors for detection of pollution. Biotechnology for Hazardous Waste Management, Persistent organic

pollutants, Xenobiotics, Biological Detoxification of PAH, Biotechniques for Air Pollution Control. Solid Waste Management

MODULE V BIOOXIDATION & MICROBIAL LEACHING 09

Biooxidation – Direct and Indirect Mechanisms – Biooxidation Kinetics; Bacterial oxidation of Sphalerite, Chalcopyrite and Pyrite.; Extraction of metals from ores; Recovery of metals from solutions; Microbes in petroleum extraction; Microbial desulfurization of coal.

Total Hours: 45

REFERENCES:

1. Amann, R.I. Stromley, J. Stahl : Applied & Environmental Microbiology
2. Environmental Microbiology, W.D. Grant & P.E. Long, Blakie, Glassgow and London.
3. Microbial Gene Technology, H. Polasa (ED.) South Asian Publishers, New Delhi.
4. Biotreatment Systems, Vol. 22, D. L. Wise (Ed.), CRC Press, INC.
5. Standard Methods for the Examination of Water and Waste Water (14 th Education), 1985. American Public health Association

OUTCOMES:

On successful completion of this module, learners will be able to have:

- An understanding of environment protection regulations and source of environmental pollutions.
- The capability to apply advanced knowledge on environmental sample analysis
- The capability to apply avalanched discipline in waste water management
- The ability to formulate technique for bioremediation process
- An understanding of how biooxidation & microbial leaching helping in the industries.

LSCY106 SIRNA/RNA INTERFERENCE

L	T	P	C
3	0	0	3

OBJECTIVES:

- To get overview of gene regulation by gene silencing.
- To develop a detailed knowledge of siRNA and miRNA.
- To develop skill to understand molecular aspects of RNAi biology.
- To get familiar with technical applications of RNAi.

MODULE I INTRODUCTION TO GENE SILENCING 09

History of RNA interference, antisense RNA, mechanism, cosuppression in Petunia

MODULE II BASIC MECHANISM 09

dsRNA cleavage, RISC activation, dicer, argonaute, gene regulation by silencing,

MODULE III PHYSIOLOGY OF RNA INTERFERENCE 09

RNAi and immunity- antiviral mechanisms in plants, Drosophila, C. elegans, Downregulation and upregulation of genes

MODULE IV APPLICATIONS 09

Gene knockdown, functional genomics, medicine, therapeutic gen modulation, antiviral therapies, cancer, biosafety issues

MODULE V RNAI BIOTECHNOLOGY 09

Food industry- production of plant toxins, production of non-narcotic natural products, development as an insecticide, generation of transgenic plants, genome wide screening

Total Hours:

REFERENCES:

1. RNAi Technology. R K Gaur, CRC Press, 2011
2. RNA Interfernce: From biology to clinical applications by Wei Ping Min. Humana Press
3. RNA Silencing by Esra Galun. World Scientific Publishing Co. Pte. Ltd.

OUTCOMES:

At the end of this course students will be able to:

- Understand gene silencing mechanisms
- Understand types of RNAi
- Understand the applications of RNAi

SEMESTER II

LSCY201	RECOMBINANT DNA TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To understand the basics of Recombinant DNA
- To learn applications of Recombinant DNA Technology

MODULE I CLONING & CLONING VECTOR 09

Types of cloning vectors viz. Plasmids, cosmids, ssDNA Phages, Yeast cloning vectors, Animal viruses, Ti plasmids and Cauliflower Mosaic Virus. Structural and Functional Organization of Plasmids, Plasmid Replication, Stringent and Relaxed Plasmids, Incompatibility of Plasmid Maintenance.

MODULE II MANIPULATION OF PURIFIED DNA 09

Enzymes involved in DNA Manipulation- Nucleases, Ligases, Polymerases and DNA modifying enzymes, Restriction endonucleases-Types, Blunt and sticky ends, Liagtion-Mode of action of DNA Ligase.

MODULE III CONSTRUCTION OF RECOMBINANT DNA 09

Preparation of competent cell-Transformation, transfection – Recombinant selection and screening- Genomic DNA library- cDNA synthesis strategies - Linkers - Adapters - Homopolymer tailing- Making genomic and cDNA libraries in plasmids and phages. PCR product cloning (TA cloning). Cloning strategies in yeast, E. coli and B. subtilis.

MODULE IV HYBRIDIZATION TECHNIQUES & MUTAGENESIS 09

DNA hybridization, colony hybridization and in-situ hybridization (Southern, Northern and Dot blots and immunological techniques Western blotting), Mutagenesis - Deletion mutagenesis, Oligonucletoide derived mutagenesis, Site directed mutagensis - Its applications- Applications of rDNA technology in Diagnostics.

MODULE V APPLICATIONS OF rDNA TECHNOLOGY 09

Gene Cloning and DNA analysis in Agriculture, Forensic Science and Medicine-Production of Recombinant pharmaceuticals, identification of genes responsible for human disease, Genetic Finger printing, Gene Therapy, Plant Genetic engineering, Problems with Genetically modified plants.

Total Hours: 45

REFERENCES:

1. Recombinat DNA Second eition by Watson
2. Gene Cloning and DNA analysis: An Introduction by T. A. Brown.

OUTCOMES:

- This course will introduce the students with the basics about genes, and approaches to manipulate the gene according to need such as production of therapeutic proteins in plants.

LSCY202	ADVANCED INSTRUMENTATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the electrochemical techniques and principles of centrifugation and spectrophotometry.
- To learn the principles of chromatography and microscopy and their several aspects.
- To understand the information of radioactive methods, detection and measurement of radioactivity.

MODULE I ELECTROCHEMICAL TECHNIQUES 09

Basic principles of Electrochemical Techniques- - pH electrode, Ion selective- gas-sensing and oxygen electrodes- biosensors. Centrifugation- basic principles-instrumentation- Centrifugation- centrifugation units-types of centrifuges-colloidal nature of particles-centrifugation methods and accessories- sedimentation velocity-sedimentation equilibrium-cell fractionation methods.

MODULE II SPECTROPHOTOMETRY 09

Principles and techniques of colorimetry and spectrophotometry-Beer-Lamberts Law -instrumentation - qualitative and quantitative methods of analysis- hypo and hyper chromicity- coupled assays –Spectrofluorimetry-Turbidimetry - Flame and Atomic absorption Spectrophotometer and Mass spectrometer. Chromatography- types- column, thin layer, paper, adsorption, partition, gas, liquid, ion exchange, affinity, HPLC-principles of each type- instrumentation and accessories- detection methods and systems qualitative and quantitative aspects-applications.

MODULE III MICROSCOPY 09

Basic principles of Microscopy and application of Light, Compound, Phase contrast inverted microscopy; Scanning Electron Microscopy (SEM)- Transmission Electron Microscopy, (TEM)- Fluorescence Microscopy- Scanning Tunneling Microscopy-(STM)- Automated Fluorescence Microscopy - Confocal Microscopy.

MODULE IV ELECTROPHORESIS 09

Types of Electrophoresis- paper and gel-agarose and PAGE-pulsed field-capillary - isoelectric focusing- 2 D electrophoresis; blotting methods-Western- Southern and Northern- application-methods in life sciences.

MODULE V RADIOACTIVE METHODS 09

Types of radioisotopes-half life- units of radioactivity- uses of radioisotopes in life

sciences and biotechnology- detection and measurement of Radioactivity- liquid scintillation counting- solid state counting- Geiger counter - Radiation hazards Techniques and applications of Electron spin resonance- Nuclear magnetic resonance- Circular Dichroism (CD) - Optical Rotary Dispersion (ORD).

Total Hours:

REFERENCES:

1. Pierre C. ORD and CD in chemistry and biochemistry: An Introduction. Academic Press, 1972.
2. Paddock S. W. Confocal Microscopy methods & protocols.1st Ed., Human Press, 1999.
3. Murphy D. B. Fundamental of Light Microscopy & Electron Imaging. 1st Ed., Wiley-Liss, 2001.
4. Horst F. Basic One and Two-dimensional spectroscopy. VCH Publisher, 1991.
5. West E. S, Todd W. R, Mason H. S, Bruggen J. Textbook of Biochemistry. 4th Ed, Oxford and IBH Publishing Co, 1995.
6. Freifelder D. M. Physical Biochemistry- Application to Biochemistry and Molecular Biology, 2nd Ed., W.H. Freeman, 1982.

OUTCOMES:

- On the completion of the above objectives student will be able to know the electrochemical techniques and principles of centrifugation, spectrophotometry, chromatography and microscopy. They will have the information of radioactive methods.

LSCY203	MOLECULAR DIAGNOSTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Developing the basic concept of molecular diagnostics
- Understanding the common procedures and which are used in disease diagnosis
- To be familiar with various types of diseases diagnosis methods and progression of diagnosed disease.

MODULE I INTRODUCTION TO MOLECULAR DIAGNOSTICS 09

Collection, preservation and storage of clinical samples, biopsy, Principles, application and limitations of Biological assays used in diagnosis- PCR, ELISA, FISH, gene sequencing, microarrays, protein arrays. GLP, SOP and ethics in molecular diagnostics.

MODULE II INFECTIONS 09

Infection and mode of transmission, types of infectious diseases- bacterial and fungal infections, diagnosis of infections caused by Streptococcus, Coliforms, Salmonella, Shigella, Vibrio, and Mycobacterium- diagnosis of fungal infections, major fungal diseases, Dermetophytoses, Candidiosis and Aspergillosis. Diagnosis of DNA and RNA viruses- pox virus, rhabdo virus, hepatitis; virus diagnosis of protozoan diseases- amoebiosis, malaria, trypanosomiosis, leishmaniasis- study of helminthic diseases- Fasciola hepatica and Ascaris lumbricoides. Filariasis and Schistosomiasis. Diagnosis of chicken guinea and swine flu.

MODULE III CLINICAL GENETICS 09

Chromosomes chemistry and packaging, Cytogenetic, Structural and numerical abnormalities of chromosomes, Chromosome bands, banding techniques , mutation and polymorphism analysis, human genome project, cancer genetics- oncogenes, tumor suppressor genes- gene therapy, genetic counseling, nucleic acid hybridization techniques, Disease linked with mitochondrial DNA Genetic linkage and chromosome and genetic mapping in human diseases, Prenatal

MODULE IV IMMUNODIAGNOSTICS 09

Introduction to immunodiagnostics, antigen-antibody reactions, antibody production, antibody markers, CD markers, FACS, Human Leukocyte Antigen (HLA) typing, agglutination (ABO/Bacterial), immunoprecipitation, immunodiffusion, flocytometer.

MODULE V FORENSIC SCIENCE 09

Introduction to Forensic Science, DNA fingerprinting / DNA Profiling / DNA Testing in Forensic Science.; Ethics, Rules and Procedures in DNA analysis. Autopsy and

toxicological diagnosis. Determination of Paternity- Human identification and sex determination. semen analysis , Case study.

Total Hours: 45

REFERENCES:

1. Tietz Textbook of Clinical Chemistry, Carl A. Burtis, Edward R. Ashwood,
2. Harcourt Brace & Company Aisa Pvt. Ltd.
3. Essentials of Diagnostic Microbiology, Lisa Anne Shimeld
4. The Science of Laboratory Diagnosis, Crocker Burnett

OUTCOMES:

- Learners will be able to define basic terminology and describes basic concepts in molecular diagnostics
- The students will know the importance and the relevance of molecular diagnostic techniques and applications of molecular diagnostics in various field including medical, forescenic, etc..

LSCY204 OMICS

L	T	P	C
3	0	0	3

OBJECTIVES:

MODULE I GENOMICS: **09**

Structural organization of genome in Prokaryotes and Eukaryotes; Organelle DNA-mitochondrial, chloroplast; DNA sequencing-principles and translation to large scale projects; Recognition of coding and non-coding sequences and gene annotation; Tools for genome analysis-RFLP, DNA fingerprinting, RAPD, PCR, Linkage and Pedigree analysis-physical and genetic mapping. Physical and Genetic Map, Genome Sequencing, Next generation sequencing methods, Genome Annotation, Functional Genomics.

MODULE II TRANSCRIPTOMICS AND PHARMACOGENETICS 09

Search for transcription factor binding sites,RNA-Seq, Microarrays, Regulatory RNAs: small or large, Computational prediction of miRNA target genes, RNA Darkmatter. High throughput screening in genome for drug discovery-identification of gene targets, Pharmacogenetics and drug development

MODULE III PROTEOMICS 09

Protein analysis (includes measurement of concentration, amino-acid composition, N-terminal sequencing); 2-D electrophoresis of proteins; Microscale solution isoelectricfocusing; Peptide fingerprinting; LC/MS-MS for identification of proteins and modified proteins; MALDI-TOF; SAGE and Differential display proteomics, Protein identification by peptide mass fingerprinting, Protein-protein interactions, Yeast two hybrid system, Applications of proteomics.

MODULE IV METABOLOMICS AND LIPIDOMICS 09

Fundamental concept - Carbohydrate, Lipid, Protein and Nucleic Acid metabolism. Plant Metabolism. Tools of metabolomics- Capillary electrophoresis, Gas chromatography, Electrochemical detectors, mass spectrometry, Case studies. Lipidomics - Basic concepts and tools Case studies

MODULE V SYSTEMS BIOLOGY AND BIOINFORMATICS. DEGRADOMICS 09

Techniques and concepts, Approaches to identify the protease and protease-substrate repertoires, or 'degradomes', on an organism-wide scale, Uncover new roles for proteases in vivo. Identification of new pharmaceutical targets to treat disease (Emerging degradomics)

Total Hours:

REFERENCES:

1. Introduction to Proteomics -Tools for the New Biology by Daniel C. Liebler, Humana Press.
2. Mass Spectrometry for Biotechnology by Gary Siuzdak, Academic Press.
3. Proteomics for Biological Discovery by Timothy Veenstra and John Yates, Wiley.
4. Metabolomics- Methods and Protocols by Wolfram Weckwerth, Humana Press.
5. Lipidomics- Technologies and Applications by Kim Ekroos, Wiley-VCH.
6. Web/Journal Resources.
7. Transcriptomics: Expression Pattern Analysis, Virendra Gomase, Somnath Tagore; VDM Publishing, 2009 – Science

OUTCOMES:

LSCY205 BIOFUELS AND BIOENERGY

L	T	P	C
3	0	0	3

OBJECTIVE

- This course will provide learning in various The course will provide students, with hands-on technical exposure to various Biofuels related science & technology topics, background & literature information besides addressing the environmental, economical, social and other Biofuels related issues.

MODULE I BIOCHEMISTRY OF BIOMASS 09

biomass (e.g. wood waste, forestry residues, agricultural residues, perennial annual crops, organic municipal solid waste). Long-term sustainability and reliability of feedstock supply; feedstock quality, minimizing feedstock cost and regional/climatic considerations of the process chain. Composition of lignocellulose (lignin, hemicellulose, cellulose); energy crops; chemical pretreatment; enzymatic pretreatment; degradation of lignocellulose by fungi and bacteria; degradation of lignin; the role of peroxidases; degradation of cellulose; trichoderma cellulases; bacterial cellulases; and comparison with degradation of high starch crops.

MODULE II BIO DIESEL 09

sources and processing of biodiesel (fatty acid methyl ester); nature of lipids, especially fatty acids and triglycerides. Sources and characteristics of lipids for use as biodiesel feedstock; and conversion of feedstock into biodisel (transesterification). Use of vegetable oil (SVO) and waste vegetable oil (WVO). Engineering, economics and environmental issues of biodisel; components and operation of a biodiesel processing system; standards for biodiesel quality; safety procedures needed to work with biodiesel in both domestic and shop environments; and major policies and regulations pertaining to the production, distribution, and use of biodiesel.

MODULE III BIOENERGY SYSTEMS 09

Course content includes overview of bioenergy systems from resource, conversion technologies to final product. Bioenergy conversion technologies and systems for heat, power, and bio-fuels. Cogeneration and polygeneration. Innovative cycles (such as biomass integrated gasification combined cycles, biomass air turbines, humid air turbines etc) for biomass resources. Evaluation of the bioenergy system performance. Economic and environmental assessments of bioenergy systems.

MODULE IV BIOFUELS & ALCOHOL TECHNOLOGY 09

Introduction to Alcohol Technology, Raw Material of AlcoholIndustry, Storage & handling of Raw material in detail, Study of different yeast strains used in alcohol industries, Study

of yeastproduction as single protein cell. Study of different recycling process, Biochemistry of alcoholproduction, The management of fermentation in the production of alcohol.

MODULE V POLICIES AND FUTURE R&D OF BIOFUELS & BIOENERGY 09

Course content includes analysis of both current and future EU regulations and directives on biofuels and bioenergy. Tax regulations. Evaluation of different production alternatives to produce bioenergy; competitiveness of bioenergy alternatives in agriculture compared to other energy sources. Evaluation of current and future R&D needs; legal framework to support sustainable development and increased use of biofuels; government policies and programs with regard to biofuels and investment opportunities worldwide. Biomass feedstocks - how do we produce them cost-effectively and for which end-use? Biofuels for transportation - what will make them technically and economically competitive? Market penetration of biofuels - how do we remove barriers?

Total Hours:

REFERENCES:

1. Biorenewable Resources: Engineering New Products from Agriculture. Robert C. Brown. Wiley-Blackwell Publishing (2003).
2. Anaerobic Biotechnology for Bioenergy Production: Principles and Applications. Samir K. Khanal. Wiley-Blackwell (2008).

OUTCOMES:

Students will be able to describe:

- How petroleum and bio-based fuels affect the global carbon cycle
- The attributes of biofuels that make them suitable as a fuel for a specific application
- Limitations of biofuels
- Global impacts of biofuels on food and energy supplies
- Technological advances and challenges to be overcome for wide-scale biofuel adoption

LSCY206 MOLECULAR FARMING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce molecular farming.
- To create complete knowledge about the recombinant protein production.
- To create awareness about the production of pharmaceutical proteins in plants.

MODULE I INTRODUCTION AND FOREIGN PROTEIN EXPRESSION 09

Introduction, foreign protein production systems- plant tissue culture, suspended cultures, hairy root cultures, shoot teratoma cultures. Strategies for improving FP production in tissue culture, expression systems, modifications to existing expression constructs, secretion of foreign proteins, foreign protein stability, stability inside the cells.

MODULE II RECOMBINANT PROTEIN PRODUCTION 09

Biology of sprouting, dicotyledonous seeds, germination, sprout, rubisco synthesis, rubisco promoters, inhibition of endogenous gene expression, expression cassette design, sprouting- equipments, conditions, sterilization, time and temperature, light, inhibition of endogenous gene expression, growth regulators, nitrogen fertilizer, seed production,quality and environmental aspects.

MODULE III PLANT VIRAL EXPRESSION SYSTEMS 10

Cereal production crops, Technical aspects, cereal transformation, expression construct design, Prodigene and Maize. Recombinant proteins expressed in Rice, Wheat, Barley. Plant RNA viruses as expression vectors- TMV, PVX, CPMV, AIMV. Biological activity of target molecules, efficacy of plant virus antigens, vaccine antigens- particle based.

MODULE IV ANTIBODIES, BIOPHARMACEUTICALS AND EDIBLE VACCINES 10

Introduction, expression of therapeutic and human proteins in plants, transgenic chloroplast system, chloroplast derived human antibodies, biopharmaceuticals, Human Serum Albumin, Human insulin like growth factor-1, Human interferon, Antimicrobial peptides, chloroplast derived vaccine antigens, cholera toxin B subModule , Bacillus anthracis protective antigen, Yersinia pestis F1-V fusion antigen, Canine Parvovirus VP2 protein.

MODULE V PLANT DERIVED RECOMBINANT THERAPEUTIC PROTEINS 07

Similarities and differences in the processing of pharmaceutical proteins from different sources, process scale, individual steps of a Downstream process, Initial processing and

extraction, chromatographic purification, regulatoryrequirements for downstream processing of plant derived products.

Total Hours: 45

REFERENCES:

1. Molecular Farming – Plant-made Pharmaceuticals and Technical Proteins, Rainer Fischer and Stefan Schillberg.
2. Wiley.VCH Verlag GmbH and Co. KGaA. 2004.

OUTCOMES:

SEMESTER III

LSCY111	BIOPHARMACEUTICALS	L	T	P	C
		3	0	0	3

OBJECTIVE:

- The purpose of this course is to provide a framework of the drug development process and its regulation as well as its impact on workers and the environment. Graduate students in toxicology, pharmaceutics, comparative medicine, bioengineering, occupational and environmental health as well as professional disciplines such as medicine, pharmacology, and nursing interested in working with the biotechnology industry will find this course particularly useful.

MODULE I INTRODUCTION TO BIOPHARMACEUTICAL 09

Introduction to Biopharmaceutical, Biogenerics and Biosimilars; The role of patents in the drug industry; Protein-based biopharmaceuticals; Manufacturing processes; Global market; International Non-proprietary Names (INN) nomenclature system biosimilars.

MODULE II CONCEPTS OF BIOPHARMACEUTICAL 09

Approved follow-on proteins/Biosimilars; Characteristics of high-selling peptides and proteins,; Products with expired patents; Challenging originator's patents; Target products for FOB (follow-on biologicals)/ Biosimilars development peptides; Recombinant non-glycosylated proteins; Recombinant glycosylated proteins; Industries dealing with biogenerics and its market value; World scenario; Indian scenario.

MODULE III PHARMACOKINETICS; PHARMACODYNAMICS 09

Problems in characterizing biologics (Types of biologic, Peptides, Non-glycosylated proteins, Glycosylated proteins, Monoclonal antibodies); Equivalence issues; Post-translational modifications; Effect of microheterogeneity; Pharmacokinetics; Pharmacodynamics; and Clinical efficacy; Analytical methods for the characterization of biosimilars (Chromatography, Protein sequencing, Mass spectrometry, UV absorption, Circular dichroism, X-ray techniques, Nuclear magnetic resonance, Electrophoresis, Western blotting, Bioassays, ELISA, Immunoprecipitation and other procedures)

MODULE IV IMMUNOGENICITY OF BIOPHARMACEUTICALS 09

Immunogenicity of biopharmaceuticals: Immunogenicity; Factors contributing to immunogenicity (product- related factors, host- related factors), Consequence of immunogenicity to biopharmaceuticals; Measurement of immunogenicity

MODULE V CASE STUDIES **09**

Case studies: Erythropoietin, Insulin, Somatotropin, Interleukin-2, Interferon Granulocyte-macrophage- CSF, DNase, Factor VIIa, Factor IX, Factor VIII, Activated protein C, Tissue plasminogen activator, Monoclonal antibodies etc.

Total Hours:

REFERENCES:

1. Sarfaraz K. Niazi, Handbook of Biogeneric Therapeutic Proteins: Regulatory, Manufacturing, Testing, andPatent Issues, CRC Press, 2006.
2. Rodney J Y Ho, MILO Gibaldi, Biotechnology & Biopharmaceuticals Transforming proteins and genes intodrugs, 1stEdition, Wiley Liss, 2003.

OUTCOMES:

- Explain the therapeutic mode of action, and understand structural considerations of at least four classes of biopharmaceutical agent.
- Outline the drug manufacturing process including the role of quality control and quality assurance in protecting the public, workers, and the environment.
- Give an oral presentation to scientific audience on the biological mechanism of action and proposed evaluation of safety, efficacy and manufacturing controls on a biopharmaceutical age

LSCY112 MOLECULAR & IMMUNO DIAGNOSTICS

L	T	P	C
3	0	0	3

OBJECTIVE:

- Identify the important parameters in the design of a laboratory to conduct the most commonly-used molecular diagnostics protocols.
- Identify the important parameters in the design of a quality system for molecular analyses.
- Become proficient with the techniques required in order to perform the most commonly-used molecular diagnostics protocols.
- Identify the important parameters in the design of a molecular diagnostic test.
- Identify the components of a well-controlled diagnostic test.
- Use critical thinking skills to trouble shoot problems as they occur and determine possible causes.

MODULE I MOLECULAR BIOLOGY AND DIAGNOSTICS 09

Molecular Biology and Diagnostics: Atomic bonds and Molecular interactions; Small organic molecules, Macromolecules; Compartmentalization of cells: transport of molecules between nucleus and cytosol, Transport of proteins into mitochondria and chloroplasts, Endoplasmic Reticulum; General principles of cell communication: Signalling - Extracellular, Intracellular, Autocrine, Signaling through G-protein- linked cell surface receptors, Signaling through enzyme-linked cell surface receptors, Signaling pathways that depend on regulated proteolysis; Cell Cycle; DNA repair pathways and methods of detection – Flow cytometry

MODULE II GENETICS AND DIAGNOSTICS 09

Genetics and Diagnostics: Origin and direction of human cytogenetics; General features of chromosomes, Chemistry and packaging of chromosomes, Chromosome bands, banding techniques and their molecular correlates; Structural and numerical abnormalities of chromosomes and their causes, Sex determination and differentiation, Y chromosome evolution and variations and X-inactivation mechanism and phenotypic effects of sex chromosome imbalances, Fragile sites, Trinucleotide repeat expansion, mechanism and associated disorders, Genomic imprinting and their disorders; Fluorescence In situ hybridization, chromosome Comparative Genomic Hybridization arrays; Genetic linkage and chromosome and genetic mapping in human diseases.

MODULE III BIOCHEMISTRY IN DIAGNOSTICS 09

Biochemistry in Diagnostics: Proteins and Amino acids, Qualitative and quantitative techniques: Protein stability, denaturation; amino acid sequence analysis; Metabolism of lipids, carbohydrates, amino acids; In-born errors of metabolism; energy requirements,

nutritional disorders; vitamins & minerals - biochemical function and deficiency manifestation. GLP and GMP.

MODULE IV TECHNIQUES IN DIAGNOSTICS 09

Nucleic acid extraction – principle and methods; Polymerase Chain Reaction – principle, types (including RT-PCR, real-time PCR, QF-PCR) and applications; DNA sequencing methods – principle, types, automated process, DNA sequencers; Hybridization techniques – Southern, Northern, in-situ (including FISH), microarrays – types and applications; Protein extraction and analysis (including PAGE and its variations); Western Blot

MODULE V IMMUNODIAGNOSTICS 09

Immunodiagnostics : Introduction, antigen-antibody binding interactions and assays; Immunoassays – types [RIA, ELISA, Chemiluminescent, IA, FIA] and specific applications; Immunohistochemistry – principle and techniques. Various drug delivery systems, targeting potentials; systems used for delivery of biotechnological products (Liposomes, microspheres, nanoparticles, immobilization techniques, etc.)

Total Hours:

REFERENCE:

1. Molecular Diagnostics: George P Patrinos and Wilhelm Ansorge, Elsevier Academic Press

OUTCOMES:

- Gain knowledge of cellular structure and function, especially DNA and RNA, to molecular diagnostic procedures.
- Gain a thorough working knowledge of nucleic acid extraction, resolution and detection.
- Gain a solid foundation in the most commonly utilized molecular diagnostic testing protocols.
- Apply the knowledge of molecular testing to the most commonly performed applications in the clinical laboratory such as: nucleic acid extraction, resolution and detection, analysis and characterization of nucleic acids and proteins, nucleic acid amplification and DNA sequencing.

LSCY113 TISSUE AND ANTIBODY ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- Understand the fundamental and quantitative principles of tissue and antibody engineering and the basic elements of the tissue engineering approach. Appreciate the important contribution of tissue and antibody engineering in producing/growing organs that can be used for therapeutic applications.Be able to discuss the use of stem cell in tissue engineering for wound healing. Appreciate the need for compatible biomaterials to support growth and differentiation of stem cells into functional organ.

MODULE I INTRODUCTION TO TISSUE ENGINEERING 09

Introduction to tissue engineering, Cells as therapeutic Agents with examples, Cell numbers and growth rates. Tissue organization, Tissue Components, Tissue types, Functional subunits. Tissue Dynamics, Dynamic states of tissues, Homeostasis in highly prolific tissues and Tissue repair. Angiogenesis. Cellular fate processes, Cell differentiation, Cell migration - underlying biochemical process.

MODULE II CELL-EXTRACELLULAR MATRIX INTERACTIONS 09

Cell-extracellular matrix interactions - Binding to the ECM, Modifying the ECM, Malfunctions in ECM signaling. Direct Cell-Cell contact - Cell junctions in tissues, malfunctions in direct cell-cell contact signaling. Response to mechanical stimuli. Cell and tissue culture - types of tissue culture, media, culture environment and maintenance of cells in vitro, cryopreservation. Basis for Cell Separation, characterization of cell separation, methods of cell separation.

MODULE III BIOMATERIALS IN TISSUE ENGINEERING 09

Biomaterials in tissue engineering - biodegradable polymers and polymer scaffold processing. Growth factor delivery, Stem cells. Gene therapy. In vivo cell & tissue engineering case studies: Artificial skin, Artificial blood vessels. Bioreactors for Tissue Engineering.

MODULE IV IMMUNOGLOBULIN 09

Immunoglobulin Genetic Locus: Generation of antibody diversity, Antibody Discovery Methodologies: Hybidoma, Display, and Direct B-cell cloning technology, Antibody structure and function.

MODULE V ANTIBODY ENGINEERING 09

Antibody engineering: humanization, Affinity maturation, Effector function, Generation of high titer cell lines1: Expression vector and Host systems, Cell culture optimization, Downstream processing , Analytical characterization, : Cell line genetic analysis Purification, formulation and stability, Antibody composition

Total Hours:

REFERENCES:

1. "Tissue Engineering", Bernhard O. Palsson, Sangeeta N. Bhatia, Pearson Prentice Hall Bioengineering.
2. Nanotechnology and Tissue engineering - The Scaffold", Cato T. Laurencin, Lakshmi S. Nair, CRC Press.

OUTCOMES:

- Execute the engineering design process: identify problem, identify design constraints on bioengineering problem, create solutions, and evaluate solutions with respect to these constraints.) In this course, students learn and then execute key steps of the engineering design process, including identification of the problem, exploration of the problem, and design of a solution. Students will learn how to identify and conduct thorough research on current tissue engineering and antibody problems, and will ultimately work in teams to propose solutions to those identified problems.

LSCY114	BIONANOTECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide an introduction to nanobiotechnology.
- To make the students understand about the functional principles of nanobiotechnology

MODULE I FUNDAMENTALS OF NANOSCIENCE 09

Introduction, the nanoscale dimension and paradigm, definitions and historical evolution (colloids etc.) and current practice, types of nanomaterials and their classifications (1D, 2D and 3D etc. nanocrystal, Nanoparticle, Quantum dot, Quantum Wire and Quantum Well etc), Polymer, Carbon, Inorganic, Organic and Biomaterials –Structures and characteristics.

MODULE II CHARACTERIZATIONS IN BIONANOTECHNOLOGY 09

Optical (UV-Vis/Fluorescence), X-ray diffraction, Imaging and size (Electron microscopy, light scattering, Zeta potential), Surface and composition (ECSA, EDAX, AFM/STM etc), Vibration (FT-IR and RAMAN), SERS -3, Magnetic, Electrical and Electrochemical**.**

MODULE III APPLICATIONS OF BIONANOTECHNOLOGY 09

Materials in Biosystems: Proteins - Lipids - RNA and DNA, Protein Targeting – Small Molecule/Nanomaterial - Protein Interactions Nanomaterial-Cell interactions-Manifestations of Surface Modification (Polyvalency),Drugs-Photodynamic therapy, molecular motors, neuroelecronic interphases, development of nanoluminiscent tags**.**

MODULE IV NANOMATERIALS AND DIAGNOSTICS 09

Drug Delivery and Therapeutics, MRI, Imaging, Surface Modified Nanoparticles, MEMS/NEMS, based on Nanomaterials, Peptide/DNA Coupled Nanoparticles, Lipid Nanoparticles For Drug Delivery, Inorganic Nanoparticles For Drug Delivery, Metal/Metal Oxide Nanoparticles (antibacterial/anti fungal/anti viral), Anisotropic and Magnetic Particles (Hyperthermia).

MODULE V NANOMATERIALS AND TOXICITY EVALUATION 09

Designer biopolymers, Procollagen, DNA Polynode, RNA topoisomerase, Protein – magnetic materials, Cyto-toxicity, Geno-toxicity, In vivo tests/assays.

Total Hours: 45

REFERENCES:

1. C. M. Niemeyer, C. A. Mirkin, Nanobiotechnology: Concepts, Applications and Perspective, Wiley – VCH, 2004.
2. 2 T. Pradeep, —Nano: The Essentials, McGraw – Hill education, 2007.
3. Nicholas A. Kotov, Nanoparticle Assemblies and Superstructures, CRC, 2006.
4. David S Goodsell, “Bionanotechnology”, John Wiley & Sons, 2004.

OUTCOMES:

- After the completion of the course the student will have the basic knowledge of nanotechnology in biotechnology. In detail understanding of the application of Nanomaterials in biotechnology and acquire the knowledge about the DNA, proteins, amino acids, drug delivery, biomedicine etc.

LSCY115 PROTEIN ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- This course aims to develop in the students' mind a concept regarding the structure and function of proteins of particular importance, the student will know the production of recombinant protein and in general how to engineer protein to be used as therapeutics.

MODULE I INTRODUCTION TO PROTEIN ENGINEERING 09

Forces stabilizing proteins – Van der waals, electrostatic, hydrogen bonding and weakly polar interactions, hydrophobic effects; Entropy – enthalpy compensation, Protein engineering and its applications, features or characteristics of proteins that can be engineered (definition and methods of study) – affinity and specificity; Spectroscopic properties; Stability to changes in parameters as pH, temperature and amino acid sequence, aggregation propensities, etc.

MODULE II TECHNIQUES FOR PROTEIN ENGINEERING 09

Methods of measuring the stability of a protein; Spectroscopic methods to study physicochemical properties of proteins: far-UV and near-UV CD; Fluorescence; UV absorbance; ORD; Hydrodynamic properties–viscosity, hydrogen-deuterium exchange.

MODULE III SITE DIRECTED MUTAGENESIS AND PROTEIN ENGINEERING 09

Altering Proteins by mutagenesis methods, techniques for Oligonucleotide directed mutagenesis by using single stranded DNA as template, Denatured double stranded DNA as template, PCR based mutagenesis, Engineering proteins by chemical modifications, Genetic fusion of domains, alteration of function by selection and screens, deletion mutagenesis. Introduction of selected mutagenesis by Oligonucleotide directed mutagenesis, Scanning mutagenesis, Insertion of unnatural mutagenesis.

MODULE IV ENGINEERING PROTEINS FOR PURIFICATION 09

Introducing cleavage sites, engineering Proteins for Chromatography, Immunoaffinity chromatography, Ion exchange chromatography, Metal affinity chromatography.

MODULE V STABILIZATION AND MODIFICATION OF PROTEINS 09

Principles of structure stabilization by solvent components, sources of exclusion, Balance between cosolvent exclusion and binding, cosolvent intertactions in the denaturation reaction, Practical considerations, Post translational modifications- Involving peptide

bond, C-terminal, side chain. Modification methods- Enzymatic, Non enzymatic, Specificity, chaperones mediated. Applications of Post translational modifications.

Total Hurs:

REFERENCE:

1. Andreas D. Baxevanis& B.F. Francis Ouellellette, Bioinformatics. A Practical Guide to the Analysis of Genes and Proteins, John Wiley & Sons, UK, 1998.
2. Baxevanis A. D, Ouellette B. F. F. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins. 3nd edition Wiley, John & Sons, Incorporated, 2004.

OUTCOMES:

- After the completion of the course the student will have the basic concept regarding the structure and function of proteins of particular importance, the student will know the production of recombinant protein and in general how to engineer protein to be used as therapeutics.

LSCY116 STEM CELL TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To obtain knowledge on wide-ranging topics related to stem cell
- To learn about the application of stem cells in health care
- To get familiar with the issues and challenges of stem cell political and ethical issues surrounding the stem cell debate.

MODULE I GENESIS OF CELLS 09

Concept of stem cells: types, self-renewal and pluripotency, isolation and characterization, Niche and its role on differentiation of stem cells, Stem cells and restorative biology, Reprogramming of genome function through epigenetic inheritance.

MODULE II STEM CELLS 09

Embryonic stem cells, Stem Cells from adults. Pluripotency necessary, or is unipotency enough? What are the mechanisms? Stem-cell plasticity, Regulators of pluripotency and differentiation of stem cell. The isolation, expansion, genetic manipulation, genomic reprogramming, and cloning of stem cells. The problem of differentiation of stem cells. Stem Cells and imprinted genes. Differences between adult and embryonic stem cells, what types of cells adult stem cells can become.

MODULE III CELL & TISSUES 09

From single to multicellular components **-** Regulation of cell division and cytoskeleton, Stem cells in regeneration, Cell specification and early signaling events during morphogenesis, Development of cell adhension and motility , Cellular imprinting**.**

MODULE IV CELL GROWTH & DEVELOPMENT 09

Factors controlling cell development **-** Environmental factors like temperature, oxeygen, location, time, cell number , Chemical factors like growth factors, hormones, cytokines, microRNAs , Genetic factors**.**

MODULE V STEM CELLS AND THERAPEUTICS 09

Cancer stem cells , Stem cells treatment to diseases , Current stem cell therapies, how we can use stem cells for studying cancer and finding cures to other diseases, Correlation between stem cells and cancer, Stem cells and aging. Clinical applications of hematopoietic stem cells from cord blood first successful transplantation of cord blood in a child with Fanconi’s anemia. Treatment of neural diseases such as Parkinson's disease,

Huntington’s disease and Alzheimer's disease. Repair of damaged organs such as the liver and pancreas. Ethical issues associated with stem cells.

Total Hours: 45

REFERENCES:

1. Kiessling A. A, Human Embryonic Stem Cells: An Introduction to the Science and Therapeutic Potential, Jones and Bartett, 2003.
2. Quesenberry P. J. Stem Cell Biology and Gene therapy, 1st Edition, Willy- Less, 1998.
3. Lanja L, Essential of stem cell Biology, 2nd Edition, Academic Press, 2006.
4. Ho A. D. and Hoffiman R. Stem Cell Transplantation Biology Processes Therapy, Willy-VCH, 2006.
5. Potten C. S. Stem Cells, Elsevier, 2006.

OUTCOMES:

- After the completion of the course the student will have overall knowledge of scientific research, management, implications and exploitation in Stem Cells in Health care.

REGULATIONS, CURRICULUM AND SYLLABI

M.Sc.
MICROBIOLOGY

(As approved by the 9th Academic Council)

JULY 2016

B.S.ABDUR RAHMAN
UNIVERSITY
B.S. ABDUR RAHMAN INSTITUTE OF SCIENCE & TECHNOLOGY
(Estd. u/s 3 of the UGC Act, 1956)
(FORMERLY B.S. ABDUR RAHMAN CRESCENT ENGINEERING COLLEGE)
Rated with A Grade by National Assessment and Accreditation Council
Seethakathi Estate, G.S.T. Road, Vandalur, Chennai - 600 048
www.bsauniv.ac.in

VISION AND MISSION OF THE DEPARTMENT OF SCHOOL OF LIFE SCIENCES

VISION

To attain new heights in biotechnology research, shaping life sciences into a premier precision tool for the future for creation of wealth and ensuring social justice-specially for the welfare of the poor

MISSION

The mission of the School of Life Sciences is to maximize the benefits of biotechnology to the University, the nation and the globe by being an excellent quality, comprehensive, multidisciplinary school that supports, coordinates, disseminates and advances biotechnology in the areas of social welfare and entrepreneurship.

PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES

M. Sc. (Microbiology)

PROGRAMME EDUCATIONAL OBJECTIVES:

The course aims to provide an advanced understanding of the core principles and topics of Microbiology and their experimental basis to enable students in acquiring a specialized knowledge by means of dedicated lecture series and subject-oriented research project. Hence, the main objectives of the program are:

- To communicate the basic knowledge in general microbiology with detailed subdivision of microbiology.
- For the basic understanding this course includes microbial biochemistry, physiology and molecular Biology to give basic understanding of the microbiology.
- Further bacteriology, virology, mycology give individual sections of microbiology with detailed information on economic importance of microbiology
- Finally this course explains the advanced sections of microbiology like Immunology, Microbial genetics, food microbiology, medical microbiology, Environmental microbiology, industrial microbiology and bioinformatics.
- This course provides necessary theoretical and practical experience in all divisions of microbiology to become an effective professional.
- This course provides broad exposure to various communities, ecological and commercial issues in the field microbiology.

PROGRAMME OUTCOMES:

- On completion of the program the graduates will have applied knowledge in microbiology and the subdivision of microbiology.
- Microbial Biochemistry, Physiology and Molecular Biology will give basic understanding of the microbiology.
- Individual sections like bacteriology, virology, mycology give will give knowledge detailed information on economic importance of microbiology.
- Advanced sections of microbiology like Immunology, Microbial genetics, food microbiology, medical microbiology, Environmental microbiology, industrial microbiology and bioinformatics will give broad information on microbiological applications and opportunities in the field of microbiology.
- Identify research and solve microbiology related problems related to the different types of microbial derived diseases.
- Ability to communicate and function effectively in multi-disciplinary team related to the microbiology.

CURRICULUM & SYLLABI FOR
M. Sc. (Microbiology)
(Four Semesters / Full Time)

Curriculum

Sl. No.	Course Code	Course Title	L	T	P	C
		SEMESTER I				
1	LSC6102	Cell and Molecular Biology	**4**	**0**	**0**	**4**
2	LSC6121	Biochemistry	**4**	**0**	**0**	**4**
3	LSC6122	Microbial Genetics	**4**	**0**	**0**	**4**
4		Elective I	**3**	**0**	**0**	**3**
5		Elective II	**3**	**0**	**0**	**3**
6	LSC6123	Lab I (Biochemistry / Molecular Biology / Microbial Genetics)	**0**	**0**	**6**	**3**
		Total				**21**
		SEMESTER II				
1	GEC6202	Research Methodology	**3**	**0**	**0**	**3**
2	LSC6201	Immunology	**4**	**0**	**0**	**4**
3	LSC6202	Bioinformatics	**4**	**0**	**0**	**4**
4		Elective III	**3**	**0**	**0**	**3**
5		Elective IV	**3**	**0**	**0**	**3**
6	LSC6203	Lab II (Immunology / Bioinformatics)	**0**	**0**	**6**	**3**
7	LSC6221	Industrial Internship	**0**	**0**	**0**	**1**
	LSC6222	Mini Project	**0**	**0**	**0**	**1**
		Total				**22**
		SEMESTER III				
1	LSC7121	Project Phase 1	**0**	**0**	**2**	**2**
2	LSC7122	Industrial, Food and Agricultural Microbiology	**4**	**0**	**0**	**4**
3	LSC7123	Environmental and Medical Microbiology	**4**	**0**	**0**	**4**
4		Elective 5	**3**	**0**	**0**	**3**
5		Elective 6	**3**	**0**	**0**	**3**
6	LSC7124	Lab III (Industrial, Food and Medical Microbiology)	**0**	**0**	**6**	**3**
		Total				**17**

Sl. No.	Course Code	Course Title	L	T	P	C
		SEMESTER IV				
1	LSC7121	Project Phase – II	**0**	**0**	**36**	**18**
		Total			**2+18=20**	
					Total Credits: 80	

Note: Two credits earned in the Project Phase 1 will be added when the complete the Phase II project

LIST OF ELECTIVES

Sl. No.	Course Code	Course Title	L	T	P	C
		SEMESTER I				
1	LSCY101	Biosafety, Bioethics, Bioentrepreneurship, Intellectual Property rights	**3**	**0**	**0**	**3**
2	LSCY104	Analytical Methods	**3**	**0**	**0**	**3**
3	LSCY121	Animal Biotechnology	**3**	**0**	**0**	**3**
4	LSCY122	Plant Biotechnology	**3**	**0**	**0**	**3**
5	LSCY123	Parasitology	**3**	**0**	**0**	**3**
6	LSCY124	Virology	**3**	**0**	**0**	**3**
		SEMESTER II				
1	LSCY201	Recombinant DNA Technology	**3**	**0**	**0**	**3**
2	LSCY203	Molecular Diagnostics	**3**	**0**	**0**	**3**
3	LSCY205	Biofuel and Bioenergy	**3**	**0**	**0**	**3**
4	LSCY211	Diagnostics of Infectious Diseases	**3**	**0**	**0**	**3**
5	LSCY212	Metagenomics	**3**	**0**	**0**	**3**
	LSCY213	Bioprocess (Microbial)	**3**	**0**	**0**	**3**
		SEMESTER III				
	LSCY111	Biopharmaceuticals	**3**	**0**	**0**	**3**
	LSCY112	Molecular and Immuno Diagnostics	**3**	**0**	**0**	**3**
	LSCY113	Tissue and Antibody Engineering	**3**	**0**	**0**	**3**
	LSCY114	Bio-nanotechnology	**3**	**0**	**0**	**3**
	LSCY115	Protein Engineering	**3**	**0**	**0**	**3**
	LSCY131	Bioremediations	**3**	**0**	**0**	**3**

SEMESTER I

LSC6102 CELL & MOLECULAR BIOLOGY

L	T	P	C
4	0	0	4

OBJECTIVES:

- To get overview of classes of cells and structural and function aspects of plasma membrane and cell organelle.
- To develop skill to understand molecular aspects of cell cycle and cell division.
- To get familiar with transcription and translation in details.
- To understand the signaling pathways in cell functioning

MODULE I INTRODUCTION TO CELL 08

Basic properties of cell, Different classes of cell: Prokaryotic, animal and plant cell. Plasma membrane- structure and function, Chemical composition of membranes, membrane lipids and proteins, fluid mosaic model, Transport across the membranes- diffusion, osmosis, facilitated diffusion, passive and active transport; membrane potential and nerve impulses.

MODULE II MEMBRANE TRANSPORT 07

Endoplasmic Reticulum, Golgi complex- glycosylation, Vesicle transport- COPI and COPII; Lysosomes - autophagy; Endocytic pathway- endocytosis and phagocytosis, transport of proteins into peroxisomes, mitochondria and chloroplast;

MODULE III ENERGY CONVERSION 10

Structure of mitochondria and organization of respiratory chain; Proton Pump and ATP generation in mitochondria; Structure of chloroplast and Photosynthesis, photorespiration; Genetic system of mitochondria and chloroplast.

MODULE IV BASIC GENETIC MECHANISMS 10

The structure and function of DNA, DNA packaging and Chromosomes, chromatin structure and function, DNA replication mechanisms, DNA damage and repair and homologous recombination and transposable elements, Telomeres, telomerase and end replication. Role of telomerase in aging and cancer.

MODULE V TRANSCRIPTION AND TRANSLATION 10

Transcription- Prokaryotic and eukaryotic Transcription- RNA polymerases- general and specific transcription factors- regulatory elements- mechanism of transcription, Transcription termination Post transcriptional modification- splicing- editing- nuclear export of mRNA- mRNA stability; Translation- Genetic code, Mechanism of initiation-

elongation andtermination- Regulation of translation.

Total Hours: 45

REFERENCES

1. Molecular Biology of Cell by Alberts et.al. John Wiley & Sons, 6Ed, 2015
2. The Cell by Cooper. ASM Press, 4Ed, 2007
3. Cell and Molecular Biology by Karp. John Wiley & Sons, 7Ed, 2013
4. Lodish H. F.Cell and Molecular Biology. W.H. Freeman & Co Ltd, 7Ed, 2000.

OUTCOMES:

- On the completion of the above objectives student will be able to get the overview of classes of cells and structural and function aspects of plasma membrane and cell organelle. They can develop skill to understand molecular aspects of cell cycle, cell division, transcription and translation.

LSC6121 BIOCHEMISTRY

L	T	P	C
4	0	0	4

OBJECTIVES:

This course aims to develop in the students' mind a concept regarding

- The diversity of metabolic processes occurring in biological system.
- The effect of the structural and functional role of the enzymes governing the metabolic processes.
- Importance of the metabolic pathways in maintaining homeostasis in biological system.
- The clinical implications of the metabolic pathway.

MODULE I AMINO ACIDS & PROTEIN: STRUCTURE AND FUNCTIONS 05

Amino acids- Classification, structure and function, proteins- primary, secondary, tertiary and quaternary structure, Ramachandran plot, super secondary structures and helix loop.

MODULE II ENZYMOLOGY 10

Classification of enzymes. How do enzymes work: activation energy, substrate specificity. Enzyme-substrate interaction: Lock and Key mechanism and Induced Fit mechanism. Effect of temperature and pH on enzyme action. Enzyme Kinetics: Michaelis-Menten Equation, Km, Measurement of Km and Vmax (Lineweaver-Burk equation). Kinetics of multisubstrate reaction: Sequential reactions and ping-pong reactions. Enzyme inhibition: reversible (competitive, uncompetitive and mixed) and irreversible. Allosteric regulation of enzyme activity. Multienzyme complex and multifunctional enzymes.

MODULE III ENERGY PRODUCTION AND OXIDATIVE PHOSPHORYLATION 14

Introduction to metabolism: Anabolism, catabolism, metabolic pathways. Characteristics of metabolic pathways

Glycolysis: glycolytic pathway. Molecular mechanism of action of the glycolytic enzymes. Energetic of glycolysis. Glycolysis and cancer biology—Warburg Hypothesis and PET scanning. Fates of Pyruvate under anaerobic conditions: alcohol and lactic acid fermentation. Importance of lactic acid fermentation.

TCA Cycle: Formation of Acetyl CoA and reactions of citric acid cycle. Molecular mechanism of pyruvate dehydrogenase complex and enzymes involved in Kreb's cycle. Energetic of TCA cycle and substrate level phosphorylation.

Lipid metabolism: Hormonal regulation of the mobilization of triglycerides from adiposities. Transport of fatty acid into mitochondria. Beta oxidation of saturated fatty acid (both even and odd). Regulation. Energetic.

Electron Transport Chain: structure and function of Electron carriers: Complex I—V. Passage of electrons from complex I to IV. Mitchell's chemiosmotic hypothesis and proton gradient. Structure of complex V or ATP synthase, Catalytic sites of ATP synthesis. Mechanism of ATP generation by Boyer's binding change mechanism—rotational catalysis. Energetic of ATP synthesis and efficiency of ATP synthase.

MODULE IV METABOLIC INTERRELATIONSHIP 09

Starve-Fed cycle. Glucose homeostasis. Switching of metabolism of liver between starve and fed cycle. Metabolic relationship of tissues in various nutritional and hormonal states—insulin resistance, diabetes, exercise, pregnancy, lactation, stress, liver and renal diseases, alcohol consumption.

MODULE V REGULATORY MECHANISMS OF METABOLIC PATHWAYS 07

Feed back inhibition by allosteric modulation of enzymes. Covalent modifications of enzymes. Isozymes. Propetolytic cleavage. Regulationg the amount of enzyme—regulation gene expression in prokaryotes and eukaryotes.

Total Hours: 45

REFERENCE:

1. Nelson D.L, Cox M. M. Lehninger's Principle of Biochemistry. 5th Ed.,W. H. Freeman, 2008.
2. Biochemistry by Lubert Stryer 7th ed. W. H. Freeman & Company.
3. Textbook of Biochemistry with Clinical Correlations. 4th Ed. Thomas M. Devlin. Wiley-Liss publication. 1997.

OUTCOMES:

At the completion of the course the student will develop an understanding about the

- Various metabolic processes occurring in biological system and their role in governing homeostasis and normal physiology.
- The importance of enzymes as a regulatory molecule in metabolism.
- The interrelationship of metabolic pathways different physiological conditions.
- The role of liver in regulating metabolism.

LSC6122 MICROBIAL GENETICS

L	T	P	C
4	0	0	4

OBJECTIVES:

- To get overview on microbial genetics, concepts, theories and genetic tools.
- To learn about the genetics of bacteriophage
- To get knowledge on fungal and viral genetics.
- To understand the concept of operon gene expression and different types of operons.

MODULE I BACTERIOPHAGE 10

Structure, Life Cycle and Lytic-Lysogenic Options of A Bacteriophage. The lambda Lifecycle, Genes involved in lysogeny and lytic cycle of lambda phage. Lifecycle Of M13-M13 Adsorption And Injection, Protection of The M13 Genome. Lifecycle of P1, Adsorption, Injection And
P1 Transducing Particles. Lifecycle of T4-T4 Adsorption And Injection.

MODULE II METHODS OF GENE TRANSFER IN BACTERIA 10

Genetics of Bacteria, Mutations and growth in bacteria. Mechanisms of Genetic Exchange in Bacteria- Transformation, conjugation, Properties of the F plasmid, F+ x F - mating, F' x F- conjugation. Hfr bacteria and chromosome mapping, Transduction: Generalized and specialized transduction.

MODULE III TRANSPOSABLE GENETIC ELEMENTS 08

Transposable elements in bacteria and yeast, Inseretion sequences- structure and occurrence, Mechanism of transpositions –Replicative, Non replicative, regulation and activation. Conjugative transpositions, Phase variation.

MODULE IV FUNGAL GENETICS 08

Fungi as Model for genetic studeis, Structure and Organization of Fungal Genome, Life Cycles, Mating Systems and Genetic Exchange in Fungi: Life cycles and sexual process, Mating system and promotion of outcrossing, Systems restricting outcrossing, Sexual differentiation and relationship to outcrossing, Hetrokaryosis, the parasexual cycle and Vegetative incompatibility, Role and consequences of Vegetative incompatibility, Sex and Outcrossing, Neurospora and Classical Genetics, Applied molecular genetics of fungi.

MODULE V REGULATION OF GENE EXPRESSION 09

Constitutive, Inducible, and Repressible Gene expression, positive and negative control of gene expression operons: coordinately regulated units of gene expression. The lactose operon in e. coli: induction and catabolite repression. The tryptophan operon in e. coli:

repression and attenuation. Translational control of gene expression, posttranslational regulatory mechanisms

Total Hours: 45

REFERENCES

1. Snyder L and Champness W. Molecular Genetics of Bacteria. 3rd Ed, ASM Press, Washington, 2002.
2. Baumberg S. Prokaryotic gene expression. Oxford University Press 2002.
3. Watson J. D, Hopkins N. H, Roberts J. W,SteitzJ. A and WeinerA. M. Molecular Biology of the Gene, 4th Ed., Benjamin/Cummings, 1987.
4. Streips U. N, Yasbin R. E. Modern Microbial Genetics, 2nd Ed., Wiley-Liss, Inc. 2002.

OUTCOMES:

- After completion of this course, scholars will get knowledge on the microbial genetics, concepts, theories and genetic tools and also on the operon, viral, bacteriophage and fungal genetics.

LSC6123	LAB I (BIOCHEMISTRY, MOLECULAR BIOLOGY AND MICROBIAL GENETICS)	L	T	P	C
		04	0	6	3

OBJECTIVES:

- To learn basic techniques in molecular biology
- To study and differentiate the electrochemical properties of nucleic acids
- To learn the preliminary methods in biochemistry by preparing buffer and adjusting pH.
- To estimate various biomolecules by biochemical assays

EXPERIMENTS:

1. Laboratory safety guidelines.
2. To determine an unknown protein concentration by plotting a standard graph of BSA using UV-Vis Spectrophotometer and validating the Beer- Lambert's Law.
3. Effect of temperature on enzyme activity.
4. Separation techniques for amino acids and sugar:
    a. apaper chromatography
    b. thin layer chromatography.
5. Separation of proteins by native and SDS-PAGE.
6. Preparation of slides from onion root tip for mitosis
7. Isolation & Purification of genomic DNA from bacteria
8. Isolation & Purification of plasmid DNA
9. Isolation of RNA
10. Agarose gel electrophoresis of chromosomal & plasmid DNA
11. Restriction Digestion of chromosomal & plasmid DNA
12. Isolation of DNA fragment from agarose gel
13. Staining Techniques (Gram staining, spore staining)
14. Antibiotic Assay - Antimicrobial Sensitivity Test (Disc Diffusion Method)
15. Growth Kinetics (Bacterial Growth Curve)
16. Isolation of antibiotic resistant mutants by chemical mutagenesis.
17. Ampicillin selection method for isolation of auxotrophic mutant. 5. Extraction and Purification of RNA from S. cerevisiae.
18. Studies on gene expression in E.coli with reference to lac operon.
19. Study of conjugation in E. coli.
20. Restriction digestion and agarose gel electrophoresis of DNA.
21. Generalized transduction in E. coli using P1 phage.

REFERENCES

1. Michel R. G and Sambrook J. Molecular Coning- A laboratory manual. Cold spring harbor laboratory press, 2012.

2. Laboratory Exercises in Microbiology, Fifth Edition by Harley−Prescott, The McGraw−Hill Companies, 2002
3. Wilson K and Walker J, Principles and Techniques in Practical Biochemistry, 5th Ed., Cambridge University Press, 2000.
4. Holtzhauer M, Basic Methods for the Biochemical Lab, Springer, 2006.
Nigam, Lab Manual in Biochemistry: Immunology and Biotechnology, Tata McGraw-Hill Education, 2007.
5. Lab manual

OUTCOME:

- On the completion of the above experiments students will be able to handle DNA samples and also to isolate, purify and visualize nucleic acid.
- On performing the above experiments students will be able to know and perform the routine biochemical assays.
- Students will be able to isolate culture and identify microbes and also to efficiently use light microscope.

SEMESTER II

GEC6202 RESEARCH METHODOLOGY

L	T	P	C
3	0	0	3

MODULE I RESEARCH METHODOLOGY-AN INTRODUCTION 09

Meaning of Research, Objectives of Research, Motivation in Research, Types of Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Criteria of Good Research, Problems Encountered by Researchers. Ethics and scientific conduct, Introduction to ethics, scientific conduct and misconduct, Misconduct and why it occurs, Fabrication, Authorship issues, The investigation and punishment of scientific misconduct.

MODULE II GOOD LABORATORY PRACTICES AND SAFETY 09

Introduction: History, definition, Principles, Good Laboratory Practices (GLP) and its application GLP training: Resources, Rules, Characterization, Documentation, quality assurance, Resources, Facilities: building and equipment, Personnel, GLP and FDA, Stepwise implementation of GLP and compliance monitoring.

MODULE III LABORATORY SAFETY AND EXPERIMENTAL RESEARCH 09

Safety in the Biology Laboratory, Safety Symbols, Science Safety Rules- Dress Code, First Aid, Heating and Fire Safety, Using Chemicals and glassware's, Handling living organisms, handling human blood and some other body fluids and tissue, disposal of bio hazardous waste.Precision, accuracy, sensitivity and specificity; variables, experimental planning – general guidelines

MODULE IV INTERPRETATION OF RESULTS AND ANALYSIS: 09

Importance and scientific methodology in recording results, importance of negative results, different ways of recording, industrial requirement, artifacts versus true results, types of analysis (analytical, objective, subjective) and cross verification, correlation with published results, discussion, outcome as new idea, hypothesis, concept, theory, model etc. Data analysis using Excel, Origin and Sigma plot Analyzing the chemical data and drawing chemical structures using Chemdraw and Chemsketch. Conceptions of error of measurement, true score theory and generalisability theory. Measures of central tendency or averages – mean median and mode. Measures of dispersion – range, variance, and standard deviation: The normal distribution and the normal probability curve.

MODULE V SCIENTIFIC WRITING, TECHNICAL PUBLICATION AND RESEARCH PROPOSAL 09

Different types of scientific and technical publications in the area of research, and their specifications, Ways to protect intellectual property – Patents, technical writing skills, definition and importance of impact factor and citation index - assignment in technical writing, The research problem, finding related literature, computer generated references sources and the research project, model research proposal.

Total Hours: 45

TEXT BOOKS AND REFERENCES:

1. Essentials of Research Design and Methodology Geoffrey R. Marczyk, David DeMatteo, David Festinger, 2005 John Wiley & Sons Publishers, Inc
2. Biochemical Calculations: How to Solve Mathematical Problems in General Biochemistry, 2nd Edition, Irwin H. Segel, 1976 John Wiley & Sons Publishers, Inc
3. Guide to Publishing a Scientific paper, Ann M. Korner, 2004, Bioscript Press.
4. P Laake, H B Benestad, B R Olsen. Research Methodology in the medical and biological sciences. Academic Press, 2007.
5. R Arora. Encyclopaedia of Research Methodology in Biological Sciences. Anmol Publishing, 2004.
6. Kothari C.R., Research Methodology, Methods and Techniques, Wiley Eastern Ltd., New Delhi, 1991.
7. Coghill M. and Gardson L.R., The ACS Style Guide Effective Communication of Scientific Information, 3rd Edn., Oxford University Press, 2006.
8. Willa Y. Garner, Maureen S. Barge, James, P, Good Laboratory Practice Standards:
9. Applications for Field and Laboratory Studies (ACS Professional References Book).

OUTCOMES:

LSC6201 IMMUNOLOGY

L	T	P	C
4	0	0	4

OBJECTIVES:

- The course is aimed at introducing the science of immunology and detailed study of various types of immune systems and their classification structure and mechanism of immune activation**.**

MODULE I OVERVIEW OF IMMUNE SYSTEM 04

Innate, adaptive and Comparative ImmModule y, Immune dysfunction and its consequences, Cells & Tissues of Immune System: Hematopoisesis, Apoptosis and Necrosis, systemic function of Immune system, organs of immune systems, Lymphoid cells and organs Evolutionary comparision. Cytokines- Properties of Cytokines, Cytokine Receptors, Cytokine Antagonists, Cytokine Secretion by TH1 and TH2 Subsets, Cytokine-Related Diseases, Therapeutic Uses of Cytokines and Their Receptors, Cytokines in Hematopoiesis

MODULE II MOLECULAR IMMUNOLOGY 05

Immunogenicity Versus Antigenicity, Factors that influence immunogenicity, Epitopes, Haptens and the Study of Antigenicity, Pattern-Recognition Receptors, drugs allegies-when medicine become immunogens, Molecular structure of antibody, Obstacles to Antibody Sequencing, Immunoglobulin Fine Structure, Antibody-Mediated Effector Functions, Antibody Classes and Biological Activities, Antigenic Determinants on Immunoglobulins, The B-Cell Receptor, The Immunoglobulin Superfamily, Monoclonal Antibodies.

MODULE III ORGANIZATION AND EXPRESSION OF IMMUNOGLOBULIN GENES 09

Genetic Model Compatible with Ig Structure, Multigene Organization of Ig Genes, Variable-Region Gene Rearrangements, Mechanism of Variable-Region DNA Rearrangements, Generation of Antibody Diversity, Class Switching among Constant-Region Genes, Expression of Ig Genes, Synthesis, Assembly, and Secretion of Immunoglobulins, Regulation of Ig-Gene Transcription, Antibody Genes and Antibody Engineering

MODULE IV ANTIGEN PROCESSING AND PRESENTATION 09

General organization and inheritance of the major histocompatibility complex (MHC), MHC molecules and genes, detailed genomic map of MHC genes, cellular distribution of MHC molecules, regulation of MHC expression, MHC and immune responsiveness, MHC and disease susceptibility self-MHC restriction of T cells, role of antigen-presenting cells,

evidence for two processing and presentation pathways, endogenous antigens: the cytosolic pathway,exogenous antigens: the endocytic pathway presentation of nonpeptide antigens

MODULE V GENERATION OF T AND B CELL RESPONSE 09

T-Cell Receptor, Early Studies of the T-Cell Receptor and αβ andγΔ T-Cell Receptors: Structure and Roles, Organization and Rearrangement of TCR Genes, T-Cell Receptor Complex: TCR-CD3,T-Cell Accessory Membrane Molecules, Three-Dimensional Structures of TCR-Peptide-

MHC Complexes,Alloreactivity of T Cells, T-Cell Maturation and the Thymus,Thymic Selection of the T-Cell Repertoire,T_H-Cell Activation, T-Cell Differentiation, Cell Death and T-Cell Populations Peripheral γΔ T-Cells, B-Cell Maturation,B-Cell Activation and Proliferation, The Humoral Response, In Vivo Sites for Induction of Humoral Responses, Germinal Centers and Antigen-Induced B-Cell Differentiation, Regulation of B-Cell Development, Regulation of the Immune Effectors Response.

Total Hours: 45

REFERENCES:

1. Kuby, RA Goldsby, Thomas J. Kindt, Barbara, A. Osborne Immunology, 6th Edition, Freeman, 2002.
2. Brostoff J, Seaddin JK, Male D, Roitt IM., Clinical Immunology, 6th Edition, Gower Medical Publishing, 2002.
3. Janeway et al., Immunobiology, 4th Edition, Current Biology publications., 1999.
4. Paul, Fundamental of Immunology, 4th edition, Lippenco

OUTCOMES:

After completing the course students will:

- have a detailed understanding of Component of immModule y
- know antigen presentation on a detailed molecular level
- understand the concept immunology and the immune system .
- have a in depth knowledge of the cellular and molecular basis for autoimmune disease and allergies.
- have basic knowledge of tumor immunology and the development of novel recombinant antibodies for treatment of cancer and autoimmune disease

LSC6202 BIOINFORMATICS

L	T	P	C
4	0	0	4

OBJECTIVES:

- To understand the programming languages applied in computational biology.
- To understand the methods and applications for sequence analysis, Phylogenetics and Protein modelling.

MODULE I INTRODUCTION TO PROGRAMMINB LANGUAGE 09

Introduction –Programming languages – Problem solving Technique: Algorithm, Flowchart, Compiling, Testing and Debugging - Basic Perl Data Types, File handle and File Tests – Perl Modules – SQL.

MODULE II PROGRAMMING IN C, C++ AND OOPS 09

C language Introduction – Tokens – Keywords, Identifier, Variables, Constants, Operators – Structure of a 'C' program - Expression – Data types – Control Statement - C++ programming – Object Oriented Concept: Encapsulation, Inheritance, Polymorphism.

MODULE III COMPUTATIONAL BIOLOGY AND SEQUENCE ANALYSIS 09

Molecular sequences, Genome sequencing: pipeline and data, Next generation sequencing data, Biological databases: Protein and Nucleotide databases, Sequence Alignment, Dynamic Programming for computing edit distance and string similarity, Local and Global Alignment, Needleman Wunsch Algorithm, Smith Waterman Algorithm, BLAST family of programs, FASTA algorithm, Functional Annotation, Progressive and Iterative Methods for Multiple sequence alignment, Applications.

MODULE IV PHYLOGENETICS 09

Introduction to Phylogenetics, Distance and Character based methods for phylogenetic tree construction: UPGMA, Neighbour joining, Ultrametric and Min ultrametric trees, Parsimonous trees, Additive trees, Bootstrapping.

MODULE V PROTEIN STRUCTURE, MODELLING AND SIMULATIONS 09

Protein Structure Basics, Visualization, Prediction of Secondary Structure and Tertiary Structure, Homology Modeling, Structural Genomics, Molecular Docking principles and applications, Molecular dynamics simulations

Total Hours: 45

REFERENCES:

1. Dan Gusfield. Algorithms on Strings Trees and Sequences, Cambridge University Press.
2. David W. Mount Bioinformatics: Sequence and Genome Analysis, Cold Spring Harbor Laboratory Press, Second Edition, 2004.
3. Arthur M. Lesk, Introduction to Bioinformatics by Oxford University Press, 2008.
4. Tisdall, James, Beginning PERL for Bioinformatics, O'Reilley Publications, 2001.
5. Andrew R. Leach, Molecular Modeling Principles and Applications, Second Edition, Prentice Hall.
6. 6 . Baldi, P., Brunak, S. Bioinformatics: The Machine Learning Approach, 2nd ed., East West Press, 2003
7. Baxevanis A.D. and Oullette, B.F.F. A Practical Guide to the Analysis of Genes and Proteins, 2nd ed., John Wiley, 2002

OUTCOMES:

- At the end of this course, students will have been familiarized with language skills and their applications in analyzing Protein structure, sequence analysis which can be used in analyzing the binding effect of drugs on proteins.

LSC6203 LAB II (IMMUNOLOGY / BIOINFORMATICS)

L	T	P	C
0	0	6	3

OBJECTIVES:

- To acquire knowledge on immunological techniques
- To train in various techniques involving antigen and antibody reactions
- To get hands on experience on plasmid construction, mappings and analysis.
- To explore to various tools in bioinformatics.

LIST OF EXPERIMENTS:

1. Double diffusion, Immuno-electrophoresis and Radial Immuno diffusion.
2. Antibody titre by ELISA method.
3. ELISA for detection of antigens and antibodies-DOT ELISA
4. Blood group mapping
5. Preparation of antigens from pathogens and parasites
6. Slide and tube agglutination reaction
7. Plasmid Construction/Restriction Mapping
8. PCR Primer Designing
9. Sequence Retrieval and Format Conversion
10. Homology Search/ Multiple Sequence Alignment
11. Motif finding in DNA and Protein Sequences
12. Protein Secondary Structure Prediction
13. Accessing Data- Use FORMATTED, LIST and COLUMN input to read raw data files, Combine SAS data sets using the DATA step.
14. Creating Data Structures- Create temporary and permanent SAS data sets, Control with observations and variables in a SAS data set are processed and output Managing Data- Investigate SAS data libraries using base SAS utility procedures.
15. Generating Reports- Generate list reports using the PRINT and REPORT procedures, Generate HTML reports using ODS statements.
16. Handling Errors- Identify and resolve programming logic errors, syntax errors, data errors.

REFERENCES:

1. Rose et al., Manual of Clinical laboratory Immunology, 6th Ed ASM Publications, 2002.
2. Lefkovis and Pernis. Immunological methods. Academic Press, 1978.
3. Hudson L. and Hay F.C. Practical Immunology. Black Well publishers, 1989
4. Rashidi H, Buehler L. K. Bioinformatics Basics: Applications in Biological Science and Medicine. 2nd Ed., CRC Press, 2005.

5. Baxevanis A. D, Ouellette B. F. F. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins. 3nd edition Wiley, John & Sons, Incorporated, 2004.
6. Krawetz S. A, Womble D. D. Introduction to Bioinformatics: A Theoretical and Practical Approach. Humana press, 2003

OUTCOMES:

- Students could independently perform diagnostics assays involving antigen-antibody reaction. They also learn to perform the qualitative and quantitative analysis using antibody.
- Students will be familiar with various soft skills/tool used in understating modern biology. They will also be able to analyze and interpolate data starting from PCR primer designing to structure predictions.

SEMESTER III

LSC7122	INDUSTRIAL, FOOD, AGRICULTURAL MICROBIOLOGY	L	T	P	C
		4	0	0	4

OBJECTIVES:

- To understand the principles of the underlying the properties and reactions of various Microorganisms and their various development strategies with a clear understanding in terms of agricultural and food Biotechnology and to update students knowledge of new developments in biology of industrial relevance.

MODULE I INDUSTRIAL BIOTECHNOLOGY- AN INTRODUCTION 09

Exploitation of microorganisms and their products, screening, strain development strategies, immobilization methods, fermentation media, raw material used in media production, antifoaming agents, buffers, downstream processing.

MODULE II FERMENTATION 09

Fermentation equipment and its uses, fermentor design, Types of fermentors and fermentations- single, batch, continuous, multiple, surface, submerged and solid state.

MODULE III MICROORGANISMS IN AGRICULTURE AND PLANT DISEASES 09

Microorganisms as biofertilizers (Rhizobial, Cyanobacterial, Mycorrhizal, Azotobacter): production and application of Microbial biopesticides, recombinant pesticides, GMO and their impact. Microbial diseases of crops: transmission of pathogens, Citrus canker, little leaf of brinjal, red rot of sugarcane, brown rot of potato, black rot, mosaic virus, tomato spot, early and late blight, wilt disease. Control of plant diseases.

MODULE IV MICROORGANISMS IN FOOD 09

Microorganisms important in food microbiology – molds, yeasts, bacteria,principles of food preservation – high and low temperatures, drying, chemical preservatives, food additives. Food spoilage and food borne infections, general principles underlying food spoilage and contamination, canned food spoilage, spoilages of vegetables, fruits, meat and meat products, milk and milk products, fish, seafood and poultry.

MODULE V FOOD PRODUCTS 09

Food produced by microbes: bread, cheese, fermented dairy products, microbial cells as food – single cell proteins, mushroom, fermented Indian foods.

Total Hours: 45

REFERENCES:

1. Principles of Food Science, Vol-I by Fennma Karrel
2. Modern Dairy Products, Lampert LH; 1970, Chemical Publishing Company
3. Casida, L.E. “Industrial Microbiology”, New Age International (P) Ltd, 1968.
4. Presscott, S.C. and Cecil G. Dunn, “Industrial Microbiology”, Agrobios (India), 2005.

OUTCOMES:

- At the end of the course the students will be able to acquire knowledge on the concepts and facts and theories relevant to the broad areas of biotechnology and the techniques applicable to the area of Biotechnology

LSC7123 ENVIRONMENTAL AND MEDICAL MICROBIOLOGY

L	T	P	C
4	0	0	4

OBJECTIVES:

- To learn the basic principles of environment and medical microbiology and be able to apply these principles to understanding and solving problems in water quality.
- To become familiar with current research in environmental microbiology and its applications.
- Develop knowledge of microbial organisms and their relevance of infectious diseases.
- Understand the principles of prevention and treatment of pathogenic microorganism infection in humans.

MODULE I INTRODUCTION TO ENVIRONMENTAL MICROBIOLOGY

Environmental Microbiology: Waste treatment - Wastes - types and characterization. Treatment of solid wastes - composting, vermiform composting, silage, pyrolysis and saccharifications. Treatment of liquid wastes - primary, secondary (anaerobic and aerobic) - trickling, A-9 21 activated sludge, oxidation pond, and oxidation ditch-tertiary - disinfection.

MODULE II DEGRADATION USING MICROBES

Degradation of of Xenobiotic compounds: Simple aromatics, chlorinated polyaromatic petroleum products, pesticides and surfactants. Biodeterioration of materials - paper, leather, wood, textiles and paint. Metal corrosion - Bioaccumulation of heavy metals. Biofouling and Bioleaching.

MODULE III MICROBIAL ASSESMENT OF WATER

Physical, chemical and microbial assessment of water and potability test for water. Physical and chemical - colour, pH, alkalinity, acidity, COD, BOD, anions and cations. Microbiological - MPN index - presumptive, completed and confirmatory tests.

MODULE IV EPIDEMOLOGY AND PATHOGENECITY OF DISEASES

Epidemiology, pathogenicity and treatment of diseases caused by Haem. influenzae, C. diphtheriae, E. coli, Pseudomonas, Bacillus anthracis, Cl. tetani, Cl. walchi, Leptospira icterohaemmorhagiae, N. gonorrhea, Mycoplasma, compylobacter. Rickettsia -cox, burneti, Chlamidiae -trachoma, New Bacterial diseases- Helicobacter, Lyme diseases, Legionella.

MODULE V INFECTION & DRUGS

Infections in Vulnerable hosts, antimicrobial drugs, Bauer Kirby test, Broth dilution test, minimum inhibitory and lethal concentrations. Mechanism of action and activity spectrum of penicillin, streptomycin, tetracycline, sulfonamides, rifampicin, polymixin - B, Amphotericin – B. Drug resistance.

Total Hours: 45

REFERENCES:

OUTCOMES:

At the end of the course students will be able to understand the basic concepts and advantages of environmental and medical microbiology. The students will be understand the different test for infection, disease and drugs.

LSC7124 LABORATORY 3

L	T	P	C
0	0	6	3

OBJECTIVES:

- To understand the principles of the underlying the properties and reactions of various Microorganisms and their various development strategies with a clear understanding in terms of agricultural and food Biotechnology and to update students knowledge of new developments in biology of industrial relevance.
- To learn the basic principles of environment and medical microbiology and be able to apply these principles to understanding and solving problems in water quality. To become familiar with current research in environmental microbiology and its applications. Develop knowledge of microbial organisms and their relevance of infectious diseases. Understand the principles of prevention and treatment of pathogenic microorganism infection in humans.

EXPERIMENTS:

1. Production and estimation of lactic acid by Lactobacillus Sp. Or Streptococcus Sp.
2. Extraction and estimation of diacetyl.
3. Sauerkraut fermentation
4. Isolation of food poisoning bacteria from contaminated foods, Dairy products
5. Extraction and detection of afla toxin for infected foods.
6. Preservation of potato/onion by UV radiation
7. Production of fermented milk by Lactobacillus acidophilus.
8. Rapid analytical techniques in food quality control using microbial Biosensors.
9. Microbial production , Extraction , purification and Confirmation of alpha amylase/ Lipase
10. Immobilization of cells and enzyme using Sodium alginate and egg albumin and measurement of enzyme activity [amylase/ /Lipase]
11. Cell disruption for endoenzymes by sonication.
12. Physical analysis of sewage/industrial effluent by measuring total solids, total dissolved solids and total suspended solids.
13. Determination of indices of pollution by measuring BOD/COD of different effluents. 3. Bacterial reduction of nitrate from ground waters
14. Microbial dye decolourization/adsorption.
15. Comparison of ethanol production using various Organic wastes /raw Material [Free cells/ immobilized cells].

REFERENCE:

1. Food Microbiology. 2nd Edition By Adams
2. Basic Food Microbiology by Banwart George J.

3. Food Microbiology: Fundamentals and Frontiers by Dolle
4. Biotechnology: Food Fermentation Microbiology, Biochemistry and Technology. Volume 2 by Joshi.
5. Fundamentals of Dairy Microbiology by Prajapati.
6. Essentials of Food Microbiology. Edited by John Garbult. Arnold International Students Edition.
7. Microbiology of Fermented Foods. Volume II and I. By Brian J. Wood.Elsiever Applied Science Publication.
8. Microbiology of Foods by John C. Ayres. J. Orwin Mundt. William E. Sandinee. W. H. Freeman and Co.
9. Dairy Microbiology by Robinson. Volume II and I.
10. Food Microbiology: Fundamentals and Frontiers. 2nd Edition by Michaell P. Doyle, Larry R. Beuchat and Thomas I. Montville (Eds.), ASM Publications.
11. Bacterial Pathogenesis A Molecular Approach. 2nd Edition. 2001 by Abigail A.Salyers and Dixie D. Whitt. ASM Publications.
12. Advances in Applied Microbiology by D. Pearlman, Academic Press.

OUTCOMES:

- At the end of the practically the students will be able to acquire knowledge on the concepts and facts and theories relevant to the broad areas of biotechnology and the techniques applicable to the area of Biotechnology
- Students will be able to perform experimental confirm and synthesis the different test for infection, disease and drugs.

LIST OF ELECTIVES

SEMESTER I

		L	T	P	C
LSCY101	**BIOSAFETY, BIOETHICS, BIOENTREPRENEURSHIP, INTELLECTUAL PROPERTY RIGHTS**	**3**	**0**	**0**	**3**

OBJECTIVES:

- Developing a good work ethics and laboratory working condition
- Understanding the importance of following and maintaining laboratory safety guidelines

MODULE I ETHICS IN BIOLOGY 09

The legal and socioeconomic impacts of biotechnology - Public education of the processes of biotechnology involved in generating new forms of life for informed decision making - Biosafety regulation and national and international guidelines - rDNA guidelines

MODULE II BIOSAFETY 09

Experimental protocol approvals - levels of containment - Environmental aspects of biotech applications - Use of genetically modified organisms and their resistance in environment - Special procedures for r-DNA based product production

MODULE III MARKETING 09

Assessment of market demand for potential product(s) of interest; Market conditions, segments; Prediction of market changes; Identifying needs of customers including gaps in the market, packaging the product; Market linkages, branding issues; Developing distribution channels; Pricing/Policies/Competition; Promotion/Advertising; Services Marketing

MODULE IV INTELLECTUAL PROPERTY RIGHTS 09

Intellectual property rights - TRIP International conventions patents and methods of application of patents - Legal implications - Biodiversity and farmers rights - Beneficial applications' and development of research focus to the need of the poor - Identification of directions for yield effect in agriculture, aquaculture Bioremediation etc.

MODULE V PATENT SYSTEM 09

Objectives of the patent system - basic principles and general requirements of patent law - biotechnological inventions and patent law - legal development - patentable subjects and protection in biotechnology - The patentability of microorganisms - IPR and WTO

regime - consumer protection and IPR - IPR and plant genetic resources - GATT and TRIPS.

Total Hours: 45

REFERENCES:

1. Beier,F.K.,Crespi,R.S. and Straus,J. *Biotechnology and Patent protection*-Oxford and IBH Publishing Co.New Delhi.
2. Sasson A, *Biotechnologies and Development*, UNESCO Publications.
3. Singh K, *Intellectual Property rights on Biotechnology*, BCIL,NewDelhi.

OUTCOMES:

- At the end of the course student will develop an idea about the importance of good laboratory practice in high quality research. They will also develop awareness about the basic fundamental safety measures that a researcher should follow in laboratory.

LSCY104 ANALYTICAL TECHNIQUES

L	T	P	C
3	0	0	3

OBJECTIVES

- The students will be exposed to basic concepts related with techniques and instrumentation widely used in Biotechnology.

MODULE I CALORIMETRY AND SPECTROSCOPY 09

Properties of electromagnetic radiations, interaction with matter. Ultraviolet spectroscopy: Origin of UV spectra, types of transition, chromophore & related terms, choice of solvent, instrumentation and applications Infra-red spectroscopy: Origin of infra-red spectra, modes of vibrations, instrumentation, sampling technique and applications; Nuclear magnetic resonance spectroscopy: Mass Spectroscopy: Origin, Instrumentation, types of ions produced, interpretation and applications of mass spectra GCMS, LCMS & MSMS.

MODULE II CENTRIFUGATION AND MICROSCOPY 09

Principle of centrifugation, rotors, different types of centrifuges, preparative and analytical centrifugation, ultra centrifugation. Optical microscopy, Bright field, Dark field, phase contrast and fluorescence microscopy. Electron microscopy: Transmission and scanning electron microscopy, Atomic force microscopy.

MODULE III ELECTROPHORESIS 09

General principle, support media. Agarose gels, polyacrylamide gels. SDS PAGE, 2D PAGE Pulsed field gel electrophoresis Iso-electric focusing Capillary electrophoresis

MODULE IV RADIOISOTOPE TECHNIQUES 09

Study of radioisotopes in biological samples, proportional and GM counter, scintillation counters, autoradiography, radio –immunoassay.

MODULE V CHROMATOGRAPHY 09

Introduction: Chromatography theory and practice. Paper chromatography. Thin layer chromatography. Ion exchange chromatography. Affinity chromatography. Partition chromatography. Adsorption chromatography. Introduction to gas chromatography and HPLC. Permeation.

Total Hours:

REFERENCES

1. Pierre C. ORD and CD in chemistry and biochemistry: An Introduction. Academic Press, 1972.

2. Paddock S. W. Confocal Microscopy methods & protocols.1st Ed., Human Press, 1999.
3. Murphy D. B. Fundamental of Light Microscopy & Electron Imaging. 1st Ed., Wiley-Liss, 2001.

OUTCOME

- At the end of the course, the students will have sufficient scientific understanding of the basic concepts in instrumentation used in Biotechnology.

LSCY121 ANIMAL BIOTECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

The student will learn about

- The basic idea about animal cell culture, drug toxicity and its application.
- Vaccines production and other technology related to antibody production.
- The basic concept of cloning and several issues related with that.
- Genomics and the role of DNA forensics.

MODULE I ANIMAL CELL CULTURE 09

Morphology and ultra-structure of animal cell, requirements for animal cell culture, media and reagents, Primary culture, secondary culture, maintaining cell line, Suspension cultures, Somatic cell cloning and hybridization, transfection and transformation, Stem cells and their application, Animal cell culture application for in vitro testing of drugs, toxicity of environmental pollutants in cell culture.

MODULE II ANIMAL HEALTH BIOTECHNOLOGY 09

Introduction to immune system, History of vaccines development, concept of vaccines, vaccine production, conventional methods and recombinant approaches, technology for antibody production, Phage display technology, radio immunoassays and enzyme immunoassays, Immunoblotting, Nucleic acid based diagnostic methods including nucleic acid probe hybridization.

MODULE III ANIMAL REPRODUCTIVE BIOTECHNOLOGY 09

Culture of embryos, Cryopreservation of embryos, Embryo transfer, Micromanipulation of animal embryos, Artificial insemination, in vitro fertilization, Transgenic animal technology and its different applications, Animal cloning- basic concepts, Cloning from embryonic cells and adult cells; Cloning of farm animals; Cloning for conservation of endangered species, Ethical, social and moral issues related to cloning, Human Cloning.

MODULE IV ANIMAL GENOMICS 09

Introduction to animal genomics; Different methods for characterization of animal genomes, SNP, STR, QTLS, RFLP, RAPD, proteomics, metobolomics, different breeds of cattle, buffalo, sheep, goats, pigs, camels, horses, canines and poultry, characterization of livestock breeds; Marker assisted breeding of livestock and poultry, Genetic basis for disease resistance; Gene knock out technology and animal models for human genetic disorders.

MODULE V DNA FORENSICS 09

Nucleic acid based methods for identification of animal species, Detection of food/feed adulteration with animal protein, adulteration detection in meat using DNA based methods, Identification of wild animal species using DNA based methods using different parts including bones, hair, blood, skin and other parts confiscated by anti-poaching agencies; Human forensics; Microbial forensics; Bioterror agents; Biocrimes and Bioterrorism.

Total Hours: 45

REFERENCES:

1. Animal Cell Culture - Practical Approach, 3rd Edition, Oxford University, Ed. John R.W. Masters, Press, 2000.
2. Ed. Martin, Clynes Animal Cell Culture Techniques, Springer, 1998.
3. Animal Cell Biotechnology. Portner, 2nd Edition, Humana Press, 2007.
4. A. Puller (ed), Genetic engineering in Animals, VCH Publishers.
5. Gordon, Reproductive Technologies in Farm Animals, CAB Intl., 2005.
6. Pinkert, Transgenic animal technology, Academic Press, 2006.

OUTCOMES:

on the completion of the above course student will learn about

- basic of animal cell culture and the production of antibodies.
- how vaccines is being produced and its importance in several aspects
- the social and moral issues related to cloning. the importance of studying Forensic science.

LSCY122 PLANT BIOTECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES

- This course gives students about the fundamentals of totipotency, plant tissue culture techniques for in vitro manipulations and transgenic technology. It also familiarizes them with the use of plants for production of biologically active therapeutic proteins.

MODULE I PLANT TISSUE CULTURE 09

Totipotency, organogenesis, somatic embryogenesis, artificial seed production, Micropropagation, somaclonal variation, Germplasm conservation and cryopreservation. Protoplast Culture and Somatic Hybridization Protoplast isolation- its culture and usage, Somatic hybridization and its applications.

MODULE II AGROBIOLOGY 09

Agrobacterium-plant interaction; Virulence; Ti and Ri plasmids; Opines and their significance; T-DNA transfer, Genetic Transformation Agrobacterium-mediated gene delivery, Direct gene transfer - PEG-mediated, electroporation, particle bombardment and alternative methods; Screenable and selectable markers, Characterization of transgenics, Gene targeting.

MODULE III MOLECULAR MAPPING & MARKER ASSISTED SELECTION (MAS) 09

Marker assisted selection for genes of agronomic importance, e.g. insect resistance, grain quality and grain yield, Molecular polymorphism, RFLP, RAPD, STS, AFLP, SNP markers; Construction of genetic and physical map, Gene mapping and cloning, strategies for Introducing Biotic and Abiotic Stress Resistance/Tolerance Bacterial resistance; Viral resistance; Fungal resistance; Insects and pathogens resistance; Herbicide resistance; Drought, salinity, thermal stress, flooding and submergence tolerance.

MODULE IV PLANT ARCHITECTURE AND METABOLISM 09

Protein engineering, Post-harvest bioengineering, Plants as Biofactories, concept of biofactories, Fermentation and production of industrial enzymes, vitamins and antibiotics and other biomolecules, secondary metabolite production, Production of pharmaceutically important compounds.

MODULE V PLANT GENOMICS 09

Positional cloning, using biochemical and expression analysis-microarray analysis, metabolomics, Characterization and functional analysis of candidate genes: transformation, mutant populations, knockout systems; Heterologous expression systems; Protein analysis; Bioinformatics and databases; Genoinformatics, Patenting of biological material; Plant breeders rights (PBRs) and farmers rights and Biosafety.

Total Hours:

REFERENCES:

1. Adrian Slater, Nigel Scott and Mark Fowler, Plant Biotechnology: The genetic manipulation of plants, 1st Edition, Oxford University Press, 2003
2. Edited by BR Jordan, 2nd Edition, The Molecular Biology and Biotechnology of Flowering, CABI, 2006.
3. Neil Wille, Phytoremediation: Methods and Reviews, 1st Edition, Humana Press, 2007.
4. Denis Murphy, Plant Breeding and Biotechnology: Societal Context and the Future of Agriculture, Cambridge University Press, 2007.

OUTCOMES:

- At the end of the course students will be able to understand the advantages of in vitro propagation of plants in various areas and methods used for production of transgenic plants with their applications in different areas.

LSCY123 PARASITOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand animal association, parasitic diseases, lifecycle and mode infection.
- To get an overview on important parasites and charactertics.
- To understand survival adaptations and significance of important parasites.

MODULE I FUNDAMENTAL OF PARASITOLOGY 08

Introduction to parasitology; type of parasites, animal associations and host – parasite relationship; distribution of diseases and Zoonoses caused by animal parasites.

MODULE II COMMON PARASITES 10

Plasmodium - morphology, life-cycle and mode of infection. Molecular biology of Plasmodium – drug targets, mechanism of drug resistance, vaccine strategies and proteomic approaches; Leishmania - morphology, life-cycle and mode of infection. Molecular biology of Leishmania – drug targets, drug resistance and vaccine strategies.

MODULE III COMMON PARASITES 09

Entamoeba - morphology, biology, life-cycle and mode of infection. Giardia - morphology, biology, life-cycles, mode of infection. Gastro-intestinal nematodes - morphology, biology, life-cycles and modes of entry of Schistosoma, Wuchereria, Brugia, Ancylostoma, Trichinella and Dracanculus; molecular biology of nematodes and vaccine strategies.

MODULE IV PARASITE IMMUNOLOGY 09

Immune response and self-defense mechanisms, immune evasion and biochemical adaptations of parasites; parasites of veterinary importance.

MODULE V INSECT PARASITES 09

Parasites of insects and their significance; nematode parasites of plants, morphology, biology, lifecycle and infection of crop plants by plant parasitic nematodes, plant parasitic nematodes, host parasite interactions.

Total Hours: 45

REFERENCES

1. Roberts L.S. and Janovy J.Foundations of Parasitology. McGraw-Hill Publishers, New York, 2008.
2. Cox F. E. G. Modern Parasitology: A Textbook of Parasitology, FEG Cox., Wiley-Blackwell, 1993.

OUTCOMES:

- After finishing this course, scholars will get knowledge on parasites causing sever ailments in humans. Students will also know parasite's lifecycle, survival adaptations and also to prevention and treatment strategies.

LSCY124 VIROLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- This course aims to develop in the students' mind a concept regarding scope of virology, Diagnostic virology, Emerging virus and challenges and applied virology.

MODULE I CONCEPT AND SCOPE OF VIROLOGY 09

Foundations of virology: Virus prehistory, discovery of viruses. Definitive properties of viruses: Morphology, Ultra structure, Chemical composition -proteins, nucleic acids, and enzymes. Classification and nomenclature of viruses; Trends in virology; Evolutionary importance of viruses. Epidemiology of Virus infection. Principles of diagnosis of virology.

MODULE II DIAGNOSTIC VIROLOGY 09

Biological activity of viruses, Physical, chemical and structural components of viruses, Visualization and enumeration of virus particles, Detection of viruses: physical, biological, immunological and molecular methods. Cultivation of viruses in embryonated eggs, laboratory animals and cell cultures. Serological methods – haemaglutinin and HAI, complement fixation, immunofluorescence methods, ELISA and RIA: Physical, chemical and molecular methods- protein, radioactive tracers, electron microscopy, nucleic acid - PCR based assays, flowcytometry and immunohistochemistry. Infectivity assays for phages and plant viruses. Characterization of viral product expressed in the infected cells. Isolation and purification of viruses.

MODULE III STUDY OF VIRUS 09

Morphology, ultra structure, chemical composition and replication of: Group I – T2 Bacteriophage, Group II – Banana bunchy top virus, Group III – Reovirus, Group IVTMV, Group V – Rhabdovirus, Group VI – HIV, Group VII – HBV. Sub-viral particles: Discovery, Structure, Classification, replication and diseases caused by Satellite, Satellites virus, Virusoids, Viroids and Prions. Cellular interactions—clathrin coated pits, lipid rafts, caveolae, endocytosis and virus uncoating mechanisms. Oncogenesis: oncogenic viruses, viral transformation by activation of cellular signal transduction pathways, viral transformation via cell cycle control pathways.

MODULE IV APPLIED VIROLOGY 09

General aspects of plant and animal viral diseases. Introduction to viral vaccines, preparation of vaccines, new vaccine technology; antiviral drugs, antiviral gene therapy, antiviral libraries, antiretrovirals—mechanism of action and drug resistance. Modern approaches of virus control: Antisense RNA, siRNA, ribozymes, in silico approaches for drug designing. T-phages, Cyanophages, Baculovirus.

MODULE V EMERGING VIRUS AND CHALLENGES 09

Mechanism of host cell damage- Host cell 'shut off',apoptosis, necrosis, alteration of signaling pathways. Viruses and the future: Promises and problems. Emerging diseases, sources and causes of emergent virus diseases. Prospectus using medical technology to eliminate specific viral and other infectious diseases. Silver lining: viruses as therapeutic agents, viruses for gene delivery, viruses to destroy other viruses. Importance of studying modern virology.

Total Hours: 45

REFERENCE:

1. Fields Virology Vol 1 and 2. B.N. Fields, D.M. Knipe, P.M. Howley, R.M. Chanock,
2. J.L. Melnick, T.P. Monath, B. Roizman, and S.E. Straus, eds.), 3rd Edition. Lippincott-Raven, Philadelphia, PA.
3. Basic Virology Edward K. Wagner, Martinez J. Hewlett, David C. Bloom, David Camerini.
4. Virology: Principles and Applications John Carter, Venetia Saunders.
5. Principles of Virology: Molecular Biology, Pathogenesis, and Control of Animal Viruses. S. J. Flint, V. R. Racaniello, L. W. Enquist, V. R. Rancaniello, A. M. Skalka.
6. Virology Methods Manual. Brian W.J. Mahy (Editor), Hillar O. Kangro (Editor). Elsevier Science & Technology Books.
7. Methods and Techniques in Virology. Pierre Payment, Trudel (Editor). Publisher: Marcel Dekker.
8. Black JG, 2002 Microbiology-Principles and Explorations. John Wiley & Sons Inc. New York.
9. Dimmock, N. J., Easton, A. J., and Leppard, K. N. 2001. Introduction to Modern Virology. 5th edn. Blackwell publishing, USA.
10. Flint, S.J., Enquist, L.W., Drug, R.M., Racaniello, V.R. and Skalka, A.M. 2000. Principles of Virology- Molecular Biology, Pathogenesis and Control. ASM Press, Washington,D.C.
11. Wagner, E.K. and Hewlett, M.J. 1999. Basic Virology. Blackwell Science. Inc.

OUTCOMES:

- At the completion of the course the student will develop an understanding about the scope of virology, Diagnostic virology, Emerging virus and challenges and applied virology.

SEMESTER II

LSCY201 RECOMBINANT DNA TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVE:

- To understand the basics of Recombinant DNA
- To learn applications of Recombinant DNA Technology

MODULE I CLONING & CLONING VECTOR 09

Types of cloning vectors viz. Plasmids, cosmids, ssDNA Phages, Yeast cloning vectors, Animal viruses, Ti plasmids and Cauliflower Mosaic Virus. Structural and Functional Organization of Plasmids, Plasmid Replication, Stringent and Relaxed Plasmids, Incompatibility of Plasmid Maintenance.

MODULE II MANIPULATION OF PURIFIED DNA 09

Enzymes involved in DNA Manipulation- Nucleases, Ligases, Polymerases and DNA modifying enzymes, Restriction endonucleases-Types, Blunt and sticky ends, Liagtion-Mode of action of DNA Ligase.

MODULE III CONSTRUCTION OF RECOMBINANT DNA 09

Preparation of competent cell-Transformation, transfection – Recombinant selection and screening- Genomic DNA library- cDNA synthesis strategies - Linkers - Adapters - Homopolymer tailing- Making genomic and cDNA libraries in plasmids and phages. PCR product cloning (TA cloning). Cloning strategies in yeast, E. coli and B. subtilis.

MODULE IV HYBRIDIZATION TECHNIQUES & MUTAGENESIS 09

DNA hybridization, colony hybridization and in-situ hybridization (Southern, Northern and Dot blots and immunological techniques Western blotting), Mutagenesis - Deletion mutagenesis, Oligonucletoide derived mutagenesis, Site directed mutagensis - Its applications- Applications of rDNA technology in Diagnostics.

MODULE V APPLICATIONS OF rDNA TECHNOLOGY 09

Gene Cloning and DNA analysis in Agriculture, Forensic Science and Medicine-Production of Recombinant pharmaceuticals, identification of genes responsible for human disease, Genetic Finger printing, Gene Therapy, Plant Genetic engineering, Problems with Genetically modified plants.

Total Hours: 45

REFERENCES:

1. Recombinat DNA Second eition by Watson
2. Gene Cloning and DNA analysis: An Introduction by T. A. Brown.

OUTCOMES:

- This course will introduce the students with the basics about genes, and approaches to manipulate the gene according to need such as production of therapeutic proteins in plants.

LSCY203 MOLECULAR DIAGNOSTICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- Developing the basic concept of molecular diagnostics
- Understanding the common procedures and which are used in disease diagnosis
- To be familiar with various types of diseases diagnosis methods and progression of diagnosed disease.

MODULE I INTRODUCTION TO MOLECULAR DIAGNOSTICS 09

Collection, preservation and storage of clinical samples, biopsy, Principles, application and limitations of Biological assays used in diagnosis- PCR, ELISA, FISH, gene sequencing, microarrays, protein arrays. GLP, SOP and ethics in molecular diagnostics.

MODULE II INFECTIONS 09

Infection and mode of transmission, types of infectious diseases- bacterial and fungal infections, diagnosis of infections caused by Streptococcus, Coliforms, Salmonella, Shigella, Vibrio, and Mycobacterium- diagnosis of fungal infections, major fungal diseases, Dermetophytoses, Candidiosis and Aspergillosis. Diagnosis of DNA and RNA viruses- pox virus, rhabdo virus, hepatitis; virus diagnosis of protozoan diseases- amoebiosis, malaria, trypanosomiosis, leishmaniasis- study of helminthic diseases- Fasciola hepatica and Ascaris lumbricoides. Filariasis and Schistosomiasis. Diagnosis of chicken guinea and swine flu.

MODULE III CLINICAL GENETICS 09

Chromosomes chemistry and packaging, Cytogenetic, Structural and numerical abnormalities of chromosomes, Chromosome bands, banding techniques , mutation and polymorphism analysis, human genome project, cancer genetics- oncogenes, tumor suppressor genes- gene therapy, genetic counseling, nucleic acid hybridization techniques, Disease linked with mitochondrial DNA Genetic linkage and chromosome and genetic mapping in human diseases, Prenatal

MODULE IV IMMUNODIAGNOSTICS 09

Introduction to immunodiagnostics, antigen-antibody reactions, antibody production, antibody markers, CD markers, FACS, Human Leukocyte Antigen (HLA) typing, agglutination (ABO/Bacterial), immunoprecipitation, immunodiffusion, flocytometer.

MODULE V FORENSIC SCIENCE 09

Introduction to Forensic Science, DNA fingerprinting / DNA Profiling / DNA Testing in Forensic Science.; Ethics, Rules and Procedures in DNA analysis. Autopsy and

toxicological diagnosis. Determination of Paternity- Human identification and sex determination. semen analysis , Case study.

Total Hours: 45

REFERENCES:

1. Tietz Textbook of Clinical Chemistry, Carl A. Burtis, Edward R. Ashwood,
2. Harcourt Brace & Company Aisa Pvt. Ltd.
3. Essentials of Diagnostic Microbiology, Lisa Anne Shimeld
4. The Science of Laboratory Diagnosis, Crocker Burnett

OUTCOMES:

- Learners will be able to define basic terminology and describes basic concepts in molecular diagnostics
- The students will know the importance and the relevance of molecular diagnostic techniques and applications of molecular diagnostics in various field including medical, forescenic, etc..

LSCY205 BIOFUELS AND BIOENERGY

L	T	P	C
3	0	0	3

OBJECTIVE

- This course will provide learning in various The course will provide students, with hands-on technical exposure to various Biofuels related science & technology topics, background & literature information besides addressing the environmental, economical, social and other Biofuels related issues.

MODULE I BIOCHEMISTRY OF BIOMASS 09

biomass (e.g. wood waste, forestry residues, agricultural residues, perennial annual crops, organic municipal solid waste). Long-term sustainability and reliability of feedstock supply; feedstock quality, minimizing feedstock cost and regional/climatic considerations of the process chain. Composition of lignocellulose (lignin, hemicellulose, cellulose); energy crops; chemical pretreatment; enzymatic pretreatment; degradation of lignocellulose by fungi and bacteria; degradation of lignin; the role of peroxidases; degradation of cellulose; trichoderma cellulases; bacterial cellulases; and comparison with degradation of high starch crops.

MODULE II BIO DIESEL 09

sources and processing of biodiesel (fatty acid methyl ester); nature of lipids, especially fatty acids and triglycerides. Sources and characteristics of lipids for use as biodiesel feedstock; and conversion of feedstock into biodisel (transesterification). Use of vegetable oil (SVO) and waste vegetable oil (WVO). Engineering, economics and environmental issues of biodisel; components and operation of a biodiesel processing system; standards for biodiesel quality; safety procedures needed to work with biodiesel in both domestic and shop environments; and major policies and regulations pertaining to the production, distribution, and use of biodiesel.

MODULE III BIOENERGY SYSTEMS 09

Course content includes overview of bioenergy systems from resource, conversion technologies to final product. Bioenergy conversion technologies and systems for heat, power, and bio-fuels. Cogeneration and polygeneration. Innovative cycles (such as biomass integrated gasification combined cycles, biomass air turbines, humid air turbines etc) for biomass resources. Evaluation of the bioenergy system performance. Economic and environmental assessments of bioenergy systems.

MODULE IV BIOFUELS & ALCOHOL TECHNOLOGY 09

Introduction to Alcohol Technology, Raw Material of AlcoholIndustry, Storage & handling of Raw material in detail, Study of different yeast strains used in alcohol industries, Study

of yeastproduction as single protein cell. Study of different recycling process, Biochemistry of alcoholproduction, The management of fermentation in the production of alcohol.

MODULE V POLICIES AND FUTURE R&D OF BIOFUELS & BIOENERGY 09

Course content includes analysis of both current and future EU regulations and directives on biofuels and bioenergy. Tax regulations. Evaluation of different production alternatives to produce bioenergy; competitiveness of bioenergy alternatives in agriculture compared to other energy sources. Evaluation of current and future R&D needs; legal framework to support sustainable development and increased use of biofuels; government policies and programs with regard to biofuels and investment opportunities worldwide. Biomass feedstocks - how do we produce them cost-effectively and for which end-use? Biofuels for transportation - what will make them technically and economically competitive? Market penetration of biofuels - how do we remove barriers?

Total Hours:

REFERENCES:

1. Biorenewable Resources: Engineering New Products from Agriculture. Robert C. Brown. Wiley-Blackwell Publishing (2003).
2. Anaerobic Biotechnology for Bioenergy Production: Principles and Applications. Samir K. Khanal. Wiley-Blackwell (2008).

OUTCOMES:

Students will be able to describe:

- How petroleum and bio-based fuels affect the global carbon cycle
- The attributes of biofuels that make them suitable as a fuel for a specific application
- Limitations of biofuels
- Global impacts of biofuels on food and energy supplies
- Technological advances and challenges to be overcome for wide-scale biofuel adoption

LSCY211 DIAGNOSTICS OF INFECTIOUS DISEASES

L	T	P	C
3	0	0	3

MODULE I DIAGNOSTIC BACTERIOLOGY 09

Epidemiology of bacterial infections, Guidelines for the collection, Transport, Processing analysis, isolation of bacterial pathogens and reporting of cultures from specimens for bacterial infections Bacterial infections of respiratory tract. Bacterial infections of gastro intestinal tract and food poisoning. Bacterial urinary tract infections. Bacterial infections of genital tract and reproductive organs. Bacterial infections of central nervous system. Skin and soft tissue infections. Bone and joint infections Eye ear and sinus infections Cardiovascular infections Tissue samples for culture Anaerobic infections Zoonotic infections. Infections associated with immunodeficiency and immune suppression Pyrexia of unknown origin.

MODULE II BACTERIAL IMMUNO SEROLOGY 09

Enteric fever Streptococal infections Syphilis Rickettsial infections B rucellosis Primary atypical pneumonia; New rapid serological diagnostic methods for bacterial infections.

Module III DIAGNOSTIC BACTERIOLOGY VIROLOGY 09

Immunodiagnostics and immunotherapy in virology – Serological methods for detection and quantitation of viruses including Hepatitis, Influenza, HIV and others. Immuno-assays: SRID, ELISA, ELISA-PCR, RIA, Western Blotting, Immunofluroscens and their application. Immune deficiencies and autoimmunity.

MODULE IV DIAGNOSTIC PARASITOLOY 09

Systematic study of following parasites (Geographical distribution, habitat, morphology and life cycle, risk of infection, pathogenesis, laboratory diagnosis prophylaxis and serological diagnosis)

MODULE V DIAGNOSTIC MYCOLOGY 09

Epidemiology, Pathogenesis, Laboratory Diagnosis of Fungal Infections. Specimen collection, preservation, Transportation & Identification of Mycological Agent. Biochemical tests for fungal identification Anti fungal agents, invitro tests. Serological tests for mycotic infections. Use of laboratory animals in Mycology.

Total Hours:

REFERENCES:

1. Colour atlas of & text book of Diagnosis Microbiology – IV Edn Felmer W. Koneman Bailey & Scott's Diagnostic Microbiology – 12th Edn

OUTCOMES:

LSCY212 METAGENOMICS

L	T	P	C
3	0	0	3

PURPOSE:

The purpose of this course is to provide focus on next generation DNA sequencing technology to describe the ecological roles of microbial communities in different environments. It also provides how the metabolic functions, taxonomic distribution, diversity, evenness and species richness of microbial communities varies across environment.

OBJECTIVES:

- To use metagenomic data to describe the taxonomic make-up, functional potential and ecological processes of microbial communities from a range of environments
- To apply next generation sequencing technology.
- To assemble and annotate genomes by identifying genes.

MODULE I ENVIRONMENTAL GENOMICS 0**9**

Environmental Metagenomics – Introduction; Pure culture and in consortium ; Cultivable and Non-cultivable microbial analysis; Recombination DNA technology and DNA cloning; Types of vectors, applications of recombination DNA technology; Molecular fingerprinting techniques (RFLP, T-RFLP, ARISA, DGGE, rDNA library, and FISH); Stable isotope probing (SIP); Suppressive subtractive hybridization (SSH); Differential expression analysis (DEA); Microarrays & Metagenome sequencing; Next-generation sequencing approaches to metagenomics.

MODULE II ISOTOPE PROBING & OLIGONUCLEOTIDE MICROARRAYS 09

Direct linking of microbial populations to specific biodegradation and biotransformation processes by stable isotope probing of biomarkers- PhyloChip & GeoChip-Detection of xenobiotic-degrading bacteria by using oligonucleotide microarrays

MODULE III CONSTRUCTION & ANALYSIS OF METAGENOMIC LIBRARIES 09

Cataloging microbes: phylogenetic tree and construction - Construction of a metagenomic library; Analysis of Metagenomic Libraries; Sequence-based Metagenomics Analysis; Functionbased Metagenomics Analysis; Phylogenetic analysis and Comparative genomics Softwares & Tools.

MODULE IV METAGENOMICS CASE STUDIES 09

Metagenomic analysis of soil microbial communities; Metagenomic analysis of marine microbial communities; Metagenome of the Microbial Community in Acid Mine Drainage ; Metagenomic Analysis of Bacteriophage; Metagenomics and Its Applications to the

Study of the Human Microbiome; Archaeal Metagenomics: Bioprospecting Novel Genes and Exploring New Concepts.

MODULE V METAGENOMICS IN ENVIRONMENTAL STUDIES 09

Application of Metagenomics to Bioremediation; Applications of Metagenomics for Industrial Bioproducts; Escherichia coli host engineering for efficient metagenomic enzyme discovery; Next-generation sequencing approaches to metagenomics; Stable isotope probing: uses in metagenomics; DNA sequencing of uncultured microbes from single cells.

Total Hours:

REFERENCES:

1. Diana Marco Universidad Nacional de Cordoba, Argentina, “Metagenomics: Theory, Methods and Applications”, Caister Academic Press,2010.
2. Diana Marco Universidad Nacional de Cordoba,Argentina “Metagenomics: Current Innovations and Future Trends”,Caister Academic Press,2011.
3. Joanna R. Freeland, Heather Kirk, Stephen Petersen, “Molecular Ecology”, Mc Graw Hill, 2nd Edition “2012.
4. Beebee T.J.C., D G. Rowe,” An Introduction to Molecular Ecology”, Mc Graw Hill, 2004.

OUTCOMES:

LSCY213 BIOPROCESS (MICROBIAL)

L	T	P	C
3	0	0	3

OBJECTIVES:

- This course is formulated with an objective to familiarize the students with the fundamentals of material balance, energy balance, media optimization techniques and variousmodels of microbial growth.

MODULE I INTRODUCTION TO MICROBIAL BIOTECHNOLOGY 09

Introduction to biotechnology and biochemical engineering, bioprocess techniques, biotechnology products. Thermodynamic preliminaries, system and process, steady state and equilibrium, law of conservation of mass, types of material balance problem, material balances with recycle and bypass streams.

MODULE II MATERIAL BALANCE 09

Stoichiometry of bioreaction and energetic of microbial growth, ATP and redox potential balance, Yield coefficients, productivity and the correlation with the stoichiometry, Growth stoichiometry and elemental balances, electron balances, Biomass yield, product stoichiometry, Theoritical oxygen demand, Maximum possible Yield. Energy Balance: Basic energy concepts, intensive & extensive properties, Studies of enthalpyfor reactive & non reactive processes. Heat of combustion, heat of reaction at Non standard conditions. Thermodynamics of microbial growth, energy balance equation for cell culture, unsteady state energy balance equations.

MODULE III MEDIUM OPTIMIZATION 09

Medium optimization techniques with special emphasize on statistical techniques, placket-Burman design, ANOVA, central; composite design, response surface methodology.Sterilization:

Media sterilization, kinetics of thermal death of cells & spores, design of batch and continuous thermal sterilization, coupling of Arhenious equation and cell death kinetics, sterilization of air and filter design, Radiation and chemical sterilization.

MODULE IV UNSTRUCTURED MODEL FOR MICROBIAL GROWTH 09

The development of different microbial growth kinetics like Malthus, Pearl and read, Monod Model, Konark Model. The limitation of Monod model and development of other constitutive models. Multisubstrate model, inhibition models for substrate, Product and toxic substances. Development of logistic equation. Maintenance and endogenous metabolism kinetics.

MODULE V STRUCTURED MODEL FOR MICROBIAL GROWTH 09

Kinetics based on molecular mechanism, Compartment models, Model of cellular Energetics and metabolism, Model of product formation, singles cell model, Model of gene expression and regulation, Plasmid Expression and Replication, Model of plasmid stability, parameter estimation, Model validation and bioprocess optimization.

Total Hours: 45

REFERENCES:

1. Bailey JE, Ollis DF; Biochemical Engineering fundamentals.
2. Blanch HW and Clark DS: Biochemical Engineering Marcel Decker.
3. Pauline M. Doran: Bioprocess Engineering Principles, Elsevier Publications.
4. 4.Schugerl K: Bellgart K H (Eds); Bioreaction Engineering, Modeling and control; Springer –verlog, berlin (2000)
5. Introduction to Biochemical Engineering by D G Rao. Tata, Mc Graw Hill, New Delhi

OUTCOME:

- After the completion of the course students will gain awareness of various media optimization techniques. Students will gain expertise in quantitative estimation of the biomass growth and product formation rate, which will help them to design bioreactor and product in

SEMESTER III

LSCY111	BIOPHARMACEUTICALS	L	T	P	C
		3	0	0	3

OBJECTIVE:

- The purpose of this course is to provide a framework of the drug development process and its regulation as well as its impact on workers and the environment. Graduate students in toxicology, pharmaceutics, comparative medicine, bioengineering, occupational and environmental health as well as professional disciplines such as medicine, pharmacology, and nursing interested in working with the biotechnology industry will find this course particularly useful.

MODULE I INTRODUCTION TO BIOPHARMACEUTICAL 09

Introduction to Biopharmaceutical, Biogenerics and Biosimilars; The role of patents in the drug industry; Protein-based biopharmaceuticals; Manufacturing processes; Global market; International Non-proprietary Names (INN) nomenclature system biosimilars.

MODULE II CONCEPTS OF BIOPHARMACEUTICAL 09

Approved follow-on proteins/Biosimilars; Characteristics of high-selling peptides and proteins,; Products with expired patents; Challenging originator's patents; Target products for FOB (follow-on biologicals)/ Biosimilars development peptides; Recombinant non-glycosylated proteins; Recombinant glycosylated proteins; Industries dealing with biogenerics and its market value; World scenario; Indian scenario.

MODULE III PHARMACOKINETICS; PHARMACODYNAMICS 09

Problems in characterizing biologics (Types of biologic, Peptides, Non-glycosylated proteins, Glycosylated proteins, Monoclonal antibodies); Equivalence issues; Post-translational modifications; Effect of microheterogeneity; Pharmacokinetics; Pharmacodynamics; and Clinical efficacy; Analytical methods for the characterization of biosimilars (Chromatography, Protein sequencing, Mass spectrometry, UV absorption, Circular dichroism, X-ray techniques, Nuclear magnetic resonance, Electrophoresis, Western blotting, Bioassays, ELISA, Immunoprecipitation and other procedures)

MODULE IV IMMUNOGENICITY OF BIOPHARMACEUTICALS 09

Immunogenicity of biopharmaceuticals: Immunogenicity; Factors contributing to immunogenicity (product- related factors, host- related factors), Consequence of immunogenicity to biopharmaceuticals; Measurement of immunogenicity

MODULE V CASE STUDIES 09

Case studies: Erythropoietin, Insulin, Somatotropin, Interleukin-2, Interferon Granulocyte-macrophage- CSF, DNase, Factor VIIa, Factor IX, Factor VIII, Activated protein C, Tissue plasminogen activator, Monoclonal antibodies etc.

Total Hours : 45

REFERENCES:

1. Sarfaraz K. Niazi, Handbook of Biogeneric Therapeutic Proteins: Regulatory, Manufacturing, Testing, andPatent Issues, CRC Press, 2006.
2. Rodney J Y Ho, MILO Gibaldi, Biotechnology & Biopharmaceuticals Transforming proteins and genes intodrugs, 1stEdition, Wiley Liss, 2003.

OUTCOMES:

- Explain the therapeutic mode of action, and understand structural considerations of at least four classes of biopharmaceutical agent.
- Outline the drug manufacturing process including the role of quality control and quality assurance in protecting the public, workers, and the environment.
- Give an oral presentation to scientific audience on the biological mechanism of action and proposed evaluation of safety, efficacy and manufacturing controls on a biopharmaceutical age

LSCY112 MOLECULAR & IMMUNO DIAGNOSTICS

L	T	P	C
3	0	0	3

OBJECTIVE:

- Identify the important parameters in the design of a laboratory to conduct the most commonly-used molecular diagnostics protocols.
- Identify the important parameters in the design of a quality system for molecular analyses.
- Become proficient with the techniques required in order to perform the most commonly-used molecular diagnostics protocols.
- Identify the important parameters in the design of a molecular diagnostic test.
- Identify the components of a well-controlled diagnostic test.
- Use critical thinking skills to trouble shoot problems as they occur and determine possible causes.

MODULE I MOLECULAR BIOLOGY AND DIAGNOSTICS 09

Molecular Biology and Diagnostics: Atomic bonds and Molecular interactions; Small organic molecules, Macromolecules; Compartmentalization of cells: transport of molecules between nucleus and cytosol, Transport of proteins into mitochondria and chloroplasts, Endoplasmic Reticulum; General principles of cell communication: Signalling - Extracellular, Intracellular, Autocrine, Signaling through G-protein- linked cell surface receptors, Signaling through enzyme-linked cell surface receptors, Signaling pathways that depend on regulated proteolysis; Cell Cycle; DNA repair pathways and methods of detection – Flow cytometry

MODULE II GENETICS AND DIAGNOSTICS 09

Genetics and Diagnostics: Origin and direction of human cytogenetics; General features of chromosomes, Chemistry and packaging of chromosomes, Chromosome bands, banding techniques and their molecular correlates; Structural and numerical abnormalities of chromosomes and their causes, Sex determination and differentiation, Y chromosome evolution and variations and X-inactivation mechanism and phenotypic effects of sex chromosome imbalances, Fragile sites, Trinucleotide repeat expansion, mechanism and associated disorders, Genomic imprinting and their disorders; Fluorescence In situ hybridization, chromosome Comparative Genomic Hybridization arrays; Genetic linkage and chromosome and genetic mapping in human diseases.

MODULE III BIOCHEMISTRY IN DIAGNOSTICS 09

Biochemistry in Diagnostics: Proteins and Amino acids, Qualitative and quantitative techniques: Protein stability, denaturation; amino acid sequence analysis; Metabolism of lipids, carbohydrates, amino acids; In-born errors of metabolism; energy requirements,

nutritional disorders; vitamins & minerals - biochemical function and deficiency manifestation. GLP and GMP.

MODULE IV TECHNIQUES IN DIAGNOSTICS 09

Nucleic acid extraction – principle and methods; Polymerase Chain Reaction – principle, types (including RT-PCR, real-time PCR, QF-PCR) and applications; DNA sequencing methods – principle, types, automated process, DNA sequencers; Hybridization techniques – Southern, Northern, in-situ (including FISH), microarrays – types and applications; Protein extraction and analysis (including PAGE and its variations); Western Blot

MODULE V IMMUNODIAGNOSTICS 09

Immunodiagnostics : Introduction, antigen-antibody binding interactions and assays; Immunoassays – types [RIA, ELISA, Chemiluminescent, IA, FIA] and specific applications; Immunohistochemistry – principle and techniques. Various drug delivery systems, targeting potentials; systems used for delivery of biotechnological products (Liposomes, microspheres, nanoparticles, immobilization techniques, etc.)

Total Hours:

REFERENCE:

1. Molecular Diagnostics: George P Patrinos and Wilhelm Ansorge, Elsevier Academic Press

OUTCOMES:

- Gain knowledge of cellular structure and function, especially DNA and RNA, to molecular diagnostic procedures.
- Gain a thorough working knowledge of nucleic acid extraction, resolution and detection.
- Gain a solid foundation in the most commonly utilized molecular diagnostic testing protocols.
- Apply the knowledge of molecular testing to the most commonly performed applications in the clinical laboratory such as: nucleic acid extraction, resolution and detection, analysis and characterization of nucleic acids and proteins, nucleic acid amplification and DNA sequencing.

LSCY113 TISSUE AND ANTIBODY ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- Understand the fundamental and quantitative principles of tissue and antibody engineering and the basic elements of the tissue engineering approach. Appreciate the important contribution of tissue and antibody engineering in producing/growing organs that can be used for therapeutic applications.Be able to discuss the use of stem cell in tissue engineering for wound healing. Appreciate the need for compatible biomaterials to support growth and differentiation of stem cells into functional organ.

MODULE I INTRODUCTION TO TISSUE ENGINEERING 09

Introduction to tissue engineering, Cells as therapeutic Agents with examples, Cell numbers and growth rates. Tissue organization, Tissue Components, Tissue types, Functional subunits. Tissue Dynamics, Dynamic states of tissues, Homeostasis in highly prolific tissues and Tissue repair. Angiogenesis. Cellular fate processes, Cell differentiation, Cell migration - underlying biochemical process.

MODULE II CELL-EXTRACELLULAR MATRIX INTERACTIONS 09

Cell-extracellular matrix interactions - Binding to the ECM, Modifying the ECM, Malfunctions in ECM signaling. Direct Cell-Cell contact - Cell junctions in tissues, malfunctions in direct cell-cell contact signaling. Response to mechanical stimuli. Cell and tissue culture - types of tissue culture, media, culture environment and maintenance of cells in vitro, cryopreservation. Basis for Cell Separation, characterization of cell separation, methods of cell separation.

MODULE III BIOMATERIALS IN TISSUE ENGINEERING 09

Biomaterials in tissue engineering - biodegradable polymers and polymer scaffold processing. Growth factor delivery, Stem cells. Gene therapy. In vivo cell & tissue engineering case studies: Artificial skin, Artificial blood vessels. Bioreactors for Tissue Engineering.

MODULE IV IMMUNOGLOBULIN 09

Immunoglobulin Genetic Locus: Generation of antibody diversity, Antibody Discovery Methodologies: Hybidoma, Display, and Direct B-cell cloning technology, Antibody structure and function.

MODULE V ANTIBODY ENGINEERING 09

Antibody engineering: humanization, Affinity maturation, Effector function, Generation of high titer cell lines1: Expression vector and Host systems, Cell culture optimization, Downstream processing , Analytical characterization, : Cell line genetic analysis Purification, formulation and stability, Antibody composition

Total Hours:

REFERENCES:

1. "Tissue Engineering", Bernhard O. Palsson, Sangeeta N. Bhatia, Pearson Prentice Hall Bioengineering.
2. Nanotechnology and Tissue engineering - The Scaffold", Cato T. Laurencin, Lakshmi S. Nair, CRC Press.

OUTCOMES:

- Execute the engineering design process: identify problem, identify design constraints on bioengineering problem, create solutions, and evaluate solutions with respect to these constraints.) In this course, students learn and then execute key steps of the engineering design process, including identification of the problem, exploration of the problem, and design of a solution. Students will learn how to identify and conduct thorough research on current tissue engineering and antibody problems, and will ultimately work in teams to propose solutions to those identified problems.

LSCY114 BIONANOTECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide an introduction to nanobiotechnology.
- To make the students understand about the functional principles of nanobiotechnology

MODULE I FUNDAMENTALS OF NANOSCIENCE 09

Introduction, the nanoscale dimension and paradigm, definitions and historical evolution (colloids etc.) and current practice, types of nanomaterials and their classifications (1D, 2D and 3D etc. nanocrystal, Nanoparticle, Quantum dot, Quantum Wire and Quantum Well etc), Polymer, Carbon, Inorganic, Organic and Biomaterials –Structures and characteristics.

MODULE II CHARACTERIZATIONS IN BIONANOTECHNOLOGY 09

Optical (UV-Vis/Fluorescence), X-ray diffraction, Imaging and size (Electron microscopy, light scattering, Zeta potential), Surface and composition (ECSA, EDAX, AFM/STM etc), Vibration (FT-IR and RAMAN), SERS -3, Magnetic, Electrical and Electrochemical**.**

MODULE III APPLICATIONS OF BIONANOTECHNOLOGY 09

Materials in Biosystems: Proteins - Lipids - RNA and DNA, Protein Targeting – Small Molecule/Nanomaterial - Protein Interactions Nanomaterial-Cell interactions-Manifestations of Surface Modification (Polyvalency),Drugs-Photodynamic therapy, molecular motors, neuroelecronic interphases, development of nanoluminiscent tags**.**

MODULE IV NANOMATERIALS AND DIAGNOSTICS 09

Drug Delivery and Therapeutics, MRI, Imaging, Surface Modified Nanoparticles, MEMS/NEMS, based on Nanomaterials, Peptide/DNA Coupled Nanoparticles, Lipid Nanoparticles For Drug Delivery, Inorganic Nanoparticles For Drug Delivery, Metal/Metal Oxide Nanoparticles (antibacterial/anti fungal/anti viral), Anisotropic and Magnetic Particles (Hyperthermia).

MODULE V NANOMATERIALS AND TOXICITY EVALUATION 09

Designer biopolymers, Procollagen, DNA Polynode, RNA topoisomerase, Protein – magnetic materials, Cyto-toxicity, Geno-toxicity, In vivo tests/assays.

Total Hours: 45

REFERENCES:

1. C. M. Niemeyer, C. A. Mirkin, Nanobiotechnology: Concepts, Applications and Perspective, Wiley – VCH, 2004.
2. 2 T. Pradeep, —Nano: The Essentials, McGraw – Hill education, 2007.
3. Nicholas A. Kotov, Nanoparticle Assemblies and Superstructures, CRC, 2006.
4. David S Goodsell, “Bionanotechnology”, John Wiley & Sons, 2004.

OUTCOMES:

- After the completion of the course the student will have the basic knowledge of nanotechnology in biotechnology. In detail understanding of the application of Nanomaterials in biotechnology and acquire the knowledge about the DNA, proteins, amino acids, drug delivery, biomedicine etc.

LSCY115 PROTEIN ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- This course aims to develop in the students' mind a concept regarding the structure and function of proteins of particular importance, the student will know the production of recombinant protein and in general how to engineer protein to be used as therapeutics.

MODULE I INTRODUCTION TO PROTEIN ENGINEERING 09

Forces stabilizing proteins – Van der waals, electrostatic, hydrogen bonding and weakly polar interactions, hydrophobic effects; Entropy – enthalpy compensation, Protein engineering and its applications, features or characteristics of proteins that can be engineered (definition and methods of study) – affinity and specificity; Spectroscopic properties; Stability to changes in parameters as pH, temperature and amino acid sequence, aggregation propensities, etc.

MODULE II TECHNIQUES FOR PROTEIN ENGINEERING 09

Methods of measuring the stability of a protein; Spectroscopic methods to study physicochemical properties of proteins: far-UV and near-UV CD; Fluorescence; UV absorbance; ORD; Hydrodynamic properties–viscosity, hydrogen-deuterium exchange.

MODULE III SITE DIRECTED MUTAGENESIS AND PROTEIN ENGINEERING 09

Altering Proteins by mutagenesis methods, techniques for Oligonucleotide directed mutagenesis by using single stranded DNA as template, Denatured double stranded DNA as template, PCR based mutagenesis, Engineering proteins by chemical modifications, Genetic fusion of domains, alteration of function by selection and screens, deletion mutagenesis. Introduction of selected mutagenesis by Oligonucleotide directed mutagenesis, Scanning mutagenesis, Insertion of unnatural mutagenesis.

MODULE IV ENGINEERING PROTEINS FOR PURIFICATION 09

Introducing cleavage sites, engineering Proteins for Chromatography, Immunoaffinity chromatography, Ion exchange chromatography, Metal affinity chromatography.

MODULE V STABILIZATION AND MODIFICATION OF PROTEINS 09

Principles of structure stabilization by solvent components, sources of exclusion, Balance between cosolvent exclusion and binding, cosolvent intertactions in the denaturation reaction, Practical considerations, Post translational modifications- Involving peptide

bond, C-terminal, side chain. Modification methods- Enzymatic, Non enzymatic, Specificity, chaperones mediated. Applications of Post translational modifications.

Total Hours:

REFERENCE:

1. Andreas D. Baxevanis& B.F. Francis Ouellellette, Bioinformatics. A Practical Guide to the Analysis of Genes and Proteins, John Wiley & Sons, UK, 1998.
2. Baxevanis A. D, Ouellette B. F. F. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins. 3nd edition Wiley, John & Sons, Incorporated, 2004.

OUTCOMES:

- After the completion of the course the student will have the basic concept regarding the structure and function of proteins of particular importance, the student will know the production of recombinant protein and in general how to engineer protein to be used as therapeutics.

LSCY131 BIOREMEDIATION

L	T	P	C
3	0	0	3

OBJECTIVES

- To impart sufficient scientific understanding of the current environmental tribulations and global concern.
- To focus the process of bioremediation, mechanisms, types, success stories & monitoring strategies.
- To focus the advance molecular techniques to facilitate bioremediation technology.
- To focus on advanced nuclear remediation program.
- To apply the concepts of bioremediation technology to the real time problems.

MODULE I BIOREMEDIATION 09

Introduction to Bioremediation: Types of Bioremediation, Factors affection Bioremediation. Bioremediation - Mechanisms.Limitations of Bioremediations. Microbes for Bioremediation: Essential Chararcteristics of Microbes for Bioremediation, Microbial Adapadation for Adverse conditions. Microbes involved in Bioremediation. Metabolic process involved in bioremediation. Bioremediation Techniques : Insitu & Exsitu bioremediation techniques. Phytoremediation.

MODULE II SPECIFIC BIOREMEDIATION TECHNOLOGIES 09

Application, specific advantages and disadvantages of specific bioremediation technologies - land farming, prepared beds, biopiles, composting, bioventing, biosparging, pump and treat method, constructed wet lands, use of bioreactors for bioremediation.

MODULE III BIOREMEDIATION OF CHLORINATED COMPOUNDS AND MOLECULAR TECHNIQUES IN BIOREMEDIATION 09

Bioremediation of phenols, chlorinated phenols, chlorinated aliphatic compounds, heterocyclic compounds, cyanides, dyes; Rhizoremediation: a beneficial plant-microbe interaction; Molecular techniques in bioremediation- Enhanced biodegradation through pathway engineering; Biodegradation of polyhalogenated compounds by genetically engineered bacteria.

MODULE IV NUCLEAR WASTE BIOREMEDIATION 09

Spent fuel characterisation, storage and disposal; Partitioning, transmutation and conditioning; Measurement of Radioactivity in the environment; Basic actinide research.

MODULE V HEAVY METAL AND OIL SPILL BIOREM EDIATION 09

Heavy metal pollution & sources; Microbial interactions with heavy metals - resistance &tolerance ;Microbial transformation; Accumulation and concentration of metals. Biosorption of heavy metals by microbial biomass and secondary metabolites – Biosurfactants. Advantages of biosurfactants over chemical surfactants.; Biotechnology and oil spills; Improved oil recovery.

Total Hours: 45

REFERENCES:

1. Bruce E. Rittmann, Perry L. McCarty, “Environmental Biotechnology: Principles and Applications” McGraw-Hill, 2001.
2. Phillip L. Buckingham , Jeffrey C. Evans,” Hazardous Waste Management” Waveland Pr Inc; Reissue edition 1, 2010.
3. S. K. Agarwal, “Environmental Biotechnology”, APH Publishing, 2000
4. Martin Alexander, “Biodegradation & Bioremediation”, Academic press, 1999.
5. Karrely D., Chakrabarty K., Omen G.S, “Biotechnology and Biodegradation”, Portfolio Pub. Co., 1990. 6. P. Rajendran, P. Guansekaran, “Microbial Bioremediation”, Mjp Publishers, 2011

OUTCOMES:

- After the completion of the course the student will have sufficient scientific understanding of the current environmental tribulations, global concern

B.S. Abdur Rahman Crescent Institute of Science & Technology
Deemed to be University u/s 3 of the UGC Act, 1956
GST Road, Vandalur, Chennai 600 048

REGULATIONS - 2017

FOR

DEGREE OF MASTER OF ARTS

M.A. ISLAMIC STUDIES

VISION AND MISSION OF THE SCHOOL OF ISLAMIC STUDIES

VISION

The School looks forward to be a pioneer in the field of Islamic Studies to promote Scholars, capable of bringing about positive change for the betterment of self, family, society and humanity on the basis of moderate approach derived from the Holy Quran and Sunnah - Tradition of the Prophet (PBUH).

MISSION

The School is committed:

- To empower the younger generation through quality education in both revealed and scientific knowledge.
- To promote competent, creative scholars in the field through scientific research.
- To provide excellent ambience for language skill development and leadership qualities through various training programmes.

PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES

M.A ISLAMIC STUDIES

OBJECTIVES:

The programme objectives covering all two years of post graduate courses are as follows:

1. To acquire revealed knowledge of Quran and Hadeeth (Traditions of Prophet (PBUH).
2. To develop students' ability in analyzing texts of Quran and Hadeeth as sources of Islamic Jurisprudence.
3. To train students in finding solutions for modern issues of family life and social life in the light of Quran and Hadeeth.
4. To develop students' language skills in both Arabic and English.
5. To learn about Muslims achievements and contributions to science and technology.

OUTCOME:

A successful learner of this programme will be able to:

1. Demonstrate Islamic viewpoints to people from all walks of life.
2. Derive principles and theories from the sources of Islamic jurisprudence.
3. Compare views of different schools of thought by applying principles of jurisprudence.
4. Address modern issues related to family and social life in the Islamic perspective.
5. Translate and interpret texts from Arabic to English and vice versa.
6. Pursue higher studies in Islamic studies, Arabic language and other fields.

B.S.Abdur Rahman Crescent Institute of Science and Technology

School of Arabic and Islamic Studies

Curriculum and Syllabus - M.A. Islamic Studies (Revised 2017)

Semester I

S.No.	Course Code	Name of the Course	L	T	P	C
Core Courses						
1	ISC 6101	Thematic Tafseer : Commentary of Holy Qur'aan	3	0	0	3
2	ISC 6102	Analysis of Hadeeth Literature	3	0	0	3
Allied Courses						
3	ISC 6103	Advent of Islam in India	3	0	0	3
4	ISC 6104	Communicative Arabic	3	0	0	3
5	ISC 6105	Early Muslim Society & Biography of great companions	3	0	0	3

Semester II

S.No.	Course Code	Name of the Course	L	T	P	C
Core Courses						
1	ISC 6211	Uloom - Sciences of Qur'aan and Hadeeth	3	0	0	3
2	ISC 6212	Usool al Fiqh: Maslaha Mursalah (Welfare) & Maqaasid al Sharee'ah (Objectives of Shareeah)	3	0	0	3
3	ISC 6213	Evolution of Islamic Jurisprudence	3	0	0	3
Allied Courses						
4	ISC 6214	Islamic Economics	3	0	0	3
5	ISC 6215	Advanced Arabic Grammar	3	0	0	3

Semester III

S.No.	Course Code	Name of the Course	L	T	P	C
Core Courses						
1	ISC 7101	Comparative Fiqh - Jurisprudence	3	0	0	3
2	ISC 7102	Law of Administration in Shari'ah: Al Siyasah al Sharayiyyah	3	0	0	3
Allied Courses						
3	ISC 7103	Islam in Spain - Andalusia	3	0	0	3
4	ISC 7104	History of Muslim Civilization: Contribution to Science and Technology	3	0	0	3
5	ISC 7105	Muslim Thinkers & Reform Movements in Modern Era	3	0	0	3

Semester IV

S.No.	Course Code	Name of the Course	L	T	P	C
Core Courses						
1	ISC 7211	A Study of Shari'ah Rulings in Qur'aan: Ahkaamul Qur'aan	3	0	0	3
2	ISC 7212 / ISC 7216	Ijthihad and Research Methodology of Imams (Or) Research Methodology	4	0	0	4
Allied Courses						
3	ISC 7213	Interest Free Banking	3	0	0	3
4	ISC 7214	Business Arabic and Translation	3	0	0	3
5	ISC 7215	Research / Dissertation	4	0	0	4

SEMESTER I

CORE COURSES:

ISC 6101	THEMATIC TAFSEER : COMMENTARY OF HOLY QUR'AAN	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course aims to:

- Introduce the General Themes of the Holy Qur'aan.
- Imparting main and sub themes in Chapters: Al A'raf, Al Israa & Al Qasas
- Focus on teaching of the Divine messages about the last day of Judgement and signs.

MODULE I		**8**

Evolution of Thematic Tafseer- commentary of Qur'an - Modern authors and their contribution to the field - Shaik Al Ghazzali – General Themes, Sub Themes and the messages in different portion of Surah Al A'raf.

MODULE II		**7**

Introduction to Main Themes of Sura al Israa - Sub Themes and the messages in different portion of Surah Al Israa - Introduction to Main Themes of Sura al Qasas- Sub Themes and the messages in different portion of Surah Al Qasas.

MODULE III		**8**

Introduction to Main Themes of Sura al Hujuraath - Discussion about the various ethics and values taught in Sura Al Hujurath – Discussion on Main themes and Sub Themes of Sura al Munafiqoon- Drawing the different moral lessons from Sura Al Munafiqoon - General Themes, Sub Themes and the messages in different portion of Surah Al Mulk.

MODULE IV		**7**

Discussion about the signs of last day of Judgement in Sura Al Haaqqah- Debate about the signs of last day of Judgement in Sura Al Muddassir - Conversation about the signs of last day of Judgement in Sura Al Qiyamah - Discussion about the signs of last day of Judgement in Sura ad Dahr.

MODULE V		**8**

Discussion about the Themes and sub themes of Sura An Naba – Evaluation of

Themes of Sura al Nazi'ath – Assessment of Themes and Sub Themes in Sura Abas – Discussion about the signs of Qiyama in Sura at Thakveer - Conversation about the indications of Qiyama in Sura al Infithar.			
MODULE VI			**7**
Discussion about the signs of Qiyama in Sura al Inshiqaq – Discusion about the signs of Qiyamah in Sura al Ghashiya – Debate on the themes of Sura az Zilzal - Discussion about the themes of Sura al Qari'a and Sura al Thakasur.			
			L – 45; Total Hours –45

TEXT BOOKS:

1. Nahwa Thafseer Mawdoo'yee li suwaril Qur'aanil Kareem, Sheik Mohammed Gazzali, 4th edition, 2000, Daarus Shurooq, Cairo.

REFERENCES:

1. At Tafseerul Mawdooyi Li Suwar Al Quran Al Kareem, Nukhbathun Min Ulamayit Tafseer Wa Uloomul Quran, University of Sharjah.

OUTCOMES:

On successful completion of the course, the student will be able to:

- **Define the concepts and Themes of Qur'aan.**
- **Analyze the main and sub themes in Chapters: Al A'raf, Al Israa & Al Qasas.**
- **Discuss about Divine messages about the last day of Judgement and its indications.**

ISC 6102	ANALYSIS OF HADEETH LITERATURE	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course aims to:

- Introduction to the Textual criticism of Hadheeth.
- Difference between Textual criticism and criticism of Sanad- Reporters Textual criticism of companions especially like Ayisha (rali).

MODULE I		8

Definition of an-naqd - Textual criticism – An Naqd Indal Muhaddiseen - Evolution Textual criticism - An naqd at the time of prophet - Al kizb ala Rasool - Naqd of meanin Hadees - Naqd of Ruwath on the aspect of labth - Bayanuth thaftheesh an adalath ruwath - Al Muthalaba bil Isnad - Knowledge of Ilm ul jarah Wa Tha'deel - Signifi dispute in jarah va tha'deel - Ilalul Reasons of Hadeeth - Famous authors in jarah tha'deel.

MODULE II		7

Imams in the field of Hadeeth criticism - Sahaabas who criticized Narrators - Tex criticism in period of Thaabiyeen - Reasons for emerging criticism of Hadeeth - Labt rawi va asaruhu in Hadheeth text - Definition of al-labth - Mujrihathul-labth - Riway Report text with original wording and reporting only meaning - Slow teaching by proph Naqdu of Prophet - Report by meaning and its kinds - Al-mufassar - Al-muhkam - mushkil - Al-mujmal - Al-muthashabih - An-nass - Al-dhahir.

MODULE III		8

Definition of At-tha'arudh- conflict- Conditions of tha'arudh – The True conflict -tha'aru Different Hadeeth texts- Method of defending the conflicts- Methodology of Shaafi Sch Methodology of Hanafi School- Methodology of Ibn Al Hajar- Combining the diffe Hadeeth - Definition and conditions- Principles of Combining the different Hadeeths types- Examples- Examples from Book of Shafi kithabi Ikhthilafi al hadeeth - Combi the different Hadheeth in ibadaath- Combining the different Hadheeth between al Aa and khass.

MODULE IV		7

Definition of Hadheeth preference -tharjeeh- Masayil fee tharjeeh- Almurajjahathu baina al ahadeeth - Almu'aradha- Preference based on reporters- sanad- Preference

based on reasons - Preference based on attributes of Narrators - Preference based on text- Preference based on external facts - Examples- Definition of Naskh & Its conditions - Difference between al naskhi va thaqyeedh- Difference between al naskhi va thakhsees- Signs of al naskh- Different opinions in mansookh- Examples of Naasikh and Mansookhih.

MODULE V		**8**

Definition of hadeesul mushkil- Difference between mushkil and muthashabih- Reasons of ishkaal- Ranks of Hadeeth of al mushkil- Solving ishkaal of hadeeth- Conflict with reason – Conflict with reality - Interpretation of ibn quthiba- Hadheeth Qudsi and modern criticism.

MODULE VI		**7**

Metodology of muhadhiseen in textual criticism - Yard stick of textual criticism in the period of sahaba- Referring Hadeeth text to Qur'aanic concept- The First Example- The second example- The third example- The fourth example - The fifth example - The sixth example - The seventh example.

			L – 45; Total Hours –45

TEXT BOOKS:

1. Juhoodul Muhaddeetheen Fee Naqdu Mathan Al Hadeeth An Nabawiyyi As Shareef, Dr. Mohammed Thahir Al Jawabi, 1986, Muassasaathu Abdul Kareem, Tunis.

REFERENCES:

1. Dhiraasat fee Uloom Al Tafseer wal Hadeeth Al Nabawi by Dr. Nisar Ahmad, Chennai, India.
2. Nukhbah al Fikr by Ibn Hajar al Asqalaani, Deoband, India.

OUTCOMES:

On successful completion of the course, the student will be able to:

- **Differentiate between Textual criticism and criticism of Sanad- Reporters**
- **Demonstrate the level and extend of Textual criticism**

ALLIED COURSES:

ISC 6103	ADVENT OF ISLAM IN INDIA	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course aims to:

- Introduction to the advent of Islam in India
- Familiarize the student with arrival of Muslims to Indian Sub continent
- Teach about the contribution of early Arab trades and Sufis to spread of Islam in India.
- Impart the brief history of Muslim rulers in India

MODULE I		8

Pre-Islamic History: An Overview – Persian and Roman Empire – Outline of Islamic His - Muslim traders at Malabar & Maldep coast in the era of Umar (ra) - First battle Usman As Saqfi - Arrival of Muhammad Bin Qasim (712 AD) – Ghaznavi and his expeditions.

MODULE II		7

Shahab-ud-din Ghori - Delhi Sultanates - Qutab ud din Abik (1206-1210) – Altmish (1211-1236) - Razia Sultana (1236-1239) - Ghias ud din Balban (1266-1286) – Khilji Dynasty - Jalaludin khilji (1290-1295) - Alauddin Khilji (1295-1315).

MODULE III		7

Tughlaq Dynasty - Ghias ud din Tughlaq (1320-1325) - Mohammad Tughlaq (1325-1351) - Feroz Tughlaq (1351-1388) - Sadat Family - Mubarak Shah (1421-1434) - Lodhi Family: Behlol Lodhi (1451- 1489) - Sikandar Lodhi (1489-1517) - Ibrahim Lodhi (1517-1526).

MODULE IV		8

Mughal Dynasty - Zaheerudin Babar (1526-1530) - Naseer ud din Humayun (1530-1540) – Sher Shah Suri (1540 – 1555) - Jalaluddidn Akbar (1556-1605) - Nooruddin Jahangir (1605-1627) – Muhammad ShahJahan (1627-1658) - Aurangzeb Alamgir (1658-1707) – Decline of Mughals - Bahadur Shah Zafar (1837-1857) - Reasons for Decline of Mughals.

MODULE V		7

Impact of Islam in Sub Continent – Prominent Muslim Preachers - Khawaja Moeen Ud Din Chishti - Khawaja Nizam Ud Din Aulia - Civilization of Sub-Continent before Islam - Caste system, Usury, drinking and gambling - Status of women.

MODULE VI			**8**
Influence of Islam - Human Equality, Social justice, Ethical life - Muslim Reformers & movements - Shah Wali Ullah - Jihadi Movement- Faraizi Movement- Educational Movements - Aligarh Movement.			
			L – 45; Total Hours –45

TEXT BOOKS:

1. Advent of Islam in India, compiled by School of Arabic and Islamic Studies, 2017.

REFERENCES:

1. A Short History of Muslim Rule in India, Dr. Ishwari Prasad, 1931, The Indian Press, Allahabad.

2. Taareekhul Mughal Fil Hind, Dr. Yoosuf Koken, 1978, Haafiza Press, Chennai.

3. History of Early India, Dr. Romila Thapar, 2001, Penguin Books, London

OUTCOMES:

At the end of the course, the student is expected to:

- **Explain way and mean of spread of Islam in Indian Sub Continent.**
- **Estimate the contribution of Arab traders and Sufis and rulers**
- **Demonstrate the administration of Muslim rulers in India**

ISC 6104	COMMUNICATIVE ARABIC	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course aims to:

- Enable the students to develop the interpersonal and communicative skills in Ara Language through learning basic vocabulary and phrase/sentence structures.
- Familiarize the student the use of the language according to context, purpose an audience.

MODULE I		**8**
Lesson 1: Al Qur'aan wa Kaif Jumia – Lesson 2: Adhwaa ala al Thareekh		
MODULE II		**7**
Lesson 3: Al Muslimoon fil Aalam – Lesson 4: Ibn Seena		
MODULE III		**8**
Lesson 5: Risalah Ila Waladi – Lesson 6: Fee Bait al Maqdis		
MODULE IV		**7**
Lesson 7: Al Shaja'ah al Adabiyah – Lesson 8: Sihhatul Bee'ah fil Islam		
MODULE V		**8**
Lesson 9: Awqaat al Faraagh – Lesson 10: Al Usus al Ijthimaiyyah fil Islam		
MODULE VI		**7**
Lesson 9: Awqaat al Faraagh – Lesson 10: Al Usus al Ijthimaiyyah fil Islam		
		L – 45; Total Hours –45

TEXT BOOKS:

1. 1. Al Arabiyah Lin Nashieen - Part :6 - (Education Ministry, K.S.A.), Bukhari Aalim Arabic College, 2005.

REFERENCES:

1. Durus Al Lugathil Arabiyya by Dr. F. Abdur Raheem, Published by Islamic Foundation Trust, Chennai, 2002.

2. Al Qirathul Arabiyya Lil Mubtadiyeen (Ummul Qura University, Makkah), Bukhari Aalim Arabic College, 2005.

OUTCOMES:

At the end of the course, the student is expected to:

- **Read and understand Arabic language elements that have been recombined**

in new ways to achieve different meanings at a similar level of simplicity.

- **Articulate minimum courtesy requirements and maintain very simple face-to-face conversations.**
- **Formulate and respond to simple questions.**

ISC 6105	EARLY MUSLIM SOCIETY & BIOGRAPHY OF GREAT COMPANIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course aims to:

- Introduction to companions of the prophet
- Impart various personalities of Sahaabah and their contribution to different field.

MODULE I		**8**
Introduction to the Muslim society in madinah – Kulafa- Abubakker siddiq – Umer ibnul Kadab- Usman ibn Affan – Ali ibn abithalib		
MODULE II		**7**
Commanders – Khalid bin Walid - Abu Ubaidha – Sa'd bin Abi Waqqas -Jafar bin Abi Thalib		
MODULE III		**8**
Traders - Abdur Rahman bin Awf- Abu sufyan- Thalah - Hudhaifa bin al Yaman – zaid ibn Harida		
MODULE IV		**7**
Fuqaha- Abdullah ibn Masood – Abdullah ibn Umer- Abdullah ibn Abbas – Muad ibn Jabal – Amr ibnul Aas		
MODULE V		**7**
Hufful Qur'aan & Hadeeth – Ubai ibn qab- Zaid ibn thabid – Abu Huraira - Abu Musa al-Ashari		
MODULE VI		**8**
Safiyyah binth Abdil Muthalib – Ayisah binth Abi Bakr – Hunasa – Fathima raliyallah - Asmaa binth Abi Bakr. Ramlah binth Abi Sufyan (Ummu Habeebah).		
		L – 45; Total Hours –45

TEXT BOOKS:

1. Suwarum min Hayath al Sahabah by Dr. Abdur Rahman Ra'fath Basha, World assembly of Muslim youth, Saudi Arabia.

REFERENCES:

1. Usudul Ghaaba Fee M'arifat As Sahaba, Abul Hasan Al Jazari, 1st Edition, 1996, Daru Ihyau at Turath Al Arabi, Beirut.

OUTCOMES
At the end of the course, the student is expected to: - **Analyze personalities of companions of the prophet** - **Extract inspiration of role models of Companions** - **Demonstrate their valuable contribution to various fields.**

SEMESTER II

CORE COURSES:

ISC 6211	ULOOMUL QUR'AAN AND HADEETH	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course aims to:

- Introduce the students the Qur'aanic science – Usool Al Tafseer and Science of Hadith – Usool Al Hadith.
- Teach the basic themes of Qur'aan: classified into five points.
- Provide the student with classification of authenticity of Hadith.

MODULE I		8

Wahy: Divine Revelation – types of Makki & Madani - Difference between makkan and madeenan - Asbaab an-Nuzool- Benefits of sababun nuzool - Total revelation and Intermittent revelation – Wisdom of Intermittent revelation - Collection and Arrangement of the Qur'aan.

MODULE II		7

Compilation of the Qur'aan in the period of Abu Bakr – Compilation of the Qur'aan in the period of Usman - Arrangement & order of the Verses and chapters – Revelation of Qur'aan in seven dialects and its wisdom - The rules needed by the interpreter - Almuhkam (Clear) and muthashabih (Obscure) - Difference in knowledge of similarity – Aam (general) Khaas (specific)

MODULE III		8

Naskh: Abrogation - Knowledge Of abrogation - Conditions For abrogation **-** Sections And Kinds Of Naskh- Mutlaq (Absolute) Muqayyad (Qualified) - Mantooq (Stated) Mafhoom (Implied) Meanings - The Miracle Of The Qur'aan - Scientific Literary and Legislation Miracle - Translation Of Qur'aan Tafseer And Ta'weel- Conditions Of Interpreters And Standard Behaviours.

MODULE IV		7

Definition of Prophetic Tradition - Hadith Al-Qudsi and the difference between Al-Qur'aan and Al-Hadith Al-Qudsi - Prophetic Tradition and its status in the Islamic legislation - Compilation of Prophetic Tradition - Traditions regarding prohibition and permissible of Hadith compilation - Uloomul Hadith, its origin and development -

Knowledge of Hadith narrators - Knowledge about Criticism of Narrators.		
MODULE V		**8**
Origin of Ilmul Jarh wat ta'dil - Stages of Jarh wat ta'dil - Aahaad Hadith - Types of Khabarul Aahaad with regard to its strength and weakness - Classification of AlKhabar AlMaqbul Ilaa Mamool wa gairi mamool - Nasikh and Mansukh -Weak Hadith.		
MODULE VI		**7**
Al-Mardud based on missing narrator - Al-Mardud based on criticized narrator – Types of Hadith: Ilaa man usnida ilaihi - Turqut tahammul wa siyagul adaai - Ilmut takhreej - Turqut takhreej – Study on chain of narrators.		
		L – 45; Total Hours –45

TEXT BOOKS:

1. Al Itqaan fee Uloom al Qur'aan by Imam Suyuthi/ Idarah Rasheediya, Deoband, India.

REFERENCES:

1. An approach to the Qur'aanic Science by Justice Mufti Mohamed Taqi Usmani , Ed-2007, Adam Publishers, Delhi
2. Mabaahith fee Uloom al Qur'aan by Manna' al Qattan, Ed. 1995, Maktabah Wahbah, Cairo, Egypt.
3. Al Fauzul Kabeer fee Usool al Tafseer by Imam Shah Waliullah Dehlavi, Fourth Edition-2002, Darus Sunnah, Lucknow, India.

OUTCOMES:

At the end of the course the student will be able to:

- **Classify the Qur'aanic science – Usool Al Tafseer and Science of Hadith – Usool Al Hadith.**
- **Analyze the five points which are considered as basic themes of Holy Qur'aan.**
- **Explain the various kinds of authenticated and unauthenticated Hadiths.**

ISC 6212	USOOL AL FIQH: MASLAHA MURSALAH (WELFARE) & MAQAASID AL SHAREE'AH (OBJECTIVES OF SHAREEAH)	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course aims to:

- Introduce the students the Shariah rulings based on public welfare (Maslaha Mursala).
- Teach the objectives of Shariah and its various kinds.
- Impart the application of Maqaasid in modern issues with examples of fatwas and resolutions of Fiqh academy.

MODULE I		8

Sources of Islamic Jurisprudence – Introduction to Maslaha Mursala - The difference of opinion among the scholars in Maslaha Mursala – The evidences presented by those who accept Maslaha Mursala - The evidences and arguments presented by Imam Malik towards Maslaha Mursala – The arguments of those who reject Maslaha Mursala.

MODULE II		7

The rulings derived by Imam Malik based on Maslaha Mursala - The objectives of rulings – The considerable welfare – The five points of Hujjatul Islam Imam Ghazzali in terms of Maqaasid.

MODULE III		8

All rulings based on the reasons – Ranks of Maslaha – The rank variation in the religious obligations (Takleefat) – Legal Provisions for Removal of harm and avoiding loss & damage.

MODULE IV		7

Maqasid Tashree': Introduction – Dharooriyat - Hajiat – Tahseeniyat – Mukmilat – The rulings derived based on Customary Law (Urf and Aada') , Al Istihsan and Sadd Dhareeah.

MODULE V		8

Orders of Maqaasid - Qawaid Kulliyah - The fundamental five Qawaaid – Application of Maqaasid Shariah in deriving modern Shariah rules by Muftis and Fiqh Academy – Examples and analysis.

MODULE VI			**7**
Introduction to Ijthihad - Qualification and conditions for Mujtahid - Individual Ijthihad and collective Ijthihad - Ijthihad on new issues - Ijthihad for preferring the opinions – Difference between fatwa and judgement.			
			L – 45; Total Hours –45
TEXT BOOKS:			
1. Usool al Fiqh al Islami by Wahbah Zuhaili , Second Edition 1998 , Dar al Fikr al Muasir, Beirut, Lebanon			
REFERENCES:			
1. Usoolul Al fiqh, Mohammed abu Zahra, 1958. 2. Al Muwafaqaat Fee Usool Al Ahkaam, Part II, Imam Al Shaatiby, 1969, Maktabathul Mohammed Ali wa Awladuhu, Cairo.			
OUTCOMES:			
At the end of the course the student will be able to: - Realize the importance of Maslaha Mursala in Shariah rulings. - Demonstrate various kinds of Objectives of Shariah and their application in issuing Fatwa on modern issues.			

ISC 6213	EVOLUTION OF ISLAMIC JURISPRUDENCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course aims to:

- Introduce the evolution of Fiqh (Islamic Jurisprudence).
- Explain various stages of development after the Prophet.
- Familiarize the student with modern codification of Islamic Jurisprudence in vario Muslim countries.

MODULE I		**8**

Introduction to the Legislation - Wahi revelation: Makkan Period, Madinan Period - Ijthih of prophet and his companions during his life time.

MODULE II		**7**

Compilation of Holy Qur'aan - Methodology of companions - Ijthihad of Umar, Ibn Masood, Ibn Umar and Ijthihad of next generation.

MODULE III		**7**

Development of four madh-habs: Maliki, Hanafi, Shafi, Hanbali

MODULE IV		**8**

Development of Fiqh after Four Imams – Various countries where the Madaahib were practiced.

MODULE V		**7**

Codification of Muslim personal Law in Turkey, Egypt and other Muslim nations.

MODULE VI		**8**

Codification of Muslim personal Law in Turkey, Egypt and other Muslim nations.

			L – 45; Total Hours –45

TEXT BOOKS:

1. Tareekh Tashree' al Islami by Manna' al Qattan, Maktabah Wahbah, Cairo. 1989.

REFERENCES:

1. The Evolution of Fiqh by Abu Ameenah Bilal Philips, Tawheed Publications, Riyadh, 1988.

OUTCOMES:

At the end of the course, the student is expected to:

- **Describe the evolution of Fiqh and its stages.**

- **Demonstrate the development of Fiqh in the golden period of Imams.**
- **Analyze the Modern codifications of Fiqh.**

ALLIED COURSES:

ISC 6214	ISLAMIC ECONOMICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course aims to:

- Introduce the students the basic concepts of Islamic economics in modern scenario.
- Enable the students to understand the significance of historical changes that take place in global economy
- Teach the students to use appropriate Islamic financial transaction concepts to provide solutions to the modern economic crisis
- Familiarize with the various kinds of financial terms.

MODULE I		8

An overview of Islamic Economics – Human nature, Materialism, Ownership and Universalism – Economic power – Islamic Economic Organization – Role of Money – Interest and Public debt – Islamic concept of Money – Banking in Islamic Economy.

MODULE II		7

Consumer Behaviour – Islamic values and consumer behaviour – Conservation of Resources – Contemporary Economic order – Social and political underdevelopment – Over population – Urbanization.

MODULE III		7

Social security system – Fighting poverty in an Islamic framework - Fiscal Management – Islamic principles of taxation – Deficit financing – diffusion of knowledge – Nature of Islamic Economics.

MODULE IV		8

Definition of Islamic Economics – Sources of Islamic Economics – Approach of Islamic Economics - Methodology of Islamic Economics – Need for the methodology – Inductive or deductive reasoning – Problem solving – Process of theorizing.

MODULE V		7

Assumption of an Ideal Islamic Society – General theory of Islamic Economy - Islamic economics in practice – Islamic Banks – Zakath – Waqf – Insurance – Al Hisbah.

MODULE VI		8

Islamic Approach to contemporary economic problems – Unemployment and inflation

– Economic power – Consumer sovereignty – Role of public policy - Holistic approach – Interest free international economic order.			
			L – 45; Total Hours –45
TEXT BOOKS:			
1. An Introduction to Islamic Economics. Muhammad Akram Khan, International institute of Islamic thought, Islamabad.			
REFERENCES:			
1. What is Islamic Economics, Chaper M. Umar, Jeddah 2. Relevance, definition and methodology of Islamic Economics, Dr. Monzer Kahf.			
OUTCOMES:			
At the end of the course the student will be able to: - **Describe the concept of Islamic economic system in modern scenario.** - **Distinguish the Islamic financial concepts from conventional financial system** - **Relate the concepts of Islamic interest free finance in modern financial transactions** - **Apply the various Islamic economic instruments to modern transactions.**			

ISC 6215	ADVANCED ARABIC GRAMMAR	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course aims to:

- Familiarize the students with the advanced rules of grammar.
- Learn grammatical rules of Naaib Faayil, Masdhar, Qasam, Idhafah etc.

MODULE I		8

Sentence: Nominal and verbal - Inna and its sisters - Kaana and its sisters - Na't wal Man'ut - Na't haqeeqi – Na't sababi

MODULE II		8

Al Idhafah: Idhafah al Lafdhiyah – Idhafa al Ma'nawiyah – Al mudhaf ila ya al muthkallim – Maa yudhaafu ilal jumla.

MODULE III		7

Ahkaam al Adad wal Ma'dud with masculine and feminine genders - Numerals: Cardinal and Ordinal numarals.

MODULE IV		7

Al Thasgheer, Al Nasab, Al Ighraa wa al Thahdheer.

MODULE V		7

Al Ikhthisaas, Al Ishthighaal, Al Nudbah.

MODULE VI		8

Al waqf, l'raabul jumal: Al jumal allathee laha mahal min al l'raab, al jumal allathee laa mahalla lahaa min al l'raab.

			L – 45; T – 15; Total Hours –45

TEXT BOOKS:

1. An Nahwul Wadhih (Secondary) by Ali Jarim & Mustafa Ameen (Part: I, II & III) / Faisal Publications, Deoband, India.

REFERENCES:

1.Hidayatun Nahv by Sirajuddin bin Usman al Awdhi & Nizamuddin Mohamed Dahlavi

OUTCOMES:

On successful completion of the course, students will be able to:

- **Explain the various advanced rules of Arabic grammar in a proper manner.**

- **Apply the grammatical rules like Naaib Faayil, Masdhar, Qasam, Idhafah etc on Arabic writing and speaking.**

SEMESTER III

CORE COURSES:

ISC 7101	COMPARATIVE FIQH – JURISPRUDENCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course aims to:

- Compare the fiqh rulings as per the four madhabs.
- Familiarize the student with the concept of rulings in Islamic Shariah.

MODULE I	Jinaayath: (Crimes)	8

Punishable crimes in Shariah are four (1) crime on person, or organs, it is called MURDER. (2) crimes by the genetic organs, it is called ADELTERY. (3) crimes done on property, they are called THEFT, ROBARY, and BURGLARY. (4) Crimes done against the respect and dignity of a person, it is called ACCU SA TION. Revenge (Qisaas). Diyaath.(Blood money). Willful murder. Murder by mistake.

MODULE II		8

Different opinions of Imaams on a Murderer who did the rime by the compulsion of someone, who deserves the punishment? The partner in a murder. The helper to the murder. Definition of Willful murder. Different opinions of Imaams on similar willful murder and similar mistake murder. The condition to be found in the victim. Revenge on many for killing one person. Revenge on male for killing female and vice-versa. Different opinions of Imaam on taking revenge on father for his killing his son and vice-versa. Is receiving Blood money compulsory on the heir of the victim ?

MODULE III		8

Different opinions of Imaam on it. Different opinions of Imaams on what is the rule if the victim excuses the murderer before his death ? The injured person excused the person who injured him, then the injured person died of that injuries. Opinions of Imaams on it. Injuring is two types, one is which deserves the revenge, another one is which deserve excuse. Different opinions of Imaams about the punishment for a group who cut one part of a person. The conditions to be found in the victim. Injuries deserve the revenge. The injuries made in the way of playing or teaching the discipline . injuries that can not be revenged equally.

MODULE IV		**7**
If a person who is right eye blind injured the right eye of another person, what to do ? How to fix the ransom ? If a unmetered boy\girl participates in a murder or causing injury who would deserve the punishment ? Will a doctor deserve punishment if the patient died of his treatment? Will a farmer deserve punishment if a person fell into the well he digged for cultivation? Will a person, who damaged the property of another person, carry the responsibility ?		
MODULE V		**7**
The ransom for each part of body which is injured. How to take revenge on a person who assaulted the eye of another person, the second one lost his sight but the eye is in good condition? Definition of adultery.		
MODULE VI		**7**
The punishment s for who commit it, married and unmarried. A married person, who lost his wife\husband , will be considered as unmarried or married ? How to prove the adultery ? can photo graph, or video clip be accepted as witness for this crime ? A person who was compelled to do this crime.		

			L – 45; Total Hours –45

TEXT BOOKS:

1. Bidayathul Mujthahid va Nihaayathul Muqthasid, By Muhammad bin Ahmad bin Rushd Al qurthubi, Volume 1.

REFERENCES:

1. Al Hidayah – By Burhanuddin Al murghinanai, Volume 1.
2. Fathhul Muieen – By Zainuddin Makhdoom, Al ponnani Al Malabari, Volume 1.

OUTCOMES:

At the end of the course, the student is expected to:

- **Understand the basic ideology of four Madhabs.**
- **Discuss about the Islamic rulings and their framework.**

ISC 7102	LAW OF ADMINISTRATION IN SHARI'AH: AL SIYASAH AL SHARAYIYYAH	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course aims to:

- Teach the student the basic principles of politics in Islamic Perspective.
- Familiarize the student with the concept of governance in Islamic Shariah.

MODULE I		8

Mahna seyashiya lukatthan va sharahan - Al hadin nabawi fee seyasthu saraeya - Hadhil al kulafa fee seyasthu saraeya - Nubudath min kalamil imam ahmed fee seyasthu saraeya - Raeil imam - Wa mada eithibarihe wa mazalathi el amal bi hi - Ar raei wa mada eithibarihe shrahan - Ma la nassa feehi - Ma ehthimalu ujoohan eddathan.

MODULE II		7

Maslahathul mursalaha - Raeil imam - Matha yamalu bi hi fee seyasthu saraeya - Man huwal imam - Kaifa tusasu ad dawlathul muslima - Akwalus shahabathu fee dimmi raei - Radda ashabu raei ala hazihi nukul

MODULE III		8

Ar raeil bathilu wa anwahu - Arraeil mahmood wa anwahu - Ar raeil allathi ufassherun nusus - Ar raeil allathi tawatha ala shalafil ummathi khalafiha - Ezthihadu rraei fee laus sharaei

MODULE IV		8

Maslahathul mursalaha - Eithibars shabha lilmuslaha - Muda eithibar maslahathu feel mazhibul matbuha - Ikthilafil madahibil arbaha feel isthidlal bil maslahathil murshala - Alkarafi wal maslaha - Tazeekul gazzali - As shathibi wal maslaha - Takayyaral ahkamil mabniya alal muslaha

MODULE V		7

Fukhaul asri wal maslaha - Hazathun naas fee asrena - Suruthil amali bi raeil imam - Takayyru raeil imamai be takayyari lurufe - Takayyru raein nbawi fee seysathu sharaeiya - Takayyar raei rasheedin - Al-thafreeq bainal Ebadhaath wal aadhathul - adhuyath wal Mua'malath endhuru ela elaliha wa maqasidhiha.

MODULE VI			**7**
Al-rasool yugayyiru raiyahu thab'an limaslahathi ra'e umar fil jizyath - Ra'e umar fil jizyath - Mawqiful fuqahae minal akhdhi bi-ra'e umar - Ra'aina fee thakeefi ra'e umar - Hagathuna ela hadhal ezthihadhil umari - Ma'aarilil nusoosi wal masalihi - Munaqashathu dha'wa tha'theel umar linnusoosil qath'eyya bi-esmil masalihi - Radhu aami ala ma edha'hoohu alal farooq - Fiqhul waqe' - Fiqhul muwaajanath - Fiqhul awlawiyyath - Fiqhuth thakhyeer.			
			L – 45; Total Hours –45

TEXT BOOKS:

1. As Siyasa ash Sharayiyya, Bukhari Aalim Arabic College, 2017.

REFERENCES:

1. Al-siyasathus shara'eya fee zaw'e nusoosi sharee'athi wa maqasithiha, Yousuf Al-qarzawi.

OUTCOMES:

At the end of the course, the student is expected to:

- **Understand the basic ideology of politics in Islamic view.**
- **Discuss about the Islamic governance and its framework.**

ALLIED COURSES:

ISC 7103	ISLAM IN SPAIN – ANDALUSIA	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course aims to

- Introduce the Islamic History, specially the contribution of Umayyads in Spain to civilization, Culture and social life.

- Familiarize the students with the Muslim rulers in Spain and the important events & the achievements in their period.

- Provide the students the reasons behind the downfall of Muslim dynasty in Spain.

MODULE I		**8**
Andalusia (Spain) – Exploits of Muslims in Spain – Tariq Ibn Ziyad.		
MODULE II		**8**
Establishment of Umayyad dynasty in Spain – Abdur Rahman Ad Daakhil -		
MODULE III		**7**
Different eras of the Muslim governments in Spain – Ali Bin Hamood – Qasim Bin Hamood.		
MODULE IV		**8**
Last days of Banu Umayyads in Spain – Murabitoon – Yousuf Bin Tashifein and battle of Zalaka – Domination of Spain by Yousuf Bin Tashifein.		
MODULE V		**7**
Al Muwahhidoon – Kingdom of Granada – Death of Abu Abdullah – Represssion and Tyranny of Granada Muslims.		
MODULE VI		**7**
Masacre of Muslims – Burning of Muslims and Islamic Books – End of Muslim rule in Spain.		

L – 45; Total Hours –45

TEXT BOOKS:

1. Al Islamu Fil Andalus, Bukhari Aalim Arabic college, 2017.

REFERENCES:

1. The Rise and Fall of Muslims, Saeed Akbarabadi, Adam Publishers and Distributors, New Delhi, 2010.

OUTCOMES:

At the end of the course, the student is expected to:

- **Describe the Islamic history in detail especially the Umayyad history in Spain.**
- **Compile the factors behind the establishment of Umayyad dynasty in Spain.**
- **Discuss the social, economic, cultural and political developments happened during the period.**
- **Analyze the reasons behind the decline of Muslims in Spain.**

ISC 7104	HISTORY OF MUSLIM CIVILIZATION: CONTRIBUTION TO SCIENCE AND TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course aims to:

- impart Muslim civilization and scientific contribution
- improve understanding of Muslim civilization
- acquaint students with development of various field of sciences

MODULE I		**8**
Translation Movement in the 7th , 8th and 9th centuries AD from Greek and Syriac, Baithul Hikma, Mu'thazilah Movement		
MODULE II		**7**
Contribution of Thabith bin Kurrah, Ibn Al-Muqaffa' and Al-Kindhi		
MODULE III		**8**
History of Bimaristan in the Abbasid Period, Contribution of Ibn Sina and Ibn Nafis		
MODULE IV		**7**
Development of Astronomy and Abbasid Period, Contribution of Nasirudin Tusi and Ibn Shatir: Recent researches and their contribution		
MODULE V		**8**
Development of Arts, Crafts , Architecture and Calligraphy in the Medieval Period		
MODULE VI		**7**
Translation from Arabic to Latin from 11th century onwards and its impact on modern European renaissance		
		L – 45; Total Hours –45

TEXT BOOKS:

1. Contribution of Muslims to Technology, Bukhari Aalim Arabic College, 2017.

REFERENCES:

1. History of Islamic Civilization, John Arthur, London.
OUTCOMES:
At the end of the course, the student will be able to: • **describe the Muslim civilization** • **Identify the scientific contribution made by Muslims.** • **conduct independent research on this topic**

ISC 7105	MUSLIM THINKERS & REFORM MOVEMENTS IN MODERN ERA	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course aims to :

- improve students' understanding of trend in Muslims' thought
- Acquaint students with various modern movements.
- impart the differences in the ideology of movements

MODULE I		**8**
Khilafat Movement of 19th century, Jamaludin Afghani and his contribution towards awakening Muslim ummah		
MODULE II		**7**
Muslim brotherhood: Establishment, Leaders and Ideology		
MODULE III		**8**
Salafi and Wahabi Movements, Iran revolution under Ayathullah Khomaini		
MODULE IV		**7**
Jamate Islami: Ideology, History, Contribution of Maududi		
MODULE V		**8**
Tabligh Jamath: Ideology, Establishment, System of functioning and leaders		
MODULE VI		**7**
Muslim Political Parties in India after Independence and their contribution to the Indian democracy		
		L – 45; Total Hours –45

TEXT BOOKS:

REFERENCES:

1. Islam and the promotion of Knowledge, A.R. Momin, Institute of Objective Studies, New Delhi.

OUTCOMES:

At the end of the course, the student will be able to:

- **identify the origin and establishment of modern Muslim movements**
- **Describe the main ideological differences among the movements.**
- **conduct independent research on the subject**

SEMESTER IV

CORE COURSES:

ISC 7211	A STUDY OF SHARI'AH RULINGS IN QUR'AAN: AHKAAMUL QUR'AAN	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course aims to:

- Impart the rulings explained in the Holy Quraan
- Train the students to derive the rulings from Quranic texts.

MODULE I		**8**
Introduction to Ahkamul Quran – Historical development of Ahkaamul Quran – Renowned authors in the subject.		
MODULE II		**7**
Various types of Ahkaam – Definition and debate on Faraaidh, Waajibaath, Ibaaha, Tahreem, Makrooh		
MODULE III		**8**
Examples from various Quranic verses for Ahkaam -		
MODULE IV		**7**
Rulings from Sura Al Baqara – Rulings from Sura An Nisa		
MODULE V		**8**
Rulings from Al Maidah – Rulings mentioned in Chapter An'aam		
MODULE VI		**7**
Methodology of deriving Ahkaam from the Quran – Examples from the experiences of Imaams.		
		L – 45; Total Hours –45

TEXT BOOKS:

1. Ahkaamul Quran, Imam Abu Bakr Jassas, Beirut. Lebanon, 1994.

REFERENCES:

1. Tafseeru Aayathil Ahkaam, Abdul Qadir Shaiba Al Hamd, Muassassathu Uloomul Quran, Damascus.

OUTCOMES:

At the end of the course, the student will be able to:

- **Demonstrate the rulings of Quranic texts.**

- **Derive the various rulings from the Quranic texts.**

ISC 7212	IJTHIHAD AND RESEARCH METHODOLOGY OF IMAMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course aims to:

- acquaint students with methodology followed by renowned Imams in their Ijthihad – research
- impart the different aspects of methodology adopted by Imams.
- impart the impact of their methodology on formation of their schools of thought

MODULE I		**8**
Intoduction to the Ijthihad – Ijthihad in the period of Prophet (Sal) - Ijthihad in the period of Shahabah.		
MODULE II		**7**
Shurut al Ijthihad - Ahl al Hadeeth and Ahl al Ra'i – Al Ifta and its conditions.		
MODULE III		**8**
Imam Abu Haneefah: Biography – Principles of Ijthihad – Brief introduction to Hanafi Madh-hab – Spread of Hanafi Madh-hab.		
MODULE IV		**7**
Imam Malik bin Anas: Biography – Principles of Ijthihad – Brief introduction to Maliki Madh-hab – Spread of Maliki Madh-hab.		
MODULE V		**8**
Imam Shafi'i: Biography – Principles of Ijthihad – Brief introduction to Shafi'i Madh-hab – Spread of Shafi'i Madh-hab.		
MODULE VI		**7**
Imam Ahmad bin Hanbal: Biography – Principles of Ijthihad – Brief introduction to Hanbali Madh		

			L – 45;; Total Hours –45

TEXT BOOKS:

REFERENCES:

1. Tareekh Al Madhaahib al Islamiya by Abu Zahrah / darul Fikr al Arabi, Cairo, Egypt.
2. Tareekh al Tashree' al Islami by Dr. P.S.Syed Masood, Bukhari Aalim Arabic College, Chennai.

OUTCOMES:

At the end of the course, the student will be able to:

- **describe the major elements of Ijthihad methodology**
- **Demonstrate the differences.**
- **identify the different impact of the methodology on Schools of thought**

ISC 7213	INTEREST FREE BANKING	L	T	P	C
		3	0	0	3

OBJECTIVES:

To make the students understand

- basic concepts, sharia'h principles and guidelines on financial transaction
- Foundation and Characteristics of Islamic Finance
- Various aspects of Fiqh-al Muamalath applied to resolve contemporary issues of finance and business transactions.
- To explain the concepts, theories, the origins and development of Islamic banking products
- To expose the students to a wider range of Islamic financing instruments used by Islamic Banks and Financial institutions

The course aims to:

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MODULE I	INTRODUCTION TO SOURCES OF ISLAMIC LAW (SHARI'AH)	

Shariah & Fiqh : Definition and Concept; Sources of Shari'ah: Quran, Sunnah, Ijma, Qiyas; Objectives of Shariah; Concept of Ijtihad and the necessary conditions; Principles of Fiqh: Introduction and importance.

MODULE II	MAJOR PROHIBITIONS IN ISLAMIC FINANCE	

Riba(Interest): Definition and Classification; Gharar (Ambiguity/ Uncertainty): Definition and Classification; Maysir & Qimar (Gambling): Definition and Classification

MODULE III		

Islamic Finance: Definition, Concept, Foundation, Features, Objectives; Islamic Finance Vs Conventional Finance; A Brief introduction of Islamic Financial Instruments and Glossary Of Islamic Finance Terminologies

MODULE IV	DEPOSIT PRODUCTS IN ISLAMIC BANKS	

Islamic Banks Deposits: Current Account, Saving Account, Investment Deposit Account: General Investment Deposit Account, Special Investment Deposit Account; Deposit Management

MODULE V	ISLAMIC MODES OF FINANCING - I	

Equity Based Products: Musharakah, Mudarabah; Deferred sale Financing – Bai

Muajjal & Murabahah;			
MODULE VI	**ISLAMIC MODES OF FINANCING - II**		
Advance Sale Financing Product – Salam & Parallel Salam, Financing Asset under Construction: Istisna & Parallel istisna;			
			L – 45; T – 15; Total Hours –45

TEXT BOOKS:

1. Understanding Islamic Finance By Muhammad Ayub
2. An introduction to Islamic finance By M. Taqi Usmani

REFERENCES:

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1. Islamic Financial Services by Mohammed Obaidullah
2. An Introduction to Islamic Banking & Finance- Abdel Fattah M.Farah
3. Meezan's Bank's Guide to Islamic Bank

OUTCOMES:

Students will be able to:

- **Understand ethical underpinning of Islamic Finance**
- **Develop an appropriate level of understanding of the main principles of interest free banking**
- **Asses the nature and characteristics of different types of contracts, their applications and implication in business transactions.**
- **Differentiate between conventional and Islamic finance products.**
- **Appreciate and apply various Islamic financing techniques used by modern Islamic banks like Musharakah, Mudarabah, Murabahah, Salam & Parallel Salam**

ISC 7214	BUSINESS ARABIC AND TRANSLATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course aims to

- Teach the significance of Arabic communication.
- Train for communication in various situations.
- Develop reading, writing and translation skills.

MODULE I	**Comprehension – Letter writing**	**8**
Personal, Official & Commercial letters.		
MODULE II	**Audio and video listening**	**7**
Introducing technical terms in Arabic.		
MODULE III	**Situational communication**	**8**
In Commercial field, administrative field Vocabularies and examples of usage.		
MODULE IV	**Situational communication**	**7**
In Engineering field and various work fields.		
MODULE V	**Introduction to Translation**	**8**
Translation Method, Comparison of Arabic and English sentence structures, Sample Study.		
MODULE VI	**Translation skill development**	**7**
Arabic to English and vice versa.		
		L-45; Total Hours –45

TEXT BOOKS:

1. Arabic for professional and employees, Bukhari Aalim Arabic College, 2013.

REFERENCES:

1. Secretarial Practice in Arabic by Haneef Palliyath, Darul Huda Book Stall, Calicut, 1996.

OUTCOMES:

At the end of the course, the student is expected to:

- **Describe the importance of commercial communication in Arabic.**
- **Communicate in Arabic in different working fields.**
- **Write letters and translate texts from Arabic to English and vice versa.**

ISC 7215	RESEARCH/ DISSERTATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course aims to:

- Teach the student to do a project on any topic related to Islamic Studies.
- Train him the research methodology and practices.

OUTCOMES:

At the end of the course, the student is expected to:

- **Prepare the dissertation on the prescribed topic.**
- **Analyze the various aspects of the research.**

ISC 7216	RESEARCH METHODOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course aims to:

- impart basic concepts, types of research and methodologies
- train to select appropriate research topics
- train to identify research problem and parameters
- prepare a project proposal (to undertake a project)
- train to organize and conduct research
- highlight forms of plagiarism

MODULE I		8

Meaning of Research – Objective of Research – Motivation in Research – Significance of Research

MODULE II		7

Characteristics of Research – Characteristics of good research – Basic Types of Research: Exploratory research – Testing out research – Problem solving research

MODULE III		8

Primary and Secondary sources – Data collection and computing

MODULE IV		7

Using Library – Taking notes – Documentary bibliography – Footnotes

MODULE V		8

Definition of Plagiarism, Forms of Plagiarism – Consequence of Plagiarism - Copyright

MODULE VI		7

Drafting and writing – Synopsis and Abstracts – Format of thesis

			L – 45; Total Hours –45

TEXT BOOKS:

REFERENCES:

1. MLA Handbook for Writers of Research Papers, Seventh Edition, Affiliated East-West Press Pvt Ltd., New Delhi.

2. Manaahij Al-Bahs Al-Ilmi, Amman University, Jordan, 2006

OUTCOMES:

At the end of the course, the student will be able to:

- **demonstrate basic concepts, types of research and methodologies**
- **select appropriate research topics**
- **identify research problem and parameters**
- **undertake a project**
- **organize and conduct research**
- **refrain from plagiarism in preparing thesis**

VISION AND MISSION OF THE DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

VISION

The vision of the Department of Computer Science and engineering is to impart quality education, inculcate professionalism and enhance the problem solving skills of the students in the domain of Computer Science and Engineering with a focus to make them industry ready, involve in possible areas of research, to pursue and have continual professional growth.

MISSION

- Equip the students with strong fundamental concepts, analytical capability, programming and problem solving skills.
- Create an ambience of education through faculty training, self learning, sound academic practices and research endeavors.
- Facilitate a research culture in the department leading to high quality publications and funded projects.
- To identify potential areas of research and create centre of excellence in those areas.
- Provide opportunities to promote organizational and leadership skills in students through various extra – curricular activities.
- Expose the students to emerging and upcoming technologies through co-curricular events.
- To make the students as for as possible industry ready to enhance their employability in the industries.
- To improve department industry collaboration through internship programme and interaction with professional society through seminar/workshops.
- Imbibe social awareness and responsibility in students to serve the society.

PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES
M.Tech. (Network Security)

PROGRAMME EDUCATIONAL OBJECTIVES

- To provide advanced knowledge and skills required in the area of network security.
- To equip the graduates with required strategies and tools for design and development of secure network systems.
- To impart knowledge to analyze and propose new schemes for the protection system relevant to industry.
- To undertake research in network security.

PROGRAMME OUTCOMES

On completion of the programme the graduates will

- Have knowledge in practices and procedures adopted for software development in security domains.
- Be able to apply tools and techniques for solving problems of network security relevant to the society.
- Be able to undertake need based research with a focus on industry related issues in network security.
- Work as a team exhibiting effective system administrative skills.

CURRICULUM & SYLLABI FOR
M.TECH. (NETWORK SECURITY)
(FOUR SEMESTERS / FULL TIME)

CURRICULUM

SEMESTER I

Sl. No	Course Code	Course Title	L	T	P	C
1	MAB6190	Statistical Techniques for Network Security	3	1	0	4
2	CSB6103	Data Structures & Analysis of Algorithms	3	0	2	4
3	CSB6104	Computer Networks & Management	3	0	2	4
4	CSB6142	Computer Security	3	0	0	3
5		Elective - I	3	0	0	3
6	CSB6101	Research Methodology for Engineers	3	1	0	4
7	CSB6143	Computer security lab	0	0	3	1
8	CSB6144	Term Paper / Seminar	0	0	2	1
						24

SEMESTER II

Sl. No	Course Code	Course Title	L	T	P	C
1	CSB6251	Modern distributed Network system	3	0	0	3
2	CSB6252	Applied Cryptography & Network Security	3	0	0	3
3	CSB6253	Digital and Cyber Forensics	3	0	0	3
4	CSB6232	Information Security	3	0	0	3
5		Elective II	3	0	0	3
6		Elective III	3	0	0	3
7	CSB6254	Cryptography lab	0	0	3	1
8	CSB6255	Information Security (Case Study)	0	0	3	1
						20

SEMESTER III

Sl. No	Course Code	Course Title	L	T	P	C
Theory						
1		Elective IV	3	0	0	3
2		Elective V	3	0	0	3
3		Elective VI	3	0	0	3
4	CSB7201	Software Project Management	3	0	0	3
6	CSB7241	Project - Phase I	0	0	12	6*
						12

SEMESTER IV

Sl. No	Course Code	Course Title	L	T	P	C
1	CSB7241	Project - Phase II	0	0	36	18*
					Total	**18+6=24**

*Credits for Project Work (Phase I) to be accounted along with Project work (Phase II) in IV Semester

TOTAL CREDITS : 80

LIST OF ELECTIVES

Sl. No	Course Code	Course
1	CSBY51	Intrusion Detection
2	CSBY52	Game theory and its Applications
3	MAB6194	Operations Research
4	CSBY53	Public Key Infrastructure & Key management
5	CSBY54	Mobile & Wireless Network security
6	CSBY55	Technical Foundation of E-commerce
7	CSBY56	Biometric Security
8	CSBY02	Soft Computing
9	CSBY08	Embedded Systems
10	CSBY57	Security issues in Cloud Computing
11	CSBY24	Service Oriented Architecture
12	CSBY58	Secure Software Systems
13	CSBY59	Advanced Digital Forensics
14	CSBY60	Advanced Algorithms
15	CSBY61	Human Aspects of Computer Security
16	CSBY18	Hacking Techniques & Digital Forensics
17	CSBY22	Object Oriented Software Engineering
18	CSBY25	Cloud Computing
19	SSBY01	Society, Technology and sustainability

SEMESTER - I

MAB6190	**STATISTICAL TECHNIQUES FOR NETWORK SECURITY**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

OBJECTIVES:

- To become familiar with the state -of - the - art in network measurement.
- To study the use of measurements in modelling, understanding and improving a network.
- To learn several statistical tools for the analysis of network measurements.

PREREQUISITES:

- Engineering Mathematics

MODULE I FOUNDATIONS **7**

Statistical Approaches and Opportunities – Fundamental Statistical Roles and Challenges in Network Security – Statistical Analysis Software.

MODULE II NETWORK TRAFFIC AND DATA CHARACTERISTICS **7**

System Specific Data- User Specific Data – Publicly Available Data – Random Variables – Variable Distributions – Network Data Modules

MODULE III NETWORK DATA MINING AND MODELING **7**

Exploring Network Data – Descriptive Analysis – Visualizing Analysis – Data Transformation – Data Reduction – Data Structure Detection – Sampling Network Traffic – Sample Size

MODULE IV ASSOCIATION AND PREDICTION **8**

Bivariate Analysis – Linear Regression Modeling – Robustness Association – Use Behaviour Pattern – Scoring Methods – Profiling Models.

MODULE V CLASSIFICATION **8**

Supervised Learning – Generalized Linear Methods – Nonparametric Methods – Nonlinear Methods – Unsupervised Learning – Probability Models – Similarity Models – Multidimensional Models.

MODULE VI DECISION ANALYSIS AND EVALUATION **8**

Analysis of Uncertainity – Statistical Control Chart – Ranking –Data Evaluation – Data Reliability, Validity and Quality – Goodness of Classification – Performance Assessment.

L-45; T-15; Total Hours: 60

REFERENCES:

1. Yan Wang, “Statistical Techniques for Network Security: Modern Statistically-Based Intrusion Detection and Protection”, IGI Global, 2008.

2. Eric D. Kolaczyk, “Statistical Analysis of Network Data: Methods and Models”, Springer Series in Statistics, Springer, 2009.

OUTCOMES:

Students who complete this course will be able to

- state applications of statistics in Network Security and apply them in Network Security problems.
- analyze and process the data.
- explain the procedures to predict, classify and evaluate Network Data.

CSB6103	DATA STRUCTURES AND ANALYSIS OF ALGORITHMS	L	T	P	C
		3	0	2	4

(Common to M.Tech (CSE, NS, CPA, CSE-BDA))

OBJECTIVES:

- To develop proficiency in the specification, representation, and implementation of Data Types and Data Structures.
- To carry out the Analysis Time and Space Complexity in different algorithms.
- To explain the applications of Data Structures for various scenarios.
- To relate data structures and algorithms with advanced computer science topics.

PREREQUISITES:

- Discrete Mathematics
- Programming languages

MODULE I INTRODUCTION **9**

The Need for Data Structures - Costs and Benefits - Abstract Data Types and Data Structures - Mathematical Preliminaries - Sets and Relations - Miscellaneous Notation - Logarithms -Summations and Recurrences - Recursion - Mathematical Proof Techniques - Direct Proof - Proof by Contradiction - Proof by Mathematical Induction – Algorithm Analysis – Best, Worst, and Average Cases - Asymptotic Analysis - Upper Bounds - Lower Bounds - Notation - Calculating the Running Time for a Program - Analyzing Problems - Empirical Analysis

MODULE II ELEMENTARY DATA STRUCTURES **7**

List – Stacks – Queues – Binary Trees – Binary Search Trees – Huffman Coding Trees – Non – Binary Trees.

MODULE III SORTING AND SEARCHING **8**

Internal Sorting Techniques – Heap Sort – Quick sort – Merge Sort – Binsort and Radix Sort – Multi Way Merging - Time complexity Analysis of Sorting Techniques – Searching Unsorted and Sorted Arrays – Self – Organizing Lists – Hashing.

MODULE IV ADVANCED DATA STRUCTURES **7**

Elementary Graph Algorithms – Minimum Spanning Tree – Single Source Shortest Path – All-Pairs shortest Path – Balanced Trees – AVL Trees- Red-Black Trees – Splay Trees – B-Trees – 1-2-3 Trees.

MODULE V ALGORITHMIC TECHNIQUES **7**

Dynamic Programming – Greedy Algorithms – Number-Theoretic Algorithms – String Matching algorithms.

MODULE VI LIMITS TO COMPUTATION **7**

Reductions - Hard Problems - The Theory of NP -Completeness – NP - Completeness Proofs - Coping with NP -Complete Problems - Impossible Problems – Uncountability.

L-45; P-15; Total Hours: 60

REFERENCES:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, “Introduction to Algorithms”, 3rd Edition, PHI Learning, 2009.
2. Clifford A. Shaffer, “Data Structures and Algorithm Analysis in C++”, 3rd Edition, Dover Publications, 2011.
3. Mark Allen Weiss, “Data Structure and Algorithm Analysis in C++”, 3rd Edition, Prentice Hall, 2006.

OUTCOMES:

Students who complete this course will be able to

- design correct and efficient algorithm for common computational tasks.
- analyze and design existing algorithms and data structures.
- apply amortized analysis on data structures, including binary search trees, mergable heaps and disjoint sets.

CSB6104 COMPUTER NETWORKS AND MANAGEMENT **L T P C**

(Common to M.Tech (CSE, NS,SE, CSE-BDA)) **3 0 2 4**

OBJECTIVES:

- To gain knowledge on the basic concepts of computer networks and OSI network model.
- To introduce the operation and management of computer networks.
- To understand the paradigms and functions of network management.
- To study the underlying applications and tools for network management.
- To acquire knowledge on broadband networks and its services.

PREQUISITES:

- Operating System

MODULE I FUNDAMENTALS OF COMPUTER NETWORK TECHNOLOGY 7

Network Topology, LAN, Network node components- Hubs, Bridges, Routers, Gateways, Switches, WAN, ISDN Transmission Technology, Communications protocols and standards.

MODULE II OSI NETWORK MANAGEMENT 7

OSI Network management model- Organizational model -Information model, Communication model. Abstract Syntax Notation - Encoding structure, Macros Functional model CMIP/CMIS.

MODULE III INTERNET MANAGEMENT 7

SNMP-Organizational model-System Overview - The information model - Communication Model - Functional model - SNMP proxy server- Management information, protocol remote monitoring.

MODULE IV BROADBAND NETWORK MANAGEMENT 8

Broadband networks and services - ATM Technology-VP,VC - ATM Packet - Integrated service - ATMLAN emulation - Virtual LAN - ATM Network Management-ATM Network reference model, integrated local management Interface- ATM Management Information base-Role of SNMD and ILMI in

ATM Management- M1, M2, M3, M4 Interface- ATM Digital Exchange Interface Management.

MODULE V NETWORK MANAGEMENT APPLICATIONS 8

Configuration management - Fault management - Performance management - Event Correlation Techniques security Management - Accounting management - Report Management- Policy Based Management Service Level Management.

MODULE VI APPLIED NETWORK MANAGEMENT 8

The Need for Management Integration- Management Integration challenge - Approaches to Management Integration- Service Level Management-The Motivation for Service Level Agreements - Identification of Service Level Parameters - Defining a Service Level Agreement- Managing for a Service Level.

L-45; P-15; Total Hours: 60

REFERENCES:

1. Mani Subramanian, "Network Management: Principles and Practices", 2nd Edition, Prentice Hall, 2012.
2. Alexander Clemm, "Network Management Fundamentals", 1st Edition, Cisco Press, 2006.
3. Adrian Farrell, "Network Management Know It All", 1st Edition, Elsevier India, 2008.
4. Richard Burke, "Network Management: Concepts & Practice, A Hands on Approach", 1st Edition, Prentice Hall, 2003.

OUTCOMES:

Students who complete this course will be able to

- correlate the fundamental importance of network information management related to the business objectives of an organization.
- use computer network management tools and the systems.
- apply the basic knowledge of current developments in information and communication technologies, standards and applications to network related applications.
- visualize the effectiveness of Broadband networks and services.

CSB6142	COMPUTER SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide the student with a foundation covering computer security issues
- To determine appropriate mechanisms for protecting networked systems.
- To help organizations increase awareness of security policies and procedures.

PREREQUISITES:

- Cryptography and Network Security

MODULE I INTRODUCTION **7**

Physical Security – Viruses – Worms – Trojan Horses –Principles of Computer Security.

MODULE II IDENTITY THEFT AND PRIVACY **7**

Identity Theft- Shredding – Internet Cookies –Phishing – Homograph Threat – Privacy Issues- Trust.

MODULE III ELEMENTS OF CRYPTOGRAPHY **7**

Principles of Cryptography - Modular Arithmetic - Integrity Check Functions - Kirchoff's Principle – Monoalphabetic -Polyalphabetic Cipher – One Time Pad – Key distribution Problem – Diffie Hellman Key Merkle Keys- Public Key Cryptography – RSA – SSL - Digital Signatures – Encryption - Strength of Mechanisms –Performance.

MODULE IV NETWORK SECURITY **9**

Internet Vulnerabilities- Port Scanning – Spoofs – Spams - Denial of Service – Firewall Basics - Authentication – Local Authentication – Biometric Techniques – Passwords - Access Control Background - Authentication and Authorization - Access Operations - Access Control Structures- Ownership-Intermediate Control - Policy Instantiation - Comparing Security Attributes.

MODULE V DATABASE SECURITY **8**

Introduction - Relational Databases- Access Control - Statistical Database Security – Integration with the Operating System - Privacy.

MODULE VI COMMUNICATION AND WEB SECURITY **7**

Protocol Design Principles - IP Security - IPsec and Network Address Translation-SSL/TLS – Xtensible Authentication Protocol - Web Services Security.

Total Hours: 45

REFERENCES:

1. David Solomon, “Foundations of Computer Security”, 1st Edition, Springer Verlag, 2005.
2. Dieter Gollmann, “Computer Security”, Pearson education, 2010.
3. Charles P. Pfleeger, “Security in Computing”, 4th Edition, Prentice-Hall International, 2006.
4. Christof Paar, Jan Pelzl, Bart Preneel, “Understanding Cryptography: A Textbook for Students and Practitioners”, 1st Edition, Springer, 2010.
5. Bruce Schneider, “Applied Cryptography Protocols, Algorithms, and Source Code in C”, 2nd Edition, John Wiley & Sons, 2007.

OUTCOMES:

Students who complete this course will be able to

- identify fundamental concepts of computer security.
- use the World Wide Web to research the latest security alerts and information.
- compare and contrast types of malicious code, including worms, Trojan horses, and viruses.

CSB6101 RESEARCH METHODOLOGY FOR ENGINEERS **L T P C**

(Common to M.Tech (CSE, SE, NS, IT, IS & DF, CPA, CSE-BDA)) **3 1 0 4**

OBJECTIVES:

- To make the students well versed in Data analysis.
- To describe the steps involved in research process.
- To explain them how to formalize research problems.
- To discuss clearly the approaches for research through some case studies.

PREQUISITES:

- Engineering Mathematics
- Operation Research

MODULE I RESEARCH PROBLEM **8**

The research problem – Sources of research problem – Information, how to deal with it – Criteria / characteristics of a good research problem – Errors in selecting a good research problem – Types of research – Nature and use of arguments.

MODULE II SAMPLING DESIGN AND SCALING TECHNIQUES **7**

Census and Sample survey – Steps in Sampling Design – Different types of Sample Designs – Complex Random Sampling Designs – Measurement scales – Techniques of Developing Measurement Tools – Scaling – Important Scaling Techniques.

MODULE III METHODS OF DATA COLLECTION AND ANALYSIS OF DATA 8

Collection of Primary Data – different types – Some other methods of Data Collection – Collection of Secondary Data – Processing Operations – Types of Analysis – Measures of Central tendency – Measures of Dispersion.

MODULE IV LINEAR PROGRAMMING **10**

Basic of Operations Research (OR): Characteristics of Operations Research – OR and Decision making- Linear programming – Stimulation and Graphical

solution of canonical and standard forms of Linear programming problem – Algebraic solution – Simplex method – Charne's method of penalties – Concept of duality – Properties of duality.

MODULE V TRANSPORTATION AND ASSIGNMENT MODELS 6

Transportation Problem – Assignment Problem – Travelling Salesman Problem.

MODULE VI CASE STUDIES 6

Presentation by students on their area of research.

L-45; T-15; Total Hours: 60

REFERENCES:

1. Kothari, C.R., "Research Methodology: Methods and Techniques", 2nd Edition, New Age International, New Delhi, 2012.
2. Nicholas Walliman, "Your Research Project", 2nd Edition, Vistaar Publication, New Delhi, 2005.
3. Taha H.A., "Operations Research: An Introduction", 7th Edition, Pearson Education Edition, Asia, New Delhi, 2002.
4. Richard A. Johnson, "Miller and Freund's Probability and Statistics for Engineers", 8th Edition, Pearson Education, Asia, 2011.

OUTCOMES:

Students who complete this course will be able to

- identify the research problem.
- become capable of analyzing the data using mathematical techniques.
- learn to apply the probability concepts in research.
- complete simple problems on apply linear programming and transportation models.

CSB6143	COMPUTER SECURITY LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To familiar with network security threats and countermeasures, including common attacks and defensive strategies.
- To work in the real world by applying networking concepts to solve real business problems.
- To explain common vulnerabilities in programs, such as buffer overflows, lack of input sanitization, etc.

PREREQUISITES:

- Network Security

LIST OF EXERCISES :

1. "Networking Basics", how do networks work?
   a) Workstation Network Configuration and Connectivity
   b) TCP/UDP Basics
   c) Network Applications
2. "Vulnerabilities and Threats", how can networks be compromised?
   a) Scanning and Enumerating the Network for Targets
   b) Attacks-Web Server, Email, DOS and Trojan Attacks
   c) Escalating Privilege-Sniffing, Key logging, Password Cracking Attacks
3. "Prevention" How do we prevent Harm to Networks?
   a) Hardening the Host Computer
   b) Securing Network Communications
4. "Detection and Response" How do we detect and respond to attacks?
   a) Preparing for and Detecting Attacks
   b) Digital Forensics

OUTCOMES:

Students who complete this course will be able to

- gain practical experience of analyzing, designing, implementing and validating solutions to computer network security challenges using common network security tools.
- explain how threats to an organization are discovered, analyzed and dealt with.
- use current tools and techniques for assessing network attacks and vulnerability.

SEMESTER II

CSB6251 MODERN DISTRIBUTED NETWORK SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To gain knowledge on distributed communication.
- To understand the working functionality of remote procedure calls.
- To understand the resource utilization in distributed computing environment.
- To study the various network simulators to analyze various functionalities in the networking system.

PREREQUISITES:

- Computer networks

MODULE I FOUNDATIONS OF DISTRIBUTED COMPUTING 8

Distributed computing systems – Evolution of distributed computing systems – Distributed computing system models – What is distributed operating system – Issues in designing distributed operating systems-Message passing – Issues in IPC by message passing –Synchronization –Buffering – Group communication.

MODULE II REMOTE PROCEDURE CALLS 8

RPC Models –Transparency of RPC – Implementing RPC mechanism – Stub generation – RPC messages–Marshaling arguments & results – Server Management – Parameter-passing semantics – Call semantics – Communication protocols for RPCs.

MODULE III DISTRIBUTED SHARED MEMORY AND FILE SYSTEMS 8

General architecture of DSM systems – Design & implementation issues of DSM – Granularity – Structure of shared memory space- Desirable features of good distributed file systems – File accessing models – File sharing– File caching schemes – Fault tolerance.

MODULE IV NETWORK & APPLICATION LAYER 7

Repeaters – Bridges – Routers – Gateway – Routing algorithms – TCP/IP – Overview – Network layer – Transport and application layers of TCP/IP – DNS – SMTP – HTTP – WWW.

MODULE V ISDN & ATM **7**

History of analog and digital network – Access to ISDN – ISDN layers – Broadband ISDN – Packet layer protocol – ATM – ATM architecture – ATM layers – Congestion control – Leaky bucket algorithm.

MODULE VI STUDY OF SIMULATION TOOLS **7**

Study of various network simulators –Designing and evaluating the performance of various Transport and Routing protocols of Wireless networks using any network simulator.

Total Hours: 45

REFERENCES:

1. Pradeep K Sinha, “Distributed Operating Systems, Concepts & Design”, Prentice Hall of India, 2009.
2. Andrew.S.Tenenbaum, “Computer Networks”, 4th Edition, Prentice Hall of India, 2008.
3. Andrew S.Tanenbaum, and Steen, Maarten van, “Distributed Systems”, 2nd Edition, Prentice Hall of India, 2007.
4. Larry L Peterson and Bruce S Davie, “Computer Networks: A Systems Approach”, 4th Edition, Morgan Kaufman Publishers, 2007.
5. Behrouz and Forouzan, “Data Communications and Networking”, 2nd Edition, Tata McGraw Hill, 2007.
6. Kasera and Seth, “ATM Networks: Concepts and Protocols”, 2nd Edition, Tata McGraw Hill, 2005.

OUTCOMES:

Students who complete this course will be able to

- Recognize the advantages and limitations of modern high speed networks.
- Evaluate various technologies and identify the most suitable one to meet a given set of requirements for typical corporate networks.
- Use simulation tool kits for analyzing the network and transport protocols in modern distributed networks.

CSB6252	APPLIED CRYPTOGRAPHY AND NETWORK SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide a practical survey of both the principles and practice of cryptography and network security.
- To know the methods of conventional encryption, concepts of public key encryption and number theory.
- To understand authentication and Hash functions, network security tools and applications, system level security.

PREREQUISITES:

- Cryptography and Network Security

MODULE I CRYPTOGRAPHIC PROTOCOLS **7**

Purpose of cryptographic protocols- protocol Building blocks-Basic Protocols-Intermediate Protocols-Advanced Protocols-Esoteric Protocols.

MODULE II CRYPTOGRAPHIC TECHNIQUES AND ALGORITHMS **8**

Key Length-Key Management-Algorithm Types and Modes-Data Encryption Standard-Other Block Ciphers- Other Stream Ciphers--Public key digital signature algorithms- key Exchange algorithms.

MODULE III SECURITY AND PRIVACY **8**

Security and Privacy in Computing and Communication Networks-Preserving Authentication Protocols for Wireless Mesh Networks-Security from Location-Anonymous Authentication Protocols for Vehicular Ad Hoc Networks.

MODULE IV NETWORK SECURITY **8**

Secure Platform Over Wireless Sensor Networks-Privacy-Secure Digital Watermarking for Fair Content Trading-Lightweight Secure Data Communication Framework Using Authenticated Encryption in Wireless Sensor Networks-Key Establishment Protocol for Wireless Sensor Networks.

MODULE V QUANTUM CRYPTOGRAPHY **7**

Quantum Cryptography-Quantum Key Management-Securing a Telecom Services Using Quantum Cryptographic Mechanisms- Applied cryptography in E-mail, web services and Electronic commerce.

MODULE VI EVOLUTIONARY CONCEPTS AND TECHNIQUES IN SECURITY **7**

Notions of Chaotic Cryptography-Sketch of a Chaos Based Cryptosystem-Chaotic Electronic Circuits in Cryptography-An En/Decryption Machine Based on Statistical Physics-Modern Technologies Used for Security of Software Applications- DNA Cryptography.

Total Hours : 45

REFERENCES:

1. Jaydip Sen, “Applied Cryptography and Network Security”, InTech, 2012.
2. Bruce Schneider, “Applied Cryptography Protocols, Algorithms, and Source Code in C”, John Wiley & Sons, 2nd Edition, 2008.
3. Hamid R. Nemati & Liyang, “Applied Cryptography for cyber security and Defense: Information Encryption and Ciphering”, Information Science Reference, 2011.

OUTCOMES:

Students who complete this course will be able to

- Compare and contrast various conventional and public key cryptographic algorithms.
- apply the concepts of various cryptographic techniques in different research areas.
- compare the modern cryptographic tools and analyse its performance in various network layers.

CSB6253 DIGITAL AND CYBER FORENSICS L T P C

3 0 0 3

OBJECTIVES:

To enable students to

- Understand key terms and concepts in cyber law, intellectual property and cyber crimes
- Understand issues associated with the nature of cyber and digital forensics.
- Undertake a simple forensic investigation using current forensic tools.

PREREQUISITES:

- Computer Security

MODULE I CYBER FORENSICS 9

Introduction to Cyber forensics - Information Security Investigations - Corporate Cyber Forensics - Scientific method in forensic analysis - Investigating large scale Data breach cases -Analyzing Malicious software.

MODULE II ETHICAL HACKING 6

Essential Terminology - Windows Hacking -Malware, Scanning, Cracking.

MODULE III DIGITAL EVIDENCE IN CRIMINAL INVESTIGATIONS 9

The Analog and Digital World -Training and Education in digital evidence - The digital crime scene - Investigating Cybercrime - Duties Support Functions and Competencies.

MODULE IV NETWORK FORENSICS 7

Investigating Network Intrusions and Cyber Crime - Network Forensics and Investigating logs – Investigating network Traffic - Investigation Web attacks - Router Forensics.

MODULE V COMPUTER FORENSICS 9

File Systems (File system organization; Memory; Registry; System logs) - Disk imaging - Programs and their traces - Searching and analysis - Investigative tools (Open Source and Proprietary) - Email & Browsers.

MODULE VI CONTEXT, LEGAL AND PRACTICAL CONSIDERATIONS 5

Cybercrime - Forensic process - Legal process and law enforcement - ACPO guidelines - Digital evidence - Incident response.

Total Hours: 45

REFERENCES:

1. Altheide, C & Carvey, H., Syngress, “Digital Forensics with Open Source Tools”, 1st Edition, Elsevier Publication, 2011.
2. Sammons, J. Syngress, “The Basics of Digital Forensics: The Primer for Getting Started in Digital Forensics”, 1st Edition, Elsevier Publication, 2012.
3. Christof paar, Jan Pelzl, “Understanding Cryptography: A Textbook for Students and Practitioners”, 3rd Edition, Heidelberg Springer, 2011.
4. John J. Barbara, “Handbook of Digital and Multimedia Forensic Evidence [Paperback]”, 2nd Edition, Humana Press, 2011.
5. EC – Council, “Computer Forensics: Investigating Network Intrusions and Cyber Crime”, 1st Edition, EC-Council Press Series: Computer Forensics, 2010.

OUTCOMES:

Students who complete this course will be able to

- list the varieties and describe impact of cybercrime.
- demonstrate the use of various computer forensic software tools and techniques as well as follow proper legal procedures for obtaining, analyzing, and reporting digital forensic evidence.
- understand the need to maintain the chain of evidence in cyber investigations and apply this in the context of simple case studies.
- explain the nature of live forensics and network-based detection techniques.

CSB6232	INFORMATION SECURITY	L	T	P	C
	(Common to M.Tech (SE, NS))	3	0	0	3

OBJECTIVES:

- To explain clearly about security policies and the major mechanisms for implementing security policies.
- To disseminate how threats to an organization are discovered, analyzed and dealt with.
- To train on procedures and practices for information security services.

PREREQUISITES:

- Computer Security and Computer Networks

MODULE I INTRODUCTION TO INFORMATION SECURITY 8

Introduction - History of information security - What is security - Need for security - CNSS security model - Components of an information system - Balancing information security and access - System development life cycle - Security systems development life cycle – Threats –Attacks - Secure software development.

MODULE II RISK MANAGEMENT 7

Introduction - isk identification – Assessment - Control strategies - Selecting a risk control strategy – Quantitative versus qualitative risk control practices.

MODULE III PLANNING FOR SECURITY 8

Introduction - Information security planning and governance - Information security policy, standards and practices - Cryptographic tools - Protocols for secure communications - Attacks on cryptosystems.

MODULE IV PHYSICAL SECURITY 7

Introduction - Physical access controls - Fire Security and safety - Failure of supporting utilities and structural collapse - Interception of Data - Remote computing security.

MODULE V IMPLEMENTING INFORMATION SECURITY 7

Information security project management - Technical aspects of implementation - Non technical aspects of implementation - Positioning and staffing the security function.

MODULE VI SOCIAL AND HUMAN ELEMENTS OF INFORMATION SECURITY 8

Human and Social Aspects of Password Authentication - Impact of the Human Element on Information Security - Social and Human Elements of Information Security: A Case Study-Security Configuration for Non-Experts: A Case Study in Wireless Network Configuration.

Total Hours: 45

REFERENCES:

1. James Michael Stewart, Ed Tittel and Mike Chapple, “Principles of Information Security”, 3rd Edition, John Wiley & Sons, 2011.
2. Jason Andress, “The Basics of Information Security”, 1st Edition, Syngress Press, Elsevier Publications, 2011.
3. Merkow, “Information Security: Principles and Practices”, 2nd Edition, Pearson Education India, 2007.

OUTCOMES:

Students who complete this course will be able to

- analyze the major information security threats to any organization.
- apply security policies, standards and practices.
- implement authorization techniques to reduce security threats.

CSB6254	CRYPTOGRAPHY LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To provide experience on different enciphering and deciphering techniques.
- To identify solutions for different cryptographic problems.
- To understand authentication protocols.

PREREQUISITES:

- Cryptography and Network Security

List of Experiments

1. Write program for Mono alphabetic cipher.
2. Encryption using classical techniques / binary/byte addition / binary/byte addition.
3. Implementation of S-DES algorithm for data encryption.
4. Implement RSA asymmetric (public key and private key)-Encryption. Encryption key (e, n) & (d, n).
5. Short Message RSA attacks and Padding.
6. Hash generation and sensitivity of hash functions to plaintext modifications.
7. Generate Digital signature using Hash code / MAC code.
8. RSA signature.
9. Attack on Digital signature/ Hash collision.
10. Writing a simple certificate Authority.

OUTCOMES:

Students who complete this course will be able to

- implement different data encryption and decryption algorithms.
- analyze on different crypto tools and apply them to overcome network attacks.
- experiment solutions for cryptographic problems using different key establishment techniques.

CSB6255 INFORMATION SECURITY (CASE STUDY) **L T P C**
0 0 3 1

OBJECTIVES:

- To empathize the basic principles and practices in information systems security.
- To gain knowledge on preparation of Document.
- To study the cryptographic tools, authentication and legal issues in security.

PREREQUISITES:

- Computer Security

Methodology of Assessment

- The class can be grouped as teams of not more than three in a team.
- Each team can present their observations based on the parameters given.
- Each team should prepare and deliver a presentation on the contents of the documents such as the SRS and Design document.

Case Study Topics

- Information security concepts
- Common attacking techniques
- Common security policies
- Basic cryptographic tools
- Authentication, Access control
- Software Security , Operating system security
- Legal and ethical issues in information systems security.
- Case study topics may be selected as per the choice of the students and the Case study may be evaluated on the following parameters
- Problem description and Analysis.
- Preparation of case study design document.
- Communication and clarity of presentation.

OUTCOMES:

Students who complete this course will be able to

- analyze the various information security threats to an organization.
- prepare an information security policy document for an organization.
- implement information security policies using various cryptographic tools.

SEMESTER - III

CSB7201	SOFTWARE PROJECT MANAGEMENT	L	T	P	C
	(Common to M.Tech (CSE, NS, SE, CPA, CSE-BDA))	3	0	0	3

OBJECTIVES:

- To highlight the importance of software project management.
- To discuss various processes in Software Project Management.
- To provide tools and techniques for project monitoring.
- To expose different project management life cycles.

PREREQUISITES:

- Software Engineering

MODULE I FUNDAMENTALS OF PROJECT MANAGEMENT 8

Defining a project- Sequence of Activities – Complex Activities – A Business focused definition - Understanding the Scope Triangle - Managing the Creeps -Importance of Classifying Projects - Fundamentals of Project Management - Introducing Project Management Life Cycles - Choosing the Best-Fit PMLC Model.

MODULE II PROJECT MANAGEMENT PROCESS GROUPS 8

Defining the Five Process Groups - Nine Knowledge Areas - Mapping Knowledge Areas to Process Groups - Using Tools, Templates, and Processes to Scope a Project - Managing Client Expectations .

MODULE III TPM PROJECT 8

Using Tools, Templates, and Processes to Plan a Project - Application Software Packages- Project Planning Tools – Planning and Conducting Joint Project - Building the WBS - Estimating - Constructing the Project Network Diagram - Effective Project Proposal - Launch a TPM Project- Monitor and Control a TPM Project.

MODULE IV ESTABLISHING PROJECT MANAGEMENT LIFE CYCLES 7

Understanding the Complexity/Uncertainty - Traditional Project Management - Incremental Project Management Life Cycle - Agile Project Management -

Iterative Project Management Life Cycle- Adaptive Project Management Life Cycle – Adapting and Integrating the APM Toolkit.

MODULE V BUILDING AN EFFECTIVE PROJECT MANAGEMENT 7

Establishing and Managing a Project Portfolio Management Process - The Project Portfolio Management Life Cycle - Establishing and Managing a Continuous Process Improvement Program - Defining Process and Practice Maturity - Using Process Improvement Tools, Templates and Processes.

MODULE VI MANAGING THE REALITIES OF PROJECTS 7

Prevention and Intervention Strategies for Distressed Projects - Using Tools, Templates, and Processes to Prevent Distressed Projects - Organizing Multiple Team Projects - Managing the Professional Development of Project Teams.

Total Hours: 45

REFERENCES:

1. Robert K. Wysocki, “Effective Project Management – Traditional, Agile, Extreme”, 6th Edition, Wiley Publication, 2011.
2. Robert K. Wysocki, “Effective Software Project Management”, 3rd Edition, Wiley Publication, 2010.

OUTCOMES:

Students who complete this course will be able to

- design a project management plan using different project management life cycles.
- find a suitable project management life cycle model for effective project execution.
- analyze the risks associated with the projects.

LIST OF ELECTIVES

CSBY51	INTRUSION DETECTION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide detailed theoretical foundation of attack detection approaches, data collection, evaluation, and intrusion response.
- To provide an overview of some of the commercially/publicly available intrusion detection and response systems.
- To study auditing systems, monitoring techniques, and various Intrusion Detection Processes and technologies that can be used for discovery of Hackers and Attacks.

PREREQUISITES:

- Computer Security

MODULE I INTRODUCTION **9**

Introduction - Intrusion detection and prevention basics – Network Attacks-Attack taxonomies-Probes-Privelege Escalation attacks-DDoS attacks-Worms Attacks - Routing attacks-Detection approaches-Data collection.

MODULE II THEORETICAL FOUNDATIONS OF DETECTION **9**

Taxonomy of Anomaly Detection system-fuzzy logic – Bayes theory – Artificial Neural networks – Support vector machine – Evolutionary computation – Association rules – Clustering-Signal processing techniques based models-Comparative study of anomaly Detection techniques.

MODULE III CORRELATION ANALYSIS OF INTRUSION ALERT **8**

Introduction - Approaches based on similarity between Alert Attributes, predefined attack scenarios, prerequisites and consequences of attacks, multiple information sources - Privacy issues in Alert correlation.

MODULE IV NETWORK ATTACKS **7**

Introduction-Preliminaries-Hardening Network to prevent multistep attacks-Response: building the link between intrusion detection alerts and security

policies-problem statement-Security policy formalism-Applying Or-BAC for thread response-The threats response system-From alerts to new policies.

MODULE V INTRUSION DETECTION AND REACTION 7

Introduction-Related work-Proposed framework-An Architecture for intrusion detection-Intrusion reaction: a system for attack source detection-Conclusions and future work.

MODULE VI APPLICATIONS AND TOOLS 5

Tool Selection and Acquisition Process - Bro Intrusion Detection – Prelude Intrusion Detection - Cisco Security IDS - Snorts Intrusion Detection – NFR security.

Total Hours: 45

REFERENCES:

1. Carl Enrolf, Eugene Schultz, Jim Mellander, “Intrusion detection and Prevention”, 1st Edition, McGraw Hill, 2004.
2. Paul E. Proctor, “The Practical Intrusion Detection Handbook”, 1st Edition, Prentice Hall, 2001.
3. Ankit Fadia and Mnu Zacharia, “Intrusiion Alert”, 2nd Edition, Vikas Publishing house Pvt., Ltd, 2007.
4. Earl Carter, Jonathan Hogue, “Intrusion Prevention Fundamentals”, 1st Edition, Pearson Education, 2006.

OUTCOMES:

Students who complete this course will be able to

- Examine the components of Intrusion Detection Systems and describe how these interact to accomplish the goals of intrusion detection.
- develop predictive measures to assess and prevent intrusion.
- understand the need to maintain Intrusion Detection System and apply this in the context of simple case studies.
- learn how to defend against computer and network attacks, multiple, complementary security devices such as intrusion detection systems (IDSs), and firewalls.

CSBY52 GAME THEORY AND ITS APPLICATIONS L T P C

3 0 0 3

OBJECTIVES:

- To provide a theoretical basis to the field of multi-agent systems.
- To provide the base for rational decision making.
- To provide a knowledge on different strategies and models for game development.

PREREQUISITES:

- Artificial Intelligence

MODULE I INTRODUCTION 8

Matrix – person games – The von Neumann Minimax Theorem – Mixed strategies – Dominated Strategies – Solving 2 x 2 games graphically – Graphical solution of 2 x m and n x 2 games – Problems.

MODULE II SOLUTION METHODS FOR MATRIX GAMES 8

2 x 2 games – Invertible matrix games – Symmetric games – A direct formulation without transforming – Linear Programming – Simplex Method – A Game Theory Model of Economic Growth.

MODULE III TWO PERSON NONZERO SUM GAMES 8

Basics – 2 x 2 Bimatrix Games – Interior Mixed Nash Points by Calculus – Nonlinear Programming Method – Choosing among several Nash Equilibria – Problems.

MODULE IV N PERSON NONZERO SUM GAMES 8

Economics applications of Nash equilibria – Duels – Auctions – Complete Information – Incomplete Information – Symmetric Independent Private Value Auctions – Symmetric Individual private value auctions – Problems.

MODULE V COOPERATIVE GAMES 8

Coalitions and Characteristic Functions – Finding the least core – The Nucleolus – The Shapley value – Bargaining – The Nash model with security point – Threats – Problems.

MODULE VI EVOLUTION AND APPLICATIONS **5**

Evolutionary Stable Strategies and Population games – Problems – Applications.

Total Hours: 45

REFERENCES:

1. E. N. Barron, “Game Theory: An Introduction”, 2nd Edition, Wiley India Pvt Ltd, 2013.
2. Steven Tadelis, “Game Theory: An Introduction”, 2nd Edition, Princeton University Press, 2012.
3. Bezalel Peleg, Peter Sudholter,”Introduction to the Theory of Cooperative Games”, 2nd Edition, Springer, 2010.
4. Thomas J Webster, “Introduction to Game Theory in Business and Economics”, 1st Edition, Segment Books, 2009.

OUTCOMES:

Students who complete this course will be able to

- recollect basic computer graphics and multimedia concepts and build animated programs.
- solve advanced and interesting games without spending time on the theory of linear programming.
- construct game theoretic models in applied fields.

MAB 6194 OPERATIONS RESEARCH L T P C

3 0 0 3

OBJECTIVES:

- To teach about linear programming techniques, transportation and assignment problems.
- To study the concept of queuing models and advanced queuing models which provides models for a number of situations that arise in real life.
- To gain the knowledge of simulation and non-linear programming of scheduling algorithms.

PREREQUISITES:

- Engineering Mathematics

MODULE I LINEAR PROGRAMMING 8

Formulation – Graphical solution – Simplex method – Two phase method – Transportation and Assignment Problems.

MODULE II SCHEDULING BY PERT AND CPM 8

Network Construction – Critical Path Method – Project Evaluation and Review Technique – Resource Analysis in Network Scheduling.

MODULE III INVENTORY MODELS 8

Inventory models – Deterministic models – Production models – Economic ordering quantity – Buffers stock – Shortage and quantity discount – Probabilistic inventory model – EOQ and safety stock calculation.

MODULE IV QUEUEING MODELS 7

Poisson Process – Markovian Queues – Single and Multi-server Models – Little's formula – Machine Interference Model – Steady State analysis – Self Service Queue – Network Optimal Path.

MODULE V SIMULATION 7

Discrete Event Simulation – Monte-Carlo Simulation – Stochastic Simulation – Applications to Queuing systems.

MODULE VI NON-LINEAR PROGRAMMING **7**

Lagrange multipliers – Equality constraints – Inequality constraints – KuhnTucker conditions – Quadratic Programming.

Total Hours: 45

REFERENCES:

1. Winston.W.L. 'Operations Research', 4th Edition, Thomson – Brooks/Cole, 2003.
2. Taha, H.A., "Operations Research: An Introduction", 9th Edition, Pearson Education Edition, Asia, New Delhi, 2002.
3. Sharma J.K., "Operations Research: Theory and Applications", Macmillan India Ltd., 3rd Edition, 2006.
4. Robertazzi. T.G., "Computer Networks and Systems – Queuing Theory and Performance Evaluation", 3rd Edition, Springer, 2002 Reprint.
5. Ross. S.M., "Probability Models for Computer Science", 2nd Edition, Academic Press, 2002.

OUTCOMES:

Students who complete this course will be able to

- use various queuing models in various domains.
- complete simple exercises on linear programming techniques, transportation and assignment problems.
- apply simulation to various situations and scheduling techniques.

CSBY53	PUBLIC KEY INFRASTRUCTURE AND KEY MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn about how the information security is deployed in an organization.
- To understand the various network security design methodologies available for providing secure solutions.
- To gain knowledge about the advanced security issues and technologies.

PREREQUISITES:

- Cryptography and Network Security

MODULE I INTRODUCTION **8**

Basic security concepts – Public key cryptography – Concept of an Infrastructure – Core PKI services: Authentication, Integrity, and confidentiality – PKI enabled Services.

MODULE II SECURITY ISSUES **8**

Certificate and Certification – Key and Certificate Management – Certificate revocation – Trust models – PKI operational Considerations – Electronic Legislation and Considerations.

MODULE III PKI STANDARDS **6**

General PKIX standardization Requirements – X.509 – PKIX – X.500 – LDAP – S/MIME – IPSec – TLS – SPKI – Open PGP EDIF ACT.

MODULE IV CONTENTS OF A SET OF PROVISIONS **8**

Introduction – Publication and Repository Responsibilities – Identification and Authentication (I&A) – Certificate Life – Cycle Operational Requirements – Facility, Management, and Operational Controls – Technical Security Controls.

MODULE V PUBLIC KEY MANAGEMENT **8**

Key Management fundamentals – Certification of public keys – Certificate life cycle – Key pair changes – Public key certificate management models – Alternate approaches.

MODULE VI CRYPTOGRAPHIC APPLICATIONS **7**

Cryptography on: Internet–Wireless local area networks – Mobile telecommunications– Security payment card transactions – Video broadcasting – Identity cards – Home users.

Total Hours: 45

REFERENCES:

1. Keith M. Martin, “Everyday Cryptography: Fundamental Principles and Applications”, Oxford University press, 2012.
2. John R. Vacca, “Public Key Infrastructure: Building Trusted Applications and Web Services”, 1st Edition, Auerbach Publications, 2004.
3. Carlisle Adams, Steve. Lloyd, “Understanding PKI: Concepts, Standards, and Deployment Considerations”, 2nd Edition, Pearson Education, 2003.

OUTCOMES:

Students who complete this course will be able to

- Identify the Infrastructure design and create a certificate template for it.
- Analyze the performance of the various certificate management tasks and deploy it.
- Summarize how security is implemented in a Web environment and correlate it using various security mechanisms.

CSBY54 MOBILE AND WIRELESS NETWORK SECURITY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn physical as wireless MAC layer alternatives techniques.
- To understand planning and operation of wireless networks.
- To gain knowledge about various wireless LAN and WAN concepts.
- To learn security issues in wireless networks.
- To identify the different security issues in wireless networks.

PREREQUISITES:

- Mobile Ad hoc Networks

MODULE I MULTIPLE RADIO ACCESS **7**

Medium Access Alternatives: Fixed-Assignment for Voice Oriented Networks Random Access for Data Oriented Networks, Handoff and Roaming Support, Security and Privacy.

MODULE II WIRELESS WANS **8**

First Generation Analog, Second Generation TDMA – GSM, Short Messaging Service in GSM, Second Generation CDMA – IS-95, GPRS - Third Generation Systems (WCDMA/CDMA 2000) - Fourth Generation Systems (OFDM).

MODULE III WIRELESS LANS **7**

Introduction to wireless LANs - IEEE 802.11 WLAN – Architecture and Services, Physical Layer- MAC sub layer- MAC Management Sub layer, Other IEEE 802.11 standards, HIPERLAN, Wi-Max standard.

MODULE IV ADHOC AND SENSOR NETWORKS **7**

Characteristics of MANETs, Table-driven and Source-initiated On Demand routing protocols, Hybrid protocols, Wireless Sensor networks- Classification, MAC and Routing protocols.

MODULE V WIRELESS MANS AND PANS **8**

Wireless MANs – Physical and MAC layer details, Wireless PANs – Architecture of Bluetooth Systems, Physical and MAC layer details, Standards – Standard Introduction to PANs – Commercial Alternatives to PANs.

MODULE VI SECURITY IN WIRELESS NETWORKS **8**

The need for wireless security – Attacks on Wireless Networks – Security Services – Wired Equivalent Privacy (WEP) Protocol – Mobile IP – Weakness in the WEP Scheme –Virtual Private Network.

Total Hours: 45

REFERENCES:

1. William Stallings, "Wireless Communications and networks", 2nd Edition, Pearson / Prentice Hall of India, 2007.
2. Dharma Prakash Agrawal & Qing-An Zeng, “Introduction to Wireless and Mobile Systems”, 2nd Edition, Thomson India Edition, 2007.
3. Georgios I. Papadimitriou, Andreas S. Pomportsis, “Wireless Networks”, 1st Edition, John Wiley & Sons Ltd., 2003.
4. Vijay. K. Garg, “Wireless Communication and Networking”, 1st Edition, Morgan Kaufmann Publishers, 2007.
5. Gary. S. Rogers & John Edwards, “An Introduction to Wireless Technology”, 1st Edition, Pearson Education, 2007.
6. Clint Smith, P.E. & Daniel Collins, “3G Wireless Networks”, 2nd Edition, Tata McGraw Hill, 2007.

OUTCOMES:

Students who complete this course will be able to

- Determine the basic functionalities and working principles of cellular networks.
- comprehend different generation of wireless networks and protocol architectures.
- examine various security threats to Wireless & Mobile networks and provide appropriate solutions.

CSBY55 TECHNICAL FOUNDATION OF E-COMMERCE **L T P C**

3 0 0 3

OBJECTIVES:

- To study technical aspects of Internet Commerce/ Web-based Electronic Business.
- To learn internet computing technologies in detail.
- To gain knowledge on different applications of E-Commerce.

PREREQUISITES:

- Web Technology

MODULE I INTRODUCTION **6**

Electronic commerce and Physical Commerce- Different type of ecommerce- some e-commerce scenario- Advantages of e-commerce.

MODULE II BASIC TECHNOLOGIES OF ECOMMERCE **8**

E-Commerce infrastructure-Client side Programming, Server Side Programming-Database connectivity- session tracking techniques.

MODULE III ADVANCE TECHNOLOGIES OF E-COMMERCE **8**

Mobile Agent- WAP- XML- Data Mining- Rich Internet Application- Web 2.0, REST Web Services- Web Mash up- Working of Search Engines- Internet Security.

MODULE IV INTERNET PAYMENT SYSTEM **7**

Characteristics of payment system- SET Protocol for credit card payment- E-cash- E-check-Micropayment system.

MODULE V E-COMMERCE STRATEGIES **8**

Strategies for marketing- Sales and Promotions- Strategies for Purchasing and support activities-Strategies for Web Auctions-Virtual Communities and web portals.

MODULE VI E-BUSINESS INTRODUCTION **8**

E-Business Vs E-commerce - Characteristics of e-Business- E-Business role and their challenges, e-business Requirements, impacts of e-business.

Total Hours: 45

REFERENCES:

1. Henry Chan, Raymond Lee, Tharam Dillon, Elizabeth Chang , “E-Commerce, Fundamentals And Applications”,1st Edition, John Wiley & Sons, 2007.

2. William S. Davis Miami University, Oxford, Ohio John Benamati Ohiol , “E-Commerce Basics: Technology Foundations and E-Business Applications” , 1st Edition, Miami University, Oxford, 2002.

OUTCOMES:

Students who complete this course will be able to

- comprehend the basic economic mechanisms and driving forces of E-Commerce.
- formulate E-Commerce strategies and provide a business solution.
- analyze ethical, social and political issues in E-Commerce.

CSBY56	BIOMETRIC SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To enable the students to understand the fundamentals of biometric security.
- To understand the working principle and technologies behind various biometric areas.
- To develop the skills of the students with this technology for improving security and trust in different fields of modern society.

PREREQUISITES:

- Image Processing
- Statistical Techniques for Network Security

MODULE I INTRODUCTION **7**

Biometric fundamentals – Biometric technologies – Biometrics Vs traditional techniques – Characteristics of a good biometric system – Benefits of biometrics – Key biometric processes: verification, identification and biometric matching – Performance measures in biometric systems: FAR, FRR, FTE rate, EER and ATV rate.

MODULE II PHYSIOLOGICAL BIOMETRICS **9**

Leading technologies : Finger-scan – Facial-scan – Iris-scan – Voice-scan – Components, working principles, competing technologies, strengths and weaknesses – Other physiological biometrics : Hand-scan, Retina-scan – Components, working principles, competing technologies, strengths and weaknesses – Automated fingerprint identification systems.

MODULE III BEHAVIOURAL BIOMETRICS **7**

Leading technologies: Signature-scan – Keystroke scan – Components, working principles, strengths and weaknesses.

MODULE IV BIOMETRIC APPLICATIONS **8**

Categorizing biometric applications – Application areas: criminal and citizen identification, surveillance, PC/network access, e-commerce and retail/ATM – Costs to deploy – Other issues in deployment.

MODULE V PRIVACY AND STANDARDS IN BIOMETRICS **7**

Assessing the Privacy Risks of Biometrics – Designing Privacy-Sympathetic Biometric Systems – Need for standards – Different biometric standards.

MODULE VI BIOMETRIC TRANSACTION **7**

Securing and trusting a Biometric Transaction – User – Biometric Reader – Trusted Biometric Devices – Non Trusted Biometric Devices - Matching Location – Local host – Authentication Server – Match on Card (MOC).

Total Hours: 45

REFERENCES:

1. Paul Reid, “Biometrics for Network Security “, 1st Edition, Pearson Education, 2008.
2. Samir Nanavathi, Michel Thieme, and Raj Nanavathi, “Biometrics -Identity verification in a network”, 1st Edition, Wiley Eastern, 2002.
3. John Chirillo and Scott Blaul,” Implementing Biometric Security”,1st Edition, Wiley Eastern Publications, 2003.
4. John Berger,” Biometrics for Network Security”, 1st Edition, Prentice Hall, 2004.

OUTCOMES:

Students who complete this course will be able to

- summarize the concepts of biometrics and its applications in various fields.
- recollect the working principles of various biometric systems based on fingerprints, face, palm print, iris, retina, and other modalities.
- design a biometric system for more secure and reliable transmission.

CSBY02	SOFT COMPUTING	L	T	P	C
	(Common to M.Tech (CSE, SE , NS,CSE-BDA))	3	0	0	3

OBJECTIVES:

- To introduce new ideas of neural networks, fuzzy logic and use of heuristics based on human experience.
- To highlight the role of soft computing algorithm.
- To understand the concepts of Genetic algorithm and its applications.

PREREQUISITES:

- Artificial Intelligence and Neural Networks

MODULE I NEURO FUZZY AND SOFT COMPUTING **7**

Soft computing constituents and Conventional Artificial Intelligence - Neuro fuzzy and soft computing characteristics - Fuzzy sets - Basic definitions - Fuzzy union, intersection and complement - Introduction to Classical Sets and Fuzzy sets – Classical Relations and Fuzzy Relations – Tolerance and Equivalence Relations –Membership Functions: Fuzzification – Methods of Membership Value Assignments – Defuzzification – Lambda-Cuts for Fuzzy sets and Fuzzy Relations – Defuzzification Methods.

MODULE II ARTIFICIAL NEURAL NETWORK **7**

Introduction – Machine Learning Basics - Fundamental concept – Evolution of Neural Networks – Basic Models of Artificial Neural Networks – Important Terminologies of ANNs – McCulloch-Pitts Neuron – Supervised Learning Network: – Multiple Adaptive Linear Neurons – Back-Propagation Network – Radial Basis Function Network.

MODULE III ARTIFICIAL NEURAL NETWORK- II **7**

Associative Memory Networks: Training Algorithms for Pattern Association – Auto associative Memory Network – Hetero associative Memory Network – Bidirectional Associative Memory – Hopfield Networks – Iterative Auto associative Memory Networks – Temporal Associative Memory Network. Unsupervised Learning Networks: Fixed weight Competitive Nets – Kohonen Self-Organizing Feature Maps – Learning Vector Quantization – Counter propagation Networks – Adaptive Resonance Theory Networks – Special Networks.

MODULE IV GENETIC ALGORITHM **8**

Introduction – Basic Operators and Terminologies in GAs – Traditional Algorithm vs. Genetic Algorithm – Simple GA – General Genetic Algorithm – The Scheme Theorem – Classification of Genetic Algorithm – Holland Classifier Systems – Genetic Programming.

MODULE V NEURO FUZZY MODELING **8**

ANFIS Architecture - Hybrid Learning Algorithm - Learning Methods that Cross-fertilize ANFIS and RBFN - ANFIS as a Universal Approximator - Simulation Examples - Extensions and Advanced Topics.

MODULE VI APPLICATIONS OF SOFT COMPUTING **8**

A Fusion Approach of Multispectral Images with SAR Image for Flood Area Analysis – Optimization of Travelling Salesman Problem using Genetic Algorithm Approach – Genetic Algorithm based Internet Search Technique – Soft Computing based Hybrid Fuzzy Controllers – Soft Computing based Rocket Engine – Control.

Total Hours: 45

REFERENCES:

1. Simon O Haykin, “Neural Networks and Learning Machines”, 3rd Edition, Pearson Higher Education, 2008.
2. S.N. Sivanandan and S.N. Deepa, “Principles of Soft Computing”, 1st Edition, Wiley India, 2007.
3. S. N. Sivanandam, S. Sumathi and S. N. Deepa, “Introduction to Fuzzy Logic using MATLAB”, 8th Edition, Springer, 2007.
4. S. Rajasekaran and G.A.V.Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithms”, 1st Edition, PHI, 2003.
5. J.S.R.Jang, C.T.Sun and E.Mizutani, “Neuro-Fuzzy and Soft Computing”, 2nd Edition, PHI, 2004.
6. James A. Freeman and David M. Skapura, “Neural Networks Algorithms, Applications, and Programming Techniques”, 1st Edition, Pearson Edition., 2003.

OUTCOMES:

Students who complete this course will be able to

- apply the theoretical and practical knowledge on design and development of basic intelligent systems.
- develop an application using various soft computing algorithms.
- solve various real world problems using neural Fuzzy tools and technologies.

CSBY08	EMBEDDED SYSTEMS	L	T	P	C
	(Common to M.Tech (CSE, SE, NS))	3	0	0	3

OBJECTIVES:

- To provide basic understanding about embedded systems.
- To understand the various building components of an embedded system.
- To give exposure to the embedded programming concepts and study the procedures for development and testing.

PREREQUISITES:

- Digital Signal Processing

MODULE I INTRODUCTION TO EMBEDDED SYSTEMS 6

Definitions – Embedded hardware components – Embedded Software – System on Chip (SoC) – VLSI Circuits – Fundamentals of Embedded System Design.

MODULE II REAL-TIME OPERATING SYSTEMS 8

Overview – Pseudo kernels to Operating Systems – Scheduling Fundamentals – System Services: Buffers - Mailboxes – Semaphores – Deadlock and Starvation Problems- Priority Inversion - Timer and Clock Services – Memory Management Issues.

MODULE III DEVICES, COMMUNICATION BUSES AND PROTOCOLS 8

I/O Devices – Device I/O Types and Examples – Synchronous Communication – ISO-Synchronous Communication – Asynchronous Communication – Serial Bus Communication Protocols – Parallel Bus Communication Protocols– Wireless and Mobile System Protocols.

MODULE IV EMBEDDED PROGRAMMING CONCEPTS 8

Assembly Language Programming Vs High Level Programming – Embedded C Programming Elements and Fundamentals – Object Oriented Programming for Embedded Systems – Cross Compliers – Memory Footprint optimization - Program Modeling Concepts.

MODULE V DEVELOPMENT AND TESTING **8**

Embedded Software Development Process - Development Tools – Hardware and Software Design Issues – Techniques and Tools for Testing, Simulation and Debugging - Design Examples and Case Studies of Program Modeling and Programming with RTOS.

MODULE VI PERFORMANCE ANALYSIS OF EMBEDDED SYSTEMS **7**

Real Time Performance Analysis – Applications of Queuing Theory – Input/ output Performance - Analysis of Memory Requirements – Metrics - Fault Tolerance – Inherent Uncertainly – Performance optimization Techniques.

Total Hours: 45

REFERENCES:

1. Phillip A. Laplante, Seppo J. Ovaska, “Real-Time Systems Design and Analysis: Tools for the Practitioner”, 4th Edition, Wiley-IEEE Press, 2011.
2. Raj Kamal, “Embedded Systems: Architecture, Programming and Design”, 2nd Edition, McGraw-Hill Education, India, 2009.
3. Kai Qian, David Den Haring, Li Cao, “Embedded Software Development with C”, 1st Edition, Springer, 2009.

OUTCOMES:

Students who complete this course will be able to

- possess the basics of embedded system and its building blocks.
- design an embedded systems by applying the embedded programming concepts.
- analyze a real time scenario and trace its performance.

CSBY57 SECURITY ISSUES IN CLOUD COMPUTING L T P C

3 0 0 3

OBJECTIVES:

This course

- introduces the students to the world of cloud computing security.
- provides a consistent way of developing cloud security competency.
- provides the knowledge and confidence to build/adopt secure cloud solutions.

PREREQUISITES:

- Cloud Computing
- Computer Security

MODULE I INTRODUCTION TO CLOUD COMPUTING AND SECURITY 7

Terminology - Risk, Perception of Risk and Cloud Computing - Introduction to Cloud Computing and Security - Understanding Cloud Computing -The IT Foundation for Cloud - The Bottom Line - An Historical View: roots of Cloud Computing - A Brief Primer on Security - A Brief Primer on Architecture - Security Architecture.

MODULE II CLOUD COMPUTING ARCHITECTURE 6

Cloud Reference Architecture - Control over Security in the Cloud Model - Making Sense of Cloud Deployment - Making Sense of Services Models - Cloud Formation and Key Examples - Cloud Reference Architecture - Real-world Cloud Usage Scenarios.

MODULE III SECURING THE CLOUD: ARCHITECTURE 8

Cloud Computing: Security Concerns - Assessing Your Risk Tolerance in Cloud Computing - Legal and Regulatory Issues - Security Requirements for the Architecture - Security Patterns and Architectural Elements - Cloud Security Architecture - Planning Key Strategies for Secure Operation.

MODULE IV DATA SECURITY 8

Overview of Data Security in Cloud Computing - Data Encryption: Applications and Limits - Cloud Data Security: Sensitive Data Categorization - Cloud Data

Storage - Cloud Lock-in - Effectively Managing Risk - Overview of Security Controls - The Limits of Security Controls - Security Monitoring.

MODULE V BUILDING AN INTERNAL CLOUD **8**

Private Clouds: Motivation and Overview - Security Criteria for Ensuring a Private Cloud - Selecting a CSP: Overview of Assurance - Selecting a CSP: Overview of Risks - Selecting a CSP: Security Criteria.

MODULE VI AN INFORMATION SECURITY FRAMEWORK **8**

Evaluating Cloud Security - Checklists for Evaluating Cloud Security - From Architecture to Efficient and Secure Operations - Security Operations Activities.

Total Hours: 45

REFERENCES:

1. Vic J.R. Winkler, “Securing the Cloud: Cloud Computer Security Techniques and Tactics”,1st Edition, Elsevier Syngress, 2011.
2. Hamid Nemati, “Optimizing Information Security and Advancing Privacy Assurance”,1st Edition, IGI Global, 2012.
3. Ronald L. Krutz, Russell Dean Vines, “Cloud Security: A Comprehensive Guide to Secure Cloud Computing”, 1st Edition, Wiley Publications, 2010.

OUTCOMES:

Students who complete this course will be able to

- enumerate Cloud Computing Architectural Frameworks.
- discuss the major security considerations for building or selecting a cloud model.
- examine security criteria to enable selection of a CSP.
- evaluate the conditions under which one should adopt Cloud Computing services and technologies.

CSBY24	SERVICE ORIENTED ARCHITECTURE	L	T	P	C
	Common to M.Tech (CSE, SE, NS,CSE-BDA))	3	0	0	3

OBJECTIVES:

- To introduce the fundamentals and issues relating to Service Oriented Architecture
- To bring out the importance of service orientation and web services.
- To teach appropriate tools as technique on how to build the Service Oriented Architecture with web services.

PREREQUISITES:

- Web Technology
- Computer Networks

MODULE I INTRODUCTION **7**

Basic definition - Fundamentals of SOA - Characteristics and misperceptions about SOA -Benefits and pitfalls of SOA.

MODULE II EVOLUTION OF SOA **7**

The evolution of SOA - Web service and primitive SOA - The extension of SOA - Web service extension.

MODULE III WEB SERVICE AND CONTEMPORARY SOA **7**

Message Exchange Pattern - Service Activity – Coordination - Atomic Transaction - Business Activity- Orchestration – Choreography – Addressing - Reliable Messaging - Correlation and Policies - Meta data Exchange - Security-Notification and Eventing.

MODULE IV PRINCIPLES OF SERVICE ORIENTATION **8**

Principles of service orientation -Building SOA - Planning and Analysis - SOA delivery strategies - Service Oriented Analysis Introduction - Service Modeling of Service Oriented Analysis.

MODULE V SERVICE ORIENTED DESIGN **8**

Introduction to service oriented design - WSDL related XML Schema language Basics - WSDL Language Basics - SOAP Language Basics - Service interface

design tools - Steps to composing SOA - Consideration for choosing service layers, positioning core SOA standards and choosing SOA extension - Service design and business process design.

MODULE VI WEB SERVICE EXTENSION AND SOA PLATFORM 8

WS Addressing language Basics - WS Reliable Messaging language Basics- WS policy Language Basics - WS Metadata Exchange Language Basics-WS security Language Basics -SOA Platform basics - SOA Support in J2EE,SOA Support in .NET- Case Studies of Rail Co ltd and Oasis Car Wash service.

Total Hours: 45

REFERENCES:

1. Thomas Erl, Pearson Education, “Service Oriented Architecture, Concepts, Technology and design”, 2009.
2. Shankar Kambhampaty, “Service Oriented Architecture for Enterprise Architecture for Enterprise Application”, 1st Edition, Wiley Publication 2008.

OUTCOMES:

Students who complete this course will be able to

- relate web services with service oriented architecture.
- apply the tools and technique for Service Oriented Architecture.
- build an SOA platform supported by J2EE and .NET.

CSBY58 SECURE SOFTWARE SYSTEMS L T P C

3 0 0 3

OBJECTIVES:

- To understand the secure software analysis.
- To describe the various thread models in software systems.
- To use UML case tools to extend security business process.

PREREQUISITES:

- Software Engineering.

MODULE I SOFTWARE RELIABILITY 8

Problem, Process, and Product - Problems of software practitioners– Approach through software reliability engineering - Experience with SRE – SRE process- Defining the product – Testing acquired software – Reliability concepts- Software and hardware reliability- Implementing Operational Profiles.

MODULE II SOFTWARE AVAILABILITY 8

Developing, identifying, crating, reviewing the operation – Concurrence rate – Occurrence probabilities- Applying operation profiles Engineering “Just Right” Reliability- Defining “failure” for the product - Choosing a common measure for all associated systems. - Setting system failure intensity objectives - Determining user needs for reliability and availability- Overall reliability and availability objectives, common failure intensity objective.

MODULE III TEST CASES 9

Developed software failure intensity objectives. - Engineering software reliability strategies - Preparing for Test - Preparing test cases. - Planning number of new test cases for current release. - Allocating new test cases. - Distributing new test cases among new operations - Detailing test cases - Preparing test procedures-Executing Test - Planning and allocating test time for the current release - Invoking test.

MODULE IV IDENTIFYING 7

Identifying failures - Analyzing test output for deviations – Determining which deviations are failures - Establishing when failures occurred. Guiding Test -

Tracking reliability growth - Estimating failure intensity - Using failure intensity patterns to guide test - Certifying reliability- Deploying SRE- Core material - Persuading your boss, your coworkers, and stakeholders. - Executing the deployment - Using a consultant.

MODULE V SECURE SYSTEMS **7**

Using UML for Security - UM L diagrams for security requirement -Security business process- Physical security - Security critical interaction - Security state - Analyzing Model - Notation - formal semantics - Security analysis - Important security opportMODULEies - Model based security engineering with UML - UML sec profile- Design principles for secure systems - Applying security patterns.

MODULE VI UML **6**

Applications - Secure channel - Developing Secure Java program- more case studies - Tool support for UML Sec - Extending UML CASE TOOLS with analysis tools - Automated tools for UML SEC- Formal Foundations - UML machines - Rely guarantee specifications- reasoning about security properties.

Total Hours: 45

REFERENCES:

1. John Musa D, “Software Reliability Engineering”, 2nd Edition, Tata McGraw-Hill, 2008 (unit I, II , III).

2. Jan Jürjens, “Secure Systems Development with UML”, 2nd Edition, Springer; 2010 (unit IV, V, VI).

OUTCOMES:

Students who complete this course will be able to

- identify current security issues in software engineering.
- analyze the requirements analysis, object-oriented design, implementation, testing in software engineering.
- implement professionalism, project management, and the legal framework for software development.

CSBY59 ADVANCED DIGITAL FORENSICS L T P C

3 0 0 3

OBJECTIVES:

- To lay down the fundamentals of digital forensics from the viewpoint of courtroom legalities.
- To introduce forensics concepts and practices focusing on networks and internet.
- To establish the know-how needed for digital forensics investigator role.
- To elaborate upon the evidence gathering over the internet.

PREREQUISITES:

- Hacking Techniques and Digital forensics.

MODULE I INTRODUCTION 8

Foundations of digital Forensics-Language of Computer Crime Investigation-Digital Evidence in the courtroom-Cybercrime law.

MODULE II DIGITAL CRIME 8

Conducting Digital investigations-Handling a Digital Crime Scene-Investigative reconstruction with Digital Evidence-Modus Operandi motive and technology.

MODULE III DIGITAL EVIDENCE AND CYBER TALKING 7

Violent Crime and Digital Evidence –Digital Evidence as Alibi-Computer Intrusions-Cyber Talking.

MODULE IV DIGITAL INVESTIGATORS 7

Computer Basics for Digital investigators-Applying Forensics Science to computers-Digital Evidence on Windows System-Digital Evidence on UNIX System-Digital Evidence on Macintosh System.

MODULE V FORENSICS AND NETWORKS 8

Network basics for Digital Investigators-Applying Forensic science to Networks-Digital Evidence on the internet.

MODULE VI DIGITAL EVIDENCE ON THE INTERNET **7**

Digital Evidence on Physical and Data link layers-Digital Evidence on Network and Transport layers.

Total Hours: 45

REFERENCES:

1. Eoghan Casey, “Digital Evidence and Computer Crime: Forensic Science, Computers and the Internet“, 3rd Edition ,Published by Elsevier, 2011.
2. Keith John Jones, Richard Bejtlich, Curtis W. Rose, “Real Digital Forensics. Mit DVD: Computer Security and Incident Response”, 5th printing, Addison Wesley Professional, 2008.
3. Terrence V. Lillard, Clint P. Garrison, “Digital Forensics for Network, Internet, and Cloud Computing: A Forensic evidence Guide for Moving Targets and Data”, 1st Edition, Elsevier 2010.

OUTCOMES:

Students who complete this course will be able to

- identify and extract digital evidence from varied networking layers.
- apply forensics techniques for analyzing computer systems and networks.
- assess digital evidence and conduct forensic investigation.
- describe the legalities, penalties and punishment associated with cyber crime.

CSBY60	ADVANCED ALGORITHMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explore the relevance of analysis to the design of efficient computer algorithms.
- To demonstrate and apply the algorithms, prove their correctness, and analyze their time complexity in a mathematically rigorous manner.
- To elucidate the basic idea behind the techniques, so that you are able to develop algorithms for new problems where these techniques can be applied.

PREREQUISITES:

- Data Structures
- Design Analysis of Algorithms

MODULE I INTRODUCTION **8**

The role of Algorithms in Computing – Getting Started – Analyzing algorithms- Designing Algorithms–Growth of Functions – Divide and conquer – Probabilistic Analysis and Randomized Algorithms.

MODULE II SORTING AND SEARCHING **8**

Heap sort – Priority Queue – Quick Sort –Performance and analysis of quick sort- Sorting in Linear time – Counting sort-Radix Sort- Bucket Sort – Binary search.

MODULE III ADVANCED DESIGN AND ANALYSIS TECHNIQUES **8**

Dynamic Programming–Rod cutting-Matrix-chain multiplication- Optimal Binary search trees – Greedy Algorithms- An activity-selection problem- Elements of the greedy strategy –Huffman codes – Matroids – Amortized Analysis – Aggregate analysis – The accounting method - Potential method.

MODULE IV GRAPH ALGORITHMS **7**

Elementary Graph Algorithms –Breadth-first search- Depth-first search – Topological sort - Minimum Spanning Trees – The algorithms of Kruskal and Prim - Single-Source Shortest Paths Bellman-Ford algorithms- Dijkstra's algorithm– All-pairs Shortest Paths – Maximum Flow.

MODULE V NUMBER-THEORETIC ALGORITHMS 7

Elementary number-theoretic notions – Greatest common divisor – Modular arithmetic – Solving modular arithmetic – Solving modular linear equations- The Chinese remainder theorem- The RSA public-key cryptosystem – Primality testing – Integer factorization.

MODULE VI STRING MATCHING AND MAXIMUM FLOW 7

The naïve-matching algorithm – the Rabin-Karp algorithm – String matching with finite automata- The Knuth-Morris-Pratt algorithm – Flow networks – The Ford-Fulkerson method – Maximum bipartite matching – Push-relabel algorithms.

Total Hours: 45

REFERENCES:

1. Thomas H.Cormen, Charless E.Leiserson , Ronald L. Rivest and Clifford Stein, “Introduction to Algorithms”, 3rd Edition, PHI Learning,2010.
2. Thomas H.Cormen “Algorithms Unlocked”, MIT Press, 2013.
3. Michael Soltys, “An Introduction to the Analysis of Algorithm”, 2nd Edition, World Scientific, 2012.
4. Jon Kleinberg, Eva Tardos,” Algorithm Design”, 1st Edition, Pearson/Addison-Wesley, 2006.
5. Sara Baase, Computer algorithms - Introduction to design and analysis, 3rd Edition, Addison-Wesley, 1999.
6. Robert Sedgewik,Kevin wayne,“Algorithms”, 4th Edition, Pearson Education, 2011.

OUTCOMES:

Students who complete this course will be able to

- explain the importance of algorithmic design.
- analyze current problems and research issues in the field of complexity theory and abstract discrete algorithms.
- identify for research resources and later identify (discover), as well as formulate, new research problems.

CSBY61 HUMAN ASPECTS OF COMPUTER SECURITY **L T P C**

3 0 0 3

OBJECTIVES:

- To identify possible countermeasures against threats and vulnerabilities in a given security scenario.
- To develop a basic understanding of cryptography, how it has evolved, and some key encryption techniques used today.
- To compare and contrast the underlying security mechanisms needed to implement security countermeasures.

PREREQUISITES:

- Computer Networks
- Computer Security

MODULE I THREATS AND SECURITY **8**

Basic concepts: threats – Vulnerabilities – Controls – Risk - Confidentiality, integrity, availability- Security policies, security mechanisms – Assurance - Prevention, detection, deterrence.

MODULE II BASIC CRYPTOGRAPHY **8**

Basic cryptographic terms: Historical background - Symmetric crypto primitives - Modes of operation - Cryptographic hash functions - Asymmetric crypto primitives.

MODULE III PROGRAM SECURITY **8**

Flaws - Malicious code: viruses, Trojan horses, worms, Program flaws: buffer overflows, time-of-check to time-of-use flaws, incomplete mediation – Defences - Software development controls Testing techniques.

MODULE IV AUTHENTICATION **7**

Memory, time, file, object protection requirements and techniques - Protection in contemporary operating systems - Identification and authentication - Identification goals - Authentication requirements - Human authentication - Machine authentication.

MODULE V TRUSTED OPERATING SYSTEMS **6**

Assurance – trust: Design principles - Evaluation criteria - Evaluation process - Database management systems security - Database integrity - Database secrecy - Inference control - Multilevel databases.

MODULE VI NETWORK SECURITY **8**

Network threats: eavesdropping, spoofing, modification, denial of service attacks - Introduction to network security techniques: firewalls, virtual private networks - Intrusion detection - Management of security - Security policies - Risk analysis - Physical threats and controls.

Total Hours: 45

REFERENCES:

1. William Stallings, “Cryptography and Network security”, 5th Edition, Pearson Publication, 2011.
2. Charles P.Pfleeger (Consulting Group Pfleeger), Shari Lawrence(RAND Corporation Pfleeger), “Security in Computing”, 4th Edition, Prentice Hall, 2009.

OUTCOMES:

Students who complete this course will be able to

- differentiate threats to information systems from attacks against information systems.
- identify and explain symmetric and asymmetric algorithms for encryption-based security of information.
- examine the issues related to administration security, physical security, and program security.
- describe the requirements and mechanisms for identification and authentication.
- determine appropriate mechanisms for protecting information systems ranging from operating systems to database management systems and to applications.

CSBY18 HACKING TECHNIQUES AND DIGITAL FORENSICS **L T P C**

(Common to M.Tech (CSE, NS)) **3 0 0 3**

OBJECTIVES:

- To educate upon the security threats.
- To understand the different vulnerabilities and modes of preventing them.
- To learn about security attacks and tools available to curtail them.

PREREQUISITES:

- Computer Security

MODULE I APPLICATION SECURITY **7**

Problem factors - Defence mechanisms - Handling user access - User input - Handling attackers - Managing the application - Web application technologies - The HTTP protocol - Web functionality - Encoding schemes.

MODULE II AUTHENTICATION AND SESSION MANAGEMENT **7**

Mapping the application - Bypassing client side control - Transmitting data via the Client - Capturing user data, HTML forms and thick-client components - Active X controls - Prevention - Attacking authentication - Design flaws in authentication - Implementation flaws in authentication - Prevention - Attacking session management - Weakness in session management generation and handling, Its prevention - Attacking access control.

MODULE III VULNERABILITIES AND PREVENTION **8**

Common vulnerabilities, Its prevention - Code injection - Injection into SQL, OS commands, web scripting techniques, SOAP, XPath, SMDP, LDAP - Attacking path traversal - Finding and exploiting path traversal vulnerabilities, Its prevention - Attacking application logic - Logic flaws - Attacking other users - XSS - Redirection attacks - HTTP header injection - Frame injection- Request forgery- JSON hijacking - Session fixation - Local privacy attacks - Advanced exploiting techniques -Its prevention.

MODULE IV SECURITY ATTACKS **8**

Burp proxy - Automating bespoke attacks - Uses for bespoke automation - Enumerating valid identifier - Fuzzing common vulnerabilities, Its prevention-

Exploiting information disclosure - Exploiting error message, Its prevention - Attacking compiled application - Buffered overflow attacks - Integer and format string vulnerabilities, Its prevention - Architectural attacks – Tiered architecture - Shared hosting and Application service providers, Its prevention - Server attack - Vulnerable application configuration and Software - Source code vulnerabilities - Different languages, Its prevention.

MODULE V HACKING AND SECURITY **7**

Hacker's toolkit - Web browsers - Integrated testing suites – Vulnerability scanners -Nikto-hydra-custom Scripts - Hacker's methodology – Mapping application content -Analyzing application-testing - Client side controls - Authentication mechanism - Session management mechanism – Access controls - Input based vulnerabilities- Logic flaws- Sharing hosting vulnerabilities- Web server vulnerabilities- Miscellaneous checks.

MODULE VI TOOLS AND TECHNOLOGIES **8**

Security tools and services - Time-based one-time passwords - Challenge/ response one-time password - Lamport's one-time password algorithm - Smart cards - RADIUS - SASI - Host-to-host authentication - PKI – Firewalls - Kinds of firewalls- Filtering services - Firewall engineering - Tunneling and VPNs - Secure communications over insecure networks - Kerberos authentication system - Link level encryption - Network level encryption - Application-level Encryption - Hidden markov model.

Total Hours: 45

REFERENCES:

1. Dafydd Stuttard and Marcus Pinto, "The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws", 2nd Edition, Wiley Publications, 2011.

2. William R.Cheswick, Steven M. Bellovin and Aviel D.Rubin, "Firewalls and Internet Security – Repelling the Wily hacker", 2nd Edition, Pearson Education, 2008.

OUTCOMES:

Students who complete this course will be able to

- utilize the latest technology that are widely used by the digital forensic experts.
- analyze on system vulnerabilities and provide solutions to overcome them.
- apply suitable tools and techniques for enforcing system security.

CSBY22 OBJECT ORIENTED SOFTWARE ENGINEERING L T P C

(Common to M.Tech (CSE, NS,CSE-BDA)) 3 0 0 3

OBJECTIVES:

- To introduce concepts that underlies object orientation.
- To study about classical software engineering life cycle models.
- To discuss the implications of various aspects of object oriented software engineering.
- To learn techniques at each stage of development, including use cases, UML.

PREREQUISITES:

- Object Oriented Programming
- Data Structures

MODULE I SOFTWARE ENGINEERING CONCEPTS 8

Software engineering concepts and development activities –Managing Software development - Software life cycle models – Iteration and Incrementation – Other life cycle models – Comparison of life cycle models.

MODULE II OBJECT ORIENTATION AND REQUIREMENT 8

Object Orientation Concepts - Requirement Elicitation Concepts – Activities – Negotiating Specifications with Clients – Maintaining Traceability – Documenting Requirements Elicitation.

MODULE III TEAM ORGANIZATION AND MODELLING WITH UML 7

Team Organization – Approaches – Choosing an appropriate Team Organization- People Capability Maturity Model Overview of UML – Modelling Concepts – A deeper view into UML.

MODULE IV ANALYSIS AND DESIGN 8

Overview of Analysis – Concepts – Activities – Managing Analysis – Design Concepts -From Modules to Objects - Cohesion- Coupling.

MODULE V TESTING **7**

Testing Concepts – Testing Activities – Managing Testing – Object Oriented Testing Strategies – Challenges and issues.

MODULE VI MANAGING CHANGE AND CONFIGURATION **7**

Rationale Management – Concepts – Activities – Documenting Rationale – Overview of Configuration Management.

Total Hours: 45

REFERENCES:

1. Stephen R.Schach "Object Oriented and Classical Software Engineering", 8th Edition, Mc Graw Hill Education, 2010.
2. Bernd Bruegge & Allen H. Dutoit, "Object-Oriented Software Engineering Using UML, Patterns, and Java", 3rd Edition, Prentice Hall, 2010.
3. Timothy C. Lethbridge, Robert Laganiere,"Object-Oriented Software Engineering – Practical Software Development Using UML and Java.", 2nd Edition, Mc-Graw Hill education, 2004.
4. Craig Larman "Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development", 3rd Edition, Prentice Hall, 2004.

OUTCOMES:

Students who complete this course will be able to

- Compare the different life cycle models and select the appropriate one for a project.
- Investigate principles of object oriented software engineering, from requirements through testing.
- Illustrate the different UML diagrams using various tools.
- Identify the different artifacts produced during software development and develop the team skills required to build software applications.

CSBY25	CLOUD COMPUTING	L	T	P	C
	(Common to M.Tech (CSE, SE, NS,CPA,CSE-BDA))	3	0	0	3

OBJECTIVES:

- To provide a comprehensive and in-depth knowledge of Cloud Computing concepts, technologies, architecture and applications.
- To provide an insight into the core of cloud computing that revolves around Internet architecture and virtualization.
- To expose the students to frontier areas of Cloud Computing and information systems.

PREREQUISITES:

- Distributed Operating System

MODULE I SYSTEMS MODELING, CLUSTERING AND VIRTUALIZATION 8

Scalable Computing Service over The Internet - Technologies for Network-based Computing - System Models for Distributed and Cloud Computing - Software Environments for Distributed Systems and Clouds - Performance, Security, and Energy-Efficiency - Clustering for Massive Parallelism - Computer Clusters and MPP Architectures - Design Principles of Computer Clusters - Cluster Job and Resource Management.

MODULE II VIRTUALIZATION 7

Implementation Levels of Virtualization - Virtualization Structures/Tools and Mechanisms - Virtualization of CPU, Memory and I/O Devices - Virtual Clusters and Resource Management - Virtualization for Datacenter Automation.

MODULE III CLOUD FUNDAMENTALS 7

Origins and Influences - Basic Concepts and Terminology - Goals and Benefits - Risks and Challenges - Roles and Boundaries - Cloud Characteristics - Cloud Delivery Models - Cloud Deployment Models- Broadband Networks and Internet Architecture - Virtualization Technology - Web Technology - Multitenant Technology - Service Technology.

MODULE IV CLOUD COMPUTING ARCHITECTURE **8**

Fundamental Cloud Architectures - Workload Distribution Architecture - Resource Pooling Architecture - Dynamic Scalability Architecture - Elastic Resource Capacity Architecture -Service Load Balancing Architecture - Cloud Bursting Architecture - Elastic Disk Provisioning Architecture - Redundant Storage Architecture.

MODULE V ADVANCED CLOUD ARCHITECTURES **8**

Hypervisor Clustering Architecture - Load Balanced Virtual Server Instances Architecture - Non-Disruptive Service Relocation Architecture - Zero Downtime Architecture - Cloud Balancing Architecture -Resource Reservation Architecture - Dynamic Failure Detection and Recovery Architecture -Bare-Metal Provisioning Architecture - Rapid Provisioning Architecture - Storage Workload Management Architecture.

MODULE VI WORKING WITH CLOUDS **7**

Cloud Delivery Models: The Cloud Provider Perspective - Cloud Delivery Models: The Cloud Consumer - Cost Metrics and Pricing Models - Business Cost Metrics - Cloud Usage Cost Metrics - Cost Management Considerations.

Total Hours: 45

REFERENCES:

1. Kai Hwang, Jack Dongarra & Geoffrey Fox, “Distributed and Cloud Computing”, 1st Edition, Morgan Kaufmann, 2011.
2. Thomas Erl, Zaigham Mahmood, Ricardo Puttini, “Cloud Computing: Concepts, Technology & Architecture”, 1st Edition, Prentice Hall/ Pearson PTR, 2013.
3. Micheal Miller, “Cloud computing”, 1st Edition, Pearson, 2009.

OUTCOMES:

Students who complete this course will be able to

- Articulate the concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing.
- Identify problems, explain, analyze and evaluate various cloud computing solutions.
- Demonstrate the various tools used in the cloud environment.
- Provide the appropriate cloud computing solutions according to the applications used.

SSBY01 SOCIETY, TECHNOLOGY AND SUSTAINABILITY

L	T	P	C
3	0	0	3

OBJECTIVES:

- Aware of new technologies through advances in Science and Engineering.
- To make them realise the profound impact on society.
- Understand the ethical issues raised by technological changes and its effect on society.
- To introduce students a broad range of perspectives on the adoption and use of technologies.
- To make them realize the need of sustainability in the context of emerging technologies.

PREREQUISITES:

- Advanced Sciences

MODULE I TECHNOLOGY AND ITS IMPACTS **9**

Origin and evolution of technologies – Nature of technology- Innovation – Historical Perspective of technology – Sources of technological change - Co-evolution of technology and economy – Scientific knowledge and technological advance – Science and Engineering aspects of Technology – Impact on the Society – Social and Ethical Issues associated with technological change – Social and environmental consequences - Impact of technological change on human life –Technology and responsibility – Technology and social justice.

MODULE II TECHNOLOGY AND ITS ADVANCEMENT **9**

Sociological aspects of technology – Ethics and technology – Technology and responsibility – International Economics, Globalisation and Human Rights – Sustainability and Technology – Population and environment - Technology, Energy and Environment – Organisations and technological change

MODULE III SOCIETY AND TECHNOLOGY **9**

Impact of technologies on contemporary society – Role of society in fostering the development of technology – Response to the adaption and use of

technology – Impact of technology on developer and consumers – Technological change and globalisation.

MODULE IV IMPACT OF A SPECIFIC TECHNOLOGY ON HUMAN WELFARE **9**

Impact of the following technologies on Human life – Medical and Biomedical – Genetics Technology – Electronics and Communications – Electronic media Technology – Information Systems Technology – Nanotechnology – Space Technology and Energy Technology.

MODULE V THE IMPORTANCE OF SUSTAINABILITY **9**

Sustainability – A brief history – Concepts and contexts for sustainability – Ecological imbalance and biodiversity loss – Climate change – Population explosion. Industrial ecology – systems approach to sustainability – Green engineering and technology- sustainable design- sustainable manufacturing- Green consumer movements – Environmental ethics – Sustainability of the planet Earth – Future planning for sustainability.

Total Hours : 45

REFERENCES:

1. Volti Rudi, “Society and Technology Change”, 6th Edition, Worth publishers Inc, USA, 2009.
2. Arthur W.A, “The nature of Technology: What it is and how it evolves”, Free Press, NY, USA, 2009.
3. Winston M and Edelbach R, “Society, Ethics and Technology”, 3rd Edition, San Francisco, USA, 2005.
4. Martin A.A Abraham, ‘Sustainability Science and Engineering: Defining Principles’, Elsevier Inc, USA, 2006.
5. R.V.G.Menon, “Technology and Society”, Pearson Education, India, 2011.

OUTCOMES:

At the end of this course, the students will be able to

- implement the benefits of modern technology for the well-being of human life.
- connect sustainability concepts and technology to the real world challenges.
- find pathway for sustainable society.

VISION AND MISSION OF THE DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

VISION

The vision of the Department of Computer Science and engineering is to impart quality education, inculcate professionalism and enhance the problem solving skills of the students in the domain of Computer Science and Engineering with a focus to make them industry ready, involve in possible areas of research, to pursue and have continual professional growth.

MISSION

- Equip the students with strong fundamental concepts, analytical capability, programming and problem solving skills.
- Create an ambience of education through faculty training, self learning, sound academic practices and research endeavors.
- Facilitate a research culture in the department leading to high quality publications and funded projects.
- To identify potential areas of research and create centre of excellence in those areas.
- Provide opportunities to promote organizational and leadership skills in students through various extra – curricular activities.
- Expose the students to emerging and upcoming technologies through co-curricular events.
- To make the students as for as possible industry ready to enhance their employability in the industries.
- To improve department industry collaboration through internship programme and interaction with professional society through seminar/workshops.
- Imbibe social awareness and responsibility in students to serve the society.

PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES
M.Tech. (Software Engineering)

PROGRAMME EDUCATIONAL OBJECTIVES

- To impart advanced concepts of software engineering design and development.
- To train the graduates in process methodologies and techniques for software development.
- To provide in depth knowledge on the application of software engineering CASE tools and their relevance to industry practices.
- To pursue research in software modeling and design for solving complex problems.

PROGRAMME OUTCOMES

On completion of the programme the graduates will

- have the knowledge and skills in the processes and practices adopted in software development.
- be able to apply software engineering tools for solving real life problems.
- be able to undertake need based research focus on issues related to industries.
- be equipped with necessary skills for technical documentation and presentation.

CURRICULUM & SYLLABI FOR M.Tech. (SOFTWARE ENGINEERING)

(FOUR SEMESTERS / FULL TIME)

CURRICULUM

SEMESTER I

Sl. No	Course Code	Course Title	L	T	P	C
1	MAB6189	Statistical Methods and Queuing Theory	3	1	0	4
2	CSB6122	Advanced Database Technology	3	0	2	4
3	CSB6123	Software Requirement Analysis and Estimation	3	0	0	3
4	CSB6104	Computer Networks And Management	3	0	2	4
5		Elective-I	3	0	0	3
6	CSB6101	Research Methodology for Engineers	3	1	0	4
7	CSB6124	Case Tools lab	0	0	3	1
8	CSB6125	Term Paper	0	0	2	1
						24

SEMESTER II

Sl. No	Course Code	Course Title	L	T	P	C
1	CSB6231	Software Design and Architecture	3	0	0	3
2	CSB6232	Information Security	3	0	0	3
3	CSB6233	Software Testing and Quality Assurance	3	0	0	3
4	CSB6234	Formal Methods for Software Engineering	3	0	0	3
5		Elective - II	3	0	0	3
6		Elective - III	3	0	0	3
7	CSB6235	Software Design (Case Study)	0	0	3	1
8	CSB6236	Software Quality Assurance lab	0	0	3	1
						20

SEMESTER III

Sl. No	Course Code	Course Title	L	T	P	C
1		Elective IV	3	0	0	3
2		Elective V	3	0	0	3
3		Elective VI	3	0	0	3
4	CSB7201	Software Project Management	3	0	0	3
5	CSB7221	Project - Phase I	0	0	12	6*
						15

SEMESTER IV

Sl. No	Course Code	Course Title	L	T	P	C
1	CSB7221	Project - Phase II	0	0	36	18*
						18 + 6 = 24

*Credits for Project Work (Phase I) to be accounted along with Project work (Phase II) of IV Semester

TOTAL CREDITS: 80

LIST OF ELECTIVES

Sl. No	Course Code	Course
1	CSBY01	Theory of computation
2	CSBY02	Soft Computing
3	CSBY03	Mobile Computing
4	CSBY26	Distributed Systems
5	CSBY04	Web Technology
6	CSBY05	XML and Web Services
7	CSBY06	Multimedia Systems
8	CSBY27	Software Agents
9	CSBY08	Embedded Systems
10	CSBY28	IT System Management
11	CSBY10	Mobile Ad hoc Networks
12	CSBY11	Data warehousing and Data mining
13	CSBY12	Performance evaluation of Computer systems and Networks
14	CSBY13	Agent Based Intelligent Systems
15	CSBY29	Personal Software Process
16	CSBY30	Team Software Process
17	CSBY31	Software Engineering for Image processing
18	CSBY24	Service Oriented Architecture
19	CSBY32	Principles of Grid Computing
20	CSBY33	Pervasive Computing
21	CSBY34	User interface design
22	CSBY35	Software maintenance
23	CSBY36	Multimodal Computing
24	CSBY25	Cloud Computing
25	SSBY01	Society, Technology and sustainability

SEMESTER I

MAB 6189 STATISTICAL METHODS AND QUEUING THEORY

L	T	P	C
3	1	0	4

OBJECTIVES:

- To teach about the probability and Random variable of the various functions. It also helps to understand the various statistical methods including the Design of experiments.
- To expose the students to apply certain probability, statistical and operational research concepts in practical applications of computer science areas.

PREREQUISITES:

- Engineering Mathematics

MODULE I BASIC PROBABILITY **8**

Axioms of probability – Addition and Multiplication theorem – Conditional probability – Total Probability – Random variables.

MODULE II DISTRIBUTIONS **8**

Binomial, Poisson, Geometric, Uniform, Normal, Exponential distributions – Moments – Moments generating functions and their properties – Function of random variables.

MODULE III ESTIMATION THEORY **8**

Partial and Multiple correlations – Partial and multiple regressions – Estimation of parameters using maximum likelihood estimator and method of moments.

MODULE IV TESTING OF HYPOTHESIS **7**

Basic definitions of statistical hypothesis – Tests based on Normal, T, Chi – square and F distributions for mean, variance and proportion.

MODULE V DESIGN OF EXPERIMENTS **7**

Analysis of variance – One way and two way classifications – Completely randomized design – Randomized block design – Latin square design – 22 factorial designs.

MODULE VI QUEUING THEORY **7**

Characteristics of Queuing Models – Poisson Queues - (M / M / 1): (FIFO / 8 /8), (M/M/C): (FIFO / 8 / 8), models.

L – 45; T – 15; Total Hours: 60

REFERENCES:

1. Taha H.A, "Operations Research: An Introduction", 7th Edition, Pearson Education Edition, Asia, New Delhi, 2002.
2. Walpole R.E., Myer R.H, Myer S.L. and Ye. K, "Probability and Statistics for Engineers and Scientists", 7th Edition, Pearson Education, Delhi, 2002.
3. Goel B.S. and Mittal S.K, "Operations Research", Pragati Prakashan, Meerut, 2000.
4. Winston. W.L. "Operations Research", 4th Edition, Thompson-Brooks/Cole, 2003.
5. Sheldon M. Ross, "Introduction to Probability Models", 10th Edition, Academic Press, USA, 2010.
6. Richard A. Johnson, "Miller and Freund's Probability and Statistics for Engineers", 8th Edition, Pearson Education, Asia, 2011.
7. R. Lyman Ott, Michael Longnecker, "An Introduction to Statistical Methods and Data Analysis", 6th Edition, Brooks/Cole Cengage Learning, USA, 2010.

OUTCOMES:

Students who complete this course will be able to

- acquire skills in handling situations involving more than one random variable and functions of random variables.
- explain the notion of sampling distributions and complete simple problems using statistical techniques useful in making rational decisions in management problems.
- apply the statistical methods designed to contribute to the process of making scientific judgments in the face of uncertainty and variation.
- apply the basic queuing models.

CSB6122 ADVANCED DATABASE TECHNOLOGY L T P C

3 0 2 4

OBJECTIVES:

- To emphasize the practical and theoretical aspects of advanced topics in databases, such as object-relational databases and data warehouses.
- To disseminate the various data analysis techniques.
- To expose the main techniques for developing database systems.

PREREQUISITES:

- Database Management System

MODULE I DATABASE MANAGEMENT 8

Relational data model - SQL - Database design - Entity-Relationship model - Relational normalization - Embedded SQL - Dynamic SQL - JDBC – ODBC.

MODULE II ADVANCED DATABASES 7

Object databases - Conceptual object data model - XML and Web Data - XML Schema - Distributed data bases - OLAP and Data Mining - ROLAP and MOLAP.

MODULE III QUERY AND TRANSACTION PROCESSING 7

Query processing basics - Heuristic optimization - Cost, size estimation - Models of transactions - Architecture - Transaction processing in a centralized and distributed system - TP monitor.

MODULE IV IMPLEMENTING AND ISOLATION 8

Schedules - Concurrency control - Objects and semantic commutatively - Locking -Crash, Abort and Media failure - Recovery - Atomic termination - Distributed deadlock - Global serialization - Replicated databases - Distributed transactions in real world.

MODULE V DATABASE DESIGN ISSUES 7

Security - Encryption - Digital signatures - Authorization - Authenticated RPC - Integrity - Consistency - Database tuning - Optimization and research issues.

MODULE VI CURRENT ISSUES **8**

Rules - Knowledge Bases - Active and Deductive Databases – Multimedia Databases – Multimedia Data Structures – Multimedia Query languages - Spatial Databases.

L-45; P-15; Total Hours: 60

REFERENCES:

1. R. Elmasri, S.B. Navathe, “Fundamentals of Database Systems”, 5th Edition, Pearson Education, 2006.
2. Philip M. Lewis, Arthur Bernstein and Michael Kifer, "Databases and Transaction Processing:An Application Oriented Approach", 2nd Edition, Addison Wesley, 2005.
3. Abraham Silberschatz, Henry. F. Korth and S.Sudharsan, "Database System Concepts", 4th Edition, Tata McGraw Hill, 2004.
4. Raghu Ramakrishna and Johannes Gehrke,"Database Management Systems, 3rd Edition, Tata McGraw Hill, 2003.

OUTCOMES:

Students who complete this course will be able to

- identify an automated database design tool to design complex database systems.
- apply object-relational data model concepts in database modeling and design.
- optimize recovery of database transactions in relevant application.

CSB6123	SOFTWARE REQUIREMENTS ANALYSIS AND ESTIMATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To enable the students to identify understand the role of requirement engineering in software engineering.
- To make the students to be aware of the fundamentals of software costing and pricing.
- To analyze the concept of risk management.

PREREQUISITES:

- Software Engineering

MODULE I THE CONTEXT OF SOFTWARE REQUIREMENTS 7

The Software Crisis – Software Estimation – Software Lifecycle – Software Projects – Management Activities in a Software Project – Requirement Engineering – Software Engineering.

MODULE II SOFTWARE REQUIREMENT DEVELOPMENT 7

Establishing the product vision and project scope – Finding the voice of customer hearing the voice of customer – Understanding user requirements – Documenting the requirements - Risk reduction through prototyping – Setting requirement priorities – Validating the requirements-Software Process model.

MODULE III SOFTWARE REQUIREMENT AND RISK MANAGEMENT 8

Elements of Risk Management – Documenting Project Risks – Planning For Risk Management – Requirements Elicitation – Requirements Analysis – Requirements Specification – Requirements Validation – Requirements Management.

MODULE IV SOFTWARE REQUIREMENTS ANALYSIS 8

Size Estimation - Two Views of Sizing- Function Point Analysis- Mark II FPA- Full Function Points – Other Function Point Extensions – Approximate Function Point Computations – Directions in Functional Size Measurements - LOC Estimation - Conversion between Size Measures.

MODULE V EFFORT, SCHEDULE AND COST ESTIMATION 7

Productivity - Estimation Factors - Approaches to Effort and Schedule Estimation - COCOMO II - Putnam Estimation Model – Using Complexity As Estimator – Estimation By Analogy - Algorithmic Models –Bottom Up Estimation - Cost Estimation – Validating Software Estimates.

MODULE VI SOFTWARE ESTIMATION TOOLS 8

Desirable features in software estimation tools- IFPUG- USC's COCOMO II - SLIM (Software Life Cycle Management) Tools.

Total Hours: 45

REFERENCES:

1. Ian Sommerville,"Software Engineering", 8th Edition, Pearson Education India, 2008.
2. Karl E Wiegers , Joy Beatty ," Software Requirements", 3rd Edition, Microsoft, 2012.
3. Swapna Kishore, Rajesh Naik, "Software Requirements and Estimation", 1st Edition, Tata McGraw Hill , 2001.

OUTCOMES:

Students who complete this course will be able to

- explain the role of software requirements development.
- explore the costs and risks of the requirements process and its relationships to the rest of the software development life cycle.
- develop different design solutions to a given problem and recommend the best one within limitations of cost, time, knowledge, existing systems and organizations.

CSB6104	COMPUTER NETWORKS AND MANAGEMENT	L	T	P	C
	(Common to M.Tech (CSE, NS,SE, CSE-BDA))	3	0	2	4

OBJECTIVES:

- To gain knowledge on the basic concepts of computer networks and OSI network model.
- To introduce the operation and management of computer networks.
- To understand the paradigms and functions of network management.
- To study the underlying applications and tools for network management.
- To acquire knowledge on broadband networks and its services.

PREREQUISITES:

- Operating System

MODULE I FUNDAMENTALS OF COMPUTER NETWORK TECHNOLOGY **7**

Network Topology, LAN, Network node components- Hubs, Bridges, Routers, Gateways, Switches, WAN, ISDN Transmission Technology, Communications protocols and standards.

MODULE II OSI NETWORK MANAGEMENT **7**

OSI Network management model- Organizational model -Information model, Communication model. Abstract Syntax Notation - Encoding structure, Macros Functional model CMIP/CMIS.

MODULE III INTERNET MANAGEMENT **7**

SNMP-Organizational model-System Overview - The information model - Communication Model - Functional model - SNMP proxy server- Management information, protocol remote monitoring.

MODULE IV BROADBAND NETWORK MANAGEMENT **8**

Broadband networks and services - ATM Technology-VP,VC - ATM Packet - Integrated service - ATMLAN emulation - Virtual LAN - ATM Network Management - ATM Network reference model, integrated local management Interface - ATM Management Information base-Role of SNMD and ILMI in

ATM Management- M1, M2, M3, M4 Interface- ATM Digital Exchange Interface Management.

MODULE V NETWORK MANAGEMENT APPLICATIONS 8

Configuration management - Fault management - Performance management - Event Correlation Techniques security Management - Accounting management - Report Management- Policy Based Management Service Level Management.

MODULE VI APPLIED NETWORK MANAGEMENT 8

The Need for Management Integration- Management Integration challenge - Approaches to Management Integration- Service Level Management-The Motivation for Service Level Agreements - Identification of Service Level Parameters - Defining a Service Level Agreement- Managing for a Service Level.

L- 45; P-15; Total Hours: 60

REFERENCES:

1. Mani Subramanian, "Network Management: Principles and Practices", 2nd Edition, Prentice Hall, 2012.
2. Alexander Clemm, "Network Management Fundamentals", 1st Edition, Cisco Press, 2006.
3. Adrian Farrell, "Network Management Know It All", 1st Edition, Elsevier India, 2008.
4. Richard Burke, "Network Management: Concepts & Practice, A Hands on Approach", 1st Edition, Prentice Hall, 2003.

OUTCOMES:

Students who complete this course will be able to

- correlate the fundamental importance of network information management related to the business objectives of an organization.
- use computer network management tools and the systems.
- apply the basic knowledge of current developments in information and communication technologies, standards and applications to network related applications.
- visualize the effectiveness of Broadband networks and services.

CSB6101 RESEARCH METHODOLOGY FOR ENGINEERS **L T P C**

(Common to M.Tech (CSE, SE, NS, IT, IS & DF, CPA,CSE-BDA)) **3 1 0 4**

OBJECTIVES:

- To make the students well versed in Data analysis.
- To describe the steps involved in research process.
- To explain them how to formalize research problems.
- To discuss clearly the approaches for research through some case studies.

PREREQUISITES:

- Engineering Mathematics
- Operational Research

MODULE I RESEARCH PROBLEM **8**

The research problem – Sources of research problem – Information, how to deal with it – Criteria / characteristics of a good research problem – Errors in selecting a good research problem – Types of research – Nature and use of arguments.

MODULE II SAMPLING DESIGN AND SCALING TECHNIQUES **7**

Census and Sample survey – Steps in Sampling Design – Different types of Sample Designs – Complex Random Sampling Designs – Measurement scales – Techniques of Developing Measurement Tools – Scaling – Important Scaling Techniques.

MODULE III METHODS OF DATA COLLECTION AND ANALYSIS OF DATA **8**

Collection of Primary Data – different types – Some other methods of Data Collection – Collection of Secondary Data – Processing Operations – Types of Analysis – Measures of Central tendency – Measures of Dispersion.

MODULE IV LINEAR PROGRAMMING **10**

Basic of Operations Research(OR): Characteristics of Operations Research – OR and Decision making- Linear programming – Stimulation and Graphical

solution of canonical and standard forms of Linear programming problem – Algebraic solution – Simplex method – Charne's method of penalties – Concept of duality – Properties of duality.

MODULE V TRANSPORTATION AND ASSIGNMENT MODELS 6

Transportation Problem – Assignment Problem – Travelling Salesman Problem.

MODULE VI CASE STUDIES 6

Presentation by students on their area of research.

L – 45; T – 15; Total Hours: 60

REFERENCES:

1. Kothari, C.R., "Research Methodology: Methods and Techniques", 2nd Edition, New Age International, New Delhi, 2012.
2. Nicholas Walliman, "Your Research Project", 2nd Edition, Vistaar Publication, New Delhi, 2005.
3. Taha H.A., "Operations Research: An Introduction", 7th Edition, Pearson Education Edition, Asia, New Delhi, 2002.
4. Richard A. Johnson, "Miller and Freund's Probability and Statistics for Engineers", 8th Edition, Pearson Education, Asia, 2011.

OUTCOMES:

Students who complete this course will be able to

- identify the research problem.
- become capable of analyzing the data using mathematical techniques.
- learn to apply the probability concepts in research.
- demonstrate the different research methods applicable to a specific problem.

CSB6124	CASE TOOLS LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To know how CASE (Computer Aided Software Engineering) tools are used in various stages of the Software Development Life Cycle.
- To give the analysis elements of the project and define the association between them.
- To become familiar with UML(Unified Modeling Language).
- To learn how to test the developed software using Rational Rose.

1. Problem Analysis and Project Planning Thorough study of the problem – Identify project scope, Objectives, infrastructure
2. Software Requirement Analysis Describe the individual Phases/ modules of the project, Identify deliverables.
3. Data Modelling Use work products – data dictionary, use case diagrams and activity diagrams, build and test class diagrams, sequence diagrams and add interface to class diagrams.
4. Software Development and Debugging.
5. Software Testing Prepare test plan, perform validation testing, coverage analysis, memory leaks, develop test case hierarchy, Site check and site monitor.

PREREQUISITES:

- Object Oriented Analysis and Design

List of Experiments:

1. Quiz System.
2. Online ticket reservation system.
3. Remote computer monitoring.
4. Student marks analysing system.
5. Expert system to prescribe the medicines for the given symptoms.

6. ATM system.
7. Platform assignment system for the trains in a railway station.
8. Stock maintenance.
9. E-mail Client system.
10. Payroll System.
11. Course Registration System.
12. Real-Time Scheduler.

Software Required:

Case Tools: Rational Suite, Win runner, Empirix.

Languages: C/C++/JDK 1.3, JSDK, INTERNET EXPLORER, UML. Front End: VB, VC++, Developer 2000.

Back End: Oracle, MS-Access, SQL.

OUTCOMES:

Students who complete this course will be able to

- analyze a problem using different UML diagrams and design the architecture for a problem.
- develop coding and apply CASE tool in all the phases of software development.
- draw Use case diagram, Class diagram, Sequence diagram and collaboration diagram.
- test the software, memory usage of the software and validate the Test cases using Rational Rose.

SEMESTER II

CSB6231	SOFTWARE DESIGN AND ARCHITECTURE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To gain knowledge on the challenges of advanced software design and various issues relating to software design.
- To understand the tools and techniques for the automatic analysis and evaluation of software.
- To introduce various software design techniques.
- To acquire knowledge on the various Architectural styles and patterns.

PREREQUISITES:

- Software Engineering

MODULE I INTRODUCTION 8

The Architecture Business Cycle: Where do architectures come from - Software processes and the architecture business cycle - what makes a “good” architecture? - What software architecture is and what it is not, other points of view - Architectural patterns, reference models and reference architectures - Importance of software architecture - Architectural structures and views.

MODULE II ARCHITECTURAL STYLES AND CASE STUDIES 8

Architectural styles - Pipes and filters - Data abstraction and object-oriented organization - Event-based, implicit invocation - Layered systems – Repositories – Interpreters - Process control - Other familiar architectures - Heterogeneous architectures. Case Studies: Keyword in Context - Instrumentation software - Mobile robotics - Cruise control - Three vignettes in mixed style.

MODULE III NON FUNCTIONAL REQUIREMENTS 9

Functionality and architecture - Architecture and quality attributes - System quality attributes - Quality attribute scenarios in practice - Other system quality attributes - Business qualities - Architecture qualities. Achieving Quality: Introducing tactics - Availability tactics - Modifiability tactics - Performance

tactics - Security tactics - Testability tactics - Usability tactics - Relationship of tactics to architectural patterns - Architectural patterns and styles.

MODULE IV ARCHITECTURAL PATTERNS – 1 **6**

Introduction from mud to structure: Layers, Pipes and Filters, Blackboard.

MODULE V ARCHITECTURAL PATTERNS – 2 **7**

Distributed Systems: Broker - Interactive Systems: MVC, Presentation-Abstraction-Control.

MODULE VI DESIGN PATTERNS **7**

Structural decomposition: Whole – Part; Organization of work: Master – Slave - Access Control: Proxy.

Total Hours: 45

REFERENCES:

1. Paul Clements, Rick Kazman, “Software Architecture in Practice – Len Bass”, 2nd Edition, Pearson Education, 2003.
2. Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal, “Pattern-Oriented Software Architecture, A System of Patterns”, 2nd Edition, Volume 1, John Wiley and Sons, 2008.
3. Mary Shaw and David Garlan,”Software Architecture- Perspectives on an Emerging Discipline”, Prentice-Hall of India, 2007.

OUTCOMES:

Students who complete this course will be able to

- apply the principles behind software patterns to design real time applications.
- acquire practical competence in the usage and application of tools to support automated software analysis.
- adopt different architectural styles for designing a system.

CSB6232	INFORMATION SECURITY	L	T	P	C
	(Common to M.Tech (SE, NS))	3	0	0	3

OBJECTIVES:

- To explain clearly about security policies and the major mechanisms for implementing security policies.
- To disseminate how threats to an organization are discovered, analyzed and dealt with.
- To train on procedures and practices for information security services.

PREREQUISITES:

- Computer security and Computer Networks

MODULE I INTRODUCTION TO INFORMATION SECURITY 8

Introduction-History of information security-What is security-Need for security-CNSS security model-Components of an information system-Balancing information security and access-System development life cycle-Security systems development life cycle- Threats-Attacks-Secure software development.

MODULE II RISK MANAGEMENT 7

Introduction- Risk identification- Assessment- Control strategies- Selecting a risk control strategy – Quantitative versus Qualitative risk control practices.

MODULE III PLANNING FOR SECURITY 8

Introduction-Information security planning and governance- Information security policy, standards and practices-Cryptographic tools-protocols for secure communications-Attacks on cryptosystems.

MODULE IV PHYSICAL SECURITY 7

Introduction-Physical access controls-Fire Security and safety-Failure of supporting utilities and structural collapse-Interception of Data-Remote computing security.

MODULE V IMPLEMENTING INFORMATION SECURITY 7

Information security project management-Technical aspects of implementation-Non technical aspects of implementation- Positioning and staffing the security function.

MODULE VI SOCIAL AND HUMAN ELEMENTS OF INFORMATION SECURITY 8

Human and Social Aspects of Password Authentication- Impact of the Human Element on Information Security-Social and Human Elements of Information Security: A Case Study-Security Configuration for Non-Experts: A Case Study in Wireless Network Configuration.

Total Hours: 45

REFERENCES:

1. James Michael Stewart, Ed Tittel and Mike Chapple, “Principles of Information Security”, 3rd Edition, John Wiley & Sons, 2011.
2. Jason Andress, “The Basics of Information Security”, 1st Edition, Syngress Press, Elsevier Publications, 2011.
3. Merkow, “Information Security: Principles and Practices”, 2nd Edition, Pearson Education India, 2007.

OUTCOMES:

Students who complete this course will be able to

- analyze the major information security threats to any organization.
- apply security policies, standards and practices.
- implement authorization techniques to reduce security threats.

CSB6233	SOFTWARE TESTING AND QUALITY ASSURANCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the theoretical aspects of software testing.
- To demonstrate the knowledge of the existing testing methods.
- To expose to various industrial practices on software testing and quality assurance strategies
- To develop into a software tester and quality controller

PREREQUISITES:

- Software Engineering

MODULE I TESTING PRINCIPLES 8

Testing as an Engineering activity – TMM – Testing fundamentals – Testing as a process - Defects – Defect hypotheses and tests - Strategies and methods for test case design – Black Box approach – Random testing – Equivalence class partitioning – Boundary value analysis – Other approaches – White box approach – Test adequacy criteria – Mapping white box testing methods with TMM.

MODULE II LEVELS OF TESTING AND TEST PLAN 8

Need for levels of testing – Unit testing – Test harness – Integration test – Strategies and procedures – Integration test plan – Different types of system tests – Regression test – alpha beta acceptance test – Role of use cases – mapping levels of testing with TMM - Test planning – components and attachments – reporting test results – Test specialist – Tester certifications – study on testing software.

MODULE III DEFECT ANALYSIS AND PREVENTION 5

Processes and Defects - History of Defect Analysis and Prevention - Necessary Support for a Defect Prevention Program - Techniques for Defect Analysis - Defect Causal Analysis - The Action Team: Making Process Changes - Monitoring Actions and Process Changes - Benefits of a Defect Prevention Program - Defect Prevention and the Three Critical Views- Defect removal analysis – Defect removal effectiveness and process maturity level.

MODULE IV SOFTWARE METRICS **8**

Scope of software metrics, Classifying software measures, Measurement basics – representational theory, scales, meaningfulness, What to measure – GOM technique, Control flow structure, product quality metrics – MTTF, defect density, customer problems, customer satisfaction, function point, Metrics for software maintenance, In-process quality metrics.

MODULE V QUALITY ASSURANCE **8**

Quality concepts – quality, quality control, quality assurance, cost of quality Software quality assurance – SQA activities, software reviews, inspections, audits, Software reviews, inspections, audits, Software reliability Quality Attributes: correctness, reliability, usability, integrity, portability, maintainability, interoperability. Ishikawa's Seven Basic Tools.

MODULE VI QUALITY STANDARDS **8**

Basic concept of – ISO 9000 & 9001, CMM, six sigma.- Real time case study on testing practices in the industry – Study on various certification procedures to become a professional tester

TOTAL HOURS: 45

REFERENCES :

1. Ilene Burnstein, practical Software Testing: A Process-Oriented Approach, Springer Professional Computing, 2003.
2. William Perry, "Effective Methods For Software Testing", 3rd Edition, Wiley publications, 2006.
3. Glenford J. Myers, "The Art of Software Testing", 2nd Edition, John Wiley & Sons, Inc., Hoboken, New Jersey, 2004.
4. Stephen Kan, "Metrics and Models in Software Quality Engineering", 2nd Edition, Addison-Wesley Professional, 2003.
5. Patton, "Software Testing", 2nd Edition, Pearson Education India, 2006.

OUTCOMES

Students who complete this course will be able to

- understand and apply the various software testing strategies and apply the same in industrial practices.
- apply software quality controls and ensure quality in a software process.
- design and implement software quality standards and take up a career as a professional software tester

CSB6234	FORMAL METHODS FOR SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the notion of formal methods in software engineering.
- To understand the theoretical foundations of software engineering in terms of basic style, constructs and notations.
- To expose the students to the tools used for formal semantic analysis.

PREREQUISITES:

- Discrete Mathematics

MODULE I INTRODUCTION **6**

Need for formal Methods – Formal Vs Informal Programming- Software Engineering to Formal Methods – Advantages of Formal Methods – Weaknesses of Formal Methods – A Survey of Formal Methods.

MODULE II LOGICAL TOOLS **8**

Applications of Logic – Antecedents - Branches of Logic - Propositional Logic – Predicate Logic - Mathematical Reminders – Relationships and Ordinals - Computability - Hoare Logic.

MODULE III Z NOTATION **8**

The Interchange Language – User Defined Identifiers – Data Types – Basic Types – Compound Types – Schemas – Additional Constructs.

MODULE IV VDM **8**

Introduction to VDM – Basic Types – Quote Types – Compound Types – Optional Types - Functions - Operations – Additional Constructs.

MODULE V FORMAL SEMANTICS AND TOOLS **8**

Operational Semantics – Denotation Semantics – Axiomatic Semantics – Proof Editors - Proof Analyzer – Symbolic Simulators –Translators – Test Generation Tools.

MODULE VI FORMAL METHODS FOR COMPLEX SOFTWARE SYSTEMS **7**

Formal Specification Techniques and Software Architectures - Formal Analysis Techniques – Element Level Analysis – Composition Analysis – Refinement Analysis.

Total Hours: 45

REFERENCES:

1. Hossam A. Gabbar, “Modern Formal Methods and Applications”, 1st Edition, Springer, 2010.
2. Jean-Francois Monin, “Understanding Formal Methods”, 1st Edition, Springer, 2003.

OUTCOMES:

Students who complete this course will be able to

- apply the notations for requirement specifications.
- use formal semantic tools for software documentation.
- analyze complex software systems using formal methods.

CSB6235	SOFTWARE DESIGN (CASE STUDY)	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To give hands on experience on tools and techniques for design practices.
- To acquire training on the preparation of Software Requirement Specification document
- To give training on the preparation of design document.
- To highlight various design methods used for solving real life problems.
- To enhance soft skills, team building and technical writing skills.

PREREQUISITES:

- Software Engineering

METHODOLOGY OF ASSESSMENT

- The class can be grouped as teams of not more than three in a team.
- Each team can present their observations based on the parameters given.
- Each team should prepare and deliver a presentation on the contents of the documents such as the SRS and Design document.
- Case Study problems may be selected as per the choice of the students and the Case study may be evaluated on the following parameters
- Problem description and Analysis.
- Requirements Gathering Activities
- Different Techniques adopted for requirements gathering
- Software Requirement Specification Document
- Design Representations.
- Selection of appropriate design methods for the problem.
- Steps Taken to Address the Problem and the Inferences.
- Preparation of design document.
- Challenges and How They were Met
- Communication and clarity of presentation.

OUTCOMES:

Students who complete this course will be able to

- prepare an effective SRS document for the given problem
- select and apply appropriate software design methodologies for the problem chosen.
- make use of various tools for design representations.
- adopt the various methods of requirement elicitation and apply them.
- co-ordinate the work in teams in a better manner.

CSB6236	SOFTWARE QUALITY ASSURANCE LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To provide hands on experience on various software testing tools like Rational Rose Suite, Rational Functional Tester, Rational Performance Tester, Load Runner.
- To plan and design test cases and create test documentation.
- To understand and make use of tools to calculate various software quality metrics.

PREREQUISITES:

- Software Engineering

SOFTWARE TESTING LAB

1. Study of types of testing :
   a. Unit Testing
   b. Regression Testing
   c. Integration Testing
   d. Validation Testing
   e. Acceptance Testing
   f. System Testing
2. Study of testing Tools:
   a. Study of Any Testing Tool (Win Runner)
   b. Study of any web testing tool (e.g. Selenium)
   c. Study of Any Bug Tracking Tool (Bugzilla, Bugbit)
   d. Study of Any Test Management Tool (Test Director)
   e. Study of any open source testing tool (Test Link)
3. Prepare test plan and develop test case hierarchy
4. Generate Test cases and Test Documentation in the following case studies
   a. Library System

b. Course Registration System

c. Banking System

d. Student Marks Analyzing System

e. Online Ticket Reservation System

MEASUREMENTS LAB

1. Study of software measurements analysis and parameters
2. Object oriented programming development: Compute method inheritance factor weighted method for class.
3. Web application to calculate the following Weighted Method Count (WMC)
   - No of Children (NoC)
   - Depth of Inheritance (DIT)
   - Response for a Class (RFC)
   - Coupling and Cohesion between Objects (CCBO)

OUTCOMES:

Students who complete this course will be able to

- demonstrate the various software testing techniques on various software testing tools.
- develop test cases and test documentation.
- implement various levels of testing for any practical application.
- estimate the various factors (such as Weighted Mount Count, Depth of Inheritance, No of Children, etc.,) on a typical web application.

SEMESTER III

CSB7201	SOFTWARE PROJECT MANAGEMENT	L	T	P	C
	(Common to M.Tech (CSE, NS, SE, CPA, CSE-BDA))	3	0	0	3

OBJECTIVES:

- To highlight the importance of software project management.
- To discuss various processes in Software Project Management.
- To provide tools and techniques for project monitoring.
- To expose different project management life cycles.

PREREQUISITES:

- Software Engineering

MODULE I FUNDAMENTALS OF PROJECT MANAGEMENT 8

Defining a project- Sequence of Activities – Complex Activities – A Business focused definition - Understanding the Scope Triangle - Managing the Creeps- Importance of Classifying Projects - Fundamentals of Project Management - Introducing Project Management Life Cycles - Choosing the Best-Fit PMLC Model.

MODULE II PROJECT MANAGEMENT PROCESS GROUPS 8

Defining the Five Process Groups - Nine Knowledge Areas - Mapping Knowledge Areas to Process Groups - Using Tools, Templates, and Processes to Scope a Project - Managing Client Expectations.

MODULE III TPM PROJECT 8

Using Tools, Templates, and Processes to Plan a Project - Application Software Packages- Project Planning Tools – Planning and Conducting Joint Project - Building the WBS - Estimating - Constructing the Project Network Diagram - Effective Project Proposal - Launch a TPM Project- Monitor and Control a TPM Project.

MODULE IV ESTABLISHING PROJECT MANAGEMENT LIFE CYCLES 7

Understanding the Complexity/Uncertainty - Traditional Project Management - Incremental Project Management Life Cycle - Agile Project Management -

Iterative Project Management Life Cycle- Adaptive Project Management Life Cycle – Adapting and Integrating the APM Toolkit.

MODULE V BUILDING AN EFFECTIVE PROJECT MANAGEMENT 7

Establishing and Managing a Project Portfolio Management Process - The Project Portfolio Management Life Cycle - Establishing and Managing a Continuous Process Improvement Program - Defining Process and Practice Maturity - Using Process Improvement Tools, Templates and Processes.

MODULE VI MANAGING THE REALITIES OF PROJECTS 7

Prevention and Intervention Strategies for Distressed Projects - Using Tools, Templates and Processes to Prevent Distressed Projects - Organizing Multiple Team Projects - Managing the Professional Development of Project Teams.

Total Hours: 45

REFERENCES:

1. Robert K. Wysocki, “Effective Project Management – Traditional, Agile, Extreme”, 6th Edition, Wiley Publication, 2011.
2. Robert K. Wysocki, “Effective Software Project Management”, 3rd Edition, Wiley Publication, 2010.

OUTCOMES:

Students who complete this course will be able to

- design a project management plan using different project management life cycles.
- find a suitable project management life cycle model for effective project execution.
- analyze the risks associated with the projects.

ELECTIVES

CSBY01	**THEORY OF COMPUTATION**	**L**	**T**	**P**	**C**
	(Common to M.Tech(CSE, SE, CSE-BDA))	**3**	**0**	**0**	**3**

OBJECTIVES:

- To explain different abstract machine models of computations mathematically.
- To introduce students to the models of computation, including Turing machines, pushdown automata and deterministic and non-deterministic finite automata.
- To enhance/develop students ability to understand and conduct mathematical proofs for computation.

PREREQUISITES:

- Computer Architecture

MODULE I INTRODUCTION TO FINITE AUTOMATA 8

Strings – Alphabets – Languages – Inductive Proofs – Finite Automata – Deterministic Finite Automata – Non Deterministic Finite Automata – Equivalence of NFA and DFA – Finite Automata with e–Moves.

MODULE II REGULAR LANGUAGES 6

Regular Languages – Regular Expressions and regular Languages – Applications of Regular Expressions – Equivalence of Regular Expressions and NFA with -Moves – Properties of Regular Languages – Pumping Lemma.

MODULE III CONTEXT FREE GRAMMAR & LANGUAGES 8

Context Free Grammar – Derivations using Grammar – Leftmost and Rightmost Derivation – Ambiguity – Derivation Trees / Parse Trees – Relationship between Derivation and Derivation Trees – Simplification of Context Free Grammars – Normal forms for Context Free Grammars – CNF and GNF.

MODULE IV PUSH DOWN AUTOMATA 8

Definition of PDA – Languages of PDA – Equivalence of Pushdown Automata and Context Free Languages – Deterministic Pushdown Automata - Pumping Lemma for Context Free Language.

MODULE V COMPUTABILITY **8**

Turing machine – Storage in State, Multiple Tracks, Subroutines – Turing Machine Construction Techniques – Two Way Infinite Tape – Multitape Turing Machine – Universal Turing machine – Turing Machine and Computers.

MODULE VI UNDECIDABILITY **7**

Halting Problem for Turing Machines - Rice Theorem – Unsolvable Problem - Post Correspondence Problem – Properties of Recursive and Recursively Enumerable Languages.

Total Hours: 45

REFERENCES:

1. John E. Hopcroft, Rajeev Motwani, Jeffery D. Ullman, "Introduction to Automata Theory, Languages and Computation", 3rd Edition, Pearson Education, 2011.
2. John.C.Martin, "Introduction to languages and Theory of Computation", 3rd Edition, Tata Mc Graw Hill Education, 2010.
3. A.M.Natarajan, A.Tamilarasi and P.Balasubramani, "Theory of Computation", 1st Edition, New Age International Publishers, 2003.
4. K.L.P.Mishra and N.Chandrasekaran, "Theory of Computation", 3rd Edition, IEEE, Prentice Hall of India, 2006.
5. Peter Linz, "An Introduction to Formal Languages and Automata", 3rd Edition, Narosa Publishing House, 2011.

OUTCOMES:

Students who complete this course will be able to

- apply principles to minimize finite automata and grammars of context free languages.
- develop abstract models to simulate complex systems and solve problems on a model of computation.
- categorize problems into solvable and unsolvable constructs.

CSBY02	SOFT COMPUTING	L	T	P	C
	(Common to M.Tech (CSE, SE, NS, CSE-BDA))	3	0	0	3

OBJECTIVES:

- To introduce new ideas of neural networks, fuzzy logic and use of heuristics based on human experience.
- To highlight the role of soft computing algorithm.
- To understand the concepts of Genetic algorithm and its applications.

PREREQUISITES:

- Artificial Intelligence
- Neural Networks

MODULE I NEURO FUZZY AND SOFT COMPUTING 7

Soft computing constituents and Conventional Artificial Intelligence - Neuro fuzzy and soft computing characteristics - Fuzzy sets - Basic definitions - Fuzzy union, intersection and complement - Introduction to Classical Sets and Fuzzy sets – Classical Relations and Fuzzy Relations – Tolerance and Equivalence Relations –Membership Functions: Fuzzification – Methods of Membership Value Assignments – Defuzzification – Lambda-Cuts for Fuzzy sets and Fuzzy Relations – Defuzzification Methods.

MODULE II ARTIFICIAL NEURAL NETWORK 7

Introduction – Machine Learning Basics - Fundamental concept – Evolution of Neural Networks – Basic Models of Artificial Neural Networks – Important Terminologies of ANNs – McCulloch-Pitts Neuron – Supervised Learning Network: – Multiple Adaptive Linear Neurons – Back-Propagation Network – Radial Basis Function Network.

MODULE III ARTIFICIAL NEURAL NETWORK- II 7

Associative Memory Networks: Training Algorithms for Pattern Association – Auto associative Memory Network – Hetero associative Memory Network – Bidirectional Associative Memory – Hopfield Networks – Iterative Auto associative Memory Networks – Temporal Associative Memory Network. Unsupervised Learning Networks: Fixed weight Competitive Nets – Kohonen Self-Organizing Feature Maps – Learning Vector Quantization – Counter

propagation Networks – Adaptive Resonance Theory Networks – Special Networks.

MODULE IV GENETIC ALGORITHM 8

Introduction – Basic Operators and Terminologies in GAs – Traditional Algorithm vs. Genetic Algorithm – Simple GA – General Genetic Algorithm – The Scheme Theorem –Classification of Genetic Algorithm – Holland Classifier Systems – Genetic Programming.

MODULE V NEURO FUZZY MODELING 8

ANFIS Architecture - Hybrid Learning Algorithm - Learning Methods that Cross-fertilize ANFIS and RBFN - ANFIS as a Universal Approximator - Simulation Examples - Extensions and Advanced Topics.

MODULE VI APPLICATIONS OF SOFT COMPUTING 8

A Fusion Approach of Multispectral Images with SAR Image for Flood Area Analysis – Optimization of Travelling Salesman Problem using Genetic Algorithm Approach – Genetic Algorithm based Internet Search Technique – Soft Computing based Hybrid Fuzzy Controllers – Soft Computing based Rocket Engine – Control.

Total Hours: 45

REFERENCES:

1. Simon O Haykin, “Neural Networks and Learning Machines”, 3rd Edition, Pearson Higher Education, 2008.
2. S.N. Sivanandan and S.N. Deepa, “Principles of Soft Computing”, 1st Edition, Wiley India, 2007.
3. S. N. Sivanandam, S. Sumathi and S. N. Deepa, “Introduction to Fuzzy Logic using MATLAB”, 8th Edition, Springer, 2007.
4. S. Rajasekaran and G.A.V.Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithms”, 1st Edition, PHI 2003.
5. J.S.R.Jang, C.T.Sun and E.Mizutani, “Neuro-Fuzzy and Soft Computing”, 2nd Edition, PHI, 2004.

6. James A. Freeman and David M. Skapura, “Neural Networks Algorithms, Applications, and Programming Techniques”, 1st Edition, Pearson Edition, 2003.

OUTCOMES:

Students who complete this course will be able to

- apply the theoretical and practical knowledge for the development of basic intelligent systems.
- develop an application using various soft computing algorithms.
- solve various real world problems using neural Fuzzy tools and technologies.

CSBY03	MOBILE COMPUTING	L	T	P	C
	(Common to M.Tech (CSE, SE, CSE-BDA))	3	0	0	3

OBJECTIVES:

- To discuss about advanced learning in the field of wireless communication.
- To expose the students to the concepts of wireless devices and mobile computing.
- To provide a knowledge about various operating systems available currently for developing mobile computing applications.
- To discuss various issues related to security of mobile computing environment.

PREREQUISITES:

- Mobile Communication

MODULE I MOBILE COMPUTING APPLICATIONS 5

Overview – mobile business, mobile government, mobile life – Mobile computing applications supporting M- Business and M- Government – Platforms to support mobile computing applications.

MODULE II OVERVIEW OF WIRELESS NETWORKS 7

Classification – Standard bodies – IEEE 802.11, IETF – GSM – GPRS - Wireless security, architecture and management – Wireless business.

MODULE III MOBILE COMPUTING PLATFORMS 8

Introduction – Local platform services for mobile devices – Wireless middleware –Wireless gateways and mobile application servers – Wireless application protocol (WAP) – Toolkits for implementing wireless environment – Voice communication browsers – Case studies: OMAP, platform and middleware for wireless sensor networks.

MODULE IV WIRELESS PERSONAL AREA NETWORKS 8

Bluetooth – Ultra Wide Band (UWB) – Wireless Sensor Networks (Zigbee) – Generation of cellular networks (From 1G to 5G).

MODULE V MOBILE COMPUTING APPLICATIONS 10

Introduction – Key characteristics – Messaging for mobile users – Mobile commerce – Mobile portal – Mobile Customer Relationship Management - Mobile supply chain management – Special mobile applications – Mobile agent applications.

MODULE VI SECURITY ISSUES IN MOBILE COMPUTING 7

Introduction – Information security – Security techniques and algorithms – Security protocols – Public key infra structure – Trust – Security models – Security framework for mobile environment.

Total Hours: 45

REFERENCES:

1. Amjad Umar. "Mobile Computing and Wireless Communications", 2nd Edition, Age solutions, Inc, 2004.
2. Asoke K Talukder, Hasan Hasan Ahmed and Roopa R Yavagal, "Mobile Computing Technology, Applications and Service Creation", 2nd Edition, McGraw-Hill Communications Engineering, 2011.
3. Jelena Misic, Vojislav Misic, "Wireless Personal Area Networks: Performance, Interconnection and Security with IEEE 802.15.4", 1st Edition, Wiley publications, 2008.

OUTCOMES:

Students who complete this course will be able to

- acquire capability to work with heterogeneous networks.
- apply the knowledge of various mobile operating systems like Android to develop mobile computing applications.
- develop mobile computing applications by analyzing their characteristics and requirements.
- identify the security algorithms to be used for mobile computing environment.

CSBY26 DISTRIBUTED SYSTEMS L T P C

3 0 0 3

OBJECTIVES:

- To provide tools and techniques to model a distributed system principal models and to acquire knowledge on how to model a distributed system.
- To introduce the higher level abstractions such as distributed file systems and peer-to-peer networks.
- To highlight the important issues pertaining to distributed environments.

PREREQUISITES:

- Computer Networks
- Distributed Computing

MODULE I INTRODUCTION TO DISTRIBUTED SYSTEMS 8

Introduction – Examples of distributed systems–Challenges-System models-Architectural models-Fundamental models-Networking and internetworking-Types of network-Network principles-Internet protocols-Ethernet-Wi-Fi-Bluetooth-ATM.

MODULE II DISTRIBUTED OBJECTS 8

API for internet protocols-External data representation-Marshalling-Client server communication-Group communication-Communication between distributed objects – Remote procedure call-Events and notifications-Case study-Java RMI.

MODULE III DISTRIBUTED FILE SYSTEMS 8

File service architecture- Case study: Sun network file system – Andrew File system-Name services-Domain name system-Directory services-Case study of global name service-Peer-To-Peer systems.

MODULE IV DISTRIBUTED TRANSACTIONS 7

Transactions-Nested transactions-Locks-Optimistic concurrency control-Timestamp ordering-Comparison of methods for concurrency control in distributed transactions-Distributed deadlocks-Transaction recovery.

MODULE V DISTRIBUTED MULTIMEDIA SYSTEMS 7

Characteristics of multimedia data-Quality of service management-Resource management-stream adaptation-Case study-Web services-IDL for web services-XML security-Coordination of web services.

MODULE VI DISTRIBUTED SHARED MEMORY 7

Design and implementation issues-Sequential consistency and Ivy case study-Release consistency and Munin case study-Other consistency models-CORBA case study.

Total Hours: 45

REFERENCES:

1. George Coulouris, Jean Dollimore,Tim Kindberg, “Distributed Systems-concepts and Design”, 4th Edition, Pearson Education, 2011.
2. Coulouris, Dollimore, Kindberg and Blair “Distributed Systems: Concepts and Design”, 5th Edition, Addison-Wesley, 2012.

OUTCOMES:

Students who complete this course will be able to

- acquire the ability to apply knowledge of distributed concepts to design and develop a solution for a given distributed application.
- apply the concepts in the design of distributed application.
- model connection-oriented and connectionless communication in 2 tier Client Server architecture.
- differentiate between client centric and data centric consistency models and describe protocols for implementing consistency models and updating replicas in a Distributed System.

CSBY04	WEB TECHNOLOGY	L	T	P	C
	(Common to M.Tech (CSE, SE, CSE-BDA))	3	0	0	3

OBJECTIVES:

- To acquire knowledge on Core technologies that are needed for the web like HTML and XML.
- To facilitate how to build XML applications with DTD and style sheets that span multiple domains ranging from finance to vector graphics to genealogy for use with legacy browsers.
- To get the knowledge on developing web sites which are secure and dynamic in nature.

PREREQUISITES:

- Web Programming Languages

MODULE I INTRODUCTION **7**

HTML Common tags: List, Tables, images, forms, Frames - Cascading Style sheets - Introduction to Java Scripts - Objects in Java Script - Dynamic HTML with Java Script.

MODULE II VBSCRIPT LANGUAGE ELEMENTS **7**

Constants - Variables and Data Types - Mathematical Operations - Logical Operators - Looping and Decision Structures - VBScript Functions and Objects: Data Conversion Functions - Mathematical Functions - Data Formatting Functions -Text Manipulation Functions - Data and Time Functions - Built-in Objects.

MODULE III ASP FUNDAMENTALS **7**

Using Server – Side Includes- Learning the SSI Directives – Creating Modular ASP Code -Using the Request Object: Using Form Information - Using Query String Information – Using Server Variables - Using the Response Object: Create Output – Managing Output – Managing the Connection.

MODULE IV USING COOKIES **8**

Introduction to Cookies: Cookies and Your Browser – Creating a Cookie – Modifying and removing Cookies – Tracking Preferences with Cookies Using

the Application, Session and Server Objects: The application Object - The Session Object – The Server Object –Using the global as a file - Active Data Objects Essentials: Microsoft's Universal Data Access Strategy – The Connection Object – The Record set and Field Objects – The Command and Parameter Objects – Using the Errors Collection.

MODULE V INTRODUCING XML 8

XML: The Life of an XML documents - Related technologies- First XML Document: Hello XML – Exploring the Simple XML Document – Assigning Meaning to XML Tags – Writing a Style Sheet for an XML Document – Attaching a Style Sheet to an XML Document – Style Languages: CSS Style Sheets, CSS Layouts, CSS Text Styles.

MODULE VI ATTRIBUTES, EMPTY TAGS & XSL 8

Attributes – Attributes versus Elements – Empty Elements and Empty Element Tags – XSL-DTDs and Validity: Document Type Definitions - Element Declarations – DTD Files – Document Type Declarations – Validating Against a DTD-Element Declaration - Entity Declarations: What Is an Entity – Internal General Entities – External General Entities – Internal Parameter Entities – External Parameter Entities – Building a Document from Places-Attribute Declaration: What is an Attribute – Declaring Attributes in DTDs - Declaring Multiple Attributes – Specifying Default Values for Attributes – Attribute Types – Predefined Attributes – A DTD for Attribute- Based Baseball Statistics.

Total Hours: 45

REFERENCES:

1. Dave Mercer, "ASP 3.0 Beginners Guide", Tata McGraw-Hill Edition, Sixth reprint, 2004.

2. Rajkamal, "Web Technology", 1st Edition, Tata McGraw - Hill, 2001.

OUTCOMES:

Students who complete this course will be able to

- utilize entry-level system analysis and design principles to solve business problems.
- analyze and create a web page and identify its elements and attributes.
- create XML documents and XML Schema.
- build and consume web services.

CSBY05	XML AND WEB SERVICES	L	T	P	C
	(Common to M.Tech (CSE, SE, CPA, CSE-BDA))	3	0	0	3

OBJECTIVES:

- To understand the basics of XML.
- To provide the background for web services.
- To explain the role of XML in web services.
- To examine the role of different technologies pertaining to web services.

PREREQUISITES:

- Web Programming Languages

MODULE I WEB SERVICES **6**

Introduction: SOAP WSDL UDDI – Origin of web services - Web Technology stack - Web services in reality - Limitations of web services.

MODULE II XML FUNDAMENTALS **9**

XML Fundamentals - XML Documents-XML namespaces Explicit and Default namespaces - Inheriting namespaces and not inheriting namespaces - Attributes and namespaces -XML Schema XML schema and namespaces - A first schema - Implementing XML schema types.

MODULE III OVERVIEW OF SOAP **7**

Overview of SOAP – HTTP – XML-RPC – SOAP: Protocol – Message Structure – Intermediaries – Actors – Design Patterns And Faults – SOAP With Attachments.

MODULE IV UDDI **8**

UDDI at a glance- The UDDI Business registry- UDDI under the covers – Accessing UDDI- How UDDI is playing out.

MODULE V SEMANTICS AND META DATA **6**

Role of semantics and meta data: Web 1.0, 2.0 and 3.0 - Types of semantics: Implicit, formal and Soft semantics - Application and Types of semantics - Models of semantics - Ontology and ontology development.

MODULE VI SEMANTICS AND APPLICATIONS **9**

Semantics for services: Nature of web services - Role of semantics in web services - Creation of Semantic meta data models and annotations – Example applications - Semantics for social data: Nature of social data -Role of semantics - Creation of semantic meta data models and annotations - Semantics for cloud computing.

Total Hours: 45

TEXT BOOKS:

1. Glenn Hostetler, Sandor Hasznos and Christine Heron, “Web Service and SOA Technologies, Practicing Safe Techs”, 1st Edition, Practicing Safe Techs publishers, 2009.

2. Sandeep Chatterjee, James Webber, “Developing Enterprise Web Services”, 1st Edition, Pearson Education, 2004.

3. Amit Sheth and Krishnaprasad Thirunarayanan, “Semantics Empowered Web 3.0: Managing Enterprise, Social, Sensor, and Cloud-based Data and Services for Advanced Applications”, 1st Edition, Morgan and Claypool publishing, 2012.

REFERENCES:

1. Frank. P. Coyle, “XML, Web Services and The Data Revolution”, 1st Edition, Pearson Education, 2002.

2. Ramesh Nagappan, Robert Skoczylas and Rima Patel Sriganesh, “Developing Java Web Services”, Wiley Publishing Inc., 2004.

OUTCOMES:

Students who complete this course will be able to

- write an XML Document along with DTD and XSD.
- design applications based on web services using XML.
- identify appropriate technology for web services based application.

CSBY06	MULTIMEDIA SYSTEMS	L	T	P	C
	(Common to M.Tech (CSE, SE,CSE-BDA))	3	0	0	3

OBJECTIVES:

- To introduce principles and current technologies in multimedia systems.
- To explain multimedia concepts such as color theory and compression schemes.
- To describe the ways of processing multimedia information.
- To introduce the multimedia Quality of Service (QoS).

PREREQUISITES:

- Computer graphics and Multimedia

MODULE I INTRODUCTION TO MULTIMEDIA 8

Introduction: Multimedia – Historical Perspective – Multimedia Data and Multimedia Systems – The Multimedia Revolution – Digital Data Acquisition: Analog and digital Signals – Signals and Systems – Sampling Theorem and Aliasing – Filtering – Fourier Theory. Media Representation and Media Formats: Digital Images – Digital Video – Digital Audio – Graphics.

MODULE II COLOR THEORY AND MULTIMEDIA AUTHORING 7

The Color Problem – Trichromaticity Theory – Color Calibration – Color Spaces – Gamma Correction and Monitor Calibration – Multimedia Authoring: Requirements for Multimedia Authoring Tools – Intramedia Processing – Intermedia Processing – Multimedia Authoring Paradigms and User Interfaces – Role of User Interfaces – Device Independent Content Authoring – Multimedia Services and Content Management – Asset Management.

MODULE III MULTIMEDIA COMPRESSION: VIDEO 8

Need for Compression – A Taxonomy of Compression – Lossless compression – Lossy Compression – Media Compression Images: Redundancy and Relevancy of Image Data – Classes of Image Compression Techniques – Lossless Image Coding – Transform Image Coding – Wavelet Based Coding – Fractal Image Coding – Transmission Issues in Compressed Images. Media Compression Video: General Theory of Video Compression – Types of

Predictions – Complexity of Motion Compensation – Video-Coding Standards – VBR Encoding, CBR Encoding, and Rate Control.

MODULE IV MULTIMEDIA COMPRESSION: AUDIO-GRAPHICS 7

Media Compression Audio: Audio-Compression Theory – Audio as a waveform – Audio Compression using Psychoacoustics – Model-Based Audio Compression – Audio Compression using Event Lists. Media Compression Graphics: 2D Graphics Objects – 3D Graphics Objects – Graphics Compression in Relation to Other Media Compression – Mesh Compression using Connectivity Encoding – Mesh Compression Using Polyhedral Simplification – Multi resolution Techniques – Wavelet Based Encoding – Progressive Encoding and Level of Detail.

MODULE V MULTIMEDIA DISTRIBUTION 8

Multimedia Networking: The OSI Architecture – LAN – Modes of Communication – Routing – Multimedia Traffic Control – Multimedia Networking Performance and Quality of Service – Multimedia Communication Standards and Protocols. Wireless Multimedia Networking: Basics of Wireless Communications – Wireless Generations and Protocols – WAP – QoS over Wireless Networks. Digital Rights Management: Watermarking Techniques – Encryption Techniques – Digital Rights Management in the media industry.

MODULE VI MULTIMEDIA DATABASES AND FRAMEWORK 7

Multimedia Databases and Querying: Multimedia Data versus Multimedia Content – Multimedia Metadata – Multimedia Systems and Databases – Standards for Metadata – User Interfaces and Browser Paradigms. Multimedia Framework: Need for Unified Framework – MPEG-21 Objectives – Digital Item Identification – Digital Item Adaptation – Digital Item Processing – Digital Rights Management in Digital Items.

Total Hours: 45

REFERENCES:

1. Parag Havaldar, Gerard Medioni, “Multimedia Systems – Algorithms, Standard and Industry Practices”, 1st Edition, Cengage Learning, July 2009.

2. Ralf Steinmetz, Klara Nahrstedt, “Multimedia systems”, 1st Edition, Springer Verlag, 2004.

OUTCOMES:

Students who complete this course will be able to

- identify different multimedia data types and multimedia databases.
- apply various multimedia standards and authoring techniques for application development.
- use multimedia compression techniques for real time applications.

CSBY27	SOFTWARE AGENTS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the concepts, techniques and applications of software agents.
- To discuss some security issues.
- To understand the functions of intelligent software agents.

PREREQUISITES:

- Object Oriented Software Engineering

MODULE I AGENTS - OVERVIEW **8**

Agent definition - Agent programming paradigms - Agent Vs Object - Aglet - Mobile agents - Agent frameworks - Agent reasoning.

MODULE II JAVA AGENTS **8**

Processes - Threads - Daemons - Components - Java Beans - ActiveX - sockets - RPCs - Distributed computing - Aglets programming - Jini architecture - Actors and Agents - Typed and proactive messages.

MODULE III MULTI AGENT SYSTEMS **8**

Interaction between agents - Reactive agents - Cognitive agents - Interaction protocols - Agent coordination - Agent negotiation - Agent cooperation - Agent organization - Self-interested agents in Electronic commerce applications.

MODULE IV INTELLIGENT SOFTWARE AGENTS **7**

Interface agents - Agent communication languages - Agent knowledge representation - Agent adaptability - Belief desire intension - Mobile agent applications.

MODULE V AGENTS AND SECURITY **7**

Agent security issues - Mobile agents security - Protecting agents against malicious hosts - Untrusted agent - Black box security - Authentication for agents - Security issues for aglets.

MODULE VI MARKET PLACE APPLICATION **7**

Introduction – Facilitator Agent Buy Sell Message – Buyer Agent Seller Agent – Enhanced Buyers and Sellers- Market Place Application. – Agent Building and Learning Environment.

Total Hours: 45

REFERENCES:

1. Bigus & Bigus, "Constructing Intelligent agents with Java ", 1st Edition, Wiley, 1998.
2. Jeffrey M.Bradshaw, "Software Agents", 1st Edition, MIT Press, 2000.
3. Russel and Norvig, "Artificial Intelligence: A Modern Approach", 2nd Edition, Pearson Education, 2003.
4. Richard Murch, Tony Johnson, "Intelligent Software Agents", Prentice Hall, 2000.
5. Gerhard Weiss, "Multi Agent Systems - A Modern approach to Distributed Artificial Intelligence", 2nd Edition, MIT Press, 2013.

OUTCOMES:

Students who complete this course will be able to

- summarize and remember the basic concepts of software agents.
- classify and categorize software agents.
- provide authentication for agents.
- apply agent communication languages for developing simple mobile agent applications.

CSBY08	EMBEDDED SYSTEMS	L	T	P	C
	(Common to M.Tech (CSE, SE, NS))	3	0	0	3

OBJECTIVES:

- To provide basic understanding about embedded systems.
- To understand the various building components of an embedded system.
- To give exposure to the embedded programming concepts and study the procedures for development and testing.

PREREQUISITES:

- Digital Signal Processing

MODULE I INTRODUCTION TO EMBEDDED SYSTEMS 6

Definitions – Embedded hardware components – Embedded Software – System on Chip (SoC) – VLSI Circuits – Fundamentals of Embedded System Design.

MODULE II REAL-TIME OPERATING SYSTEMS 8

Overview – Pseudo kernels to Operating Systems – Scheduling Fundamentals – System Services: Buffers - Mailboxes – Semaphores – Deadlock and Starvation Problems- Priority Inversion - Timer and Clock Services – Memory Management Issues.

MODULE III DEVICES, COMMUNICATION BUSES AND PROTOCOLS 8

I/O Devices – Device I/O Types and Examples – Synchronous Communication – ISO Synchronous Communication – Asynchronous Communication – Serial Bus Communication Protocols – Parallel Bus Communication Protocols– Wireless and Mobile System Protocols.

MODULE IV EMBEDDED PROGRAMMING CONCEPTS 8

Assembly Language Programming vs High Level Programming – Embedded C Programming Elements and Fundamentals – Object Oriented Programming for Embedded Systems – Cross Compliers – Memory Footprint optimization - Program Modeling Concepts

MODULE V DEVELOPMENT AND TESTING 8

Embedded Software Development Process - Development Tools – Hardware and Software Design Issues – Techniques and Tools for Testing, Simulation and Debugging - Design Examples and Case Studies of Program Modeling and Programming with RTOS.

MODULE VI PERFORMANCE ANALYSIS OF EMBEDDED SYSTEMS 7

Real Time Performance Analysis – Applications of Queuing Theory – Input/ Output Performance - Analysis of Memory Requirements – Metrics - Fault Tolerance – Inherent Uncertainly – Performance optimization Techniques.

Total Hours: 45

REFERENCES:

1. Phillip A. Laplante, Seppo J. Ovaska, “Real-Time Systems Design and Analysis: Tools for the Practitioner”, 4th Edition, Wiley-IEEE Press, 2011.
2. Raj Kamal, “Embedded Systems: Architecture, Programming and Design”, 2nd Edition, McGraw-Hill Education, India, 2009.
3. Kai Qian, David Den Haring, Li Cao, “Embedded Software Development with C”, 1st Edition, Springer, 2009.

OUTCOMES:

Students who complete this course will be able to

- possess the basics of embedded system and its building blocks.
- design an embedded systems by applying the embedded programming concepts.
- analyze a real time scenario and trace its performance.

CSBY28 IT SYSTEMS MANAGEMENT L T P C

3 0 0 3

OBJECTIVES:

- To focus on the importance of information systems management and their leadership issues
- To provide knowledge on the Technologies for developing and managing information resources and systems
- To Support Decision Making followed by the Challenges Ahead for rising societal risks of IT and messaging.

PREREQUISITES:

- Information Technology
- Management Information System

MODULE I INTRODUCTION 5

Importance of information systems management- History - The organizational environment - Technology environment - Mission of IS organizations – Model.

MODULE II LEADERSHIP ISSUES 6

ISO organization – CIO's responsibilities – Strategic uses of information technology – Information systems planning.

MODULE III MANAGING THE ESSENTIAL TECHNOLOGIES 10

Distributed systems – Overall architecture – Seven types of distributed systems - Defining the overall IT architecture – Importance of IT infrastructure – Managing telecommunications – Managing information resources – Managing operations- Case study.

MODULE IV MANAGING SYSTEM DEVELOPMENT 9

Technologies for developing systems – Management issues in system development – Case study.

MODULE V SYSTEMS FOR SUPPORTING KNOWLEDGE BASED WORK 8

Supporting Decision Making – Supporting Collaboration – Supporting Knowledge Work – Case study.

MODULE VI THINKING AHEAD **7**

The Challenges Ahead - Business continuity and disaster recovery – Problem management – Exception management.

Total Hours: 45

REFERENCES:

1. Barbara McNurlin, Ralph Sprague and Tung Bui," Information systems management in practice", 8th Edition, Prentice Hall, 2008.
2. Schiesser and Rich, "IT Systems Management", 2nd Edition, Prentice Hall of India, New Delhi, 2010.
3. Turban, Efraim, Rainer, R.Kelly, Potter and Richard E.," Introduction to Information Technology", 3rd Edition, John Wiley, 2005.

OUTCOMES:

Students who complete this course will be able to

- select and apply bullet-proof processes in areas ranging from change management to production acceptance, technology environment and information systems planning.
- use appropriate technology for managing operations and systems more efficiently and effectively.
- apply information resources to develop systems for supporting knowledge based work in business.

CSBY10	MOBILE AD HOC NETWORKS	L	T	P	C
	(Common to M.Tech (CSE, SE,CSE-BDA))	3	0	0	3

OBJECTIVES:

- To provide a broad overview of the state of wireless and mobile ad hoc networking.
- To discuss physical, networking and architectural issues of mobile ad hoc networks.
- To elaborate the functions of various routing protocols under unicast, multicast and transport layer protocols.
- To give a knowledge about issues in QoS, energy management and security of ad hoc wireless networks.

PREREQUISITES:

- Computer Networks

MODULE I INTRODUCTION **9**

Introduction – Fundamentals of wireless communication technology – The Electromagnetic spectrum – Radio propagation mechanisms – Characteristics of the wireless channel – IEEE 802.11a,b standard – Origin of Ad hoc: Packet radio networks – Technical challenges – Architecture of PRNETs – Components of packet radios – Adhoc wireless networks – Heterogeneity in mobile devices – Wireless sensor networks – Traffic profiles – Types of Ad hoc mobile communications – Types of mobile host movements – Challenges facing Ad hoc mobile networks – Ad hoc wireless internet.

MODULE II ROUTING PROTOCOLS **8**

Introduction – Issues in designing a routing protocol for Ad hoc wireless networks – Classifications of routing protocols – Table-Driven routing protocols – Destination Sequenced Distance Vector (DSDV) – Source-Initiated On-Demand approaches – Ad hoc On-Demand Distance Vector Routing (AODV) – Dynamic Source Routing (DSR) –Temporally Ordered Routing Algorithm (TORA) –Location–Aided Routing (LAR) – Power-Aware Routing (PAR) – Zone Routing Protocol (ZRP).

MODULE III MULTICASTING PROTOCOLS **7**

Introduction – Issues in designing a multicast routing protocol – Operation of multicast routing protocols – An architecture reference model for multicast routing protocols –Classifications of multicast routing protocols – Tree-Based multicast routing protocols – Mesh-based multicast routing protocols – Summary of tree and mesh based protocols – Energy–efficient multicasting– Comparisons of multicast routing protocols.

MODULE IV TRANSPORT LAYER PROTOCOLS **7**

Introduction – Issues in designing a transport layer protocol for Ad hoc wireless networks – Design goals of a transport layer protocol for Ad hoc wireless networks –Classification of transport layer solutions – TCP over Ad hoc wireless networks – Other transport layer protocols for Ad Hoc wireless networks.

MODULE V QOS AND ENERGY MANAGEMENT **7**

Introduction – Issues and challenges in providing QoS in Ad hoc wireless networks –Classifications of QoS solutions – MAC layer solutions – Network layer solutions – QoS frameworks for Ad hoc wireless networks energy management in Ad hoc wireless networks –Introduction – Need for energy management in Ad hoc wireless networks – Classification of energy management schemes – Battery management schemes – Transmission power management schemes – System power management schemes.

MODULE VI SECURITY PROTOCOLS **7**

Security in Ad hoc wireless networks – Network security requirements – Issues and challenges in security provisioning – Network security attacks – Key management – Secure routing in Ad hoc wireless networks.

Total Hours: 45

REFERENCES:

1. C.Siva Ram Murthy and B.S. Manoj, ”Ad hoc Wireless Networks Architectures and Protocols”, 2nd Edition, Pearson Education, 2007.

2. Charles E. Perkins, “Ad hoc Networking”, 1st Edition, Addison Wesley, 2000.

3. Stefano Basagni, Marco Conti, Silvia Giordano and Ivan stojmenovic, “Mobile ad hoc networking”, 1st Edition, Wiley-IEEE press, 2004.

4. Mohammad Ilyas, “The handbook of Adhoc wireless networks”, 1st Edition, CRC press, 2002.

OUTCOMES:

Students who complete this course will be able to

- assess the platform architectures that are suitable for Mobile Adhoc networks.
- identify the issues in wireless networks and how they can be addressed.
- examine various security threats to ad hoc networks and propose solutions.

CSBY11	DATA WAREHOUSING AND DATA MINING	L	T	P	C
	(Common to M.Tech (CSE, SE))	3	0	0	3

OBJECTIVES:

- To provide students with basic knowledge of tools and techniques for understanding the system performance and technologies for storing and mining large databases.
- To explain the computational tools and techniques for Data mining and Data Warehousing.

PREREQUISITES:

- DatabaseTechnology

MODULE I DATA WAREHOUSING AND BUSINESS ANALYSIS 8

Data warehousing Components –Building a Data warehouse – Mapping the Data Warehouse to a Multiprocessor Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools – Metadata – reporting – Query tools and Applications – Online Analytical Processing (OLAP) – OLAP and Multidimensional Data Analysis.

MODULE II DATA MINING AND ASSOCIATION RULE MINING 7

Data Mining Functionalities – Data Preprocessing – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization and Concept Hierarchy Generation - Efficient and Scalable Frequent Item set Mining Methods – Mining Various Kinds of Association Rules – Association Mining to Correlation Analysis – Constraint-Based Association Mining.

MODULE III CLASSIFICATION AND PREDICTION 8

Issues Regarding Classification and Prediction – Classification by Decision Tree Introduction – Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction – Accuracy and Error Measures – Evaluating the Accuracy of a Classifier or Predictor – Ensemble Methods – Model Section.

MODULE IV CLUSTER ANALYSIS **7**

Types of Data in Cluster Analysis – A Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical methods – Density-Based Methods – Grid-Based Methods – Model-Based Clustering Methods – Clustering HighDimensional Data – Constraint-Based Cluster Analysis – Outlier Analysis.

MODULE V MINING STREAMS, TIME SERIES AND SEQUENCE DATA **7**

Mining Data Streams - Mining Time-Series Data - Mining Sequence Patterns in Transactional Databases - Mining Sequence Patterns in Biological Data - Graph Mining - Social Network Analysis and Multi relational Data Mining.

MODULE VI APPLICATIONS **8**

Mining Object, Spatial, Multimedia, Text and Web Data: Multidimensional Analysis and Descriptive Mining of Complex Data Objects – Spatial Data Mining – Multimedia Data Mining – Text Mining – Mining the World Wide Web. Applications and Trends in Data Mining: Data Mining Applications, Data Mining System Products and Research Prototypes, Additional Themes on Data Mining and Social Impacts of Data Mining.

Total Hours: 45

REFERENCES:

1. Jiawei Han & Micheline Kamber, “Data Mining – Concepts and Techniques”, 3rd Edition, Morgan Kaufmann Publishers, Elsevier, 2011.

2. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, “Introduction to Data Mining”, 1st Edition, Pearson education, 2006.

OUTCOMES:

Students who complete this course will be able to

- distinguish between database and data warehouse, and design appropriate data warehouse multi dimensional model.
- perform basic data mining operations and apply standard data mining algorithms for association rule mining, clustering and classification and solve real time problems.

- correlate data mining techniques to current scenarios in various fields and inculcate the ability to apply tools for mining and analysis.
- review the various latest research activities going on in the field of Data Mining, thereby creating an interest for research.

CSBY12 PERFORMANCE EVALUATION OF COMPUTER SYSTEMS AND NETWORKS

L	T	P	C
3	0	0	3

(Common to M.Tech (CSE, SE))

OBJECTIVE:

- To explain the different metric for measuring the performance of the system.
- To understand the importance of workloads and to predict the nature of future loads.
- To provide students with basic knowledge and understanding of queuing theory, petrinets and test beds.
- To train the students on the basics of simulation modeling.

PREREQUISITES:

- Probability and Queuing Theory

MODULE I INTRODUCTION **8**

Need for performance evaluation - Role of performance evaluation - Performance evaluation methods - Performance metrics and evaluation criteria - CPU and I/O architectures - Distributed and network architectures-Secondary storage - Topologies - Computer architecture - Fundamental concepts and performance measures.

MODULE II PROBABILITY AND STOCHASTIC PROCESSES **8**

Scheduling algorithms - Workloads - Random variables - Probability distributions - Densities - Expectation - Stochastic processes - Poisson process - Birth-Death process - Markov process.

MODULE III QUEUING THEORY **7**

Queuing systems - Networks of queues - Estimating parameters and distributions - Computational methods - Simulation process - Time control - Systems and modeling.

MODULE IV PETRINETS AND SYSTEM PERFORMANCE **8**

Petri nets - Classical Petri nets - Timed Petri nets - Priority-based Petri nets - Colored Petri nets - Generalized Petri nets - Tool selection - Validation of

results - Performance metrics -Evaluation - Multiple server computer system analysis.

MODULE V ANALYSIS **7**

OS components - System architecture - Workloads - Design – Simulation Analysis - Database system performance - Computer networks components - Simulation modeling of LAN.

MODULE VI DISCRETE EVENT SIMULATION **7**

Simulation - Simulation Techniques - Computing the Accuracy of Stochastic Simulations - Monte Carlo Simulation Random Number Generators - CDF Inversion.

Total Hours: 45

REFERENCES :

1. Paul J. Fortier and Howard E. Michael, “Computer Systems Performance Evaluation and Prediction", 1st Edition, Elsevier Science, USA, 2003.

2. Jean-Yves Le Boudec, “Performance Evaluation of Computer and Communication Systems”, 1st Edition, EPFL press, Lausanne, Switzerland, 2010.

OUTCOMES:

Students who complete this course will be able to

- carry out the performance analysis of their computer systems.
- categorize the different queuing models and algorithms for the analysis of networks.
- design a test bed and a simulator for a particular problem.

CSBY13 AGENT BASED INTELLIGENT SYSTEMS L T P C

(Common to M.Tech (CSE, SE, CPA, CSE-BDA)) 3 0 0 3

OBJECTIVES:

- To provide basic knowledge of employing intelligent agents in solving complex problems.
- To give the awareness of the building blocks of agents and working of different types of agents.
- To analyze the reasons for uncertainty and ability to design agents to handle them.

PREREQUISITES:

- Software Agents

MODULE I INTRODUCTION 7

Definitions – History – Hybrid Intelligent Agents – Agents vs Multi Agent Systems– Structure – Environment – Basic Problem Solving Agents – Complex Problem Solving Agents – Formulating Search Strategies – Intelligent Search.

MODULE II CONCEPTS FOR BUILDING AGENTS 6

Situated Agents: Actions and Percepts - Proactive and Reactive Agents: Goals and Events- Challenging Agent Environments: Plans and Beliefs - Social Agents - Agent Execution Cycle.

MODULE III KNOWLEDGE BASED AGENTS 8

Knowledge Representation – Logic – First Order Logic – Reflex Agent – Building a Knowledge Base – General Ontology – Interference – Logical Recovery.

MODULE IV PLANNING AGENTS 8

Situational Calculus – Representation of Planning – Partial Order Planning – Practical Planners– Conditional Planning - Preplanning Agents.

MODULE V AGENTS AND UNCERTAINITY 8

Acting under uncertainty – Probability – Baye's Rule – Belief Networks – Utility

Theory - Decision Network- Value of Information – Decision Theoretic Agent Design.

MODULE VI HIGHER LEVEL AGENTS **8**

Learning Agents – General Model – Inductive Learning – Learning Decision Tree – Reinforcement Learning – Knowledge in Learning – Communicative Agents – Types of Communicative Agents – Future of AI.

Total Hours: 45

REFERENCES:

1. Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach”, 3rd Edition, Prentice Hall, 2010.
2. Lin Padgham, Michael Winikoff, “Developing Intelligent Agent Systems: A Practical Guide”, 1st Edition, John Wiley & Sons, 2004.
3. Zili Zhang,Chengqi Zhang, “Agent-Based Hybrid Intelligent Systems: An Agent-Based Framework for Complex Problem Solving”, 1st Edition, Springer-Verlag New York, LLC , 2004.
4. Ngooc Thanh Nguyaaen, Lakhmi C. Jain, “Intelligent Agents in the Evolution of Web and Applications”, 4th Edition, Springer, 2009.

OUTCOMES:

Students who complete this course will be able to

- differentiate the types of agents and learn how to apply them in different problem based on requirements.
- design knowledge based agents for challenging environment.
- explore the scenarios of uncertainty and design planning agents to handle them.

CSBY29	PERSONAL SOFTWARE PROCESS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explain how the estimating and planning skills can be improved.
- To discuss ways to measure the size, time, and defects in their work.
- To elaborate on the PSP quality strategy to manage the defects in the work and support the team's quality goals.

PREREQUISITES:

- Software Engineering

MODULE I INTRODUCTION **6**

Personal Process Strategy – Baseline Personal Process - Software Engineers Job.

MODULE II TIME MANAGEMENT **6**

Time Management - Tracking Time - Period and Product Planning – Product Planning.

MODULE III ESTIMATION AND MANAGEMENT **8**

Measuring Software Size – Software Estimating – Probe Estimating Model – Product size - Function points.

MODULE IV MANAGING AND PLANNING **8**

Managing your time – Managing commitments – Managing Schedules – Planning – Project Plan.

MODULE V DEFECT HANDLING **9**

Defects – Finding Defects – Code Review Checklist – Projecting Defects – Economics of Defect Removal – Design Defects.

MODULE VI QUALITY **8**

Product Quality – Process Quality – Personal Commitment to Quality – PSP Design Templates.

Total Hours : 45

REFERENCES:

1. Humphrey, Watts S. “Introduction to the Personal Software Process”, 2nd Edition, Pearson Education, 2009.
2. Humphrey, Watts S., “PSP: A Self - Improvement Process for Software Engineers”, 1st Edition, Boston, MA: Addison - Wesley, 2005.
3. Steve McConnell, “Code Complete: A Practical Handbook of Software Construction”, 2nd Edition, Microsoft Press, 2004.
4. Roger S Pressman, “Software Engineering: A Practitioner's Approach”, 6th Edition, Tata McGrawhill, 2005.

OUTCOMES:

Students who complete this course will be able to

- apply the time management skills in personal software development process.
- analyze and improve the quality of personal software development process.
- identify the various kinds of software defects in defect development life cycle.

CSBY30 TEAM SOFTWARE PROCESS L T P C

3 0 0 3

OBJECTIVES:

- To provide a comprehensive introduction to term software development.
- To expose the students to realistic team work problems and give a practical teamwork experience.

PREREQUISITES:

- Software Engineering

MODULE I INTRODUCTION 7

TSP overview - TSP process - Logic of the TSP - Launching a Team project – SCM

MODULE II THE MANAGER AND THE TEAM ROLES 8

Team leader role - Development manager role - Planning manager role - Quality/ process manager role - support manager role.

MODULE III STRATEGY AND PLANNING 8

Development strategy - Development plan - Software inspections.

MODULE IV DESIGNING AND DEVELOPMENT 7

Defining the requirements – Designing with teams – Product implementation.

MODULE V TESTING AND IMPLEMENTATION 7

Product Implementation – Integration and System testing-Postmortem.

MODULE VI MANAGING A TEAM 8

Managing yourself- Being on a team – Teamwork- Case Study.

Total Hours : 45

REFERENCES:

1. Watts S Humphrey," Introduction to the Team Software Process", Boston MA: Addison – Wesley, 2008.

2. Roger S Pressman, "Software Engineering: A practitioner's Approach", 6th edition, R.S. Pressman and Associates, 2005.

OUTCOMES:

Students who complete this course will be able to

- explain role of team software process in programming.
- describe role of team manager in software development Apply principles of TSP for effective software development List the conflicts that undermine team work.

CSBY31	SOFTWARE ENGINEERING FOR IMAGE PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To describe the use of object oriented programming for the implementation of image processing and analysis software.
- To get the knowledge of basic principles of object oriented analysis, design and programming.
- To discuss software engineering issues which are relevant for image processing.

PREREQUISITES:

- Software Engineering
- Image Processing

MODULE I SOFTWARE ENGINEERING AND IMAGING SOFTWARE 6

Introduction – A Case for a Software Engineering Approach to Building Imaging Systems – Classification of Software Qualities – Basic Software Engineering.

MODULE II SOFTWARE PROCESS AND LIFE CYCLE MODELS 10

Software Processes and Methodologies – Software Life Cycle Models – Software Standards – Software Requirements: Requirements Engineering Process – Types of Requirements – Requirements Users – Formal Methods in Software Specification – Specification of Imaging Systems: A Survey of Current Practices – Case Study– Object Oriented Analysis – Object– Oriented vs. Structured Analysis – Organizing the Requirements Document – Requirements Validation and Review.

MODULE III SOFTWARE SYSTEM DESIGN 8

The Design Activity – Procedural– Oriented Design– Object– Oriented Design – Hardware Considerations in Imaging System Design – Fault– Tolerant Design– The Software Production Process– Programming – Writing and Testing Code– Coding – Reviews and Audits– Documentation.

MODULE IV SOFTWARE MEASUREMENT AND TESTING 5

The Role of Metrics – Faults, Failures, and Bugs – The Role of Testing – Testing Techniques– Design of Testing Plans.

MODULE V HARDWARE– SOFTWARE INTEGRATION 8

Goals of System Integration – System Unification – System Verification – System Integration Tools – Software Integration– Post integration Software Optimization – A Software Reengineering Process Model – Software Reuse.

MODULE VI MANAGEMENT OF SOFTWARE PROJECTS 8

Concept– Software Project Management Themes – General Project Management Basics – Software Project Management – Managing and Mitigating Risks – Personnel Management – Assessment of Project Personnel– Tracking and Reporting Progress.

Total Hours: 45

REFERENCES:

1. Phillip A. Laplante, “Software Engineering For Image Processing Systems”, 2nd Edition, CRC Press, 2005.
2. Alejandro C Frery, Talita Perciano, “Introduction to Image Processing Using R”, 1st Edition, Springer, 2013.

OUTCOMES:

Students who complete this course will be able to

- become familiar with the basic principles of object oriented analysis, design and programming.
- apply various Image Processing Techniques in real world problems.
- solve interface problem when integrating various Multimedia objects.

CSBY24	SERVICE ORIENTED ARCHITECTURE	L	T	P	C
	(Common to M.Tech (CSE, SE, NS, CSE-BDA))	3	0	0	3

OBJECTIVES:

- To introduce the fundamentals and issues relating to Service Oriented Architecture.
- To bring out the importance of service orientation and web services.
- To teach appropriate tools as technique on how to build the Service Oriented Architecture with web services.

PREREQUISITES:

- Web Technology
- Computer Networks

MODULE I INTRODUCTION **7**

Basic definition - Fundamentals of SOA - Characteristics and misperceptions about SOA -Benefits and pitfalls of SOA.

MODULE II EVOLUTION OF SOA **7**

The evolution of SOA - Web service and primitive SOA - The extension of SOA - Web service extension.

MODULE III WEB SERVICE AND CONTEMPORARY SOA **7**

Message Exchange Pattern - Service Activity – Coordination - Atomic Transaction - Business Activity- Orchestration – Choreography – Addressing - Reliable Messaging - Correlation and Policies - Meta data Exchange - Security-Notification and Eventing.

MODULE IV PRINCIPLES OF SERVICE ORIENTATION **8**

Principles of service orientation -Building SOA - Planning and Analysis - SOA delivery strategies - Service Oriented Analysis Introduction - Service Modeling of Service Oriented Analysis.

MODULE V SERVICE ORIENTED DESIGN **8**

Introduction to service oriented design - WSDL related XML Schema language

Basics - WSDL Language Basics - SOAP Language Basics - Service interface design tools - Steps to composing SOA - Consideration for choosing service layers, positioning core SOA standards and choosing SOA extension - Service design and business process design.

MODULE VI WEB SERVICE EXTENSION AND SOA PLATFORM 8

WS Addressing language Basics - WS Reliable Messaging language Basics- WS policy Language Basics - WS Metadata Exchange Language Basics-WS security Language Basics -SOA Platform basics - SOA Support in J2EE,SOA Support in .NET- Case Studies of Rail Co ltd and Oasis Car Wash service.

Total Hours: 45

REFERENCES:

1. Thomas Erl, “Service Oriented Architecture, Concepts, Technology and Design”, Pearson Education, 2009.

2. Shankar Kambhampaty, “Service Oriented Architecture for Enterprise Architecture for Enterprise Application”, 1st Edition, Wiley Publication, 2008.

OUTCOMES:

Students who complete this course will be able to

- relate web services with service oriented architecture.
- apply the tools and technique for Service Oriented Architecture.
- build an SOA platform supported by J2EE and .NET.

CSBY32 PRINCIPLES OF GRID COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce necessary fundamentals that enable the students for advanced studies in the area of grid computing.
- To trace the evolution and progress of models of computation, from clusters to grid computing.

PREREQUISITES:

- Distributed Computing

MODULE I INTRODUCTION **8**

Basic Concepts - Entering into Grid - Definitions - Grid projects - Grid Layered Architecture - Distributed Computing - Computational Grids - Data Grids. Dynamic Virtual Organization – Distributed Shared Memory in Grid.

MODULE II GRID COMPUTING TECHNOLOGIES **8**

Service Oriented Architecture (SOA) - Web Services in Grid - Xml, Related Technologies and their role in Grid.

MODULE III GRID PLATFORMS **7**

Open Grid Service Architecture (OGSA) – OGSA Basic Services – Open Grid Services infrastructure (OGSI).

MODULE IV GRID IMPLEMENTATIONS **8**

Grid Computing Security – Globus Tool kit – Grid Technologies, Systems and Scheduling- Case study: Mobile Grid Computing.

MODULE V GRID COMPUTING MODELS **7**

Cluster Computing Models – Grid Models – Mobile grid Models – Applications.

MODULE VI STIMULATED ALGORITHMS **7**

Distributed Algorithms for Job Shop Scheduling - Parallel Stimulated Annealing algorithms- Case Studies.

Total Hours: 45

REFERENCES:

1. P.Venkata Krishna,M.Rajasekara babu,V Saritha, “Principles of Grid computing”, 1st Edition, Ane Books Pvt Lmt, 2010.
2. D.Janakiram, “Grid Computing Models”, 1st Edition, Tata McGraw-Hill Education, 2005.
3. Joshy Joseph, Craig Fellenstein, “Grid Computing”, 1st Edition, IBM Press, 2009.

OUTCOMES:

Students who complete this course will be able to

- apply the technologies such as high-speed links and storage area networks for building computational and data grids.
- utilize grid computing and cluster computing middleware, such as Globus Tool kits and HPC Portals for implementing virtual super computing resources.
- apply parallel and distributed computing algorithms in collaborated problem solving methodologies.
- apply the new ideas to solve open problems in distributed computing applications.

CSBY33 PERVASIVE COMPUTING L T P C

3 0 0 3

OBJECTIVES:

- To give an insight knowledge about the principles of pervasive computing , its elements and architecture.
- To highlight the role of sensor networks, wireless protocols in the design of pervasive applications.

PREREQUISITES:

- Distributed Systems
- User Interface Design

MODULE I ARCHITECTURE 8

Relationship of Wireless Computing - Ubiquitous Computing - Internet Computing - Related Ideas: Ambient Computing - Elements of Pervasive architecture - Requirements of computational infrastructure - Failure management - General issues: security, performance, dependability - Web architectures - Local networks - Store and forward - Multi-network architectures.

MODULE II DEVICES TECHNOLOGY 7

Device and network technologies - Devices categories - Devices characteristic Heterogeneity and Interoperability - Mobile Agents - Device management - Compaq iPAQ - 3G devices - Palm Tungsten - WindowsCE devices - Symbian devices - J2ME-enabled devices.

MODULE III SENSOR NETWORKS AND RFIDS 8

Introduction to Sensor networks - Types of sensor networks - Berkeley Motes - Sensor network organization - Sensor network routing mechanisms - Platforms for Wireless sensor networks - Sensor Node Architecture - Sensor Network Architecture- RFID: Introduction, transponder and reader architecture- Types of tags and readers- Frequencies of operation- Selection criteria for RFID systems- Information processing in the transponder and reader- Fundamental Operating principles- Antennas for RFIDs.

MODULE IV LOCAL AND WIDE AREA TECHNOLOGIES 8

Local area wireless networks: IEEE 802.11 technologies - Mobile IP- Infrared technologies. Bluetooth networks (OBEX Protocol) - Messaging Systems - Personal Area Networks - Network Management - Quality of Service - Wireless protocols - Establishing Wide area wireless networks: Concept and structure of "cell"- Call establishment and maintenance - Channel management- Frequency Assignment techniques- Difference from a wired network.

MODULE V PROTOCOLS 7

Protocols: Networking protocols - Packet switched protocols - Routing Protocols for Sensor Networks - Data Centric Protocols - Hierarchical Protocols Location-based protocols - Multimedia Messaging Service (MMS) Protocols Wireless Application Protocol (WAP).

MODULE VI APPLICATIONS 7

Applications: Mobile access to patient information in a hospital, sales support, retailing- Services support, tracking applications - Designing for small screen devices - Search interfaces - Context- awareness - Determining "locality".

Total Hours: 45

REFERENCES:

1. Burkhardt, Henn, Hepper, Rintdorff, Schaeck. "Pervasive Computing", 6th Edition, Addison Wesley, 2009.

2. Jochen Burkhardt, Horst Henn, Stefan Hepper, Klaus Rindtorff, Thomas Schack, "Pervasive Computing: Technology and Architecture of Mobile Internet Applications", 1st Edition, Addison-Wesley, 2002.

OUTCOMES:

Students who complete this course will be able to

- differentiate pervasive computing from normal computing applications.
- explain the architecture of pervasive computing.
- describe how the devices (sensors and RFIDs) operate in a pervasive computing environment.
- identify the performance of various data dissemination techniques and compare the algorithms for mobile real-time applications.
- apply the basic techniques, algorithms, protocols of different types of networks for designing pervasive computing system.

CSBY34 USER INTERFACE DESIGN L T P C

3 0 0 3

OBJECTIVES:

- To learn the prototyping and testing of user interfaces.
- To understand the importance of iterative design in producing usable software.
- Comprehend the techniques for evaluating the usability of an interface.

PREREQUISITES:

- Graphics and Multimedia

MODULE I INTRODUCTION 7

Human–Computer Interface – Characteristics of Graphics Interface – Direct Manipulation Graphical System – Web User Interface – Popularity – Characteristic & Principles.

MODULE II HUMAN COMPUTER INTERACTION 7

User Interface Design Process – Obstacles – Usability – Human Characteristics In Design – Human Interaction Speed – Business Functions – Requirement Analysis – Direct – Indirect Methods – Basic Business Functions– Design Standards – System Timings – Human Consideration In Screen Design.

MODULE III STRUCTURES OF MENUS 7

Functions of Menus– Contents of Menu – Formatting – Phrasing The Menu – Selecting Menu Choice – Navigating Menus – Graphical Menus.

MODULE IV WINDOWS 8

Characteristics – Components – Presentation Styles – Types – Managements– Organizations – Operations – Web Systems – Device – Based Controls Characteristics – Screen – Based Controls – Operate Control – Text Boxes– Selection Control – Combination Control – Custom Control – Presentation Control.

MODULE V MULTIMEDIA 9

Expansion of functions - Multi-resolution analysis - Scaling functions – MRA

refinement equation – Wavelet series expansion – Discrete Wavelet Transform (DWT) – Continuous Wavelet Transform – Fast Wavelet Transform – 2-D wavelet Transform – JPEG-2000 encoding – Digital Image Watermarking – Basics, SE, Erosion, Dilation, Opening, Closing – Hit-or-Miss Transform – Boundary Detection – Hole filling – Connected components, convex hull, thinning, thickening, skeletons, pruning – Geodesic Dilation – Erosion – Reconstruction by dilation and erosion.

MODULE VI WINDOWS LAYOUT– TEST 7

Prototypes – Kinds of Tests – Retest – Information Search – Visualization – Hypermedia – WWW– Software Tools.

Total Hours: 45

REFERENCES:

1. Wilbent. O. Galitz, "The Essential Guide To User Interface Design", 3rd Edition, John Willey & Sons Publication, 2007.
2. Ben Shneiderman, "Design the User Interface", 5th Edition, Pearson Education, 2009.

OUTCOMES:

Students who complete this course will be able to

- apply design principles, guidelines and heuristics to create a user-interaction strategy that solves a real-world problem.
- design a usable and compelling user-interface for given set of requirements.
- conduct an evaluation of a user-interface by employing a series of evaluation methods.

CSBY35 SOFTWARE MAINTENANCE L T P C

3 0 0 3

OBJECTIVES:

- To describe the importance of software maintenance.
- To demonstrate the software maintenance processes and tools for maintenance
- To explain the normal and special practices for software maintenance.

PREREQUISITES:

- Software Engineering

MODULE I INTRODUCTION 7

Introduction - Issues in software maintenance - Body of knowledge – Definition - Difference between operations - development and Maintenance - standards, process and Activity – Categories - Maintenance Measurement - Service measurement and benchmarking – Maturity models in Software Engineering.

MODULE II PROCESS MODEL AND MANAGEMENT DOMAIN 7

Context of software Maintenance - Classification of software maintenance processes - Process domain and key process areas in software Maintenance– Goals – Links - Expected results and service definition - Training-Performance and Deployment of KPA.

MODULE III MANAGEMENT AND EVOLUTION ENGINEERING DOMAIN 8

Event Request Management KPA - Maintenance Planning KPA - Request Software Monitoring and Control KPA -SAM KPA - Pre delivery and Transition services KPA - Operational Support services KPA - Correction Services KPA - Verification and Validation KPA.

MODULE IV ENGINEERING DOMAIN AND PROCESS MANAGEMENT 8

Configuration and Version Management KPA - SQA KPA - MMA KPA - Casual Analysis and Problem Resolution - Software Rejuvenation - Migration and Retirement - Maintenance Process Focus - Service Definition – Training - Process Performance - Innovation and Deployment.

MODULE V DETAILED EXEMPLARY PRACTICES 8

Event Request Management KPA - Maintenance Planning KPA - Requests/ Software monitoring and Control KPA - SLA SAM KPA - Pre Delivery and Transition to software Maintenance - Operational Support services KPA - Software Evolution and Correction and services KPA - Verification and Validation KPA.

MODULE VI SUPPORT AND CASE STUDIES 7

Configuration and Change Management – Process - Service and Software Quality Assurance - Maintenance Measurement and Analysis - Casual Analysis and Problem Resolution - Evolution process and Support and Case Studies.

Total Hours: 45

REFERENCES:

1. Alain April, Alain Abrain, “Software Maintenance Management Evaluation and Continuous Improvement”, IEEE computer Society Publication, 2008.

2. Penny Grubb, Armstrong A .Takang, “Software Maintenance Concepts and Practice”, 3rd Edition, World Scientific Publishing Company, 2008.

OUTCOMES:

Students who complete this course will be able to

- formulate the maintenance procedures in routine maintenance.
- apply process models and software maintenance tools in Software maintenance.
- apply methods to solve software problems and analyze the case studies in Software maintenance.

CSBY36 MULTIMODAL COMPUTING L T P C

3 0 0 3

OBJECTIVES:

- To introduce the concept of multimodal systems and interfaces.
- To make them understand the importance of audio attention modeling and recognition.
- To give good rearing on the issues in the design and implementation of multimodal system.

PREREQUISITES:

- Programming Languages

MODULE I INTRODUCTION TO MULTIMODAL SYSTEMS 9

Introduction to Multimodal systems, Multimodal Interfaces: Unimodal - Multimedia interfaces - GUI. Interaction Modalities: Acoustic - Tactile - Visual - Basics of data acquisition: Audio - Video - Single microphone source separation - Admissibility of audio evidence - Acquisition of digital evidence.

MODULE II AUDIO ATTENTION MODELLING AND DATA FUSION 9

Audio attention modelling and data fusion: Types of attention - Measuring attention - Fusion of audiovisual attention – Multimodal integration and understanding: Early approaches - Unification multimodal integration and Parsing.

MODULE III AUDIO RECOGNITION AND CLASSIFICATION 9

Audio recognition and classification: Feature extraction - Hidden Markov Modelling - Training and pattern matching - Training and pattern matching. Audio enhancement techniques for forensics: Objectives of forensic analysis– Case study: Gaze recognition.

MODULE IV ISSUES IN THE DESIGN AND IMPLEMENTATION 8

Issues in the design and implementation of Multimodality: Multimodal user interface client - Modality recognition - Modality integration and understanding - Multimodal generation: Multimodal output planning - Multimodal synchronization - Multimodal Dialog management.

MODULE V SECURITY AND SURVEILLANCE APPLICATIONS 5

Security and surveillance applications: Requirements analysis - Challenges - Audio analysis as part of larger systems.

MODULE VI HUMAN COMPUTER INTERACTION 5

Audio-based human computer interaction: Audio scene analysis - Source localisation - Source separation - Performance analysis and comparison – Case Study involving Gesture recognition.

Total Hours: 45

REFERENCES:

1. Pradipta Biswas, Carlos Duarte, Patrick Langdon, Luis Almeida, Christoph Jung, “A Multimodal End-2-End Approach to Accessible Computing”,1st Edition, Springer 2013.
2. P. Maragos, A. Potamianos, P. Gros, “Multimodal Processing and Interaction: Audio, Video, Text”, Springer, 2010.
3. D. Wang, G. Brown, “Computational Auditory Scene Analysis: Principles, Algorithms, and Applications”, Wiley - IEEE Press, 2006.

OUTCOMES:

Students who complete this course will be able to

- identify the strengths and weaknesses of multimodal interfaces by proper comparison of different types.
- apply the human-computer interaction interfaces in employing new interaction techniques for restricted tasks.
- analyze and understand the various the security issues in the design and implementation of multimodal system tools.

CSBY25	CLOUD COMPUTING	L	T	P	C
	(Common to M.Tech (CSE, SE, NS,CPA.CSE-BDA))	3	0	0	3

OBJECTIVES:

- To provide a comprehensive and in-depth knowledge of Cloud Computing concepts, technologies, architecture and applications.
- To provide an insight into the core of cloud computing that revolves around Internet architecture and virtualization.
- To expose the students to frontier areas of Cloud Computing and information systems.

PREREQUISITES:

- Distributed Operating System

MODULE I SYSTEMS MODELING, CLUSTERING AND VIRTUALIZATION 8

Scalable Computing Service over The Internet - Technologies for Network-based Computing - System Models for Distributed and Cloud Computing - Software Environments for Distributed Systems and Clouds - Performance, Security, and Energy-Efficiency - Clustering for Massive Parallelism - Computer Clusters and MPP Architectures - Design Principles of Computer Clusters - Cluster Job and Resource Management.

MODULE II VIRTUALIZATION 7

Implementation Levels of Virtualization - Virtualization Structures/Tools and Mechanisms - Virtualization of CPU, Memory and I/O Devices - Virtual Clusters and Resource Management - Virtualization for Datacenter Automation.

MODULE III CLOUD FUNDAMENTALS 7

Origins and Influences - Basic Concepts and Terminology - Goals and Benefits - Risks and Challenges - Roles and Boundaries - Cloud Characteristics - Cloud Delivery Models - Cloud Deployment Models- Broadband Networks and Internet Architecture - Virtualization Technology - Web Technology - Multitenant Technology - Service Technology.

MODULE IV CLOUD COMPUTING ARCHITECTURE 8

Fundamental Cloud Architectures - Workload Distribution Architecture -

Resource Pooling Architecture - Dynamic Scalability Architecture – Elastic Resource Capacity Architecture -Service Load Balancing Architecture - Cloud Bursting Architecture - Elastic Disk Provisioning Architecture - Redundant Storage Architecture.

MODULE V ADVANCED CLOUD ARCHITECTURES 8

Hypervisor Clustering Architecture – Load Balanced Virtual Server instances Architecture – Non-Disruptive service relocation Architecture – Zero Downtime Architecture- Cloud Balancing architecture – Resource reservation Architecture- Dynamic failure detection and recovery Architecture- Bare-Metal provisioning Architecture – Rapid Provisioning Architecture- Storage Workload Management Architecture.

MODULE VI WORKING WITH CLOUDS 7

Cloud Delivery Models: The Cloud Provider Perspective - Cloud Delivery Models: The Cloud Consumer - Cost Metrics and Pricing Models - Business Cost Metrics - Cloud Usage Cost Metrics - Cost Management Considerations.

Total Hours: 45

REFERENCES:

1. Kai Hwang, Jack Dongarra & Geoffrey Fox, “Distributed and Cloud Computing”, 1st Edition, Morgan Kaufmann, 2011.
2. Thomas Erl, Zaigham Mahmood, Ricardo Puttini, “Cloud Computing: Concepts, Technology & Architecture”, 1st Edition, Prentice Hall/ Pearson PTR, 2013.
3. Micheal Miller, “Cloud computing”, 1st Edition, Pearson, 2009.

OUTCOMES:

Students who complete this course will be able to

- Articulate the concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing.
- Identify problems, explain, analyze and evaluate various cloud computing solutions.
- Demonstrate the various tools used in the cloud environment.
- Provide the appropriate cloud computing solutions according to the applications used.

SSBY01 SOCIETY, TECHNOLOGY AND SUSTAINABILITY

L	T	P	C
3	0	0	3

OBJECTIVES:

- Aware of new technologies through advances in Science and Engineering.
- To make them realise the profound impact on society.
- Understand the ethical issues raised by technological changes and its effect on society.
- To introduce students a broad range of perspectives on the adoption and use of technologies.
- To make them realize the need of sustainability in the context of emerging technologies.

PREREQUISITES:

- Advanced Sciences

MODULE I TECHNOLOGY AND ITS IMPACTS **9**

Origin and evolution of technologies – Nature of technology- Innovation – Historical Perspective of technology – Sources of technological change - Co-evolution of technology and economy – Scientific knowledge and technological advance – Science and Engineering aspects of Technology – Impact on the Society – Social and Ethical Issues associated with technological change – Social and environmental consequences - Impact of technological change on human life –Technology and responsibility – Technology and social justice.

MODULE II TECHNOLOGY AND ITS ADVANCEMENT **9**

Sociological aspects of technology – Ethics and technology – Technology and responsibility – International Economics, Globalisation and Human Rights – Sustainability and Technology – Population and environment - Technology, Energy and Environment – Organisations and technological change.

MODULE III SOCIETY AND TECHNOLOGY **9**

Impact of technologies on contemporary society – Role of society in fostering the development of technology – Response to the adaption and use of technology – Impact of technology on developer and consumers Technological change and globalisation.

MODULE IV IMPACT OF A SPECIFIC TECHNOLOGY ON HUMAN WELFARE 9

Impact of the following technologies on Human life – Medical and Biomedical – Genetics Technology – Electronics and Communications – Electronic media Technology – Information Systems Technology – Nanotechnology – Space Technology and Energy Technology.

MODULE V THE IMPORTANCE OF SUSTAINABILITY 9

Sustainability – A brief history – Concepts and contexts for sustainability – Ecological imbalance and biodiversity loss – Climate change – Population explosion. Industrial ecology – systems approach to sustainability – Green engineering and technology- sustainable design- sustainable manufacturing- Green consumer movements – Environmental ethics – Sustainability of the planet Earth – Future planning for sustainability.

Total Hours : 45

REFERENCES:

1. Volti Rudi, “Society and Technology Change”, 6th Edition, Worth publishers Inc, USA, 2009.
2. Arthur W.A, “The nature of Technology: What it is and how it evolves”, Free Press, NY, USA, 2009.
3. Winston M and Edelbach R, “Society, Ethics and Technology”, 3rd Edition, San Francisco, USA, 2005.
4. Martin A.A Abraham, ‘Sustainability Science and Engineering: Defining Principles’, Elsevier Inc, USA, 2006.
5. R.V.G.Menon, “Technology and Society”, Pearson Education, India, 2011.

OUTCOMES:

At the end of this course, the students will be able to

- implement the benefits of modern technology for the well-being of human life.
- connect sustainability concepts and technology to the real world challenges.
- find pathway for sustainable society.

VISION AND MISSION OF THE SCHOOL OF LIFE SCIENCES

VISION

To attain new heights in biotechnology research, shaping life sciences into a premier precision tool for the future for creation of wealth and ensuring social justice-specially for the welfare of the poor.

MISSION

- The mission of the school of life sciences and Technology is to maximize the benefits of biotechnology to the University, the nation and the globe by being an excellent quality, comprehensive, multidisciplinary school that supports, coordinates, disseminates and advances biotechnology in the areas of social welfare and entrepreneurship.

PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES
M.Tech. BIOTECHNOLOGY

PROGRAMME EDUCATIONAL OBJECTIVES

The course aims to provide an advanced understanding of the core principles and topics of Biotechnology and their experimental basis, and to enable students to acquire a specialized knowledge and understanding of selected aspects by means of a lecture series and a research project. Hence, the main objectives of the program are:

- To provide an introduction to the basic concepts of Biotechnology and its recent advances.
- For the basic understanding, this course includes advanced biochemistry, cell and molecular biology, immunotechnology, and microbial biotechnology.
- Moreover, several laboratory courses given in the individual sections of the curriculum with detailed information on the importance of biotechnology in basic and applied research.
- Finally this course explains the advanced sections of biotechnology like genetic engineering, nanobiotechnology, computational biology and medical biotechnology.
- This course provides necessary theoretical and practical experience in all divisions of biotechnology to pursue a professional career in this field.
- To provide broad exposure to various societal, ethical and commercial issues in the various aspects of biotechnology.

PROGRAMME OUTCOMES

After successfully completing this course, the student should be able to:

- Apply their knowledge of biotechnology into high end research.
- Advanced sections of like Immunology, bioinformatics, nano-biotechnology will give broad information on applications and opportunities in the field of biotechnological research.

- Identify research and solve biochemistry, cell and molecular biology related problems related to the different types of animal and plant diseases.
- Ability to work with multidisciplinary subjects in industries and research.
- Ability to communicate and function effectively in multi-disciplinary team related to the biochemistry and molecular biology.

CURRICULUM & SYLLABI FOR M.TECH. (BIOTECHNOLOGY) (FOUR SEMESTERS / FULL TIME)

SEMESTER I

Sl. No	Course Code	Course Title	L	T	P	C
1	LSB6101	Advanced Biochemistry	4	0	0	4
2	LSB6102	Cell & Molecular Biology	3	0	0	3
3	LTB6101	Applied Biostatistics for Biotechnologists	3	0	0	3
4	LTB6102	Immunotechnology	4	0	0	4
5	LSB6105	Biomedical Instrumentation Technology	3	0	0	3
6	LTB6103	Microbial Biotechnology	3	0	0	3
7	LSB6107	Biochemistry Lab	0	0	3	1
8	LSB6108	Cell Biology Lab	0	0	3	1
9 1	LSB6109	Immunotechnology Lab		0	0	3
		Credits				**23**

SEMESTER II

Sl. No	Course Code	Course Title	L	T	P	C
1	LTB6201	Genomics & Proteomics	4	0	0	4
2	LTB6202	Bioprocess Engineering & Downstream Processing	4	0	0	4
3	LSB6203	Genetic Engineering	3	0	0	3
4	LSB6204	Computational Biology	3	0	0	3
5	LTB6203	Environmental Biotechnology	3	0	0	3
6	LSB6205	Computational Biology Lab	0	0	3	1
7	LSB6206	Genetic Engineering Lab	0	0	3	1
8	LTB6204	Mini Project	0	0	3	1
		Credits				**20**

SEMESTER III

Sl. No	Course Code	Course Title	L	T	P	C
1	LTB7101	Pharmacogenomics	3	0	0	3
2	LSB7102	Plant & Medical Biotechnology	4	0	0	4
3		Elective II	3	0	0	3
4		Elective III	3	0	0	3
5	LTB7102	Mini Project	3	0	0	6
		Credits				**19**

SEMESTER IV

Sl. No	Course Code	Course Title	L	T	P	C
1	LTB7201	Project work	0	0	20	8
		Credits				**18**
		TOTAL CREDITS				**80**

ELECTIVES

Course Code	Electives I	L	T	P	C
LSBY021	Bioenterpreneurship	3	0	0	3
LSBY022	IPR and Patent Law	3	0	0	3
LSBY023	Biosafety & Bioethics	3	0	0	3
LSBY028	Bionanotechnology	3	0	0	3
	Electives II				
LSBY024	Molecular Diagnostics	3	0	0	3
LSBY025	Food Process technology	3	0	0	3
LSBY026	Animal Biotechnology	3	0	0	3
LSBY029	Industrial Biotechnology	3	0	0	3

SEMESTER I

LSB6101	**ADVANCED BIOCHEMISTRY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

This course aims to develop in the students' mind a concept regarding

- The diversity of metabolic processes occurring in biological system.
- The effect of the structural and functional role of the enzymes governing the metabolic processes.
- Importance of the metabolic pathways in maintaining homeostasis in biological system.
- The clinical implications of the metabolic pathway.

MODULE I AMINO ACIDS & PROTEIN: STRUCTURE AND FUNCTIONS 5

Amino acids- Classification, structure and function, proteins- primary, secondary, tertiary and quaternary structure, Ramachandran plot, super secondary structures and helix loop.

MODULE II ENZYMOLOGY 10

Classification of enzymes. How do enzymes work: activation energy, substrate specificity. Enzyme-substrate interaction: Lock and Key mechanism and Induced Fit mechanism. Effect of temperature and pH on enzyme action. Enzyme Kinetics: Michaelis-Menten Equation, Km, Measurement of Km and Vmax (Lineweaver-Burk equation). Kinetics of multisubstrate reaction: Sequential reactions and ping-pong reactions. Enzyme inhibition: reversible (competitive, uncompetitive and mixed) and irreversible. Allosteric regulation of enzyme activity.Multienzyme complex and multifunctional enzymes.

MODULE III ENERGY PRODUCTION AND OXIDATIVE PHOSPHORYLATION 14

Introduction to metabolism: Anabolism, catabolism, metabolic pathways. Characteristics of metabolic pathways

Glycolysis: glycolytic pathway. Molecular mechanism of action of the glycolytic enzymes.Energetic of glycolysis. Glycolysis and cancer biology—Warburg

Hypothesis and PET scanning. Fates of Pyruvate under anaerobic conditions: alcohol and lactic acid fermentation. Importance of lactic acid fermentation.

TCA Cycle: Formation of Acetyl CoA and reactions of citric acid cycle. Molecular mechanism of pyruvate dehydrogenase complex and enzymes involved in Kreb's cycle.Energetic of TCA cycle and substrate level phosphorylation.

Lipid metabolism: Hormonal regulation of the mobilization of triglycerides from adiposities. Transport of fatty acid into mitochondria.Beta oxidation of saturated fatty acid (both even and odd).Regulation.Energetic.

Electron Transport Chain: structure and function of Electron carriers: Complex I—V. Passage of electrons from complex I to IV. Mitchell's chemiosmotic hypothesis and proton gradient.Structure of complex V or ATP synthase, Catalytic sites of ATP synthesis. Mechanism of ATP generation by Boyer's binding change mechanism—rotational catalysis. Energetic of ATP synthesis and efficiency of ATP synthase.

MODULE IV METABOLIC INTERRELATIONSHIP 9

Starve-Fed cycle.Glucose homeostasis. Switching of metabolism of liver between starve and fed cycle. Metabolic relationship of tissues in various nutritional and hormonal states—insulin resistance, diabetes, exercise, pregnancy, lactation, stress, liver and renal diseases, alcohol consumption.

MODULE V REGULATORY MECHANISMS OF METABOLIC PATHWAYS 7

Feed back inhibition by allosteric modulation of enzymes. Covalent modifications of enzymes.Isozymes.Propetolytic cleavage.Regulationg the amount of enzyme—regulation gene expression in prokaryotes and eukaryotes.

Total Hours : 45

REFERENCE:

1. Nelson D.L, Cox M. M. Lehninger's Principle of Biochemistry. 5th Ed.,W. H. Freeman, 2008.
2. Biochemistry by LubertStryer 7th ed. W. H. Freeman & Company.
3. Textbook of Biochemistry with Clinical Correlations. 4th Ed. Thomas M. Devlin. Wiley-Liss publication. 1997.

OUTCOMES:

At the completion of the course the student will develop an understanding about the

- Various metabolic processes occurring in biological system and their role in governing homeostasis and normal physiology.
- The importance of enzymes as a regulatory molecule in metabolism.
- The interrelationship of metabolic pathways different physiological conditions.
- The role of liver in regulating metabolism.

LSB6102 CELL & MOLECULAR BIOLOGY L T P C

3 0 0 3

OBJECTIVES:

- To get overview of classes of cells and structural and function aspects of plasma membrane and cell organelle.
- To develop skill to understand molecular aspects of cell cycle and cell division.
- To get familiar with transcription and translation in details.
- To understand the signaling pathways in cell functioning

MODULE I INTRODUCTION TO CELL 8

Basic properties of cell, Different classes of cell: Prokaryotic, animal and plant cell.Plasma membrane- structure and function, Chemical composition of membranes, membrane lipids and proteins,fluid mosaic model, Transport across the membranes- diffusion, osmosis, facilitated diffusion,passive and active transport; membrane potential and nerve impulses.

MODULE II MEMBRANE TRANSPORT 7

Endoplasmic Reticulum, Golgi complex- glycosylation, Vesicle transport- COPI and COPII; Lysosomes-autophagy;Endocytic pathway- endocytosis and phagocytosis,transport of proteins into peroxisomes, mitochondria and chloroplast.

MODULE III ENERGY CONVERSION 10

Structure of mitochondria and organization of respiratory chain; Proton Pump and ATP generation in mitochondria; Structure of chloroplast and Photosynthesis, photorespiration; Genetic system of mitochondria and chloroplast.

MODULE IV BASIC GENETIC MECHANISMS 10

The structure and function of DNA, DNA packaging and Chromosomes, chromatin structure and function, DNA replication mechanisms, DNA damage and repair and homologous recombination and transposable elements, Telomeres, telomerase and end replication.Role of telomerase in aging and cancer.

MODULE V TRANSCRIPTION AND TRANSLATION 10

Transcription- Prokaryotic and eukaryotic Transcription- RNA polymerases- general and specific transcription factors- regulatory elements- mechanism of transcription, Transcription termination Post transcriptional modification- splicing- editing- nuclear export of mRNA- mRNA stability; Translation- Genetic code, Mechanism of initiation- elongation andtermination- Regulation of translation.

Total Hours : 45

REFERENCES

1. Molecular Biology of Cell by Alberts et.al. John Wiley & Sons, 6th Ed, 2015
2. The Cell by Cooper. ASM Press, 4th Ed, 2007
3. Cell and Molecular Biology by Karp. John Wiley & Sons, 7th Ed, 2013
4. Lodish H. F.Cell and Molecular Biology. W.H. Freeman & Co Ltd, 7th Ed, 2000.

OUTCOMES:

- On the completion of the above objectives student will be able to get the overview of classes of cells and structural and function aspects of plasma membrane and cell organelle. They can develop skill to understand molecular aspects of cell cycle, cell division, transcription and translation.

LTB6101 APPLIED BIOSTATISTICS FOR BIOTECHNOLOGISTS **L T P C**

3 0 0 3

OBJECTIVES:

This course aims to provide students with fundamental knowledge of statistical issues arising in biomedical research, and of important methods for the analysis of biostatistical data.

- Students will be able to make informed decisions based on data
- Students will be able to correctly apply a variety of statistical procedures and tests
- Students will know the uses, capabilities and limitations of various statistical procedures
- Students will be able to interpret the results of statistical procedures and tests

MODULE I CONCEPTS IN STATISTICS **9**

Population and sample, qualitative and quantitative data, nominal, ordinal, ratio, interval data; cross sectional and time series data; discrete and continuous data. Descriptive statistics and Random variables; Measures of central tendency: mean, median, mode; the uses of measure of central tendency, Measures of spread: range, percentile, standard deviation, some properties of variance and standard deviation, the coefficient of variation, group data.

MODULE II INFERENTIAL STATISTICS **9**

Displaying data: frequency table, line graph, bar chart, histograms, stem and-leaf plots, dot plot, scatter plot, box plots, frequency distributions; definition of probability, rules for calculating probability, definition from epidemiology, Bayes' theorem, probability in sampling, Bernoulli, Binomial, Poisson; Geometric distributions; Continuous random variables: Normal; Exponential distributions; Standard normal distribution. Counting and Probability, Permutations; Combinations.

MODULE III INTERVAL ESTIMATION **9**

Prediction, confidence and tolerance Intervals, distribution free interval, confidence interval based on normal distribution, confidence interval and

sample size, Point and interval estimates; the relation between population and sample, Random-Number tables, randomized clinical trials, estimation of the Mean of Distribution, estimation of -variance of distribution, binominal distribution and poisson distribution.

MODULE III HYPOTHESIS TESTING 9

Hypothesis testing: null and alternative hypotheses, decision criteria, critical values, type I and type II errors, Meaning of statistical significance; Power of a test; One sample hypothesis testing: Normally distributed data: z, t and chi-square tests; Binomial proportion testing, nonparametric hypothesis testing, Two sample hypothesis testing; Nonparametric methods: signed rank test, rank sum test; Kruskal-Wallis test;

MODULE IV CURVE FITTING AND ANOVA 9

Regression and correlation: simple linear regression; Least squares method; Analysis of enzyme kinetic data; Michaelis-Menten; Lineweaver-Burk and the direct linear plot; Logistic Regression; Polynomial curve fitting. Analysis of variance: One-way ANOVA, two-way ANOVA. Fixed effect model, Random effect model, the intraclass correlation coefficient.

MODULE V ANALYSIS OF SURVEY DATA 9

Introduction, study design, measures of effect for categorical data, attribution risk, confounding and standardization, methods of inference for stratified categorical data-The Mantel-Haenszel test, power and sample, multiple logistic regression, meta Analysis, equivalence study, the cross-over design, longitudinal data analysis, measurement-error Methods.

Total Hours : 45

REFERENCES:

1. Bernard Rosner, Fundamentals of Biostatistics, 5th Edition, Thomson Brooks/ Cole, 2000.
2. Richard A. Johnson, Probability and Statistics for Engineers, 6th Edition, Prentice Hall, 2000.
3. Morris H. DeGroot, Mark J. Schervish, Probability and Statistics, 3rd Rev. Edition, Addison-Wesley, 2002.
4. E. Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley, 2006.

OUTCOMES:

At the end of the course students will be able to

- Explain how the Central Limit Theorem applies in inference
- Interpret the meaning of condence intervals in context
- Interpret the results of hypothesis tests
- Make an informed decision, based on the results of inferential procedures

LTB6102 IMMUNOTECHNOLOGY L T P C

3 0 0 3

OBJECTIVES:

- Learn the structural features of the components of the immune system and their functions.
- Understanding the mechanisms involved in immune system development and responsiveness.
- To understand about how immunologists think and work.

MODULE I IMMUNOLOGY: CONCEPT AND COMPONENTS OF IMMUNE SYSTEM 7

Overview and Concepts, Discovery of humoral and cellular immunity, Components of innate and acquired immunity, Hematopoiesis, Organs and cells of the immune system- primary and secondary lymphoid organs, Lymphocyte circulation; Lymphocyte homing; Mucosal and Cutaneous associated Lymphoid Tissue.(MALT&CALT); Mucosal Immunity.

MODULE II ANTIGENS & ANTIBODY: BASIC PROPERITIES AND THEIR INTERACTIONS 9

Properities of antigens and antibodies, Epitopes, Heptens, Immunogenicity versus antigenecity, Antibody structure, classes and subclasses of Immunoglobulin, Theories of antibody formation.structural basis of antibody diversity; properties of immunoglobulins, subtypes. Immunoglobulins as antigens, monoclonal antibody techniques Hybridoma, Production of murine hybridoma, antigen antibody interactions.

MODULE III REGULATION OF IMMUNE RESPONSE BY B AND T LYMPHOCYTES 10

Major Histocompatibility Complex - MHC genes, MHC and immune responsiveness and disease susceptibility, HLA typing, Cellular distribution of MHC molecule, Antigen processing and presentation – exogenous and endogenous antigen processing. Self -MHC restriction of T cells. Presentation of non-peptide antigens. B-cell receptor; B cell maturation, activation and differentiation; Generation of antibody diversity; T-cell maturation, activation and differentiation and T-cell receptors; Functional T Cell Subsets;

MODULE III UNDERSTANDING CLINICAL IMMUNOLOGY 9

Cellular Immunity, Immune Tolerance and suppression, Immunity to infection : Bacteria, viral, fungal and parasitic infection. Hypersensitivity Reactions, Types of Hypersensitivity, Autoimmunity, Immune Dysfunction and Its component Cytokines -Properties, receptors, antagonists, diseases, Cytokine secretion by TH1and TH2 subsets therapeutic use of Cytokines. Cytokine related diseases, Cytokines in hematopoisesis. Complement system - Activation, Regulation, Biological consequence of complement activation and Complement deficiency, inflammation, and opsonization

MODULE V IMMUNOTECHNIQUES 10

Introduction: scope of Immunotechnology, Strength of antigen and antibody reaction- cross reactivity, precipitation and agglutination reactions, Radioimmunoassay and ELISA, Markers of immunocompetant cells, separation and purification of immunocompetant cells. Functional tests for immunocompetant cells and histocompatibility testing.Immunological assays- Complementfixation tests, In-vivo tests/ neutralization tests, immunodiffusion, immunoblotting, immunohistochemistry and immunofluorescenece techniques. Biosenor assays for assessing ligand –receptor interaction, CMI techniques- lymphoproliferation assay, Mixed lymphocyte reaction, Cell Cytotoxicity assays, Apoptosis, Microarrays, Transgenic mice, Gene knock outs

Total Hours : 45

REFERENCES:

1. Kuby, RA Goldsby, Thomas J. Kindt, Barbara, A. Osborne Immunology, 6th Edition, Freeman, 2002.
2. Brostoff J, Seaddin JK, Male D, Roitt IM., Clinical Immunology, 6th Edition, Gower Medical Publishing, 2002.
3. Janeway et al., Immunobiology, 4th Edition, Current Biology publications., 1999.
4. Paul, Fundamental of Immunology, 4th edition, Lippenco

OUTCOMES:

After completing the course students will:

- have a detailed understanding of Component of immunity
- know antigen presentation on a detailed molecular level
- understand the concept immunology and the immune system .
- have a in depth knowledge of the cellular and molecular basis for autoimmune disease and allergies.
- have basic knowledge of tumor immunology and the development of novel recombinant antibodies for treatment of cancer and autoimmune disease.

LSB6105 BIOMEDICAL INSTRUMENTATION L T P C

3 0 0 3

OBJECTIVES:

- To understand the application of Biomedical instrumentation.
- To introduce the student to the various devices of electrical origin and non electrical origin.
- To provide awareness of electrical safety of medical equipments.
- To know the important and modern methods of imaging techniques.

MODULE I FUNDAMENTALS OF MEDICAL INSTRUMENTATION 10

Role of technology in medicine, landmark developments in biomedical instrumentation, physiological systems of the body, sources of biomedical signals, basic medical instrumentation system, performance requirements of medical instrumentation systems, intelligent medical instrumentation systems, consumer and portable medical equipment, implantable medical devices, Basic components of a biomedical system, Transducers, Piezoelectric, ultrasonic transducers, Temperature measurements, Fibre optic temperature sensors. Amplifiers: Preamplifiers, differential amplifiers, chopper amplifiers Isolation amplifier.

MODULE II BIOELECTRIC SIGNALS AND ELECTRODES 9

Origin of bioelectric signals, recording electrodes, silver-silver chloride electrodes, Electrodes, Limb electrodes, floating electrodes, pregelled disposable electrodes, electrodes for ECG, electrodes for EEG, electrodes for EMG, electrical conductivity of electrode jellies and creams, microelectrodes, Micro, needle and surface electrodes, Typical waveforms, Electrical safety in medical environment: shock hazards, leakage current-Instruments for checking safety parameters.

MODULE III BIOMEDICAL RECORDER 8

Measurement of blood pressure, Heart rate, Pulmonary function measurements, spirometer, Photo Plethysmography, Body Plethysmography, Blood Gas analysers : pH of blood measurement of blood pCO2, pO2, finger-tip oxymeter - ESR, GSR measurements, Electrocardiograph, vector cardiograph (VCG), phonocardiograph (PCG),digital stethoscope,

electroencephalograph (EEG), electromyography, other biomedical recorders, biofeedback instrumentation.

MODULE IV CLINICAL INSTRUMENTS AND PATIENT MONITORING SYSTEMS 9

Medical diagnosis with chemical tests, spectrophotometry, spectrophotometer type instruments, colorimeters, spectrophotometers, clinical flame photometers, selective-ion electrodes based electrolytes analyser, automated biochemical analysis systems, Radio graphic and fluoroscopic techniques, Computer tomography, MRI, Ultrasonography, X-ray Machines and Digital Radiography, Blood cell counter.

MODULE V THERAPEUTIC EQUIPMENTS AND PATIENT SAFETY 9

Audiometers and Hearing Aids, Pacemakers, Defibrillators, Ventilators, Nerve and muscle stimulators, Diathermy, Heart – Lung machine, Dialysers, Lithotripsy, electric shock hazards, leakage currents, safety codes for electromedical equipment, electrical safety analyzer, testing of biomedical equipment.

Total Hours : 45

OUTCOMES:

After the completion of the course

- The student acquires an adequate knowledge and could co relates the human body to the parameters that have clinical importance.
- The student learn the fundamental principles of medical equipment and patient safety.

REFERENCES:

1. R.S.Khandpur, 'Hand Book of Bio-Medical instrumentation', McGraw Hill Publishing Co Ltd. 2003.
2. M.Arumugam, 'Bio-Medical Instrumentation', Anuradha Agencies, 2003.
3. L.A. Geddes and L.E.Baker, 'Principles of Applied Bio-Medical Instrumentation', John Wiley & Sons, 1975.
4. J.Webster, 'Medical Instrumentation', John Wiley & Sons, 1995.
5. C.Rajarao and S.K. Guha, 'Principles of Medical Electronics and Bio-medical Instrumentation', Universities press (India)

LTB6103 MICROBIAL BIOTECHNOLOGY L T P C

3 0 0 3

OBJECTIVES:

- To learn the microbial growth kinetics, isolation and screening
- To understand the principles of bioprocess
- To get the protein expression strategies &recombinant production
- To give basic idea on metagenomics & risk management
- To inform students about application in microbial biotechnology

MODULE I MICROBIAL GROWTH KINETICS, ISOLATION AND SCREENING 9

Microbial growth kinetics: batch cultures, continuous cultures, fed-batch culture. Isolation and screening of industrially important microbes; Large scale cultivation of industrial microbes; Strain improvement to improve yield of selected compounds e.g. antibiotics, enzymes or recombinant proteins. Biofilms, immobilized enzymes and immobilized cells as biocatalysts.

MODULE II PRINCIPLES OF BIOPROCESS 9

Basic principles of bioprocess as applied to selected microbes; Process optimization of selected products. Thermo-bacteriology: Thermal microbial destruction kinetic. Decimal reduction time.

MODULE III PROTEIN EXPRESSION STRATEGIES&RECOMBINANT PRODUCTION 9

Overview of protein expression strategies – choosing a heterologous host. Protein folding and inclusion bodies – the problem of protein refolding. Protein expression in E. coli and other Gram negative hosts.Recombinant protein production in microbes; Commercial issues pertaining to the production of recombinant products from microbes; Downstream processing approaches; Industrial microbes as cloning hosts (Streptomyces/Yeast).

MODULE IV METAGENOMICS & RISK MANAGEMENT 9

Culture Collections and Gene Banks. Microbial resources.Establishment of culture collections.Taxonomic Terminology. How are the strains preserved

Patent depository. Seed lot and cell bank system. Metagenomics in Biotechnology: understanding and exploiting microbial diversity. Risk management solutions to indoor biological contamination.Risk management solutions to indoor biological contamination.

MODULE V APPLICATION IN MICROBIAL BIOTECHNOLOGY 9

Pathways of microbial biotech product development, compliance, and regulation.Microbial monitoring during bacterial vaccine manufacturing processes and rapid microbial identification in a pharmaceutical Quality Control (QC) microbiology laboratory. Industrial enzymes for biopolymer degradation: starch, pectin, biomass applications. Industrial biocatalysis: sweetener, detergent, textile, lipid hydrolysis applications. Environmental application of microbes; Ore leaching; Toxic waste removal; soil remediation.

Total Hours : 45

REFERENCES:

1. Basic Biotechnology, Third Edition 2006. Colin Ratledge, Bjorn Kristiansen Editors. ISBN 0521840317, Cambridge University Press.
2. Demain AL, Davies JE, editors in chief 1999. Manual of Industrial Microbiology and Biotechnology. ASM Press Washington, D.C. second edition.
3. Microbial Biotechnology, Second Edition, 2007. Alexander N. Glazer, Hiroshi Nikaido. ISBN 9780521842105, Cambridge University Press.

OUTCOMES:

At the end of this course, students will:

- Describe microbial growth kinetics, isolation and screening and metabolic pathway engineering approaches to engineer microbes for the over-production of metabolic intermediates and to generate novel compounds.
- Explain how microbial enzymes and genetically engineered microbes are used in industrial biocatalysis.
- The capability to apply principles of bioprocess to the enzyme production.
- Explain the advantages and disadvantages of production of peptides, proteins, glycoproteins, in Gram negative, Gram positive, yeast expression systems.

- Mathematically describe microbial growth and product formation in batch, fed-batch, continuous cultures and immobilized cells. Explain how each of these methods is used in microbial biotechnology and environmental remediation.
- An understanding of how science relates application in microbial biotechnology

LSB6107	BIOCHEMISTRY LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To learn the preliminary methods in biochemistry by preparing buffer and different solutions.
- To learn about the factors affecting enzymatic activity.
- learn about several techniques of separations of sugar and amino acids.

1. Laboratory safety guidelines.
2. To prepare an Acetic-Na Acetate Buffer system and validate the Henderson-Hasselbach equation.
3. To determine an unknown protein concentration by plotting a standard graph of BSA using UV-Vis Spectrophotometer and validating the Beer- Lambert's Law.
4. Determination of pH optima of an enzyme.
5. Determination of Km and Kcat of a particular enzyme.
6. Effect of temperature on enzyme activity.
7. Separation techniques for amino acids and sugar:
   (a) paper chromatography
   (b) thin layer chromatography.
8. Separation of proteins by native and SDS-PAGE.
9. Quantification of reducing sugar in different food material.
10. Estimation of different biochemical parameters of blood
    (a) sugar (b) cholesterol (c) urea.

OUTCOMES:

On performing the above experiments students will be able to:

- quantify different biomolecules from unknown samples.
- develop an idea about the separation of different biomolecules like proteins and carbohydrate.

- develop an idea about the factors regulating enzyme activity.
- determine the various parameters defining enzyme activity.
- estimate the concentration of various biomolecules in a wide range of samples.

REFERENCES:

1. Wilson K and Walker J, Principles and Techniques in Practical Biochemistry, 5th Ed., Cambridge University Press, 2000.
2. Holtzhauer M, Basic Methods for the Biochemical Lab, Springer, 2006.
3. Nigam, Lab Manual in Biochemistry: Immunology and Biotechnology, Tata McGraw-Hill Education, 2007.

LSB6108	CELL BIOLOGY LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To learn basic techniques in molecular biology
- To study and differentiate the electrochemical properties of nucleic acids

EXPERIMENTS **30**

1. Preparation of competent cell by calcium chloride method and checking its efficiency
2. Preparation of slides from onion root tip for mitosis
3. Isolation & Purification of genomic DNA from bacteria
4. Isolation & Purification of plasmid DNA
5. Isolation of RNA
6. Agarose gel electrophoresis of chromosomal & plasmid DNA
7. Restriction Digestion of chromosomal & plasmid DNA
8. Isolation of DNA fragment from agarose gel

REFERENCES

1. Michel R. G and Sambrook J. Molecular Coning- A laboratory manual. Cold spring harbor laboratory press, 2012.

OUTCOMES:

- On the completion of the above experiments students will be able to handle DNA samples and also to isolate, purify and visualize nucleic acid.

LSB6109	IMMUNOTECHNOLOGY LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To acquire knowledge on immunological techniques
- To train in various techniques involving antigen and antibody reactions

LIST OF EXPERIMENTS:

1. Double diffusion, Immuno-electrophoresis and Radial Immuno diffusion.
2. Rocket electrophoresis
3. Antibody titre by ELISA method.
4. ELISA for detection of antigens and antibodies-DOT ELISA
5. Sandwich ELISA
6. Blood group mapping
7. Separation of leucocytes by dextran method
8. Separation of mononuclear cells by Ficoll-Hypaque
9. Preparation of antigens from pathogens and parasites
10. Slide and tube agglutination reaction
11. Complement fixation test.
12. Immunofluorescence technique
13. Lymphoproliferation by mitogen / antigen induced
14. SDS-PAGE, Immunoblotting, Dot blot assays

REFERENCES:

1. Rose et al., Manual of Clinical laboratory Immunology, 6th Ed ASM Publications, 2002.
2. Lefkovis and Pernis. Immunological methods. Academic Press, 1978.
3. Hudson L. and Hay F.C. Practical Immunology. Black Well publishers, 1989

OUTCOMES:

- Students could independently perform diagnostics assays involving antigen-antibody reaction. They also learn to perform the qualitative and quantitative analysis using antibody.

SEMESTER II

LTB6201	GENOMICS AND PROTEOMICS	L	T	P	C
		4	0	0	4

OBJECTIVES:

- To provide information about genomics and proteomics and
- To offer basic knowledge of genome sequencing, major differences between prokaryotic and eukaryotic genomes.
- To understand the basic proteomics and its potential application of both genomics and proteomics.

MODULE I INTRODUCTION **10**

Genomics classification, Prokaryotic and Eukaryotic genome; mitochondrial and chloroplast genome; DNA sequencing-principles and methods, Sanger Dideoxy and fluorescence method; coding and non-coding sequences and gene annotation; Tools for genome analysis-RFLP, DNA fingerprinting, RAPD, PCR, Linkage and Pedigree analysis-physical and genetic mapping.

MODULE II GENOME SEQUENCING PROJECTS **8**

Gene database for Microbes, plants and animals; Accessing and retrieving genome project; Comparative genomics, Identification and classification using molecular markers-16S rRNA typing/sequencing, ESTs and SNPs.

MODULE III PROTEOMICS TECHNIQUES **9**

Introduction to proteomics; Protein separation techniques: chromatography-ion-exchange, size-exclusion and affinity chromatography; Protein analysis-Polyacrylamide gel electrophoresis, Isoelectric focusing (IEF), Two dimensional PAGE for proteome analysis and image analysis of 2D gels; measurement of protein concentration, amino-acid composition, N-terminal sequencing.

MODULE IV PROTEIN ENGINEERING **9**

Peptide fingerprinting; LC/MS-MS for identification of proteins and modified proteins; MALDI-TOF; SAGE and Differential display proteomics, Protein-protein interactions, Yeast two hybrid system. High throughput screening in genome for drug discovery-identification of gene targets, Pharmacogenetics and drug development.

MODULE V FUNCTIONAL GENOMICS AND PROTEOMICS 9

Recombinant DNA technology: Fundamentals of DNA cloning, Polymerase chain reaction, Human genome project; Analysis of microarray data; Protein and peptide microarray-based technology; PCR-directed protein in situ arrays.

Total Hours : 45

OUTCOMES:

- After completing the course the student will have a better understanding to the basics of the genomic and proteomic principles.
- The course will provide an updated knowledge about the different tools and applications of genomics and proteomics.

REFERENCES:

1. Brown TA, Genomes, 3rd Edition. Garland Science 2006
2. Campbell AM &Heyer LJ, Discovering Genomics, Proteomics and Bioinformatics, 2nd Edition. Benjamin Cummings 2007
3. Primrose S &Twyman R, Principles of Gene Manipulation and Genomics, 7th Ed, Blackwell, 2006.
4. Glick BR & Pasternak JJ, Molecular Biotechnology, 3rd Edition, ASM Press, 1998.

LTB6202 BIOPROCESS TECHNOLOGY & DOWNSTREAM PROCESSING

L	T	P	C
4	0	0	4

OBJECTIVES:

- To develop the skills in the area of bioprocess technology and downstream processing and understand different types of fermentors, the separation and isolation steps involved in downstream process and methods in product purification and formulation.

MODULE I BIOPROCESS TECHNOLOGY **9**

Design features of bioreactors / fermenters, Fundamentals of bioprocess technology, Principles underlying product formation, Principles underlying product recovery and purification, Large scale production of fermentation products, Fermentation kinetics: Reaction kinetics, Scale up of fermentation process, Downstream processing, Biosynthetic pathways for some secondary metabolites.

MODULE II MODELING AND DESIGN OF FERMENTATION PROCESSES **9**

Principles of model building for biotechnological processes, modeling of recombinant systems. biomass growth and product formation, Kinetics of substrate utilization, inhibition on cell growth and product formation. Design and operation of continuous cultures, chemostat in series, batch and fed batch cultures, total cell retention cultivation, Case studies on Production of green chemicals, algal biofuels, recombinant Insulin. Case studies should deal with medium design, reactor design & process optimization etc.

MODULE III DOWNSTREAM PROCESSING **9**

Introduction-downstream processing, biomolecules and bioprocesses, biomass removal and disruption technique- centrifugation, sedimentation, flocculation, ficrofiltration, sonication, Homogenizers, chemical lysis, enzymatic lysis , pretreatment and stabilisation of bioproducts.

MODULE IV SEPERATION AND ISOLATION **9**

Unit operations for solid-liquid separation - filtration and centrifugation. Membrane based purification: Ultrafiltration; Reverse osmosis; Dialysis; Diafiltration; Pervaporation; Perstraction Adsorption and chromatography: size,

charge, shape, hydrophobic interactions, Biological affinity; Process configurations (packed bed, expanded bed, simulated moving beds)

MODULE V PRODUCT PURIFICATION AND FORMULATION 9

Ammonium Sulfate-precipitation, solvent),Chromatography, principles, instruments and practice, adsorption, reverse phase, ionexchange, size exclusion, hydrophobic interaction, bioaffinity and pseudo affinity chromatographic techniques. Crystallization, drying and lyophilization in final in product formulation.

Total Hours : 45

OUTCOMES:

After the completion of the course

- The student will be able to learn about bioprocess techniques and downstream processing.
- The student will learn types of fermentors
- The student will be able to understand various techniques involved in the a product isolation, purification and formulation.

REFERENCES:

1. P.A. Belter, E.L. CusslerAnd Wei-Houhu – Bioseparations – Downstream Processing For Biotechnology, Wiley Interscience Pub. (1988).
2. R.O. Jenkins, (Ed.) – Product Recovery In Bioprocess Technology – Biotechnology By Open Learning Series, Butterworth-Heinemann (1992).
3. Shuler, M.L. and Kargi, F. Bioprocess Engineering : Basic concepts, 2nd ed., Prentice-Hall, 2002.
4. Doran Pauline M, Bioprocess Engineering Principles, Academic Press, 1995
5. Nielsen, J. and Villadsen, J. “Bioreaction Engineering Principles”. Springer, 2007.
6. Blanch, H.W and Clark D.S., “Biochemical Engineering”, Marcel Dekker, 1997.

LTB6203 GENETIC ENGINEERING L T P C

3 0 0 3

OBJECTIVES:

- To learn about genetic engineering, principles involved in manipulating genes and DNA.
- To know about cloning strategies and expression systems.
- To acquire basic understanding of techniques in genetic engineering.

MODULE I BASICS CONCEPTS 9

DNA Structure and properties; Restriction Enzymes; DNA ligase, Klenow enzyme, T4 DNA polymerase, Polynucleotide kinase, Alkaline phosphatase; Cohesive and blunt end ligation; Linkers; Adaptors; Homopolymeric tailing; Labeling of DNA: Nick translation, Random priming, Radioactive and non-radioactive probes, Hybridization techniques: Northern, Southern and Colony hybridization, Fluorescence in situ hybridization; Chromatin Immuno precipitation; DNA-Protein Interactions-Electromobility shift assay; DNaselfootprinting.

MODULE II CLONING VECTORS 9

Plasmids; Bacteriophages; M13 mp vectors; PUC19 and Bluescript vectors, Phagemids; Lambda vectors; Insertion and Replacement vectors; Cosmids; Artificial chromosome vectors (YACs; BACs); Animal Virus derived vectors-SV-40; vaccinia/bacculo& retroviral vectors; Expression vectors; pMal; GST; pET-can be omitted vectors; Protein purification; His-tag; GST-tag; MBP-tag etc.; Intein-based vectors; Inclusion bodies; Methodologies to reduce formation of inclusion bodies; Baculovirus and pichia vectors system, Plant based vectors, Ti and Ri as vectors, Yeast vectors, Shuttle vectors. Criteria for selection of vectors.

MODULE III CLONING METHODOLOGIES 9

Insertion of Foreign DNA into Host Cells; Transformation; Transfection, Transduction, Construction of libraries; Isolation of mRNA and total RNA; cDNA and genomic libraries; cDNA and genomic cloning; Expression cloning; Jumping and hopping libraries; South western and Far-western cloning;

Protein-protein interactive cloning and Yeast two hybrid system; Phage display; Principles in maximizing gene expression. Methods to confirm cloning and reporter genes and proteins.

MODULE IV PCR AND ITS APPLICATIONS 9

Primer design; Fidelity of thermostable enzymes; DNA polymerases; Types of PCR – multiplex, nested, reverse transcriptase, real time PCR, touchdown PCR, hot start PCR, colony PCR, cloning of PCR products; Tvectors; Proof reading enzymes; PCR in gene recombination; Deletion; addition; Overlap extension; and SOEing; Site specific mutagenesis; PCR in molecular diagnostics; Viral and bacterial detection; PCR based mutagenesis detection. Sequencing methods; Enzymatic DNA sequencing; Chemical sequencing of DNA; Automated DNA sequencing; RNA sequencing; Chemical Synthesis of oligonucleotides.

MODULE V APPLICATION OF GENETIC ENGINEERING 9

Gene silencing techniques; Introduction to siRNA; siRNA technology; Micro RNA; Construction of siRNA vectors; Principle and application of gene silencing; Gene knockouts and Gene Therapy; Creation of knock out mice; Disease model; Somatic and germ-line therapy- in vivo and ex-vivo; Suicide gene therapy; Gene replacement; Gene targeting; Transgenics; cDNA and intragenic arrays; Differential gene expression and protein array. Ethics in genetic engineering and global policy.

Total Hours : 45

TEXT/REFERENCES

1. S.B. Primrose, R.M. Twyman and R.W.Old; Principles of Gene Manipulation. 6th Edition, S.B.University Press, 2001.
2. J. Sambrook and D.W. Russel; Molecular Cloning: A Laboratory Manual, Vols 1-3, CSHL, 2001.
3. Brown TA, Genomes, 3rd ed. Garland Science 2006.
4. Selected papers from scientific journals.
5. Desmond S. T. Nicholl An Introduction to Genetic Engineering Cambridge University Press 2008.

5. Technical Literature from Stratagene, Promega, Novagen, New England Biolab etc.

OUTCOMES:

- On completion of the course the scholars will acquire knowledge on the concepts and terminology in genetic engineering.
- Students will be familiar with various cloning strategies in prokaryotes as well as in eukaryotes.
- Students will learn various techniques in genetic engineering.
- They will also get awareness about the social and ethical issues concerning cloning by genetic engineering

LSB6204 COMPUTATIONAL BIOLOGY L T P C

3 0 0 3

OBJECTIVES:

- To understand the programming languages applied in computational biology.
- To understand the methods and applications for sequence analysis, Phylogenetics and Protein modelling.

MODULE I INTRODUCTION TO PROGRAMMINB LANGUAGE 9

Introduction –Programming languages – Problem solving Technique: Algorithm, Flowchart, Compiling, Testing and Debugging - Basic Perl Data Types, File handle and File Tests – Perl Modules – SQL.

MODULE II PROGRAMMING IN C, C++ AND OOPS 9

C language Introduction – Tokens – Keywords, Identifier, Variables, Constants, Operators – Structure of a 'C' program - Expression – Data types – Control Statement - C++programming – Object Oriented Concept: Encapsulation, Inheritance, Polymorphism.

MODULE III COMPUTATIONAL BIOLOGY AND SEQUENCE ANALYSIS 9

Molecular sequences, Genome sequencing: pipeline and data, Next generation sequencing data, Biological databases: Protein and Nucleotide databases, Sequence Alignment, Dynamic Programming for computing edit distance and string similarity, Local and Global Alignment, Needleman Wunsch Algorithm, Smith Waterman Algorithm, BLAST family of programs, FASTA algorithm, Functional Annotation, Progressive and Iterative Methods for Multiple sequence alignment, Applications.

MODULE IV PHYLOGENETICS 9

Introduction to Phylogenetics, Distance and Character based methods for phylogenetic tree construction: UPGMA, Neighbour joining, Ultrametric and Min ultrametric trees, Parsimonous trees, Additive trees, Bootstrapping.

MODULE V PROTEIN STRUCTURE, MODELLING AND SIMULATIONS 9

Protein Structure Basics, Visualization, Prediction of Secondary Structure and Tertiary Structure, Homology Modeling, Structural Genomics, Molecular Docking principles and applications, Molecular dynamics simulations.

Total Hours : 45

REFERENCES:

1. Dan Gusfield. Algorithms on Strings Trees and Sequences, Cambridge University Press.
2. David W. Mount Bioinformatics: Sequence and Genome Analysis, Cold Spring Harbor Laboratory Press, Second Edition, 2004.
3. Arthur M. Lesk, Introduction to Bioinformatics by Oxford University Press, 2008.
4. Tisdall, James, Beginning PERL for Bioinformatics, O'Reilley Publications, 2001.
5. Andrew R. Leach, Molecular Modeling Principles and Applications, Second Edition, Prentice Hall.
6. Baldi, P., Brunak, S. Bioinformatics: The Machine Learning Approach, 2nd ed., East West Press, 2003
7. Baxevanis A.D. and Oullette, B.F.F. A Practical Guide to the Analysis of Genes and Proteins, 2nd ed., John Wiley, 2002

OUTCOMES:

- At the end of this course, students will have been familiarized with language skills and their applications in analyzing Protein structure , sequence analysis which can be used in analyzing the binding effect of drugs on proteins.

LTB6204 ENVIRONMENTAL BIOTECHNOLOGY L T P C

3 0 0 3

OBJECTIVES:

- To learn the environment protection Act and Law related to environmental biotechnology
- To give basic idea on environmental sample analysis
- To understand the basic principles involved in waste water management
- To get the information on usage of Bioremediation-biotechnology
- To inform students about Biooxidation& microbial leaching

MODULE I INTRODUCTION TO ENVIRONMENTAL BIOTECHNOLOGY 9

Water, Soil and Air: their sources and effects. Removal of Specific Pollutants: Sources of Heavy Metal Pollution, Microbial Systems for Heavy Metal Accumulation, Biosorption& detoxification mechanisms. Environment protection Act: Environmental laws, Environmental policies, Environmental ethics. UN declaration.Environmental protection and conservation. Environmental Impact Assessment, Ecoplanning and Sustainable Development.

MODULE II ENVIRONMENTAL SAMPLE ANALYSIS 9

Physicochemical and bacteriological analysis of soil and water, Problems associated with soil alkali soils, sodic soils, and solid waste, Fate of insecticides fungicides, pesticides in soil, use of genetically modified (insect- , pest- and pathogen resistant) plants. Ecotoxicology of soil pollutants, Municipal solid waste treatment strategies.

MODULE III WASTE WATER MANAGEMENT 9

Waste water constituents, Analysis and selection of flow rates and loadings, Process Selection, Physical unit operations, Chemical unit operations, Fundamentals of biological treatment, Role of biotechnology in water purification systems. Types and kinetics of biological treatment, Advanced waste water treatment, Biological Processes for Industrial and domestic effluent, Treatment, Aerobic Biological Treatment,Anaerobic Biological Treatment.

MODULE IV BIOREMEDIATION-BIOTECHNOLOGY 9

Bioremediation-Biotechnology for clean environment, Biomaterials as substitutes for non-degradable materials, Metal microbe interactions: Heavy Metal Pollution and impact on environment, Microbial Systems for Heavy Metal Accumulation, Biosorption, molecular mechanisms of heavy metal tolerance Bioindicators and biosensors for detection of pollution. Biotechnology for Hazardous Waste Management, Persistent organic pollutants, Xenobiotics, Biological Detoxification of PAH, Biotechniques for Air Pollution Control. Solid Waste Management.

MODULE V BIOOXIDATION & MICROBIAL LEACHING 9

Biooxidation – Direct and Indirect Mechanisms – Biooxidation Kinetics; Bacterial oxidation of Sphalerite, Chalcopyrite and Pyrite.; Extraction of metals from ores; Recovery of metals from solutions; Microbes in petroleum extraction; Microbial desulfurization of coal.

Total Hours : 45

REFERENCES:

1. Amann, R.I. Stromley, J. Stahl : Applied & Environmental Microbiology.
2. Environmental Microbiology, W.D. Grant & P.E. Long, Blakie, Glassgow and London.
3. Microbial Gene Technology, H. Polasa (ED.) South Asian Publishers, New Delhi.
4. Biotreatment Systems, Vol. 22, D. L. Wise (Ed.), CRC Press, INC.
5. Standard Methods for the Examination of Water and Waste Water (14th Education), 1985. American Public health Association

OUTCOMES:

On successful completion of this module, learners will be able to have:

- An understanding of environment protection regulations and source of environmental pollutions.
- The capability to apply advanced knowledge on environmental sample analysis
- The capability to apply avalanched discipline in waste water management
- The ability to formulate technique for bioremediation process
- An understanding of how biooxidation& microbial leaching helping in the industries.

LSB6205	COMPUTATIONAL BIOLOGY LAB	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To get hands on experience on plasmid construction, mappings and analysis.
- To explore to various tools in bioinformatics.

EXPERIMENTS **30**

1. Plasmid Construction
2. Restriction Mapping
3. PCR Primer Designing
4. Sequence Retrieval and Format Conversion
5. ORF Finding
6. Homology Search
7. Multiple Sequence Alignment
8. Gene Prediction in prokaryotes
9. Motif finding in DNA and Protein Sequences
10. Structure Visualization
11. Phylogenetic Analysis
12. Protein Secondary Structure Prediction

REFERENCES

1. Rashidi H, Buehler L. K. Bioinformatics Basics: Applications in Biological Science and Medicine. 2nd Ed., CRC Press, 2005.
2. Baxevanis A. D, Ouellette B. F. F. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins. 3nd edition Wiley, John & Sons, Incorporated, 2004.
3. Krawetz S. A, Womble D. D. Introduction to Bioinformatics: A Theoretical and Practical Approach. Humana press, 2003.

OUTCOMES:

- Students will be familiar with various soft skills/tool used in understating modern biology. They will also be able to analyze and interpolate data starting from PCR primer designing to structure predictions.

LSB6206	GENETIC ENGINEERING LABORATORY	L	T	P	C
		0	0	3	3

OBJECTIVES:

- To practice the earned theoretical knowledge in genetic engineering techniques
- To get acquainted with DNA/gene products know about cloning strategies and expression systems.
- To get familiarize with the sequential processes in genetic engineering.

LIST OF EXPERIMENTS:

1. Isolation of desired DNA/gene by PCR or restriction enzymes
2. Gel elution and purification of inserts
3. Ligation
4. Transformation
5. Verification of cloning by PCR or reporter gene or by patching the positive colonies
6. Plasmid isolation from PCR positive colonies
7. Confirmation of cloning by restriction digestion
8. Set up DNA sequencing reaction
9. Cleaning the sequencing reaction product
10. Automated DNA sequencing
11. Sequence Editing
12. Sequence analysis by BLAST

REFERENCES:

Laboratory Manual

OUTCOMES:

- Students will be familiar with various techniques globally used in engineering DNA and gene.
- Students will also be able to analyze the successfully cloned products.
- Students will be able to independently plan and execute the cloning of desired gene.

SEMESTER III

LTB7101	**PHARMACOGENOMICS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

- Learn the basic principles of genetic variation in treatment response.
- Learn the molecular and cellular biology to explain the genetic basis of variability in drug response.
- Understand the concept of pharmacogenomics in different therapeutic areas.
- To identify important sources and reliable databases with pharmacogenomics knowledge base.

MODULE I GENOMIC APPROACHES TO BIOLOGY 9

Principles of Human Genomics, Organization, human Population Genomics, Application of Population Genomics to Genomic Medicine, Genomic Approaches to Complex Disease, Identifying Common and Rare Genomic Variations in the Population, Relating DNA Variation to Phenotypes, Human Health and Disease: Introduction to basic concept of pharmacogenomics. Importance, clinical application and challenges in Pharmacogenomics. Basic principles and paradigms of molecular biology (DNA?RNA?Protein) information on gene promoters, miRNA, identification of targets, splicing/ alternate splicing. Introduction to genetic variation, types of variants, SNPs, coding and cis/trans regulatory variants, insertion/deletions, copy number variants SNPs, allele nomenclature, databases, National pharmacogenetics resources/efforts (PGRN).

MODULE II EPIGENETICS AND THE ENVIRONMENT 9

DNA Methylation Patterns Chromatin Modification DNA Methylation and Chromatin StatesCo-operatively Determine the State of Activityof Genes, Epigenetics and Human Disease, Systems Biology and the Emergence of Systems Medicine, Multi -parameter Blood-bourne Biomarkers, Emerging in vivo and in vitro Technologies,Technology Platforms for GenomicMedicine, DNA Sequencing for the Detection of Human Genome Variation and Polymorphism, DNA Sequencing, Other Methodologies for Polymorphism

Detection, Genome-Wide Association Studies and Genotyping, Copy Number Variation and Human Health, Detecting CNVs in a Genome-wide Manner, Association of CNVs to Disease and Disease Susceptibility, Implications of CNVs.

MODULE III PROTEOMICS: THE DECIPHERING OF THE FUNCTIONAL GENOME 9

Gel-based and Solution-based Proteomics, Mass Spectrometry, Bioinformatics, Impact of Proteomics on Understanding Diseases, Comprehensive Metabolic Analysis for Understanding of Disease Mechanisms Comparison of NMR and MS Technologies for Unbiased Metabolic Profiling, MS Methods for Targeted Metabolic Profiling, Examples of NMR-based Metabolic Profiling in, Disease Research, Examples of Targeted MS-based Metabolic Profiling for Understanding of Disease Mechanisms, Comprehensive Analysis of Gene Function: RNAinterference and Chemical Genomics Chemical Genomics Gene Function Studies.

MODULE IV INFLUENCE OF PHARMACOGENOMICS BASED DRUG INTERACTIONS 9

Introduction to proteins of importance in drug pharmacokinetics. Understanding the role of proteins involved in phase I drug metabolism in pharmacogenomics, Proteins Involved in Pharmacogenetics, Pharmacogenetics of Phase I drug metabolizing enzymes, CYP2C9 Pharmacogenetic, CYP2D6 Pharmacogenomics, CYP2D19 Pharmacogenetics, PhaseII Drug Metabolizing Enzymes, The role of proteins involved in phase I drug metabolism in pharmacogenomics, drug transporter pharmacogenetics, how genetic variation in drug transporters contribute to inter-individual differences in drug PK and PD.

MODULE V PHARMACOGENOMICS IN THERAPEUTIC AREAS 9

Role of Pharmacogenomics in Drug Development, Pharmacokinetic profiles for metabolic CYP2D6 metabolizers (Metoprolol as Example Compound), Pharmacodynamic response profiles for metabolic CYP2D6 metabolizers (Metoprolol as Example Compound) Combined consideration and Clinical interpretation of significance of CYP2D6 metabolizer status for metoprolol, Cardiovascular Example of pharmacogenomic based drug drug interaction differential for statin based therapy, Other Cardiovascular based examples

of the significance of pharmocogenomics, Pharmacogenomics of Tamoxifin Epidermal Growth Factor Receptors and KRAS,Irinotecan and UGT1A1 Capecitabine and 5-FU in solid tumors, pharmacogenomics and adverse drug reaction, Carbamazepine and Abacavir induced ADRs

Total Hours : 45

REFERENCE:

1. McLeod, et. al (eds.) (2009). Pharmacogenomics: Applications to Patient Care, 2nd Ed. American Association of Colleges of Pharmacy

OUTCOMES:

- After the completition of the course the student will be able
- Understand and use pharmacogenomic concepts to a particular drug therapy.
- Recognize ethical implication of genetic testing and the resultant individualization of drug therapy.
- Understand how variability in genes encoding drug metabolizing enzymes, drug transporting proteins, and drug receptors (targets) may result in drug disposition leading to changes in pharmacokinetics, pharmacodynamics, and clinical outcome.

LSB7102 PLANT AND MEDICAL BIOTECHNOLOGY L T P C

3 0 0 3

OBJECTIVES:

- to learn about embryogenesis and other type of hybridization techniques.
- to know about genetic transformation and techniques about gene delivery.
- to have an idea about gene mapping and cloning and different type of biotic and abiotic stress.
- to know about protein engineering and different type of bioinformatics analysis.

MODULE I PLANT TISSUE CULTURE 9

Totipotency, organogenesis, somatic embryogenesis, artificial seed production, Micropropagation, somaclonal variation, Germplasm conservation and cryopreservation.Protoplast Culture and Somatic Hybridization Protoplast isolation- its culture and usage, Somatic hybridization and its applications.

MODULE II AGROBIOLOGY 9

Agrobacterium-plant interaction; Virulence; Ti and Ri plasmids; Opines and their significance; T-DNA transfer, Genetic Transformation Agrobacterium-mediated gene delivery, Direct gene transfer - PEG-mediated, electroporation, particle bombardment and alternative methods; Screenable and selectable markers, Characterization of transgenics, Gene targeting.

MODULE III MOLECULAR MAPPING & MARKER ASSISTED SELECTION (MAS) 9

Marker assisted selection for genes of agronomic importance, e.g. insect resistance, grain quality and grain yield, Molecular polymorphism, RFLP, RAPD, STS, AFLP, SNP markers; Construction of genetic and physical map, Gene mapping and cloning, strategies for Introducing Biotic and Abiotic Stress Resistance/Tolerance Bacterial resistance; Viral resistance; Fungal resistance; Insects and pathogens resistance; Herbicide resistance; Drought, salinity, thermal stress, flooding and submergence tolerance.

MODULE IV MOLECULAR THERAPEUTICS **9**

Basic concept of stem cell therapy, neutraceuticals, nanotechnology and clinical trials, revolution in diagnosis, changing approaches of therapy, FDA Organization chart and regulatory measures for drug discovery. Drug discovery - Overview, rational drug design, combinatorial chemistry in drug development, computer assisted drug design, role of bioinformatics in genome based therapy, antisense DNA technology for drug designing. Stem cells in therapy.

MODULE V VACCINES **9**

Biotechnological approaches to obtain blood products: Tissue plasminogen activator and erythropoietin, Vaccine technology: Subunit vaccines, drawbacks of existing vaccines, criteria for successful vaccine, peptide vaccine, minicells as vaccines, impact of genetic engineering on vaccine production, viral vector vaccines and AIDS vaccine chiral technology.

Total Hours : 45

REFERENCES:

1. Adrian Slater, Nigel Scott and Mark Fowler, Plant Biotechnology: The genetic manipulation of plants, 1st Edition, Oxford University Press, 2003.
2. Edited by BR Jordan, 2nd Edition, The Molecular Biology and Biotechnology of Flowering, CABI, 2006.
3. Neil Wille, Phytoremediation: Methods and Reviews, 1st Edition, Humana Press, 2007.
4. Denis Murphy, Plant Breeding and Biotechnology: Societal Context and the Future of Agriculture, Cambridge University Press, 2007.

OUTCOMES:

On the completion of course student will be able to understand

- different hybridization techniques and basics of embrogenesis.
- they will be able to learn about different gene delivery techniques.
- they will learn about genomics, protein engineering and other bioinformatics tools.

ELECTIVES-I

LSBY021	BIO-ENTREPRENEURSHIP	L	T	P	C
		3	0	0	3

OBJECTIVES:

The objective of the course is to

- To understand concepts and process involved with bio-entrepreneurship
- To make the students aware of the importance of entrepreneurship opportunities available in the society for the entrepreneur.
- Acquaint them with the challenges faced by the entrepreneur

MODULE I ACCOUNTING AND FINANCE 9

Taking decision on starting a venture; Assessment of feasibility of a given venture/new venture; Approach a bank for a loan; Sources of financial assistance; Making a business proposal/Plan for seeking loans from financial institution and Banks; Funds from bank for capital expenditure and for working; Statutory and legal requirements for starting a company/venture; Budget planning and cash flow management; Basics in accounting practices: concepts of balance sheet, P&L account, and double entry bookkeeping; Estimation of income, expenditure, profit, income tax etc.

MODULE II MARKETING 9

Assessment of market demand for potential product(s) of interest; Market conditions, segments; Prediction of market changes; Identifying needs of customers including gaps in the market, packaging the product; Market linkages, branding issues; Developing distribution channels; Pricing/Policies/ Competition; Promotion/ Advertising; Services Marketing.

MODULE III NEGOTIATIONS/STRATEGY 9

With financiers, bankers etc.; with government/law enforcement authorities; with companies/ Institutions for technology transfer; Dispute resolution skills; External environment/changes; Crisis/ Avoiding/Managing; Broader vision– Global thinking

MODULE IV INFORMATION TECHNOLOGY &HUMAN RESOURCE DEVELOPMENT 9

How to use IT for business administration; Use of IT in improving business performance; Available software for better financial management; E-business setup, management. Human Resource Development (HRD)- Leadership skills; Managerial skills; Organization structure, pros & cons of different structures; Team building, teamwork; Appraisal; Rewards in small scale set up.

MODULE V ROLE OF KNOWLEDGE CENTRE AND R&D 9

Support mechanism for entrepreneurship in India; Knowledge centres like universities and research institutions; Role of technology and upgradation; Assessment of scale of development of Technology; Managing Technology Transfer; Regulations for transfer of foreign technologies; Technology transfer agencies.

Total Hours : 45

REFERENCES:

1. Roy Rajeev, Entrepreneurship Oxford Latest Edition.
2. E. Gordon & K. Natarajan Entrepreneurship Development Himalaya 2008.
3. Coulter Entrepreneurship in Action PHI 2nd Edition.
4. P. C. Jain Handbook For New Entrepreneur .Oxford Latest Edition.
5. S. S. Khanka Entrepreneurial Development S. Chand, Latest Edition.
6. Thomas W. Zimmerer& Norman M. Scarborough Essentials of Entrepreneurship and small business management, PHI 4th Edition.
7. Dr.VidyaHattangadi Entrepreneurship, Himalaya 2007.
8. Vasant Desai Small Scale Industries and Entrepreneurship, Himalaya 2008.
9. Dr. V. B. Angadi, Dr. H. S. Cheema & Dr. M. R. Das Entrepreneurship, Growth, and Economic Integration A linkage, Himalaya 2009.

OUTCOMES:

On successful completion of this module, learners will be able to have:

- An understanding of accounting and finance related to bio-entrepreneurship.
- The capability to apply advanced assessment strategies on marketing of product.
- The capability to apply knowledge on negotiations strategy related to bio-entrepreneurship.
- The ability to apply and handle information technology & human resource development.
- Addressing the problems associated with role of knowledge centre and R&D.

LSBY022 INTELLECTUAL PROPERTY RIGHTS & PATENT LAW L T P C

3 0 0 3

OBJECTIVES:

- To learn about the Intellectual Property Rights
- To understand about criteria in applying and maintaining patents.
- To be familiarized with the law and enforcement in Intellectual Property Rights

MODULE I INTRODUCTION TO IPR 9

General regime of intellectual property rights and law.Theories of Intellectual Property Rights, Kinds of Intellectual Property.Intellectual Property as an Instrument of Development, Economic importance of Intellectual Property.Need for Protecting Intellectual Property.National and international perspectives.

MODULE II TRADE MARK 9

Introduction to Trade mark, Trade mark registration and maintenance Process, Transfer of Rights, Inter parties Proceeding, Infringement, Dilution Ownership of Trade mark, Likelihood of confusion, Trademarks claims, Trademarks Litigations and International Trade mark Law. Trade Secret, Employee Limitation, Unfair Competition and Trade Secret Litigations.

MODULE III COPYRIGHTS 9

Introduction to Copyrights, Principles of Copyright, Copyright Law, Copy right Ownership, Transfer and duration, Right to prepare Derivative works, Rights of Distribution, Rights of Perform the work Publicity Copyright Formalities and Registrations, Limitions, Copyright disputes and International Copyright Law.

MODULE IV GEOGRAPHICAL INDICATIONS 9

Registration, Duration of Protection and Renewal; Infringement, Penalties and Remedies. Layout designs of Integrated Circuits- Semiconductor Integrated Circuits Layout-Design Act, 2000, Registration and Effect of Registration, Assignment and Transmission. Protection of Plant Varieties and Farmers' Rights - Authority and Registry, Duration, Effect of Registration and

Benefit Sharing, Farmers' Rights, Plant Varieties Protection Appellate Tribunal, Infringement, Offences and Penalties.

MODULE V IPR LEGISTLATION AND PATENTING 9

World Intellectual property organization WIPO – establishment, role, membership, etc., Indian IPR legislation, Indian patent act, national intellectual property policy. Rationale for Intellectual Property Protection in Biotechnology, Patenting Biotechnology Inventions-Objective, Concept of Novelty, Concept of inventive step, Microorganisms, Moral Issues in Patenting Biotechnological inventions. Protection of Plant Varieties.Protection of Traditional Knowledge. Case studies on Basmati rice, turmeric, neem and also current cases.

Total Hours : 45

REFERENCES:

1. Debirag E. B. Intellectual Property. Cengage learning, New Delhi.
2. Prabhuddha G. Intellectual Property Rights. Tata Mc-Graw–Hill, New Delhi.
3. Gopalakrishnan N. S. and Agitha, T. G. Principles of Intellectual Property, Eastern Book Company, Lucknow 2009.
4. Subbaram N. R. Handbook of Indian patent law and practice, S. Viswanathan printers and publishers Pvt Ltd, 1998.

OUTCOMES:

- On the completion of the above objectives student will be able to know about IPR and also the importance of protecting their innovation. They will be familiar with international and national law practiced and also recent issues on it.

LSBY023	BIOSAFETY AND BIOETHICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Developing a good work ethics and laboratory working condition.
- Understanding the importance of following and maintaining laboratory safety guidelines.

MODULE I ETHICS IN BIOLOGY **9**

Principles and purpose of studying bioethics, legal, moral and ethical issues in biological research, human rights, privacy and justice, IPR and technology transfer.

MODULE II BIOSAFETY **9**

Biosafety in laboratory practices, laboratory associated infections and other hazards, assessment of biological hazards and levels of biosafety, biosafety regulations in handling of recombinant DNA processes and products.

MODULE III GENETICALLY MODIFIED CROPS AND FOOD **9**

Genetically modified food and biosafety assessment procedures for GM foods and related consumables, including transgenic food crops, ecological safety assessment of recombinant organisms and transgenic crops, case studies of relevance (e.g. BT cotton).

MODULE IV ETHICAL ISSUES IN LABORATORY RESEARCH **9**

Ethical issues and guidelines for research with laboratory animals, current uses of laboratory animals in biomedical research, animal experimentation using hazardous chemicals, animal care and maintenance, CPSEA guidelines for laboratory animals.

MODULE V ETHICAL ISSUES IN CLINICAL RESEARCH **9**

Ethical issues and guidelines for research with clinical samples and humans studies, Role of Institutional Human ethical board, ICMR's ethical guidelines and clinical trials registration in India and challenges in clinical trials.

Total Hours : 45

REFERENCES:

1. Thomas, J.A., Fuch, R.L. Biotechnology and Safety Assessment (3rd Ed). Academic Press, 2002

2. Fleming, D.A., Hunt, D.L. Biological safety Principles and practices (3rd Ed). ASM Press, Washington, 2000.

3. H.-J. Rehm and G. Reed, Biotechnology - A comprehensive treatise (Vol. 12). Legal economic and ethical dimensions VCH.

OUTCOMES:

- At the end of the course student will develop an idea about the importance of good laboratory practice in high quality research. They will also develop an awareness about the basic fundamental safety measures that a researcher should follow in laboratory.

LSBY028 BIONANOTECHNOLOGY L T P C

3 0 0 3

OBJECTIVES:

- To provide an introduction to nanobiotechnology.
- To make the students understand about the functional principles of nanobiotechnology

MODULE I FUNDAMENTALS OF NANOSCIENCE 9

Introduction, the nanoscale dimension and paradigm, definitions and historical evolution (colloids etc.) and current practice, types of nanomaterials and their classifications (1D, 2D and 3D etc. nanocrystal, Nanoparticle, Quantum dot, Quantum Wire and Quantum Well etc), Polymer, Carbon, Inorganic, Organic and Biomaterials –Structures and characteristics.

MODULE II CHARACTERIZATIONS IN BIONANOTECHNOLOGY 9

Optical (UV-Vis/Fluorescence), X-ray diffraction, Imaging and size (Electron microscopy, light scattering, Zeta potential), Surface and composition (ECSA, EDAX, AFM/STM etc), Vibration (FT-IR and RAMAN), SERS -3, Magnetic, Electrical and Electrochemical.

MODULE III APPLICATIONS OF BIONANOTECHNOLOGY 9

Materials in Biosystems: Proteins - Lipids - RNA and DNA, Protein Targeting – Small Molecule/Nanomaterial - Protein Interactions Nanomaterial-Cell interactions-Manifestations of Surface Modification (Polyvalency), Drugs-Photodynamic therapy, molecular motors, neuroelecronic interphases, development of nanoluminiscent tags.

MODULE IV NANOMATERIALS AND DIAGNOSTICS 9

Drug Delivery and Therapeutics, MRI, Imaging, Surface Modified Nanoparticles, MEMS/NEMS, based on Nanomaterials, Peptide/DNA Coupled Nanoparticles, Lipid Nanoparticles For Drug Delivery, Inorganic Nanoparticles For Drug Delivery, Metal/Metal Oxide Nanoparticles (antibacterial/anti fungal/ anti viral), Anisotropic and Magnetic Particles (Hyperthermia).

MODULE V NANOMATERIALS AND TOXICITY EVALUATION 9

Designer biopolymers, Procollagen, DNA Polynode, RNA topoisomerase, Protein –magnetic materials, Cyto-toxicity, Geno-toxicity, In vivo tests/assays.

Total Hours : 45

REFERENCES:

1. C.M. Niemeyer, C.A. Mirkin, Nanobiotechnology: Concepts, Applications and Perspective, Wiley – VCH, 2004.
2. 2 T. Pradeep, Nano: The Essentials, McGraw – Hill education, 2007.
3. Nicholas A. Kotov, Nanoparticle Assemblies and Superstructures, CRC, 2006.
4. David S Goodsell, “Bionanotechnology”, John Wiley & Sons, 2004.

OUTCOMES:

- After the completion of the course the student will have the basic knowledge of nanotechnology in biotechnology. In detail understanding of the application of Nanomaterials in biotechnology and acquire the knowledge about the DNA, proteins, amino acids, drug delivery, biomedicine etc.

ELECTIVES II

LSBY024	MOLECULAR DIAGNOSTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Developing the basic concept of molecular diagnostics
- Understanding the common procedures and which are used in disease diagnosis.
- To be familiar with various types of diseases diagnosis methods and progression of diagnosed disease.

MODULE I INTRODUCTION TO MOLECULAR DIAGNOSTICS 9

Collection, preservation and storage of clinical samples, biopsy, Principles, application and limitations of Biological assays used in diagnosis- PCR, ELISA, FISH, gene sequencing, microarrays, protein arrays. GLP, SOP and ethics in molecular diagnostics.

MODULE II INFECTIONS 9

Infection and mode of transmission, types of infectious diseases- bacterial and fungal infections, diagnosis of infections caused by Streptococcus, Coliforms, Salmonella, Shigella, Vibrio, and Mycobacterium- diagnosis of fungal infections, major fungal diseases, Dermetophytoses, Candidiosis and Aspergillosis. Diagnosis of DNA and RNA viruses- pox virus, rhabdo virus, hepatitis; virus diagnosis of protozoan diseases- amoebiosis, malaria, trypanosomiosis, leishmaniasis- study of helminthic diseases- Fasciola hepatica and Ascarislumbricoides. Filariasis and Schistosomiasis.Diagnosis of chicken guinea and swine flu.

MODULE III CLINICAL GENETICS 9

Chromosomes chemistry and packaging, Cytogenetic, Structural and numerical abnormalities of chromosomes, Chromosome bands, banding techniques , mutation and polymorphism analysis, human genome project, cancer genetics- oncogenes, tumor suppressor genes- gene therapy, genetic counseling, nucleic acid hybridization techniques, Disease linked with mitochondrial DNA Genetic linkage and chromosome and genetic mapping in human diseases, Prenatal.

MODULE IV IMMUNODIAGNOSTICS **9**

Introduction to immunodiagnostics, antigen-antibody reactions, antibody production, antibody markers, CD markers, FACS, Human Leukocyte Antigen (HLA) typing, agglutination (ABO/Bacterial), immunoprecipitation, immunodiffusion, flocytometer.

MODULE V FORENSIC SCIENCE **9**

Introduction to Forensic Science, DNA fingerprinting / DNA Profiling / DNA Testing in Forensic Science; Ethics, Rules and Procedures in DNA analysis. Autopsy and toxicological diagnosis.Determination of Paternity- Human identification and sex determination.semen analysis, Case study.

Total Hours : 45

REFERENCES:

1. Tietz Textbook of Clinical Chemistry, Carl A. Burtis, Edward R. Ashwood,
2. Harcourt Brace & Company AisaPvt. Ltd.
3. Essentials of Diagnostic Microbiology, Lisa Anne Shimeld
4. The Science of Laboratory Diagnosis, Crocker Burnett

OUTCOMES:

- Learners will be able to define basic terminology and describes basic concepts in molecular diagnostics
- The students will know the importance and the relevance of molecular diagnostic techniques and applications of molecular diagnostics in various field including medical, forescenic, etc..

LSBY025 FOOD PROCESS TECHNOLOGY L T P C

3 0 0 3

OBJECTIVES:

- To explore about food process and technology.
- To get overview of processing of various types of food
- To expose themselves to storage and handling of food and food products.

MODULE I STORAGEA & HANDLING OF CEREALS 9

Infestation control; Drying of grains, Processing of rice and rice products.Milling of wheat and production of wheat products, including flour and semolina.Milling of corn, barley, oat, coarse grains including sorghum, ragi and millets; Processing of tea, coffee and cocoa.

MODULE II FRESH FRUITS AND VEGETABLES 9

Preservation of fruits and vegetable by heat treatment.Production and preservation of fruits and vegetable juices, preservation of fruit juice by hurdle technology.Non-alcoholic beverages; Food Laws, food rules and standards, Statistical Quality Control; Various types of packaging.

MODULE III SEA FOOD 9

Commercial handling, storage and transport of raw fish; Average composition of fish; Freshness criteria and quality assessment of fish; Spoilage of Fish; Methods of Preservation of fish: Canning, Freezing, Drying, Salting, Smoking and Curing. Quality control of processed fish; Fish processing industries in India.

MODULE IV ANIMAL PRODUCT 9

Slaughtering technique of animal; Meat cuts and portions of meat, muscle; Color of meat; Post mortem changes of meat; Meat processing - curing and smoking; fermented meat products (meat sausages & sauces); Frozen meat & meat storage. Classification of poultry meat; Composition and nutritional value of poultry meat &eggs ; Processing of poultry meat and eggs; Spoilage and control; Byproduct utilization and future prospects; Poultry farms in India.

MODULE V DIARY PRODUCT **9**

Composition of milk; Varieties of milk; Checks for purity of milk; Handling of fresh milk.Pasteurization of milk; HTST and UHT techniques; Packaging of milk; Fermentation of milk and fermented milk products. Manufacture of milk products like evaporated milk, powder milk, condensed milk, cream butter, cheese, yogurt, ice cream, ghee, baby food and sweet meat. Quality control of milk and milk products; Milk plant hygiene and sanitation.

Total Hours : 45

REFERENCES

1. Principles of Food Science, Vol-I by FennmaKarrel
2. Modern Dairy Products, Lampert LH; 1970, Chemical Publishing Company.
3. Developments in Dairy Chemistry – Vol 1 & 2;
4. Processed Meats; Pearson AM & Gillett TA; 1996, CBS Publishers.
5. Meat; Cole DJA & Lawrie RA; 1975, AVI Pub.
6. Post Harvest Technology of cereal pulse and oil seeds by Chakraborty, AC
7. Egg and poultry meat processing; Stadelman WJ, Olson VM, Shemwell GA & Pasch S; 1988, Elliswood Ltd.
8. Preservation of Fruits & Vegetables by Girdhari Lal, Sidhapa and Tandon
9. Developments in Meat Science – I & II, Lawrie R; Applied Science Pub. Ltd.
10. Egg Science & Technology; Stadelman WJ &Cotterill OJ; 1973, AVI Pub.
11. Technology of Food Preservation by Desrosier Fish as Food; Vol 1 & 2; Bremner HA; 2002, CRC Press.
12. Fish & Fisheries of India; Jhingram VG; 1983, Hindustan Pub Corp.
13. Robinson RK; 1996; Modern Dairy Technology, Vol 1 & 2; Elsevier Applied Science Pub.
14. Milk & Milk Processing; Herrington BL; 1948, McGraw-Hill Book Company.
15. Fox PF; Applied Science Pub Ltd. Outlines of Dairy Chemistry, De S; Oxford.

OUTCOMES:

- On the completion of the above objectives student will have a sound knowledge on the various techniques involved in food processing, storage and handling of food and food products.

LSBY026 ANIMAL BIOTECHNOLOGY L T P C

3 0 0 3

OBJECTIVES:

The student will learn about

- The basic idea about animal cell culture, drug toxicity and its application.
- Vaccines production and other technology related to antibody production.
- The basic concept of cloning and several issues related with that.
- Genomics and the role of DNA forensics.

MODULE I ANIMAL CELL CULTURE 9

Morphology and ultra-structure of animal cell, requirements for animal cell culture, media and reagents, Primary culture, secondary culture, maintaining cell line, Suspension cultures, Somatic cell cloning and hybridization, transfection and transformation, Stem cells and their application, Animal cell culture application for in vitro testing of drugs, toxicity of environmental pollutants in cell culture.

MODULE II ANIMAL HEALTH BIOTECHNOLOGY 9

Introduction to immune system, History of vaccines development, concept of vaccines, vaccine production, conventional methods and recombinant approaches, technology for antibody production, Phage display technology, radio immunoassays and enzyme immunoassays, Immunoblotting, Nucleic acid based diagnostic methods including nucleic acid probe hybridization.

MODULE III ANIMAL REPRODUCTIVE BIOTECHNOLOGY 9

Culture of embryos, Cryopreservation of embryos, Embryo transfer, Micromanipulation of animal embryos, Artificial insemination, in vitro fertilization, Transgenic animal technology and its different applications, Animal cloning- basic concepts, Cloning from embryonic cells and adult cells; Cloning of farm animals; Cloning for conservation of endangered species, Ethical, social and moral issues related to cloning, Human Cloning.

MODULE IV ANIMAL GENOMICS **9**

Introduction to animal genomics; Different methods for characterization of animal genomes, SNP, STR, QTLS, RFLP, RAPD, proteomics, metobolomics, different breeds of cattle, buffalo, sheep, goats, pigs, camels, horses, canines and poultry, characterization of livestock breeds; Marker assisted breeding of livestock and poultry, Genetic basis for disease resistance; Gene knock out technology and animal models for human genetic disorders.

MODULE V DNA FORENSICS **9**

Nucleic acid based methods for identification of animal species, Detection of food/feed adulteration with animal protein, adulteration detection in meat using DNA based methods, Identification of wild animal species using DNA based methods using different parts including bones, hair, blood, skin and other parts confiscated by anti-poaching agencies; Human forensics; Microbial forensics; Bioterror agents; Biocrimes and Bioterrorism.

Total Hours : 45

REFERENCES:

1. Animal Cell Culture - Practical Approach, 3rd Edition, Oxford University, Ed. John R.W. Masters, Press, 2000.
2. Ed. Martin, Clynes Animal Cell Culture Techniques, Springer, 1998.
3. Animal Cell Biotechnology. Portner, 2nd Edition, Humana Press, 2007.
4. A. Puller (ed), Genetic engineering in Animals, VCH Publishers.
5. Gordon, Reproductive Technologies in Farm Animals, CAB Intl., 2005.
6. Pinkert, Transgenic animal technology, Academic Press, 2006.

OUTCOMES:

On the completion of the above course student will learn about

- basic of animal cell culture and the production of antibodies.
- how vaccines is being produced and its importance in several aspects
- the social and moral issues related to cloning.
- the importance of studying Forensic science.

LSBY029 INDUSTRIAL BIOTECHNOLOGY L T P C

3 0 0 3

OBJECTIVES:

- To obtain knowledge on wide-ranging topics related to applications of biotechnology in industries.
- To learn about bioprocess technology and its applications
- To get familiar with enzymes and microbes used for industrial purposes.

MODULE I FERMENTATION & PROCESSING 7

Introduction to fermentation technology: Upstream and downstream processing of biomolecules. Isolation, Preservation and Improvement of Industrial Micro-Organisms; Medium requirements for fermentation process; Criteria for good medium; Sterilization - batch and continuous heat sterilization of liquid media, filter sterilization of liquid media and Air. Design of sterilization equipment

MODULE II KINETICS OF SUBSTRATE UTILIZATION, PRODUCT FORMATION AND BIOMASS PRODUCTION 10

Phases of cell growth in batch cultures - transient growth kinetics, Simple unstructured kinetic Models for microbial growth, Growth of filamentous organisms; Environmental conditions affecting growth kinetics, substrate and product inhibition on cell growth and product formation; structured kinetic Models, segregated kinetic Models of growth. Production of primary and secondary metabolites. The production of some commercially important Organic acids, amino acids and alcohols, study of production processes for various classes of low molecular weight secondary metabolites: Antibiotics, quinones, aromatics, Vitamins and Steroid.

MODULE III BIOPROCESSING 9

Industrial use of micro organisms; Microbes exploited commercially-Saccharomyces, Lactobacillus, Penicillium, Acetobactor, Bifidobacterium, Lactococcus, Streptococcus etc; Fermentation-process, media and systems; Upstream and downstream processing; Product development; Dairy fermentation and fermented products.

MODULE III BIOREACTORS **9**

Animal Cells as bioreactors, characteristics of bioreactors, expression and over production of targeted proteins –human growth hormones – production of α and interferon's. Good manufacturing practice bio safety issues bioethics, Intellectual Property patenting issues.

MODULE V INDUSTRIAL APPLICATION OF ENZYMES **10**

Immobilized enzymes - principles & techniques of immobilization - commercial production of enzymes; amylases, proteases, cellulose, artificial enzymes, industrial applications, fermentation, enzymes Modification, site directed mutagenesis; immobilized enzyme in industrial processes.Structure and function of coenzyme - reactions involving TPP, pyrodoxal phosphate, nicotinamide, flavin nucleotide, coenzyme A and biotin.Industrial utilization of enzymes, food, detergents, energy, waste treatment, pharmaceuticals and medicine.

Total Hours : 45

REFERENCES:

1. Maheshwari, D.K. et. al., Biotechnological applications of microorganisms, IK . International, New Delhi, 2006.
2. Stanbury, P.F. et. al., Principles of Fermentation Technology, 2nd Edition, Elsevier, UK, 1995.
3. Waites, M.J. et. al., Industrial Biotechnology: An Introduction, Blackwell publishing, UK, 2007.

OUTCOMES:

- After the completion of the course the student will have overall knowledge of scientific industrial biotechnology and applications of microbes and enzymes used in industry.

REGULATIONS, CURRICULUM AND SYLLABI

M.Sc.
BIOCHEMISTRY AND MOLECULAR BIOLOGY

(As approved by the 9th Academic Council)

JULY 2016

B.S.ABDUR RAHMAN
UNIVERSITY
B.S. ABDUR RAHMAN INSTITUTE OF SCIENCE & TECHNOLOGY
(Estd. u/s 3 of the UGC Act, 1956)
(FORMERLY B.S. ABDUR RAHMAN CRESCENT ENGINEERING COLLEGE)
Rated with A Grade by National Assessment and Accreditation Council
Seethakathi Estate, G.S.T. Road, Vandalur, Chennai - 600 048
www.bsauniv.ac.in

UNIVERSITY VISION AND MISSION

VISION

B.S. Abdur Rahman Institute of Science and Technology aspires to be a leader in Education, Training and Research in Engineering, Science, Technology and Management and to play a vital role in the Socio-Economic progress of the Country.

MISSION

- To blossom into an internationally renowned University
- To empower the youth through quality education and to provide professional leadership
- To achieve excellence in all its endeavors to face global challenges
- To provide excellent teaching and research ambience
- To network with global institutions of Excellence, Business, Industry and Research Organizations
- To contribute to the knowledge base through Scientific enquiry, Applied research and Innovation

VISION AND MISSION OF THE DEPARTMENT OF SCHOOL OF LIFE SCIENCES

VISION

To be a leader in providing quality education and to carryout research in the field of Mathematics and its application in Science, Engineering and Technology

MISSION

- To provide quality education in higher mathematics through well designed programs
- To provide quality mathematical foundation for all science and engineering programs
- To offer programs in specialized areas such as Actuarial Science to meet the needs of Insurance and other Industries
- To undertake fundamental, applied and interdisciplinary research

PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES

M. Sc. (Biochemistry and Molecular Biology)

PROGRAMME EDUCATIONAL OBJECTIVES:

The course aims to provide an advanced understanding of the core principles and topics of Biochemistry and Molecular Biology, and to enable students to acquire a specialized knowledge and understanding of selected aspects by means of a lecture series and a research project. Hence, the main objectives of the program are:

- To provide an introduction to the basic concepts of biochemistry and molecular biology necessary for biochemical and biotechnology studies.
- For the basic understanding, this course includes biochemistry, cell and molecular biology, animal and plant biochemistry and immunology which will impart basic understanding of the biochemistry and molecular biology.
- Moreover, several laboratory courses given in the individual sections of the curriculum with detailed information on the importance of biochemistry and molecular biology in various fields of biological importance.
- Finally this course explains the advanced sections of molecular biology like Immunology, recombinant DNA technology, nanobiotechnology, stem cells research, Pharmaceutical biotechnology and bioinformatics which will strengthen the academic foundation of the student.
- This course provides necessary theoretical and practical experience in all divisions of biochemistry and molecular biology to become an effective professional in biotechnology sector.
- To provide broad exposure to various societal, ethical and commercial issues in the biochemistry and molecular biology.

PROGRAMME OUTCOMES:

After successfully completing this course, the student should be able to:

- Demonstrate a clear understanding of the properties of biomolecules and be able to predict behavior of molecules from in various biological environments.
- Apply their knowledge of cell and molecular biology into high end research.

- Advanced subject areas like Immunology, bioinformatics, nano-biotechnology will give broad information on applications and opportunities in the field of biochemistry and molecular biology.
- Identify research and solve biochemistry and molecular biology related problems related to the different types of human diseases.
- Ability to communicate and function effectively in multi-disciplinary team related to the biochemistry and molecular biology.

REGULATIONS – 2016
FOR
M.Tech. / MCA / M.Sc. DEGREE PROGRAMMES

1.0 PRELIMINARY DEFINITIONS AND NOMENCLATURE

In these Regulations, unless the context otherwise requires

i. **"Programme"** means a Post Graduate Degree Programme (M.Tech./ MCA/ M.Sc.)

ii. **"Course"** means a theory or practical subject that is normally studied in asemester, like Applied Mathematics, Structural Dynamics, Computer Aided Design, etc.

iii. **"University"** means B.S.Abdur Rahman University, Chennai, 600048.

iv. **"Institution"** unless otherwise specifically mentioned as an autonomousor off campus institution means B.S.Abdur Rahman University.

v. **"Academic Council"** means the Academic Council, which is the apex body on all academic matters of this University

vi. **"Dean (Academic Affairs)"** means Dean (Academic Affairs) ofB.S.Abdur Rahman University, who administers the academic matters.

vii. **"Dean (P.G. Studies)"** meansDean (P.G. Studies) of B.S. Abdur Rahman University who administers all P.G Programmes of the University in coordination with Dean (Academic Affairs)

viii. **"Dean (Student Affairs)"** means Dean (Student Affairs) of B.S.Abdur Rahman University, who looks after the welfare and discipline of the students.

ix. **"Controller of Examinations"** means the Controller of Examinations ofB.S.Abdur Rahman University who is responsible for conduct of examinations and declaration of results.

2.0 PROGRAMMES OFFERED, MODE OF STUDY AND ADMISSION REQUIREMENTS

2.1 P.G. Programmes Offered

The various P.G. Programmes and their modes of study are as follows:

Degree	Mode of Study
M. Tech. /M.C.A. / M.Sc.	Full Time & Part Time – Day / Evening / Weekends

2.2 Modes of Study

2.2.1 Full-time

Students admitted under "Full-Time" shall be available in the Institution during the

complete working hours for curricular, co-curricular and extra-curricular activities assigned to them.

2.2.2 A full time student, who has completed all non-project courses desiring to do the Project work in part-time mode for valid reasons, shall apply to the Dean (Academic Affairs) through the Head of the Department. Permission may be granted based on merits of the case. Such conversion is not permitted in the middle of a semester.

2.2.3 Part-time

In this mode of study, the students are required to attend classes for the courses in the time slots selected by them, during the daytime (or) evenings (or) weekends.

2.3 Admission Requirements

2.3.1 Students for admission to the first semester of the Master's Degree Programme shall be required to have passed the appropriate degree examination of this University as specified in the Table shown for eligible entry qualifications for admission to P.G. programmes or any other degree examination of any University or authority accepted by this University as equivalent thereto.

2.3.2 Eligibility conditions for admission such as class obtained, number of attempts in the qualifying examination and physical fitness will be as prescribed by this Institution from time to time.

2.3.3 All part-time students should satisfy other conditions regarding experience, sponsorship etc., which may be prescribed by this Institution from time to time.

2.3.4 Student eligible for admission to M.C.A under lateral entry scheme shall be required to have passed three year degree in B.Sc (Computer Science) / B.C.A / B.Sc (Information Technology)

3.0 DURATION AND STRUCTURE OF THE P.G. PROGRAMME

3.1 The minimum and maximum period for completion of the P.G. Programmes are given below:

Programme	Min. No. of Semesters	Max. No. of Semesters
M.Tech. (Full Time)	4	8
M.Tech. (Part Time)	6	12
M.C.A. (Full Time)	6	12
M.C.A. (Part Time)	9	18
M.C.A. (Full Time) – (Lateral Entry)	4	8
M.C.A. (Part Time) – (Lateral Entry)	6	12
M.Sc. (Full Time)	4	8

M. Sc. (Part Time)	6	12

3.2 The PG. programmes consist of the following components as prescribed in the respective curriculum

i. Core courses
ii. General Elective courses
iii. Professional Elective courses
iv. Project work / thesis / dissertation
v. Laboratory Courses
vi. Case studies
vii. Seminars
viii. Mini Project
ix. Industrial Internship

3.3 The curriculum and syllabi of all PG. programmes shall be approved by the Academic Council of this University.

3.4 The minimum number of credits to be earned for the successful completion of the programme shall be specified in the curriculum of the respective specialization of the P.G. programme.

3.5 Each academic semester shall normally comprise of 80 working days. Semester-end examinations will follow immediately after the last working day.

ELIGIBLE ENTRY QUALIFICATIONS FOR ADMISSION TO P.G. PROGRAMMES

Sl. No.	Name of the Department	P.G. Programmes offered	Qualifications for admission
01	Civil Engineering	M. Tech. (Structural Engineering)	B.E / B. Tech. (Civil Engineering) / (Structural Engineering)
		M. Tech. (Construction Engineering and Project Management)	
02	Mechanical Engineering	M. Tech. (Manufacturing Engineering)	B.E. / B. Tech. (Mechanical / Auto / Manufacturing / Production / Industrial / Mechatronics / Metallurgy / Aerospace /Aeronautical / Material Science / Marine Engineering)
		M. Tech. (CAD/CAM)	
03	Polymer Engineering	M. Tech. (Polymer Technology)	B. E. / B. Tech. Mechanical / Production /Polymer Science or Engg or Tech / Rubber Tech / M.Sc. (Polymer Sc./ Chemistry Appl. Chemistry)
04	Electrical and Electronics Engineering	M. Tech. (Power Systems Engg)	B.E / B.Tech (EEE / ECE / E&I / I&C / Electronics / Instrumentation)
		M. Tech. (Power Electronics & Drives)	B.E / B.Tech (EEE / ECE / E&I / I&C / Electronics / Instrumentation)
05	Electronics and Communication	M. Tech. (Communication Systems)	B.E / B.Tech (EEE/ ECE / E&I / I&C / Electronics / Instrumentation)

Sl. No.	Name of the Department	P.G. Programmes offered	Qualifications for admission
	Engineering	M. Tech. (VLSI and Embedded Systems)	B.E. / B. Tech. (ECE / Electronics / E&I / I&C / EEE)
06	ECE Department jointly with Physics Dept.	M. Tech. (Optoelectronics and Laser Technology)	B.E. / B. Tech. (ECE / EEE / Electronics / EIE / ICE) M.Sc. (Physics / Materials Science / Electronics / Photonics)
07	Electronics and Instrumentation Engineering	M. Tech. (Electronics and Instrumentation Engineering)	B.E. / B. Tech. (EIE / ICE / Electronics / ECE / EEE)
08	Computer Science and Engineering	M. Tech. (Computer Science and Engineering)	B.E. / B. Tech. (CSE / IT / ECE / EEE / EIE / ICE / Electronics / MCA)
		M. Tech. (Software Engineering)	B.E. / B. Tech. (CSE / IT) MCA
		M. Tech. (Network Security)	B.E. / B. Tech. (CSE / IT / ECE / EEE / EIE / ICE / Electronics / MCA)
		M. Tech. (Computer Science and Engineering with specialization in Big Data Analytics)	B.E. / B. Tech. (CSE / IT / ECE / EEE / EIE / ICE / Electronics / MCA)
09	Information Technology	M. Tech. (Information Technology)	B.E / B. Tech. (IT / CSE / ECE / EEE / EIE / ICE / Electronics) MCA
		M. Tech. (Information Security & Digital Forensics)	B.E / B. Tech. (IT / CSE / ECE / EEE / EIE / ICE / Electronics) MCA
10	Computer Applications	M.C.A.	Bachelor Degree in any discipline with Mathematics as one of the subjects (or) Mathematics at +2 level
		M.C.A. – (Lateral Entry)	B.Sc. Computer Science / B.Sc. Information Technology / B.C.A
		M. Tech. (Systems Engineering and Operations Research)	BE / B. Tech. (Any Branch) or M.Sc., (Maths / Physics / Statistics / CS / IT / SE) or M.C.A.
		M. Tech. (Data & Storage Management	BE / B. Tech. (Any Branch) or M.Sc., (Maths / Physics / Statistics / CS / IT / SE) or M.C.A.
11	Mathematics	M.Sc. (Actuarial Science)	Any Degree with Mathematics / Statistics as one of the subjects of study.
		M.Sc. Mathematics	B.Sc. (Mathematics)
12	Physics	M.Sc.(Physics)	B.Sc.(Physics / Applied Science / Electronics / Electronics Science / Electronics & Instrumentation)
		M.Sc. (Material Science)	B.Sc.(Physics / Applied Science / Electronics / Electronics Science / Electronics & Instrumentation)

Sl. No.	Name of the Department	P.G. Programmes offered	Qualifications for admission
13	Chemistry	M.Sc.(Chemistry)	B.Sc. (Chemistry / Applied Science)
14	Life Sciences	M.Sc. Molecular Biology & Biochemistry	B.Sc. in any branch of Life Sciences
		M.Sc. Genetics	B.Sc. in any branch of Life Sciences
		M.Sc. Biotechnology	B.Sc. in any branch of Life Sciences
		M.Sc. Microbiology	B.Sc. in any branch of Life Sciences
		M.Sc. Bioscience	B.Sc. in any branch of Life Sciences
		M. Tech. Biotechnology	B. Tech. (Biotechnology / Chemical Engineering) / M.Sc. in any branch of Life Sciences

3.6 The curriculum of PG programmes shall be so designed that the minimum prescribed credits required for the award of the degree shall be within the limits specified below:

Programme	Minimum prescribed credits
M.Tech.	73
M.C.A.	120
M.Sc.	72

3.7 Credits will be assigned to the courses for all P.G. programmes as given below:

- One credit for one lecture period per week (or) 15 periods per semester
- One credit for one tutorial period per week
- One credit each for seminar/practical session/project of two or three periods per week
- One credit for two weeks of industrial internship
- One credit for 15 periods of lecture (can even be spread over a short span of time)

3.8 The number of credits registered by a student in non-project semester and project semester should be within the range specified below:

P.G. Programme	Full Time		Part Time	
	Non-project Semester	Project semester	Non-project Semester	Project semester
M. Tech.	9 to 28	12 to 28	6 to 12	12 to 28
M.C.A.	9 to 29	12 to 29	6 to 12	12 to 29
M.Sc.	9 to 25	12 to 20	6 to 12	12 to 20

3.9 The student may choose a course prescribed in the curriculum from any department depending on his /her convenient time slot. All attendance will be maintained course-wise only.

3.10 The electives from the curriculum are to be chosen with the approval of the Head of the Department.

3.11 A student may be permitted by the Head of the Department to choose electives from other PG programmes either within the Department or from other Departments up to a maximum of nine credits during the period of his/her study, with the approval of the Head of the Departments offering such courses.

3.12 To help the students to take up special research areas in their project work and to enable the department to introduce courses in latest/emerging areas in the curriculum, "Special Electives" may be offered. A student may be permitted to register for a "Special Elective" up to a maximum of three credits during the period of his/her study, provided the syllabus of this course is recommended by the Head of the Department and approved by the Chairman, Academic Council before the commencement of the semester, in which the special elective course is offered. Subsequently, such course shall be ratified by the Board of Studies and Academic Council.

3.13 The medium of instruction, examination, seminar and project/thesis/ dissertation reports will be English.

3.14 Industrial internship, if specified in the curriculum shall be of not less than two weeks duration and shall be organized by the Head of the Department.

3.15 Project Work / Thesis / Dissertation

3.15.1 Project work / Thesis / Dissertation shall be carried out under the supervision of a Faculty member in the concerned Department.

3.15.2 A student may however, in certain cases, be permitted to work for the project in an Industrial/Research Organization, on the recommendation of the Head of the Department. In such cases, the project work shall be jointly supervised by a faculty of the Department and an Engineer / Scientist from the organization and the student shall be instructed to meet the faculty periodically and to attend the review committee meetings for evaluating the progress.

3.15.3 Project work / Thesis / Dissertation (Phase - II in the case of M.Tech.) shall be pursued for a minimum of 16 weeks during the final semester, following the preliminary work carried out in Phase-1 during the previous semester.

3.15.4 The Project Report/Thesis / Dissertation report / Drawings prepared according to approved guidelines and duly signed by the supervisor(s) and the Head of the Department shall be submitted to the concerned department.

3.15.5 The deadline for submission of final Project Report / Thesis / Dissertation is within 30 calendar days from the last working day of the semester in which Project / Thesis / Dissertation is done.

3.15.6 If a student fails to submit the Project Report / Thesis / Dissertation on or before the specified deadline he / she is deemed to have not completed the Project Work / Thesis / dissertation and shall re-register the same in a subsequent semester.

4.0 CLASS ADVISOR AND FACULTY ADVISOR

4.1 Class Advisor

A faculty member will be nominated by the HOD as Class Advisor for the whole class.

He/she is responsible for maintaining the academic, curricular and co-curricular records of all students throughout their period of study.

4.2 Faculty Advisor

To help the students in planning their courses of study and for general counseling on the academic programme, the Head of the Department of the students will attach a certain number of students to a faculty member of the department who shall function as Faculty Advisor for the students throughout their period of study. Such Faculty Advisor shall offer advice to the students on academic and personal matters and guide the students in taking up courses for registration and enrolment every semester.

5.0 CLASS COMMITTEE

5.1 Every class of the PG Programme will have a Class Committee constituted by the Head of the Department as follows:

i. Teachers of all courses of the programme
ii. One senior faculty preferably not offering courses for the class, as Chairperson.
iii. Minimum two students of the class, nominated by the Head of the Department.
iv. Class Advisor / Faculty Advisor of the class - Ex-Officio Member
v. Professor in-charge of the PG Programme - Ex-Officio Member.

5.2 The Class Committee shall be constituted by the respective Head of the Department of the students.

5.3 The basic responsibilities of the Class Committee are to review periodically the progress of the classes to discuss problems concerning curriculum and syllabi and the conduct of classes. The type of assessment for the course will be decided by the teacher in consultation with the Class Committee and will be announced to the students at the beginning of the semester. Each Class Committee will communicate its recommendations to the Head of the Department and Dean (Academic Affairs). The class committee, **without the student members,** will also be responsible for finalization of the semester results and award of grades.

5.4 The Class Committee is required to meet at least thrice in a semester, first within a week of the commencement of the semester, second, after the first assessment and the third, after the semester-end examination to finalize the grades.

6.0 COURSE COMMITTEE

Each common theory course offered to more than one group of students shall have a "Course Committee" comprising all the teachers teaching the common course with one of them nominated as Course coordinator. The nomination of the Course coordinator shall be made by the Head of the Department / Dean (Academic Affairs) depending upon whether all the teachers teaching the common course belong to a single department or to several departments. The Course Committee shall meet as often as possible and ensure uniform evaluation of the tests and arrive at a common scheme of evaluation for the tests. Wherever it is feasible, the Course Committee may also prepare a common question paper for the test(s).

7.0 REGISTRATION AND ENROLMENT

7.1 For the first semester every student has to register for the courses within one week from the commencement of the semester

7.2 For the subsequent semesters registration for the courses will be done by the student one week before the last working day of the previous semester. The curriculum gives details of the core and elective courses, project and seminar to be taken in different semester with the number of credits. The student should consult his/her Faculty Advisor for the choice of courses. The Registration form shall be filled in and signed by the student and the Faculty Advisor.

7.3 From the second semester onwards all students shall pay the prescribed fees and enroll on a specified day at the beginning of a semester.

7.4 A student will become eligible for enrolment only if he/she satisfies clause 9 and in addition he/she is not debarred from enrolment by a disciplinary action of the Institution. At the time of enrolment a student can drop a course registered earlier and also substitute it by another course for valid reasons with the consent of the Faculty Advisor. Late enrolment will be permitted on payment of a prescribed fine up to two weeks from the date of commencement of the semester.

7.5 Withdrawal from a course registered is permitted up to one week from the date of the completion of the first assessment test.

7.6 Change of a course within a period of 15 days from the commencement of the course, with the approval of Dean (Academic Affairs), on the recommendation of the HOD, is permitted.

7.7 Courses withdrawn will have to be taken when they are offered next if they belong to the list of core courses.

7.8 A student undergoing a full time PG Programme should have enrolled for all preceding semesters before registering for a particular semester

7.9 A student undergoing the P.G. programme in Part Time mode can choose not to register for any course in a particular semester with written approval from the head of the department. However the total duration for the completion of the programme shall not exceed the prescribed maximum number of semesters (vide clause 3.1)

8.0 TEMPORARY BREAK OF STUDY FROM THE PROGRAMME

A student may be permitted by the Dean (Academic Affairs) to avail temporary break of study from the programme up to a maximum of two semesters for reasons of ill health or other valid grounds. Such student has to rejoin only in the same semester from where he left. However the total duration for completion of the programme shall not exceed the prescribed maximum number of semesters (vide clause 3.1).

9.0 MINIMUM REQUIREMENTS TO REGISTER FOR PROJECT / THESIS / DISSERTATION

9.1 A student is permitted to register for project semester, if he/she has earned the minimum number of credits specified below:

Programme	Minimum No. of credits to be earned to enroll for project semester
M.Tech. (Full time / Part time)	18
M.C.A. (Full time / Part time)	45
M.C.A. (Full time / Part time) – (Lateral Entry)	22
M.Sc.(Full time / Part time)	18

9.2 If the student has not earned minimum number of creditsspecified, he/she has to earn the required credits, at least to the extent of minimum credits specified in clause 9.1 and then register for the project semester.

10.0 DISCIPLINE

10.1 Every student is required to observe discipline and decorous behavior both inside and outside the campus and not to indulge in any activity, which will tend to bring down the prestige of the Institution.

10.2 Any act of indiscipline of a student reported to the Head of the Institution will be referred to a Discipline and Welfare Committee for taking appropriate action.

11.0 ATTENDANCE

11.1 Attendance rules for all Full Time Programme and Part time Programmes are given in the following sub-clause.

11.2 Ideally every student is expected to attend all classes and earn 100% attendance in the contact periods of every course, subject to a maximum relaxation of 25% for genuine reasons like on medical grounds, representing the University in approved events etc., to become eligible to appear for the semester-end examination in that course, failing which the student shall be awarded "I" grade in that course. If the course is a core course, the student should register for and repeat the course when it is offered next. If the course is an elective, either he/she can register and repeat the same elective or can register for a new elective.

11.3 The students of Full Time mode of study, who have not attended a single hour in all courses in a semester and awarded ‘I’ grade are not permitted to write the examination and also not permitted move to next higher semester. Such students should repeat all the courses of the semester in the next Academic year.

12.0 SUMMER TERM COURSES

12.1 Summer term courses may be offered by a department on the recommendation of the Departmental Consultative Committee and approved by the Dean (Academic Affairs). No student should register for more than three courses during a summer term.

12.2 Summer term courses will be announced by the Head of the department at the end of the even semester before the commencement of the end semester examinations. A student will have to register within the time stipulated in the announcement. A student has to pay the fees as stipulated in the announcement.

12.3 The number of contact hours and the assessment procedure for any course during summer term will be the same as those during regular semesters.

Students with U grades will have the option either to write semester end arrears exam or to redo the courses during summer / regular semesters, if they wish to improve their continuous assessment marks subject to the approval of the Head of the department.

12.4 Withdrawal from a summer term course is not permitted. No substitute examination will be conducted for the summer term courses.

12.5 The summer term courses are not applicable for the students of Part Time mode.

13.0 ASSESSMENTS AND EXAMINATIONS

13.1 The following rule shall apply to all the PG programmes (M.Tech./ M.C.A. / M.Sc.)

For lecture-based courses, normally a minimum of two assessments will be made

during the semester. The assessments may be combination of tests and assignments. The assessment procedure as decided in the Class Committee will be announced to the students right from the beginning of the semester by the course teacher.

13.2 There shall be one examination of three hours duration, at the end of the semester.

13.3 In one (or) two credit courses that are not spread over the entire semester, the evaluation will be conducted at the completion of the course itself. Anyhow approval for the same is to be obtained from the HoD and the Dean of Academic Affairs.

13.4 The evaluation of the Project work will be based on the project report and a Viva-Voce Examination by a team consisting of the supervisor concerned, an Internal Examiner and External Examiner to be appointed by the Controller of Examinations.

13.5 At the end of industrial internship, the student shall submit a certificate from the organization and also a brief report. The evaluation will be made based on this report and a Viva-Voce Examination, conducted internally by a Departmental Committee constituted by the Head of the Department.

14.0 WEIGHTAGES

14.1 The following shall be the weightages for different courses:

i) Lecture based course

Two continuous assessments	50%
Semester-end examination	50%

ii) Laboratory based courses

Laboratory work assessment	75%
Semester-end examination	25%

iii) Project work

Periodic reviews	50%
Evaluation of Project Report by	
External Examiner	20%
Viva-Voce Examination	30%

14.2 Appearing for semester end examination for each course (Theory and Practical) is mandatory and a student should secure a minimum of 40% marks in semester end examination for the successful completion of the course.

14.3 The markings for all tests, tutorial, assignments (if any), laboratory work and examinations will be on absolute basis. The final percentage of marks is calculated in each course as per the weightages given in clause 13.1.

15.0 SUBSTITUTE EXAMINATION

15.1 A student who has missed for genuine reasons any one of the three assessments including semester-end examination of a course may be permitted to write a substitute examination. However, permission to take up a substitute examination will be given under exceptional circumstances, such as accident or admissions to a hospital due to illness, etc.

15.2 A student who misses any assessment in a course shall apply in a prescribed form to the Dean (Academic Affairs) through the Head of the department within a week from the date of missed assessment. However the substitute tests and examination for a course will be conducted within two weeks after the last day of the semester-end examinations.

16.0 COURSEWISE GRADING OF STUDENTS AND LETTER GRADES

16.1 Based on the semester performance, each student is awarded a final letter grade at the end of the semester in each course. The letter grades and the corresponding grade points are as follows, but grading has to be relative grading

Letter grade	Grade points
S	10
A	9
B	8
C	7
D	6
E	5
U	0
W	-
I	-
AB	-

- Flexible range grading system will be adopted
- **“W”** denotes withdrawal from the course.
- **"I"** denotes inadequate attendance and hence prevention from semester-end examination
- **"U"** denotes unsuccessful performance in a course.
- **“AB”** denotes absent for the semester end examination

16.2 A student is considered to have completed a course successfully if he / she secure five grade points or higher. A letter grade ‘U’ in any course implies unsuccessful performance in that course.

16.3 A course successfully completed cannot be repeated for any reason.

17.0 AWARD OF LETTER GRADE

17.1 A final meeting of the Class Committee without the student member(s) will be convened within ten days after the last day of the semester end examination. The letter grades to be awarded to the students for different courses will be finalized at the meeting.

17.2 After finalization of the grades at the class committee meeting the Chairman will forward the results to the Controller of Examinations, with copies to Head of the Department and Dean (Academic Affairs).

18.0 DECLARATION OF RESULTS

18.1 After finalization by the Class Committee as per clause 16.1 the Letter grades awarded to the students in the each course shall be announced on the departmental notice board after duly approved by the Controller of Examinations.

18.2 In case any student feels aggrieved about the results, he/she can apply for revaluation after paying the prescribed fee for the purpose, within one week from the announcement of results.

A committee will be constituted by the concerned Head of the Department comprising of the Chairperson of the concerned Class Committee (Convener), the teacher concerned and a teacher of the department who is knowledgeable in the concerned course. If the Committee finds that the case is genuine, it may jointly revalue the answer script and forward the revised marks to the Controller of Examinations with full justification for the revision, if any.

18.3 The “U” and “AB” grade once awarded stays in the grade sheet of the students and is not deleted when he/she completes the course successfully later. The grade acquired by the student later will be indicated in the grade sheet of the appropriate semester.

19.0 COURSE REPETITION AND ARREARS EXAMINATION

19.1 A student should register to re-do a core course wherein"I" or "W" grade is awarded. If the student is awarded "I" or "W" grade in an elective course either the same elective course may be repeated or a new elective course may be taken.

19.2 A student who is awarded “U” or “AB” grade in a course shall write the semester-end examination as arrear examination, at the end of the next semester, along with the regular examinations of next semester courses.

19.3 A student who is awarded “U” or “AB” grade in a course will have the option of either to write semester end arrear examination at the end of the subsequent semesters, or to redo the course whenever the course is offered. Marks earned during the redo period in the continuous assessment for the course, will be used

for grading along with the marks earned in the end-semester (re-do) examination.

19.4 If any student obtained "U" or "AB" grade, the marks earned during the redo period for the continuous assessment for that course will be considered for further appearance as arrears.

19.5 If a student with "U" or "AB" grade prefers to redo any particular course fails to earn the minimum 75% attendance while doing that course, then he/she will not be permitted to write the semester end examination and his / her earlier 'U' grade and continuous assessment marks shall continue.

20.0 GRADE SHEET

20.1 The grade sheet issued at the end of the semester to each student will contain the following:

(i) the credits for each course registered for that semester.

(ii) the performance in each course by the letter grade obtained.

(iii) the total credits earned in that semester.

(iv) the Grade Point Average (GPA) of all the courses registered for that semester and the Cumulative Grade Point Average (CGPA) of all the courses taken up to that semester.

20.2 The GPA will be calculated according to the formula

$$GPA = \frac{\sum_{i=1}^{n}(C_i)(GP_i)}{\sum_{i=1}^{n}(C_i)}$$

where n = number of courses

where C_i is the number of credits assigned for i^{th} course

GP_i - Grade point obtained in the i^{th} course

for the cumulative grade point average (CGPA) a similar formula is used except that the sum is over all the courses taken in all the semesters completed up to the point of time.

'I' and 'W' grades will be excluded for GPA calculations.

'U', 'AB' 'I' and 'W' grades will be excluded for CGPA calculations.

20.3 Classification of the award of degree will be as follows:

20.3.1 For students under full time mode of study

CGPA	Classification
8.50 and above, having completed all courses in first appearance	First class with Distinction
6.50 and above, having completed within a period of 2 semesters beyond the programme period	First Class
All others	Second Class

However, to be eligible for First Class with Distinction, a student should not have obtained U or I grade in any course during his/her study and should have completed the PG Programme within a minimum period covered by the minimum duration (clause 3.1) plus authorized break of study, if any (clause 8). To be eligible for First Class, a student should have passed the examination in all courses within the specified minimum number of semesters reckoned from his/her commencement of study plus two semesters. For this purpose, the authorized break of study will not be counted. The students who do not satisfy the above two conditions will be classified as second class. For the purpose of classification, the CGPA will be rounded to two decimal places. For the purpose of comparison of performance of students and ranking, CGPA will be considered up to three decimal places.

20.3.2 For students under part timemode of study

CGPA	Classification
8.50 and above, having completed all courses in first appearance	First class with Distinction
6.50 and above	First Class
All others	Second Class

For the purpose of classification, the CGPA will be rounded to two decimal places.

21.0 ELIGIBILITY FOR THE AWARD OF THE MASTERS DEGREE

21.1 A student shall be declared to be eligible for the award of the Masters Degree, if he/she has:

i) successfully acquired the required credits as specified in the Curriculum corresponding to his/her programme within the stipulated time,

ii) no disciplinary action is pending against him/her.

21.2 The award of the degree must be approved by the University.

22.0 POWER TO MODIFY

Notwithstanding all that have been stated above, the Academic Council has the right to modify any of the above regulations from time to time.

CURRICULUM & SYLLABI FOR
M. Sc. (Actuarial Science)
(Four Semesters / Full Time)

Curriculum

Sl. No.	Course Code	Course Title	L	T	P	C
		SEMESTER I				
1	LSC6101	Advanced Biochemistry	**4**	**0**	**0**	**4**
2	LSC6102	Cell and Molecular Biology	**4**	**0**	**0**	**4**
3	LSC6103	Genetic Engineering	**4**	**0**	**0**	**4**
4		Elective I	**3**	**0**	**0**	**3**
5		Elective II	**3**	**0**	**0**	**3**
6	LSC6104	Lab I (Biochemistry, Molecular Biology and Genetic Engineering)	**0**	**0**	**6**	**3**
		Total				**21**
		SEMESTER II				
1	GEC6202	Research Methodology	**3**	**0**	**0**	**3**
2	LSC6201	Immunology	**4**	**0**	**0**	**4**
3	LSC6202	Bioinformatics	**4**	**0**	**0**	**4**
4		Elective II	**3**	**0**	**0**	**3**
5		Elective III	**3**	**0**	**0**	**3**
6	LSC6203	Lab II (Immunology/ Bioinformatics)	**0**	**0**	**6**	**3**
7	LSC6241	Industrial Internship	**0**	**0**	**0**	**1**
8	LSC6242	Mini Project	**0**	**0**	**0**	**1**
		Total				**22**
		SEMESTER III				
1	LSC7141	Project Phase I	**0**	**0**	**2**	**2**
2	LSC7142	Clinical Biochemistry	**4**	**0**	**0**	**4**
3	LSC7143	Genomics, Proteomics and Metabolomics	**4**	**0**	**0**	**4**
4		Elective V	**3**	**0**	**0**	**3**
5		Elective VI	**3**	**0**	**0**	**3**
6	LSC7144	Lab III (Clinical Biochemistry /Omics)	**0**	**0**	**6**	**3**
		Total				**17**

Sl. No.	Course Code	Course Title	L	T	P	C
		SEMESTER IV				
1	LSC7141	Project Phase II	**0**	**0**	**36**	**18**
		Total			**2+18=20**	
					Total Credits: 80	

Note: Two credits earned in the Project Phase 1 will be added when the complete the Phase II project

LIST OF ELECTIVES

Sl. No.	Course Code	Course Title	L	T	P	C
		SEMESTER I				
1	LSCY101	Biosafety, Bioethics, Bioentrepreneurship, Intellectual Property rights	**3**	**0**	**0**	**3**
2	LSCY102	Microbiology	**3**	**0**	**0**	**3**
3	LSCY103	Food Process Technology	**3**	**0**	**0**	**3**
4	LSCY104	Analytical Methods	**3**	**0**	**0**	**3**
5	LSCY105	Environmental Biotechnology	**3**	**0**	**0**	**3**
6	LSCY106	SiRNA/RNA Interference	**3**	**0**	**0**	**3**
		SEMESTER II				
1	LSCY201	Recombinant DNA Technology	**3**	**0**	**0**	**3**
2	LSCY202	Advanced Instrumentation	**3**	**0**	**0**	**3**
3	LSCY203	Molecular Diagnostics	**3**	**0**	**0**	**3**
4	LSCY204	Omics	**3**	**0**	**0**	**3**
5	LSCY205	Biofuel and Bioenergy	**3**	**0**	**0**	**3**
6	LSCY206	Molecular Farming	**3**	**0**	**0**	**3**
		SEMESTER II				
1	LSCY111	Biopharmaceuticals	**3**	**0**	**0**	**3**
2	LSCY112	Molecular and immuno Diagnostics	**3**	**0**	**0**	**3**
3	LSCY113	Tissue andAntibody Engineering	**3**	**0**	**0**	**3**
4	LSCY114	Bio-nanotechnology	**3**	**0**	**0**	**3**
5	LSCY115	Protein Engineering	**3**	**0**	**0**	**3**
6	LSCY116	Stem Cell Technology	**3**	**0**	**0**	**3**

SEMESTER I

LSC6101 ADVANCED BIOCHEMISTRY

L	T	P	C
4	0	0	4

OBJECTIVES:

This course aims to develop in the students' mind a concept regarding

- The diversity of metabolic processes occurring in biological system.
- The effect of the structural and functional role of the enzymes governing the metabolic processes.
- Importance of the metabolic pathways in maintaining homeostasis in biological system.
- The clinical implications of the metabolic pathway.

MODULE I AMINO ACIDS & PROTEIN: STRUCTURE AND FUNCTIONS 05

Amino acids- Classification, structure and function, proteins- primary, secondary, tertiary and quaternary structure, Ramachandran plot, super secondary structures and helix loop.

MODULE II ENZYMOLOGY 10

Classification of enzymes. How do enzymes work: activation energy, substrate specificity. Enzyme-substrate interaction: Lock and Key mechanism and Induced Fit mechanism. Effect of temperature and pH on enzyme action. Enzyme Kinetics: Michaelis-Menten Equation, Km, Measurement of Km and Vmax (Lineweaver-Burk equation). Kinetics of multisubstrate reaction: Sequential reactions and ping-pong reactions. Enzyme inhibition: reversible (competitive, uncompetitive and mixed) and irreversible. Allosteric regulation of enzyme activity. Multienzyme complex and multifunctional enzymes.

MODULE III ENERGY PRODUCTION AND OXIDATIVE PHOSPHORYLATION 14

Introduction to metabolism: Anabolism, catabolism, metabolic pathways. Characteristics of metabolic pathways

Glycolysis: glycolytic pathway. Molecular mechanism of action of the glycolytic enzymes. Energetic of glycolysis. Glycolysis and cancer biology—Warburg Hypothesis and PET scanning. Fates of Pyruvate under anaerobic conditions: alcohol and lactic acid fermentation. Importance of lactic acid fermentation.

TCA Cycle: Formation of Acetyl CoA and reactions of citric acid cycle. Molecular mechanism of pyruvate dehydrogenase complex and enzymes involved in Kreb's cycle. Energetic of TCA cycle and substrate level phosphorylation.

Lipid metabolism: Hormonal regulation of the mobilization of triglycerides from adiposities. Transport of fatty acid into mitochondria. Beta oxidation of saturated fatty acid (both even and odd). Regulation. Energetic.

Electron Transport Chain: structure and function of Electron carriers: Complex I—V. Passage of electrons from complex I to IV. Mitchell's chemiosmotic hypothesis and proton gradient. Structure of complex V or ATP synthase, Catalytic sites of ATP synthesis. Mechanism of ATP generation by Boyer's binding change mechanism—rotational catalysis. Energetic of ATP synthesis and efficiency of ATP synthase.

MODULE IV METABOLIC INTERRELATIONSHIP 09

Starve-Fed cycle. Glucose homeostasis. Switching of metabolism of liver between starve and fed cycle. Metabolic relationship of tissues in various nutritional and hormonal states—insulin resistance, diabetes, exercise, pregnancy, lactation, stress, liver and renal diseases, alcohol consumption.

MODULE V REGULATORY MECHANISMS OF METABOLIC PATHWAYS 07

Feedback inhibition by allosteric modulation of enzymes. Covalent modifications of enzymes. Isozymes. Propetolytic cleavage. Regulationg the amount of enzyme—regulation gene expression in prokaryotes and eukaryotes.

Total Hours: 45

REFERENCE:

1. Nelson D.L, Cox M. M. Lehninger's Principle of Biochemistry. 5th Ed.,W. H. Freeman, 2008.
2. Biochemistry by LubertStryer 7th ed. W. H. Freeman & Company.
3. Textbook of Biochemistry with Clinical Correlations. 4th Ed. Thomas M. Devlin. Wiley-Liss publication. 1997.

OUTCOMES:

At the completion of the course the student will develop an understanding about the

- Various metabolic processes occurring in biological system and their role in governing homeostasis and normal physiology.
- The importance of enzymes as a regulatory molecule in metabolism.
- The interrelationship of metabolic pathways different physiological conditions.
- The role of liver in regulating metabolism.

LSC6102 CELL & MOLECULAR BIOLOGY

L	T	P	C
4	0	0	4

OBJECTIVES:

- To get overview of classes of cells and structural and function aspects of plasma membrane and cell organelle.
- To develop skill to understand molecular aspects of cell cycle and cell division.
- To get familiar with transcription and translation in details.
- To understand the signaling pathways in cell functioning

MODULE I INTRODUCTION TO CELL 08

Basic properties of cell, Different classes of cell: Prokaryotic, animal and plant cell.Plasma membrane- structure and function, Chemical composition of membranes, membrane lipids and proteins, fluid mosaic model, Transport across the membranes-diffusion, osmosis, facilitated diffusion,passive and active transport; membrane potential and nerve impulses.

MODULE II MEMBRANE TRANSPORT 07

Endoplasmic Reticulum, Golgi complex- glycosylation, Vesicle transport- COPI and COPII; Lysosomes-autophagy;Endocytic pathway- endocytosis and phagocytosis,transport of proteins into peroxisomes, mitochondria and chloroplast;

MODULE III ENERGY CONVERSION 10

Structure of mitochondria and organization of respiratory chain; Proton Pump and ATP generation in mitochondria; Structure of chloroplast and Photosynthesis, photorespiration; Genetic system of mitochondria and chloroplast.

MODULE IV BASIC GENETIC MECHANISMS 10

The structure and function of DNA, DNA packaging and Chromosomes, chromatin structure and function, DNA replication mechanisms, DNA damage and repair and homologous recombination and transposable elements, Telomeres, telomerase and end replication. Role of telomerase in aging and cancer.

MODULE V TRANSCRIPTIONAND TRANSLATION 10

Transcription- Prokaryotic and eukaryotic Transcription- RNA polymerases-general and specific transcription factors- regulatory elements- mechanism of transcription, Transcription termination Post transcriptional modification- splicing-editing- nuclear export of mRNA- mRNA stability; Translation- Genetic code,

Mechanism of initiation-elongation andtermination- Regulation of translation.

Total Hours: 45

REFERENCES

1. Molecular Biology of Cell by Alberts et.al. John Wiley & Sons, 6Ed, 2015
2. The Cell by Cooper. ASM Press, 4Ed, 2007
3. Cell and Molecular Biology by Karp. John Wiley & Sons, 7Ed, 2013
4. Lodish H. F.Cell and Molecular Biology. W.H. Freeman & Co Ltd, 7Ed, 2000.

OUTCOMES:

- On the completion of the above objectives student will be able to get the overview of classes of cells and structural and function aspects of plasma membrane and cell organelle. They can develop skill to understand molecular aspects of cell cycle, cell division, transcription and translation.

LSC6103 GENETIC ENGINEERING

L	T	P	C
4	0	0	4

OBJECTIVES:

- To learn about genetic engineering, principles involved in manipulating genes and DNA.
- To know about cloning strategies and expression systems.
- To acquire basic understanding of techniques in genetic engineering.

MODULE I BASICS CONCEPTS 09

DNA Structure and properties; Restriction Enzymes; DNA ligase, Klenow enzyme, T4 DNA polymerase, Polynucleotide kinase, Alkaline phosphatase; Cohesive and blunt end ligation; Linkers; Adaptors; Homopolymeric tailing; Labeling of DNA: Nick translation, Random priming, Radioactive and non-radioactive probes, Hybridization techniques: Northern, Southern and Colony hybridization, Fluorescence in situ hybridization; Chromatin Immunoprecipitation; DNA-Protein Interactions-Electromobility shift assay; DNaseIfootprinting

MODULE II CLONING VECTORS 09

Plasmids; Bacteriophages; M13 mp vectors; PUC19 and Bluescript vectors, Phagemids; Lambda vectors; Insertion and Replacement vectors; Cosmids; Artificial chromosome vectors (YACs; BACs); Animal Virus derived vectors-SV-40; vaccinia/bacculo& retroviral vectors; Expression vectors; pMal; GST; pET-can be omitted vectors; Protein purification; His-tag; GST-tag; MBP-tag etc.; Intein-based vectors; Inclusion bodies; Methodologies to reduce formation of inclusion bodies; Baculovirus and pichia vectors system, Plant based vectors, Ti and Ri as vectors, Yeast vectors, Shuttle vectors. Criteria for selection of vectors.

MODULE III CLONING METHODOLOGIES 09

Insertion of Foreign DNA into Host Cells; Transformation; Transfection, Transduction, Construction of libraries; Isolation of mRNA and total RNA; cDNA and genomic libraries; cDNA and genomic cloning; Expression cloning; Jumping and hopping libraries; Southwestern and Far-western cloning; Protein-protein interactive cloning and Yeast two hybrid system; Phage display; Principles in maximizing gene expression. Methods to confirm cloning and reporter genes and proteins.

MODULE IV PCR AND ITS APPLICATIONS 09

Primer design; Fidelity of thermostable enzymes; DNA polymerases; Types of PCR – multiplex, nested, reverse transcriptase, real time PCR, touchdown PCR, hot start PCR, colony PCR, cloning of PCR products; Tvectors; Proof reading enzymes; PCR in gene

recombination; Deletion; addition; Overlap extension; and SOEing; Site specific mutagenesis; PCR in molecular diagnostics; Viral and bacterial detection; PCR based mutagenesis detection. Sequencing methods; Enzymatic DNA sequencing; Chemical sequencing of DNA; Automated DNA sequencing; RNA sequencing; Chemical Synthesis of oligonucleotides.

MODULE V APPLICATION OF GENETIC ENGINEERING 09

Gene silencing techniques; Introduction to siRNA; siRNA technology; Micro RNA; Construction of siRNA vectors; Principle and application of gene silencing; Gene knockouts and Gene Therapy; Creation of knock out mice; Disease model; Somatic and germ-line therapy- in vivo and ex-vivo; Suicide gene therapy; Gene replacement; Gene targeting; Transgenics; cDNA and intragenic arrays; Differential gene expression and protein array. Ethics in genetic engineering and global policy.

Total Hours:

TEXT/REFERENCES

1. S.B. Primrose, R.M. Twyman and R.W.Old; Principles of Gene Manipulation. 6th Edition, S.B.University Press, 2001.
2. J. Sambrook and D.W. Russel; Molecular Cloning: A Laboratory Manual, Vols 1-3, CSHL, 2001.
3. Brown TA, Genomes, 3rd ed. Garland Science 2006
4. Selected papers from scientific journals.
5. Desmond S. T. Nicholl An Introduction to Genetic Engineering Cambridge University Press 2008
6. Technical Literature from Stratagene, Promega, Novagen, New England Biolab etc.

OUTCOMES:

- On completion of the course the scholars will acquire knowledge on the concepts and terminology in genetic engineering.
- Students will be familiar with various cloning strategies in prokaryotes as well as in eukaryotes.
- Students will learn various techniques in genetic engineering.
- They will also get awareness about the social and ethical issues concerning cloning by genetic engineering

LSC6104	LAB I (BIOCHEMISTRY, MOLECULAR BIOLOGY AND GENETIC ENGINEERING)	L	T	P	C
		0	0	6	3

OBJECTIVES:

- To learn basic techniques in molecular biology
- To study and differentiate the electrochemical properties of nucleic acids
- To learn the preliminary methods in biochemistry by preparing buffer and adjusting pH.
- To estimate various biomolecules by biochemical assays

EXPERIMENTS:

1. Laboratory safety guidelines.
2. To determine an unknown protein concentration by plotting a standard graph of BSA using UV-Vis Spectrophotometer and validating the Beer- Lambert's Law.
3. Effect of temperature on enzyme activity.
4. Separation techniques for amino acids and sugar:
    a. paper chromatography
    b. thin layer chromatography.
5. Separation of proteins by native and SDS-PAGE.
6. Preparation of slides from onion root tip for mitosis
7. Isolation & Purification of genomic DNA from bacteria
8. Isolation & Purification of plasmid DNA
9. Isolation of RNA
10. Agarose gel electrophoresis of chromosomal & plasmid DNA
11. Restriction Digestion of chromosomal & plasmid DNA
12. Isolation of DNA fragment from agarose gel
13. Competent cell preparation
14. Transformation and Efficiency of competent cells
15. SDS PAGE
16. Polymerase Chain Reaction
17. Isolation of Genomic DNA from Plants

REFERENCES:

1. Michel R. G and Sambrook J. Molecular Coning- A laboratory manual. Cold spring harbor laboratory press, 2012.
2. Laboratory Exercises in Microbiology, Fifth Edition by Harley−Prescott, The McGraw−Hill Companies, 2002
3. Wilson K and Walker J, Principles and Techniques in Practical Biochemistry, 5th Ed., Cambridge University Press, 2000.
4. Holtzhauer M, Basic Methods for the Biochemical Lab, Springer, 2006.

Nigam, Lab Manual in Biochemistry: Immunology and Biotechnology, Tata McGraw-Hill Education, 2007.

5. Lab manual

OUTCOME:

- On the completion of the above experiments students will be able to handle DNA samples and also to isolate, purify and visualize nucleic acid.
- On performing the above experiments students will be able to know and perform the routine biochemical assays.
- Students will be able to isolate culture and identify microbes and also to efficiently use light microscope.

SEMESTER II

GEC6202 RESEARCH METHODOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

MODULE I RESEARCH METHODOLOGY-AN INTRODUCTION 09

Meaning of Research, Objectives of Research, Motivation in Research, Types of Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Criteria of Good Research, Problems Encountered by Researchers. Ethics and scientific conduct, Introduction to ethics, scientific conduct and misconduct, Misconduct and why it occurs, Fabrication, Authorship issues, The investigation and punishment of scientific misconduct.

MODULE II GOOD LABORATORY PRACTICES AND SAFETY 09

Introduction: History, definition, Principles, Good Laboratory Practices (GLP) and its application GLP training: Resources, Rules, Characterization, Documentation, quality assurance, Resources, Facilities: building and equipment, Personnel, GLP and FDA, Stepwise implementation of GLP and compliance monitoring.

MODULE III LABORATORY SAFETY AND EXPERIMENTAL RESEARCH 09

Safety in the Biology Laboratory, Safety Symbols, Science Safety Rules- Dress Code, First Aid, Heating and Fire Safety, Using Chemicals and glassware's, Handling living organisms, handling human blood and some other body fluids and tissue, disposal of bio hazardous waste.Precision, accuracy, sensitivity and specificity; variables, experimental planning – general guidelines

MODULE IV INTERPRETATION OF RESULTS AND ANALYSIS: 09

Importance and scientific methodology in recording results, importance of negative results, different ways of recording, industrial requirement, artifacts versus true results, types of analysis (analytical, objective, subjective) and cross verification, correlation with published results, discussion, outcome as new idea, hypothesis, concept, theory, model etc. Data analysis using Excel, Origin and Sigma plot Analyzing the chemical data and drawing chemical structures using Chemdraw and Chemsketch. Conceptions of error of measurement, true score theory and generalisability theory. Measures of central tendency or averages – mean median and mode. Measures of dispersion – range,

variance, and standard deviation: The normal distribution and the normal probability curve.

MODULE V SCIENTIFIC WRITING, TECHNICAL PUBLICATION AND RESEARCH PROPOSAL 09

Different types of scientific and technical publications in the area of research, and their specifications, Ways to protect intellectual property – Patents, technical writing skills, definition and importance of impact factor and citation index - assignment in technical writing, The research problem, finding related literature, computer generated references sources and the research project, model research proposal.

Total hours: 45

TEXT BOOKS AND REFERENCES:

1. Essentials of Research Design and Methodology Geoffrey R. Marczyk, David DeMatteo, David Festinger, 2005 John Wiley & Sons Publishers, Inc
2. Biochemical Calculations: How to Solve Mathematical Problems in General Biochemistry, 2nd Edition, Irwin H. Segel, 1976 John Wiley & Sons Publishers, Inc
3. Guide to Publishing a Scientific paper, Ann M. Korner, 2004, Bioscript Press.
4. P Laake, H B Benestad, B R Olsen. Research Methodology in the medical and biological sciences. Academic Press, 2007.
5. R Arora. Encyclopaedia of Research Methodology in Biological Sciences. Anmol Publishing, 2004.
6. Kothari C.R., Research Methodology, Methods and Techniques, Wiley Eastern Ltd., New, Delhi, 1991.
7. Coghill M. and Gardson L.R., The ACS Style Guide Effective Communication of Scientific, Information, 3rd Edn., Oxford University Press, 2006.
8. Willa Y. Garner, Maureen S. Barge, James, P, Good Laboratory Practice Standards:
9. Applications for Field and Laboratory Studies (ACS Professional References Book).

OUTCOMES:

LSC6201 IMMUNOLOGY

L	T	P	C
4	0	0	4

OBJECTIVES:

- The course is aimed at introducing the science of immunology and detailed study of various types of immune systems and their classification structure and mechanism of immune activation**.**

MODULE I OVERVIEW OF IMMUNE SYSTEM 04

Innate, adaptive and Comparative ImmModule y, Immune dysfunction and its consequences, Cells & Tissues of Immune System:Hematopoisesis, Apoptosis and Necrosis, systemic function of Immune system, organs of immune systems, Lymphoid cells and organs Evolutionary comparision. Cytokines- Properties of Cytokines, Cytokine Receptors, Cytokine Antagonists, Cytokine Secretion by TH1 and TH2 Subsets, Cytokine-Related Diseases, Therapeutic Uses of Cytokines and Their Receptors, Cytokines in Hematopoiesis

MODULE II MOLECULAR IMMUNOLOGY 05

Immunogenicity Versus Antigenicity, Factors that influence immunogenicity, Epitopes, Haptens and the Study of Antigenicity, Pattern-Recognition Receptors, drugs allegies-when medicine become immunogens, Molecular structure of antibody, Obstacles to Antibody Sequencing, Immunoglobulin Fine Structure, Antibody-Mediated Effector Functions, Antibody Classes and Biological Activities, Antigenic Determinants on Immunoglobulins, The B-Cell Receptor, The Immunoglobulin Superfamily, Monoclonal Antibodies.

MODULE III ORGANIZATION AND EXPRESSION OF IMMUNOGLOBULIN GENES 09

Genetic Model Compatible with Ig Structure, Multigene Organization of Ig Genes, Variable-Region Gene Rearrangements, Mechanism of Variable-Region DNA Rearrangements, Generation of Antibody Diversity, Class Switching among Constant-Region Genes, Expression of Ig Genes, Synthesis, Assembly, and Secretion of Immunoglobulins, Regulation of Ig-Gene Transcription, Antibody Genes and Antibody Engineering

MODULE IV ANTIGEN PROCESSING AND PRESENTATION 09

General organization and inheritance of the major histocompatibility complex (MHC), MHC molecules and genes, detailed genomic map of MHC genes, cellular distribution of MHC molecules, regulation of MHC expression, MHC and immune responsiveness, MHC and disease susceptibility self-MHC restriction of T cells, role of antigen-

presenting cells, evidence for two processing and presentation pathways, endogenous antigens: the cytosolic pathway,exogenous antigens: the endocytic pathway presentation of nonpeptide antigens

MODULE V GENERATION OF T AND B CELL RESPONSE 09

T-Cell Receptor, Early Studies of the T-Cell Receptor and αβ andγΔ T-Cell Receptors: Structure and Roles, Organization and Rearrangement of TCR Genes, T-Cell Receptor Complex: TCR-CD3,T-Cell Accessory Membrane Molecules, Three-Dimensional Structures of TCR-Peptide-

MHC Complexes,Alloreactivity of T Cells, T-Cell Maturation and the Thymus,Thymic Selection of the T-Cell Repertoire,T_H-Cell Activation, T-Cell Differentiation, Cell Death and T-Cell Populations Peripheral γΔ T-Cells, B-Cell Maturation,B-Cell Activation and Proliferation, The Humoral Response, In Vivo Sites for Induction of Humoral Responses, Germinal Centers and Antigen-Induced B-Cell Differentiation, Regulation of B-Cell Development, Regulation of the Immune Effectors Response.

Total hours: 45

REFERENCES

1. Kuby, RA Goldsby, Thomas J. Kindt, Barbara, A. Osborne Immunology, 6th Edition, Freeman, 2002.
2. Brostoff J, Seaddin JK, Male D, Roitt IM., Clinical Immunology, 6th Edition, Gower Medical Publishing, 2002.
3. Janeway et al., Immunobiology, 4th Edition, Current Biology publications., 1999.
4. Paul, Fundamental of Immunology, 4th edition, Lippenco

OUTCOMES:

After completing the course students will:

- have a detailed understanding of Component of immModule y
- know antigen presentation on a detailed molecular level
- understand the concept immunology and the immune system .
- have a in depth knowledge of the cellular and molecular basis for autoimmune disease and allergies.
- have basic knowledge of tumor immunology and the development of novel recombinant antibodies for treatment of cancer and autoimmune disease

LSC6202 BIOINFORMATICS

L	T	P	C
4	0	0	4

OBJECTIVES:

- To understand the programming languages applied in computational biology.
- To understand the methods and applications for sequence analysis, Phylogenetics and Protein modelling.

MODULE I INTRODUCTION TO PROGRAMMINB LANGUAGE 09

Introduction –Programming languages – Problem solving Technique: Algorithm, Flowchart, Compiling, Testing and Debugging - Basic Perl Data Types, File handle and File Tests – Perl Modules – SQL.

MODULE II PROGRAMMING IN C, C++ AND OOPS 09

C language Introduction – Tokens – Keywords, Identifier, Variables, Constants, Operators – Structure of a ‘C’ program - Expression – Data types – Control Statement - C++programming – Object Oriented Concept: Encapsulation,Inheritance, Polymorphism.

MODULE III COMPUTATIONAL BIOLOGY AND SEQUENCE ANALYSIS 09

Molecular sequences, Genome sequencing: pipeline and data, Next generation sequencing data, Biological databases: Protein and Nucleotide databases, Sequence Alignment, Dynamic Programming for computing edit distance and string similarity, Local and Global Alignment, Needleman Wunsch Algorithm, Smith Waterman Algorithm, BLAST family of programs, FASTA algorithm, Functional Annotation, Progressive and Iterative Methods for Multiple sequence alignment, Applications.

MODULE IV PHYLOGENETICS 09

Introduction to Phylogenetics, Distance and Character based methods for phylogenetic tree construction: UPGMA, Neighbour joining, Ultrametric and Min ultrametric trees, Parsimonous trees, Additive trees, Bootstrapping.

MODULE V PROTEIN STRUCTURE, MODELLING AND SIMULATIONS 09

Protein Structure Basics, Visualization, Prediction of Secondary Structure and Tertiary Structure, Homology Modeling, Structural Genomics, Molecular Docking principles and applications, Molecular dynamics simulations

Total Hours: 45

REFERENCES:

1. Dan Gusfield. Algorithms on Strings Trees and Sequences, Cambridge University Press.
2. David W. Mount Bioinformatics: Sequence and Genome Analysis, Cold Spring Harbor Laboratory Press, Second Edition, 2004.
3. Arthur M. Lesk, Introduction to Bioinformatics by Oxford University Press, 2008.
4. Tisdall, James, Beginning PERL for Bioinformatics, O'Reilley Publications, 2001.
5. Andrew R. Leach, Molecular Modeling Principles and Applications, Second Edition, Prentice Hall.
6. Baldi, P., Brunak, S. Bioinformatics: The Machine Learning Approach, 2nd ed., East West Press, 2003
7. Baxevanis A.D. and Oullette, B.F.F. A Practical Guide to the Analysis of Genes and Proteins, 2nd ed., John Wiley, 2002

OUTCOMES:

- At the end of this course, students will have been familiarized with language skills and their applications in analyzing Protein structure , sequence analysis which can be used in analyzing the binding effect of drugs on proteins.

LSC6203 LAB II (IMMUNOLOGY/ BIOINFORMATICS)

L	T	P	C
0	0	6	3

OBJECTIVES:

- To acquire knowledge on immunological techniques
- To train in various techniques involving antigen and antibody reactions
- To get hands on experience on plasmid construction, mappings and analysis.
- To explore to various tools in bioinformatics.

LIST OF EXPERIMENTS:

1. Double diffusion, Immuno-electrophoresis and Radial Immuno diffusion.
2. Antibody titre by ELISA method.
3. ELISA for detection of antigens and antibodies-DOT ELISA
4. Blood group mapping
5. Preparation of antigens from pathogens and parasites
6. Slide and tube agglutination reaction
7. Plasmid Construction/Restriction Mapping
8. PCR Primer Designing
9. Sequence Retrieval and Format Conversion
10. Homology Search/ Multiple Sequence Alignment
11. Motif finding in DNA and Protein Sequences
12. Protein Secondary Structure Prediction
13. Accessing Data- Use FORMATTED, LIST and COLUMN input to read raw data files, Combine SAS data sets using the DATA step.
14. Creating Data Structures- Create temporary and permanent SAS data sets, Control with observations and variables in a SAS data set are processed and output Managing Data- Investigate SAS data libraries using base SAS utility procedures.
15. Generating Reports- Generate list reports using the PRINT and REPORT procedures, Generate HTML reports using ODS statements.
16. Handling Errors- Identify and resolve programming logic errors, syntax errors, data errors.

REFERENCES:

1. Rose et al., Manual of Clinical laboratory Immunology, 6th Ed ASM Publications, 2002.
2. Lefkovis and Pernis. Immunological methods. Academic Press, 1978.
3. Hudson L. and Hay F.C. Practical Immunology. Black Well publishers, 1989
4. Rashidi H, Buehler L. K. Bioinformatics Basics: Applications in Biological Science and Medicine. 2nd Ed., CRC Press, 2005.

5. Baxevanis A. D, Ouellette B. F. F. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins. 3nd edition Wiley, John & Sons, Incorporated, 2004.
6. Krawetz S. A, Womble D. D. Introduction to Bioinformatics: A Theoretical and Practical Approach. Humana press, 2003

OUTCOMES:

- Students could independently perform diagnostics assays involving antigen-antibody reaction. They also learn to perform the qualitative and quantitative analysis using antibody.
- Students will be familiar with various soft skills/tool used in understating modern biology. They will also be able to analyze and interpolate data starting from PCR primer designing to structure predictions.

SEMESTER III

LSC7142 CLINICAL BIOCHEMISTRY

L	T	P	C
3	0	0	3

OBJECTIVES:

- This course aims to elucidate the clinical implications of the different metabolic pathways of biochemistry thus enable the students to understand the physiological implications of the different biochemical pathways.

MODULE I CELL STRUCTURE AND CLINICAL CORRELATION OF ORGANELLES 09

Eukaryotic Cell Compartments and Their Major Functions. Clinical correlations of Mitochondrial (Luft's disease), Lysosomal (Gout, lysosomal acid lipase deficiency) and Peroxisomal (Zellweger Syndrome) disfunction. Membrane fluidity in diseases conditions. Ion Channels and cystic fibrosis and Mitochondrial Myopathies.

MODULE II PROTEINS AND ENZYMES—CLINICAL CORRELATIONS 09

Plasma Proteins in Diagnosis of Disease. Use of Amino Acid Analysis in Diagnosis of Disease—Phenylketoneuria, Cystinuria, Hartnup disease and Fanconi's syndrome. Clinical implications of abnormal protein synthesis-- Ehlers–Danlos syndrome, osteogenesis imperfecta, and scurvy. Alteration in protein structure and its clinical impact—Sickle Cell Anemia and Glycosylated Hemoglobin.

Physiological effect of Km (alcohol sensitivity), Coenzyme Binding Site (Cystathioninuria), thermal stability (Hemolytic Anemia), pH optima (alcohol sensitivity) of an enzyme.

MODULE III CARBOHYDRATE METABOLISM—CLINICAL CORRELATIONS 09

Impaired glycolysis and TCA cycle--Arsenic Poisoning, Lactic Acidosis, Pyruvate Kinase Deficiency and Hemolytic Anemia, Pyruvate Dehydrogenase Deficiency, Fumarase Deficiency,Leigh disease, Cyanide Poisoning and Hypoxic Injury. Glycogen Storage Diseases and Von Gierke's Disease.

MODULE IV LIPID METABOLISM—CLINICAL CORRELATIONS 09

Genetic Deficiencies in—Carnitine Transport or Carnitine Palmitoyltransferase, AcylCoA Dehydrogenases and Diabetic Ketoacidosis.

Physiological implications of lipid levels—Respiratory Distress Syndrome, Atherosclerosis and Treatment of Hypercholesterolemia.

MODULE V METABOLIC INTERRELATIONSHIP 09

Pathogenesis, laboratory diagnosis, prophylaxis and treatment of the diseases caused by Bacteria, (Staphylococcus; Streptococcus; Neisseria; Bacillus; Corynebacterium; Clostridium; Enterobacteriaceae family) fungi (Entamoeba; Giardia; Trichomonas; Plasmodium; Trypanosoma) and viruses (Chicken pox, Rabies virus, common cold, hepatitis, meningitis, encephalitis, AIDS, SARS).

Total Hours: 45

REFRENCES

1. Textbook of Biochemistry with Clinical Correlations: Fourth Edition; Edited by Thomas M. Devlin, Ph.D. WileyLiss, Inc.
2. Nelson D.L, Cox M. M. Lehninger's Principle of Biochemistry. 5th Ed.,W. H. Freeman, 2008.
3. Biochemistry by LubertStryer 7th ed. W. H. Freeman & Company.

OUTCOMES:

- At the end of the course students will be able to demonstrate an in-depth knowledge about the role of the various metabolic processes involving the different biomolecules and their role in maintaining the physiological homeostasis of human body.

LSC7143 GENOMICS, PROTEOMICS AND METABOLOMICS

L	T	P	C
4	0	0	4

OBJECTIVES:

- Genomics, proteomics and metabolomics with their applications deals with a rapidly evolving scientific area that introduces students into genomes, proteomes and metabolites that store various data about genes, proteins, genomes and proteomes. The main objective is to organize the large amount of information about genomics, proteomics and metabolomics and offer basic knowledge of genome sequencing, major differences between prokaryotic and eukaryotic genomes, basic proteomics and its applications.

MODULE I STRUCTURAL PROPERTIES 09

Structural organization of genome in Prokaryotes and Eukaryotes; Organelle DNA-mitochondrial, chloroplast; DNA sequencing-principles and translation to large scale projects; Recognition of coding and non-coding sequences and gene annotation; Tools for genome analysis-RFLP, DNA fingerprinting, RAPD, PCR, Linkage and Pedigree analysis-physical and genetic mapping.

MODULE II GENOMICS 09

Genome sequencing projects Microbes, plants and animals; Accessing and retrieving genome project information from web; Comparative genomics, Identification and classification using molecular markers-16S rRNA typing/sequencing, ESTs and SNPs.

MODULE III PROTEOMICS 09

Proteomics, Protein analysis (includes measurement of concentration, amino-acid composition, N-terminal sequencing); 2-D electrophoresis of proteins; Microscale solution isoelectricfocusing; Peptide fingerprinting; LC/MS-MS for identification of proteins and modified proteins; MALDI-TOF; SAGE and Differential display proteomics, Protein-protein interactions, Yeast two hybrid system.

MODULEIV PHARMACOGENETICS 05

Pharmacogenetics High throughput screening in genome for drug discovery-identification of gene targets, Pharmacogenetics and drug development

MODULEV FUNCTIONAL GENOMICS, PROTEOMICS AND METABOLOMICS 13

Analysis of microarray data; Protein and peptide microarray-based technology; PCR-directed protein in situ arrays; Structural proteomics, Proteomics and metabolomics, Medical focus: Ovarian cancer. How proteomics can be used to find biomarkers for

diseases for which none exist., Different spectroscopic methods, Data produced by each method, Protein identification, quantitation, function. The US Food and Drug Administration criteria for biomarkers,Future technologies.

Total Hours:

REFERENCES:

1. Voet D, Voet JG & Pratt CW, Fundamentals of Biochemistry, 2nd Edition. Wiley 2006
2. Brown TA, Genomes, 3rd Edition. Garland Science 2006
3. Campbell AM &Heyer LJ, Discovering Genomics, Proteomics and
4. Bioinformatics, 2nd Edition. Benjamin Cummings 2007
5. Primrose S &Twyman R, Principles of Gene Manipulation and Genomics, 7th Edition,

OUTCOMES:

- The information obtained during the course should be helpful to those students who want to work in core facilities and commercial biological laboratories as well as in postgraduate studies.

LSC7144 LAB III (CLINICAL BIOCHEMISTRY /OMICS)

L	T	P	C
0	0	6	3

OBJECTIVES:

- To give hands-on training on the clinical biochemistry parameters like SGOT, SGPT, alkaline phosphatase, acid phosphatase, bilirubin etc….
- To understand the mechanism of enzyme reactions,

EXPERIMENTS:

1. Estimation of SGOT in blood sample
2. Estimation of SGPT in blood sample
3. Estimation of alkaline phosphatase in blood sample
4. Estimation of acid phosphatase in blood sample
5. Estimation of bilirubin in blood sample
6. Estimation of Na+, K+ & Ca++
7. Estimation of common parameters in urine
8. Biochemical tests for anemia.
9. Detection / Estimation of C-reactive proteins.
10. Preparation of DNA from prokaryotes and eukaryotes.
11. Synthesis and sequencing of DNA.
12. Isolation of plasmids from E.coli cells.
13. Agarose gel electrophoresis of plasmid and chromosomal DNA.
14. Restriction endonuclease digestion of plasmid and chromosomal DNA of E. coli cells.
15. DNA ligation methods. Construction of recombinant DNA.
16. Transformation of competent E. coli cells. Colony hybridisation. Southern blotting.

REFERENCES:

1. Lab Manual

OUTCOMES:

- At the end of the course students will be able to demonstrate an in-depth knowledge about the role of the various metabolic processes involving the different biomolecules and their role in maintaining the physiological homeostasis of human body.

LIST OF ELECTIVES

SEMESTER I

		L	T	P	C
LSCY101	**BIOSAFETY, BIOETHICS, BIOENTREPRENEURSHIP, INTELLECTUAL PROPERTY RIGHTS**	**3**	**0**	**0**	**3**

OBJECTIVES:

- Developing a good work ethics and laboratory working condition
- Understanding the importance of following and maintaining laboratory safety guidelines

MODULE I ETHICS IN BIOLOGY 09

The legal and socioeconomic impacts of biotechnology - Public education of the processes of biotechnology involved in generating new forms of life for informed decision making - Biosafety regulation and national and international guidelines - rDNA guidelines

MODULE II BIOSAFETY 09

Experimental protocol approvals - levels of containment - Environmental aspects of biotech applications - Use of genetically modified organisms and their resistance in environment - Special procedures for r-DNA based product production

MODULE III MARKETING 09

Assessment of market demand for potential product(s) of interest; Market conditions, segments; Prediction of market changes; Identifying needs of customers including gaps in the market, packaging the product; Market linkages, branding issues; Developing distribution channels; Pricing/Policies/Competition; Promotion/Advertising; Services Marketing

MODULE IV INTELLECTUAL PROPERTY RIGHTS 09

Intellectual property rights - TRIP International conventions patents and methods of application of patents - Legal implications - Biodiversity and farmers rights - Beneficial applications' and development of research focus to the need of the poor - Identification of directions for yield effect in agriculture, aquaculture Bioremediation etc.

MODULE V PATENT SYSTEM 09

Objectives of the patent system - basic principles and general requirements of patent law - biotechnological inventions and patent law - legal development - patentable

subjects and protection in biotechnology - The patentability of microorganisms - IPR and WTO regime - consumer protection and IPR - IPR and plant genetic resources - GATT and TRIPS.

Total Hours: 45

REFERENCES:

1. Beier,F.K.,Crespi,R.S. and Straus,J. *Biotechnology and Patent protection*-Oxford and IBH Publishing Co.New Delhi.
2. Sasson A, *Biotechnologies and Development*, UNESCO Publications.
3. Singh K, *Intellectual Property rights on Biotechnology*, BCIL,NewDelhi.

OUTCOMES:

- At the end of the course student will develop an idea about the importance of good laboratory practice in high quality research. They will also develop awareness about the basic fundamental safety measures that a researcher should follow in laboratory.

LSCY102 MICROBIOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To expose the fundamentals and scope of microbiology.
- To learn the classification of bacteria, Virus, Fungi & Protozoa
- Learn microbial culture and disease related to microbes.

MODULE I INTRODUCTION TO MICROBIOLOGY 09

History and scope of microbiology- Classification of microorganisms-bacteria, fungi, virus, alga, protozoa- sterilization techniques, disinfectant and antiseptic agents. Microscopy - types of microscopes and their applications-simple and compound, bright field, dark field, fluorescence, phase-contrast and electron microscopes.

MODULE II BACTERIOLOGY 09

Major groups of bacteria- Archaebacteria, Actinomycetes, chemoautotrophs, eubacteria, Pseudomonads, cyanobacteria, rickettsias, chlamydias and spirochetes- Bacterial cell-structure and functions of cellular components cell wall composition of Gram positive and Gram negative bacteria, sub-cellular organizations, flagella, capsule and spores-bacterial staining-antimicrobial
agents-antibiotics, chemotherapeutic drugs-antibacterial agents-mode of action-antibiotic resistance.

MODULE III VIROLOGY 09

Classification, morphology and characteristics of virus, fungi and Protozoa. Structure of DNA and RNA viruses, viral replication, Bacteriophages- lysogeny and lytic cycle- virus like agents-satellites, viroids and prions, antiviral and antifungal drugs. Classification of Helminthic parasites- Life cycle of malarial and filarial parasites.

MODULE IV CULTURING OF MICROORGANISMS 08

Microbial culture, continuous and synchronous culture- composition of culture media - solid and liquid media, chemically defined media, complex and differential media- Effect of PH, temperature and radiation on microbial growth.

MODULE V MICROBES AND DISEASES 10

Major human diseases caused by bacterial, viral and fungal pathogens Diseases of the respiratory tract-diphtheria, tuberculosis, pneumonia, influenza, mumps- Diseases of the skin-systemic mycoses, candidiasis- herpes viral infections, chicken pox, zoster and small pox- Genito-urinary infections- Gonorrhea, syphilis, leptospirosis, and AIDS-

trichomoniasis- Diseases of GITCholera, ETEC and EIEC infections- shigellosis- Typhoid- Hepatitis,
gasteroenteritis. Major human protozoan diseases-Malaria, Amebiasis, Toxoplasmiases.

Total Hours: 45

REFERENCES:

1. Prescott, Harley and Klein, Microbiology, 5th Edition- Publisher: mcgraw Hill science 2002.
2. Gerard J. T, Berdell R. F, Christine L. C, Microbiology: An Introduction, 8th Edition, Benjamin Cummings, 2004.
3. Kenneth J. R,George R, John C. S, Medical Microbiology: An Introduction to Infectious Diseases, mcgraw-Hill Professional, 2003.

OUTCOMES:

- On the completion of the above objectives student will be able to learn the fundamentals and scope of microbiology, classification of Protozoa, bacteria, Fungi Virus, microbial culture and diseases.

LSCY10 FOOD PROCESS TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To explore about food process and technology.
- To get overview of processing of various types of food
- To expose themselves to storage and handling of food and food products.

MODULEI STORAGE AND HANDLING OF CEREALS 09

Infestation control; Drying of grains, Processing of rice and rice products. Milling of wheat and production of wheat products, including flour and semolina. Milling of corn, barley, oat, coarse grains including sorghum, ragi and millets; Processing of tea, coffee and cocoa.

MODULE II FRESH FRUITS AND VEGETABLES 09

Preservation of fruits and vegetable by heat treatment. Production and preservation of fruits and vegetable juices, preservation of fruit juice by hurdle technology. Non-alcoholic beverages; Food Laws, food rules and standards, Statistical Quality Control; Various types of packaging.

MODULEIII SEA FOOD 09

Commercial handling, storage and transport of raw fish; Average composition of fish; Freshness criteria and quality assessment of fish; Spoilage of Fish; Methods of Preservation of fish: Canning, Freezing, Drying, Salting, Smoking and Curing. Quality control of processed fish; Fish processing industries in India.

MODULEIV ANIMAL PRODUCT 09

Slaughtering technique of animal; Meat cuts and portions of meat, muscle; Color of meat; Post mortem changes of meat; Meat processing - curing and smoking; fermented meat products (meat sausages & sauces); Frozen meat & meat storage. Classification of poultry meat; Composition and nutritional value of poultry meat &eggs ; Processing of poultry meat and eggs; Spoilage and control; Byproduct utilization and future prospects; Poultry farms in India.

MODULE V DIARY PRODUCT 09

Composition of milk; Varieties of milk; Checks for purity of milk; Handling of fresh milk. Pasteurization of milk; HTST and UHT techniques; Packaging of milk; Fermentation of milk and fermented milk products. Manufacture of milk products like evaporated milk, powder milk, condensed milk, cream butter, cheese, yogurt, ice cream, ghee, baby food

and sweet meat. Quality control of milk and milk products; Milk plant hygiene and sanitation.

Total Hours: 45

REFERENCES:

1. Principles of Food Science, Vol-I by FennmaKarrel
2. Modern Dairy Products, Lampert LH; 1970, Chemical Publishing Company.
3. Developments in Dairy Chemistry – Vol 1 & 2;
4. Processed Meats; Pearson AM & Gillett TA; 1996, CBS Publishers.
5. Meat; Cole DJA & Lawrie RA; 1975, AVI Pub.
6. Post Harvest Technology of cereal pulse and oil seeds by Chakraborty, AC
7. Egg and poultry meat processing; Stadelman WJ, Olson VM, Shemwell GA & Pasch S; 1988, Elliswood Ltd.
8. Preservation of Fruits & Vegetables by Girdhari Lal, Sidhapa and Tandon
9. Developments in Meat Science – I & II, Lawrie R; Applied Science Pub. Ltd.
10. Egg Science & Technology; Stadelman WJ &Cotterill OJ; 1973, AVI Pub.
11. Technology of Food Preservation by Desrosier Fish as Food; Vol 1 & 2; Bremner HA; 2002, CRC Press.
12. Fish & Fisheries of India; Jhingram VG; 1983, Hindustan Pub Corp.
13. Robinson RK; 1996; Modern Dairy Technology, Vol 1 & 2; Elsevier Applied Science Pub.
14. Milk & Milk Processing; Herrington BL; 1948, McGraw-Hill Book Company.
15. Fox PF; Applied Science Pub Ltd. Outlines of Dairy Chemistry, De S; Oxford.

OUTCOMES:

- On the completion of the above objectives student will have a sound knowledge on the various techniques involved in food processing, storage and handling of food and food products.

LSCY104 ANALYTICAL TECHNIQUES

L	T	P	C
3	0	0	3

OBJECTIVES:

- The students will be exposed to basic concepts related with techniques and instrumentation widely used in Biotechnology.

MODULE I CALORIMETRY AND SPECTROSCOPY 09

Properties of electromagnetic radiations, interaction with matter. Ultraviolet spectroscopy: Origin of UV spectra, types of transition, chromophore & related terms, choice of solvent, instrumentation and applications Infra-red spectroscopy: Origin of infra-red spectra, modes of vibrations, instrumentation, sampling technique and applications; Nuclear magnetic resonance spectroscopy: Mass Spectroscopy: Origin, Instrumentation, types of ions produced, interpretation and applications of mass spectra GCMS, LCMS & MSMS.

MODULE II CENTRIFUGATION AND MICROSCOPY 09

Principle of centrifugation, rotors, different types of centrifuges, preparative and analytical centrifugation, ultra centrifugation. Optical microscopy, Bright field, Dark field, phase contrast and fluorescence microscopy. Electron microscopy: Transmission and scanning electron microscopy, Atomic force microscopy.

MODULE III ELECTROPHORESIS 09

General principle, support media. Agarose gels, polyacrylamide gels. SDS PAGE, 2D PAGE Pulsed field gel electrophoresis Iso-electric focusing Capillary electrophoresis

MODULE IV RADIOISOTOPE TECHNIQUES 09

Study of radioisotopes in biological samples, proportional and GM counter, scintillation counters, autoradiography, radio –immunoassay.

MODULE V CHROMATOGRAPHY 09

Introduction: Chromatography theory and practice. Paper chromatography. Thin layer chromatography. Ion exchange chromatography. Affinity chromatography. Partition chromatography. Adsorption chromatography. Introduction to gas chromatography and HPLC. Permeation.

Total Hours:

REFERENCES:

1. Pierre C. ORD and CD in chemistry and biochemistry: An Introduction. Academic

Press, 1972.
2. Paddock S. W. Confocal Microscopy methods & protocols.1st Ed., Human Press, 1999.
3. Murphy D. B. Fundamental of Light Microscopy & Electron Imaging. 1st Ed., Wiley-Liss, 2001.

OUTCOMES:

- At the end of the course, the students will have sufficient scientific understanding of the basic concepts in instrumentation used in Biotechnology.

LSCY105 ENVIRONMENTAL BIOTECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn the environment protection Act and Law related to environmental biotechnology
- To give basic idea on environmental sample analysis
- To understand the basic principles involved in waste water management
- To get the information on usage of Bioremediation-biotechnology
- To inform students about Biooxidation& microbial leaching

MODULE I INTRODUCTION TO ENVIRONMENTAL BIOTECHNOLOGY 09

Water, Soil and Air: their sources and effects. Removal of Specific Pollutants : Sources of Heavy Metal Pollution, Microbial Systems for Heavy Metal Accumulation, Biosorption& detoxification mechanisms. Environment protection Act: Environmentallaws, Environmentalpolicies, Environmentalethics. UN declaration. Environmental protection and conservation. Environmental Impact Assessment, Ecoplanning and Sustainable Development

MODULE II ENVIRONMENTAL SAMPLE ANALYSIS 09

Physicochemical and bacteriological analysis of soil and water, Problems associated with soil alkali soils, sodic soils, and solid waste, Fate of insecticides fungicides, pesticides in soil, use of genetically modified (insect- , pest- and pathogen resistant) plants. Ecotoxicology of soil pollutants, Municipal solid waste treatment strategies.

MODULE III WASTE WATER MANAGEMENT 09

Waste water constituents, Analysis and selection of flow rates and loadings, Process Selection, Physical unit operations, Chemical unit operations, Fundamentals of biological treatment, Role of biotechnology in water purification systems. Types and kinetics of biological treatment, Advanced waste water treatment, Biological Processes for Industrial and domestic effluent, Treatment, Aerobic Biological Treatment,Anaerobic Biological Treatment.

MODULE IV BIOREMEDIATION-BIOTECHNOLOGY 09

Bioremediation-Biotechnology for clean environment, Biomaterials as substitutes for non-degradable materials, Metal microbe interactions: Heavy Metal Pollution and impact on environment, Microbial Systems for Heavy Metal Accumulation, Biosorption, molecular mechanisms of heavy metal tolerance Bioindicators and biosensors for detection of pollution. Biotechnology for Hazardous Waste Management, Persistent

organic pollutants, Xenobiotics, Biological Detoxification of PAH, Biotechniques for Air Pollution Control. Solid Waste Management

MODULE V BIOOXIDATION & MICROBIAL LEACHING 09

Biooxidation – Direct and Indirect Mechanisms – Biooxidation Kinetics; Bacterial oxidation of Sphalerite, Chalcopyrite and Pyrite.; Extraction of metals from ores; Recovery of metals from solutions; Microbes in petroleum extraction; Microbial desulfurization of coal.

Total Hours: 45

REFERENCES:

1. Amann, R.I. Stromley, J. Stahl : Applied & Environmental Microbiology
2. Environmental Microbiology, W.D. Grant & P.E. Long, Blakie, Glassgow and London.
3. Microbial Gene Technology, H. Polasa (ED.) South Asian Publishers, New Delhi.
4. Biotreatment Systems, Vol. 22, D. L. Wise (Ed.), CRC Press, INC.
5. Standard Methods for the Examination of Water and Waste Water (14 th Education), 1985. American Public health Association

OUTCOMES:

On successful completion of this module, learners will be able to have:

- An understanding of environment protection regulations and source of environmental pollutions.
- The capability to apply advanced knowledge on environmental sample analysis
- The capability to apply avalanched discipline in waste water management
- The ability to formulate technique for bioremediation process
- An understanding of how biooxidation& microbial leaching helping in the industries.

LSCY106 SIRNA/RNA INTERFERENCE

L	T	P	C
3	0	0	3

OBJECTIVES:

- To get overview of gene regulation by gene silencing.
- To develop a detailed knowledge of siRNA and miRNA.
- To develop skill to understand molecular aspects of RNAi biology.
- To get familiar with technical applications of RNAi.

MODULE I INTRODUCTION TO GENE SILENCING 09

History of RNA interference, antisense RNA, mechanism, cosuppression in Petunia

MODULE II BASIC MECHANISM 09

dsRNA cleavage, RISC activation, dicer, argonaute, gene regulation by silencing,

MODULE III PHYSIOLOGY OF RNA INTERFERENCE 09

RNAi and immunity- antiviral mechanisms in plants, Drosophila, C. elegans, Downregulation and upregulation of genes

MODULE IV APPLICATIONS 09

Gene knockdown, functional genomics, medicine, therapeutic gen modulation, antiviral therapies, cancer, biosafety issues

MODULE V RNAI BIOTECHNOLOGY 09

Food industry- production of plant toxins, production of non-narcotic natural products, development as an insecticide, generation of transgenic plants, genome wide screening

Total Hours:

REFERENCES:

1. RNAi Technology. R K Gaur, CRC Press, 2011
2. RNA Interfernce: From biology to clinical applications by Wei Ping Min. Humana Press
3. RNA Silencing by EsraGalun. World Scientific Publishing Co. Pte. Ltd.

OUTCOMES:

At the end of this course students will be able to:

- Understand gene silencing mechanisms
- Understand types of RNAi
- Understand the applications of RNAi

SEMESTER II

LSCY201 RECOMBINANT DNA TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVE:

- To understand the basics of Recombinant DNA
- To learn applications of Recombinant DNA Technology

MODULE I CLONING & CLONING VECTOR 09

Types of cloning vectors viz. Plasmids, cosmids, ssDNA Phages, Yeast cloning vectors, Animal viruses, Ti plasmids and Cauliflower Mosaic Virus. Structural and Functional Organization of Plasmids, Plasmid Replication, Stringent and Relaxed Plasmids, Incompatibility of Plasmid Maintenance.

MODULE II MANIPULATION OF PURIFIED DNA 09

Enzymes involved in DNA Manipulation- Nucleases, Ligases, Polymerases and DNA modifying enzymes, Restriction endonucleases-Types, Blunt and sticky ends, Liagtion-Mode of action of DNA Ligase.

MODULE III CONSTRUCTION OF RECOMBINANT DNA 09

Preparation of competent cell-Transformation, transfection – Recombinant selection and screening- Genomic DNA library- cDNA synthesis strategies - Linkers - Adapters - Homopolymer tailing- Making genomic and cDNA libraries in plasmids and phages. PCR product cloning (TA cloning). Cloning strategies in yeast, E. coli and B. subtilis.

MODULE IV HYBRIDIZATION TECHNIQUES & MUTAGENESIS 09

DNA hybridization, colony hybridization and in-situ hybridization (Southern, Northern and Dot blots and immunological techniques Western blotting), Mutagenesis - Deletion mutagenesis, Oligonucletoide derived mutagenesis, Site directed mutagensis - Its applications- Applications of rDNA technology in Diagnostics.

MODULE V APPLICATIONS OF RDNA TECHNOLOGY 09

Gene Cloning and DNA analysis in Agriculture, Forensic Science and Medicine-Production of Recombinant pharmaceuticals, identification of genes responsible for human disease, Genetic Finger printing, Gene Therapy, Plant Genetic engineering, Problems with Genetically modified plants.

Total Hours: 45

REFERENCES:

1. Recombinat DNA Second eition by Watson
2. Gene Cloning and DNA analysis: An Introduction by T. A. Brown.

OUTCOMES:

- This course will introduce the students with the basics about genes, and approaches to manipulate the gene according to need such as production of therapeutic proteins in plants.

LSCY202 ADVANCED INSTRUMENTATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn the electrochemical techniques and principles of centrifugation and spectrophotometry.
- To learn the principles of chromatography and microscopy and their several aspects.
- To understand the information of radioactive methods, detection and measurement of radioactivity.

MODULE I ELECTROCHEMICAL TECHNIQUES 09

Basic principles of Electrochemical Techniques- - pH electrode, Ion selective- gas-sensing and oxygen electrodes- biosensors. Centrifugation- basic principles-instrumentation- Centrifugation- centrifugation units-types of centrifuges-colloidal nature of particles-centrifugation methods and accessories- sedimentation velocity-sedimentation equilibrium-cell fractionation methods.

MODULE II SPECTROPHOTOMETRY 09

Principles and techniques of colorimetry and spectrophotometry-Beer-Lamberts Law -instrumentation - qualitative and quantitative methods of analysis- hypo and hyper chromicity- coupled assays –Spectrofluorimetry-Turbidimetry - Flame and Atomic absorption Spectrophotometer and Mass spectrometer. Chromatography- types-column, thin layer, paper, adsorption, partition, gas, liquid, ion exchange, affinity, HPLC- principles of each type- instrumentation and accessories- detection methods and systems qualitative and quantitative aspects-applications.

MODULE III MICROSCOPY 09

Basic principles of Microscopy and application of Light, Compound, Phase contrast inverted microscopy; Scanning Electron Microscopy (SEM)- Transmission Electron Microscopy, (TEM)- Fluorescence Microscopy- Scanning Tunneling Microscopy-(STM)- Automated Fluorescence Microscopy - Confocal Microscopy.

MODULE IV ELECTROPHORESIS 09

Types of Electrophoresis- paper and gel-agarose and PAGE-pulsed field-capillary - isoelectric focusing- 2 D electrophoresis; blotting methods-Western- Southern and Northern- application-methods in life sciences.

MODULE V RADIOACTIVE METHODS 09

Types of radioisotopes-half life- units of radioactivity- uses of radioisotopes in life

sciences and biotechnology- detection and measurement of Radioactivity- liquid scintillation counting- solid state counting- Geiger counter - Radiation hazards Techniques and applications of Electron spin resonance- Nuclear magnetic resonance- Circular Dichroism (CD) - Optical Rotary Dispersion (ORD).

Total Hours:

REFERENCES:

1. Pierre C. ORD and CD in chemistry and biochemistry: An Introduction. Academic Press, 1972.
2. Paddock S. W. Confocal Microscopy methods & protocols.1st Ed., Human Press, 1999.
3. Murphy D. B. Fundamental of Light Microscopy & Electron Imaging. 1st Ed., Wiley-Liss, 2001.
4. Horst F. Basic One and Two-dimensional spectroscopy. VCH Publisher, 1991.
5. West E. S, Todd W. R, Mason H. S, Bruggen J. Textbook of Biochemistry. 4th Ed, Oxford and IBH Publishing Co, 1995.
6. Freifelder D. M. Physical Biochemistry- Application to Biochemistry and Molecular Biology, 2nd Ed., W.H. Freeman, 1982.

OUTCOMES:

- On the completion of the above objectives student will be able to know the electrochemical techniques and principles of centrifugation, spectrophotometry, chromatography and microscopy. They will have the information of radioactive methods.

LSCY203 MOLECULAR DIAGNOSTICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- Developing the basic concept of molecular diagnostics
- Understanding the common procedures and which are used in disease diagnosis
- To be familiar with various types of diseases diagnosis methods and progression of diagnosed disease.

MODULE I INTRODUCTION TO MOLECULAR DIAGNOSTICS 09

Collection, preservation and storage of clinical samples, biopsy, Principles, application and limitations of Biological assays used in diagnosis- PCR, ELISA, FISH, gene sequencing, microarrays, protein arrays. GLP, SOP and ethics in molecular diagnostics.

MODULE II INFECTIONS 09

Infection and mode of transmission, types of infectious diseases- bacterial and fungal infections, diagnosis of infections caused by Streptococcus, Coliforms, Salmonella, Shigella, Vibrio, and Mycobacterium- diagnosis of fungal infections, major fungal diseases, Dermetophytoses, Candidiosis and Aspergillosis. Diagnosis of DNA and RNA viruses- pox virus, rhabdo virus, hepatitis; virus diagnosis of protozoan diseases- amoebiosis, malaria, trypanosomiosis, leishmaniasis- study of helminthic diseases- Fasciola hepatica and Ascarislumbricoides. Filariasis and Schistosomiasis. Diagnosis of chicken guinea and swine flu.

MODULE III CLINICAL GENETICS 09

Chromosomes chemistry and packaging, Cytogenetic, Structural and numerical abnormalities of chromosomes, Chromosome bands, banding techniques , mutation and polymorphism analysis, human genome project, cancer genetics- oncogenes, tumor suppressor genes- gene therapy, genetic counseling, nucleic acid hybridization techniques, Disease linked with mitochondrial DNA Genetic linkage and chromosome and genetic mapping in human diseases, Prenatal

MODULE IV IMMUNODIAGNOSTICS 09

Introduction to immunodiagnostics, antigen-antibody reactions, antibody production, antibody markers, CD markers, FACS, Human Leukocyte Antigen (HLA) typing, agglutination (ABO/Bacterial), immunoprecipitation, immunodiffusion, flocytometer.

MODULE V FORENSIC SCIENCE 09

Introduction to Forensic Science, DNA fingerprinting / DNA Profiling / DNA Testing in Forensic Science.; Ethics, Rules and Procedures in DNA analysis. Autopsy and

toxicological diagnosis. Determination of Paternity- Human identification and sex determination. semen analysis , Case study.

Total Hours: 45

REFERENCES:

1. Tietz Textbook of Clinical Chemistry, Carl A. Burtis, Edward R. Ashwood,
2. Harcourt Brace & Company Aisa Pvt. Ltd.
3. Essentials of Diagnostic Microbiology, Lisa Anne Shimeld
4. The Science of Laboratory Diagnosis, Crocker Burnett

OUTCOMES:

- Learners will be able to define basic terminology and describes basic concepts in molecular diagnostics
- The students will know the importance and the relevance of molecular diagnostic techniques and applications of molecular diagnostics in various field including medical, forescenic, etc..

LSCY204 OMICS

L	T	P	C
3	0	0	3

MODULE I GENOMICS: **09**

Structural organization of genome in Prokaryotes and Eukaryotes; Organelle DNA-mitochondrial, chloroplast; DNA sequencing-principles and translation to large scale projects; Recognition of coding and non-coding sequences and gene annotation; Tools for genome analysis-RFLP, DNA fingerprinting, RAPD, PCR, Linkage and Pedigree analysis-physical and genetic mapping. Physical and Genetic Map, Genome Sequencing, Next generation sequencing methods, Genome Annotation, Functional Genomics.

MODULE II TRANSCRIPTOMICS AND PHARMACOGENETICS 09

Search for transcription factor binding sites,RNA-Seq, Microarrays, Regulatory RNAs: small or large, Computational prediction of miRNA target genes, RNA Darkmatter. High throughput screening in genome for drug discovery-identification of gene targets, Pharmacogenetics and drug development

MODULE III PROTEOMICS 09

Protein analysis (includes measurement of concentration, amino-acid composition, N-terminal sequencing); 2-D electrophoresis of proteins; Microscale solution isoelectricfocusing; Peptide fingerprinting; LC/MS-MS for identification of proteins and modified proteins; MALDI-TOF; SAGE and Differential display proteomics, Protein identification by peptide mass fingerprinting, Protein-protein interactions, Yeast two hybrid system, Applications of proteomics.

MODULE IV METABOLOMICS AND LIPIDOMICS 09

Fundamental concept - Carbohydrate, Lipid, Protein and Nucleic Acid metabolism. Plant Metabolism. Tools of metabolomics- Capillary electrophoresis, Gas chromatography, Electrochemical detectors, mass spectrometry, Case studies. Lipidomics - Basic concepts and tools Case studies

MODULE V SYSTEMS BIOLOGY AND BIOINFORMATICS. DEGRADOMICS 09

Techniques and concepts, Approaches to identify the protease and protease-substrate repertoires, or 'degradomes', on an organism-wide scale, Uncover new roles for proteases in vivo. Identification of new pharmaceutical targets to treat disease (Emerging degradomics)

Total Hours:

REFERENCES:

1. Introduction to Proteomics -Tools for the New Biology by Daniel C. Liebler, Humana Press.
2. Mass Spectrometry for Biotechnology by Gary Siuzdak, Academic Press.
3. Proteomics for Biological Discovery by Timothy Veenstra and John Yates, Wiley.
4. Metabolomics- Methods and Protocols by Wolfram Weckwerth, Humana Press.
5. Lipidomics- Technologies and Applications by Kim Ekroos, Wiley-VCH.
6. Web/Journal Resources.
7. Transcriptomics: Expression Pattern Analysis, VirendraGomase, Somnath Tagore; VDM Publishing, 2009 – Science

OUTCOMES:

LSCY205 BIOFUELS AND BIOENERGY

L	T	P	C
3	0	0	3

OBJECTIVE

- This course will provide learning in various The course will provide students, with hands-on technical exposure to various Biofuels related science & technology topics, background & literature information besides addressing the environmental, economical, social and other Biofuels related issues.

MODULE I BIOCHEMISTRY OF BIOMASS 09

biomass (e.g. wood waste, forestry residues, agricultural residues, perennial annual crops, organic municipal solid waste). Long-term sustainability and reliability of feedstock supply; feedstock quality, minimizing feedstock cost and regional/climatic considerations of the process chain. Composition of lignocellulose (lignin, hemicellulose, cellulose); energy crops; chemical pretreatment; enzymatic pretreatment; degradation of lignocellulose by fungi and bacteria; degradation of lignin; the role of peroxidases; degradation of cellulose; trichodermacellulases; bacterial cellulases; and comparison with degradation of high starch crops.

MODULE II BIO DIESEL 09

sources and processing of biodiesel (fatty acid methyl ester); nature of lipids, especially fatty acids and triglycerides. Sources and characteristics of lipids for use as biodiesel feedstock; and conversion of feedstock into biodisel (transesterification). Use of vegetable oil (SVO) and waste vegetable oil (WVO). Engineering, economics and environmental issues of biodisel; components and operation of a biodiesel processing system; standards for biodiesel quality; safety procedures needed to work with biodiesel in both domestic and shop environments; and major policies and regulations pertaining to the production, distribution, and use of biodiesel.

MODULE III BIOENERGY SYSTEMS 09

Course content includes overview of bioenergy systems from resource, conversion technologies to final product. Bioenergy conversion technologies and systems for heat, power, and bio-fuels. Cogeneration and polygeneration. Innovative cycles (such as biomass integrated gasification combined cycles, biomass air turbines, humid air turbines etc) for biomass resources. Evaluation of the bioenergy system performance. Economic and environmental assessments of bioenergy systems.

MODULEIV BIOFUELS & ALCOHOL TECHNOLOGY 09

Introduction to Alcohol Technology, Raw Material of AlcoholIndustry, Storage & handling of Raw material in detail, Study of different yeast strains used in alcohol

industries, Study of yeastproduction as single protein cell. Study of different recycling process, Biochemistry of alcoholproduction, The management of fermentation in the production of alcohol.

MODULE V POLICIES AND FUTURE R&D OF BIOFUELS& BIOENERGY 09

Course content includes analysis of both current and future EU regulations and directives on biofuels and bioenergy. Tax regulations. Evaluation of different production alternatives to produce bioenergy; competitiveness of bioenergy alternatives in agriculture compared to other energy sources. Evaluation of current and future R&D needs; legal framework to support sustainable development and increased use of biofuels; government policies and programs with regard to biofuels and investment opportunities worldwide. Biomass feedstocks - how do we produce them cost-effectively and for which end-use? Biofuels for transportation - what will make them technically and economically competitive? Market penetration of biofuels - how do we remove barriers?

Total Hours:

REFERENCES:

1. Biorenewable Resources: Engineering New Products from Agriculture. Robert C. Brown. Wiley-Blackwell Publishing (2003).
2. Anaerobic Biotechnology for Bioenergy Production: Principles and Applications. Samir K. Khanal. Wiley-Blackwell (2008).

OUTCOMES:

Students will be able to describe:

- How petroleum and bio-based fuels affect the global carbon cycle
- The attributes of biofuels that make them suitable as a fuel for a specific application
- Limitations of biofuels
- Global impacts of biofuels on food and energy supplies
- Technological advances and challenges to be overcome for wide-scale biofuel adoption

LSCY206 MOLECULAR FARMING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce molecular farming.
- To create complete knowledge about the recombinant protein production.
- To create awareness about the production of pharmaceutical proteins in plants.

MODULE I INTRODUCTION AND FOREIGN PROTEIN EXPRESSION 09

Introduction, foreign protein production systems- plant tissue culture, suspended cultures, hairy root cultures, shoot teratoma cultures. Strategies for improving FP production in tissue culture, expression systems, modifications to existing expression constructs, secretion of foreign proteins, foreign protein stability, stability inside the cells.

MODULEII RECOMBINANT PROTEIN PRODUCTION 09

Biology of sprouting, dicotyledonous seeds, germination, sprout, rubisco synthesis, rubisco promoters, inhibition of endogenous gene expression, expression cassette design, sprouting- equipments, conditions, sterilization, time and temperature, light, inhibition of endogenous gene expression, growth regulators, nitrogen fertilizer, seed production,quality and environmental aspects.

MODULE III PLANT VIRAL EXPRESSION SYSTEMS 10

Cereal production crops, Technical aspects, cereal transformation, expression construct design, Prodigene and Maize. Recombinant proteins expressed in Rice, Wheat, Barley. Plant RNA viruses as expression vectors- TMV, PVX, CPMV, AIMV. Biological activity of target molecules, efficacy of plant virus antigens, vaccine antigens- particle based.

MODULEIV ANTIBODIES, BIOPHARMACEUTICALS AND EDIBLE VACCINES 10

Introduction, expression of therapeutic and human proteins in plants, transgenic chloroplast system, chloroplast derived human antibodies, biopharmaceuticals, Human Serum Albumin, Human insulin like growth factor-1, Human interferon, Antimicrobial peptides, chloroplast derived vaccine antigens, cholera toxin B subModule , Bacillus anthracis protective antigen, Yersinia pestis F1-V fusion antigen, Canine Parvovirus VP2 protein.

MODULE V PLANT DERIVED RECOMBINANT THERAPEUTIC PROTEINS 07

Similarities and differences in the processing of pharmaceutical proteins from different sources, process scale, individual steps of a Downstream process, Initial processing

and extraction, chromatographic purification, regulatoryrequirements for downstream processing of plant derived products.

Total Hours: 45

REFERENCES:

1. Molecular Farming – Plant-made Pharmaceuticals and Technical Proteins, Rainer Fischer and Stefan Schillberg.
2. Wiley.VCHVerlag GmbH and Co. KGaA. 2004.

OUTCOMES:

SEMESTER III

LSCY111 BIOPHARMACEUTICALS

L	T	P	C
3	0	0	3

OBJECTIVE:

- The purpose of this course is to provide a framework of the drug development process and its regulation as well as its impact on workers and the environment. Graduate students in toxicology, pharmaceutics, comparative medicine, bioengineering, occupational and environmental health as well as professional disciplines such as medicine, pharmacology, and nursing interested in working with the biotechnology industry will find this course particularly useful.

MODULE I INTRODUCTION TO BIOPHARMACEUTICAL 09

Introduction to Biopharmaceutical, Biogenerics and Biosimilars; The role of patents in the drug industry; Protein-based biopharmaceuticals; Manufacturing processes; Global market; International Non-proprietary Names (INN) nomenclature system biosimilars.

MODULE II CONCEPTS OF BIOPHARMACEUTICAL 09

Approved follow-on proteins/Biosimilars; Characteristics of high-selling peptides and proteins,; Products with expired patents; Challenging originator's patents; Target products for FOB (follow-on biologicals)/ Biosimilars development peptides; Recombinant non-glycosylated proteins; Recombinant glycosylated proteins; Industries dealing with biogenerics and its market value; World scenario; Indian scenario.

MODULE III PHARMACOKINETICS; PHARMACODYNAMICS 09

Problems in characterizing biologics (Types of biologic, Peptides, Non-glycosylated proteins, Glycosylated proteins, Monoclonal antibodies); Equivalence issues; Post-translational modifications; Effect of microheterogeneity; Pharmacokinetics; Pharmacodynamics; and Clinical efficacy; Analytical methods for the characterization of biosimilars (Chromatography, Protein sequencing, Mass spectrometry, UV absorption, Circular dichroism, X-ray techniques, Nuclear magnetic resonance, Electrophoresis, Western blotting, Bioassays, ELISA, Immunoprecipitation and other procedures)

MODULE IV IMMUNOGENICITY OF BIOPHARMACEUTICALS 09

Immunogenicity of biopharmaceuticals: Immunogenicity; Factors contributing to immunogenicity (product- related factors, host- related factors), Consequence of immunogenicity to biopharmaceuticals; Measurement of immunogenicity

MODULE V CASE STUDIES **09**

Case studies: Erythropoietin, Insulin, Somatotropin, Interleukin-2, Interferon Granulocyte- macrophage- CSF, DNase, Factor VIIa, Factor IX, Factor VIII, Activated protein C, Tissue plasminogen activator, Monoclonal antibodies etc.

Total Hours:

REFERENCES:

1. Sarfaraz K. Niazi, Handbook of Biogeneric Therapeutic Proteins: Regulatory, Manufacturing, Testing, andPatent Issues, CRC Press, 2006.
2. Rodney J Y Ho, MILO Gibaldi, Biotechnology & Biopharmaceuticals Transforming proteins and genes intodrugs, 1stEdition, Wiley Liss, 2003.

OUTCOMES:

- Explain the therapeutic mode of action, and understand structural considerations of at least four classes of biopharmaceutical agent.
- Outline the drug manufacturing process including the role of quality control and quality assurance in protecting the public, workers, and the environment.
- Give an oral presentation to scientific audience on the biological mechanism of action and proposed evaluation of safety, efficacy and manufacturing controls on a biopharmaceutical age

L	T	P	C
3	0	0	3

OBJECTIVE:

- Identify the important parameters in the design of a laboratory to conduct the most commonly-used molecular diagnostics protocols.
- Identify the important parameters in the design of a quality system for molecular analyses.
- Become proficient with the techniques required in order to perform the most commonly-used molecular diagnostics protocols.
- Identify the important parameters in the design of a molecular diagnostic test.
- Identify the components of a well-controlled diagnostic test.
- Use critical thinking skills to trouble shoot problems as they occur and determine possible causes.

MODULE I OLECULAR BIOLOGY AND DIAGNOSTICS 09

Molecular Biology and Diagnostics: Atomic bonds and Molecular interactions; Small organic molecules, Macromolecules; Compartmentalization of cells: transport of molecules between nucleus and cytosol, Transport of proteins into mitochondria and chloroplasts, Endoplasmic Reticulum; General principles of cell communication: Signalling - Extracellular, Intracellular, Autocrine, Signaling through G-protein- linked cell surface receptors, Signaling through enzyme-linked cell surface receptors, Signaling pathways that depend on regulated proteolysis; Cell Cycle; DNA repair pathways and methods of detection – Flow cytometry

MODULE II GENETICS AND DIAGNOSTICS 09

Genetics and Diagnostics: Origin and direction of human cytogenetics; General features of chromosomes, Chemistry and packaging of chromosomes, Chromosome bands, banding techniques and their molecular correlates; Structural and numerical abnormalities of chromosomes and their causes, Sex determination and differentiation, Y chromosome evolution and variations and X-inactivation mechanism and phenotypic effects of sex chromosome imbalances, Fragile sites, Trinucleotide repeat expansion, mechanism and associated disorders, Genomic imprinting and their disorders; Fluorescence In situ hybridization, chromosome Comparative Genomic Hybridization arrays; Genetic linkage and chromosome and genetic mapping in human diseases.

MODULE III BIOCHEMISTRY IN DIAGNOSTICS 09

Biochemistry in Diagnostics: Proteins and Amino acids, Qualitative and quantitative techniques: Protein stability, denaturation; amino acid sequence analysis; Metabolism of lipids, carbohydrates, amino acids; In-born errors of metabolism; energy requirements,

nutritional disorders; vitamins & minerals - biochemical function and deficiency manifestation. GLP and GMP.

MODULE IV TECHNIQUES IN DIAGNOSTICS 09

Nucleic acid extraction – principle and methods; Polymerase Chain Reaction – principle, types (including RT-PCR, real-time PCR, QF-PCR) and applications; DNA sequencing methods – principle, types, automated process, DNA sequencers; Hybridization techniques – Southern, Northern, in-situ (including FISH), microarrays – types and applications; Protein extraction and analysis (including PAGE and its variations); Western Blot

MODULE V IMMUNODIAGNOSTICS 09

Immunodiagnostics : Introduction, antigen-antibody binding interactions and assays; Immunoassays – types [RIA, ELISA, Chemiluminescent, IA, FIA] and specific applications; Immunohistochemistry – principle and techniques. Various drug delivery systems, targeting potentials; systems used for delivery of biotechnological products (Liposomes, microspheres, nanoparticles, immobilization techniques, etc.)

Total Hours:

REFERENCE:

1. Molecular Diagnostics: George P Patrinos and Wilhelm Ansorge, Elsevier Academic Press

OUTCOMES:

- Gain knowledge of cellular structure and function, especially DNA and RNA, to molecular diagnostic procedures.
- Gain a thorough working knowledge of nucleic acid extraction, resolution and detection.
- Gain a solid foundation in the most commonly utilized molecular diagnostic testing protocols.
- Apply the knowledge of molecular testing to the most commonly performed applications in the clinical laboratory such as: nucleic acid extraction, resolution and detection, analysis and characterization of nucleic acids and proteins, nucleic acid amplification and DNA sequencing.

LSCY113 TISSUE AND ANTIBODY ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- Understand the fundamental and quantitative principles of tissue and antibody engineering and the basic elements of the tissue engineering approach. Appreciate the important contribution of tissue and antibody engineering in producing/growing organs that can be used for therapeutic applications.Be able to discuss the use of stem cell in tissue engineering for wound healing. Appreciate the need for compatible biomaterials to support growth and differentiation of stem cells into functional organ.

MODULE I INTRODUCTION TO TISSUE ENGINEERING 09

Introduction to tissue engineering, Cells as therapeutic Agents with examples, Cell numbers and growth rates. Tissue organization, Tissue Components, Tissue types, Functional subunits. Tissue Dynamics, Dynamic states of tissues, Homeostasis in highly prolific tissues and Tissue repair. Angiogenesis. Cellular fate processes, Cell differentiation, Cell migration - underlying biochemical process.

MODULE II CELL-EXTRACELLULAR MATRIX INTERACTIONS 09

Cell-extracellular matrix interactions - Binding to the ECM, Modifying the ECM, Malfunctions in ECM signaling. Direct Cell-Cell contact - Cell junctions in tissues, malfunctions in direct cell-cell contact signaling. Response to mechanical stimuli. Cell and tissue culture - types of tissue culture, media, culture environment and maintenance of cells in vitro, cryopreservation. Basis for Cell Separation, characterization of cell separation, methods of cell separation.

MODULE III BIOMATERIALS IN TISSUE ENGINEERING 09

Biomaterials in tissue engineering - biodegradable polymers and polymer scaffold processing. Growth factor delivery, Stem cells. Gene therapy. In vivo cell & tissue engineering case studies: Artificial skin, Artificial blood vessels. Bioreactors for Tissue Engineering.

MODULE IV IMMUNOGLOBULIN 09

Immunoglobulin Genetic Locus: Generation of antibody diversity, Antibody Discovery Methodologies: Hybidoma, Display, and Direct B-cell cloning technology, Antibody structure and function.

MODULE V ANTIBODY ENGINEERING 09

Antibody engineering: humanization, Affinity maturation, Effector function, Generation of high titer cell lines1: Expression vector and Host systems, Cell culture optimization, Downstream processing , Analytical characterization, : Cell line genetic analysis Purification, formulation and stability, Antibody composition

Total Hours:

REFERENCES:

1. "Tissue Engineering", Bernhard O. Palsson, Sangeeta N. Bhatia, Pearson Prentice Hall Bioengineering.
2. Nanotechnology and Tissue engineering - The Scaffold", Cato T. Laurencin, Lakshmi S. Nair, CRC Press.

OUTCOMES:

- Execute the engineering design process: identify problem, identify design constraints on bioengineering problem, create solutions, and evaluate solutions with respect to these constraints.) In this course, students learn and then execute key steps of the engineering design process, including identification of the problem, exploration of the problem, and design of a solution. Students will learn how to identify and conduct thorough research on current tissue engineering and antibody problems, and will ultimately work in teams to propose solutions to those identified problems.

LSCY114 BIONANOTECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide an introduction to nanobiotechnology.
- To make the students understand about the functional principles of nanobiotechnology

MODULE I FUNDAMENTALS OF NANOSCIENCE 09

Introduction, the nanoscale dimension and paradigm, definitions and historical evolution (colloids etc.) and current practice, types of nanomaterials and their classifications (1D, 2D and 3D etc. nanocrystal, Nanoparticle, Quantum dot, Quantum Wire and Quantum Well etc), Polymer, Carbon, Inorganic, Organic and Biomaterials –Structures and characteristics.

MODULE II CHARACTERIZATIONS IN BIONANOTECHNOLOGY 09

Optical (UV-Vis/Fluorescence), X-ray diffraction, Imaging and size (Electron microscopy, light scattering, Zeta potential), Surface and composition (ECSA, EDAX, AFM/STM etc), Vibration (FT-IR and RAMAN), SERS -3, Magnetic, Electrical and Electrochemical**.**

MODULE III APPLICATIONS OF BIONANOTECHNOLOGY 09

Materials in Biosystems: Proteins - Lipids - RNA and DNA, Protein Targeting – Small Molecule/Nanomaterial - Protein Interactions Nanomaterial-Cell interactions-Manifestations of Surface Modification (Polyvalency),Drugs-Photodynamic therapy, molecular motors, neuroelecronic interphases, development of nanoluminiscent tags**.**

MODULE IV NANOMATERIALS AND DIAGNOSTICS 09

Drug Delivery and Therapeutics, MRI, Imaging, Surface Modified Nanoparticles, MEMS/NEMS, based on Nanomaterials, Peptide/DNA Coupled Nanoparticles, Lipid Nanoparticles For Drug Delivery, Inorganic Nanoparticles For Drug Delivery, Metal/Metal Oxide Nanoparticles (antibacterial/anti fungal/anti viral), Anisotropic and Magnetic Particles (Hyperthermia).

MODULE V NANOMATERIALS AND TOXICITY EVALUATION 09

Designer biopolymers, Procollagen, DNA Polynode, RNA topoisomerase, Protein – magnetic materials, Cyto-toxicity, Geno-toxicity, In vivo tests/assays.

Total Hours: 45

REFERENCES:

1. C. M. Niemeyer, C. A. Mirkin, Nanobiotechnology: Concepts, Applications and Perspective, Wiley – VCH, 2004.
2. 2 T. Pradeep, —Nano: The Essentials, McGraw – Hill education, 2007.
3. Nicholas A. Kotov, Nanoparticle Assemblies and Superstructures, CRC, 2006.
4. David S Goodsell, “Bionanotechnology”, John Wiley & Sons, 2004.

OUTCOMES:

- After the completion of the course the student will have the basic knowledge of nanotechnology in biotechnology. In detail understanding of the application of Nanomaterials in biotechnology and acquire the knowledge about the DNA, proteins, amino acids, drug delivery, biomedicine etc.

LSCY115 PROTEIN ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

This course aims to develop in the students' mind a concept regarding the structure and function of proteins of particular importance, the student will know the production of recombinant protein and in general how to engineer protein to be used as therapeutics.

MODULE I INTRODUCTION TO PROTEIN ENGINEERING 09

Forces stabilizing proteins – Van der waals, electrostatic, hydrogen bonding and weakly polar interactions, hydrophobic effects; Entropy – enthalpy compensation, Protein engineering and its applications, features or characteristics of proteins that can be engineered (definition and methods of study) – affinity and specificity; Spectroscopic properties; Stability to changes in parameters as pH, temperature and amino acid sequence, aggregation propensities, etc.

MODULE II TECHNIQUES FOR PROTEIN ENGINEERING 09

Methods of measuring the stability of a protein; Spectroscopic methods to study physicochemical properties of proteins: far-UV and near-UV CD; Fluorescence; UV absorbance; ORD; Hydrodynamic properties–viscosity, hydrogen-deuterium exchange.

MODULE III SITE DIRECTED MUTAGENESIS AND PROTEIN ENGINEERING 09

Altering Proteins by mutagenesis methods, techniques for Oligonucleotide directed mutagenesis by using single stranded DNA as template, Denatured double stranded DNA as template, PCR based mutagenesis, Engineering proteins by chemical modifications, Genetic fusion of domains, alteration of function by selection and screens, deletion mutagenesis. Introduction of selected mutagenesis by Oligonucleotide directed mutagenesis, Scanning mutagenesis, Insertion of unnatural mutagenesis.

MODULE IV ENGINEERING PROTEINS FOR PURIFICATION 09

Introducing cleavage sites, engineering Proteins for Chromatography, Immunoaffinity chromatography, Ion exchange chromatography, Metal affinity chromatography.

MODULE V STABILIZATION AND MODIFICATION OF PROTEINS 09

Principles of structure stabilization by solvent components, sources of exclusion, Balance between cosolvent exclusion and binding, cosolventintertactions in the denaturation reaction, Practical considerations, Post translational modifications-

Involving peptide bond, C-terminal, side chain. Modification methods- Enzymatic, Non enzymatic, Specificity, chaperones mediated. Applications of Post translational modifications.

Total Hours:

REFERENCE:

1. Andreas D. Baxevanis& B.F. Francis Ouellellette, Bioinformatics. A Practical Guide to the Analysis of Genes and Proteins, John Wiley & Sons, UK, 1998.
2. Baxevanis A. D, Ouellette B. F. F. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins. 3nd edition Wiley, John & Sons, Incorporated, 2004.

OUTCOMES:

- After the completion of the course the student will have the basic concept regarding the structure and function of proteins of particular importance, the student will know the production of recombinant protein and in general how to engineer protein to be used as therapeutics.

LSCY116 STEM CELL TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To obtain knowledge on wide-ranging topics related to stem cell
- To learn about the application of stem cells in health care
- To get familiar with the issues and challenges of stem cell political and ethical issues surrounding the stem cell debate.

MODULE I GENESIS OF CELLS 09

Concept of stem cells: types, self-renewal and pluripotency, isolation and characterization, Niche and its role on differentiation of stem cells, Stem cells and restorative biology, Reprogramming of genome function through epigenetic inheritance.

MODULE II STEM CELLS 09

Embryonic stem cells, Stem Cells from adults. Pluripotency necessary, or is unipotency enough? What are the mechanisms? Stem-cell plasticity, Regulators of pluripotency and differentiation of stem cell. The isolation, expansion, genetic manipulation, genomic reprogramming, and cloning of stem cells. The problem of differentiation of stem cells. Stem Cells and imprinted genes. Differences between adult and embryonic stem cells, what types of cells adult stem cells can become.

MODULE III CELL &TISSUES 09

From single to multicellular components **-** Regulation of cell division and cytoskeleton, Stem cells in regeneration, Cell specification and early signaling events during morphogenesis, Development of cell adhension and motility , Cellular imprinting**.**

MODULE IV CELL GROWTH &DEVELOPMENT 09

Factors controlling cell development **-** Environmental factors like temperature, oxeygen, location, time, cell number , Chemical factors like growth factors, hormones, cytokines, microRNAs , Genetic factors**.**

MODULE V STEM CELLS AND THERAPEUTICS 09

Cancer stem cells , Stem cells treatment to diseases , Current stem cell therapies, how we can use stem cells for studying cancer and finding cures to other diseases, Correlation between stem cells and cancer, Stem cells and aging. Clinical applications of hematopoietic stem cells from cord blood first successful transplantation of cord blood in a child with Fanconi’s anemia. Treatment of neural diseases such as

Parkinson's disease, Huntington’s disease and Alzheimer's disease. Repair of damaged organs such as the liver and pancreas. Ethical issues associated with stem cells.

Total Hours: 45

REFERENCES

1. Kiessling A. A, Human Embryonic Stem Cells: An Introduction to the Science and Therapeutic Potential, Jones and Bartett, 2003.
2. Quesenberry P. J. Stem Cell Biology and Gene therapy, 1st Edition, Willy- Less, 1998.
3. Lanja L, Essential of stem cell Biology, 2nd Edition, Academic Press, 2006.
4. Ho A. D. and Hoffiman R. Stem Cell Transplantation Biology Processes Therapy, Willy-VCH, 2006.
5. Potten C. S. Stem Cells, Elsevier, 2006.

OUTCOMES:

- After the completion of the course the student will have overall knowledge of scientific research, management, implications and exploitation in Stem Cells in Health care.

REGULATIONS - 2018
(With Amendments Incorporated till March 2019)

M.ARCH (GENERAL)

REGULATIONS - 2018

FOR

M. ARCH DEGREE PROGRAMME

1.0 PRELIMINARY DEFINITIONS & NOMENCLATURE

In these Regulations, unless the context otherwise requires:

i) "Programme" means Post Graduate Degree Programme (M.Arch degree)

ii) "Branch" means specialization or discipline of M. Arch degree programmes.

iii) "Course" means a theory or studio or theory cum studio that is normally studied in a semester, like Architectural Reading, Architectural Studio, etc.

iv) "Institute" means B.S.Abdur Rahman Crescent Institute of Science and Technology

v) "Dean (Academic Affairs)" means the Dean (Academic Affairs) of B.S.Abdur Rahman Crescent Institute of Science and Technology

vi) "Dean (Student Affairs)" means the Dean (Students Affairs) of B.S.Abdur Rahman Crescent Institute of Science and Technology

vii) "Controller of Examinations" means the Controller of Examination of B.S.Abdur Rahman Crescent Institute of Science and Technology who is responsible for conduct of examinations and declaration of results.

2.0 PROGRAMMES OFFERED, MODE OF STUDY AND ADMISSION REQUIREMENTS

2.1 Post graduate degree of M. Arch (General) is offered in full-time in Crescent School of Architecture.

2.2 MODE OF STUDY

2.2.1 Students admitted under “Full-time” shall be available in the Institution during the complete working hours for curricular, co-curricular and extra-curricular activities assigned to them.

2.3 ADMISSION REQUIRMENTS:

2.3.1 The candidate with a minimum of 50 % marks in aggregate in a Bachelor of Architecture degree course or equivalent courses recognized by the Council of Architecture shall be admitted to the programme in architecture.

2.3.2 The eligibility criteria such as marks, number of attempts and physical fitness shall be

as prescribed by the Institute from time to time.

3.0 DURATION AND STRUCTURE OF THE PROGRAMME

3.1 The minimum and maximum period of completion for the PG degree programme is as given below:

Programme	Minimum No of semesters	Maximum No of Semesters
M. Arch	4	8

3.2 The curriculum structure of M. Arch Degree programme shall consists of:

i. "Theory" courses
ii. "Theory cum studio" courses iii.
"Studio" courses

3.3 Every semester curriculum shall normally have a blend of theory, theory cum studio and studio courses.

3.4 Theory courses shall carry one credit per lecture period per week and studio courses carry one credit per two/three periods. All theory courses will be having evaluated through the continuous assessment and semester end examinations. Theory cum studio & Studio courses will be evaluated through continuous assessments and Semester end Viva-voce Examinations.

3.5 For the award of the degree a student should have earned all credits mentioned in the curriculum.

4.0 CLASS ADVISOR

A faculty member will be nominated by the HOD as Class Advisor for the class throughout the period of study.

The Class Advisor shall be responsible for maintaining the academic, curricular and co-curricular records of students of the class throughout their period of study.

5.0 COURSE COMMITTEE

Any course commonly offered to more than one discipline or group, shall have a "Course Committee", comprising all the faculty members teaching the common course with one among them nominated as Course Coordinator. The nomination of the course coordinator shall be made by the Head of the Department / Dean (Academic Affairs), depending on whether all the faculty members teaching the common course belong to the same department or different departments.

6.0 CLASS COMMITTEE

A class committee comprising faculty members handling the classes, student representatives and a senior faculty member not handling the courses as chairman will be constituted branch-wise and semester-wise

6.1 The composition of the class committee will be as follows:

- One senior faculty member preferably not handling courses for the concerned semester, appointed as chairman by the Head of the Department
- Faculty members of all courses of the semester
- Two student representatives (male and female) of each class nominated by the Head of the Department in consultation with the relevant faculty advisors
- All faculty advisors and the class advisors.
- Head of the Department

6.2 The class committee shall meet at least four times during the semester. The first meeting will be held within two weeks from the date of commencement of classes, in which the nature of continuous assessment for various courses and the weightages for each component of assessment will be decided for the first and second assessment. The second meeting will be held within a week after the date of first assessment report, to review the students' performance and for follow up action. The third meeting will be held within a week after the second assessment report, to review the students' performance and for follow up action.

6.3 During these three meetings the student members representing the entire class, shall meaningfully interact and express opinions and suggestions to improve the effectiveness of the teaching-learning process.

6.4 The fourth meeting of the class committee, excluding the student members, shall meet within 10 days from the last day of the semester end examination to analyze the performance of the students in all the components of assessments and decide their grades in each course. The grades for a common course shall be decided by the concerned course committee and shall be presented to the class committee(s) by the concerned course coordinator.

7.0 REGISTRATION AND ENROLMENT

7.1 Except for the first semester, every student shall register for the ensuing semester during a specified week before the semester end examination of the ongoing semester. Every student shall submit a completed registration form indicating the list of courses intended to be enrolled during the ensuing semester. Late registration with the approval of the Dean (Academic Affairs) along with a late fee will be permitted up to the last working day of the current semester.

7.2 From the second year onwards, all students shall pay the prescribed fees for the year on a specific day at the beginning of the semester confirming the registered courses. Late enrolment along with a late fee will be permitted up to two weeks from the date of commencement of classes. If a student does not enroll, his/her name will be removed from rolls.

7.3 The students of first semester shall register and enroll at the time of admission by paying the prescribed fees.

7.4 A student should have registered for all preceding semesters before registering for a particular semester.

7.5 A student can change an enrolled course within 10 working days from the commencement of the course, with the approval of the Dean (Academic Affairs), on the

recommendation of the Head of the Department of the student.

7.6 A student can withdraw from an enrolled course at any time before the first assessment for genuine reasons, with the approval of the Dean (Academic Affairs), on the recommendation of the Head of the Department of the student.

8.0 TEMPORARY BREAK OF STUDY FROM A PROGRAMME

A student can avail a one time temporary break of study covering the current semester and/or next semester period with the approval of the Head of the Institution at any time before the start of first assessment of the ongoing semester, within the maximum period of two semester as the case may be. If any student is debarred for want of attendance or suspended due to any act of indiscipline, it will not be considered as break of study. A student who has availed break of study has to rejoin in the same semester only.

8.1 A student can avail one time temporary break of study covering the current semester and/or next semester period. However if a student intends to temporarily discontinue the programme in the middle for valid reasons (such as accident or hospitalization due to prolonged ill health) and to rejoin the programme in a later semester he/she shall apply to the Dean in advance, in any case, not later than the last date of registering for the semester-end examinations, through the Dean stating the reasons therefore.

8.2 A student availed break of study has to rejoin only in the same semester from where he left.

8.3 If any student is detained for want of requisite attendance, progress and good conduct, the period spent in that semester shall not be considered as permitted "Break of Study".

9.0 CONDITION FOR ENROLMENT & MOVEMENT TO HIGHER SEMESTER

9.1 A student who has arrears in the studio course in

- I semester cannot move to the III semester
- II semester cannot move to the IV semester

10.0 ASSESSMENT PROCEDURE AND PERCENTAGE WEIGHTAGE OF MARKS

10.1 Every Teacher shall maintain an Attendance and Assessment record, which consists of attendance marked for each lecture or studio sessions, the test marks and the topic covered. This should be submitted to the Dean as the case may be at regular intervals (at least two times in a semester) for checking the syllabus covered and the assessments made. At the end of the semester the Dean shall verify and keep the Attendance and Assessment records in safe custody for a period of five years.

10.2 A minimum of three continuous assessments and an semester end examination for Theory and elective courses will be conducted. The weightage for the semester end examination shall be 50% and the continuous assessments shall be 50%. The three continuous assessments for the courses may be in the form of assignments,

seminars, skill development, etc.

10.3 Assessment for Theory cum studio and Studio subjects shall have 70% weightage for continuous assessments and 30% weightage for semester end examination in the form of viva-voce by an external examiner proposed by the Dean.

10.4 Dissertation:

Every student shall undertake a project on a topic approved by the Review Committee. The Review Committee shall comprise of the Dean, Supervisor of the project and two internal members appointed by the Dean in the beginning of the semester. The progress of the student in the project shall be reviewed by the review committee at least three times during the semester for a weightage of 70% and 30 % weightage for semester end examination in the form of viva-voce by a team consisting of the supervisor concerned, Internal and External Examiners proposed by the Dean and appointed by the Controller of Examinations.

10.5 Architectural Thesis:

- Every student shall undertake a project on a topic approved by the Review Committee. The Review Committee shall comprise of the Dean, Supervisor of the project and two External members appointed by the Dean in the beginning of the semester. The progress of the student in the project shall be reviewed by the review committee at least three times during the semester for a weightage of 70%.
- The student shall submit the thesis at the end of the IV semester. The evaluation of the Project work will be based on the thesis and a viva-voce examination by a team consisting of the supervisor concerned, external examiner nominated by the Dean and appointed by the Controller of Examinations. Viva-voce examination shall carry a weightage of 3**0%.**

Weightage of Marks for continuous assessment and semester-end examination

Sl. No.	Courses	Weightage of Continuous Assessment	Weightage for Semester End Examination
1	Theory and Elective courses	5	50%
2	Theory cum Studio courses	7	30%
3.	Studio Courses	7	30%
4.	Dissertation	7	30%
5.	Architectural Thesis	7	30%

10.5 For the Theory cum studio & Studio courses, Architectural thesis, a minimum of 45 % marks in continuous assessment is mandatory, without which the student will not be eligible to appear for the semester end viva voce.

10.6 In all courses a student has to secure a minimum of 45% marks in Semester End

Examination / viva voce and a minimum of 45% marks in continuous assessment and semester end examination / viva voce put together.

10.7 If a student fails to secure a minimum 45% marks in the continuous assessment in the studio course - he/she shall improve the internal assessment by resubmitting the improved drawings during the subsequent year, obtain minimum 45% marks in the continuous assessment and appear for viva voce examination. Securing 45% in internals is mandate to appear for External viva voce Examination.

10.8 If a student fails to secure a minimum 45% marks in the viva voce examinations he/she shall appear for viva voce examination during the subsequent year.

10.9 For Architectural thesis, a student who secures less than 45% marks in the continuous assessment shall not be permitted to submit the thesis and take the Viva Voce Examinations at the end of the Semester. He/she shall redo the thesis with the same topic or in a different topic in the subsequent year and secure fresh internal assessment marks.

10.10 If a student fails to secure a pass in the Architectural thesis, having obtained not less than 45% of the total marks prescribed for the continuous assessment but less than
45% of the total marks prescribed for the Viva voce Examinations, he / she shall improve the thesis on the same topic and resubmit the thesis at the end of the subsequent semester. In such cases, the continuous internal assessment marks already secured by the candidate shall remain valid. The resubmitted thesis shall be assessed through a viva voce examination as in the case of a regular candidate.

10.11 If a candidate wishes to change the topic of architectural thesis in case of a failure or in the case of a prevention, he/she shall join the course when in session next, get the topic approved, secure fresh internal assessment marks and submit the new thesis as in the case of a regular candidate.

11.0 SUBSTITUTE EXAMINATIONS

11.1 A student who has missed, for genuine reasons, a maximum of one of the three continuous assessments of a course may be permitted to write a substitute examination paying the prescribed substitute examination fees. However, permission to take up a substitute examination will be given under exceptional circumstances, such as accidents, admission to a hospital due to illness, etc. by a committee constituted by the Dean of School for that purpose. However there is no Substitute Examination for Semester End examination.

11.2 A student who misses any continuous assessment test in a course shall apply for substitute exam in the prescribed form to the Head of the Department / Dean of School within a week from the date of missed assessment test. However the Substitute Examination will be conducted after the last working day of the semester and before Semester End Examination.

12.0 ATTENDANCE REQUIREMENT AND SEMESTER / COURSE REPETITION

12.1 A student shall earn 100% attendance in the contact periods of every course, subject to a maximum relaxation of 25% (for genuine reasons such as medical grounds or representing the University in approved events etc.) to become eligible to appear for the semester-end examination in that course, failing which the student shall be awarded "I" grade in that course. If the course is a core course, the candidate should register for and repeat the course when it is offered next.

12.2 The faculty member of each course shall cumulate the attendance details for the semester and furnish the names of the students who have not earned the required attendance in that course to the Class Advisor. The Class Advisor will consolidate and furnish the list of students who have earned less that 85% attendance, in various courses, to the Dean (Academic Affairs) through the Head of the Department/ Dean of School. Thereupon, the Dean (Academic Affairs) shall announce, course-wise, the names of such students prevented from writing the semester end examination in each course.

12.3 A student should register to re-do a core course wherein "I" or "W" grade is awarded. If the student is awarded, "I" or "W" grade in an elective course either the same elective course may be repeated or a new elective course may be taken with the approval of Head of the Department / Dean of School.

12.4 A student who is awarded "U" grade in a course will have the option to either write the semester end arrear examination at the end of the subsequent semesters, or to redo the course in the evening when the course is offered by the department. Marks scored in the continuous assessment during the redo classes shall be considered for grading along with the marks scored in the semester-end (redo) examination. If any student obtained "U" grade in the redo course, the marks scored in the continuous assessment test (redo) for that course will be considered as internal mark for further appearance of arrear examination.

12.5 If a student with "U" grade, who prefers to redo any particular course, fails to earn the minimum 85% attendance while doing that course, then he / she will not be permitted to write the semester end examination and his / her earlier "U" grade and continuous assessment marks shall continue.

12.6 A student who has obtained 'I' grade in all the courses in a semester is not permitted to move to next higher semester. Such student shall repeat all the courses of the semester in the subsequent academic year.

13.0 REDO COURSES

13.1 A student can register for a maximum of two redo courses per semester in the evening after regular college hours, if such courses are offered by the concerned department. Students may also opt to redo courses offered during regular semesters.

13.2 The Head of the Department with the approval of Dean Academic Affairs may arrange for the conduct of a few courses during the evening, depending on the availability of faculty members and subject to a specified minimum number of students registering for each of such courses.

13.3 The number of contact hours and the assessment procedure for any redo course will be the same as those during regular semesters except that there is no provision for any substitute examination and withdrawal from an evening redo course.

14.0 PASSING AND DECLARATION OF RESULTS AND GRADE SHEET

14.1 All assessments of a course will be made on absolute marks basis. However, the Class Committee without the student members shall meet within 10 days after the semester- end examination and analyze the performance of students in all assessments of a course and award letter grades. The letter grades and the corresponding grade points are as follows:

Mark interval	Letter Grade	Grade Points
85 – 100	S	10
75 – 84	A	9
65 – 74	B	8
57 – 64	C	7
51 – 56	D	6
45 – 50	E	5
< 44	U	0
	W	0

	I	0
	AB	0

"W" denotes withdrawal from the course.
"I" denotes inadequate attendance and hence prevention from semester- end examination
"U" denotes unsuccessful performance in the course.
"AB" denotes absence for the semester-end examination.

14.2 A student who earns a minimum of five grade points ('E' grade) in a course is declared to have successfully completed the course. Such a course cannot be repeated by the student for improvement of grade.

14.3 The results, after awarding of grades, shall be signed by the Chairman of the Class Committee and Head of the Department/Dean of Schools and the results shall be declared by the Controller of Examinations.

14.4 Within one week from the date of declaration of result, a student can apply for revaluation of his / her semester-end theory examination answer scripts of one or more courses, on payment of prescribed fee, through proper application to Controller of Examination. Subsequently the Head of the Department/ Dean of School offered the course shall constitute a revaluation committee consisting of Chairman of the Class Committee as Convener, the faculty member of the course and a senior member of faculty knowledgeable in that course. The committee shall meet within a week to revalue the answer scripts and submit its report to the Controller of Examinations for consideration and decision.

14.5 After results are declared, grade sheets shall be issued to each student, which will contain the following details. The list of courses enrolled during the semester including redo courses, if any, and the grade scored, the Grade Point Average (GPA) for the semester and the Cumulative Grade Point Average (CGPA) of all courses enrolled from first semester onwards. GPA is the ratio of the sum of the products of the number of credits of courses registered and the points corresponding to the grades scored in those courses, taken for all the courses, to the sum of the number of credits of all the courses in the semester.

If Ci, is the number of credits assigned for the i^{th} course and GPi is the Grade Point in the i^{th} course

$$GPA = \frac{\sum_{i=1}^{n}(C_i)(GPi)}{\sum_{i=1}^{n} C_i}$$

Where n = number of courses
The Cumulative Grade Point Average CGPA shall be calculated in a similar manner, considering all the courses enrolled from first semester.
"I" and "W" grades will be excluded for calculating GPA .
"U", "I", "AB" and **"W"** grades will be excluded for calculating CGPA.
The formula for the conversion of CGPA to equivalent percentage of marks shall be as follows:
Equivalent Percentage of Marks = CGPA X 10

14.6 After successful completion of the programme, the Degree will be awarded with the following classifications based on CGPA.

Classification	**CGPA**

First Class with Distinction	8.50 and above and passing all the courses in first appearance and completing the programme within the prescribed period of 8 semester for normal entry and 6 semesters for lateral entry
First Class	6.50 and up to 8.5 and completing the programme within a maximum of 8 semester for normal entry and 6 semesters for lateral entry
Second Class	Others

However, to be eligible for First Class with Distinction, a student should not have obtained 'U' or 'I' grade in any course during his/her study and should have completed the P.G. programme within a minimum period (except break of study). To be eligible for First Class, a student should have passed the examination in all the courses within the specified minimum number of semesters reckoned from his/her commencement of study. For this purpose, the authorized break of study will not be counted. The students who do not satisfy the above two conditions will be classified as second class. For the purpose of classification, the CGPA will be rounded to two decimal places. For the purpose of comparison of performance of students and ranking, CGPA will be considered up to three decimal places.

15.0 ELECTIVE CHOICE:

15.1 Apart from the various elective courses listed in the curriculum for each branch of specialization, the student can choose a maximum of two electives from any other specialization under any department, during the entire period of study, with the approval of the Head of the parent department and the Head of the other department offering the course.

15.2 Online / Self Study Courses

Students are permitted to undergo department approved online/ self study courses not exceeding a total of six credits with the recommendation of the Head of the Department / Dean of School and with the prior approval of Dean Academic Affairs during his/ her period of study. In case of credits earned through online mode ratified by the respective Board of Studies, the credits may be transferred following the due approval procedures. The students shall undergo self study courses on their own with the mentoring of a member of the faculty. The online/ self study courses can be considered in lieu of elective courses.

16.0 SUPPLEMENTARY EXAMINATION

Final Year students can apply for supplementary examination for a maximum of two courses thus providing an opportunity to complete their degree programme. Like wise students with less credits can also apply for supplementary examination for a maximum of two courses to enable them to earn minimum credits to move to higher semester. The students can apply for supplementary examination within two weeks of the declaration of results.

17.0 PERSONALITY AND CHARACTER DEVELOPMENT

All students shall enrol, on admission, in any of the personality and character development programmes, NCC / NSS / NSO / YRC / Rotaract and undergo practical training.

- **National Cadet Corps (NCC)** will have to undergo specified number of parades.
- **National Service Scheme (NSS)** will have social service activities in and around Chennai.

- **National Sports Organization (NSO)** will have sports, games, drills and physical exercises.
- **Youth Red Cross (YRC)** will have social service activities in and around Chennai.
- **Rotaract** will have social service activities in and around Chennai.

18.0 DISCIPLINE

18.1 Every student is required to observe disciplined and decorous behaviour both inside and outside the campus and not to indulge in any activity which will tend to affect the prestige of the Institute.

18.2 Any act of indiscipline of a student, reported to the Dean (Student Affairs), through the Dean will be referred to a Discipline and Welfare Committee nominated by the Vice- Chancellor, for taking appropriate action.

19.0 ELIGIBILITY FOR THE AWARD OF DEGREE

19.1 A student shall be declared to be eligible for the award of M. Arch degree provided the student has:

i) successfully Should have passed all the courses specified in the programme curriculum and earned the required number credits prescribed for the programme within a maximum period of 4 semesters (2 years) from the date of admission, including the break of study.

ii) no dues to the Institution, Library, Hostels

iii) no disciplinary action pending against him/her.

19.2 The award of the degree must have been approved by the Institute.

20.0 POWER TO MODIFY

Notwithstanding all that has been stated above, the Academic Council has the right to modify the above regulations from time to time.